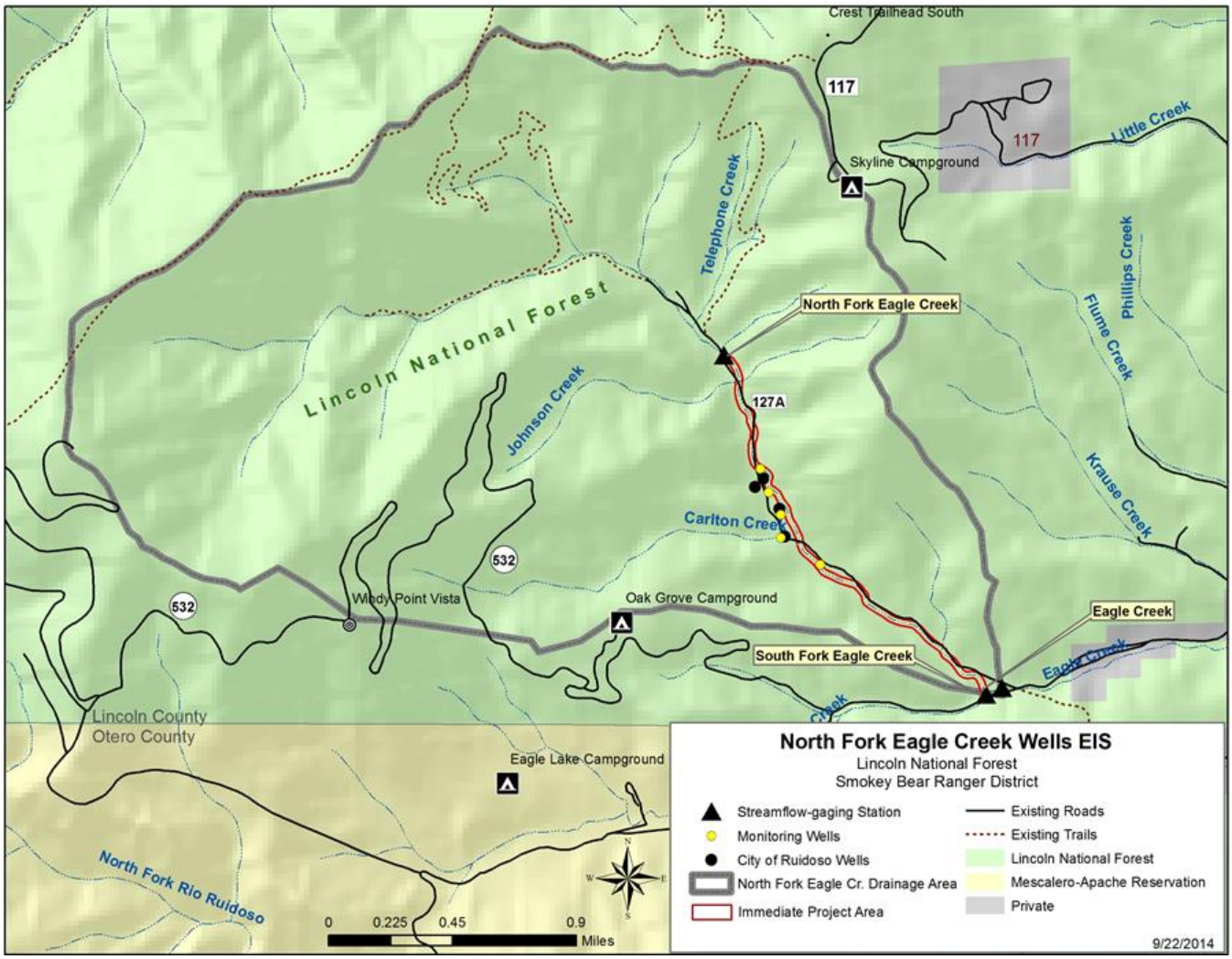
United States Department of Agriculture

Final Environmental Impact Statement

North Fork Eagle Creek Wells Special Use Authorization



Forest Service | Southwestern Region | Lincoln National Forest | MB-R3-08-08 August 2015

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Final Environmental Impact Statement for the North Fork Eagle Creek Wells Special Use Authorization Project

Lincoln National Forest, Lincoln County, New Mexico

Lead Agency:	USDA Forest Service
Responsible Official:	Travis G. Moseley, Forest Supervisor 3463 Las Palomas Road Alamogordo, NM 88310
For Information Contact:	Dave Warnack, District Ranger 901 Mechem Drive Ruidoso, NM 88345 (575) 257-4095

Abstract: We (USDA Forest Service, Lincoln National Forest) propose to authorize, under a new special use permit, the operation of four municipal supply water wells (and their associated facilities as described in more detail in chapter 1) located on National Forest System land in the North Fork Eagle Creek drainage. This proposal addresses the need for: (1) authorizing, under a special use permit, the Village of Ruidoso's ability to access and divert groundwater from its North Fork Eagle Creek wells on National Forest System land, as a substantial component of the municipal water supply system that the Village of Ruidoso, New Mexico, residents and visitors rely upon; and (2) protecting natural resources on the national forest by maintaining adequate surface and groundwater flows to sustain or improve the riparian and aquatic ecosystems that may be affected by groundwater drawdown from pumping of these wells. The new permit would include additional monitoring and mitigation measures as part of the permit's terms and conditions. These requirements respond to the purpose and need for action and minimize potential adverse impacts to surface water and groundwater resources from well operations. This final environmental impact statement (FEIS) compares environmental effects of implementing three alternatives, including (1) continuation of pumping; (2) no pumping; and (3) an adaptive management approach to continued pumping.

The preferred alternative is alternative 1. The preferred alternative would continue pumping from the North Fork well field. We would authorize, under a new special use permit, the operation and maintenance of four municipal supply water wells (three equipped and one unequipped) and associated monitoring wells; well house control station; underground pipeline and power line; and road access located in the North Fork Eagle Creek drainage on National Forest System land. The new permit would be authorized for up to 20 years, with stipulations for frequent reviews and verification of the permit terms and conditions. These reviews could occur as often as every year but would occur at least every 5 to 10 years and would be based on review of available monitoring information. The permit term would be shortened if necessary, based on the results of these more frequent reviews and verifications of permit terms and conditions. The new permit would also include additional

monitoring and mitigation measures, as part of terms and conditions of the new permit, as described in detail in chapter 2.

We released the North Fork Eagle Creek Wells Special Use Authorization Project Supplemental Draft Environmental Impact Statement (SDEIS) on November 14, 2014 for public comment. We published notices that it was available for public comment in the Federal Register and as a legal notice in the Ruidoso News; and in email and letter notifications to all those on the project mailing list. We requested comments within a 45 day period. We received several requests for extensions to the comment period and Forest Supervisor Moseley granted two additional 15-day extensions; requesting all comments be submitted no later than January 28, 2015. We received 23 responses during the 75-day public comment period for the SDEIS.

We prepared this Final EIS based on public and other agency comments received during the Supplemental Draft EIS comment period and additional interdisciplinary team input. It includes the identification of our preferred alternative (alternative 1 – continuation of current management). It incorporates corrections and changes suggested by the public (as summarized at the beginning of chapter 1 and in appendix E), and the project interdisciplinary team. The result is a balance providing municipal water to the Village of Ruidoso and protecting natural resources.

Administrative Review Process: This FEIS and associated draft decision document (Record of Decision) are subject to the predecisional administrative review process (objection process) pursuant to 36 CFR 218, subparts A and B. Objections will only be accepted from those who have previously submitted specific written comments regarding this proposed project during scoping or other designated opportunity for public comment in accordance with §218.5(a). Issues raised in objections must be based on previously submitted, timely, specifically written comments regarding this proposed planning effort unless based on new information arising after the designated comment opportunities.

The objection must contain the minimum content requirements specified in §218.8(d) and incorporation of documents by reference is permitted only as provided in §218.8(b). All objections are available for public inspection during and after the objection process. At a minimum an objection must include the following (36 CFR 218.8(d)): (1) The objector's name and address, with a telephone number, if available; (2) a signature or other verification of authorship upon request (a scanned signature for Email may be filed with the objection); (3) when multiple names are listed on an objection, identification of the lead objector (verification of the identity of the lead objector shall be provided upon request); (4) the name of the proposed project, the name and title of the Responsible Official, and the name(s) of the National Forest(s) and/or Ranger District(s) on which the proposed project will be implemented; and (5) a description of those aspects of the proposed project addressed by the objection, including specific issues related to the proposed project, if applicable, how the objector believes the environmental analysis or draft decision specifically violates law, regulation, or policy; suggested remedies that would resolve the objection; supporting reasons for the reviewing officer to consider; and (6) a statement that demonstrates connection between prior specifically written comments on the particular proposed activity and the content of the objection, unless the objection concerns an issue that arose after the opportunity for formal comment.

Objections, including attachments, must be filed within 45 days from the publication date of legal notice in the Ruidoso News, the newspaper of record. Attachments received after the 45-day objection period will not be considered. The publication date in the newspaper of record is the exclusive means for calculating the time to file an objection. Those wishing to object this project should not rely upon dates or timeframe information provided by any other source. It is the objector's responsibility to

ensure timely filing of a written objection with the reviewing officer pursuant to §218.9. The regulations prohibit extending the time to file an objection.

The objection must be filed by way of regular mail, fax, e-mail, hand-delivery, or express delivery or messenger service (Monday through Friday, 8:a.m.to 4:30 p.m., excluding holidays). Objections may be submitted via e-mail in word (.doc), portable document format (.pdf), rich text format (.rtf), text (.txt), or hypertext markup language (.html) with Subject: North Fork Eagle Creek Wells. An automated response will confirm the electronic objection has been received. In cases where no identifiable name is attached to an electronic message, a verification of identity will be required. A scanned signature is one way to provide verification. Please submit your objections to the Regional Forester as follows:

Mail: Southwestern Region
333 Broadway SE
Albuquerque, NM 87102

Phone: 505-842-3292

TTY: 505-842-3198

FAX: 505-842-3110

Email: objections-southwestern-regional-office@fs.fed.us

Summary

We (the USDA Forest Service, Lincoln National Forest) propose to authorize, under a new special use permit, the operation of four municipal supply water wells (three equipped and one unequipped) and associated monitoring wells; well house control station; underground pipelines and power lines; and road access located on National Forest System land in the North Fork Eagle Creek (North Fork) drainage. The new permit would be authorized for up to 20 years, with stipulations for frequent review and verification of the permit terms and conditions. These could occur as often as every year but would occur at least every 5 to 10 years. The new permit would include terms and conditions reflecting monitoring and mitigation measures; responding to the purpose and need for action, and minimizing potential adverse impacts to surface water and groundwater resources from well operations.

North Fork Eagle Creek is located in the Sacramento Mountains of south-central New Mexico in Lincoln County north of the Village of Ruidoso and approximately 2.5 miles west of Alto, New Mexico (figure 1). The project area consists of approximately 5 acres of National Forest System land occupied by the Village of Ruidoso's four wells and surrounding National Forest System land upstream from the Eagle Creek gaging station. This area is within the North Fork Eagle Creek drainage, which totals 5.3 square miles, or approximately 3,400 acres. The North Fork Eagle Creek between the North Fork stream gage and the Eagle Creek stream gage, totaling approximately 2 stream miles, is the emphasis of this environmental analysis (figure 2).

Eagle Creek Conservation Association, Inc., Gerald Ford, and Dr. William S. Midkiff filed a lawsuit in 2005 based on concerns that operating these wells could be affecting streamflow in Eagle Creek. The case was dismissed in 2006 after all parties to the lawsuit signed a Stipulation Agreement, in which the Lincoln National Forest agreed to complete an environmental analysis before a new permit can be issued to the Village of Ruidoso. As part of that analysis, the agreement also requires that an independent watershed and geohydrologic study of Eagle Creek and the North Fork wells be undertaken by an entity not previously involved in the lawsuit.

We have studied the environmental effects of authorizing, under a special use permit, the operation of the existing wells and their associated pipeline, underground power cable, well control house, and road access in this FEIS. These wells supply a substantial amount of the Village of Ruidoso's municipal water system. They provide, on average, a direct contribution to the Village of Ruidoso water supply ranging from 24 to 29 percent. When indirect annual contributions are added to direct contributions (based on factoring in diversions from return flow credits, described in more detail in chapter 1 and in chapter 3), this increases to 36 to 43 percent. During the summer months, data show that 57 to 87 percent of total direct and indirect annual diversions can be attributable to the North Fork wells). There is a need for: (1) authorizing, under a special use permit, the Village of Ruidoso's ability to access and divert groundwater from its North Fork wells on National Forest System land, as a substantial component of the municipal water supply system) that Ruidoso residents and visitors rely upon; and (2) protecting natural resources on National Forest System lands by maintaining adequate surface and groundwater flows to sustain or improve riparian and aquatic ecosystems that may be affected by groundwater drawdown from pumping of these wells.

We published a Notice of Intent to prepare an environmental impact statement in the Federal Register on February 3, 2011, initiating the public scoping period for this project. We held a public meeting on February 17, 2011, in Ruidoso to answer questions from the public and discuss the project and process. We received a total of 102 comment letters from the public—including agencies, organizations, individuals, and elected officials—in response to our request for input. We analyzed all

of these scoping comments to identify the issues and information that have been analyzed in this EIS (appendix A). Based on public and internal scoping results, we identified five significant issues. These significant issues include effects of well pumping on water resources, aquatic habitat and fish, riparian vegetation, water rights, and socioeconomics. These issues were used to develop alternatives to alternative 3 (identified in the DEIS and the SDEIS as the proposed action) including:

- **No Change (Continue Current Management) Alternative**: The USDA Forest Service would issue a new permit with no change in existing well pumping operations. Pumping would continue at historic levels, in accordance with the Village of Ruidoso's water rights. The new permit would be issued with similar terms, conditions, and history of water use that has been in operation since 1988.
- **No Action (No Pumping) Alternative**: The USDA Forest Service would not issue a new permit for the Village of Ruidoso's North Fork well operations and maintenance; the use of these wells would not be authorized and would be discontinued.

We released the DEIS for public comment on May 25, 2012. The Little Bear Fire started on June 4, 2012 and encompassed approximately 99 percent of the project area. Because of the substantial impact this wildfire had on the project area and resources analyzed in the DEIS, we stopped the comment period on the DEIS and prepared a supplemental information report to document the extent of the changed conditions and the need for a supplemental DEIS. A Notice of Intent to prepare a supplemental DEIS was published in the Federal Register on July 20, 2012. We received 19 comments between June and September 2012 (email, letters, or phone calls) that were either related to the content of the DEIS prior to suspension of the comment period or on our request for information on changed conditions due to the Little Bear Fire (appendix C).

We incorporated much of the May 2012 DEIS into the SDEIS, with changes made necessary by the effects of the Little Bear Fire. We used information from:

- public comments we received on the DEIS before we suspended the comment period;
- multiple interdisciplinary team discussions;
- discussion and coordination with project stakeholders (Village of Ruidoso, Eagle Creek Conservation Association, and the U.S. Geological Survey);
- literature review; and
- amended resource analyses of the post-fire project area.

We released the SDEIS for public comment on November 14, 2014, and received 23 responses during the 75-day public comment period. We prepared this Final EIS based on public and other agency comments received during the SDEIS comment period and additional interdisciplinary team input (see appendix E). It includes the identification of our preferred alternative (alternative 1 – continuation of pumping at historic levels). It incorporates corrections and changes suggested by the public (as summarized at the beginning of chapter 1 and in appendix E) and the project interdisciplinary team. The result is a balance between providing municipal water to the Village of Ruidoso and protecting natural resources.

Based upon effects of the alternatives, the Lincoln National Forest Supervisor must decide whether to issue a new permit to re-authorize the Village of Ruidoso's North Fork well operations on National Forest System lands, and if so, under what permit terms and conditions, including adaptive management requirements.

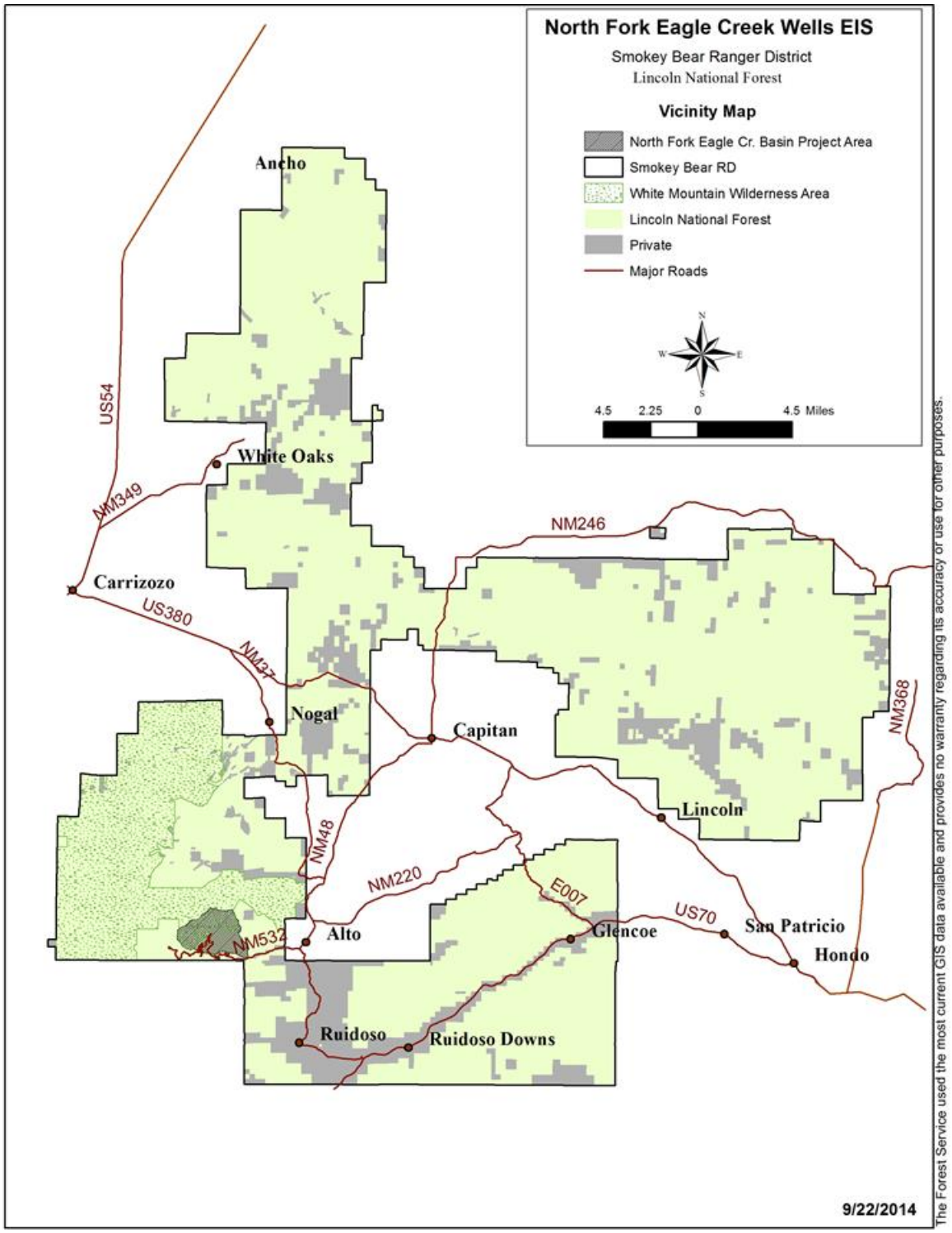
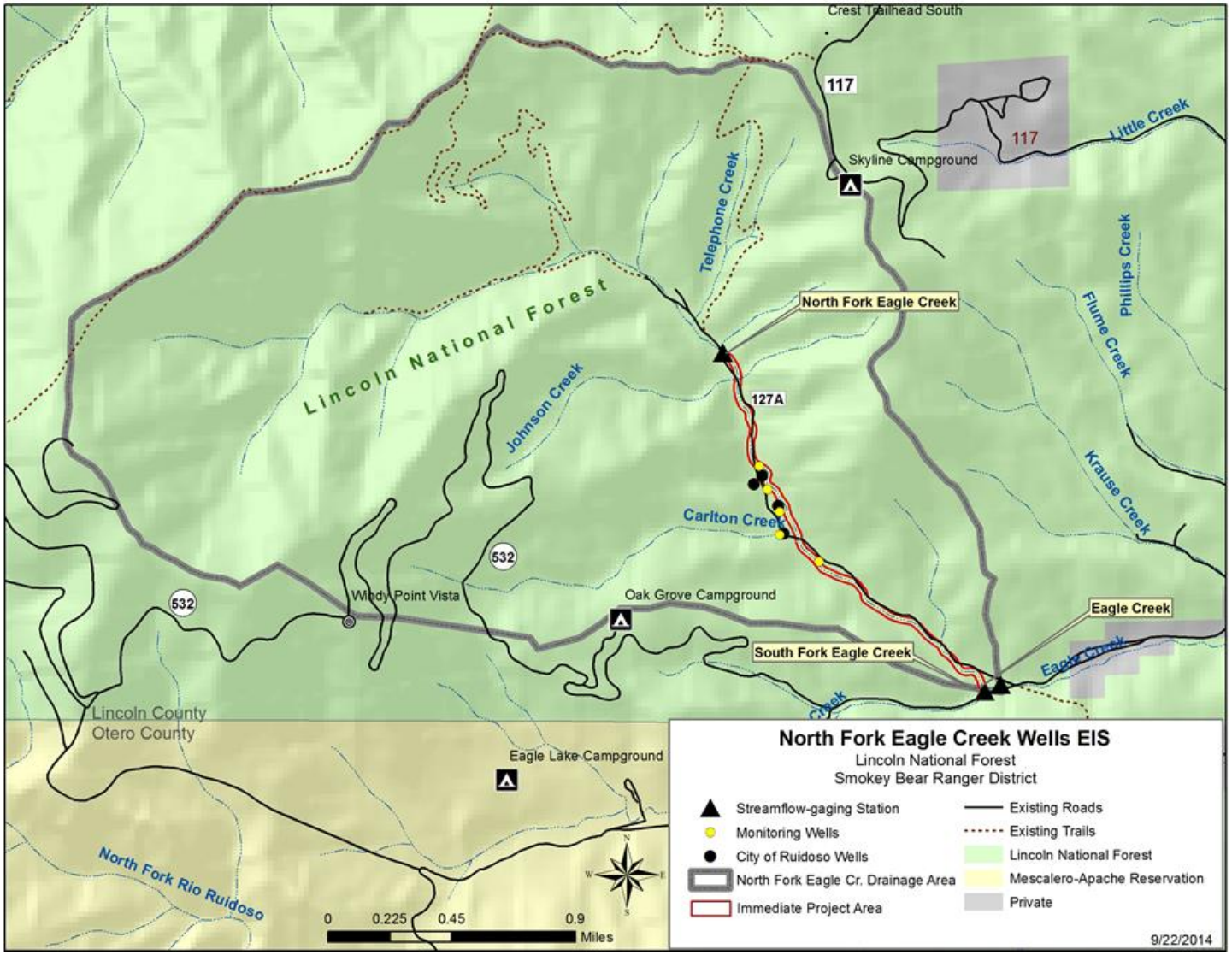


Figure 1. Project vicinity



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Chapter 1. Purpose of and Need for Action

We (the USDA Forest Service, Lincoln National Forest) propose to authorize, under a new special use permit, the operation of four municipal supply water wells located on National Forest System land in the North Fork Eagle Creek (or North Fork) drainage. The new permit would be authorized for up to 20 years, with stipulations for frequent review and verification of the permit terms and conditions. These could occur as often as every year but would occur at least every 5 to 10 years. The new permit would add terms and conditions to the permit reflecting monitoring and mitigation measures; responding to the purpose and need for action, and minimizing potential adverse impacts to surface water and groundwater resources from well operations.

Background

The Village of Ruidoso drilled four production wells on National Forest System land along the North Fork of Eagle Creek. Three of these wells were put into service in 1988 and remain in use. The permit for the operation of these wells expired on December 31, 1995. Between 1996 and 2005, the Forest Service began discussions with the Office of the State Engineer, the Village of Ruidoso, and the Eagle Creek Conservation Association concerning permit renewal. Since 2005, well operations have continued under annual operating plans while the environmental analysis and decisionmaking process for issuing a new permit is being conducted.

Urban and resort development and drought conditions have placed increasing demands on surface water and groundwater resources within the Eagle Creek basin. These wells supply a substantial amount of the Village of Ruidoso's municipal water system. They provide, on average, a direct contribution to the Village of Ruidoso water supply ranging from 24 to 29 percent. When indirect annual contributions are added to direct contributions (based on factoring in diversions from return flow credits, described in more detail in the next section and in chapter 3), this increases to 36 to 43 percent. During the summer months, data show that 57 to 87 percent of total direct and indirect annual diversions can be attributable to the North Fork wells.

The U.S. Geological Survey conducted an independent study from 2007 to 2009 to determine potential effects of the North Fork Eagle Creek well field on streamflow in the Eagle Creek basin and to provide data for this FEIS. The final report was released on October 21, 2010, and subsequently revised in November 2010 and November 2011 (Matherne, Myers and McCoy 2011). Findings show that:

- North Fork Eagle Creek is a perennial stream maintained by base flow from groundwater in its upper reaches and becomes intermittent in the 2 miles upstream from the Eagle Creek gage (figure 26, page 55 in Matherne, Myers and McCoy 2011); see figure 2 on the previous page. Without pumping, North Fork Eagle Creek would still be intermittent below the wells. About 1,600 feet downstream of the North Fork stream gage the creek's water sinks into the stream channel alluvium and bedrock aquifer, so this reach remains dry during dry periods, although water resurfaces from the alluvium in some downstream reaches (stretches ranging from 10 to 50 feet long). Streamflow, when present, tends to occur in reaches where there are bedrock outcrops in the channel or the alluvium is thin. There are three gaging stations; one each for the South Fork, North Fork, and Eagle Creek.
- When groundwater is pumped from the North Fork wells, a temporary decline in the water table results and creates a cone of depression around the wells.

- Pumping and streamflow are related, and pumping near a stream (generally) will cause streamflow depletion. However, the degree of connection and the nature of groundwater flow paths is complex in this area and have not been fully characterized.
- During the U.S. Geological Survey study period there was less available sustained base flow than there was before the wells began pumping in 1988. Annual discharge, direct runoff, and base flow were lower during the study period (2007–2009) than before 1988 (1969–1980). Although years of below average precipitation were recorded during both time periods, there were no days of zero flow recorded at the Eagle Creek gage from 1969–1980. No-flow days were recorded in 11 years (totaling 789 days) of the 20 years analyzed after 1988, with 8 of the last 10 years having no-flow days. No-flow days occurred during periods of both below and above average precipitation during the study period but no-flow days did not occur during periods of below average precipitation before 1988. It is important to note that the Eagle Creek gage measures flow from both North Fork and South Fork, and that the Eagle Creek gage used to be (1969–1980) at a different location further downstream along Eagle Creek. The exact position of this prior location is not known with certainty (this is described in more detail in the water resources section of chapter 3).
- Average annual groundwater recharge was estimated to average 490 acre-feet, or about 4 percent of precipitation (1970–1980). Groundwater flow out of the basin (552 acre-feet) was estimated to represent about 16 percent of basin yield (1970–1980), and mean annual groundwater pumping (578 acre-feet for 1988–2000) was estimated to be about 17 percent of basin yield.
- The streambed has a capacity to transmit water at a threshold rate of about 0.7–1 cubic feet per second. The amount of water needed to saturate the alluvium to the bottom of the stream channel at its greatest cross-sectional area between the North Fork and Eagle Creek gages was estimated using Darcy's law to range from 0.6 to 1.2 cubic feet per second. Sustained flows greater than 2.2 cubic feet per second (threshold rate of 1.0 cubic feet per second loss to bedrock plus 1.2 cubic feet per second) are needed to both saturate the alluvium and maintain continuous flow in the North Fork. From September 2007 through March 2009, 2.2 cubic feet per second of discharge was equaled or exceeded at the North Fork gaging station 2 percent of the time. During the study period, a discharge of 1.2 cubic feet per second was equaled or exceeded at the North Fork gaging station 8 percent of the time.

These results are consistent with other studies conducted in this area. For instance, Balleau (2004) used the Glover-Balmer (1954) approximation to estimate streamflow loss caused by pumping of the North Fork wells at Eagle Creek of between 0.5 and 0.8 cubic feet per second. Finch et al. (2004) determined by a mass balance analysis of the Balleau groundwater model that about 70 percent of the water pumped by the North Fork wells was derived from surface water and 30 percent from groundwater storage.

If the cone of depression continues to expand, it could impact water-dependent resources outside the stream corridor. This situation is exacerbated by the location of the wells within the stream channel, together with the low storage capacity of the aquifer.

The June 2012 Little Bear Fire, started by lightning, burned approximately 35,300 acres within the Smokey Bear Ranger District. It affected the North Fork Eagle Creek drainage area where it burned approximately 3,380 acres of the 3,400-acre project area (or 99 percent). It burned with a mix of severities as follows:

- 26 percent high burn severity
- 26 percent moderate burn severity
- 27 percent low burn severity
- 21 percent unburned or very low severity

Wildfire is widely acknowledged to be a major watershed disturbance, which potentially creates substantial changes in watershed dynamics and water balance factors. These changes are often more pronounced when these extensive, severe fires occur in coniferous mountain watersheds such as the Eagle Creek headwaters. As summarized in the following "Existing Condition" description and described in more detail in the "Water Resources" section of chapter 3, several hydrological aspects of the North Fork Eagle Creek watershed have been changed or are expected to change over time because of the Little Bear Fire.

Water Rights

As described in more detail in chapter 3, the Village of Ruidoso (the applicant; the entity that is applying for a special use permit) owns water rights in Eagle Creek basin. The applicant was originally adjudicated a total of 5,648 acre-feet per annum from the North Fork wells subject to beneficial use. In June 2007, the Village of Ruidoso filed Proof of Beneficial Use with the State Engineer which was used as a basis for a 2010 consent order adjudicating a total of 2,539.34 acre-feet per annum with an additional 846.46 acre-feet per annum subject to beneficial use to be filed on or before December 31, 2024. The 2010 Consent Order also adjudicated the North Fork wells authorizing supplemental well diversion up to 761.12 acre-feet per annum for the Village of Ruidoso surface water rights on Eagle Creek.

The Village of Ruidoso and Rio Hondo Land and Cattle Company, L.L.P., entered into a memorandum of agreement on July 26, 2011, regarding Village of Ruidoso water rights in the Eagle Creek basin. To our knowledge as of April 2015, this agreement between the two parties has not been acknowledged by the Office of the State Engineer. If an updated consent order from the Office of the State Engineer including this agreement is issued, we will recognize the updated consent order as the most current description of the Village of Ruidoso's water rights. Until that time, we will use the 2009 final adjudication as the Village of Ruidoso's water rights in the North Fork Eagle Creek. More details regarding this memorandum are included in the "Water Rights" section of chapter 3. The alternatives presented in this document for analysis would not be affected by implementing this memorandum of agreement.

On October 23, 2014, the Office of the State Engineer issued a permit to the Village of Ruidoso allowing the transfer of 700.83 acre-feet per year from the one of the North Fork Eagle Creek wells (H-1979) to the surface point of diversion at Eagle Creek and Alto Lake. The permit severed the adjudicated rights to this H-1979 NFEC well. However, the Village of Ruidoso's municipal rights pertaining to proof of beneficial use, in the amount of 350.42 acre feet per year, remain provable at the H-1979 NFEC well (for more details, see the water rights section of chapter 3). Because the proof of beneficial use amount of 350.42 remains with H-1979 and has to be pumped to be proven as a water right, this will allow the Village of Ruidoso's future pumping levels to remain comparable to the historical pumping averages at around 740 acre-feet per year.

In New Mexico, the Office of New Mexico State Engineer has authority to administer water rights, even on Federal land, except for Federal reserved water rights. The Forest Service has authority to allow or deny use of National Forest System lands and to determine what is reasonable access (e.g. conditions of use of National Forest System land).

Changes between the Supplemental Draft EIS and the Final EIS

In response to public comment (described in detail in appendix E) and continued interdisciplinary team input, we have made some changes to this FEIS. Changes include:

- Additions to the Public Involvement section in chapter 1 to reflect the public comment period on the SDEIS;
- Revisions to the water resources section of chapter 3 to address public comments, including the addition of some new figures;
- Minor revisions to the aquatic habitat section of chapter 3 to address concerns regarding fishing creel data;
- Revisions to the socioeconomic section of chapter 3 to reflect the addition of cost information;
- Minor revisions to the riparian section of chapter 3 to ensure consistency with changes made to the water resources section;
- Minor revisions to the water rights section of chapter 3 to reflect new information regarding water rights transfers in the project area;
- Additions to the Alternatives Considered but Dismissed from detailed analysis section of chapter 2;
- Minor adjustments to mitigation measures and monitoring for the alternatives analyzed in detail in chapter 2;
- Clarifications to analysis and conclusions sections to identify alternative 2 (no pumping) as the baseline condition against which impacts of the action alternatives are compared;
- Addition of appendix E to summarize public comments received on the SDEIS and the Forest Service response;
- Identification of alternative 1 (no change; continue pumping at historic levels) as the preferred alternative.

Purpose and Need for Action

The USDA Forest Service's purpose of taking action at this time is to respond to a request by the Village of Ruidoso for authorization to access their existing wells on National Forest System lands.

There is also an equal need to provide for protection of forest resources on National Forest System lands in the project area.

To develop the purpose and need, we compared desired conditions to existing conditions.

Desired Condition

We developed the following desired condition description based on a review of the 1986 "Lincoln National Forest Land and Resource Management Plan," as amended (forest plan); applicable USDA Forest Service management direction in laws, regulations, Forest Service Manual and Handbooks (summarized later in this chapter under "Management Direction"); studies and reports pertinent to the project area; and input from USDA Forest Service personnel and stakeholders. We also considered the changes in condition in the project area due to the Little Bear Fire.

Adequate surface flows between the North Fork gage and the Eagle Creek gage are maintained in order to provide streamflow (consistent with an intermittent stream). North Fork and South Fork tributaries provide streamflow to the Eagle Creek gage, measured either at the gage and/or measured at associated monitoring wells, during dry periods, and no-flow days average 20–30 days or less per year, or their equivalent measured at associated monitoring wells, roughly half of the average number of no-flow days experienced between 1989 and 2011.

Groundwater discharge sustains base flows in North Fork Eagle Creek and is a source of water for springs and seeps and water-dependent ecosystems. Riparian habitat along North Fork Eagle Creek is present and provides ecological diversity and wildlife habitat and functions to aid in restoration of watershed conditions affected by the Little Bear Fire. Water quality in North Fork Eagle Creek is maintained, recognizing that short-term adverse impacts due to the Little Bear Fire are likely, but that these effects will diminish over the long-term.

North Fork Eagle Creek provides streamside recreation and wildlife viewing. The thresholds for average or median water table depth annually or seasonally (based on monitoring) is maintained.

The Village of Ruidoso's North Fork wells are authorized under an existing special use permit and provide an important source of water to the Village of Ruidoso; these wells provide water to the Village of Ruidoso, but with a focus on water conservation, management flexibility, and seeking opportunities for transferring water rights to locations off of National Forest System land.

Existing Condition

We developed the following existing condition description based on the best available information at the time of this writing regarding conditions and uses along North Fork Eagle Creek. Information used is listed in the references section later in this document, included in the project record, and discussed in more detail in each resource section of chapter 3.

North Fork Eagle Creek is a perennial stream maintained by base flow from groundwater in its upper reaches (above the North Fork gage) and an intermittent stream below the North Fork gage for approximately 2 miles downstream to the Eagle Creek gage. Streamflow below the wells, when present, occurs in reaches where bedrock outcrops into the channel or where bed load (sand and gravel) deposits are thinner. North Fork Eagle Creek has less available sustained base flow than it did before the wells began pumping in 1988. Annual discharge, direct runoff, and base flow were lower during the U.S. Geological Survey study period (2007–2009) than before 1988 (1969–1980). No-flow days average approximately 46 days per year (1988–2011).

Several hydrological aspects of North Fork Eagle Creek watershed have been changed or are expected to change because of the Little Bear Fire, as described in more detail in chapter 3 and in the Water Resources Report in the project record (AECOM 2015). These include:

- Changes in upland vegetation and reduced canopy interception, which can modify moisture availability, lead to greater runoff from storms and snowmelt, and temporarily increase surface water yield.
- Reduced storage of water in litter which can increase overland water flow.

- Reduced transpiration which can increase soil moisture, increase streamflow and possibly increase recharge from large monsoonal events.
- Reduced infiltration which can increase overland flow and erosion.
- Changed surface streamflow resulting in temporary increases in ‘flashy’ responses to rainfall and rapid snowmelt, seasonal changes in snowmelt and altered water quality.
- Reduced infiltration and recharge resulting in short-term decreases in baseflow. Over the long-term, there could be a return to pre-burn baseflow conditions, or increased baseflow due to tree and shrub densities, reduced evapotranspiration and monsoonal recharge.
- Increased stormflow and sediment/debris yields resulting from greater peak flow rates, greater volumes of sediment and debris, greater flash flood frequency, increased erosive power, and modified channel conditions.
- Increased snow accumulation (due to reduced canopy cover), which can be offset by increased or accelerated evaporation, sublimation, and melt.
- Vegetation within the project area riparian corridor consists primarily of ponderosa pine and boxelder in the overstory and grass in the understory. Obligate wetland species are generally not supported by this stream based on the results of surveys conducted in 2010–2011; willows and sedges were only occasionally observed. North Fork Eagle Creek provides streamside recreation and wildlife viewing.

As described in more detail in chapter 3 and in the “Riparian Vegetation Report” in the project record (Miller 2015), the Little Bear Fire affected vegetation in the project area, including the riparian corridor (200 feet on either side of North Fork Eagle Creek). However, the wildfire burned primarily at or below low intensity in this corridor; only 1 acre (or less than 1 percent) burned at moderate intensity and there was no high intensity fire. There was little loss of vegetation in the riparian corridor due to the wildfire but some areas showed signs of sediment flow where vegetation was covered in sediment, bank scouring and deep cobble deposits near the confluence of the North Fork and South Fork of Eagle Creek.

The Village of Ruidoso’s North Fork wells provide an important source of water to the municipal water supply system, but are currently operating under an expired special use permit. Estimates of their contribution to the municipal water supply varies (as described in more detail in the “Socioeconomics” section of chapter 3), but when both direct and indirect contributions are factored in, they supply up to an average of 43 percent annually and up to 87 percent during the summer months (Wilson and Company 2005; AECOM 2012 and 2015; Hennighausen and Olsen 2012 and Atkins Engineering Associates, Inc. 2014).

The Village of Ruidoso’s methods for managing water supplied by the North Fork Eagle Creek wells were affected by the Little Bear Fire, in combination with continued drought conditions. This is described in an updated summary of “water rights, return flow and conditions resulting from the Little Bear Fire and drought” prepared by Atkins Engineering Associates (2014). Due to the wildfire, the Village of Ruidoso lost their ability to use Eagle Creek surface water because of poor water quality and debris flows. Groundwater availability was also reduced due to damage to aquifer recharge. Since the 2012 Little Bear Fire, the Village of Ruidoso has been diverting more surface and groundwater from the Rio Ruidoso to meet the demand for municipal water. Water storage in Grindstone Reservoir by diversion from the Rio Ruidoso has declined to historic lows. The Village of Ruidoso anticipates the effects of the wildfire on water quality and aquifer recharge in Eagle Creek will stabilize over a period of years so that resumption of their normal operations would be possible in the future.

Need for Action

Using the model Desired Condition – Existing Condition = Need for Change, there is a need for:

- Authorizing, under a special use permit, the Village of Ruidoso's ability to access and divert groundwater from its North Fork wells on National Forest System land, as a substantial component of the Ruidoso municipal water supply system that residents and visitors rely upon; and
- Protecting natural resources on the national forest by maintaining adequate surface and groundwater flows to sustain or improve riparian and aquatic ecosystems that may be affected by groundwater drawdown from pumping these wells.

Management Objectives

We are responding to the Village of Ruidoso's application for a new permit to access their wells on National Forest System land as required by law, regulation and policy. The above needs and the following management objectives will be used to guide implementation of this project.

- Recognizing the importance of the well field to municipal water supply by providing water to the Village of Ruidoso while also encouraging water conservation, management flexibility, and opportunities for transferring water rights to locations off of National Forest System land; and
- Minimizing impacts of groundwater drawdown from well field pumping by maintaining adequate surface and groundwater flows and protecting water dependent ecosystems.

The Little Bear Fire has affected watershed conditions in the project area and is likely to result in altered conditions in both the short- and long-term as described in more detail in chapter 3. We recognize the importance of watershed stabilization post-Little Bear Fire and the importance of adequate surface and groundwater, and upland and riparian vegetation in this stabilization.

This need for action and these management objectives are consistent with USDA Forest Service policy and direction, as described in more detail in the "Consistency with Management Direction" section later in this chapter. In summary, the Lincoln National Forest is to be managed to provide a favorable flow of water for users by maintaining watersheds in satisfactory condition. Standards and guidelines in the forest plan include that riparian areas and fish habitat are to be maintained and enhanced and existing water rights are to be maintained and protected. Forest Service Manual and Handbook direction also applies to special use authorizations and water uses and development and requires that 'thoughtful and prudent' management be applied to groundwater beneath National Forest System lands as a valuable resource.

Preferred Alternative

To begin moving the project area toward desired conditions and to address the purpose and need for action and management objectives, we propose to authorize, under a new special use permit:

- operation of four municipal supply water wells (three equipped and one unequipped) and associated monitoring wells;
- well house control station;
- underground pipelines and power lines; and
- road access located in the North Fork Eagle Creek drainage on National Forest System land.

The new permit would be authorized for up to 20 years, with stipulations for frequent reviews and verification of the permit terms and conditions. These could occur as often as every year but would

occur at least every 5 to 10 years. The new permit would include an operating plan with new requirements reflecting additional monitoring and mitigation measures; responding to the purpose and need for action, and minimizing potential adverse impacts to surface water and groundwater resources from well operations.

The preferred alternative; once finalized in a Record of Decision and included in the operating plan, which is part of the special use permit; would require the Village of Ruidoso to implement and pay for any identified monitoring of groundwater and surface water resources,. Cost estimates for the alternatives are included in the socioeconomics section of chapter 3. The USDA Forest Service, with assistance from the U.S. Geological Survey, if possible, may also assist with certain aspects as mutually agreed upon by all parties.

Decision Framework

The Lincoln National Forest Supervisor must decide whether to issue a new permit to re-authorize the Village of Ruidoso's North Fork well operations on National Forest System lands, and if so, under what terms and conditions, including adaptive management requirements.

Public Involvement

We released the "North Fork Project Notice of Intent to Prepare an EIS and Proposed Action" on February 3, 2011, for a 45-day scoping period. We continue to accept comments throughout the process. We mailed a scoping letter with a detailed purpose and need and proposed action description to 174 stakeholders including private landowners, agencies, organizations, and tribes. We also posted information on the Lincoln National Forest web site and published a news release in the Ruidoso News on February 15, 2011. We held a public open house at the Ruidoso Middle School on February 17, 2011, to provide project information and answer questions. As of January 2012, we received a total of 102 comment letters from you, the public—including agencies, organizations, individuals, and elected officials—in response to our request for input. Appendix A displays all those who provided comments prior to January 2012 and the completion of the DEIS, the consolidation of all these comments, and how these comments were addressed in the DEIS.

We released the North Fork Eagle Creek Wells Special Use Authorization Project Draft Environmental Impact Statement (DEIS) on May 25, 2012. The notification of its availability for public comment was published in the Federal Register, a legal notice was published in the Ruidoso News, and email and letter notifications were distributed to all those on the project mailing list. We requested comments by July 9, 2012. We received several requests for extensions to the comment period and Lincoln National Forest Supervisor Trujillo granted an additional 60-day extension, requesting all comments be submitted no later than September 9, 2012.

The Little Bear Fire started on June 4, 2012. Because of the substantial impact this wildfire had on the project area analyzed in the DEIS, Lincoln National Forest Supervisor Trujillo decided to stop the comment period on the DEIS and begin the process to prepare a supplemental DEIS that would address the changed conditions in the project area. This was published in the Federal Register on July 20, 2012. While we discontinued the formal comment period on the DEIS, we did invite any comments on the changed conditions in the project area by September 7, 2012. We also received comments on initial drafts of chapters 1 and 2 of the DEIS from stakeholders and these comments were also considered in development of this document. Appendix C includes a summary of the comments that were received and how they were used in preparation of the SDEIS.

We released the SDEIS on November 14, 2014. We published notices that it was available for public comment in the Federal Register, and as a legal notice in the Ruidoso News; and in email and letter notifications to all those on the project mailing list. We requested comments within a 45 day period. We received several requests for extensions to the comment period and Forest Supervisor Moseley granted two additional 15-day extensions, requesting all comments be submitted no later than January 28, 2015. We received 23 responses during the 75-day public comment period for the SDEIS.

We prepared this Final EIS based on public and other agency comments received during the Supplemental Draft EIS comment period and additional interdisciplinary team input. It includes the identification of our preferred alternative (alternative 1 – continuation of pumping at historic levels). Some changes have been made as a result of additional discussion among the project interdisciplinary team to achieve a balance between providing municipal water to the Village of Ruidoso and protecting natural resources. The Final EIS also incorporates suggested corrections and changes in response to public comments. The changes are summarized at the beginning of chapter 1 and our response to public comments is detailed in appendix E.

Significant Issues

Based on the content analysis process, we have identified five significant issues for the North Fork project. We used the significant issue measurement indicators described below to identify and compare differences in effects among alternatives in chapter 3. Where necessary, we updated these for the SDEIS to reflect changed conditions due to the Little Bear Fire.

Water Resources

Well pumping changes the dynamics of groundwater (groundwater drawdown and water table) and surface water (streamflows, wetlands, springs, and seeps). Surface water and groundwater availability are linked and limited by accessible available quantities of water. Water resources over time can also be affected by climate change.

Measurement Indicators

Well pumping may affect the quantity and quality of streamflow, groundwater, wetlands, springs, and seeps. Effects of climate change may affect well pumping alternatives over time. Alternatives will be compared using the following indicators:

- **Streamflow Quantity**: Compare estimated durations of no surface flow conditions anticipated to occur at the Eagle Creek gage during a year of average precipitation. No-flow conditions are defined as anything less than 0.01 cubic feet per second in the stream at the gage.
- **Streamflow Quantity**: Compare estimated occurrence of flows equal to or greater than 1.2 cubic feet per second at the Eagle Creek gage during a year of average precipitation. This flow value is a selected benchmark simply used for impact comparisons. Other larger or smaller rates could have been selected as a comparison metric (e.g., 1.0 cubic feet per second), but the 1.2 value lies between the 50 percent exceedance flows for the pre-pumping (1.6) and post-pumping periods (1.1) at the Eagle Creek confluence gage. In addition, for the pre-pumping period 1970 through 1980 (full measurement years) at that gage, the average annual baseflow was calculated to be 1.13 cubic feet per second, and the median was 1.19 cubic feet per second, based on table 4 of the USGS report (Matherne, et. al. 2011). This comparative metric for potential impacts is not used as an adaptive management trigger under Alternative 3.

- **Springs and Seeps**: Identify springs and seeps that may be affected by pumping as those within the projected drawdown (see figure 12 and figure 13 in chapter 3). (For impact assessment purposes, it is assumed that these features are connected to the more general basin groundwater system. Actual conditions may differ.
- **Domestic Wells**: Identify domestic wells that may be affected by pumping as those within the projected drawdown (see figure 12 and figure 13 in chapter 3).
- **Success of the Alternatives Over Time Considering Climate Change**: This indicator involves a qualitative analysis without significance determination, based on a general review of the indicators above under possible climate change effects. Potential effects on water resources from climate changes may include reduced basin yield and recharge from changes in rainfall, reduced snowpack accumulation, evapotranspiration, more frequent early season snowmelt, and reduced seasonal peak flows and/or shorter flow durations.

Aquatic Habitat and Fish

Well pumping results in changes in the water table which may affect streamflow to varying degrees. Lowering streamflow may increase temperatures and temperature related fish mortality. Quantity, quality, and waterflow availability that mirrors natural flow patterns are important for aquatic habitat and fish. Suitable water quality and temperatures, which are partially based on water depth and channel conditions, are necessary to support fish populations. Sufficient water supplies must also be available during summer months to provide water temperatures needed for survival of aquatic species.

Measurement Indicators

Well pumping may affect the quantity and quality of aquatic habitat; including temperature, (salmonids require summer water temperatures at or below 68 degrees Fahrenheit), and waterflow availability and seasonality (seasonal and year-long flows compared to expected flows without pumping). Alternatives will be compared using the water resource streamflow quantity indicator. While water quality, particularly related to temperature, is important for assessing impacts to fish, the former streamflow quality indicator that was used in the 2012 DEIS as part of the water resources analysis has been removed. This is because this indicator is not likely to apply either to short-term or long-term post-wildfire conditions, since the North Fork Eagle Creek channel will transport and re-work sediment and debris for a considerable number of years. This is described in more detail in the Water Resources Report (AECOM 2015). However, water quality will be used in a general sense to compare the alternatives in chapter 3 qualitatively.

Riparian Vegetation

Well pumping results in changes in the water table which may affect streamflow to varying degrees. These water quantity changes could indirectly affect quantity and quality of riparian vegetation along the stream corridor.

Measurement Indicators

Well pumping may affect riparian vegetation canopy cover, species composition, and overall riparian condition. Alternatives will be compared using the following indicators:

- **Canopy Cover**: Predicted qualitative shifts in canopy cover for trees over time, based on implementing each alternative.
- **Species Composition**: Predicted qualitative shifts in plant communities over time, based on implementing each alternative.

Socioeconomics

Effects on water available for diversion have potential to affect local social and economic conditions. Well pumping may result in changes in groundwater and surface water availability. Limiting access to groundwater pumping has potential to alter municipal water supply, affect streamside recreational use (public use of streams for streamside recreation, fishing, and wildlife viewing), and affect private land (availability of water for domestic wells).

Measurement Indicators

Well pumping may affect municipal and private land water available for diversion based on information presented in the water resources specialist report. Well pumping may also affect streamside recreational use based on potential effects to surface water used for recreation. Alternatives will be compared using the following indicators:

- **Municipal Water Supply**: Estimates of potential forgone water diversion from groundwater withdrawal limitations are used to measure the potential for change to historic North Fork well diversion. Effects of groundwater withdrawal limitations will be examined on historic North Fork well diversion (average annual), diversion for Alto Creek and Grindstone Reservoirs (average annual) and projected demands from the 40-year water plan. In addition, effects of groundwater withdrawal limitations will be examined on historic North Fork well diversion during the 5-month summer resort period (high demand on water use) from May to September.
- Av**ailability of Domestic Well Water and Water for Irrigation (private land water supply)**: Availability of domestic well water indicators will be used to measure potential for change to private land water supply using an estimate of water drawdown similar to the springs and seeps (as described in the “Water Resources” section earlier in this chapter).
- **Streamside Recreational Use:** Streamside recreational use indicators will be used to measure potential for change to quality of recreation experience from streamflow quantity, streamflow quality, and riparian vegetation associated with springs and seeps (as described in the “Water Resources” section earlier in this chapter).
- **Financial Efficiency:** A method called present net value will be used to estimate overall cost of alternative implementation, including identified monitoring measures.
- **Values, Beliefs and Attitudes**: Where economic or other effects on area communities cannot be quantified, a qualitative discussion of nonmarket and social values will be used. Accordingly, values, beliefs, and attitudes of area communities are presented to address social considerations.
- **Environmental Justice**: Executive Order 12898, issued in 1994, orders federal agencies to identify and address environmental justice effects, which are any adverse human health and environmental effects of agency programs that disproportionately impact minority and low income populations.

Water Rights

Well pumping results in changes in dynamics of groundwater and surface water. Surface water and groundwater availability are linked and are limited not only by accessible available quantities of water, but also by available water rights. Limiting access to groundwater pumping has potential to alter municipal water supply and affect beneficial use of the Village of Ruidoso’s total adjudicated water rights.

Measurement Indicators

Well pumping may affect available water rights and beneficial use of the Village of Ruidoso's total adjudicated water rights. Alternatives will be compared using the following indicator:

- Beneficial use of Village of Ruidoso's adjudicated water rights.

Nonsignificant Issues

Nonsignificant issues are sometimes important for understanding the full context of alternatives. Mitigation measures are generally used to mitigate these types of concerns which we will discuss in chapter 2. Unlike significant issues, these nonsignificant issues are not usually subject to detailed analysis, so these will be addressed more briefly in chapter 1 or chapter 3 of the FEIS. We have identified the following six for the North Fork project:

Soil Quality

There is little potential for measurable effects to soil quality based on implementation of the alternatives. New ground disturbance is not proposed (except under the no pumping alternative); we have identified mitigation measures (chapter 2) that would be used to ensure any potential for effects are minimized. Therefore, soil quality will not be discussed in chapter 3.

Vegetation

Besides riparian vegetation (which is a significant issue), there is some potential for effect to other types of vegetation such as invasive plant occurrence, sensitive plants, and, to a limited extent, upland vegetation. The possible effect of conifer density on water yield in the drainage was also identified during scoping as a concern. This will be discussed briefly in chapter 3.

Wildlife

Besides aquatic habitat and fish (which is a significant issue), other types of wildlife such as federally listed and sensitive species, management indicator species, and migratory birds are discussed in chapter 3; these nonaquatic wildlife species are not significant to this project and are, therefore, only discussed briefly in chapter 3.

Cultural Resources

There is little potential for measurable effects to cultural resources based on implementation of the alternatives; archaeological surveys have been conducted in the project area and there are no known sites within the vicinity of the wells. Only minimal new ground disturbance is proposed under any of the alternatives and the impacts of this disturbance would be adequately minimized by implementation of mitigation measures as described in chapter 2. These measures would require that the forest archaeologist be notified before any ground-disturbing activities to ensure surveys are up to date and no protection measures are needed. Therefore, this project would not affect cultural resources, and cultural resources are not discussed in chapter 3.

Recreation and Scenery

Besides streamside recreational use (which is a significant issue) there are no other types of recreation or visual resources within or near the project area with potential to be affected by proposed actions due to the limited nature of effects from well pumping, as summarized below. Therefore, this project would not affect recreation and scenery and these topics are not discussed in chapter 3.

There are no wild and scenic rivers within or near the project area.

White Mountain Wilderness is approximately 2 miles from the project area upstream from the North Fork gage and would not be affected by implementation of alternatives downstream.

There are no inventoried roadless areas in or near the project area.

There are several streams in the White Mountain Wilderness designated in the State of New Mexico as Outstanding National Resource Waters[1] (New Mexico Environment Department 2011) but these are all upstream from the project area and do not have potential to be affected by proposed actions.

There would be no changes in access (roads and trails) to or within the project area, including access for outfitter/guides or other special use permit holders.

The Eagle Creek Summer Home area occurs upstream of the North Fork Eagle Creek wells. Effects to this area are evaluated as part of domestic water supply under "Water Resources."

North Fork Eagle Creek primarily provides opportunities for dispersed recreation; there are no developed recreation sites along the North Fork Eagle Creek between the North Fork gage and Eagle Creek gage; the nearest developed recreation site is Oak Grove Campground, greater than 1 mile from the North Fork Eagle Creek well field. Dispersed recreation, as defined in the forest plan, is recreation use that occurs outside of developed sites and requires few, if any, facilities other than roads and trails. In the project area, dispersed recreation activities primarily including hiking, backpacking, and camping. The only aspects of dispersed recreation with potential to be affected by the alternatives are streamside recreational use and fishing opportunities. Since these recreation aspects are discussed in other sections of chapter 3 (under "Aquatic Habitat and Fish" and "Socioeconomics"), dispersed recreation is not discussed further.

There are no active livestock grazing allotments in the project area, so grazing will not be addressed in chapter 3 of the FEIS. However, depending on results of the water resources analysis and the possibility of effects to springs and seeps in the larger drainage, there is potential for a cumulative effect. Monitoring measures are identified for springs to determine if any effects are occurring; the likelihood is small as discussed in the "Water Resources" section of chapter 3.

Most of the project area is in the recreation opportunity spectrum class of roaded natural. Changes in pumping levels would not result in any changes to this recreation opportunity spectrum class and is consistent with management direction for Management Area 1I and this recreation opportunity spectrum class. The scenic integrity of project area is classified primarily as high with a high sensitivity level. These recreation and scenery classifications would not be directly or indirectly affected by North Fork Eagle Creek well pumping.

Public Safety and Well Security

Any potential effects to public safety and security of well facilities would be mitigated by following State-regulated safety standards and requirements. The permit would require the Village of Ruidoso to comply with all other laws and regulations, and because it is their responsibility under State lawto ensure safe and secure facilities, public safety and security will not be addressed in chapter 3. Each wellhead is secured and locked. As stated in the description of alternative 1 (preferred alternative, continue pumping at historic levels) and alternative 3 (adaptive management), the Village of Ruidoso

[1] State of New Mexico Outstanding National Resouces Waters possess certain water quality, wildlife habitat, recreational opportunities or ecological attributes, as defined by state standards, which are available at: https://www.env.nm.gov/swqb/ONRW/.

may install security fencing around each well, if needed, and this would be captured in an operating plan that is a component of the permit.

Regulatory Framework and Consistency with Management Direction

Several important laws and policies form the regulatory framework applicable to managing the Lincoln National Forest. These include, but are not limited to, the: Endangered Species Act, National Historic Preservation Act, Clean Water Act, National Environmental Policy Act, National Forest Management Act, and various Executive Orders. Chapter 3 of this document (and in more detail in resource reports in the project record) identifies the regulatory framework that is applicable to each resource analysis.

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders."

The preferred alternative is consistent with applicable management direction in laws, regulations, Forest Service manuals and handbooks, and the forest plan, as described in more detail below. No forest plan amendments are needed for this particular project. The forest plan is incorporated by reference and key sections applicable to this project are summarized below. Best management practices, other additional specific mitigating measures, and adaptive management options have been developed so that forest plan consistency can be assured.

Lincoln National Forest Land and Resource Management Plan (1986, as amended)

The mission of the Lincoln National Forest is to manage resources under multiple use and sustained yield principles in a way that maximizes long-term net public benefits consistent with resource integration, environmental quality, and management considerations (p. 11 of the forest plan).

The forest plan goals for water resource management on the Lincoln National Forest include (pp. 12-13 of the forest plan):

- Provide support to resource management activities with emphasis on maintaining water quality and quantity.
- Secure and provide an adequate supply of water for the protection and management of the forest; contribute to the forest's estimated 123,000 acre-feet per year (acre-feet per year) of water yield (p. 9 and p. 217 of the forest plan).
- Manage for a favorable flow of water for users by improving or maintaining all watersheds to a satisfactory or higher condition (the 2011 Watershed Condition Classification Technical Guide (USDA Forest Service 2011) would be used to determine satisfactory conditions).
- Manage riparian areas to provide optimum vegetation and ecological diversity (the 2011 Watershed Condition Classification Technical Guide (USDA Forest Service 2011) would be used to determine these conditions).

The project area occurs within forest plan management area 1I – Upper Ruidoso. This management area is managed primarily for recreation (p. 78 of the forest plan). There are no specific standards and guidelines for this management area that apply to special use permit authorizations or water resources. The project area is not within lands identified as base-in-exchange, or lands identified by

the Forest Plan for possible exchange out of National Forest System management because other lands may better accomplish desired management objectives.

Standards and guidelines applicable to all management areas (p. 28 of the forest plan) relevant to this project include:

- Protect and enhance riparian habitat.
- Maintain and enhance fish habitat. Avoid causing disturbances to existing habitats.
- Update water rights inventory, maintain and protect existing water rights.
- Limit special use permits to only necessary public utilities on land identified as base-in-exchange.

Agency Direction

The Forest Service is in the process of revising agency-wide groundwater management directives, separate from this project. A draft of these directives was made available for public review and comment on May 6, 2014. However, the proposed groundwater directives were put on hold in December 2014 and formally withdrawn in a June 2015 federal register notice pending further discussions with states and tribes. A new proposal will eventually be published and available for public comment. When approved, these directives will outline agency policy and procedures for groundwater management. They will not however create any new legal authority that the agency does not already possess. Once finalized, we will review them for applicability to this project. In the meantime, we have thoroughly reviewed and considered current agency direction related to groundwater management for this project.

Current Forest Service Manual (FSM) directives for groundwater resource management include:

FSM 2500, Chapter 2530 – Water Resource Management

- Objectives include: (1) produce water of a quality suitable for the beneficial uses identified in the land and resource management planning process (FSM 1920) and (2) ensure safe drinking water subject to public use on national forests, whether the source is a natural or developed water supply (FSM 7420). Where State standards do not exist, observe Environmental Protection Agency (EPA) water quality criteria (FSM 2532.02).
- Include a water quality evaluation for all environmental analyses (FSM 1950). Identify the water quality implications of proposed and alternative land management practices (FSM 2532.03).

FSM 2500, Chapter 2540 – Water Uses and Development –

FSM 2541.04c Region 3 Supplement – National Forest System Water Rights – Forest Supervisors

- Maintain and update annually the forest's water uses, requirements, and rights inventory. Assure that wells and pipelines proposed by the Forest Service are evaluated with the same criteria established below for entities other than the Forest Service. A state water permit is not needed for water use under the reservation doctrine. All other Federal water uses, however, must be in compliance with applicable state law and pursuant to state-based water right or permit. Whether a water right is based on state or Federal law, water development by the Forest Service requires NEPA compliance.

FSM 2541.34 - Water Uses and Development – National Forest System Water Rights - Water Rights and Uses for Other Purposes

- Evaluate projected water requirements of uses of National Forest System lands for purposes such as hotels, power developments, and transmission lines not directly related to Forest Service programs. Assess environmental effects of the use before authorizing the use. If the projected water requirements conflict with existing or potential Forest Service uses and rights or will adversely affect national forest resources, the potential permittee must seek alternative water sources or develop mitigation plans acceptable to the Forest Service.

FSM 2541.35 Region 3 Supplement

- Groundwater beneath National Forest System lands in the region is a valuable resource that requires thoughtful and prudent management. Understanding ground and surface water interactions facilitates the protection of surface water rights. Where surface and groundwater are connected, groundwater discharge sustains base flows in National Forest System streams and is the source of water for springs and seeps. This groundwater discharge may be critical for sustaining aquatic and riparian ecosystems along with the numerous resources and activities dependent upon them. Data describing ground and surface water interactions are valuable information for State agencies to have as they fulfill their responsibilities for the administration of water rights (FSM 2541.35).
- If water supplies in sufficient quantities to meet the applicant's needs are located in existing wells or found through exploration, a detailed plan to determine impacts should be required. This plan will be site specific and designed to identify potential impacts to forest resources and neighboring water supplies, and must be approved by the Forest Service before testing for impacts.
- In considering requests to use water from a known aquifer underlying National Forest System lands, modeling drawdown and resultant impacts may be sufficient provided that there is adequate information available regarding key aquifer parameters such as transmissivity, storativity (capacity), recharge rate, saturated thickness, etc. Modeling shall be conducted using a groundwater flow model approved by the Forest Service in consultation with the appropriate state agencies. In the absence of sufficient information to model impacts, an aquifer test such as long-term pumping of existing and/or exploratory well(s) may be required. The purpose of the test is to evaluate the potential impacts of removing water at production levels from the well(s) under consideration. As testing occurs, there should be simultaneous measurements of water levels and/or pressures in other wells within the vicinity and of flows in adjacent surface waters. Any aquifer test(s) should be conducted during periods of appropriate flows in adjacent surface waters so that impacts can be identified and used to support modeling of drawdown characteristics and/or impacts to surface water resources over time. Chemical characterization may be necessary to further evaluate the potential connection between ground and surface water sources. If the proposal involves the transport of groundwater pumped from nearby non-National Forest System lands across National Forest System lands, the above testing may still be required to evaluate impacts of the groundwater withdrawal (40 CFR § 1508.25 Scope, 40 CFR § 1508.7 Cumulative impact). Note that in the analysis of impacts, the state may play a pivotal role in the determination of impact based on state law and priority dates. For example, the state may find that a negative impact to a junior appropriator is acceptable to meet the needs of a senior water rights holder. In the documentation and decision process, consider the statement in 40 CFR § 1508.14 Human environment: "economic or social effects are not intended by themselves to require preparation of an environmental impact statement" (Sec. 3(b)).

- All monitoring or mitigation measures necessary to ensure protection of forest resources during the construction of water pumping, storage, or transport facilities, and during the long-term removal of groundwater should be included in annual plans of operation attached to and made a part of the permit(s). Mitigation measures such as not pumping during critical times of the year or returning water to streams and springs will be considered only if they have been granted all applicable state authorizations and if forest resources can be protected over a long-term period.
  - The holder would be required to bear the costs of monitoring and mitigation either directly through permit language or indirectly through the use of a collection agreement that funds the Forest Service to accomplish the work.
  - If long-term monitoring detects additional or unforeseen adverse impacts to forest resources, or if mitigation measures do not adequately protect forest resources, the permit shall be suspended or revoked as appropriate (36 CFR § 251.60 (a)(2)(D)). To reverse or prevent a suspension, the holder shall undertake such efforts as are necessary to eliminate adverse impacts (sec. 5).
  - Applicable laws and regulations governing wells and water rights shall be adhered to for all proposals. This includes state requirements for notifications, drilling permits, well abandonment procedures, and water rights; and Federal (for example, Environmental Protection Agency) requirements and recommendations for monitoring wells, construction, sampling, and abandonment.
- In the event that testing, modeling, or monitoring indicates a possibility that appropriable waters are or may be impacted, the Forest Service shall follow the procedures appropriate for the state(s) in which the development is located. If an appropriate state remedy is not available, the Forest Service may seek remedy in any court of jurisdiction. The Forest Service shall not issue a permit for construction or issue/reissue a permit for production unless the applicable state authorization has been granted for the proposed development. In the event that a state withholds authorization for a water development proposed by the Forest Service, the requesting Forest Service official is advised to consult with the Office of General Counsel. Permits issued by the Forest Service for exploration, evaluation, construction, and/or production do not convey a water right to the holder (sec. 6).

FSM and Forest Service Handbook (FSH) directives for special use permitting include:

FSH 2709.11, 52.3 – Special Uses – Standard Forms and Supplemental Clauses

- C-8. Operating Plan. The holder shall provide an operating plan [optional - and revise the plan every (year(s)/month(s)]. The plan shall be prepared in consultation with the authorized officer or designated representative and cover operation and maintenance of facilities, dates or season of operations, and other information required by the authorized officer to manage and evaluate the occupation and/or use of National Forest System lands. The provisions of the operating plan and the annual revisions shall become a part of this authorization and shall be submitted by the holder and approved by the authorized officer or their designated representative(s). This operating plan is hereby made a part of the authorization.

FSM 2716.12 - Special Use Authorizations - Review before Reissuance

- Before approving the issuance of a new special use permit for an established use, an analysis of the conditions of the use shall be made to determine whether changes in permit conditions are needed. Every opportunity should be taken to correct deficiencies and bring older facilities and permit areas up to standard. New requirements must be reasonable and

defensible. To ensure an orderly and planned accomplishment of objectives, a schedule of completion dates shall be made a part of the permit.

- When an existing use is no longer desirable, or when the area is needed for uses of higher priority, the permittee should be given written notice that a request for a new permit will not be approved if the improvements are transferred. This notice will allow the permittee to make the most satisfactory arrangements possible, and is to be given at the earliest possible date.

FSM 2800, Chapter 2880 – Geologic Resources, Hazards and Services

- In analyzing land management activities, consider: (1) location, function, and value of groundwater-dependent resources; (2) value of groundwater-dependent vegetation to provide fish and wildlife habitat, control sediment, and maintain stream temperatures and stream channel stability; (3) groundwater recharge and discharge areas and effluent and influent stream channel conditions; (4) water quality and deposition or buffering of potential water pollutants; (5) fluctuations in groundwater levels, discharge quantities, and timing of flow; and (6) cumulative effects of management activities on groundwater resources (FSM 2881.2).
- The objectives of geologic resources activities are to protect, manage, and improve groundwater and groundwater-dependent ecosystems, recognizing their unique values, while implementing land management activities (FSM 2882.02).
- Manage groundwater dependent ecosystems in relation to legal mandates, including but not limited to those associated with flood plains, wetlands, water quality, dredge and fill material, endangered species, and cultural resources (FSM 2882.03).

Title 36, Code of Federal Regulations, Part 251, Subpart B, Special Uses

Section 251.50 - Scope

- All uses of National Forest System lands, improvements, and resources, except those authorized by the regulations governing sharing use of roads (§212.9); grazing and livestock use (part 222); the sale and disposal of timber and special forest products, such as greens, mushrooms, and medicinal plants (part 223); and minerals (part 228) are designated “special uses.” Before conducting a special use, individuals or entities must submit a proposal to the authorized officer and must obtain a special use authorization from the authorized officer, unless that requirement is waived….

Section 251.51 – Definitions

- Permit—a special use authorization which provides permission, without conveying an interest in land, to occupy and use National Forest System land or facilities for specified purposes, and which is both revocable and terminable.

§251.54 Proposal and application requirements and procedures.

- Pre-application actions—(1) Initial screening. Upon receipt of a request for any proposed use other than for noncommercial group use, the authorized officer shall screen the proposal to ensure that the use meets the following minimum requirements applicable to all special uses: (i) The proposed use is consistent with the laws, regulations, orders, and policies establishing or governing National Forest System lands, with other applicable Federal law, and with applicable State and local health and sanitation laws. (ii) The proposed use is consistent or can be made consistent with standards and guidelines in the applicable forest land and resource management plan prepared under the National Forest Management Act and 36 CFR part 219. (iii) The proposed use will not pose a serious or substantial risk to public health or

safety. (iv) The proposed use will not create an exclusive or perpetual right of use or occupancy. (v) The proposed use will not unreasonably conflict or interfere with administrative use by the Forest Service, other scheduled or authorized existing uses of the National Forest System, or use of adjacent non-National Forest System lands. (vi) The proponent does not have any delinquent debt owed to the Forest Service under terms and conditions of a prior or existing authorization, unless such debt results from a decision on an administrative appeal or from a fee review and the proponent is current with the payment schedule. (vii) The proposed use does not involve gambling or providing of sexually oriented commercial services, even if permitted under State law. (viii) The proposed use does not involve military or paramilitary training or exercises by private organizations or individuals, unless such training or exercises are federally funded. (ix) The proposed use does not involve disposal of solid waste or disposal of radioactive or other hazardous substances.

Section 251.61 Applications for new, changed, or additional uses or area

- Holders shall file a new or amended application for authorization of any new, changed, or additional uses or area, including any changes that involve any activity that has an impact on the environment, other uses, or the public. In approving or denying new, changed, or additional uses or area, the authorized officer shall consider, at a minimum, the findings or recommendations of other affected agencies and whether to revise the terms and conditions of the existing authorization or issue a new authorization. Once approved, any new, changed, or additional uses or area must be reflected in the existing or a new authorization.

Section 251.64 - Renewals

- When a special use authorization provides for renewal, the authorized officer shall renew it where such renewal is authorized by law, if the project or facility is still being used for the purpose(s) previously authorized and is being operated and maintained in accordance with all the provisions of the authorization. In making such renewal, the authorized officer may modify the terms, conditions, and special stipulations to reflect any new requirements imposed by current Federal and state land use plans, laws, regulations or other management decisions. Special uses may be reauthorized upon expiration so long as such use remains consistent with the decision that approved the expiring special use or group of uses. If significant new information or circumstances have developed, appropriate environmental analysis must accompany the decision to reauthorize the special use.
- When a special use authorization does not provide for renewal, it is discretionary with the authorized officer, upon request from the holder and prior to its expiration, whether or not the authorization shall be renewed. A renewal pursuant to this section shall comply with the same provisions contained in the paragraph above.

Chapter 2. Alternatives, Including the Preferred Alternative

Introduction

This chapter describes and compares alternatives considered for the North Fork project, and includes updates made since we released the SDEIS for public comment. It includes a description of each alternative considered in detail, as well as those alternatives that were initially considered but not developed for further analysis. Alternatives considered in detail are compared based on alternative components, measurement indicators, and how well they achieve the purpose and need for action and address the significant issues. A summary table of the environmental effects of each alternative is included at the end of this chapter.

Alternatives Analyzed in Detail

The USDA Forest Service developed three alternatives for detailed analysis, considering public comments, USDA Forest Service direction, internal scoping, and changed conditions resulting from the Little Bear Fire. These include a 'no change' alternative that would continue pumping at historic levels with no change in current management, a 'no action' alternative that would discontinue pumping, and the adaptive management alternative. The no action alternative sets the baseline against which the effects of pumping are compared. A no action alternative is required in an EIS (40 CFR 1502.14(c)).

Alternative 1 – Preferred Alternative - No Change - Continue Pumping at Historic Levels

Alternative 1 is the Village of Ruidoso's proposal as reflected in their request for a new special use permit. It reflects continued pumping from the North Fork well field, a continuation of current management, reflected under a new special use permit and associated operating plan.

The USDA Forest Service would authorize, under a new special use permit, the operation and maintenance of four municipal supply water wells (three equipped and one unequipped) and associated monitoring wells; well house control station; underground pipeline and power line; and road access located in the North Fork Eagle Creek drainage on National Forest System land. The new permit would be authorized for up to 20 years, with stipulations for frequent reviews and verification of the permit terms and conditions, as detailed in an annual operating plan. The Forest Service and Village of Ruidoso would meet periodically to determine overall success of implementation and applicability of terms and conditions and determine if changes are necessary due to monitoring results. These reviews could occur as often as every year but would occur at least every 5 to 10 years. These reviews may result in adjustments to the annual operating plan or permit amendments..

The existing municipal water supply system is composed of these four wells (three equipped and one unequipped) and the following associated facilities and structures which were, except for the monitoring wells, previously approved by the USDA Forest Service and constructed and installed in 1985-1986:

- Approximately 1.4 miles of 14-inch diameter underground ductile iron pipeline
- One cinder block pump control house (6 foot by 8 foot)
- Approximately 1.3 miles of underground electric power cable

- Four alluvial monitoring wells (MW-1A, MW-2A, MW-3A, and MW-5A) and one nested bedrock monitoring well (MW-1B and MW-1C) which were previously installed by the U.S. Geological Survey along the North Fork in the area of the North Fork well field to measure groundwater (figure 2).

The Village of Ruidoso would conduct periodic routine repair/maintenance to these structures as needed. Prior to any maintenance or repair, the Village of Ruidoso would contact us for approval and scheduling prior to performing the work. For this analysis, it is assumed that any ground disturbance necessary for anticipated maintenance or repair of the pipeline, control house, well, monitoring wells, or underground electric cable would be minimized. Prior review and approval of any maintenance or repair activities would ensure any needed mitigations would be applied to minimize any potential for adverse impacts due to ground disturbance or noise (see "Mitigation Measures" section later in this chapter).

The Village of Ruidoso would also maintain National Forest System Road 127A from State Road 532 to the North Fork well sites. Any maintenance activities performed by the Village (including the low water crossing of National Forest System Road 127A across North Fork Eagle Creek) would only occur following review and approval by the Forest Service. Security fencing may be installed around each wellhead; the Village of Ruidoso would contact the Forest Service for approval and scheduling prior to this work being performed to ensure that any needed mitigations would be applied to minimize any potential for adverse impacts due to this ground disturbance or noise (see "Mitigation Measures" section later in this chapter).

We would issue a new permit with no change in existing well pumping operations. This means that pumping would continue at historic levels[2], in accordance with the Village of Ruidoso's water rights. The new permit would be issued with similar terms, conditions, and history of water use that has been in operation since 1988, as described below. While the terms and conditions of the permit would be similar to the expired permit, the new permit would adhere to the most current special use permit templates.

Water use would likely average approximately 740 acre feet per year, with highest use between March and September (ranging from a combined total of 60 to 117 acre feet per month); between 2002 and 2010, use averaged 569 acre-feet per year and ranged between 433 and 807 acre-feet per year. As discussed in the "Background" section of chapter 1 and in more detail in the "Socioeconomics" and "Water Rights" sections of chapter 3, from 2001 to 2006, the Village of Ruidoso obtained approximately 31 percent of its water supply from the North Fork well field. Based on recent information from the Village of Ruidoso, 46 to 75 percent of its water supply can be attributed to North Fork Eagle Creek well diversions (Village of Ruidoso 2012). In 2010, this was estimated at 77 percent (Atkins Engineering Associates, Inc. 2014). While it is possible that recent or future water rights transfer may affect (reduce) the pumping levels (see the water rights section in chapter 1 and 3 for more information on this topic), due to uncertainty of any potential transfer of rights, the analysis assumes that historic (pre-2010) pumping levels would continue. This represents a conservative or 'maximum' potential effect because pumping is likely to be less than the historic level with any transfer. As part of the special use permit, the authorization would include an annual

[2] These estimates of historic water use are based on the best available information at the time of preparation of this document. We recognize that the applicant has instituted some changes in the way in which the North Fork well field is managed in conjunction with its Eagle Creek surface diversion and its water rights from the Rio Ruidoso due to the changes caused by Little Bear Fire. We recognize that these recent management adjustments are not typical and that the applicant anticipates resumption of pumping levels from the North Fork well field in a period of years when the effects of the Little Bear Fire are reduced (Atkins Engineering Associates, Inc. 2014).

operating plan that the Village of Ruidoso would prepare in consultation with us. We would require the Village of Ruidoso to prepare monthly reports, with electronic reports in spreadsheet format, with the following information:

- **Well Static/Pumping Water Levels**: Water levels (static and pumping) would be collected at least once a month from the following wells within and upstream of the project area: MW-1A, B, C; MW-2A; MW-3A; and MW-5A (see figure 12 and figure 13, chapter 3). Where possible, data would be collected electronically via transducers and data loggers that would provide daily measurements.
- **Well Pumping Reports**: Daily pumping quantities of water from each of the North Fork wells would be reported in gallons per minute (summarized for the month).

The Village of Ruidoso would be responsible for daily operations, facilities and road maintenance (National Forest System Road 127A maintenance is the responsibility of the Village of Ruidoso from NM 532 to the gate below the summer homes) and coordinating with us on maintenance/repair projects or data collection activities.

The Village of Ruidoso would be required to notify us if they implement stage 5 water restrictions (stringent water conservation measures). This would prompt a joint Forest Service and Village of Ruidoso review of the annual operation plan and development of an agreement to temporarily modify well pumping if needed to address a critical water situation.

While alternative 1 (no change) is essentially continuing the Village of Ruidoso's current well operations, it does include added mitigation and monitoring measures that are not currently part of the Village of Ruidoso's annual operating plan. These would not constitute new restrictions on water availability and use; but would provide necessary protections related to ground disturbing activities for wildlife and water quality, and improved monitoring information. These measures would become part of a new annual operating plan under this alternative and are described under the "Mitigation Measures" and "Monitoring" headings later in this section. These include the following potentially ground disturbing actions in addition to periodic monitoring and data collection:

- Installing two new alluvial monitoring wells (one near the Eagle Creek gage and one near the North Fork gage). Alluvial wells would be approximately 10 to 20 feet deep. Installing new wells generally consists of mobilizing a drill rig to drill the holes and casing the holes to prevent collapse.

- Rehabilitating existing wells, as needed.

- Conducting either a slug test or an aquifer pumping test. The slug test is performed utilizing existing wells and does not typically involve any ground disturbance; it involves either removing or adding a volume of water from or to the well and measuring the rate of recovery or decline of the water level in the well. If an aquifer test is necessary, it may also be done utilizing existing wells, if they are deemed adequate with known screen intervals. A site review would be necessary prior to performing an aquifer test. The pumping, or aquifer test involves a pumping well and one or more observation wells and pumping at a relatively constant rate for a period of time ranging from a few weeks to a couple of months (at least). The water pumped from the well during the test would need to be transported away from the area of the aquifer test in order to avoid infiltration of the pumped water, which could bias the test.

- Identifying a new water quality sampling location and marking this for future use.

- Installing a new precipitation gage in coordination with the United States Geological Survey.

With these added mitigations and monitoring, alternative 1 (no change) addresses the purpose and need and the significant issues, as shown in the analysis in chapter 3 (and summarized in table 2 and table 3). Implementation of these additional mitigations and monitoring were assumed for implementation of this alternative and were considered in the effects analysis provided in chapter 3 and summarized at the end of chapter 2.

An implementation plan (with schedule, tasks, responsible parties, reporting requirements, quality control measures and costs) would also be developed.

Alternative 2 – No Action (No Pumping) - Discontinue All Pumping

The USDA Forest Service would deny a new permit for the Village of Ruidoso's North Fork well operations and maintenance. Using these four municipal water supply wells and associated monitoring wells; well house control station; underground pipeline and power line; and road access located on National Forest System land would not be authorized and would be discontinued, except those identified for future monitoring. The Village of Ruidoso would be required to remove wells and associated facilities from National Forest System lands within approximately 6–12 months of notifying the Village of Ruidoso their permit would not be reissued. National Forest System road 127A would no longer be maintained by the Village of Ruidoso.

If this alternative were selected, the Village of Ruidoso would have the option to file an application with the Office of the State Engineer to transfer the point of diversion of their water rights to location(s) off National Forest System land, as described in the "Water Rights" section of chapter 3. The Village of Ruidoso would no longer be able to access and put to beneficial use their adjudicated water rights at this current location, and would be required to move them, subject to approval by the Office of the State Engineer.

While this is outside the scope of this analysis, we anticipate that the existing North Fork stream gage would be removed at some point in the future if this alternative were selected, but the Eagle Creek and South Fork Eagle Creek gages may remain in place for future monitoring. These gages are the property of the U.S. Geological Survey and this would be a decision they would make if their use were no longer needed.

If the gages remain and if funding were provided through the U.S. Geological Survey or other parties, surface water monitoring may continue at the existing Eagle Creek below South Fork gage (U.S. Geological Survey 08387600), even if pumping were no longer authorized. Water levels may be monitored at selected locations in or near the well downstream of the existing well field in the vicinity of MW-5. Recording devices or methods, measurement frequencies, and reporting provisions would be determined and implemented cooperatively between the USDA Forest Service and the U.S. Geological Survey.

Alternative 2 (no pumping) includes some additional mitigation and monitoring measures as described in the "Mitigation Measures" and "Monitoring" sections later in this section. Alternative 2 (no pumping) addresses some aspects of the purpose and need and the significant issues, as shown in the analysis in chapter 3 (and summarized in table 2 and table 3). The Village of Ruidoso would not be responsible for any aspects of stream gage- or monitoring well-operation or maintenance or any mitigation or monitoring measures if this alternative were selected. Implementing this additional mitigation and monitoring was assumed for this alternative and considered in the effects analysis provided in chapter 3 and summarized at the end of chapter 2.

Alternative 3 - Adaptive Management

This alternative was developed to address the purpose and need for action and management objectives and provides a balance between providing municipal water to the Village of Ruidoso while also ensuring maintenance or improvement of water-dependent resources. It incorporates revisions necessary to reflect the changed conditions in the project area from the Little Bear Fire.

The Forest Service would authorize, under a new special use permit, the operation of four municipal supply water wells (three equipped and one unequipped) and associated monitoring wells; well house control station; underground pipeline and power line; and road access located in the North Fork Eagle Creek drainage on National Forest System land. The new permit would be authorized for up to 20 years, with stipulations for frequent reviews and verification of the permit terms and conditions. The Forest Service and Village of Ruidoso would meet periodically to determine overall success of implementation and applicability of terms and conditions and determine if changes are necessary due to monitoring results. These reviews could occur as often as every year but would occur at least every 5 to 10 years. The permit term would be shortened if necessary, based on the results of these more frequent reviews and verifications of permit terms and conditions.

All existing associated facilities (underground pipeline, power line, well control house and monitoring wells) that are described for alternative 1 (no change) would also be approved as part of the permit under alternative 3 (adaptive management). As stated for alternative 1 (no change), the Village of Ruidoso would conduct periodic routine repair/maintenance to these structures as needed. Prior to any maintenance or repair, the Village of Ruidoso would contact us for approval and scheduling prior to performing any work. For this analysis, it is assumed that any ground disturbance necessary for anticipated maintenance or repair of the pipeline, control house, well, monitoring wells, or underground electric cable would be minimal. Prior review and approval of any maintenance or repair activities would ensure any needed mitigations would be applied to minimize any potential for adverse impacts due to ground disturbance or noise (see “Mitigation Measures” section later in this chapter).

Security fencing may be installed around each wellhead; the Village of Ruidoso would contact the Forest Service for approval and scheduling prior to this work being performed to ensure that any needed mitigations would be applied to minimize any potential for adverse impacts due to this ground disturbance or noise (see “Mitigation Measures” section later in this chapter).

As under alternative 1 (no change), the Village of Ruidoso would also maintain National Forest System Road 127A from State Road 532 to the North Fork well sites, following review and approval by the Forest Service prior to performing any maintenance work, including the low water crossing of National Forest System Road 127A across North Fork Eagle Creek.

The new permit would include an annual operating plan that would reflect current adaptive management strategies which both respond to the purpose and need for action, and mitigate potential adverse impacts to surface water and groundwater resources from well operations. Water use would equal approximately 900 cumulative acre feet or less over any 3 consecutive water years (300 acre-feet per year or less). This could vary based on monitoring results of the adaptive management triggers described in more detail below. This water use threshold would be implemented as a starting point only and could be adjusted (up or down), depending on the results of monitoring. The Village of Ruidoso would prepare an annual operating plan in consultation with us. We would require the Village of Ruidoso to prepare monthly reports, electronic reports in spreadsheet format, with the following information:

- **Well Static/Pumping Water Levels**: Water levels (static and pumping) would be collected at least once a month from the following wells within and upstream of the project area: MW-1A, B, C; MW-2A; MW-3A; and MW-5A (see figure 3). Where possible, data would be collected electronically via transducers and data loggers that would provide daily measurements.
- **Well Pumping Reports**: Daily pumping quantities of water from each of the North Fork wells would be reported in gallons per minute (summarized for the month).

The Village of Ruidoso would be responsible for costs associated with the adaptive management strategy and monitoring, daily operations, facilities, and road maintenance (National Forest System Road 127A maintenance is the responsibility of the Village of Ruidoso from NM 532 to the gate below the summer homes), and coordinating with us on maintenance/repair projects or data collection activities. These include the following potentially ground disturbing actions in addition to periodic monitoring and data collection:

- Installing two new alluvial monitoring wells (one near the Eagle Creek gage and one near the North Fork gage). Alluvial wells would be approximately 10 to 20 feet deep. Installing new wells generally consists of mobilizing a drill rig to drill the holes and casing the holes to prevent collapse.
- Rehabilitating existing wells, as needed.
- Conducting either a slug test or an aquifer pumping test. The slug test is performed utilizing existing wells and does not typically involve any ground disturbance; it involves either removing or adding a volume of water from or to the well and measuring the rate of recovery or decline of the water level in the well. If an aquifer test is necessary, it may also be done utilizing existing wells, if they are deemed adequate with known screen intervals. A site review would be necessary prior to performing an aquifer test. The pumping, or aquifer test involves a pumping well and one or more observation wellsand pumping at a relatively constant rate for a period of time ranging from a few weeks to a couple of months (at least). The water pumped from the well during the test would need to be disposed of (e.g. released on site or hauled away).
- Identifying a new water quality sampling location and marking this for future use.
- Installing a new precipitation gage in coordination with the United States Geological Survey.

Implementing the additional mitigation and monitoring identified for alternative 3 was assumed for this alternative and considered in the effects analysis provided in chapter 3 and summarized at the end of chapter 2.

The adaptive management strategy would take into consideration the dynamic nature of groundwater systems by establishing a feedback process to guide management of groundwater withdrawal rates over time. The North Fork Eagle Creek basin is characterized as highly transmissive - (water moves through it easily); yet with a relatively low groundwater storage capacity. These two characteristics make it sensitive to variations in precipitation patterns and intensity.

An implementation plan (with schedule, tasks, responsible parties, reporting requirements, quality control measures, and costs) would also be developed.

The Village of Ruidoso would be required to notify us if they implement stage 5 water restrictions (stringent water conservation measures). This would prompt a joint Forest Service and Village of Ruidoso review of the annual operation plan and development of an agreement to temporarily modify well pumping if needed to address a critical water situation.

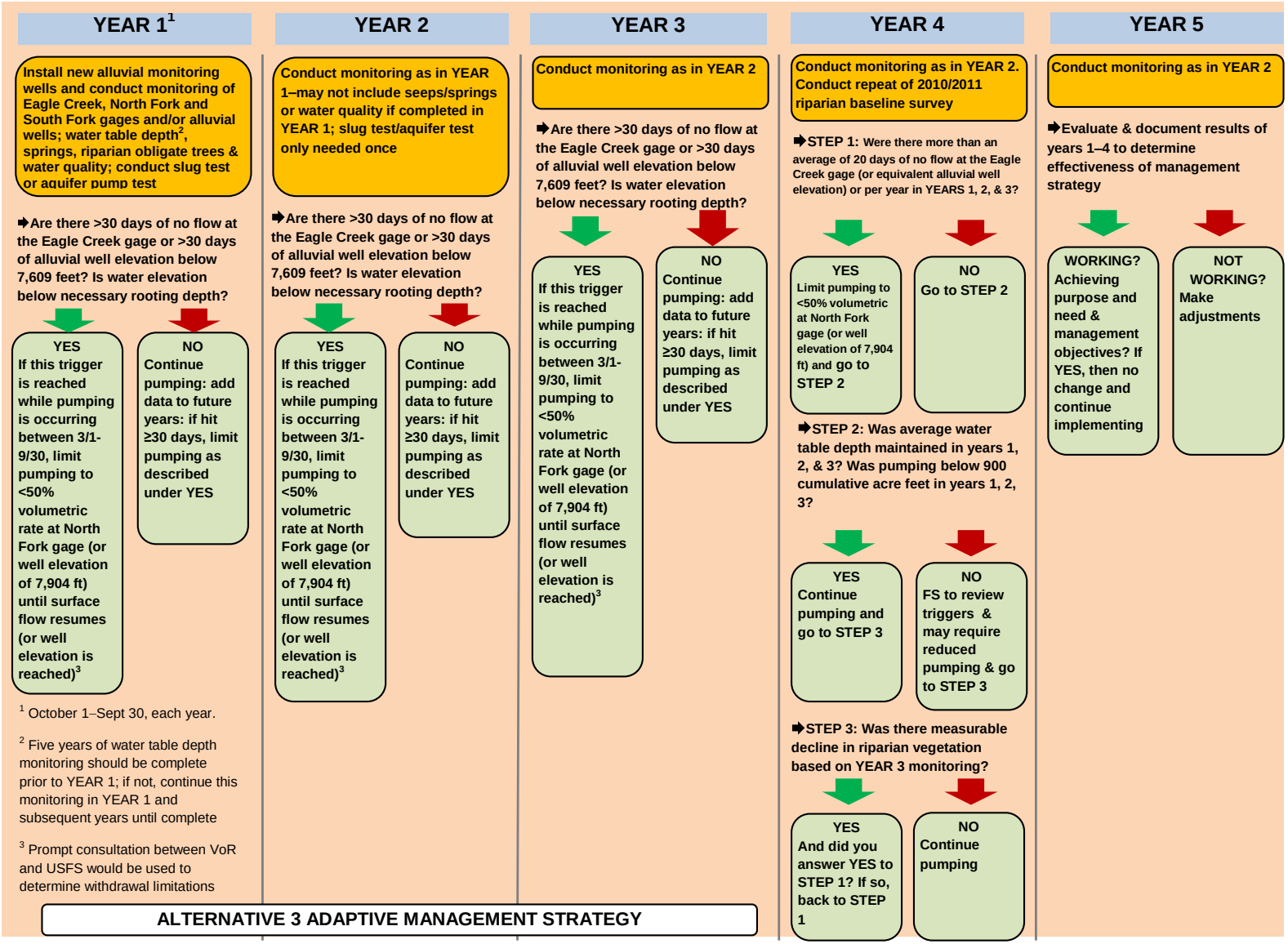

Figure 3. Flowchart of the proposed adaptive management strategy for alternative 3

Thresholds would be established for streamflow and alluvial water depth, water table depths, and riparian vegetation as described below. Exceeding these thresholds would trigger implementation of adaptive management strategies to mitigate the impact to surface resources (figure 3). If thresholds are not exceeded, there would be no restrictions on pumping. Adaptive management strategies currently under consideration, if thresholds are exceeded, include limitations on groundwater withdrawal rates and cessation of pumping for short periods. In addition, a threshold would be established for the total volume of water withdrawn from the Village of Ruidoso's wells over a consecutive 3-year period, where exceeding the threshold would trigger a review of the other thresholds and mitigations to prevent degradation of surface resources.

The proposed action would require the Village of Ruidoso and USDA Forest Service to work in partnership, with assistance from the U.S. Geological Survey, if possible, to conduct monitoring and adaptive management of groundwater and surface water resources. Generally, direct costs associated with adaptive management and monitoring would be the responsibility of the Village of Ruidoso (see socioeconomics section of chapter 3 for cost estimates). Four key adaptive management triggers; which would be identified through the monitoring indicators; would be used to evaluate the effectiveness of this management strategy. This adaptive management strategy would be incorporated into the operating plan for the permit. The use of an automated control system such as electronic switches or something similar, would be considered as part of adaptive management and monitoring implementation, in combination with interactive staff communications to ensure success.

Adaptive Management Triggers (Monitoring Indicators)

Trigger #1 - North Fork Surface Flow Volume and Alluvial Water Depth

This trigger would act as an indicator of surface and subsurface flows necessary to maintain or improve existing riparian and aquatic ecosystems along the North Fork Eagle Creek below the existing well field. The Village of Ruidoso would be responsible for continued collection of alluvial water depth measurements collected at new wells located at the Eagle Creek gage (U.S. Geological Survey 08387600) and the North Fork gage (U.S. Geological Survey 08387550), at existing or rehabilitated monitoring wells at the MW-1A and MW-5A well locations along the North Fork Eagle, and existing pumping wells. The Eagle Creek stream gage, located just below the confluence of the North Fork and South Fork tributaries, records surface flow volume rates (quantities) in cubic feet per second. These data are currently collected and stored by the U.S. Geological Survey, and available to the USDA Forest Service and public on the U.S. Geological Survey water data web site (http://waterdata.usgs.gov/nwis).

Because these data may no longer be reliable due to the Little Bear Fire and subsequent debris loading in the Eagle Creek drainage, this adaptive management trigger would use these Eagle Creek gage streamflow data (if deemed available and reliable), in conjunction with water depth measurements from monitoring wells along North Fork Eagle Creek including new monitoring wells to be located at the North Fork and Eagle Creek stream gages. Common elevation datums and transects would be established by surveys and permanently located in the field at the North Fork gage and its new monitoring well, at MW-1A and MW-5A, and at the Eagle Creek gage and its new monitoring well. These surveys would relate historic and current streamgage stages to benchmark water levels in monitoring wells and to elevations of the streambed and banks. If stream gage data are deemed unavailable or unreliable, water level data from alluvial monitoring wells would be used instead as adaptive management benchmarks. Flows and/or water levels in wells would be monitored on at least a daily basis, and transformed at least monthly into elevations based on a common established datum.

If there are more than 20 days per year of no surface flow (less than 0.01 cubic feet per second or an equivalent monitoring well elevation) over a period of 3 consecutive water years at the Eagle Creek gage, or more than 30 no-flow days within any single water year (October 1–September 30), the Village of Ruidoso would reduce groundwater withdrawal rates from pumping wells. Based on recent pre-wildfire streamgaging data, this flow trigger (0.01 cubic feet per second) has historically corresponded to an equivalent water surface elevation of 7,609.0 feet at the Eagle Creek gage. (This value is accurate to approximately 0.2 feet.)

If either of these adaptive management triggers (streamflow or water level thresholds) is activated while pumping is occurring between March 1 and September 30, then groundwater withdrawals from the North Fork pumping wells would be limited. Prompt consultation between appropriate Village of Ruidoso and USDA Forest Service staff would be required and the conclusive results of this consultation would determine groundwater withdrawal limitations. Groundwater withdrawals would be limited to 50 percent of the volumetric rate of surface flow at the North Fork gage (or a monitoring well elevation of 7,904 feet at the North Fork gage upstream from the pumping wells) until: 1) surface flow at the Eagle Creek gage resumes, or 2) the water level elevation in a new monitoring well at the current Eagle Creek gage location reaches at least 7,609 feet; or 3) other criteria determined by the USDA Forest Service staff at the time of consultation on this trigger are met.

The following parameters and assumptions form the basis on which the North Fork Eagle Creek surface flow and alluvial water depth trigger would be modeled and managed:

- Using a 3-year running average allows for natural fluctuations in precipitation and snowmelt runoff, and periodic short-term drought cycles, considering historic trends.
- The 3-year threshold of 20 no-flow days is equal to about half the average number of no-flow days experienced since pumping began (1988-2011), and should result in an improved trend in surface flows and moisture regimes in the North Fork tributary and its associated riparian area. The number of no-flow days and alluvial water depth measurements would be evaluated based on real time daily recordings from the Eagle Creek stream gage (if deemed reliable and available) in conjunction with a new monitoring well near the Eagle Creek with daily measurements taken.
- If we identify additional criteria for groundwater withdrawals in response to trigger activation and required consultation, the criteria would be documented in writing and distributed appropriately. Such criteria may be provisional if needed, and could be based on pumping volumes, durations, or other monitored parameters. There are naturally-occurring monthly, seasonal, and annual variations in precipitation, evapotranspiration, runoff, and groundwater recharge. Eagle Creek watershed characterizations have been based on historical data. Contrasting dry, average, or wet periods exist in these historic data. Similar natural moisture swings will occur in the future. Also, the long-term regional climate may change, creating local effects. Therefore, flexibility in the adaptive management response to flow or water level triggers is needed. Monitoring and mitigation measures are recommended for the purpose of enhancing multiple-resource management in the project area. In particular, using information gathered from monitored snowpack, precipitation, and water levels would allow site-specific responses to adaptive management triggers to be tailored to existing conditions, forecasted or reasonably expected conditions, or other considerations.
- We recognize that the Eagle Creek stream gage includes flow contributions from the South Fork tributary. For consistency with data gathered since 1969, the Eagle Creek stream gage location would continue to be used, assuming there are no measurable changes in human development or water use within the North or South Fork drainages. The South Fork and North Fork stream gages or the new monitoring well located at the North Fork gage location

(U.S. Geological Survey 083875550) would also continue to be used in long-term monitoring, but have insufficient historical data to initially be used as an effective trigger. Additional surveying and monitoring will allow these locations to be incorporated into the adaptive management framework. The relationship between the current Eagle Creek gage location and its previous location is discussed in more detail in the water resources section of chapter 3.

- Alluvial water level elevation triggers in new monitoring wells at the current Eagle Creek and North Fork gage locations (U.S. Geological Survey 08387600 and 08387550, respectively) are based on historical elevations for the 0.01 cubic feet per second ("no flow") condition at those sites. As of October 2012, post-wildfire streambed surface elevations at the North Fork gage are approximately 3 feet higher than the pre-wildfire condition, and substantial channel disturbance also has occurred at the Eagle Creek gage due to sediment accumulation and site repair.
- An initial survey traverse with appropriate closure would be conducted at the start of the monitoring program to correlate channel and bank elevations, gage datums and stages, and monitoring well water level elevations between the North Fork gage location (U.S. Geological Survey 08387550), all monitoring wells, and the Eagle Creek gage location (U.S. Geological Survey 08387600). Cross-sectional elevation surveys would be conducted annually at the permanently-located transects (at the North Fork gage, MW-1A, MW-5A, and the Eagle Creek gage locations) to identify ongoing modifications in streambed and bank levels and locations.

This trigger is different than that described in the DEIS and incorporates modifications as a result of the anticipated changes in the project area along the North Fork Eagle Creek following the Little Bear Fire. Even as hillslope conditions eventually restore to reasonably stable post-Little Bear Fire conditions, a substantial amount of deposited sediment and debris is expected to move through the drainage system for decades. This will modify channel and bank conditions, streamflow occurrence and water levels, and gaging conditions. By tying adaptive management streamflow triggers to water level elevations, and by connecting monitoring locations to established elevation benchmarks, these flows, water levels and alluvial conditions can be more successfully tracked over time.

Trigger #2 - Water Table Depth

This trigger would provide a continuous indicator of the status of groundwater storage along the North Fork Eagle Creek. The Village of Ruidoso would continue to maintain monitoring well MW-1B and other selected wells in or near the North Fork Eagle Creek well field, using them to retrieve daily data on water table levels. Data for pumping rates from individual pumping wells would also be retrieved. Water table depth data (feet below ground surface) have been collected by U.S. Geological Survey and stored in the acre-feet database. These data and the values additionally collected would be continuously reported to the Forest Service and public on a water data web site maintained by the Village of Ruidoso as real time and historic daily averages. The U.S. Geological Survey water data Web site or a database maintained by the New Mexico Office of the State Engineer may be used for these reporting purposes, pending an agreement with either agency. The reporting frequency (e.g., daily or weekly) would be determined through further interactions between the USDA Forest Service, the Village of Ruidoso, and other interested parties.

Using the sum of all monitoring data collected prior to implementation (2 years of data collected by U.S. Geological Survey during their study plus the data collected by the Forest Service during the EIS process, estimated at approximately 5 years of data), the Forest Service would evaluate these data to establish an adaptive management trigger (threshold) for average or median water table depth. For

example, if the water level in monitoring well MW-1B declines to more than 75 feet below ground surface, then pumping shall cease until the water level recovers to 65 feet below ground surface. The water table depth threshold may be established on an annual or seasonal basis (e.g. growing season, or spring, summer and fall), and would be based on interpretation of data representing periods of no pumping and pumping. If selected, the seasonal orientation would consider water table fluctuations under conditions of snow accumulation, snowmelt, low precipitation, and monsoonal moisture. Upon data collection and interpretations, individual thresholds may be established for different wells monitored at different locations along the North Fork Eagle Creek. To avoid extreme conditions, 10 percent of the values would be trimmed from both the highest and lowest portions of the dataset(s).

The Village of Ruidoso would be required to maintain a corresponding average water table depth that is equal to or above these thresholds over 3 consecutive water years. If groundwater pumping of North Fork wells results in a declining trend in the average water table depths over any 3-year period, the Village of Ruidoso would reduce diversions from the wells until the average water table depth is reestablished and the Forest Service determines that pumping may resume without creating further departures over a 3-year period.

In addition, the unnamed spring on the right bank of the North Fork upstream from the North Fork gage (UTM coordinates of 430344.177, 3697589.137 meters) would be monitored monthly for continued flow. Water chemistry at this spring would be characterized to ascertain its source (e.g., deep bedrock). After at least two years of monthly monitoring, changes or cessation of flow rates at this spring would be used to further inform potential adaptive management actions.

Trigger #3 - Riparian Vegetation

This trigger would provide an indicator of the effects of groundwater withdrawal on the condition and trend of surface resources in and downstream from the North Fork Eagle Creek basin and was developed to complement the surface flow and alluvial water depth trigger.

The riparian inventory conducted in 2010-2011 would be used as a comparison so that any future changes in riparian vegetation in the project area would be apparent with future monitoring. Short-term and long-term trends in riparian vegetation canopy cover, composition, and conditions would be evaluated and documented by repeating the riparian inventory at least every five years, between June 1 and July 15. This will provide an opportunity to examine any noticeable shifts in riparian vegetation at a community level. This inventory would be coordinated with stream geometry monitoring along the North Fork Eagle Creek, as further detailed under “Monitoring, Water Resources and Fisheries” below.

We would conduct annual monitoring of riparian obligate tree species (e.g. willows, boxelder) and other facultative wetland species in the project area in order to detect short-term changes in condition and canopy cover. Individual monitoring plots known to contain facultative wetland vegetation would be examined annually for continued presence/absence of these species.

Trigger #1 for streamflow and alluvial water depth would be used to determine when pumping would be reduced. As a guideline for trigger #1, we chose the minimum rooting depth of 30 inches for shining willow (*Salix lucida*) and 34 inches boxelder (*Acer negundo*)[3] to define the inner and outer edge of the riparian area, respectively and their growing season (March 1 through September 30). If water level elevations in monitoring wells used for trigger #1 decline greater than these depths below

[3] Minimum rooting depths were developed from the USDA Natural Resources Conservation Service PLANTS database, minus a six inch buffer (USDA, NRCS 2015).

their benchmark elevations [currently 7,609 feet above mean sea level NAVD88 at the Eagle Creek gage location, 7,904 feet above mean sea level NAVD88 at the North Fork gage location, or other benchmark elevations to be identified at monitored wells], then pumping would be reduced until water level elevations are within 30 to 34 inches of the water level benchmark or other mitigating arrangements are made and implemented with the Village of Ruidoso. If riparian conditions are adversely affected by stream channel or bank instabilities, monitoring locations and/or trigger activation would be modified as deemed necessary by qualified agency riparian specialists.

If annual monitoring of riparian obligate or other facultative wetland species detects substantial reductions in condition or canopy cover, or if the 5-year re-reading of the baseline riparian inventory detects measurable declines in canopy cover or composition, the Forest Service may require diversions from the wells to be reduced to below 50 percent of the annual average well diversions (in acre-feet per year or acre-feet per year), or may modify benchmark water level elevations in monitoring wells that serve as the baseline for other triggers, to help restore riparian vegetation. This trigger would be used in conjunction with the streamflow and alluvial water depth trigger to determine if reductions in pumping are necessary.

The following parameters and assumptions form the baseline on which the North Fork Eagle Creek riparian trigger would be managed:

- Annual monitoring would be relatively fast and inexpensive while still providing a method to detect rapid changes in keystone obligate and facultative wetland plants that occur in the project area and upstream of the current baseline monitoring area.
- Because the riparian corridor was not substantially affected by the Little Bear Fire and experienced primarily low intensity fire only, using the pre-wildfire riparian inventory baseline survey conducted in 2010-2011 is still appropriate and would provide an important method for gaging change in riparian conditions over time. Changes in alluvial deposits, soil deposition and bank shearing observed in some areas post-wildfire will be noted and documented.

Trigger #4 - Well Pumping Volume

The Village of Ruidoso would continue daily monitoring and recording of groundwater withdrawals through the North Fork Eagle Creek wells (pumping volumes in acre feet). Combined with precipitation and streamflow records over time, this metric would be used to develop an additional reliable indicator for modeling anticipated effects of groundwater withdrawals on surface resources within the North Fork Eagle Creek basin by accurately modeling the cone of depression.[4]

An initial adaptive management trigger (threshold) of 900 cumulative acre feet over any 3 consecutive water years (300 acre-feet per year) would trigger a review by the Forest Service of the current thresholds and mitigations at maintaining or improving surface resource conditions. This threshold is based on 500 acre-feet per year recharge for the North Fork basin as determined by the chloride balance method described in the U.S. Geological Survey report (Matherne et al. 2011). If the

[4] The cone of depression is based on Figure 16 of Matherne and others (2011) [see FEIS Figure 12]. Bedrock water level at piezometers MW-1B and MW-1C are measured halfway between the pumping center and the North Fork gage. In March of 2009, MW-1B showed a drawdown of 75 feet at a time when the pumping rate was approximately 600 acre feet per year. At 75 feet of drawdown, Figure 16 shows that the cone of depression has negligible effect in the vicinity of the North Fork gage. If drawdown at MW-1B or MW-1C is limited to 75 feet, then effects to the upper reaches of the North Fork would be minimized. This water level maintenance would be independent of wet or dry periods, as the cone of depression would have the same shape whatever the pumping rate is to achieve it. However, Figure 16 makes note that the alluvial wells were dry in March of 2009, which will also need to be considered in the adaptive management for riparian areas.

water level elevations in the alluvial wells or at MW-1B are shallower than related adaptive management triggers, then greater pumping volumes may be allowed. If analysis results indicate that current thresholds and mitigations are not sufficient to maintain surface resource conditions, management of groundwater withdrawals would be adjusted to provide additional protections against further degradation of riparian and other surface resources within the North Fork Eagle Creek basin.

Adjustments in Management of Water Withdrawals

As time and funding allow, we would conduct periodic North Fork project area site visits to observe facility operations, gages and wells, streamflow, and riparian conditions. Notes and photographs (if applicable) would be taken and added to the project file. Every 5 years that the permit is in effect, or when triggered by exceeding the water withdrawal threshold described above, the Forest Service would evaluate and document monitoring results to determine effectiveness of the adaptive strategy and determine whether an adjustment to the parameters of this adaptive management strategy are warranted. These 5-year evaluations would correspond with the New Mexico Office of the State Engineer (Office of the State Engineer) (Roswell District) 5-year water accounting periods. For water accounting purposes, the Office of the State Engineer water year runs from November 1 through October 31, and the year is numbered by the October date (e.g., Office of the State Engineer Water Year 2014 begins on November 1, 2013 and ends October 31, 2014). Forest Service 5-year adaptive management evaluations would be conducted on a schedule that coordinates with the Office of the State Engineer accounting periods.

- Even as hillslope conditions eventually restore to reasonably stable post-Little Bear Fire conditions, a substantial amount of deposited sediment and debris is expected to move through the drainage system for decades. This will modify channel and bank conditions, streamflow occurrence and water levels, and gaging conditions. By tying adaptive management streamflow triggers to water level elevations, and by connecting monitoring locations to established elevation benchmarks, these flows, water levels and alluvial conditions can be tracked over time.
- Based on the 5-year evaluations of the special use permit, the Forest Service may relax or further restrict specific parameters of this adaptive management strategy, with modification to the operating plan of the permit. These 5-year evaluations would coincide, if possible, with the State Engineer 5-year accounting periods for the Hondo Basin.
- Adjusting these parameters would be based on USDA Forest Service determinations of the extent to which the North Fork well operations are consistent with the purpose and need and identified management objectives.

Adaptive management adjustments include limitations on groundwater withdrawal rates and cessation of pumping for short periods; increases in withdrawal rates could also occur depending on the results of monitoring.

Alternative 3 (adaptive management) includes some additional mitigation and monitoring measures as described in the “Mitigation Measures” and “Monitoring” sections (below). Alternative 3 (adaptive management) addresses the purpose and need and the significant issues, as shown in the analysis in chapter 3 (and summarized in table 2 and table 3).

Mitigation Measures

Forest Service resource specialists have developed the following mitigation measures that would apply to implementation of the alternatives, including any adaptive management or monitoring requirements. Some would differ by alternative, as indicated below.

Wildlife and Fish

- **All Alternatives**: In the event that any mechanized equipment use that may be necessary for implementing repair, maintenance or operation activities of the wells/associated facilities, fencing activities around the wells, or for monitoring or adaptive management (or for well and facility removal under alternative 2 (no pumping)), this activity would not occur within 0.25 mile of the northern goshawk post-fledging area from March 1 to September 30 to minimize disturbance during the breeding season. The Village of Ruidoso would contact the Smokey Bear Ranger District for this location.
- **All Alternatives**: In the event that any mechanized equipment use that may be necessary for implementing repair, maintenance or operation activities of the wells/associated facilities or for monitoring or adaptive management (or for well and facility removal under alternative 2 (no pumping)), this activity would not occur within 0.25 mile of the adjacent protected activity center during the Mexican spotted owl breeding season (March 1–August 31).

Water, Soil, and Vegetation

- **All Alternatives**: USDA Forest Service Southwestern Region best management practices (USDA Forest Service 1982) for water quality management and the National Best Management Practices for Water Quality Management on National Forest System Lands (USDA Forest Service 2012) would be applied to any ground-disturbing activities under any of the alternatives related to maintenance and operation of the wells/associated facilities or for monitoring (or for well and facility removal under alternative 2 (no pumping)). These practices would ensure that any potential for increased soil erosion or vegetation disturbance would be minimized.
- **Alternative 3 (adaptive management):** The adaptive management triggers (monitoring indicators) described for this alternative serve as measures that would minimize the potential for adverse impact to water, soil, and vegetation resources.
- **Alternative 1 (preferred alternative; continue pumping at historic levels) and alternative 3 (adaptive management)**: The Village of Ruidoso would be required to develop and implement a water conservation strategy as part of the terms and conditions of their special use permit.

Cultural Resources

- **Alternative 2 (no pumping):** The Lincoln National Forest archaeologist would be consulted prior to removal of any wells and associated facilities in order to ensure cultural resource protections are provided, as needed. No impacts are expected at this time since no known sites are located within the area of potential effect.
- **All Alternatives**: If any human remains or artifacts determined to fall under the Native American Graves Protection and Repatriation Act guidelines are unearthed during project activities, we would consult with all appropriate tribes.

Public Safety and Health

- The Village of Ruidoso is responsible for ensuring all wells and associated facilities are safe and do not pose a danger to public health or safety.

Monitoring

The first eight monitoring measures described below for water resources and fisheries would be implemented for either alternative 1 (preferred alternative; continue pumping at historic levels) or

alternative 3 (adaptive management). Monitoring is also recommended for alternative 2 (no pumping) and is described below as monitoring measure nine.

These measures would be used in conjunction with those already identified as part of the alternative descriptions provided earlier in this chapter, including those discussed as part of adaptive management under alternative 3 (adaptive management).

Implementing these additional monitoring measures was assumed for these alternatives and was considered in the effects analysis provided in chapter 3 and summarized at the end of chapter 2.

Water Resources and Fisheries

1. **Under alternative 1 (preferred alternative) or alternative 3:** The Village of Ruidoso would rehabilitate existing monitoring wells, or construct new ones upstream and downstream of the well field, to ensure that only one individual water-bearing zone of interest is monitored within each screened zone. New alluvial monitoring wells would be constructed by the Village of Ruidoso adjacent to the North Fork of Eagle Creek, at the locations of the existing North Fork streamgage (U.S. Geological Survey 08387550) and Eagle Creek below South Fork streamgage (U.S. Geological Survey 08387600). In order of increasing depth, the individual groundwater zones of interest in the well field area include the stream alluvium, shallower fractured and weathered zones within volcanic bedrock, and deeper bedrock zones within the same volcanic aquifer system. Well rehabilitation can include sealing off multiple completions with bentonite and/or grout as appropriate; or other means of isolating a source zone by adaptations of the wells already in place. In addition, if a pumping alternative is selected, deep, long-screen wells would be selected or newly constructed and monitored both upstream and downstream of the well field to track water table depths as part of monitoring. The screened portions of these two wells would be the same as the elevation range of the screened or open zones of the pumping wells. The results of this monitoring would be used (along with proposed riparian monitoring) to assist in determining potential effects to riparian vegetation by comparing to minimum rooting depths of facultative wetland species.
2. **Under alternative 1 (preferred alternative) or alternative 3:** Using the re-configured as well as new monitoring wells completed from Monitoring Measure 1, the Village of Ruidoso would conduct slug tests or aquifer pumping tests of the individual water-bearing zones of interest at the well field. The choice of tests would ultimately depend on the time and resources available, and on conclusions reached during coordinating efforts that would be completed between the Village of Ruidoso and USDA Forest Service. Comparable and contemporaneous tests would be completed for each water-bearing zone of interest, so that comparisons can be made between appropriate test results and a greater understanding of the hydrogeologic nature of the well field can be gained. Surface flow observations would also be made before, during, and after the groundwater tests at selected locations along North Fork Eagle Creek.
3. **Under alternative 1 (preferred alternative) or alternative 3:** Monthly water quality field measurements would be made by the Village of Ruidoso at all three existing surface flow gages on the North Fork, South Fork, and Eagle Creek. An additional streamflow sampling location would be determined and marked or monumented immediately below the well field, at or near existing monitoring well MW-5 or wherever surface flow frequently occurs downstream. Field sampling constituents would include water temperature, air temperature, pH, turbidity, dissolved oxygen, and specific conductance. If approved in writing by the USDA Forest Service, the frequency of sampling could be reduced to a quarterly basis or less. All data records would be filed with the Lincoln National Forest Supervisor’s office on a quarterly basis during the first year, and as agreed-on thereafter.

4. **Under alternative 1 (preferred alternative) or alternative 3:** Daily mean flow and/or water level measurements would continue to be recorded or calculated by the Village of Ruidoso at the three stream gages or new monitoring wells, and at monitoring wells used in the U.S. Geological Survey program. Foundation conditions at the Eagle Creek stream gage would be ascertained, and if significant alluvial underflow occurs, then modifications would be implemented to either minimize or measure alluvial underflow past the gage. An investigation of the relationships between South Fork gage readings and the Eagle Creek gage readings would be undertaken to further understand any correlations. Rehabilitated or newly constructed wells described in measure #1 above may be substituted for existing monitoring wells as needed, and may be used to substitute for surface flow gages. Recording devices or methods, and measurement frequencies, would be determined cooperatively between the USDA Forest Service and Village of Ruidoso. If digital devices are employed, data recording time-steps and clocks would be consistent between all monitoring wells and flow gages; time-steps would be four hours, six hours, or twelve hours. Time-steps would not fluctuate. Flow or water level measurements would generally correspond to water quality field data collection efforts if conducted under Water Resources Monitoring Measure 3. Data would be reported on a monthly basis to the USDA Forest Service, U.S. Geological Survey, and the New Mexico Office of the State Engineer, and stored in a publically available database maintained by one of these agencies as determined through further coordination and decisionmaking. Quarterly and annual data summaries and conclusions would be developed and made publically available by the Village of Ruidoso, with the USDA Forest Service acting in an agency review and approval capacity.
5. **Under alternative 1 (preferred alternative) or alternative 3:** Eight springs and seeps in the North Fork Eagle Creek drainage would be identified and monitored by the Village of Ruidoso on a monthly basis for 1 year: priority locations would be such features alongside or in the channels in the upper North Fork Eagle Creek and Carlton Canyon. Locations are indicated on figure 2 (and also on figures 1 and 33-B in the water resources report, AECOM 2015)). Monitoring constituents at springs would consist of common parameters including flow rate, temperature, pH, and specific conductivity. Additional water quality constituents (e.g., carbonate, bicarbonate, chloride, sulfate) would be included for springs if specified by the USDA Forest Service, and samples would then be retrieved and handled for laboratory analyses of those constituents if they were deemed necessary.
6. **Under alternative 1 (preferred alternative) or alternative 3:** Stream gradient, planform, and stability indicators would be monitored and documented annually by the Village of Ruidoso between June 1 and July 15 at selected and benchmarked cross-section locations along the North Fork Eagle Creek for the first 5 years during the term of the permit. Cross-sections would be located a minimum of every 1,000 feet downstream from the existing North Fork Eagle Creek streamgage location to the Eagle Creek below South Fork streamgage location, below major tributary junctions, and at selected sharp bends. Stream channel width, bank height and angle, aggradation or degradation of sediment or debris, longitudinal profile, flow estimates, pool locations, and other selected geomorphic characteristics would be documented each year in the field by the Village of Ruidoso and submitted in an annual summary report to the USDA Forest Service that includes data forms, summary tables, photographs and figures, and interpretations. After the first 5 years of the term of the permit, The Village of Ruidoso would measure these parameters at these same locations every 3 years, or less if approved in advance by the Forest Service, between June 1 and July 15.
7. **Under alternative 1 (preferred alternative) or alternative 3:** Snowpack on Sierra Blanca would be monitored by the Village of Ruidoso for the permit duration through access to the Natural Resources Conservation Service data portal. Anticipated dry, average, or wet spring

seasonal moisture conditions will be ascertained monthly and documented by monthly memoranda to the Forest Service for the months of January, February, March, and April every year. At least one precipitation gage along the North Fork Eagle Creek watershed divide would be maintained by the Village of Ruidoso for the permit duration in cooperation with the U.S. Geological Survey, and monthly total precipitation accumulations would be reported to the USDA Forest Service on a quarterly basis every year.

8. **Under alternative 1 (preferred alternative) or alternative 3:** The Village of Ruidoso would develop and apply a data-synthesis and visualization tool depicting historic and updated hydrologic conditions and management in the North Fork watershed. The purpose of this tool would be to depict historic and recent pumping management with contemporaneous hydrologic states at locations within the watershed, and to inform subsequent pumping management to the extent possible. Information from this would be shared with the USDA Forest Service. The implementation could consist of a set of spreadsheets and associated graphics, a database with a graphical user interface, an adaptation of an existing non-proprietary agency tool, or a more specific numerical model. From this application, system behavior under pumping and no-pumping conditions would be better understood and predicted. Time-steps for historic and updated conditions (e.g., weekly, monthly, etc.) would be determined through coordination between the USDA Forest Service and Village of Ruidoso. If practicable, the USDA Forest Service preference would be to develop, reasonably calibrate, document, and update a site-specific groundwater computer model in a cooperative effort among the Forest Service and other selected, qualified parties representing appropriate stakeholder interests along the North Fork of Eagle Creek. Such a model would be developed and calibrated during the initial three years of the term of the permit, and used through the continuation of the permit term to further inform adaptive management of surface and groundwater relationships along the North Fork Eagle Creek.

9. **Under alternative 2 (no pumping):** Surface water monitoring would continue at the existing Eagle Creek gage below the South Fork (USGS 08387600), and water levels would be monitored at a selected well downstream of the existing well field in the vicinity of MW-5. Foundation conditions at the Eagle Creek stream gage would be ascertained, and if significant alluvial underflow occurs, then modifications would be implemented to either minimize or measure alluvial underflow past the gage. Recording devices or methods, measurement frequencies, and reporting provisions would be determined cooperatively between the USDA Forest Service and U.S. Geological Survey. This monitoring would be conducted as time and funding allowed and would be used to determine possible changes in flow due to discontinuation of pumping. If digital devices are employed, data recording time-steps and clocks would be consistent between all monitoring wells and flow gages; time-steps would be either four hours, six hours, or twelve (12) hours. Time-steps would not fluctuate.

Riparian Vegetation

1. **Under alternative 1 (preferred alternative) or alternative 3:** The 2010 baseline riparian vegetation survey would be repeated every 5 years, as described in the adaptive management strategy description of alternative 3 earlier in this chapter. Annual monitoring of riparian obligate tree species (e.g. willows, boxelder) and other facultative wetland species within the project area would also be used to detect short-term changes in condition and canopy cover. This monitoring would be coordinated with stream geometry and stability monitoring as described above for “Water Resources and Fisheries”.

2. **Under alternative 2 (no pumping):** The 2010 baseline riparian vegetation survey would be repeated at 5-year intervals, as time and funding allows.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by the NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14).

We received comments from the public on our proposed action during the scoping period and the formal SDEIS comment period, and many of these offered suggestions for alternative methods for achieving the purpose and need. For an alternative to be analyzed in detail in an EIS, it should meet the purpose and need for action, address one or more significant issues, and reduce the potential for significant impacts. Reasonable alternatives include those that are practical or feasible from a technical and economic standpoint; they do not necessarily have to be within USDA Forest Service jurisdiction to implement. Alternatives not considered in detail in an EIS may include, but are not limited to, those that fail to meet the purpose and need, are technologically infeasible or illegal, or would result in unreasonable environmental harm. We also considered applicable USDA Forest Service direction as summarized in chapter 1.

The following sections describe the comments we received from the public related to alternatives during scoping and the formal comment period on the SDEIS, and why these were not carried forward for detailed analysis in this document.

Suggestions for Changes to Alternative 3 (Adaptive Management) – General

No-flow days (days where there is zero flow in North Fork Eagle Creek) should be eliminated entirely from the adaptive management alternative - assure that the stream flows every day.

The no pumping alternative will be analyzed in detail and is the alternative with the best potential to eliminate no-flow days. This alternative would “leave downstream flows in the same state that they would be absent the pumping of the North Fork Eagle Creek wells” which is required for the EIS analysis as part of the stipulation agreement.

As stated in the U.S. Geological Survey report and summarized in chapter 2 of the EIS, although years of below average precipitation were recorded during the time period before the wells began pumping and after the wells began pumping, there were no days of zero flow recorded at the Eagle Creek gage from 1969-1980. A total of 789 no-flow days were recorded in 11 years of the 20 years analyzed after 1988, with 8 of the last 10 years having no-flow days. No-flow days occurred during periods of both below and above average precipitation during the study period but no-flow days did not occur during periods of below average precipitation before 1988. It is important to note that the Eagle Creek gage measures flow from both the North Fork and South Fork.

The “Manual Direction Summary” document (USDA Forest Service 2011) and Thompson (2015) illustrates that we do not have the authority in New Mexico to establish a minimum instream flow and that certain Forest Service manual direction related to instream flow does not apply to this particular project. Requiring zero no-flow days as part of alternative 3 (adaptive management) would not be consistent with these conclusions or our interpretation of New Mexico state law.

The purpose and need for taking action and the management objectives outlined for this project would not be achieved with eliminating no-flow days completely. Alternative 3 (adaptive management) proposes to reduce the number of no-flow days to an average of 20–30 days or less per year, roughly half of the average number of no-flow days experienced between 1989 and 2011. This would allow

pumping to occur under a closely monitored adaptive management strategy designed to ensure protection of forest resources while providing needed municipal water to the Village of Ruidoso.

For these reasons, this suggestion to eliminate no-flow days completely was not added to alternative 3 (adaptive management), but will be addressed by the no pumping alternative. However, the predicted number of no-flow days per year may be used as an indicator in the "Water Resources" section of chapter 3 in order to compare and contrast alternatives in the EIS.

The term of the permit should be 10 years with an option to renew (instead of the stated 30 years). There should be a review of the permit every 4 years, not every 5 or 10 years as stated.

The term of the permit has been revised slightly in the description of alternative 3 (adaptive management) since public scoping, as follows: "The new permit could be authorized for up to 20 years, with stipulations for frequent reviews and verification of the permit terms and conditions. These could occur as often as every year, but would occur at least every 5 to 10 years."

We changed the term of the permit from 30 years as originally stated to 20 years and also added in a provision for annual reviews based on a review of Forest Service manual and handbook direction regarding special use permitting.

Stipulations for review and verification of the operating plan of the permit are important at regular intervals during the administration of a permit; this is stated in the description of alternative 3 (adaptive management). Keep in mind that the alternative that is ultimately selected for implementation in the record of decision would be inserted into the new permit authorization. One of the terms will be an operating plan which would include mitigation measures, monitoring, and adaptive management details. The USDA Forest Service and the Village of Ruidoso would develop an operating plan each year to guide management for that year. As also stated in alternative 3 (adaptive management), the permit and its operating plan would go through frequent reviews possibly as often as every year, but at least every 5 to 10 years. Changes to the permit's annual operating plan (including any need for changes in adaptive management monitoring) could be made as a result of these reviews to ensure forest resource protection is being achieved.

Therefore, this alternative was dismissed from further detailed analysis since it is very similar to alternative 3 (adaptive management).

Don't authorize well #2 and decommission it since it is not being used and never has – this is required by the State Engineer Office water regulations.

The Village of Ruidoso does not use well #2 because it is not equipped, is not tied into the main line, and does not have power. However, the proposed action includes mention of this well in the Village of Ruidoso's permit in order to authorize its presence on National Forest System land. If we did not mention this well in the permit, the Village of Ruidoso would be required to cap it or remove it from National Forest System land. Removal of an existing well also has the potential to impact water rights associated with the well. Removal of an existing well would result in ground disturbance and additional environmental impacts that would need to be carefully evaluated. Capping the well permanently would preclude its use in the future for other management needs such as monitoring.

If the Village of Ruidoso proposed to begin pumping water from well #2 at some point in the future, this use would still be guided by all the parameters established for the well field as a whole. If any new impacts not analyzed in the EIS would result from this new use of well #2, new or additional environmental analysis may be necessary at that time.

For these reasons, we feel permitting well #2 is appropriate in the proposed action and would provide the most flexibility for future management without resulting in any additional environmental impacts. This alternative was dismissed from further detailed analysis.

Don't authorize well #3 since it is damaged and is not currently being used.

As stated above, the proposed action includes mention of this well in the Village of Ruidoso's permit in order to authorize its presence on National Forest System land. If we did not mention this well in the permit, the Village of Ruidoso would be required to cap it or remove it from National Forest System land. Removal of an existing well also has the potential to impact water rights associated with the well. Removal of an existing well would result in ground disturbance and additional environmental impacts that would need to be carefully evaluated. Capping the well permanently would preclude its use in the future for other management needs such as monitoring.

If the Village of Ruidoso proposed to begin pumping water from well #3 at some point in the future, this use would still be guided by all the parameters established for the well field as a whole. If any new impacts not analyzed in the EIS would result from this new use of well #3, new or additional environmental analysis may be necessary at that time.

For these reasons, we feel permitting the presence of well #3 is appropriate in the proposed action and would provide the most flexibility for future management without resulting in any additional environmental impacts. This alternative was dismissed from further detailed analysis.

Suggestions for Changes to the Proposed Action – Monitoring and Adaptive Management

Install a bedrock saturation switch instead of using a depth to water threshold.

We developed the depth to water threshold as described in the proposed action in order to define water table depth based on an average over several years so as to allow for natural fluctuations in precipitation and runoff. Once the average is identified, the monitoring wells would be used to provide water table depth indicators; these wells would provide this information nearly as quickly as a bedrock saturation switch.

Using this switch to shut off the pumps whenever the bedrock is not saturated is very similar to the suggestion to not allow any no-flow days under the proposed action. The aquifer in communication with the stream needs to remain saturated, or the stream will lose flow to the aquifer. For the reasons described above for not eliminating no-flow days from the proposed action, we do not feel that the requirement for saturated bedrock before any pumping can occur meets the purpose and need for action or the management objectives for this project.

Under the proposed action, the Village of Ruidoso would be required to maintain water table depth at or above the identified threshold (threshold would be identified after 5 years of data are collected) over 3 consecutive water years. If groundwater pumping of the North Fork Eagle Creek wells results in a declining trend in the average water table depth over any 3-year period, the Village of Ruidoso would be required to reduce pumping until the average water table depth is reestablished and the USDA Forest Service determines that pumping may resume without creating further departures over a 3-year period. Use of this threshold would allow pumping to occur under a closely monitored adaptive management strategy designed to ensure protection of forest resources while providing needed municipal water to the Village of Ruidoso.

For these reasons, this suggestion to maintain saturated bedrock and to use a switch to detect this condition so that pumps are turned off when it is not achieved was not added to the proposed action, but will be addressed by the no pumping alternative. Detailed prescriptions from the alternative (identified in the record of decision) which is ultimately selected for implementation would be inserted into the operating plan for the permit. This includes mitigations, monitoring, and adaptive management actions. The USDA Forest Service and the Village of Ruidoso would develop an annual operating plan each year based on the terms and conditions of the permit to guide management for that year. As also stated in the proposed action, the permit would go through a review and renewal at least every 5 to 10 years. Changes to the operating plan of the permit (including any need for changes in adaptive management monitoring) could be made during any of these steps to ensure forest resource protection is being achieved; they may require additional environmental analysis.

All monitoring information should be relayed electronically to the Forest Service and then made available to the public via the Web.

Having all monitoring information available electronically would be beneficial for management and would make it easier to disseminate this information to those who are interested. However, the specifics regarding how monitoring information is collected, stored, analyzed, and otherwise made available is outside the scope of this environmental analysis. The EIS will evaluate the effects of various well pumping alternatives on forest resources and socioeconomics; how data are relayed and made available for any of the alternatives would not result in any differences in effects to forest resources or socioeconomics.

For these reasons, this suggestion was dismissed from further detailed analysis. However, the USDA Forest Service will consider this suggestion when deciding how best to implement whatever alternative is ultimately selected in the record of decision.

All monitoring should be conducted by the Forest Service or the Office of State Engineer and not the Village of Ruidoso.

As discussed above, the specifics regarding how monitoring is conducted is outside the scope of this environmental analysis. The EIS will evaluate the effects of various well pumping alternatives on forest resources and socioeconomics. While monitoring is a large component of the proposed action and has the potential for some effects (i.e. primarily labor implications and cost), exactly who would conduct the monitoring is not relevant to the environmental analysis.

For these reasons, this suggestion was dismissed from further detailed analysis. However, the USDA Forest Service recognizes the importance of monitoring to this project and the desire for objective evaluations and adherence to whatever monitoring plan is ultimately selected in the record of decision. Any actions included in the operating plan of the USDA Forest Service special use permit must be authorized and approved by the USDA Forest Service. It is common practice for certain special use permit terms and conditions or the operating plan provisions (such as monitoring) to be conducted by the USDA Forest Service or an approved contractor or third party and paid for by the Village of Ruidoso.

Adaptive management monitoring should be on a 5-year rotation/ Adaptive management monitoring should be on a 4-year rotation.

The proposed action includes verifying the success of the adaptive management strategy every 5 years, so that adjustments would be made within 5 years if needed to ensure protection of forest resources. Therefore, the suggestion for a 5-year rotation is achieved by the proposed action.

Shifting this verification to every 4 years instead of every 5 years would not likely result in any measurable difference in “on-the-ground” effects to forest resources due to the similarity between a 4-year review and a 5-year review and the variability in forest resource measurements over a 1-year period. As described previously, special use permits are to be managed with multiple levels of review and adjustment. Detailed prescriptions from the alternative (identified in the record of decision) which is ultimately selected for implementation would be inserted into the permit. The USDA Forest Service and Village of Ruidoso would develop an annual operating plan each year based on the mitigation measures of the permit. As also stated in the proposed action, the permit would go through a review at least every 5 to 10 years. Changes to the terms and conditions of the permit (including any need for changes in adaptive management monitoring) could be made during any of these steps to ensure forest resource protection is being achieved; they may require additional environmental analysis. For these reasons, this suggestion was dismissed from further detailed analysis.

Depth to water threshold should be based on a pre-well baseline and not on a post-well baseline, as is currently described.

The USDA Forest Service developed the depth to water threshold as described in the proposed action in order to define water table depth based on an average over several years to allow for natural fluctuations in precipitation and runoff. Once the average is identified, the monitoring wells would be used to provide water table depth indicators. However, we recognize that any post pumping water table surface is curved (within the cone of depression) and is transitory and is not the same as the pre-well pumping baseline.

Using a pre-well baseline for average water table depth instead of the 5-year post-well average is very similar to the suggestion to not allow any no-flow days under the proposed action or to use a bedrock saturation switch. The pre-well average water table depth was likely close to the stream channel, but we have no way of knowing exactly what the water table depth was before pumping began; this can only be inferred based on Eagle Creek gage information and some other factors as described in the U.S. Geological Survey report. For the reasons described above (for not eliminating no-flow days from the proposed action and not requiring bedrock saturation) in the proposed action, we do not feel that establishing a water table depth based on pre-well conditions meets the purpose and need for action or the management objectives for this project. We intend to use the average water table depth threshold as a baseline for comparison; a datum by which current conditions are compared. It is a method for measuring relative change.

Under the proposed action, the Village of Ruidoso would be required to maintain water table depth at or above the identified threshold (threshold would be identified after 5 years of data are collected) over 3 consecutive water years. If groundwater pumping of the North Fork Eagle Creek wells results in a declining trend in the average water table depth over any 3-year period, the Village of Ruidoso would be required to reduce pumping until the average water table depth is reestablished and the Forest Service determines that pumping may resume without creating further departures over a 3-year period. Using this threshold, in combination with the other identified indicators, would allow pumping to occur under a closely monitored adaptive management strategy designed to ensure protection of forest resources while providing needed municipal water to the Village of Ruidoso. For these reasons, this suggestion to use a pre-well baseline for water table depth was not added to the proposed action, but will be addressed by the no pumping alternative.

There should be no limit on pumping during drought – you should use precipitation and projected streamflow instead.

Not instituting any control over pumping during drought situations would not meet the purpose and need for action. The thresholds for water table depth, streamflow, riparian conditions, and pumping volumes in the proposed action include using 3-year running averages. This considers historic trends and allows for natural fluctuations in precipitation and snowmelt runoff, and periodic short-term drought cycles. While we recognize that water demand may be highest during times of below average precipitation, this is also the time when water-dependent resources are also stressed. Use of the thresholds identified in the proposed action would allow pumping to occur under a closely monitored adaptive management strategy designed to ensure protection of forest resources while providing needed municipal water to the Village of Ruidoso. For these reasons, this suggestion was not added to the proposed action but will be addressed by the no action (no change) alternative.

The 5-year monitoring requirement for water table depth before making adjustments is too long.

The proposal to base the water table depth threshold on the average depth based on 5 years of data collection was developed to allow for natural fluctuations in precipitation, snowmelt runoff, recharge, and periodic short-term drought cycles. We do not think that using 5 years of data is too long since it is important to ensure the average depth is based on a long enough time period to capture these natural fluctuations. However, we recognize that waiting until a decision is made on this project to initiate the last 3 years of this needed monitoring is not ideal at present, it appears feasible for the USDA Forest Service to conduct monthly water table depth monitoring on monitoring well MW-1B beginning immediately. If this occurs, this means that the average water table depth could be determined prior to a decision on this project.

This statement in the proposed action has been revised slightly to capture this.

Using the 5-year water level average is not accurate. This should be removed since it is not supported by the U.S. Geological Survey study.

Please see the response above regarding use of the average water table depth based on 5 years of data. We do not agree that developing an average water table depth based on multiple years of data (and not just the 2 years collected during the U.S. Geological Survey study) is in conflict with the findings of the U.S. Geological Survey study. The U.S. Geological Survey study used a 5-year moving average to analyze the precipitation trend, so it is consistent with that approach, especially since we are concerned about the relationship between drought and water table depth.

Groundwater withdrawals should be based on 50 percent of the streamflow measured at the North Fork gage.

The proposed action includes monitoring streamflow as follows: “If there are more than 20 days per year of no surface flow (less than 0.01 cubic feet per second) over a period of 3 consecutive water years at the Eagle Creek gage, or more than 30 no-flow days within any single water year (October 1–September 30), the Village of Ruidoso must reduce groundwater withdrawal rates from these wells. If either of those thresholds is exceeded, then groundwater withdrawals from the North Fork wells would be limited to 50 percent of the volumetric rate of surface flow at the North Fork gage (which is upstream from the wells) until surface flow at the Eagle Creek gage resumes.”

The proposed action includes basing groundwater withdrawals on 50 percent of the flow measured at the North Fork gage, as you suggest, if the thresholds for no-flow days is reached.

Weekly field checks should be added to the monitoring strategy.

We recognize the value in periodic visual inspections during the course of implementation of any adaptive management strategy. While visual observations would not contribute to the data needed to verify the adaptive management triggers (monitoring indicators), it could provide anecdotal information on flow patterns, flood events, gage and well conditions, and vegetation condition and recreational use, to name a few. Conducting periodic visual observations has been added to the proposed action under the adaptive management strategy. However, we do not agree that mandatory weekly field checks are necessary to ensure an effective monitoring strategy. With limited funding and personnel, this would be difficult to implement.

If there are violations to the stipulations, immediate actions should be taken until artesian flow regimes are regained.

We recognize that in successfully implementing the new permit, there must be consequences in the event the Village of Ruidoso does not comply with the terms and conditions. However, this is outside the scope of this environmental analysis. This EIS evaluates the effects of various well pumping alternatives on forest resources and socioeconomics. Effects are analyzed on the assumption that all the components of any alternative (including mitigations, monitoring, and adaptive management strategies) are implemented as described. In other words, it assumes full compliance. If the Village of Ruidoso is in noncompliance with applicable statutes or regulations or the terms and conditions of the authorization, the USDA Forest Service would handle it administratively per Federal Regulations. 36 CFR 251.60 (B). For these reasons, this alternative was dismissed from further detailed analysis.

The water table depth monitoring should be based on information from NF-1, NF-3 and NF-4 and MW-1B, not just MW-1B as is currently stated.

We agree that the wording in the explanation of how monitoring well MW-1B would be used for monitoring water table depth is not entirely accurate. We agree that all available information should be used and this may include data from the other monitoring wells and water supply wells. This clarification has been added to the proposed action.

Comments on Stream Augmentation

Drop stream augmentation from any further consideration. It does not address the purpose and need and could result in adverse impacts by expanding the cone of depression and exacerbating these effects to forest resources and by introducing chemical properties of groundwater above the surface.

Stream augmentation has been proposed by the Village of Ruidoso as a way to mitigate the potential for adverse effects to streamflow due to well pumping. We recognize that there are advantages and disadvantages to the use of stream augmentation and that there is literature available on this topic.

Stream augmentation with groundwater is sometimes used to provide surface flow where there would otherwise be little or none. This may be beneficial, as in the case of saving an endangered species; or it can create other issues. The most obvious of these being added lowering of the water table and the potential for surface water degradation. We considered the following factors in determining whether or not stream augmentation should be carried forward for detailed analysis:

- Sommer and Horwitz (2009) made the observation that ". . . artificial augmentation will inevitably change the system in another direction, i.e. the 'recovered' state will be slightly different to the original state. In addition, it will require ongoing care, will use a valuable

resource relatively inefficiently, and will not address the root causes of the problem, namely overextraction of groundwater and declining rainfall."

- Parasiewicz (2008) emphasized the importance of simulating the natural variable discharge that any stream will have throughout the year, minus the extreme spikes. Lowering the stream temperature in the summer or raising temperature in the winter by addition of groundwater may be detrimental to fisheries (Cowx 2004). Lower dissolved oxygen content of augmenting groundwater could also lead to asphyxiation of fish and invertebrate species (ibid.).
- Constituents generally not present or in very low concentrations in surface runoff may be highly enriched in groundwater which has equilibrated with the host aquifer. Utilizing groundwater to augment lakes in Florida resulted in significant increases in radium activity. The radium in this case was from the Floridian aquifer (Brenner et al. 2006). Water of high ionic strength potentially being released from aquifer storage and recovery projects for Everglades restoration was recognized as representing a "major ecological change" (National Research Council 2002).
- Additional pumping near a stream that is disconnected, or above the water table, can increase the length of the stream that is disconnected, resulting in more flow reduction (Brunner et al. 2011).

Any withdrawal of groundwater to augment the creek at any point would result in a cone of depression that would be in addition to whatever drawdown is being caused by water supply pumping. As documented in more detail in the project record, we evaluated two scenarios. For the first, the transmissivity was set at 2,941 square feet per day and the storage coefficient was set at 0.0014 (these numbers were taken from Atkins-Landfair, Inc. 1985). Based on this rough calculation under this scenario, water table drawdown would be approximately 2 feet within 50 feet from the pumping well after 1 year. For the second, the transmissivity was set at 1,250 square feet per day and a storage coefficient was set at 0.002 (these numbers were taken from Balleau Groundwater, Inc. 2004). Based on this rough calculation under this second scenario, drawdown would roughly be 4 feet within 50 feet from the pumping well after 1 year.

These two simulations assume the aquifer is homogenous. Any barriers, such as faults or areas of lower hydraulic conductivity would serve to increase these drawdown effects. And again, these estimated drawdowns would be additive to any drawdown resulting from water supply pumping. The deeper the cone of depression formed due to water supply pumping or stream augmentation, the longer it would take for the water table to recover.

Another aspect of evaluating this alternative is ensuring that we can describe it in enough detail so it can be meaningfully evaluated and compared to the other alternatives. In order to determine these specific parameters (e.g. When would we decide to augment flow? How long would it be used? How would we decide to stop augmenting flow?), the Village of Ruidoso proposed a pilot study to us and the New Mexico Surface Water Quality Bureau. The Surface Water Quality Bureau stated that this type of study falls under the jurisdiction of the Environmental Protection Agency and requires a National Pollutant Discharge Elimination System permit. The Environmental Protection Agency stated that the use of groundwater is inconsistent with surface water and that North Fork Eagle Creek needs to be managed for aquatic systems and the Surface Water Quality Bureau considers it swimmable/fishable. This implies that this action could result in adverse effects to water quality and aquatic ecosystems. Because of these factors, the Village of Ruidoso would need to go through a lengthy permitting process with the Environmental Protection Agency, effectively eliminating the opportunity to conduct a pilot study in time to inform the EIS.

The Village of Ruidoso initially filed a National Pollutant Discharge Elimination System permit application to conduct a pilot test to the Environmental Protection Agency Region 6 office on October 27, 2011, with the final filing occurring on November 28, 2011. The Village of Ruidoso is currently awaiting action on this application (Atkins Engineering Associates 2014).

Without a pilot study, we do not have any measurable parameters for how, specifically, this alternative would be implemented. Using the adaptive management triggers from the proposed action would be unrealistic since these are based on groundwater maintenance. The pilot study was to be used to assist in determining some of these parameters and to see if streamflow could be maintained. We would need these parameters in order to effectively analyze this alternative in the EIS.

Implementing stream augmentation would not meet the purpose and need for taking action or the management objectives for this project because of the potential for adverse impacts to forest resources, expansion of the cone of depression, and lack of detail regarding how stream augmentation would be used on North Fork Eagle Creek. It also would not address any of the significant issues for analysis. For these reasons, this alternative was dismissed from further detailed analysis.

Add a pilot test of the stream augmentation adaptive management option to the proposed action so this can be tested for feasibility early on in the permit.

We removed stream augmentation as a potential adaptive management adjustment in the proposed action upon further examination of the range of alternatives and the desire for each alternative to stand alone. As discussed above, stream augmentation was initially considered as a stand-alone alternative and we recognized at that time the value of conducting a pilot test. After the Little Bear Fire we reevaluated this option to see if changes due to the fire would allow us to test stream augmentation without negatively affecting other resources. However, as stated above, because of the potential for adverse impacts to forest resources, possible expansion of the cone of depression, and the lack of detail regarding how stream augmentation would be used on North Fork Eagle Creek, stream augmentation would not meet the purpose and need for taking action or the management objectives for this project. It also would not address any of the significant issues for analysis. For these reasons, this alternative was dismissed from further detailed analysis.

Keep stream augmentation. It will enhance riparian vegetation.

See responses above.

The current description of the stream augmentation alternative does not make sense. How will thresholds for groundwater maintenance be used to determine when to augment streamflow?

Following the release of the notice of intent, the interdisciplinary team realized that the way in which the stream augmentation alternative was described may not be implementable. There is a disconnect between how the monitoring thresholds would be used to decide when to augment streamflow. As currently written, exceeding the thresholds for streamflow, water table depth, and riparian vegetation would trigger augmentation of streamflow by pumping groundwater into the North Fork of Eagle Creek stream channel to mitigate adverse impacts to surface resources.

As we explained in the responses above, we do not have information on what thresholds could be used to determine when to augment streamflow. Initially, a pilot test was proposed to identify these parameters and thresholds. However, there is not enough time to complete a pilot test within a reasonable timeframe for this EIS analysis. Because of this and the other reasons described above, this alternative has been dismissed from further detailed analysis.

Suggestions for New Alternatives

Ensure that the range of alternatives includes all reasonable alternatives (and no less than one) that leave downstream flows in the same state they would be absent pumping, to be in compliance with the stipulation agreement.

This is addressed by alternative 2 (no pumping). The no pumping alternative would leave downstream flows in the same state they would be absent pumping and is currently in the range of alternatives for detailed analysis. This alternative will provide a very valuable comparison to the other alternatives to show the effects well pumping has on forest resources and economics. It is within the discretion of the decision maker for this project to select this alternative following their review of the final EIS and all public comments received.

We could not identify any other reasonable alternatives besides the no pumping alternative that would also meet the purpose and need for action, the management objectives, and be consistent with our manual direction, as summarized in the separate “Manual Direction Summary” document (USDA Forest Service 2011) and in chapter 1. For these reasons, no additional alternatives were developed to meet this criterion. We feel this is consistent with the stipulation agreement.

Build a water purification plant.

This suggestion is outside the scope of this project. While we recognize the value in reclaiming and reusing wastewater for municipal water needs, the specifics of how, when, and where this is done is outside the jurisdiction of the USDA Forest Service. However, we will ensure the Village of Ruidoso is aware of this suggestion. For these reasons, this alternative was dismissed from detailed analysis.

Add more storage capacity to the system.

This suggestion is outside the scope of this project. While we recognize the value in additional water storage, the specifics of how much, when, and where this is done is outside the jurisdiction of the USDA Forest Service.

Having additional water storage would allow the Village of Ruidoso to pump water from the North Fork of Eagle Creek during high flow periods and store the water so it could then be used during dry periods. Removing excess water from the system during high flow periods and limiting pumping during low flow periods would provide for forest resource needs and municipal water. It could also minimize the need for extensive mitigations, monitoring, and adaptive management actions. However, adding more storage to the system would be difficult due to the high volume of storage needed to meet demand and the logistics and cost this would entail.

Based on some rough calculations, the Village of Ruidoso requires approximately 41–42 million gallons of water during the typical dry season to meet the demand for municipal water.

A household’s average water use was estimated to be 0.5 acre feet per year. This is 163,000 gallons of water per household. According to the census Web site, the Ruidoso/Ruidoso Downs metropolitan area has the equivalent of 4,600 households needing 2,300 acre feet (750 million gallons) per year. Three weeks of storage would amount to about 42 million gallons. The largest storage tanks are about 2 to 3 million gallon capacity, which would require 14 to 21 of the largest tanks, or a 13-acre surface reservoir with an average 10-foot depth.

In speaking with one company that supplies water storage tanks (Aquastore tanks and domes), each tank would cost about 2.8 million dollars, for a total cost of approximately 40 million dollars. Besides the cost, there is added difficulty in determining if there is a feasible location.

Constructing a new dam impounding 50 acre feet (about 16 million gallons) would cost from 2.5 to 3.5 million dollars, based on some rough estimates. A new dam in this area would be considered "high hazard" since it is most likely that people would be living downstream of it. Expansion of an existing dam, such as Alto Reservoir, is a complex undertaking. A 50-acre-foot dam would typically be about 25 feet high. An alternative to a single large reservoir could be a series of smaller dams, which would lessen the hazard, but would cost about the same.

Adding more storage capacity to the system to address water shortage during times of drought is typically not feasible due to economic considerations. During times of drought, source production would be the main limiting factor for water quantity. If the source cannot produce enough water, it is not economical to add additional water storage capacity if demand does not change during times of drought.

Water storage capacity for a drinking water system is based upon several calculations such as pressure requirements, maximum flow velocities within the piping, piping sizes, and most important, peak hourly demand, and maximum fire flow requirements. These are specific to the water system design. The need for additional storage during dry periods is not typically incorporated into the calculations for a water system because of the economic factors of overbuilding. The water system would need to be evaluated to determine capacity, if additional water treatment methods would be necessary (per New Mexico Environment Department regulations), and if the water system infrastructure would have the capacity to distribute the additional water. This evaluation would need to consider additional engineering, design, and construction implications for the water system infrastructure. Environmental impacts related to the ground disturbance associated with added infrastructure would also need to be considered.

For these reasons, this alternative was dismissed from further detailed analysis. We will ensure the Village of Ruidoso is aware of this suggestion.

Clear vegetation on private land to improve the water table and increase fire protection.

How vegetation is managed on private land is outside the jurisdiction of the USDA Forest Service and outside the scope of this project. However, we recognize that upland vegetation can influence the water table. The EIS includes an evaluation of the effects of forest density (and any changes in forest density over time, if known) within the North Fork Eagle Creek drainage to water availability, as a component of the cumulative impacts analysis. For these reasons, this alternative was dismissed from detailed analysis.

Don't build any more golf courses or other new developments.

This suggestion is outside the jurisdiction of the USDA Forest Service and outside the scope of this project. While we recognize the value in reducing future demands on the municipal water supply through limiting new development, the specifics of how, when, and where this is done is outside the jurisdiction of the USDA Forest Service. However, we will ensure the Village of Ruidoso is aware of this suggestion. For these reasons, this alternative was dismissed from detailed analysis.

Minimum Instream Flow Alternative

The components of this suggested alternative are included below:

- Install new gage on North Fork Eagle Creek above the confluence with South Fork Eagle Creek
- Install electronic monitoring switches on pumps and gages

- Establish a minimum instream flow (we suggest 1.2 cubic feet per second based on the U.S. Geological Survey study)
- When flows are below the minimum instream flow measured at the new gage, stop pumping (the switches on the pumps will automatically shut off)
- When flow is greater than the minimum instream flow, continue pumping
- Add storage capacity to the system so that more water can be pumped and stored during high flows
- Authorize a 10-year permit term with options for renewal

The basis for this alternative is in establishing and then managing for a minimum instream flow at all times. The flow suggested (1.2 cubic feet per second) is supported by the U.S. Geological Survey study if our desired condition is continuous flow. Here is the excerpt from the U.S. Geological Survey Report Abstract:

> If it is assumed that, without pumping, the bedrock aquifer would be saturated to the base of the alluvium, then a discharge of only 1.2 cubic feet per second required to saturate the alluvium in its thickest and widest reach would be needed to sustain continuous flow in the stream. During the study period, a discharge of 1.2 cubic feet per second was equaled or exceeded at the North Fork gaging station 8 percent of the time. Based on the discharge record at the Eagle Creek gage, given alluvium and channel configurations similar to those described in this study, streamflow in some part of the stream channel between the North Fork and Eagle Creek gages was likely discontinuous during part of the year during both time periods.

We compared the number of months per year when flow was less than 1.2 cubic feet per second during the early period (August 1969 through December 1980) and after pumping began (April 1988 through 2011), as shown in table 1.

Table 1. Streamflow before 1980 and after 1988, measured at the Eagle Creek gage

Flow Measured at Eagle Creek Gage	Percent of Time	Months per Year
Early Period (1969-1980)[a]		
Time dry	0.0 percent	0.0
Flow greater than 0.12 to 1.2 cubic feet per second	46.1 percent	5.5
Flow greater than 1.2 cubic feet per second	53.9 percent	6.5
Late Period (1989-2011)[b]		
Time dry	12.3 percent	1.5
Flow greater than 0.01 to 1.2 cubic feet per second	57.2 percent	6.9
Flow greater than 1.2 cubic feet per second	30.5 percent	3.7

a - Data used for this calculation came from 1969-1980; this results in slightly different figures than that reported in table 5 because 2 additional years were used (1969 and 1970); however the results are similar.

b - Data used for this calculation came from 1989-2011; this results in slightly different figures than that reported in table 5 because 2005 data were used; however the results are similar.

Before pumping began, flow measured at the Eagle Creek gage was greater than 1.2 cubic feet per second about 54 percent of the time, or for approximately 6.5 months out of every year. Since pumping began, flow has been greater than 1.2 cubic feet per second about 30 percent of the time or for approximately 3.5 months out of every year. To manage pumping to maintain this minimum

instream flow continuously would mean that we would be managing for a condition that did not exist before the wells began pumping.

We recognize flow has changed since pumping began and that dry periods have increased. We reanalyzed this data to make interpretations regarding all available data, which is presented in the water resources section of chapter 3.

As stated in our response to the suggestion to eliminate no-flow days completely from the proposed action, the USDA Forest Service does not have the authority in New Mexico to establish a minimum instream flow and the relevant sections of our Forest Service Manual do not apply to this project since North Fork Eagle Creek does not meet certain criteria (see separate "Manual Direction Summary" document (USDA Forest Service 2011) for further information). Therefore, requiring the Village of Ruidoso to manage for a continuous minimum instream flow is not consistent with these conclusions and is outside the jurisdiction of the USDA Forest Service in New Mexico.

As stated in the purpose and need for taking action, the management objectives outlined for this project, and the desired conditions for the project area, we are not striving to attain continuous flow in North Fork Eagle Creek. Rather we are striving to: (1) attain increased flow (measured by a reduction in no-flow days), consistent with the intermittent nature of North Fork Eagle Creek in the project area; (2) ensure groundwater discharge sustains base flows and is a source of water for springs and seeps and water-dependent ecosystems; and (3) ensure riparian vegetation is maintained or improved and that streamside recreation opportunities are available.

We recognize the value in having a separate stream gage for North Fork Eagle Creek. This would simplify the necessary calculations between the Eagle Creek gage and the South Fork gage and would provide easily obtainable flow measurements continually for North Fork Eagle Creek flows in the project area. However, there are already three gages installed on this system; installing a fourth would require additional funding (estimated between $18,000 and $100,000 in addition to annual maintenance costs; the North Fork gage cost $32,608 to install), additional time and labor, additional manpower for monitoring, and added stress to the system. Gages have impacts on stream habitat. While these effects can be minimized, they need to be considered before installing any new structures in streams. As one example, they can result in barriers to fish movement. There is already concern that the various gages and road crossings on North Fork Eagle Creek are limiting the ability for fish passage and movement within and upstream from the project area. Finally, finding a suitable location for a gage upstream from the confluence with the South Fork would be difficult due to the width of the channel here and the depth of the alluvium.

We re-considered this suggestion for a new gage upstream from the Eagle Creek gage in response to additional suggestions during the SDEIS comment period. We reached the same conclusion, as described above, and did not feel this merited additional analysis. We also recognized that there is difficulty in being able to find a suitable gage location nearer to the North Fork wells due to the width of the channel in this location. We concluded that the proposed use of the existing gages, and additional alluvial wells as proposed as part of alternative 3 should provide the necessary data needed.

The USDA Forest Service agrees that using electronic monitoring switches would be beneficial for management and would minimize monitoring efforts. This type of system would only work with establishing a minimum instream flow, and as stated above, this is outside the jurisdiction of the Forest Service and would not meet the purpose and need for action.

Adding additional storage capacity to the system and evaluating different permit term lengths have been addressed in previous responses. For these reasons, the minimum instream flow alternative was dismissed from further detailed analysis.

Limited Restrictions Alternative

The components of this suggested alternative are included below:

- Instead of using the 300 acre-feet per year threshold per year, use the 2009-2010 pumping volume of 738 acre-feet per year. The 300 acre-feet per year threshold (which is based on 490 acre-feet per year annual recharge rate from the U.S. Geological Survey study based on the chloride mass balance method). This should instead be based on 1,950 acre-feet per year (which is the mid-range based on the annual groundwater recharge rate computed by U.S. Geological Survey using the basin yield method and acknowledges the range of error). Using 738 acre-feet per year is more in keeping with the 1,950 number.
- Do not apply the requirement for no more than 20–30 no-flow days per year during times of drought. Instead use measured annual precipitation and projected streamflow.
- Allow stream augmentation during drought conditions to benefit riparian vegetation.
- Do not use the 5-year average water table depth as a monitoring indicator as it does not take into account the fluctuating nature of the aquifer during drought and subsequent recharge during precipitation events. There is no evidence of an expanding cone of depression outside of National Forest System lands. Remove the riparian monitoring threshold.
- Allow groundwater diversions to continue at 2009-2010 water year levels at least until the Village of Ruidoso has been granted approval to move their water rights and allow sufficient diversion of municipal water rights off of National Forest System lands.
- Account for Office of the State Engineer required reporting per the Hondo Basin duty of water special master report.

The 300 acre-feet per year threshold per year was based on the 500 acre-feet per year recharge for the North Fork basin as determined by the chloride balance method described in the U.S. Geological Survey report. The recharge rate from the chloride balance method was used instead of the rates calculated using the basin yield because of less certainty in evapotranspiration estimation. The chloride balance method also gives a maximum value for recharge because the rocks may contribute chlorine. We do not agree that calculating the recharge rate and then the acceptable well pumping threshold based on the basin yield method is appropriate since the proposed action includes adaptive management to achieve the desired conditions. The use of the recharge rate determined by chloride balance is a safe starting point because it should represent a maximum groundwater recharge rate method.

That being said, the initial threshold of 900 cumulative acre feet over any 3 consecutive water years (300 acre feet per year) is not a stand-alone threshold. As stated in the proposed action, hitting this threshold would trigger a review by the USDA Forest Service of the other current thresholds and mitigations at maintaining or improving surface resource conditions. We would decide, based on evaluation of all monitoring indicators, if changes would be needed.

We are also unclear regarding the suggestion to use 1,950 acre-feet per year; this amount would exceed the current water right for 1,692 acre-feet per year (based on the 2010 Consent Order) which is based on maximum pumping.

We recognize that the 300 acre-feet per year threshold was only a starting point based on the best available information at the time the proposed action was developed. We have since re-evaluated this number based on additional reanalysis of all available information (as recently discussed at the hydrologist technical meeting held in April 2011 and the results of which are documented in chapter 3) and conclude that it still valid based on the best available science. However, the proposed action includes adaptive management strategies that would allow for additional monitoring results to be used to continually review and refine these thresholds based on new information.

For these reasons, the suggestion to use the 2009-2010 pumping volume of 738 acre-feet per year as the well pumping volume threshold was dismissed from further detailed analysis but will be addressed by the no action (no change) alternative.

The other suggestions for removing the no-flow day thresholds, removing the average water table depth threshold, removing the riparian thresholds, and allowing groundwater diversions to continue at 2009-2010 levels are essentially a description of the no action (no change) alternative. The no action (no change) alternative will be analyzed in detail in chapter 3.

The suggestion to use stream augmentation is addressed in the previous responses to stream augmentation earlier in this document.

In regards to the request for Office of the State Engineer reporting, we defer to them in the allocation, adjudication, and transferability of water, even on public lands. The USDA Forest Service as a federal entity recognizes fully adjudicated basins and the apportionment of waters of a designated district by a Water Master.

The Village of Ruidoso would be allowed to pump up to 50 percent of the volumetric rate of surface flow greater than 1.2 cubic feet per second, up to a total of 300 acre-feet per year, measured at the North Fork gage upstream of the wells.

We considered whether this alternative would meet the purpose and need for action. While it would likely meet the second need statement (protecting natural resources on the national forest by maintaining adequate surface and groundwater flows to sustain or improve the riparian and aquatic ecosystems that may be affected by groundwater drawdown from the pumping of these wells) it would not likely meet the first need statement (authorizing, under a special use permit, the Village of Ruidoso's ability to access and divert groundwater from its North Fork Eagle Creek wells on National Forest System land, as a substantial component of the municipal water supply system (attributable, at times, to providing up to 75 percent of the municipal water supply) that Village of Ruidoso residents and visitors rely upon). While this alternative would continue to provide the Village of Ruidoso with water access, it would not likely continue to contribute substantially to the municipal water supply.

The occurrence of flows greater than 1.2 cubic feet per second at the North Fork gage is quite limited (often occurring less than 4 percent of the time). Calculations based on a cutoff of 1.2 cubic feet per second at the North Fork gage from September 2007 through November 2011 data, show that:

- The Village of Ruidoso would be able to divert 300 acre-feet per year (or more, if allowed) during average or wetter years under this alternative. The ability to divert, however, would be much more severely limited during dryer years. It is possible that in some years, the well field would produce less than 10 acre-feet per year under these proposed criteria.
- The average available water for pumping would be approximately 152 acre-feet per year (based on these 4 years of available data only), which would be substantially less than the Village of Ruidoso's current average (569 acre-feet per year based on data from 2002-2010).

Thus, this suggested alternative is very narrow and does not provide the needed flexibility to respond to the first need statement; it could result in an immediate and significant reduction in current levels of use.

The basis for this alternative is in establishing and then managing for a minimum instream flow at all times, measured at the North Fork gage. The flow suggested (1.2 cubic feet per second) is supported by the U.S. Geological Survey study if our desired condition is continuous flow. As stated in our response to the suggestion to eliminate no-flow days completely from the proposed action and to our response to the minimum instream flow alternative (see previous responses to these suggested alternatives earlier in this section), the USDA Forest Service does not have the authority in New Mexico to establish a minimum instream flow. Certain sections of our Forest Service Manual do not apply to this project since North Fork Eagle Creek does not meet certain criteria (see separate "Manual Direction Summary" document (USDA Forest Service 2011) for further information). Therefore, requiring the Village of Ruidoso to manage for a continuous minimum instream flow is not consistent with these conclusions and is outside the jurisdiction of the USDA Forest Service in New Mexico.

For these reasons, this alternative was dismissed from further detailed analysis.

The Village of Ruidoso would be allowed to pump up to 80 percent of the average annual quantity of groundwater recharge

This suggestion was provided during the SDEIS comment period and includes the following:

- Allow the Village of Ruidoso to pump up to 80 percent of the average annual quantity of groundwater recharge that will occur post-wildfire based current canopy density, vegetation type and distribution, and soil moisture requirements.
- Recharge estimates after 10 years can be recalculated and should be based on actual USDA Forest Service forest management performed and USDA Forest Service financial assurances related to maintaining a healthy watershed.
- The calculation of groundwater recharge must not be performed using the chloride mass-balance method.
- Village monitoring would include:
  - Groundwater levels in North Fork monitoring wells: MW- lA, MW- lB, MW-lC, MW-3A, and MW-5A.
    - Monitoring frequency: hourly
    - Reporting frequency: monthly
  - Monitor groundwater levels in North Fork production wells H-1979 (North Fork 1), H-1981 (North Fork 3), and H-1982 (North Fork 4)
    - Monitoring frequency: hourly
    - Reporting frequency: monthly
  - Monitor diversions from North Fork production wells H-1979 (North Fork 1), H-1981 (North Fork 3), and H-1982 (North Fork 4)
    - Monitoring frequency: monthly
    - Reporting frequency: monthly
  - Streamflow at North Fork Eagle Creek gage (08387550), South Fork Eagle Creek gage (08387575), and Eagle Creek below South Fork gage (08387600)

- Monitoring frequency: real time data as currently performed by USGS
- Reporting frequency: as currently provided on USGS website

We considered this a suggestion. We compared it to the purpose and need and evaluated whether, from a hydrologic standpoint, if it was feasible and implementable and if it would meet the purpose and need for action.

The Village's recommended alternative may be useful as a management tool in the future, and revisiting recharge estimates (and other conditions) after ten years is warranted. However, at this point in time, the 80 percent seems to be an arbitrary value. In addition, current estimates of recharge are acknowledged to be uncertain, further complicating a volume estimate to apply for ten years. The approach may simply compound the potential effects of pumping on the hydrologic system. Also, uncertainties about recharge volumes may endure beyond a ten-year period. In the interim, the objective of further quantifying recharge should not distract from more direct management of riparian condition and watershed health based on factors and approaches already considered.

It also appears to only consider adjustments in management after a 10-year period ("Recharge estimates after 10 years can be recalculated"...). It is unclear if the desired conditions of "no-flow days average 20–30 days or less per year" or if "[t]he thresholds for average or median water table depth annually or seasonally (based on monitoring)" could be met by this alternative if management adjustments are not considered on a continual basis. It is also unclear if the need "to provide for protection of forest resources on National Forest System lands" can be met without an adaptive management approach during years of below average annual recharge.

For these reasons, this alternative was dismissed from further detailed analysis.

Alternative 3 Described in the DEIS as the Proposed Action

Alternative 3 described in this document is not exactly the same as the proposed action that was described in the DEIS and distributed for public comment, although they are quite similar. Since the distribution of the DEIS we have made a few adjustments to address anticipated conditions due to the Little Bear Fire and the ability for successful adaptive management and monitoring into the future, as well as public input on the DEIS. The intent of the proposed action, however, is the same and it includes similar adaptive management triggers and monitoring to the proposed action described in the DEIS.

Comparison of Alternatives

This section provides a summary of the primary alternative components and how well the alternatives achieve the purpose and need (table 2) and summarizes the effects of implementing each alternative (table 3). The effects of implementing each alternative are described in detail in chapter 3.

Table 2. Summary of alternative components

Components	Alternative 1 – Preferred Alternative - No Change (Continue Pumping)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Permit	New permit issued and authorized for up to 20 years, with stipulations for frequent reviews and verification of the permit terms and conditions. These could occur as often as every year, but would occur at least every 5 to 10 years.	No permit issued; wells and associated facilities would no longer be authorized and all use would be discontinued.	Same as alternative 1.
Wells Used	Four wells authorized under permit (three equipped and one unequipped); wells #1 and #4 would typically be used. If the Village of Ruidoso proposed to begin pumping water from wells #2 or #3, permit terms and conditions would be reviewed; new environmental analysis may be necessary.	None - wells would be removed from National Forest System land within 6-12 months	Same as alternative 1.
Associated Facilities	Permit includes operation and maintenance of existing monitoring wells, well house control station, underground pipeline and power line, and National Forest System Road 127A road maintenance between NM 532 and gate below summer home area. Under alternative 1, security fencing would also be installed around each well and 2 new alluvial monitoring wells (one near Eagle Creek gage and one near North Fork gage) would be installed	None – associated facilities would be removed from National Forest System land within 6-12 months, and no new facilities would be installed	Same as alternative 1.
Annual Well Pumping Volumes	Approximately 740 acre feet per year, with highest use between March and September (ranging from a combined total of 60 to 117 acre feet per month); between 2002-2010, use averaged 569 acre-feet per year and ranged between 433 and 807 acre-feet per year.	None	Approximately 900 cumulative acre feet or less over any 3 consecutive water years (300 acre feet per year or less). May vary based on monitoring results of other adaptive management triggers. This would be implemented as a starting point only and could be adjusted (up or down), depending on the results of monitoring.
Gages	It is assumed that the North Fork, South Fork and Eagle Creek U.S. Geological Survey gages would remain in place and would continue to be periodicaly monitored by the U.S. Geological Survey.	North Fork gage would possibly be removed; South Fork and Eagle Creek gages would possibly remain and would be monitored by the U.S. Geological Survey.	Same as alternative 1. However, the adaptive management strategy also identifies the use of new alluvial monitoring wells as an integral component of this alternative.

Components	Alternative 1 – Preferred Alternative - No Change (Continue Pumping)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Monitoring	The Village of Ruidoso would provide monthly reports to the USDA Forest Service including bimonthly static and pumping water levels, well operation schedules, and daily pumping quantities (summarized for the month) for the month in acre-feet. As described in more detail in the monitoring section (beginning on page 42) in this chapter, several monitoring measures would be implemented for alternative 1: #1: Existing monitoring wells would be rehabilitated or new ones constructed upstream and downstream of the well field. New alluvial monitoring wells would be constructed by the Village of Ruidoso adjacent to North Fork Eagle Creek, at the locations of the North Fork stream gage and Eagle Creek stream gage. #2: Using the reconfigured and new monitoring wells from measure #1, the Village of Ruidoso would conduct slug tests or aquifer pumping tests of the individual water-bearing zones of interest at the well field. #3: The Village of Ruidoso would take monthly water quality field measurements at all three existing surface flow gages on the North Fork, South Fork, and Eagle Creek, and one additional streamflow sampling location immediately below the well field or wherever surface flow frequently occurs downstream. #4: The Village of Ruidoso would continue to record daily mean flow and water level measurements at the three stream gages or new monitoring wells and monitoring wells used in the U.S. Geological Survey program. #5: The Village of Ruidoso would identify and monitor eight springs and seeps in the North Fork Eagle Creek drainage on a monthly basis for 1 year.	Surface water monitoring would continue at the existing Eagle Creek below South Fork gage (U.S. Geological Survey 08387600), and water levels would be monitored at a selected well downstream of the existing well field in the vicinity of MW-5. Recording devices or methods, measurement frequencies, and reporting provisions would be determined cooperatively between the USDA Forest Service and U.S. Geological Survey. Adding a transducer that would record hourly so diurnal variations could be accounted for would be considered. The 2010 baseline riparian vegetation survey would be repeated at 5-year intervals, as time and funding allows.	Same as alternative 1, but with the following additional monitoring indicators which would be used to inform the adaptive management triggers described under alternative 3 (beginning on page 36): Baseline: An initial survey traverse with appropriate closure would be conducted at the start of the monitoring program to correlate channel and bank elevations, gage datums and stages, and monitoring well water level elevations between the North Fork gage location (U.S. Geological Survey 08387550), all monitoring wells, and the Eagle Creek gage location (U.S. Geological Survey 08387600). Cross-sectional elevation surveys would be conducted annually at the permanently-located transects (at the North Fork gage, MW-1A, MW-5A, and the Eagle Creek gage locations) to identify ongoing modifications in streambed and bank levels and locations. #1: Surface flow volume would be measured at the Eagle Creek gage and North Fork gage and/or alluvial water elevations measured at new wells located at the Eagle Creek gage and North Fork gage. #2: Water table depth in monitoring wells and water wells would be measured monthly and reported. #3: Annual monitoring of riparian obligate species (e.g. willow and boxelder) would occur. Trends in riparian condition, vegetation canopy cover, and composition would be evaluated and documented at least every 5 years.

Components	Alternative 1 – Preferred Alternative - No Change (Continue Pumping)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Monitoring (cont.)	#6: The Village of Ruidoso would monitor and document stream gradient, planform, and stability indicators annually between June 1 and July 15 at selected and benchmarked cross-section locations along the North Fork Eagle Creek for the first five (5) years of the permit term. After the first five years of the permit term, these parameters would be measured every three years or less (if approved in advance) during the permit term. #7: The Village of Ruidoso would monitor snowpack on Sierra Blanca for the permit duration. At least one precipitation gage along the North Fork Eagle Creek watershed divide would be maintained, monitored and reported on by the Village of Ruidoso for the permit duration to the USDA Forest Service on a quarterly basis every year. #8: The Village of Ruidoso would develop and calibrate a site-specific groundwater computer model in cooperation with the Forest Service and other selected, qualified parties representing appropriate stakeholder interests along the North Fork of Eagle Creek. An implementation plan with schedule, tasks, responsible parties, reporting requirements, quality control measures, and costs would be developed.		Daily pumping quantities in cubic feet would be collected and reported monthly. An implementation plan with schedule, tasks, responsible parties, reporting requirements, quality control measures, and costs would be developed.
Summary of Connected Actions related to Monitoring	Existing well rehabilitation and/or reconfiguration Slug test or aquifer pumping test of individual water bearing zones Identification of one new water quality sampling station (marked or monumented) Identification of one new precipitation gage in NFEC basin, in cooperation with USGS	None	Same as alternative 1

Table 3. Summary of environmental effects by alternative

Water Resources - Well pumping results in changes in dynamics of groundwater (groundwater drawdown and water table) and surface water (streamflows, wetlands, springs and seeps). Surface water and groundwater availability are linked and limited by accessible available quantities of water. Water resources over time can also be affected by climate change.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Estimated duration of no surface flow conditions at the Eagle Creek Gage	One to 2 weeks a year during average precipitation periods; 8 to10 weeks a year during drier periods	Zero no-surface flow periods at the Eagle Creek gage	No more than 4 weeks a year, or 3 weeks a year over 3 years, based on implementation of adaptive management triggers, regardless of dry or wet year
Estimated occurrence of flows equal to or greater than 1.2 cubic feet per second at the Eagle Creek Gage	Forty-six percent of the time during an average precipitation year, or about 5.5 months per year; 19 percent of the time during a below-average precipitation year, or about 2.3 months per year	Fifty-seven percent of the time, or about 6.8 months per year during an average precipitation year	Would likely range from 47 percent to 57 percent of the time, regardless of dry or wet year
Impacts to springs and seeps based on drawdown	Two springs are within the area of projected drawdown (figure 12 and figure 13 in chapter 3) and could be affected; effects would likely range from moderate to severe. Other existing groundwater modeling indicates that more extensive drawdown could occur (Balleau Groundwater 2004). Under those conditions, a number of other springs or seeps in the upper North Fork drainage could be similarly adversely affected	No spring or seeps affected	Pumping would continue to adversely impact springs and seeps due to projected groundwater drawdown. However, when compared to alternative 1, decreased drawdown and shorter water-level recovery times would also decrease the duration and extent of drawdown, reducing impacts to springs and seeps. Impacts would be local and long term, but minor to moderate since some recovery would be provided during dry periods.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Impacts to domestic wells based on drawdown	Two domestic wells are within the area of project drawdown (figure 12 and figure 13 in chapter 3) and could be affected; effects would likely range from moderate to severe. Other existing groundwater modeling indicates that more extensive drawdown could occur (Balleau Groundwater 2004). Under those conditions, a number of other domestic wells in the upper North Fork drainage could be similarly adversely affected	No domestic wells affected	Pumping would continue to adversely impact domestic wells due to projected drawdown. However, when compared to alternative 1, decreased drawdown and water level recovery times would also decrease the duration and extent of drawdown, reducing the impacts to domestic wells compared to alternative 1. Impacts would be local and long term, but minor to moderate since some recovery would be provided during dry periods. When compared to alternative 2 (no pumping), domestic wells would continue to be adversely impacted by projected groundwater drawdown
Success of the alternatives over time considering possible climate change	If climate change predictions occur, streamflow quantities may decline; spatial extent and duration of no-flow conditions and flow conditions below 1.2 cubic feet per second could increase; stream temperatures could increase; springs, seeps, and domestic wells may experience declining flows or water levels at a faster pace under potential changing climatic conditions over the long term.	If predicted changes in temperature, precipitation and runoff conditions occur, they could continue to create long-term declines in North Fork flows, even without pumping. Water temperatures may rise overall; this could be particularly noticeable during summer low flows. Springs, seeps, and nearby domestic wells may eventually experience declines or go dry. Qualitatively, these effects could occur at a slower pace than under alternative 1. This could allow greater flexibility and time for resource management to adapt to changing conditions, if they occur.	Predicted effects of climate changes may still occur over the long run, as described for alternative 1 and 2. However, adaptive management strategies could reduce the timing and severity of these effects to the extent possible, when compared to alternative 1. If they occur, increased temperatures, reduced snowpack, and accelerated snowmelt would require ongoing adjustments in adaptive strategies to maintain streamflows and groundwater availability. However, experience gained through adaptive management could allow more informed strategies to be developed for water resources management under changing climatic conditions, if they occur.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Updated Direct and Indirect Effects due to Little Bear Fire: Short Term	Over the short term (until water recovery occurs in about 2019), continued pumping would reduce streamflow and groundwater. While increased soil moisture and streamflow are possible due to reduced transpiration losses, these are likely to be offset by increased runoff and reduced infiltration and groundwater recharge. The accumulation of sediment and debris could increase depth to saturated conditions. In some locations, greater thickness of newly deposited alluvium could reduce the presence of surface flow or pooling; continued pumping at historic levels could further reduce the occurrence of surface flow or pools.	Over the short term (until water recovery occurs in about 2019), effects of no pumping would encourage the occurrence of streamflow and increased groundwater levels. Large portions of the stream would remain intermittent during periods of average precipitation. The accumulation of sediment and debris could increase depth to saturated conditions. In some locations, greater thickness of newly deposited alluvium could reduce the presence of surface flow or pooling, even without pumping. If this occurs, it would be less frequent or extensive than under either alternative 1 or 3.	Over the short term (until water recovery occurs in about 2019), water resource impacts from implementing alternative 3 would be limited by the application of pumping restrictions. During this period, impacts of natural post-wildfire recovery would override some of the pumping impacts and some of the adaptive management effort. During the short term post-wildfire recovery period, pumping effects would be limited to the extent possible through an iterative and adaptive approach as the landscape, stream channel, and groundwater recharge processes adjust to the fire disturbance.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Updated Direct and Indirect Effects due to Little Bear Fire: Long Term	In the long term (after post-wildfire recovery), watershed conditions are expected to trend toward approximate pre-wildfire conditions. If conifer stands burned at moderate to high severity convert to grass or shrubs, less evapotranspiration could improve water yield and groundwater availability. Effects from implementing alternative 1 over the long term would be the same as, or potentially slightly less than, those described above for each indicator for the pre-wildfire assessment.	In the long term (after post-wildfire recovery), watershed conditions are expected to return to approximate pre-wildfire conditions. If conifer stands burned at moderate to high severity convert to grass or shrubs, less evapotranspiration could improve water yield and groundwater availability. If this occurs in the absence of pumping under alternative 2, aquatic habitats could be enhanced and additional opportunities for improving riparian conditions would result.	Over the long term, the Village of Ruidoso would be able to pump its municipal supply from the North Fork Eagle Creek most of the time, and would be able to pump at reduced levels during some, but not all, of the restricted periods. During dry years, adaptive management would improve flow conditions and reduce the amount of no-flow days along the North Fork Eagle Creek. With respect to surface flows and alluvial groundwater levels, an approximate middle ground between alternative 1 and 2 would be attained during average precipitation years under alternative 3. Drawdown effects may still occur at springs, seeps, and domestic wells, but are anticipated to be less than those expected under alternative 1. If climate changes to warmer and drier conditions occur, ongoing adjustments in management strategies to maintain streamflows, alluvial groundwater levels, and Village of Ruidoso water supplies would be required. Experience gained through adaptive management would allow more informed water resources strategies if climatic changes occur. In the long term (after post-wildfire recovery), watershed conditions are expected to return to approximate pre-wildfire conditions. If conifer stands burned at moderate to high severity convert to grass or shrubs, less evapotranspiration could improve water yield and groundwater availability. If this occurs with adaptive management of North Fork Eagle Creek pumping under alternative 3, aquatic habitats could be enhanced and additional opportunities for improving riparian conditions could result.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Cumulative Effects	Cumulative water resources impacts would involve ongoing reductions in flow and water quality along Eagle Creek within the cumulative impact area, due primarily to reduced groundwater recharge. These would be adverse, long-term and regional impacts that would range in severity from moderate to severe. Additional water supply developments in the region would create further impacts to surface water, groundwater, and associated resources and would likely extend beyond the North Fork watershed.	Beneficial cumulative recharge effects to aquifers, springs and seeps, and possibly stream baseflows may result within parts of the Eagle Creek drainage. The magnitude and extent of these effects is unknown, since it is likely that the Village of Ruidoso would continue to exercise its water rights and make withdrawals elsewhere in the Eagle Creek system. Impacts from such activities could offset beneficial impacts from no pumping at the North Fork Eagle Creek well field.	Cumulative water resources impacts would include flow and water quality reductions in Eagle Creek within the cumulative impact area. Water supply pumping for the Village of Ruidoso is conducted at five water wells along lower Eagle Creek and the Village of Ruidoso diverts surface water from the stream a short distance below the Eagle Creek gage. As a result, groundwater recharge in downstream alluvial and bedrock aquifers would still be adversely affected, to a greater extent than alternative 2 (no pumping), but to a lesser extent than under alternative 1. Implementing alternative 3 would have minor effects on these impacts, as pumping in the North Fork Eagle Creek would generally be permitted most of the time.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Updated Cumulative Effects due to Little Bear Fire: Short Term	Over the short term (until water recovery occurs in about 2019), continued pumping under alternative 1 would add cumulatively to downstream water resources impacts from the fire as well as other water uses outside the forest boundary, resulting in reductions of downstream baseflows and groundwater levels. Adverse effects to streamflows would be masked by accelerated surface runoff, erosion and debris flows, channel geometry changes, and reduced water quality, however. Other water users in the cumulative impact study boundary would affect surface drainage and groundwater levels. Depending on the timing and volumes of these other water withdrawals and returns, all these factors would combine to largely obscure the downstream effects of North Fork Eagle Creek pumping.	Over the short term (until water recovery occurs in about 2019), the cessation of pumping under alternative 2 would contribute beneficially to downstream baseflows and groundwater levels outside the forest boundary. Beneficial effects to streamflows could be masked by accelerated surface runoff, erosion and debris flows, channel geometry changes, and reduced water quality, however. Other water users in the cumulative impact study boundary would affect surface drainage and groundwater levels. Depending on the timing and volumes of these other water withdrawals and returns, these factors could obscure some of the beneficial effects from alternative 2 in the short term. This may allow more opportunity for resource management responses to climatic conditions.	Over the short term (until water recovery occurs in about 2019), management of pumping under alternative 3, when compared to the current condition (alternative 1) would contribute beneficially to downstream baseflows and groundwater levels outside the forest boundary. These beneficial effects to streamflows could be masked by accelerated surface runoff, erosion and debris flows, channel geometry changes, and reduced water quality, however. Other water users in the cumulative impact study boundary would affect surface drainage and groundwater levels. Depending on the timing and volumes of these other water withdrawals and returns, these factors could obscure some of the beneficial effects from alternative 3 in the short term. When compared to no pumping (alternative 2), this alternative would not result in the same benefical impacts to downstream baseflows and grounwater levels.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Updated Cumulative Effects due to Little Bear Fire: Long Term	Over the long term, cumulative effects would be the same as those described above for the pre-wildfire assessment; potential cumulative effects on streamflows and groundwater would not be restricted to water uses by the Village of Ruidoso, as described in detail in chapter 3.	Over the long term, additional streamflow and groundwater would pass downstream from North Fork Eagle Creek into the cumulative impact study area resulting in beneficial recharge effects to aquifers, springs and seeps, riparian condition, and possibly stream baseflows. Due to the number of other water users in the cumulative impact study area, the magnitude and extent of these effects is unknown. Implementing alternative 2 would preclude the use of the North Fork Eagle Creek well field for municipal water which would create additional demands and associated pumping drawdown effects on other water resources in the Eagle Creek drainage or nearby.	Over the long term, post fire cumulative impacts would be the same as those described above for the pre-wildfire assessment. Potential cumulative effects on streamflows and groundwater would not be restricted to water uses by the Village of Ruidoso, as described in detail in chapter 3. Implementing alternative 3 would occasionally create temporary demands by the Village for other water sources. It is likely that the Village would met those demands by pumping groundwater supplies elsewhere, by additional leasing of existing water rights, by developing additional storage facilities, by enacting further water use limitations beyond its current practices, or some combination of these.

Aquatic Habitat and Fish - Well pumping results in changes in the water table which may affect streamflow to varying degrees. Lowering streamflow may increase temperatures and temperature-related fish mortality. Quantity, quality, and water flow availability that mirrors natural flow patterns are important for aquatic habitat and fish. Suitable water quality and temperatures, which are partially based on water depth and channel conditions, are necessary to support fish populations. Sufficient water supplies must also be available during summer months to provide water temperatures needed for survival of aquatic species.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Streamflow quality and quantity indicators for water resources and implications for aquatic habitat and fish	The North Fork Eagle Creek below the well field to the Eagle Creek gage was probably never a high quality fishery and has always been limited by the intermittent nature of the creek. There are now fewer fish in North Fork Eagle Creek and fewer opportunities for recreational fishing along North Fork Eagle Creek than there were before 1988. This is probably due, at least in part, to reduced streamflow as a result of North Fork Eagle Creek well pumping. This trend would continue by implementing alternative 1.	Improved surface flow, eliminated or reduced no-flow days and reduced duration of stream temperatures above 68 degrees Fahrenheit would improve aquatic habitat and fishing potential. While this segment of North Fork Eagle Creek is not considered a high quality trout fishery and this would not change with implementation of alternative 2, aquatic habitat conditions would improve over the long term and provide higher quality fish habitat over time and fish recovery would be enhanced.	Effects would be similar to alternative 2 because surface flow would improve, no-flow days would be reduced (but not eliminated) and there would be a reduction in the duration of stream temperatures above 68 degrees F; these changes would result in improved aquatic habitat and fishing potential, but these changes would be less than those for alternative 2 but greater than those for alternative 1.
Updated Effects due to the Little Bear Fire: Short Term	No fish were observed in the upper perennial reaches (upstream of the North Fork gage) during surveys conducted in 2013 after the fire. Aquatic invertebrates typically decline immediately after a fire. In the short term, reduced water quality, channel morphology changes, and deeper alluvial deposits due to the fire would continue to reduce the fish and aquatic habitat quality in the project area while the watershed is recovering. Pools and stretches of surface water may be reduced and this would affect aquatic habitat and fish presence. Continued pumping under alternative 1 during the short term is expected to continue to limit the potential for fish and aquatic habitat improvement.	In the short term, reduced water quality, channel morphology changes, and deeper alluvial deposits due to the fire would continue to reduce the fish and aquatic habitat quality in the project area while the watershed is recovering. The effects of no pumping, however, would encourage the occurrence of streamflow and increased groundwater levels (more so than under alternative 1) although large portions of the stream would remain intermittent during periods of average precipitation. Pools and stretches of surface water may be reduced and this would affect aquatic habitat and fish presence. Under alternative 2, the potential for fish and aquatic habitat improvement will continue to be limited but not as much as under alternative 1.	In the short term, reduced water quality, channel morphology changes, and deeper alluvial deposits due to the fire would continue to reduce the fish and aquatic habitat quality in the project area while the watershed is recovering. During the short term post-wildfire recovery period, pumping effects would be limited to the extent possible through an iterative and adaptive approach as the landscape, stream channel, and groundwater recharge processes adjust to the fire disturbance. Under alternative 3, the potential for fish and aquatic habitat improvement will continue to be limited but not as much as under alternative 1.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Updated Effects due to the Little Bear Fire: Long Term	Over the long term, after post-wildfire recovery, watershed conditions are expected to return to approximate pre-wildfire conditions. Aquatic invertebrates could respond positively to increased stream productivity but the timeframe for this recovery is difficult to predict. Water yield and groundwater availability may improve as shown in the water resources analysis and debris flows could result in a more dynamic channel environment benefiting fish habitat. However, continued pumping would obscure some of these potential benefits. Therefore, adverse effects from implementing alternative 1 over the long term would be the same as, or slightly less than, the pre-wildfire assessment for alternative 1.	Over the long term, after watershed recovery, effects from no pumping would be the same as those described in the pre-wildfire assessment for alternative 2. Aquatic invertebrates could respond positively to increased stream productivity but the timeframe for this recovery is difficult to predict. Water yield and groundwater availability may improve as shown in the water resources analysis and debris flows could result in a more dynamic channel environment benefiting fish habitat. With the cessation of pumping, these potential benefits could be increased Therefore, beneficial effects from implementing alternative 2 over the long term would be the same as, or slightly more than, the pre-wildfire assessment for alternative 2.	When compared to alternative 2 (no pumping), over the long term, flow conditions would continue to be adversely impacted by pumping. When compared to alternative 1, ver the long term, during dry years, adaptive management would improve flow conditions and reduce the amount of no-flow days along the North Fork Eagle Creek. With respect to surface flows and alluvial groundwater levels, an approximate middle ground between alternative 1 and 2 would be attained during average precipitation years under alternative 3. In the long term (after post-wildfire recovery), watershed conditions are expected to return to approximate pre-wildfire conditions. If conifer stands burned at moderate to high severity convert to grass or shrubs, less evapotranspiration could improve water yield and groundwater availability. If this occurs with adaptive management of North Fork Eagle Creek pumping under alternative 3, aquatic habitats could be enhanced and additional opportunities for improving riparian conditions could result. Therefore, beneficial effects from implementing alternative 3 over the long term would be the same as the pre-wildfire assessment for alternative 3.

Riparian Vegetation - Well pumping results in changes in the water table which may affect streamflow to varying degrees. These water quantity changes could indirectly affect quantity and quality of riparian vegetation along the stream corridor.

Measurement Indicators	Alternative 1 – Preferred Alternative - No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Predicted qualitative shifts in communities over time	Because baseline riparian vegetation monitoring was not undertaken prior to the development of the wellfield, predictions regarding the effects of the alternatives on riparian communities are uncertain. Alternative 1 has likely led to a shift in the riparian community to one more reflective of drier condtions Since the spatial extent and duration of no-flow conditions and flows less than 1.2 cubic feet per second would increase over time (climate change combined with continued pumping), there would be less water available in the alluvium for plant growth and sustenance. If groundwater levels lower beyond current levels, there would be an increase in xeric, upland species and a decrease or loss in riparian species dependent on shallow groundwater, over the long term.	Because baseline riparian vegetation monitoring was not undertaken prior to the development of the wellfield, predictions regarding the effects of the alternatives on riparian communities are uncertain Project design features minimize any direct effects to riparian vegetation during well and facility removal. Indirectly, improved groundwater and surface flow would increase available moisture for riparian vegetation and could result in maintenance or expansion of the riparian zone over time; slight increases in communities featuring facultative wetland species is possible, but may not be fully realized due to the possibility of continued climate change-related drying trends, over the long term.	Because baseline riparian vegetation monitoring was not undertaken prior to the development of the wellfield, predictions regarding the effects of the alternatives on riparian communities are uncertain. The drainage would remain an intermitten stream in the area near the wellfied and therefore, riparian vegetation expansion would continue to be limited under alternative 3. Pumping would continue to adversely impact groundwater and surfaceflow and this would continue to decrease available moisture for riparian vegetation. Compared to alternative 1, however, improved groundwater and surface flow would increase available moisture for riparian vegetation and could result in maintenance or expansion of the riparian zone over time; slight increases in communities featuring facultative wetland species is possible, but may not be fully realized due to the possibility of continued climate change-related drying trends, over the long term. Effects would be more similar to alternative 2 than alternative 1 due to improvements in water availability.

Measurement Indicators	Alternative 1 – Preferred Alternative - No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Predicted qualitative shifts in riparian tree species	Box elder, Pacific willow and other riparian tree species would show signs of stress and reduced canopy cover over time due to reductions in groundwater and streamflow. It is likely that Pacific willow would eventually die out and would no longer occur along North Fork Eagle Creek below the well field over the long term (Pacific willow upstream of the North Fork gage would not be affected).	Project design features would minimize any direct effects to riparian trees during well and facility removal. Indirectly, increased water availability would likely not result in measurable changes in box elder but Pacific willow would likely experience increased seedling recruitment and could expand; however, this may not be a substantial change over the current condition considering the possibility of continued climate change-related drying trends, over the long term.	Indirect effects to box elder and Pacific willow would be more similar to alternative 2 than alternative 1 due to improvements in water availability.

Measurement Indicators	Alternative 1 – Preferred Alternative - No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Updated Effects due to Little Bear Fire: Short Term	In the short term, fire effects are likely to result in a shifting of sediment and cobble. This channel instability could result in some riparian areas being buried and an increase in alluvium that would reduce surface flow. However, these adverse effects to riparian tree species and communities could be offset by the opportunity for species such as willows to colonize new areas.	In the short term, fire effects are likely to result in a shifting of sediment and cobble. This channel instability could result in some riparian areas being buried and an increase in alluvium that would reduce surface flow. However, these adverse effects to riparian tree species and communities could be offset by the opportunity for species such as willows to colonize new areas. The effects of no pumping would encourage the occurrence of streamflow and increased groundwater levels (more so than under alternative 1) although large portions of the stream would remain intermittent during periods of average precipitation. Pools and stretches of surface water may be reduced and this could affect riparian habitat. Under alternative 2, the potential for riparian habitat improvement will continue to be limited but not as much as under alternative 1.	In the short term, fire effects are likely to result in a shifting of sediment and cobble. This channel instability could result in some riparian areas being buried and an increase in alluvium that would reduce surface flow. However, these adverse effects to riparian tree species and communities could be offset by the opportunity for species such as willows to colonize new areas. During the short term post-wildfire recovery period, pumping effects would be limited to the extent possible through an iterative and adaptive approach as the landscape, stream channel, and groundwater recharge processes adjust to the fire disturbance. Under alternative 3, the potential for riparian habitat improvement will continue to be limited but not as much as under alternative 1. Alternative 3 would encourage the occurrence of streamflow and increased groundwater levels (more so than under alternative 1) although large portions of the stream would remain intermittent during periods of average precipitation. Pools and stretches of surface water may be reduced and this could affect riparian habitat.

Measurement Indicators	Alternative 1 – Preferred Alternative - No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Updated Effects due to Little Bear Fire: Long Term	Over the long term, water yield and groundwater availability may improve as shown in the water resources analysis, benefiting riparian habitat. However, continued pumping would obscure some of these potential benefits. Therefore, adverse effects from implementing alternative 1 over the long term would be the same as, or slightly less than, the pre-wildfire assessment for alternative 1.	Over the long term, after watershed recovery, effects from no pumping would be the same as those described in the pre-wildfire assessment for alternative 2.	Over the long term, during dry years, adaptive management would improve flow conditions and reduce the amount of no-flow days along the North Fork Eagle Creek. With respect to surface flows and alluvial groundwater levels, an approximate middle ground between alternative 1 and 2 would be attained during average precipitation years under alternative 3. Over the long term, after watershed recovery, effects from implementing an adaptive management strategy would be the same as those described in the pre-wildfire assessment for alternative 3.

Socioeconomics - Effects on water available for diversion have potential to affect local social and economic conditions. Well pumping may result in changes in groundwater and surface water availability. Limiting access to groundwater pumping has potential to alter municipal water supply, affect streamside recreational use (public use of streams for streamside recreation, fishing, and wildlife viewing), and affect private land (availability of water for domestic wells).

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Municipal water supply (overall and during 5-month summer resort period)	Average annual contributions from North Fork Eagle Creek wells would continue to provide from 25 to 29 percent percent of the Village of Ruidoso water supply if current trends in total diversion and North Fork Eagle Creek wells diversion continue; past trends in North Fork Eagle Creek wells diversion during the 5-month summer resort period would also continue (38 to 58 percent in 2006 and 2004, respectively). Consideration of additional contributions attributable to North Fork Eagle Creek well diversions (50 percent return flow credit) North Fork Eagle Creek wells would continue to provide 36-43 percent to the municipal water supply overall, and 57-87 percent during the summer months. Annual diversions in the future could average approximately 569 acre-feet per year.	North Fork Eagle Creek wells would not contribute 25-29 percent of the municipal water supply or 38-58 percent during the summer months; this need would have to come from another water source There would be no water diverted; this water would need to come from another source.	There would be periodic restrictions on pumping, particularly during the summer. Based on the streamflow adaptive management triggers, North Fork Eagle Creek wells would provide about 23-25 percent to the municipal water supply overall, and 25-57 percent during the summer. Including the 50 percent return flow credit; North Fork Eagle Creek wells would continue to provide 34.5-37.5 percent to the municipal water supply overall, and 37.5-85.5 percent during the summer months. Restrictions based on the streamflow triggers would likely be enacted fequently during below-average precipitation years but infrequently during average or above average precipitation years. Annual diversions could average 236 acre-feet per year or more depending on how the adaptive management triggers were implemented
Projected production	If average annual diversion from these wells continues they would contribute 11 percent of the projected adjusted diversion needs (5,097 acre-feet) for the year 2045.	Without groundwater withdrawal, North Fork Eagle Creek wells would not contribute towards future Village of Ruidoso demand and their projected contribution (11 percent) in 2045 would have to come from another source.	Average annual diversion from North Fork Eagle Creek wells would continue and they would continue to contribute towards future Village of Ruidoso demand; Based on enacting the streamflow adaptive management triggers, their projected contribution in 2045 would be 0.1 - 1.3 percent less than under alternative 1.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Streamflow quality and quantity and springs/seeps indicators for water resources and implications for streamside recreational use	With continued periods of no flow days, flows below 1.2 cubic feet per second, periods of stream temperatures above 68 degrees Fahrenheit and effects to springs/seeps (as shown in the water resources section), streamside recreational use would be negatively affected; the quality of this recreation experience would be less than that provided by either alternative 2 or 3.	With elimination of no-flow days and approximately 7 months annually with flows above 1.2 cubic feet per second, and no effects to springs/seeps (as shown in the water resources section), streamside recreational use would improve over current conditions and would be of higher quality compared to either alternative 1 or 3.	Pumping would continue to adversely influence streamflow quantity and springs and seeps. However, when compared to alternative 1, with a decrease in the number of no-flow days an increase in the duration of flows greater than 1.2 cubic feet per second, a reduction in times when stream temperatures are above 68 degrees Fahrenheit, and a decrease in the potential effect to springs/seeps, streamside recreational use would improve over current conditions and over that provided by alternative 1, but would be of lower quality than that provided by alternative 2.
Domestic wells indicator for water resources and implications for private land water supply	The potential for adverse effects to the availability of domestic well water are greatest under this alternative compared to alternative 2 or 3; up to two domestic wells could be directly affected.	Because no domestic wells would be directly affected by groundwater drawdown under this alternative, there would be no effect to the availability of water for domestic use.	Pumping would continue to impact domestic wells by groundwater drawdown. However, drawdown would decreased and water level recovery times would decrease the duration and extent of existing drawdown, which would lessen the on-going impacts to domestic wells. The potential for adverse effects to the availability of domestic well water would be less than alternative 1 but greater than alternative 2.
Financial Efficiency	Present net value would range from $4.6 to $7.2 million. The Village of Ruidoso would be required to incur costs associated with monitoring activities proposed under this alternative Benefits would be realized from on-going use of the wells for municipal water supply	Present net value would be approximately $217,000; more financially efficient (in terms of cost) than alternatives 1 or 3. Resource benefits from maintained streamflow and maintenance or improvement of riparian vegetation would be realized No benefit realized from contribution to municipal water supply	Same as alternative 1

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Values, attitudes and beliefs	Quality of life as it relates to municipal water supply would remain unchanged under this alternative; quality of life associated with the quality of recreation experience and the availability of domestic well water would remain unchanged; the Lincoln National Forest would continue to support quality of life at levels experienced currently.	Quality of life as it relates to municipal water supply would be adversely affected since North Fork Eagle Creek wells would no longer contribute to the water supply; quality of life associated with the quality of recreation experience and the availability of domestic well water would be improved over current conditions; the Lincoln National Forest would continue to support quality of life in the area but less than currently supported from municipal water supply and more in terms of the quality of recreation experience and the availability of domestic well water.	Quality of life as it relates to municipal water supply would be less than experienced currently due to restrictions on North Fork Eagle Creek well pumping. However, quality of life associated with the quality of recreation experience and the availability of domestic well water would be improved over current conditions; the Lincoln National Forest would continue to support quality of life in the area but less than currently supported from municipal water supply and more in terms of the quality of recreation experience and the availability of domestic well water.
Environmental justice (effects of agency programs that disproportionately impact minority and low income populations)	There would be no disproportionately high or adverse human health or environmental effect on minority or low-income populations. Quality of life related to water supply, recreation and domestic well water would remain unchanged from current conditions.	There would be no disproportionately high or adverse human health or environmental effect on minority or low-income populations. While adverse effects to total municipal water diversions are anticipated they are expected to be distributed amongst all segments of the Village of Ruidoso population since water diversion from the North Fork Eagle Creek wells cannot be attributed to supply certain areas of the Village of Ruidoso. Consequently, effects are not considered disparate since effects would occur to communities regardless of racial, ethnic or poverty status.	There would be no disproportionately high or adverse human health or environmental effect on minority or low-income populations. While adverse effects to total municipal water diversions are anticipated they would be the same as those described for alternative 2.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Cumulative effects	Since there are no direct and indirect effects (conditions would remain unchanged), there would be no cumulative effects.	Regardless of the contributions of the North Fork Eagle Creek wells to the water supply, future water supply needs exceed existing supply and existing water rights, even with implementation of utility use reduction and conservation. Without North Fork Eagle Creek contributions, the potential for adverse cumulative effects to municipal water supply would be greater under this alternative than either alternative 1 or 3. However, adverse cumulative economic effects to the quality of recreation experience would be less under this alternative than alternative 1 or 3. Similarly, adverse cumulative economic effects to nearby domestic wells would be less under this alternative than alternative 1 or 3.	Regardless of the contributions of the North Fork Eagle Creek wells to the water supply, future water supply needs exceed existing supply and existing water rights, even with implementation of utility use reduction and conservation. With limited North Fork Eagle Creek contributions, adverse cumulative economic effects to municipal water supply would be greater under this alternative than under alternative 1but less than alternative 2. Adverse cumulative economic effects to the quality of recreation experience would be less under this alternative than under alternative 1 but more than alternative 2. In addition, the potential for adverse cumulative economic effects to nearby domestic wells would be less than under alternative 1 but more than alternative 2.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Updated Direct, Indirect and Cumulative Effects Due to Little Bear Fire	Implementation of alternative 1 would achieve the first need statement regarding the Village of Ruidoso's ability to access and divert groundwater from its North Fork Eagle Creek wells because it would continue to provide water to the Village of Ruidoso. Once conditions allow for North Fork Eagle Creek well pumping to resume at pre-wildfire levels it is likely that the Village of Ruidoso will have made water supply adjustments in order to meet water supply demand and their reliance on North Fork Eagle Creek well pumping may be less. While the short-term effects of implementing alternative 1 to other aspects of the socioeconomic analysis are uncertain during the watershed recovery period, the long-term effects are the same as those described above for the pre-wildfire assessment.	Alternative 2 does not address the first need statement and would not provide any contribution to the municipal water supply. Without groundwater withdrawal, the North Fork wells would not provide their pre-fire share of Village of Ruidoso water supply and would not contribute toward future demands for water diversion. While the short-term effects of implementing alternative 2 to other aspects of the socioeconomic analysis are uncertain during the watershed recovery period, the long-term effects are the same as those described above for the pre-wildfire assessment.	Implementation of alternative 3 would achieve the first need statement regarding the Village of Ruidoso's ability to access and divert groundwater from its North Fork Eagle Creek wells because it would continue to provide water to the Village of Ruidoso. However, alternative 3 may not provide the pre-wildfire share of water as would alternative 1. Regardless, when additional indirect contributions attributable to the 50 percent return flow credit are considered under alternative 3, North Fork Eagle Creek wells would continue to provide 37.5 to 85.5 percent of municipal water supply during the 5-month summer resort period. Once conditions allow for North Fork Eagle Creek well pumping to resume at pre-wildfire levels it is likely that the Village of Ruidoso will have made water supply adjustments in order to meet water supply demand. Consequently reliance on North Fork Eagle Creek well pumping may be less than depicted above. While the short-term effects of implementing alternative 3 to other aspects of the socioeconomic analysis are uncertain during the watershed recovery period, the long-term effects are the same as those described above for the pre-wildfire assessment.

Water Rights - Well pumping results in changes in dynamics of groundwater and surface water. Surface water and groundwater availability are linked and are limited not only by accessible available quantities of water, but also by available water rights. Limiting access to groundwater pumping has potential to alter municipal water supply and affect beneficial use of the Village of Ruidoso's total adjudicated water rights.

Measurement Indicators	Alternative 1 – Preferred Alternative - No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Beneficial use of the Village of Ruidoso's water rights	Without limitations on groundwater withdrawal, the Village of Ruidoso would be able to access and put to beneficial use their adjudicated water rights, which, as of 2014, total 1838.51 acre feet per year.	Without groundwater withdrawal at the current location, the Village of Ruidoso would need to file application with the Office of the State Engineer to transfer the point of diversion of theirwater rights (updated in 2014). If protests are filed the Office of the State Engineer would hold a formal hearing and decide the case. This decision could be appealed. These hearings can take months or years to complete. This is a state of New Mexico process that does not involve the USDA Forest Service.	With the potential for limited groundwater withdrawal at the current location, the Village of Ruidoso would need to file application with the Office of the State Engineer to transfer the point of diversion of a portion of their water rights (as summarized for alternative 2).
Updated Effects due to the Little Bear Fire: Short Term	The fire halted the production of both surface and groundwater diversions along Eagle Creek due to water quality and debris flow issues. This impacted water production and the Village of Ruidoso's ability to access the return flow credits along the Rio Ruidoso. The shift from the Eagle Creek watershed to the Rio Ruidoso watershed created a temporary redistribution of water rights along the Rio Ruidoso (also impacted by water quality from the Little Bear Fire). Approved on an emergency basis by the Office of the State Engineer, the Village of Ruidoso received a temporary additional point of diversion, at the confluence of the Rio Ruidoso and Carrizo Creek to the south, to provide water to the Grindstone Dam for use in the municipal supply. This redistribution is anticipated to be short-term in nature. Lack of diversion due to emergency circumstances created by the Little Bear Fire in 2012 is not expected to have a direct effect on the beneficial use of the Village of Ruidoso's adjudicated water rights.	Same as alternative 1.	Same as alternative 1.

Measurement Indicators	Alternative 1 – Preferred Alternative - No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Updated Effects due to the Little Bear Fire: Long Term	Over the long term, historic water rights and allocation will remain as defined in the 2010 Consent Order. Therefore, the effects of implementing alternative 1 to the beneficial use of the Village of Ruidoso's water rights is the same as that described in the pre-wildfire assessment above.	Same as alternative 1.	Same as alternative 1.

Non-Significant Issue - Vegetation (other than riparian)

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Invasive Plants (musk thistle)	There would be no direct effects since there would be no ground disturbance. This species occurs in a wide enough range of conditions to be neither beneficially nor detrimentally affected by changes in water depth. Therefore, there would be no direct or indirect effects on the increased risk of spread for musk thistle or other non-native invasive plants.	This alternative includes removal of facilities with the end of the permit. Although the area of the disturbance would be relatively small, this ground disturbance would still contribute to the increased likelihood of non-native plant spread, minimized by the implementation of mitigation measures.	Same as alternative 1
2013 Regional Forester's Sensitive Species (Wooton's hawthorn and Sierra Blanca cliff daisy)	No effect to Regional Forester's sensitive species determination. There would be no direct effects since there would be no ground disturbance. Because Sierra Blanca cliff daisy is not dependent on groundwater or surface water there would be no indirect effects to this species. Wooton's hawthorn populations are stable to increasing in the project area and appear to have a wide enough range of conditions to not be indirectly affected by changes in groundwater or surface water.	No effect to Regional Forester's sensitive species determination. Mitigation measures would be implemented to ensure there would be no direct effects from ground disturbance associated with removal of wells and facilities. Indirect effects would be the same as those described for alternative 1.	Same as alternative 1

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Upland Vegetation	There would be no direct effects since there would be no ground disturbance. Indirect effects of water drawdown would reach into the North Fork Eagle Creek basin and would result in a reduction of available moisture for new growth. However, upland vegetation is not as sensitive to water fluctuation as riparian vegetation and would be resistant to changes in moisture; adverse effects would be minimal. Growth of individual trees may be stunted, but would not result in any measurable affects across the project area as a whole.	There would be no direct effects since ground-disturbing activities would be limited to the riparian corridor and project design features would minimize the effects to vegetation in the area of disturbance. Having more groundwater available in the North Fork Eagle Creek basin would provide added moisture for new growth. However, upland vegetation is not as sensitive to water fluctuation as riparian vegetation; beneficial effects would be minimal. Growth of individual trees may increase, but would not result in any measurable affects across the project area as a whole.	There would be no direct effects since there would be no ground disturbance. Indirect effects would be the same as alternative 2.

Measurement Indicators	Alternative 1 – Preferred Alternative No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Updated effects to Vegetation due to the Little Bear Fire	Upland vegetation burned by the fire is likely to experience additional stress due to effects from fire damage and therefore could be adversely impacted from reduced water availability due to drawdown from well pumping. Therefore, the potential for adverse impacts from alternative 1, as described above, could be somewhat greater than predicted above, post-wildfire. Because upland vegetation is less sensitive to groundwater drawdown effects from pumping than vegetation in the riparian zone, these differences between pre-wildfire and post-wildfire effects are likely negligible to minor. The impacts to Wooton's Hawthorn and Sierra Blanca cliff daisy are the same as those described for the pre-wildfire assessment above. All musk thistle populations were burned in the project area and increases in occurrences in the project area are likely as a result of the wildfire. Native seeding was undertaken following the Little Bear Fire to reduce further noxious weed spread (USDA Forest Service 2012). Project design features would minimize spread. Therefore, the impacts to invasive plants are the same as those described for the pre-wildfire assessment above.	Same as alternative 1	Same as alternative 1

Non-Significant Issue - Wildlife

Measurement Indicators	Alternative 1 – Preferred Alternative - No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Federally listed species (Mexican spotted owl)	No effect determination under section 7 of the Endangered Species Act; nearest nesting area is 0.75 miles from North Fork Eagle Creek; no suitable nesting/roosting or critical habitat within action area. There would be a mitigation measure to avoid disturbance activities to Mexican spotted owl during breeding and nesting season from March 1 to August 31.	Same as alternative 1	Same as alternative 1
2013 Regional Forester's Sensitive Species	No effect to Regional Forester's sensitive species (Northern goshawk, Sacramento mountains salamander, Ruidoso red squirrel). Nearest northern goshawk nesting area is 0.1 mile from action area; nearest known salamander location is 0.4 mile from action area; no known populations of Ruidoso red squirrels in project area There would be a mitigation measure to avoid disturbance activities to northern goshawks during the breeding season.	Same as alternative 1	Same as alternative 1
Management Indicator Species	No management indicator species for riparian habitat are known to occur in the project area; management indicator species for mixed conifer (pygmy nuthatch), aspen (hairy woodpecker), high quality browse (mule deer), mixed conifer (elk and Ruidoso red squirrel) would not be affected; Forest-wide habitat and population trends as a whole would not be affected due to the small size of the project area.	Same as alternative 1; the increase in available surface water and indirect benefit to riparian vegetation could result in improved water availability (particularly for elk and deer) and habitat quality	Same as alternative 1

Measurement Indicators	Alternative 1 – Preferred Alternative - No Change (Continue Pumping at Historic Levels)	Alternative 2 – No Action (No Pumping)	Alternative 3 –Adaptive Management
Migratory Birds	There would be no impact to migratory bird species or their habitats There would be no unintentional take of adults, eggs, and/or chicks and no ground or habitat disturbance for migratory birds. The mitigation measure to avoid disturbance activities to northern goshawks and Mexican spotted owls during the breeding season would also minimize the potential for effects to migratory birds.	Same as alternative 1	Same as alternative 1
Updated Effects due to the Little Bear Fire	While impacts from the Little Bear Fire to threatened, endangered and sensitive species, management indicator species, migratory birds, and their habitats are not known with certainty, it is likely that some of these species were affected to some degree, at least in the short term. However, based on supplemental analysis, implementation of any of the alternatives post-wildfire should not contribute to any additional direct or indirect adverse impacts (see the wildlife section in chapter 3). The effects from implementing alternative 1 are the same as those for the pre-wildfire assessment.	Same as alternative 1	Same as alternative 1

Chapter 3. Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in the alternatives chapter. Significant issues (water resources, aquatic habitat and fish, riparian vegetation, socioeconomics, and water rights) are discussed first, followed by nonsignificant issues.

Where there are differences in the affected environment and environmental consequences of the alternatives due to the Little Bear Fire, these are noted.

Figure 4 is a map of the project area and the cumulative impact analysis area. Figure 5 depicts the boundary and burn severities of the Little Bear Fire in relation to the North Fork project area.

Methodology

The impact analysis and conclusions contained in this chapter were based on Lincoln National Forest staff knowledge of the resources and site, reviewing of existing literature and agency studies, information provided by specialists within the USDA Forest Service, other agencies and contractors, and professional judgment. The methodology section at the beginning of each resource heading describes any additional specific data collection/analysis or other methods used for that resource.

Potential impacts in this chapter are described in terms of type (direct, indirect, cumulative and are the effects beneficial or adverse?), context (are the effects site specific, local, or even regional?), duration (are the effects short term or long term?), and intensity.

Direct effects occur at the same time and in the same locations as actions that cause them. Indirect effects are those that occur at a later time or in a different location than the actions that were their cause. Cumulative impacts result from the additive impacts of past, present, and reasonably foreseeable future actions in or near the area.

For purposes of this analysis, short-term effects are those expected within the next 1 to 10 years and long-term effects are those that are expected between 10 and 20 years or more unless specifically defined in individual resource sections below.

The analysis we present for alternative 3 (adaptive management) in each resource section considers the direct, indirect, and cumulative impacts resulting from implementing all adaptive management triggers, as described in the description of the adaptive management alternative in chapter 2 as well as the implementation of identified mitigations and monitoring measures. The analysis we present for alternatives 1 and 2 in each resource section considers the direct, indirect and cumulative impacts resulting from the implementation of all mitigation measures and monitoring specific to these alternatives (as described at the end of chapter 2) are implemented.

The methodology portion of each resource section in this chapter includes a summary of any changes to the methods used for analysis based on the Little Bear Fire.

The specialist reports used in preparation of this chapter are:

- Final Water Resources Report for the FEIS(AECOM 2015)
- Riparian Vegetation Report and Botanical Resources Report for the FEIS (Miller 2015a and Miller 2015b)
- Fish and Wildlife Report and Biological Evaluation and Wildlife Biological Assessment for the FEIS (Bright 2015a and Bright 2015b)
- Socioeconomics Report for the FEIS (Eichman 2015)
- Water Rights Report for the FEIS (Thompson 2015)

Past, Present, and Reasonably Foreseeable Future Actions

Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes the action (40 CFR 1508.7).

The baseline used for cumulative effects analysis is the no action alternative. The cumulative effects analysis; while it includes some consideration of past human actions; does not fully quantify all effects of past human actions by adding up all prior actions on an action-by-action basis. By looking at current conditions, we capture residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005, regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.” The cumulative effects analysis in this EIS is also consistent with Forest Service NEPA regulations (36 CFR 220.4(f)). For these reasons, while some past actions are listed and considered, the focus of the cumulative analysis is based on current environmental conditions, and to the extent possible, the no action (no pumping alternative).

The North Fork Eagle Creek project area lies wholly within the 3,400-acre North Fork Eagle Creek basin, which is located within the larger 10,300-acre upper Eagle Creek drainage. The upper Eagle Creek drainage is a subset of the 37,200-acre Devil’s Canyon hydrological unit code 6th field (HUC 6) watershed. We assessed watershed conditions within the Devil’s Canyon HUC 6 as part of a nationwide effort (USDA Forest Service 2010) and these assessment results were used in evaluation of cumulative effects.

We chose the upper Eagle Creek drainage (figure 4) for the cumulative impact analysis area because of the potential for impacts of multiple actions on the natural environment, particularly hydrologic resources, within this one drainage. As described in more detail in the “Water Resources” section later in this chapter, this smaller and more relevant drainage boundary was used instead of the larger Devil’s Canyon HUC 6 boundary in order to focus analysis on that portion of the Eagle Creek drainage above Alto Lake and within a few miles downstream of the lake, with the most potential to be affected by North Fork Eagle Creek well pumping in combination with other actions in the same drainage. Alto Lake controls the flows downstream and is part of the Village of Ruidoso’s and Alto’s water supply. The drainage area below this is also quite different than the upper drainage in terms of climate, geology, and precipitation. However, the area of cumulative impact may differ depending on the resource affected. If a different cumulative impact area is chosen for a specific resource, we discuss this in that specific resource section later in this chapter.

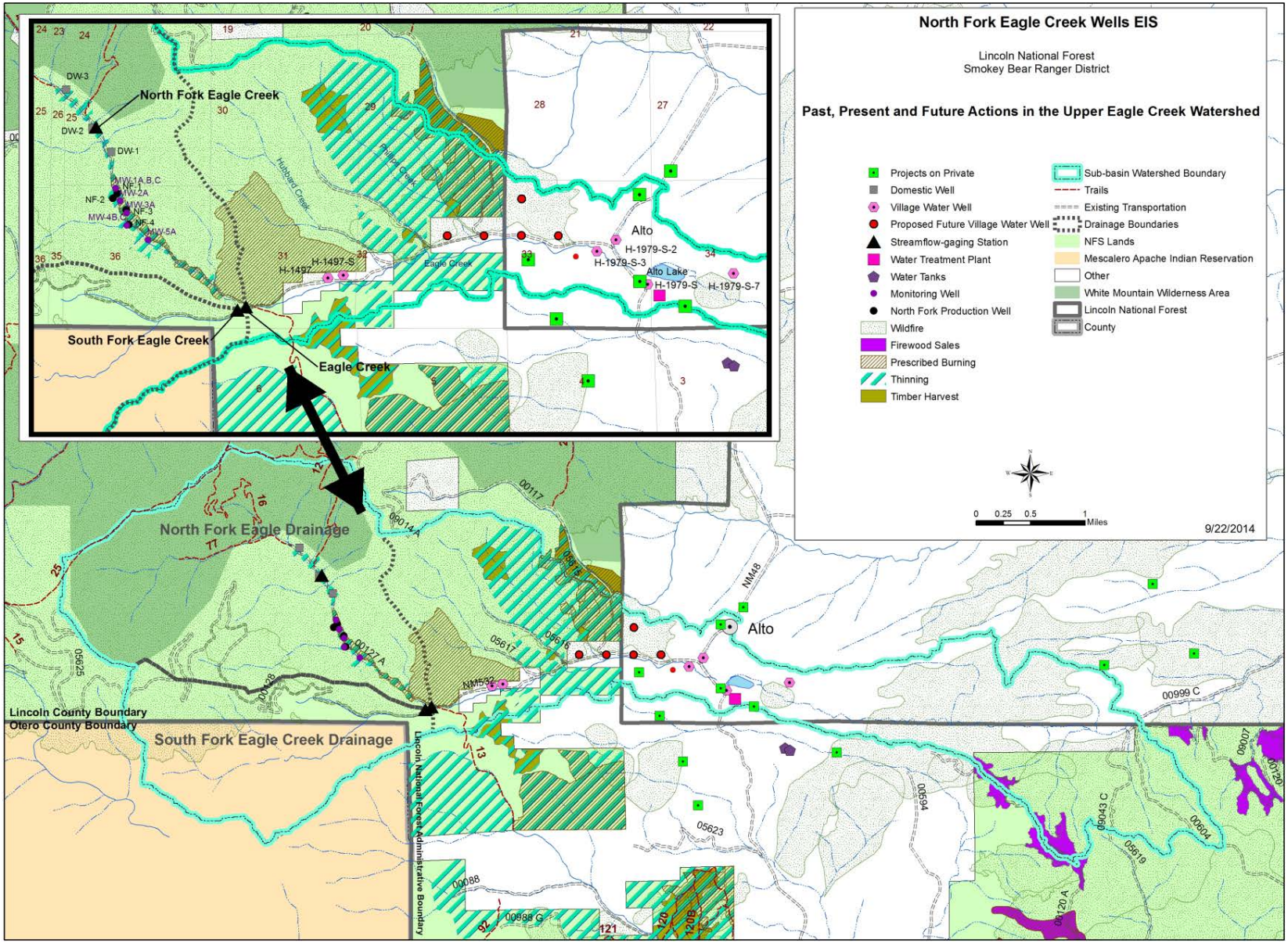

Figure 4. Upper Eagle Creek drainage for cumulative impact analysis

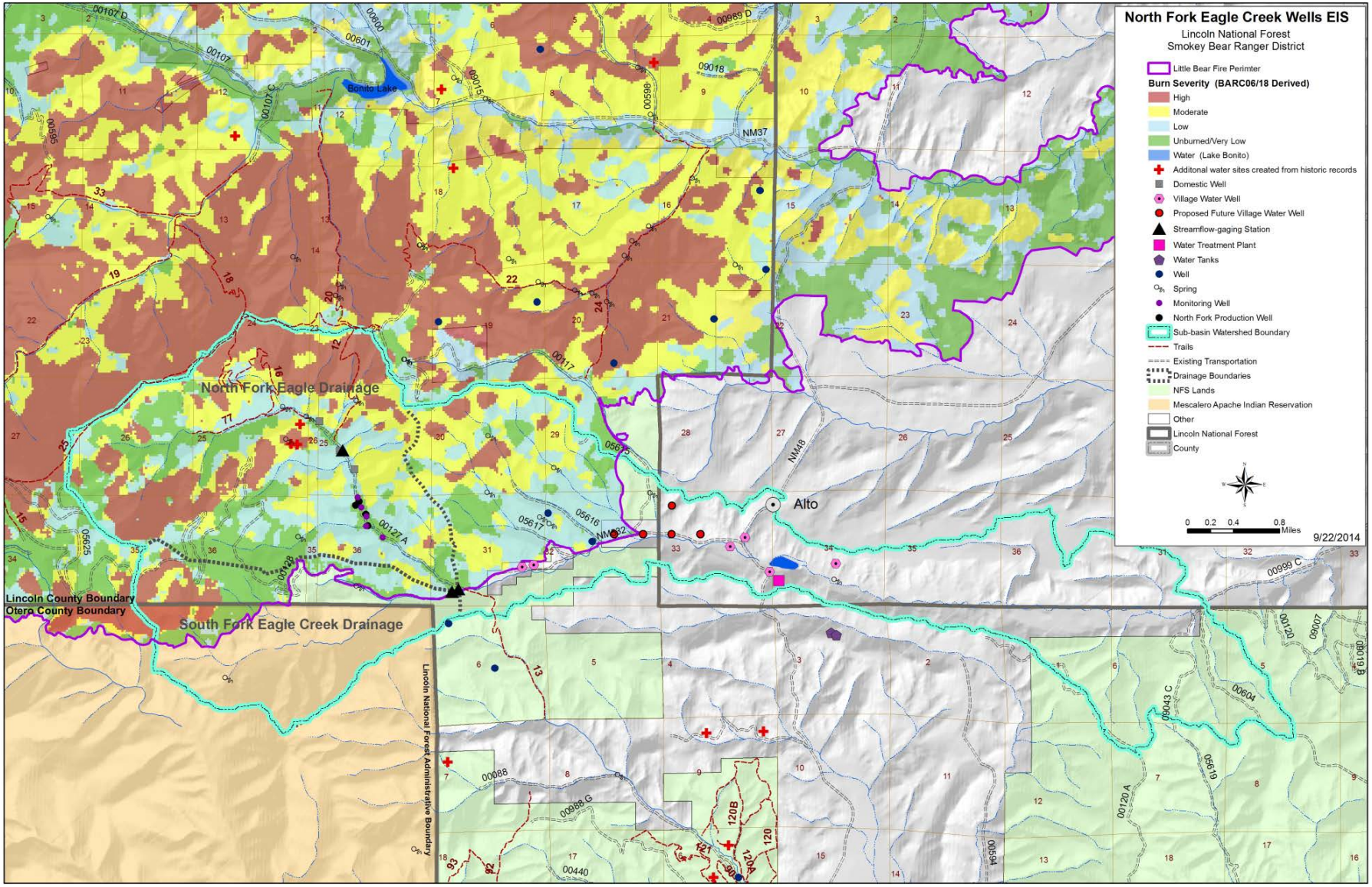

Figure 5. Little Bear Fire Burn Severity

We received several comments during the public scoping period and subsequent comment periods related to the size and boundary of the cumulative impact study area, as shown in appendix A, C and E but we continue to feel confident in the size and configuration of the cumulative impact study area as depicted in figure 4 and figure 5, for the reasons described above. The list in table 4 and the actions shown on the map in figure 4 have been updated since the 2012 DEIS.

The upper Eagle Creek drainage is comprised of approximately 66 percent National Forest System land (6,750 acres), 11 percent Bureau of Indian Affairs land (1,150 acres on the Mescalero Apache Reservation) and 23 percent private land (2,360 acres). Populated communities within the upper Eagle Creek drainage include Alto and portions of the Village of Ruidoso. Generally, the major use of private property located within the drainage is for the rural residential lifestyle. Many residences are seasonally occupied.

A catalog of certain actions (ones that are contributing effects to affected resources analyzed) occurring within the upper Eagle Creek drainage is summarized in table 4 below. In progress or planned actions, known as of this writing, are also included and were compiled from the “Lincoln National Forest Schedule of Proposed Actions” (queried in August 2011, May 2014, and again in April 2015), input from the district staff, New Mexico State Forestry Division, and applicant.

As shown in table 4, approximately 3,406 acres within the 10,300-acre upper Eagle Creek drainage (or 33 percent) have been treated or are planned for treatment in the foreseeable future with fuel reduction, road work, or facility construction. Approximately 6,700 acres (or 65 percent of the drainage) has been burned in past wildfires, including the recent 2012 Little Bear Fire.

There are currently no reasonably foreseeable future plans for vegetation treatments on National Forest System lands within the drainage but one New Mexico State Forestry project is planned in the next 1–2 years.

The “Affected Environment” sections for each resource later in this chapter discuss the current conditions in the project area. Cumulative watershed effects analysis assumes all planned projects have been completed.

The “Water Resources” and “Socioeconomics” sections of this chapter provide additional detail related to the municipal water supply and how this is currently managed and plans for future management.

Table 4. Past, in progress and planned activities within the Upper Eagle Creek drainage

Project	Type/Timing	Within Upper Eagle Creek Drainage?	Approximate Acreage/miles within Upper Eagle Creek Drainage
Forest Service in progress or planned projects			
El Capitan mineral exploration	Test core drilling/planned	No	
Hale Lake and East Hale Lake grazing allotments management	Livestock grazing/ongoing	No	
Stokes Easement and road construction/reroute of National Forest System Road 256	Acquisition of an easement to cross private land and reroute portion of National Forest System Road 256	No	
NM 532 road realignment	Rebuilding of three curves on NM 532 is planned for FY12.	Yes	2 miles
Integrated Non-native Invasive and Native Invasive Plant Project	Vegetation management	Yes	
Divide Grazing allotment management	Livestock grazing	No	
Grindstone Wetland Development	Watershed management	No	
Merchant Grazing allotment management	Livestock grazing	No	
Skinner Grazing Allotment	Livestock grazing	No	
Seven Cabins Road Realignment	Road management	No	
Ski Apache Postfire Rehabilitation	Special Use Management	Yes	80 acres
Ski Apache Recreation Enhancement	Special Use Management	Yes	40 acres
West Mountain Push Units 7-9	Fuels Management	No	
Forest Service ongoing, routine management activities			
Outfitter/guide permittees	Outfitter/guides utilize the Eagle Creek area for access to trails and dispersed camping.	Yes	N/A
North Fork wells maintenance	Routine maintenance of the municipal North Fork well field and pipeline	Yes	4 acres
National Forest System Road 127A maintenance	Routine maintenance of National Forest System Road 127A for access to dispersed camping, well field, and Summer Homes Tract.	Yes	2 miles
National Forest System Road 117 maintenance	Routine maintenance of National Forest System Road 117 for access to national forest.	Yes	7 miles

Project	Type/Timing	Within Upper Eagle Creek Drainage?	Approximate Acreage/miles within Upper Eagle Creek Drainage
Forest Trail T-12 maintenance	Routine maintenance of T-12 in the Summer Home Tract. This trail is located directly above the Eagle Creek well field.	Yes	2 miles
Relevant Forest Service past activities			
U.S. Geological Survey gage installation	U.S. Geological Survey installed weirs in Upper Eagle Creek and at the confluence of the north and south forks. A flume was also installed along the south fork.	Yes	0.25 acre
National Forest System Road 127A road work	The first low water crossing was rebuilt after a flood event in 2008.	Yes	0.25 acre
Village of Ruidoso surface diversion	The Village of Ruidoso surface diversion for collection of water along Eagle Creek.	Yes	0.25 acre 1 surface diversion along Eagle Creek
Village of Ruidoso municipal well field installation	The Village of Ruidoso municipal well field and pipeline were installed in the early 1980s for access to groundwater rights supplemental to the surface diversion.	Yes	4 acres
Eagle Creek Summer Homes domestic well installation	A series of six domestic wells were installed at the summer home tract for drinking water in 2009.	Yes	6 domestic wells
Eagle Creek Summer Homes septic tank installation	A series of septic tanks were installed at the summer home tract for waste disposal in 2009.	Yes	0.5 acre
NM 532 road reconstruction	Reconstruction of NM 532 at mile marker #3 due to flood in 2008.	Yes	0.5 mile
Burned Area Emergency Response Treatment	Trash bars installed at mouth of Carlton Canyon in response to Ski Run Fire.	Yes	0.25 acre
Eagle II thin and hand pile projects	Thinning, hand piling, and burning projects.	Yes	1,770 acres
Oak Grove Host site	Construction of a host site at Oak Grove Campground above the North Fork of Eagle Creek.	Yes	0.25 acre
Ski Run Wildfire	Wildfire in 2003 located between Carlton and Johnson Canyons. Fire bisected by NM 532. Area burned to around 1 mile of Eagle Creek Summer Home Tract.	Yes	265 acres
Cree Wildfire	Wildfire in May 2000	Yes – a portion	912 acres
Little Bear Fire	Wildfire in 2012	Yes	5498 acres
Thinning in southeast corner of project area		Yes – a portion	2 acres
Firewood sales	Firewood treatments	Yes – a portion	89 acres

Project	Type/Timing	Within Upper Eagle Creek Drainage?	Approximate Acreage/miles within Upper Eagle Creek Drainage
Burned Area Emergency Response (BAER) Activities for the Little Bear Fire	The placement of 150 feet of Jersey barriers along Eagle Creek; installation of 100 cubic yards Gabion baskets; installation of a 10 foot culvert extension and overflow drain; installation of concrete slope paving around each bridge; aerial seeding and mulching was accomplished in high-severity burned areas in the drainage and hillsides above the cabin areas.	Yes	100 acres
Past and ongoing activities outside of National Forest System lands			
Eagle Creek RV Resort	Installation of a privately owned campground 3 miles downstream from the North Fork Eagle Creek in 2010.	Yes	33 acres
Bottlehouse Cabin rentals	Installation of cabins and rental units ¼ mile south of well field on private land in 2009.	Yes	Unknown
Various domestic wells	Approximately 20+ domestic wells at residences located below the Eagle Creek well field.	Yes	1 acre Water use – greater than 20 domestic wells
Softball field	Municipal softball fields are located on village land approximately 3 miles below the Eagle Creek well field	Yes	5 acres
Ruidoso Winter Park tubing area	A private tubing area is located on private lands 3 miles below the Eagle Creek well field. Snow blowing machines utilizing private Eagle Creek water rights are used to supplement snowfall. The tubing area was installed in 2008 approximately.	Yes	5 acres water use
State Forestry projects	Hazardous fuel reduction and wildland-urban interface biomass projects.	Yes	900 acres
State Forestry projects	Hazardous fuel reduction and wildland-urban interface treatments (Moon Mountain and Lincoln Country Wildland-urban Interface).	No	
Village of Ruidoso water line	The abandonment and relocation of a water line within Eagle Creek. Requirement by the Dam Safety Bureau after the Little Bear Fire	Yes	5 acres
Village of Ruidoso wells	Rehabilitation of North Fork well #4	Yes	0.25 acres
Village of Ruidoso surface diversion	Cleaning and maintenance of the Village of Ruidoso surface diversion	Yes	1 acre
Village of Ruidoso wells	Placement of jersey barriers around National Forest System well #4 and Green well. New Mexico Environment Department requirement for security	Yes	0.5 acres
Village of Ruidoso wells	Deepening supplemental wells to 1,500 feet	Yes	4 acres

Project	Type/Timing	Within Upper Eagle Creek Drainage?	Approximate Acreage/miles within Upper Eagle Creek Drainage
Planned activities outside of National Forest System lands			
State Forestry project	Hazardous fuel reduction project planned for 2012–2013	Yes	300 acres
Village of Ruidoso wells	Applications to pump from an additional 7 wells, supplemental to the North Fork Eagle Creek wells	Yes	7 wells
Totals: Acreage/miles within Upper Eagle Creek Drainage	**15 miles of road and trail maintenance** **345 acres of past or ongoing ground disturbance due to structures or facilities** **6,700 acres of area burned in previous wildfires** **1,861 acres of fuels reduction and firewood treatments (National Forest System lands)** **1,200 acres of state forestry fuels reduction treatments** **Approximately 33 municipal water and domestic wells combined**		

Significant Issue: Water Resources

The major issue addressed in this section is the effect that well pumping has on hydrologic resources in the North Fork Eagle Creek drainage, including potential cumulative effects downstream in the larger Eagle Creek drainage. This issue encompasses multiple subjects that include understanding the connection between the stream, the alluvial aquifer, and the deeper groundwater that is extracted by the wells, as well as characterizing the effects that climate change may be playing in these processes.

Well pumping results in changes in the dynamics of groundwater (groundwater drawdown and water table elevations, spring flows, and seeps), surface water (streamflows and pools), and associated resources (riparian conditions, wetlands). Lowering streamflow may increase surface water temperatures, and reduce the amount of water accessible to vegetation. Surface water and groundwater availability are linked and are limited not only by accessible available quantities of water, but also by available water rights. Water resources over time can also be affected by climate change.

The final supplemental Water Resources Report (AECOM 2015) provides a more detailed description of affected environment, methods, and environmental consequences, considering the changes caused by the Little Bear Fire. These reports are incorporated by reference, discussed briefly below, and available in their entirety in the project record.

Methodology

The direct effects study area is the upper Eagle Creek drainage (figure 2) above the Eagle Creek gage. The cumulative impacts area extends through the Eagle Creek drainage to the location of the former U.S. Geological Survey stream gage named Eagle Creek near Alto, New Mexico (Eagle Creek near Alto, U.S. Geological Survey gage number 08387800) (figure 4). This area incorporates an additional approximately 7 stream miles of Eagle Creek below the direct effects study area.

The cumulative impact area occupies 15.7 square miles (including the project study area) and extends into lower elevations than the North Fork drainage. Eagle Creek near Alto gage, now discontinued, is located at approximately 6,840 feet above mean sea level. Major water features in the cumulative impact area, but outside the direct effects study area, include the Eagle Creek surface water diversion for the applicant; lower Eagle Creek; Alto Reservoir; several additional municipal water supply wells; and Alto Crest Water Treatment Plant No. 3. The Water Resources Report provides more details regarding why this area was selected (AECOM 2015).

Water supply pumping for the applicant is conducted at six water wells along lower Eagle Creek (figure 11), and the Village of Ruidoso diverts surface water from the stream a short distance below the Eagle Creek gage. Approximately 26 individual homes are located along the North Fork and upper Eagle Creek, a number of which are located downstream of the North Fork well field.

The analysis methods we use here are based on a comprehensive review of existing hydrologic and geologic reports and memoranda, as well as data available for groundwater depths, aquifer characteristics, streamflows, and water chemistry. We undertook a time-intensive program of additional data collection and interpretation for the project in coordination with the USGS. We describe and compare hydrologic conditions based on a review of these data, the geologic conditions, and the hydrologic conditions with and without groundwater pumping. Potential effects on the hydrologic system for the alternatives are displayed on either a qualitative to quantitative basis, depending on the data, information and resources available. We used descriptive or analytical approaches for this effort, employing existing data that include known or assumed characteristics of

aquifers, geologic factors, groundwater levels, streamflows, channel conditions, surface water and groundwater chemistry, wells, and well field pumping. No further groundwater modeling or data collection efforts were undertaken.

The original impact assessment as documented in the 2012 DEIS was based on carefully-selected long-term data that included a pre-pumping ("no pumping") period (before the North Fork Eagle Creek well field was activated). These data and other collected information form the assessment basis for alternative 2 (no action – no pumping). By using extended periods-of–record in the original assessment, the effects of short-term natural variation were minimized when comparing potential pumping impacts. Short-term natural variation effects are believed to be substantial in the mountainous watershed setting, so the original assessment approach and its impact indicators are judged to remain appropriate for longer-term post-wildfire impact comparisons. Given the complications of limited post-wildfire data availability and quality, qualitative appraisals have been used as necessary in the post-wildfire water resources impact assessment.

We describe direct, indirect, and cumulative effects in terms of duration and extent. Short-term impacts include those that would be in effect over a relatively limited duration. For purposes of this assessment, short-term refers to a period of approximately 3 months or less. We have determined this on the basis of annual seasons and the general responses of surface water and groundwater conditions to seasonal variations. In addition, at the fairly high elevations and limited fair weather durations in the North Fork, perturbations to water resource conditions may have related effects on watershed condition, riparian communities, aquatic resources, and recreational uses in a 3-month period or less. We describe long-term impacts as those having effects greater than 3 months. Typically for this project, however, long-term impacts would affect surface water, groundwater, or their uses by water dependent resources for periods of years.

We considered context and intensity when describing impacts. An action must be analyzed in several contexts—such as the immediate vicinity, affected interests, and locality. Intensity refers to the severity of the impact. Thus, we describe impacts in terms of negligible, minor, moderate, or substantial. Because of the complexity of the water resources setting and the level of quantification available from existing data and information in both the project study area and the cumulative impact area, the significance of potential impacts is qualitatively assessed. Professional judgment is involved here, with the goal of making an unbiased assessment that addresses USDA Forest Service management objectives and the project purpose and need. These findings may depart from other determinations based on differing information or viewpoints.

The spatial extent of potential impacts is described as being site specific, local, and/or regional. For the purposes of this assessment, site-specific impacts are those that would occur at the North Fork Eagle Creek well field and in the immediate vicinity approximately one-half mile upstream (to the North Fork gage) or downstream. Local impacts would extend over the upper Eagle Creek drainage, defined as the drainage area upstream of the Eagle Creek gage. The Eagle Creek gage, with its long data history and location at the mouth of the drainage, serves as a logical limit of focus for local concerns and water resources characterization. Regional impacts would occur within the cumulative impact area, as shown in figure 4.

Updates to Methodology Due to the Little Bear Fire

The Little Bear Fire modified watershed conditions in the North Fork of Eagle Creek drainage area. Major wildfire effects that influence the water balance of the area include changes in the frequencies and magnitudes of surface runoff and groundwater recharge, modified snow accumulation and melt, shifts in evapotranspiration rates, and additional sedimentation and debris accumulation in the stream

channel. Most of these factors will offset each other or may possibly allow greater overall water yield from the North Fork (as surface water flow or groundwater recharge). However, the accumulation and movement of coarse sediment through the North Fork Eagle Creek valley and stream system is likely to occur for many years. This will affect the locations and time-spans of flow exposure in the open channel.

Based on recent research, a transient or short-term wildfire recovery period may last roughly three to seven years from the summer of 2012 (when the Little Bear Fire occurred). During this transition, there is likely to be reduced infiltration, increased surface water runoff, and reduced partitioning of precipitation to groundwater recharge. Approximately four to eight years following the Little Bear Fire, long-term post-wildfire conditions are expected to more generally resemble the pre-wildfire hydrologic setting. Plant cover regrowth will slow runoff. Overall evapotranspiration rates will likely be reduced from shifts in vegetation. Flood magnitudes are expected to decline, as are sediment yields from snowmelt or smaller rainfall. Under major storm events, however, we anticipate large volumes of sediment and debris would still be eroded and transported to the valley floor. The North Fork is expected to accumulate and route runoff and sediment inputs from its tributaries. This will change channel conditions over a longer time period.

If long-term stand conversions from coniferous forest to grass or shrubs occur extensively in the study area, decreased evapotranspiration could encourage greater water yield as surface water flow or groundwater recharge. The potential for this could be greater if more extensive grassland types become established in the watershed. Preliminary results from ongoing regional studies also suggest that exceptional monsoonal moisture also may provide additional groundwater recharge in some areas where tree cover is reduced (Newton et al. 2012a, b). However, the North Fork Eagle Creek has a different geologic setting than the area in that investigation, so such recharge may or may not occur in the project study area. In short, once the transitional wildfire recovery period has passed, hillslopes and surface runoff conditions should plateau, and water yield from the North Fork Eagle Creek watershed is expected to be similar or somewhat greater than pre-wildfire conditions.

Uncertainties exist about current and future recharge and groundwater availability estimates based on differences of opinion about post-fire watershed conditions and their timing. These relate primarily to the reduced evapotranspiration losses following post-fire vegetation changes, and the amount of incoming precipitation that is partitioned to surface runoff instead of to groundwater recharge and storage. Eventually, post-fire recovery is expected to return the North Fork project area to approximate pre-fire water resources conditions. For this reason, much of the original pre-fire impact assessments remain pertinent to long-term anticipated post-fire effects of the alternatives.

Measurement Indicators

We used the following measurement indicators to compare the potential impacts of implementing the alternatives.

Streamflow Quantity: Compare the estimated durations of no surface flow conditions anticipated to occur at the Eagle Creek gage during a year of average precipitation. No-flow conditions are defined as 0.01 cubic feet per second or less in the stream at the gage.

Streamflow Quantity: Compare the estimated occurrence of flows equal to or greater than 1.2 cubic feet per second at the Eagle Creek gage during a year of average precipitation. This flow value is a selected benchmark simply used for impact comparisons. Other larger or smaller rates could have been selected as a comparison metric (e.g., 1.0 cubic feet per second), but the 1.2 value lies between the 50 percent exceedance flows for the pre-pumping (1.6) and post-pumping periods (1.1) at the

Eagle Creek confluence gage. In addition, for the pre-pumping period 1970 through 1980 (full measurement years) at that gage, the average annual baseflow was calculated to be 1.13 cubic feet per second, and the median was 1.19 cubic feet per second, based on Table 4 of the USGS report (Matherne, et. al. 2011). This comparative metric for potential impacts is not used as an adaptive management trigger under the adaptive management alternative.

Pre-wildfire Streamflow Quality indicator: Based on available surface water and air temperature data, analyze the adaptive management alternative, and compare it with project alternatives, for the anticipated occurrence of periods when the mid-day streamflow temperature during the growing season (May to October) would exceed 20 degrees Celsius (68 degrees Fahrenheit) at the Eagle Creek gage. After the Little Bear Fire, this impact indicator no longer applies. Soil erosion and nutrient changes, organic debris, and sediment and rubble transport will continue to modify North Fork Eagle Creek water chemistry, turbidity, and channel geometry (depth, width) over time after the wildfire. Based on this, the broad pre-wildfire trends in streamflow temperature at the Eagle Creek gage (or other locations) probably would not apply to general post-wildfire conditions, and post-wildfire data to modify this indicator are lacking.

Springs and Seeps: Identify springs and seeps that may be affected by pumping as those within the area of projected drawdown (see figure 12 and figure 13). For impact assessment purposes, it is assumed that these features are connected to the more general basin groundwater system. Actual conditions may differ.

Domestic Wells: Identify domestic wells that may be affected by pumping as those within the area of projected drawdown (see figure 12 and figure 13).

Success of the Alternatives over Time Considering Climate Change: This indicator involves a qualitative analysis without significance determination, based on a general review of the indicators above under possible climate change effects. Potential effects on water resources from climate changes may include reduced basin yield and recharge from changes in rainfall, reduced snowpack accumulation, evapotranspiration; more frequent early season snowmelt; later onset of winter, reduced seasonal peak flows, and/or shorter flow durations.

We derived these measurement indicators on the basis of existing data, anticipated future data that may result with additional monitoring (see chapter 2), and the management objectives stated in more detail in chapter 1 and in the final supplemental Water Resources Report (AECOM 2015). These indicators are oriented to flow presence in the North Fork, water availability for riparian vegetation and aquatic habitat, improving watershed condition, and maintaining domestic water uses along the North Fork.

The climate change indicator was developed in response to USDA Forest Service policy requirements (Joyce 2008). It is based on a review of recent research and published agency viewpoints for the Southwestern U.S. Currently none of the alternatives are anticipated to have a noticeable effect on climate change. Actions that typically may have an effect on climate change are generally those that create substantial greenhouse gas emissions. Due to the nature of the well field infrastructure (wells, pumps, electrical power, and pipelines), greenhouse gas emissions are expected to be negligible. Based on this, the anticipated effects of climate change are oriented to potential effects on the project alternatives, rather than potential effects from the project alternatives.

We provide more detail regarding the rationale for the selection of these measurement indicators, and why others were not used, in the Water Resources Report (AECOM 2012) and final supplemental

Water Resources Report (AECOM 2015). We document below the process used to review each of these indicators following the Little Bear Fire.

Updates to Measurement Indicators Due to the Little Bear Fire

We reviewed fire effects on stream gage conditions and data records, of monitoring well data records, of precipitation data and well field pumping records. Sediment and debris adversely affected data collections at stream gages, and either wildfire effects or access restrictions appear to have adversely affected some of the monitoring well data. Interruptions in electrical power sources for data logging equipment may also have resulted from the Little Bear Fire.

In reexamining water resources impact indicators, an effort was made to compare pre-wildfire streamflow and monitoring well conditions to similar post-wildfire conditions. This effort was limited by the short timeframe for data collection following the wildfire, by compromised or missing data, and by the considerable natural variation of precipitation inputs to the hydrologic system over the relatively short pre-wildfire versus post-wildfire comparison periods. As described in more detail in AECOM 2015, periods selected for attempted comparisons of wildfire effects focused on generally similar precipitation inputs for a 2- or 3-month, season when stream flows would primarily reflect groundwater conditions, and lesser evapotranspiration effects. Based on this detailed exercise and other similar reviews, no consistent comparative impact indicators were developed for pre-wildfire versus post-wildfire conditions. In addition, the post-wildfire watershed recovery period, estimated at approximately 3 to 7 years after the summer of 2012, is temporary enough to have minimal influence on the alternatives or decision-making.

For these reasons, the original water resources impact indicators, with the exception of the streamflow water quality indicator, are valid for longer-term post-wildfire conditions. The former streamflow water quality indicator is not likely to apply either to short-term or long-term post-wildfire conditions, since the North Fork Eagle Creek channel will transport and rework sediment and debris for a considerable number of years. In the short-term, additional nutrient content in surface flows may enhance aquatic habitat conditions for some species. As stream deposits are reworked over the long-term, additional turbidity and suspended organic carbon and silt will likely increase surface water temperatures and reduce oxygen availability as a result of the fire. Such reworking will likely occur periodically over the long term, due to intense rainfall or snowmelt events. During relatively stable interim periods, however, parts of the channel could reflect water quality similar to that before the fire. These areas would be pools and riffles that form and change over time as the channel geometry adjusts.

Incomplete or Unavailable Data

Although a substantial amount of surface water and groundwater data are available in the study area and the cumulative impact area, much of these data are sparse or have been retrieved at different times and locations. This prevents a thorough understanding of the hydrologic systems involved. In addition, some factors of interest (such as water quality) simply have too little data for anything other than cursory interpretations. The North Fork Eagle Creek hydrologic system is complex, and varies from season to season, from year to year, and from place to place. Characterizing this system by itself, as well as in the light of manmade perturbations, requires a consistent and extensive dataset both temporally and spatially. Information lacking in the water resources data and analysis include water quantity and quality information for surface water and groundwater; further definition of water-bearing zone characteristics; and a strong definition of the temporal and spatial relationships between pumping activities, groundwater levels in the various zones, and the extent, magnitudes, and durations of surface flows. We describe monitoring methods in chapter 2 that satisfy these information needs.

Updates to Incomplete and Unavailable Data Due to the Little Bear Fire

Several factors complicated the original pre-wildfire assessment; and comparisons between pumping conditions and time periods were configured to treat these factors as similarly as possible between the pre-pumping period and subsequent pumping periods. Uncertainties in the approaches and the assessment results were clearly spelled out in previous resource documentation. It must be emphasized that impact assessments are based on comparing the predicted impacts of one alternative to another. If possible, comparisons should account for other variables in a consistent manner from one case to another. To encourage this, available data should be treated and used similarly across comparisons unless departures can be accurately defined. For example, in the pre-pumping data for Eagle Creek (approximately 1980 and earlier), there are no separate data available for flows from the South Fork tributary. South Fork contributions are essentially a random signal in that data set. In fact, South Fork flows are reflected in all Eagle Creek flow data. Specific South Fork data are only available for four years beginning in September 2007, approximately 30 years after the onset of pumping. For purposes of comparisons, removing the South Fork contribution from the Eagle Creek confluence gage data would require a convincing and accurate approach to projecting those tributary flows back to other time periods considered in the assessment (e.g., the pre-pumping period, and other periods before records began in September 2007). Such an approach would need to consistently explain what happens to South Fork flows when they are greater than the Eagle Creek flows, which occurs almost as frequently as the lesser condition, and then treat (i.e., modify) all data through time (many years) with a consistent and convincing quantification of tributary watershed responses and variations in gaging conditions. Issues with that approach can be visualized by examining Figure 6 below, wherein South Fork flows sometimes mimic the confluence gage, sometimes are an order of magnitude less, or sometimes are larger than the confluence flows. Or alternatively, impact comparisons could (and did) treat South Fork contributions to the Eagle Creek gage consistently, as essentially a random signal in all the downstream flow data used in the assessment.

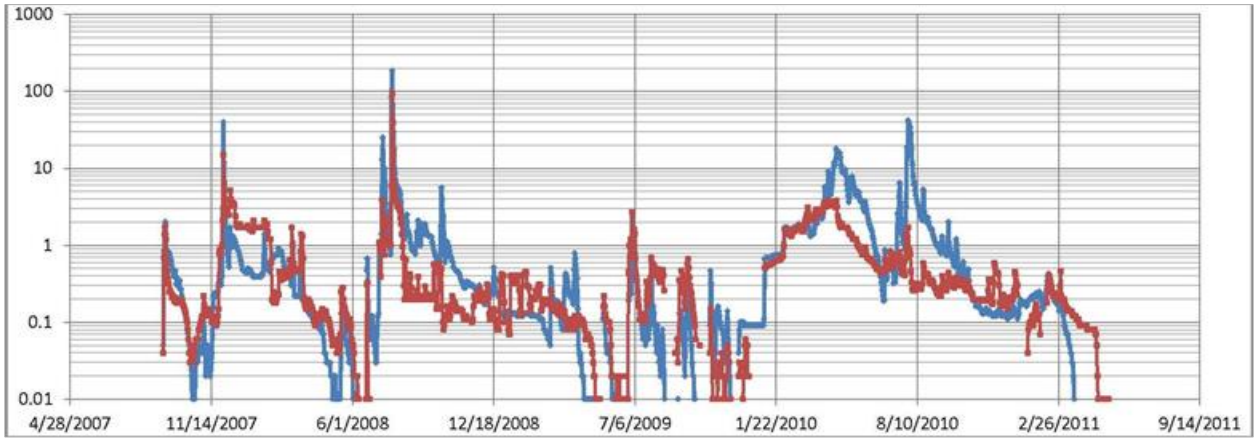

Figure 6. South Fork flows (red) compared to Eagle Creek confluence flows (blue)

Alluvial underflow at the surface water gages is probably a factor influencing Eagle Creek streamflow records. After the original water resources impact assessments were completed in 2011, the USDA Forest Service and AECOM learned from the Village of Ruidoso that the Eagle Creek gage had been moved downstream from its original location in the mid-1980s. The original gaging site is not specifically known. More importantly, it was not known during earlier EIS work if alluvial underflow at the old U.S. Geological Survey gage location was greater than, less than, or equal to conditions at the new location.

Current anecdotal input from the Village (2015) is that the new location has alluvial underflow and the old location was on bedrock. If, as maintained by the Village, up to 0.16 cubic feet per second may underflow the current Eagle Creek gage, that could offset the flow differences between the historical periods used to derive comparisons of potential impacts between pumping and non-pumping alternatives. Further investigation into this indicates that while there may be an underflow effect at the "new" gage location, the conclusion that flow effects result from pumping still pertains.

Derivation of the maximum underflow value (0.16 cubic feet per second) mentioned by the Village has not been documented. Using Figure 29 from the U.S. Geological Survey report (Matherne, et. al. 2011), between 0.05 and 0.12 cubic feet per second could flow through the alluvium at the Eagle Creek gage. Based on contributing watershed areas, it can be reasonably assumed that at least one-third of the alluvial underflow at the Eagle Creek gage originates from the South Fork. Using the remaining two-thirds leaves approximately 0.033 to 0.08 cubic feet per second underflowing the gage from the North Fork, or an average between them of about 0.06 cubic feet per second. It should be noted that these are very small values, and within the inaccuracies of gage measurements.

At the Eagle Creek gage, the long-term pre-pumping daily flow at the 50 percent exceedance level is about 1.6 cubic feet per second at the "old" gage location. Under similar precipitation and record length, the similar post-pumping value is about 1.0 cubic feet per second at the "new" gage location. Adding any of the North Fork underflow values (0.033, 0.06, or 0.08 cubic feet per second) back into the post-pumping value would not substantially change the conclusions about long-term pumping effects on typical stream flows.

An additional review was done for the no-flow assessment, in an effort to place the pre-pumping (old gage location) and post-pumping (new gage location) conditions on a similar basis. Simply adding a default flow value to the newer Eagle Creek gage data would instantly create continuous flow, since the lowest possible recorded value is zero. Instead, the underflow values determined above from USGS data were subtracted from the older gage data, as though that station had allowed underflow similar to that suspected at the new location. Using ten-year periods of record, flows less than or equal to 0.01 cubic feet per second (defined as no-flow) were tallied for the underflows. This allowed negative values to be counted as no-flow. For the 0.08 cubic feet per second underflow case, 73 no-flow days (2 percent) occurred at the simulated "old" gage location. This is generally similar to the 91 no-flow days determined for the ten-year "pumping" period (1989-1998) at the new gage location in previous investigations. For the 0.033 cubic feet per second underflow case, there were zero no-flow days at the simulated old gage, and for the 0.06 cubic feet per second underflow case, there were 19 no-flow days at the simulated old gage. It can be seen that this exercise is quite sensitive to input values; in addition, gaging inaccuracies are acknowledged to exist. As a check, however, results from most of these exercises still indicate a general decline in streamflows from the pre-pumping condition to the pumping condition. Comparison to the Rio Ruidoso (figure 7 and figure 8) and to other work for the area (figure 9 and figure 10) also appear to confirm this.

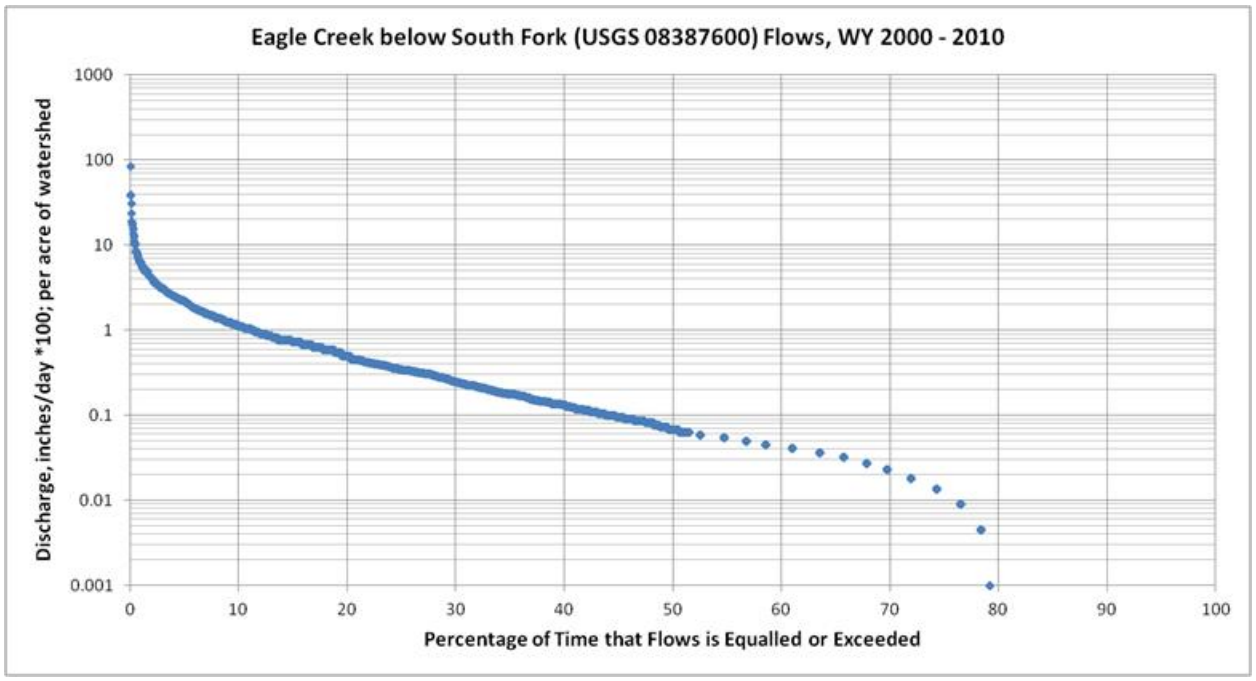

Figure 7. Flow frequency of Eagle Creek, water years 2000-2010

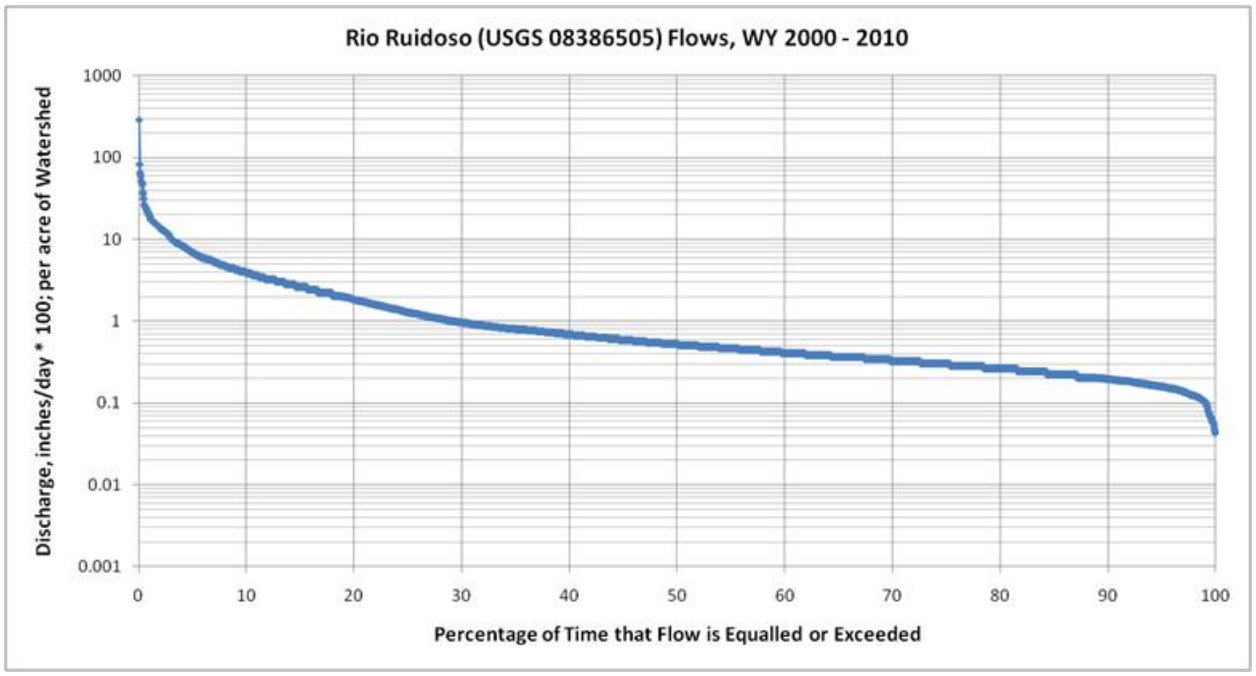

Figure 8. Flow frequency of Rio Ruidoso, water years 2000-2010

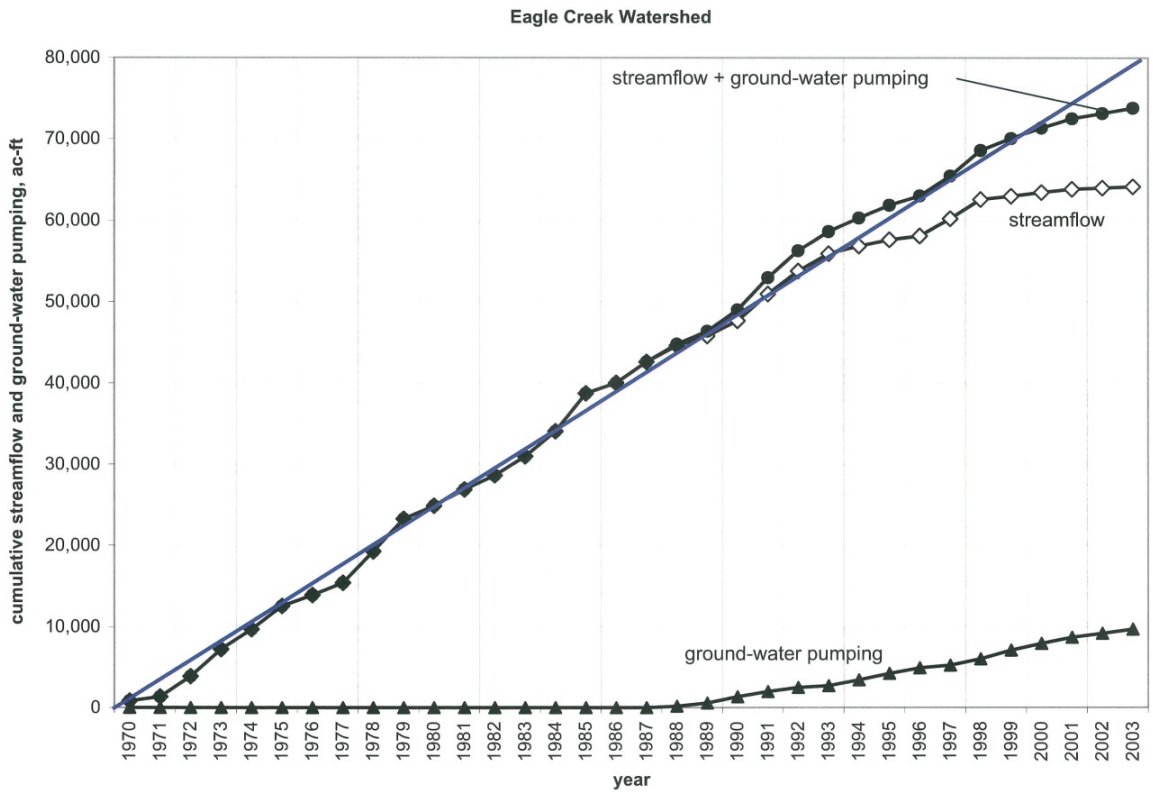

Figure 9. Cumulative streamflow and diversions from North Fork Wells (Source: Finch et al. 2004, Figure 15)

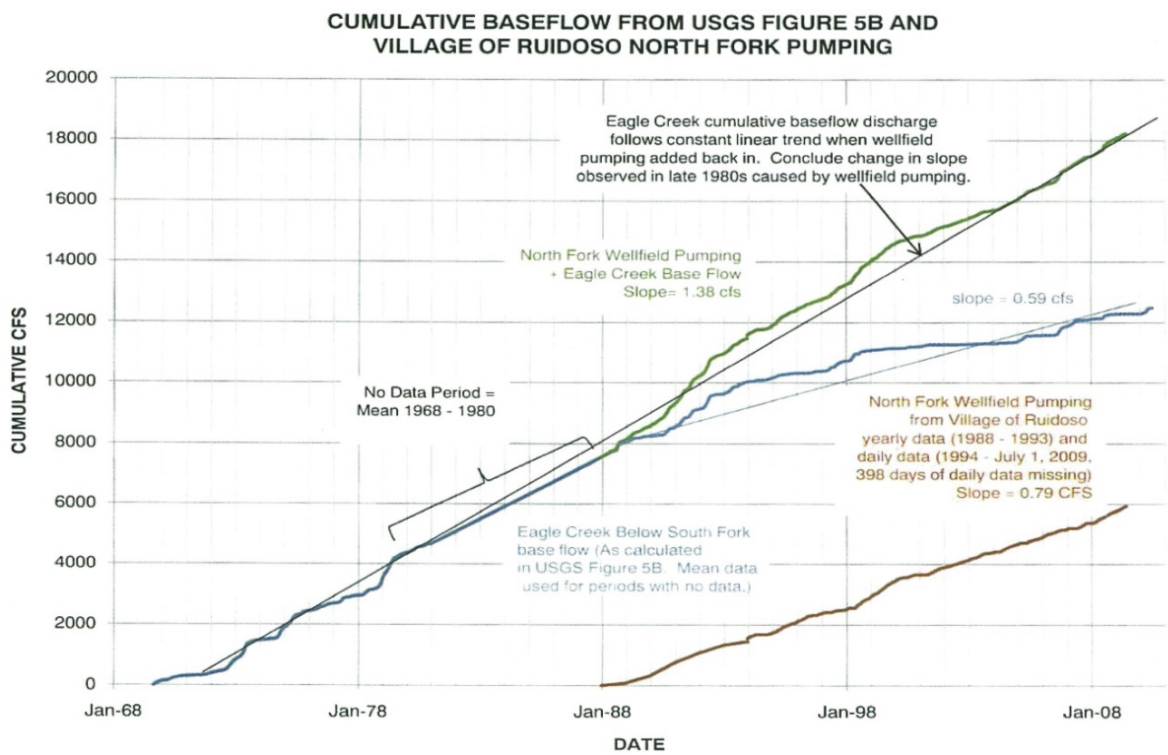

Figure 10. Cumulative baseflow comparison over time (Source: Balleau and Silver 2010, Attachment 9)

For this and other data-based reasons, uncertainties and approximations in the assessments were identified in the pre-wildfire water resources text. The Little Bear Fire has not changed those, and instead has added further complexity. In particular, uncertainty remains as to the long-term average groundwater recharge volume in the North Fork Eagle Creek basin. This is discussed in greater detail in other sections, in the U.S. Geological Survey project study (Matherne et. al. 2011), in several consulting documents, and in the alternatives discussion section in chapter 2 of the FEIS. This uncertainty is largely caused by year-to-year natural variation, and by differences in measurement and estimation techniques between investigators. The Little Bear Fire has not modified these conditions, which are the natural variation and differences between estimation techniques. In fact, further uncertainties about current and future recharge estimates exist, based on differences of opinion about post-fire watershed conditions.

During supplemental document preparation following the Little Bear Fire, additional background information was collected from the U.S. Geological Survey, the Western Regional Climate Center, the Village of Ruidoso (including Shomaker and Associates and others), and Balleau Groundwater (Balleau 2014). Information provided by the Village of Ruidoso consisted of water level data collected from ongoing measurements at monitoring wells along the North Fork Eagle Creek, daily pumping records for recent years, and a summary of water supply issues related to the Little Bear Fire (Peery 2013, Atkins 2014). Information from the U.S. Geological Survey consisted of their post-wildfire debris flow probability report (Tillery and Matherne 2013) as well as additional monitoring data for streamflow and local precipitation. Western Regional Climate Center information consisted of additional precipitation, snowfall, and temperature data for recent years. This additional information is largely discussed in the Post-Little Bear Fire Affected Environment text.

Reduced water quality and debris flows resulting from the Little Bear Fire adversely affected Village surface diversions and storage facilities. Significant sediment as well as suspended and dissolved organic matter prevented surface water treatment. In addition, reduced aquifer recharge adversely affected the North Fork Eagle Creek well field capacity (Atkins 2014). New pump installations were completed in North Fork wells NF-1 and NF-4 to maintain sufficient groundwater supply in light of these issues. Reduced surface water and groundwater production along Eagle Creek also created the need by the Village of Ruidoso to increase diversions of both surface water and groundwater from the Rio Ruidoso. Surface water from that source was similarly contaminated by the Little Bear Fire, or was unavailable due to drought. At the same time, water for the Village of Ruidoso in storage at Grindstone Reservoir was at historic lows (Atkins 2014). After the recent drought and the Little Bear Fire, surface water diverted from Eagle Creek has been non-existent or extremely polluted with ash and silt during flash flood events (Atkins 2014). This water is not treatable in the Village of Ruidoso's existing facilities.

Since 1966, the Village of Ruidoso has been authorized by the New Mexico Office of the State Engineer (Office of the State Engineer) to divert part of its water supply from the Rio Ruidoso by discharging ("returning") treated municipal wastewater to that stream. Some of that discharged water is originally diverted from the Eagle Creek drainage (both surface water and groundwater) for Village supply. The surface water diversion on Eagle Creek is downstream of the North Fork Eagle Creek; currently used water wells are both within and downstream of the North Fork Eagle Creek. After use and treatment, Eagle Creek water is released to the Rio Ruidoso for effluent credits, allowing additional diversion from the latter system. All of these diversion points and wells are metered, and daily readings are reported monthly to the Office of the State Engineer. The Rio Ruidoso has greater surface water and groundwater availability, and is a primary source of Village supply. Additional details on Village water supplies are presented in the Water Rights and Socioeconomics reports.

The Little Bear Fire reduced the Village's ability to divert adequate supplies from the Eagle Creek drainage and maintain return flow credits on the Rio Ruidoso. Historically, water from the North Fork Eagle Creek well field has significantly contributed to the Eagle Creek/Rio Ruidoso credits (Atkins 2014). To meet municipal demand under the post-wildfire circumstances, the Village has relied on basic water rights to divert from the Rio Ruidoso system. These basic rights are being depleted at a rate that will exhaust them well before the end of their associated five-year accounting period ending on October 31, 2016 (Atkins 2014). By October 31, 2013, the Village of Ruidoso's five-year basic rights accounting totals on the Rio Ruidoso had been substantially expended. At that time, basic water rights remaining for diversion in the Rio Ruidoso drainage had been depleted to only 865 acre-feet for the remainder of the accounting period. The Village will have diverted all of its basic rights on the Rio Ruidoso by approximately the end of August 2014 (Atkins 2014).

In addition to these supply concerns, the need to lease and temporarily move water rights has created additional costs to the Village for the leases, Office of the State Engineer permitting, and related litigation. The Village anticipates that a number of years will pass before the Little Bear Fire effects are sufficiently reduced to allow a return to full use of Eagle Creek surface water and groundwater, as well as diversion credits for return flows on the Rio Ruidoso. A substantial contributor to the Eagle Creek/Rio Ruidoso credits historically has been the North Fork Eagle Creek well field (Atkins 2014).

The Village of Ruidoso continues to rely on the Eagle Creek well field and drainage area for its water supply. Following a Memorandum of Agreement and settlement with Rio Hondo Land and Cattle Company, the Village's right to water diversion within the drainage consists of approximately 1,624 acre-feet per year of groundwater, approximately 761 acre-feet per year of surface water, and supplemental groundwater from all Eagle Creek wells on and off National Forest System lands. In addition, the Village has an approximately 137 acre-feet per year groundwater right in the H-1497 and S wells, for a total of approximately 2,523 acre-feet per year, plus return flow credit from diversion of approximately 2,386 acre-feet per year. Some of these water rights have priority dates as early as 1882 (Atkins 2014). Further information indicates that on October 23, 2014, the Office of the State Engineer issued a permit to the Village allowing the transfer of 700.83 acre-feet year from Well H-1979 to the surface point of diversion at Eagle Creek and Alto Lake. The permit severed the adjudicated rights to H-1979. However, the Village's municipal rights pertaining to Proof of Beneficial Use, in the amount of 350.42 acre-feet year, remain provable at H-1979. Additional discussion of this recent activity is presented in the Water Rights section later in this chapter and in more detail in the Water Rights report (Thompson 2015).

Information provided by Balleau Groundwater, Inc. further described the local and regional groundwater modeling work being done by that firm. Preliminary simulations conducted by Balleau Groundwater for long-term post-wildfire conditions indicate that pumping the North Fork Eagle Creek wells for a 20-year period would create drawdown and stream depletions at the well field. The potential for more extensive regional pumping effects was also discussed in Balleau Groundwater investigations and supporting material (U.S. Environmental Protection Agency 2013).

If the Forest Service approved a special use permit allowing North Fork Eagle Creek well field pumping, an important tool resulting from the Balleau Groundwater modeling work is that, over the post-wildfire long term, North Fork Eagle Creek well field pumping rate and North Fork Eagle Creek stream depletion can be correlated. Their modeling indicated a time-lag (in years) between pumping adjustments and water levels in the well field; in addition, some simulations of well field management indicated dry conditions along the North Fork Eagle Creek much of the time (Balleau 2014).

The cumulative study area for water resources was determined by reviewing available streamgaging data along the Eagle Creek drainage; the increasing complexity of the geologic and water resources

setting at greater distances from the mountain front; the availability of data within that setting; and the substantial expansion of water uses and returns, water rights, infrastructure, and related data requirements downstream of National Forest System lands. The USDA Forest Service has no jurisdiction for permits, monitoring, or mitigation outside its own boundaries. So, while water use and supply issues are regional concerns in south-central New Mexico, they are difficult to address due to USDA Forest Service jurisdictional issues.

It should be noted that there are considerable differences of opinion between credible, qualified water resource specialists about the potential effects of pumping the North Fork Eagle Creek well field. For example, see the discussions in this report under “Extent of Pumping Drawdown” and “Mountain-Front Recharge”. Other investigators note that assumptions used in calculating stream depletions frequently lead to overstating actual effects, and that lack of data often leads to overly-conservative analysis (Finch 2014). Because of these discussions, an additional measure to include an overall data visualization tool; which may include groundwater model development, calibration, and application through stakeholder cooperation; has been added to chapter 2 of the EIS (see “Monitoring; Water Resources and Fisheries; Item 8) . If implemented, that measure would enhance the potential for informed well field management if a special use permit is issued by the Forest Service.

This recommended data compilation and visualization measure would likely provide valuable management tools. If implemented, modeling would require cooperative development and documentation of the inputs, the calibration criteria, and the interpretation of outputs for well field management purposes. Other recommended adaptive management practices, monitoring, and mitigation measures (see chapter 2) would be implemented during the modeling timeframe if a special use permit for continued pumping is approved through a selected alternative.

Pre-Little Bear Fire Affected Environment

Climate and Geology

The study area encompasses approximately 8.1 square miles and has a total relief of over 2,900 feet. The North Fork drainage covers an area of 5.3 square miles and confluences with Eagle Creek just upstream from the Eagle Creek gage at 7,610 feet in elevation. It is a steep-sided drainage (slopes approaching 50 percent in areas) consisting of evergreen forest, with a riparian corridor up to several hundred feet wide that flanks the stream channel in the lower reaches near the confluence with the South Fork (Matherne et al. 2011) (We describe riparian vegetation more fully in the “Riparian Vegetation” section of this chapter). North Fork Eagle Creek stream channel gradient ranges from over 1,400 feet of rise per mile of run (27 percent slope) in the headwater reaches to less than 190 feet per mile (4 percent) in the lower reaches. The average gradient along the North Fork channel upstream from the confluence as defined by the U.S. Geological Survey 7.5 minute topographic map is approximately 470 feet per mile (9 percent).

Precipitation varies with altitude, varying from an average 37 inches per year or more at the Sierra Blanca climate station (10,280 feet above mean sea level) to 14 inches per year at Fort Stanton climate station (6,220 feet above mean sea level) and lower averages at other stations at lower elevations (Matherne et al. 2011, Western Regional Climate Center 2011). Precipitation consists mainly of winter snow and summer monsoonal rains. On average, 65 percent of the annual precipitation falls as monsoonal rains from mid-June through October. Precipitation not only varies significantly by elevation and time of year, but also from year to year. The Ruidoso climatic station (6,930 feet above mean sea level) averaged 21.8 inches per year from 1942 through 2010, with a range of values from 34.81 inches (1965) to 12.27 inches (1970) (National Climatic Data Center 2010, Western Regional Climate Center 2010).

The study area lies within the Sierra Blanca Structural Basin with Permian and Cretaceous sedimentary rocks that are overlain by up to 3,000 feet of Tertiary volcanic flows and flow breccias. The lower part of the North Fork drainage is comprised of the Tertiary Sierra Blanca volcanics, which consist of andesitic lava flows and pyroclastic deposits up to 3,000 feet thick (Matherne et al. 2011, Rawling 2009, Allen and Kottlowski 1981).

The geology underlying the alluvium and volcanic rocks is not well defined. Outside the study area but within the cumulative impacts area, significant geologic changes occur along the reach between Alto Reservoir and the old gage location (see figure 4 where there is a substantial geologic fault system – the Ruidoso Fault Zone (Rawling 2009).

Based on data compilation and evaluation of the best available information (as described in detail in AECOM 2015), the Tertiary volcanics are fractured and there may be a number of major fracture sets that have not been previously recognized in field mapping. These fractures have the potential to control groundwater flow and may allow for connection between groundwater in the Tertiary volcanics and surface waterflow in the North Fork.

Groundwater

The groundwater system in the North Fork drainage consists of a fractured volcanic rock aquifer overlain in some locations by discontinuous alluvial aquifer along the North Fork. The volcanic aquifer outcrops in the area near and directly downstream of the North Fork gage. The alluvial aquifer is present where the river valley widens in the general area of the village well field, beginning near the location of monitoring well MW-1A and extending to the confluence with the South Fork with volcanic bedrock outcrops in areas below the well field forcing any alluvial water to the stream.

Both the volcanic system and the alluvial system are recharged by streamflow. The volcanic system is recharged through fracture zones in outcrops along the stream channel, including near the North Fork gage. Recharge of the alluvial system in the area of the well field exhibits some amount of dependence upon whether the volcanic aquifer’s water level is depressed. If the water level is depressed, a streamflow between 0.8 and 1.2 cubic feet per second is necessary to overcome the induced infiltration occurring at the volcanic outcrop before alluvial recharge can occur. The alluvial system easily transmits water horizontally, where it discharges back to the stream in the form of base flow, but does not readily transmit water vertically into the underlying volcanic aquifer.

The aquifer tests of the volcanic system by Atkins-Landfair (1985) and Shomaker (1989) have yielded a range of estimates for the hydraulic properties of the village well field along the North Fork. The best estimate for transmissivity seems to be in the range of 1,200 to 1,500 feet squared per day. This is the range found in the reanalysis of the Atkins-Landfair (1985) data and in the one radial flow plot found by Shomaker (1989). The storage coefficient estimates range from 0.0001 to 0.006. Probably, the best estimate is in the range of 0.001 to 0.002.

The Village of Ruidoso wells in the volcanic aquifer show both radial flow and fracture flow. Most of the wells show fracture flow early in the drawdown history and this can change over to radial flow with time. The key is the proximity of the well to a fracture and whether the well is a pumping or monitor well. As noted by Shomaker (1989), fracture flow will give way to radial flow as water is drained from the fracture. In a few cases, we noticed the unit slope on a radial flow plot and this can be interpreted as indicating a boundary condition that forces the well to draw water from the aquifer as if it were draining a closed volume. Because of the limited duration of the pumping tests, the different screened intervals within the volcanic aquifer for the village wells, the dominant effect of fracture flow, and the fact that none of the village wells are fully penetrating, we should view any

interpretation of boundary effects with caution. The aquifer in the Tertiary volcanics is not confined, is not homogeneous, and does not meet the limiting assumptions used in developing type curves for the hydraulic properties of an aquifer. Thus, the results of the aquifer tests by Atkins-Landfair (1985) and Shomaker (1989) need to be used with caution and treated as a general approximation of the behavior of the aquifer in the Tertiary volcanics in response to pumping. Storage in fractured volcanic aquifers is generally lower than for porous media equivalents, with the exception of the upper weathered zone; and though the hydraulic conductivity may be high, a unit volume of such an aquifer only holds a small percentage of water.

Multiple springs and seeps have been mapped or documented in the study area and are depicted on figure 13. In the North Fork drainage, these features range in elevation from approximately 8,020 feet to nearly 8,400 feet above mean sea level. A group of springs are present near the summer home area just upstream of well DW-3 along the North Fork and another group approximately 0.25 mile up the side-canyon that enters from the southwest in that area. A spring and a seep have been noted approximately 0.4 mile up the eastern branch of Telephone Canyon. A spring is also mapped approximately 0.5 mile up Carlton Canyon. Two springs are mapped in the South Fork drainage, one approximately 0.3 mile up the draw that Road 532 follows and at approximately 7,880 feet above mean sea level, and the other approximately 0.5 mile upstream of Eagle Lake No. 2 on another draw at approximately 8,360 feet above mean sea level (USDA Forest Service 2007; Chaves County District Court 1979). These springs may or may not be connected to the more extensive groundwater system that provides stream baseflows, depending on whether or not they are associated with a perched aquifer; more information is necessary to determine this.

Surface Water

North Fork Eagle Creek is classified on the U.S. Geological Survey 7.5 minute topographic map as an intermittent stream, which indicates flow during wet seasons and times when the groundwater table is higher than the stream, contributing to the surface flow. In its upper reaches upstream of the North Fork well field, perennial streamflow conditions are maintained in years of average and higher precipitations by springs fed by groundwater (Matherne et al. 2011). Both the South Fork and Eagle Creek below the confluence were originally classified as perennial streams with year-round flow (U.S. Geological Survey 1963). In general, at the well field and downstream, the North Fork Eagle Creek flowed intermittently in most years prior to pumping. The extent and duration of surface flow has since been reduced along the North Fork by pumping. We ascertained general relationships between flow in the North Fork and pumping using consistent, fairly long-term data periods. These are summarized below from the preceding text sections, but described in detail in AECOM (2015).

We derived water balance estimates and reviewed flow frequencies for three separate time periods of the same length before the Little Bear Fire. The first time period, from 1971 to 1980, was a period prior to the Village of Ruidoso’s well field installation. This period’s overall precipitation was slightly above average based on regional meteorological data. The second time period, from 1989 to 1998, was after the village had begun pumping. The overall precipitation for this second period was again slightly above average. The third period, from 2000 to 2010 (excluding water year 2005 due to a lack of gaging data) was a period of pumping during overall below average precipitation. Severe back-to-back drought years and a few wet years characterized this latter period.

We made general qualitative comparisons between these pre-wildfire periods from the water balance approximations, as follows.

When comparing the first two periods—where the major difference in watershed conditions was the onset of well field pumping—the latter period (with pumping) shows somewhat reduced overall

streamflow, reduced average base flow, and an increase in total estimated average recharge plus pumping. These conclusions are consistent with independent findings by Finch et al. (2004) and Balleau Groundwater (2004).

The last period (2000–2010) indicates generally lower average basin yield than the preceding periods, due to droughty conditions in the late 1990s/early 2000s and vacillating wet/dry conditions later in the period. During this back-and-forth climatic condition, mean annual base flows generally appear to decline still further when compared to the previous two periods. Similarly, further reduction in overall mean annual streamflow has apparently occurred, beyond the amount that might be anticipated by reduced basin yield. However, this is complicated by the occurrence of drought.

Complicating factors in the water balances mainly include: estimating basinwide precipitation from point precipitation data, potential changes in forest canopy evapotranspiration over time, and relocation of the Eagle Creek stream gage in 1988 to a site that may allow more alluvial underflow. In addition, there may be a slight regional groundwater effect from snowmaking withdrawals at Ski Apache wells in the nearby Rio Ruidoso watershed. Basinwide precipitation estimates were derived consistently for all of the time periods examined. Forest canopy changes are known to have occurred since the late 1800s; the change between analysis periods beginning in 1971 is unknown. The stream gage relocation may have had a slight effect on flow measurements; more information on this would be needed if future flow monitoring is done. While it is possible that there may be interbasin groundwater transfer based on the nature of the fractured volcanic aquifer, the fact that Ski Apache wells are outside the Eagle Creek watershed reduces the likelihood that those diversions have affected flow at the Eagle Creek gage. While these factors and others contribute some quantitative uncertainty to the comparisons, well field pumping remains the dominant hydrologic influence between comparison periods.

In general, some reduction in streamflows and increases in recharge factors result on the North Fork from pumping during average to wet years. These effects are somewhat moderated during multiple years of average or greater precipitation. During drought years or more extended dry periods, pumping effects on North Fork streamflows and groundwater conditions are more noticeable. In either case, the greatest pumping influences on surface water, over longer periods of time, appear to be on the occurrence of lower flow rates in the North Fork. These flows in particular are reduced so that the presence of water in deeper pools, or in isolated stream portions that flow over bedrock, is less likely now than before pumping began.

We did not discover any direct correlation between pumping and streamflow over shorter time steps (e.g. daily, weekly or monthly), even when considering multiple variables, as discussed in more detail in AECOM (2012 and 2015). This result is likely due to data limitations and the wide variation in hydrologic factors at shorter time periods.

Streamflow and Pumping Correlation Based on Geology and Water Chemistry

We evaluated the potential effect of village well pumping on North Fork streamflow through examination of the village wells, the geology of the North Fork area, the aquifer properties of the Tertiary volcanics, and the chemistry of surface and groundwater. We discuss this approach in detail in AECOM (2015). We describe conclusions from this evaluation here.

The study of Finch et al. (2004) of monitored flow along the North Fork Eagle Creek shortly after the village wells had been shut off and were recovering, showed a definite loss of streamflow in the range of 0.3 to 0.69 cubic feet per second while the water table was depressed over 200 feet below the base of the stream. This study used five flow measurement locations along the stream reach near the

village wells. Flow measurement techniques were not documented, but results suggest streamflow loss by induced infiltration. This hypothesis would be consistent with the geology of the North Fork area and also the water chemistry. Matherne et al. (2011) also showed that there are periods when the water table in the volcanics can rise even when the village wells are pumping and conversely, the water table can fall when the village wells are not pumping. This suggests that the key to streamflow loss along the North Fork is the depth of the water table below the base of the stream. The village wells can certainly affect the water table depth when they are pumping, but other factors can depress the water table, even when the wells have been shut off.

Balleau and Silver (2010) estimated the potential base flow capture by the village wells by comparing prepumping flows along the North Fork as recorded at the Eagle Creek gage with flows since the onset on pumping and for the period from approximately 1989 to 2010. Their analysis showed that the wells capture about 0.7 cubic feet per second of flow along the North Fork on an average annual basis. The maximum capture would be the pumping rate, which is approximately 0.8 cubic feet per second on an average annual basis (Balleau and Silver 2010).

Geochemistry of Surface and Groundwater

Groundwater tapped by village wells NF-4 and NF-3 and the monitor wells MW-4B and MW-4C near these village wells is distinct from groundwater tapped by village wells NF-1 and NF-2 and the monitor wells MW-1B and MW-1C. This may be due to the somewhat deeper well screens in NF-4 and NF-3 and their associated monitor wells. NF-1 (as shown in figure 13) has never been used by the applicant; it is not equipped nor tied into the main line and it does not have power.

If there is any interaction between surface water and groundwater along the North Fork, it is near village well NF-1. Groundwater near this well may be the result of infiltration of surface water and reaction of the surface water with the minerals in the surrounding rock. Groundwater near NF-4 does not interact with surface water, except possibly in MW-4B due to a fault that connects to lower Carlton Canyon (Matherne et al. 2011). Groundwater along the North Fork has an isotope signature for deuterium and oxygen-18 that is distinct from surface water; deuterium and oxygen-18 isotopes suggest that surface water does not directly recharge groundwater. The isotope signatures are distinctly different, even though groundwater is mostly less than 30 years old.

Domestic and Municipal Water Use

Downstream from the North Fork, the majority of water rights along Eagle Creek are for domestic and municipal uses, with some irrigation use and a few commercial uses. Surface diversions have historically occurred just outside the study area downstream on Eagle Creek below the confluence of the North and South Forks prior to 1985 and through to present time. Existing water rights in the project area are discussed in more detail in the “Water Rights” section later in this chapter.

Roughly 20–30 individual domestic water wells occur in the upper Eagle Creek drainage and 6 of these are located in the Eagle Creek summer home area upstream from the North Fork well field (Medlock 2011 and Forest Service files). The available well log information indicates that, for wells along the North Fork with recorded construction details, recent installations were completed in fractured basalt zones at depths ranging from about 50 to 60 feet, or through to deeper zones ranging from about 160 to 180 feet. Additional information (Midkiff 2002) indicates that some of the early private wells along Eagle Creek Canyon Road were originally less than 100 feet deep. Other early wells were about 110-feet deep (H. Puckett in Medlock 2011). Since the late 1990s, several historic wells have been deepened to between 200 to 400 feet (Midkiff 2002). Some wells may have shallower or deeper source zones. Original estimated yields varied broadly, on the order of 5 to 25

gallons per minute, and some wells may still deliver in the higher range of these yields. Substantial declines in well yields were noted around the year 2002 (Midkiff 2002).

It is assumed that most of the homes along the North Fork use septic systems. Self-supplied domestic demands for homes on septic systems are about 44 gallons per capita per day (New Mexico Office of the State Engineer 2005). Assuming 3 individuals year around for each of 26 assumed homes in the vicinity of the North Fork well field, the total demand from domestic wells would be approximately 1.25 million gallons per year (about 3.8 acre-feet per year). This is a negligible amount in comparison to well field pumping.

Village of Ruidoso Water Supply

The Village of Ruidoso water supply system provides supply from two subwatersheds, Devils Canyon (Eagle Creek) and Upper Rio Ruidoso, through surface water diversion and groundwater pumping in both. These two subwatersheds are both part of the larger Pecos River basin. The delivery system infrastructure consists of 2 raw water reservoirs, 2 surface water treatment plants, and 18 permitted wells, of which 11 are active wells, capable of together producing peak capacity of approximately 6 million gallons per day (Wilson and Company et al. 2005). Groundwater is combined with surface water at Alto Lake Reservoir and piped to the Alto Crest Water Treatment Plant (WTP 3) and treated before being pumped into the system. Potable water production from Alto Crest WTP 3 varies depending upon water demands from the system, averaging as much as 2.3 million gallons per day (7.06 acre-feet per day), or as little as 0.5 million gallons per day (1.53 acre-feet per day) for water supply (Wilson and Company et al. 2005).

The Village of Ruidoso water supply in the Eagle Creek drainage includes surface water from the Eagle Creek surface diversion just downstream from the Eagle Creek gage, the four North Fork wells (although NF-1 is not used and is not tied into the system), four supplemental wells to the North Fork wells located near Alto Lake, and both the brown well and green well located near the surface diversion. Figure 11 illustrates this system. We provide more details regarding both the Eagle Creek and Rio Ruidoso water supply in AECOM (2015), the socioeconomics report (Eichman 2015), and the water rights report (Thompson 2015). Both the “Socioeconomics” and “Water Rights” sections of this chapter provide additional information regarding municipal water supply.

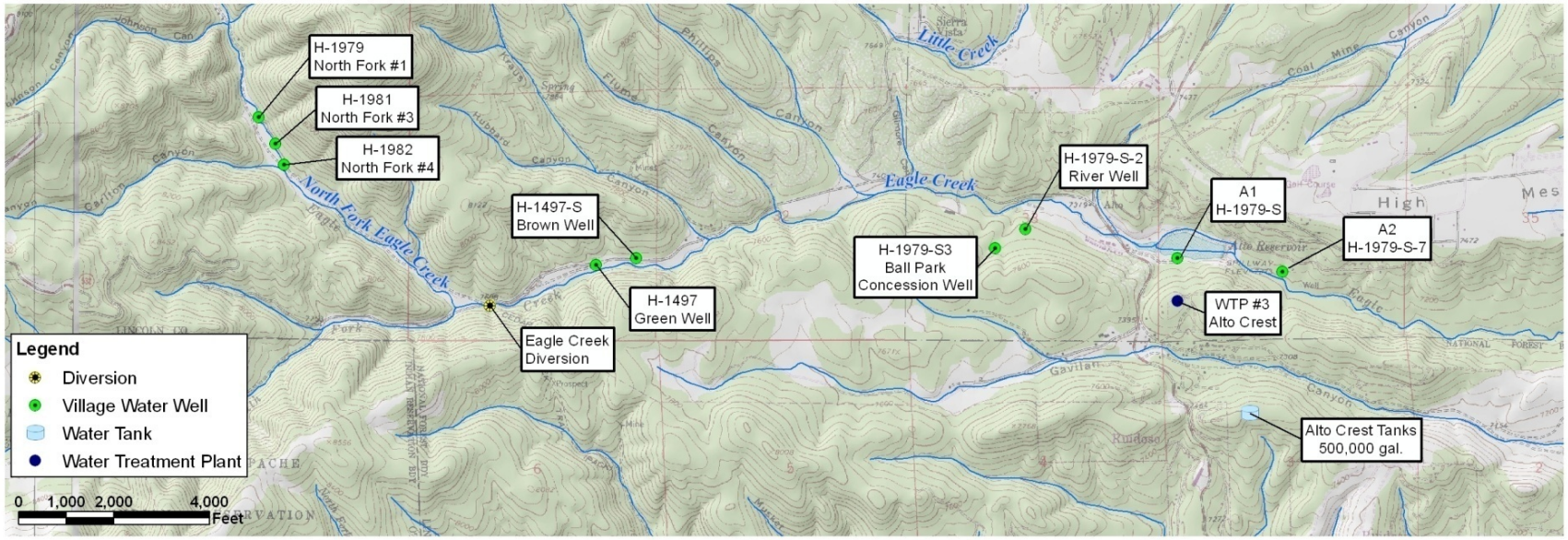

Figure 11. Village of Ruidoso water supply in the Eagle Creek drainage

Watershed Condition Classification

Regionally, watershed conditions have been recently classified by the USDA Forest Service according to a nationwide Agency program (the "Watershed Condition Framework," USDA Forest Service 2011a) and its associated protocols (Potyondy and Geier 2011). Objectives of the program include integrating ecosystem-based approaches to managing watersheds; improving efforts to restore watersheds and aquatic habitats; and enabling priority-based resource allocations for restoration efforts. This program establishes a consistent approach to watershed assessment. Twelve indicators are scored (either good, fair, or poor and then averaged) by multidisciplinary agency teams, and used to classify watershed condition. These indicators represent underlying ecological, hydrological, and geomorphic functions and processes that can affect watershed condition. The major program emphasis is on aquatic and terrestrial processes and conditions that Forest Service management activities can influence on National Forest System lands (USDA Forest Service 2011a, Potyondy and Geier 2011).

These average scores are then further averaged between indicators to ultimately arrive at an overall score by which to assign watershed condition classes 1, 2, or 3 as follows:

- Class 1 (functioning properly) scores of 1 to 1.6;
- Class 2 (functioning at risk) scores from 1.7 to 2.2; and
- Class 3 (impaired function) scores from 2.3 to 3 (USDA Forest Service 2011a).

Based on the "Watershed Condition Framework," the North Fork and South Fork drainage areas on National Forest System lands have been classified as impaired function (USDA Forest Service 2011b, Banks 2011). Watersheds classified at impaired function exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition (Potyondy and Geier 2011). Typically such drainages have exceeded some physical, hydrological, or biological threshold, and substantial changes to the factors that caused the degraded state are needed to restore proper functioning condition (Potyondy and Geier 2011). On National Forest System lands in the study area, the lowest relative scores were received for aquatic habitat, aquatic biota, riparian/wetland vegetation, fire regime, and terrestrial invasive species.

Regional Extent of Pumping Drawdown

Information from the U.S. Geological Survey and other investigators (Finch et al. 2004, Balleau Groundwater 2004, Midkiff 2002) show that when groundwater is pumped from the North Fork wells, a temporary decline in the water table results, creating a cone of depression around the wells. This cone of depression deepens water levels in both the alluvium and underlying volcanics. Pumping and streamflow are related, in that pumping near a stream will deplete surface flows in a porous channel setting. This effect occurs within the North Fork Eagle Creek. As a result, the intermittent (seasonal) flows or pools that historically occurred from a short distance above the well field downstream to the Eagle Creek gage have been reduced in magnitude and extent by pumping. These effects are more pronounced during dry seasons or dry years. However, the degree of these connections and the nature of groundwater flow paths are complex in the North Fork Eagle Creek study area and have not been fully characterized. For this reason, the actual extent of long-term drawdown from pumping is unknown, as are the details of pumping effects on streamflows and groundwater levels. These conditions have been estimated by the investigations described above.

Because of the fractured nature of the Tertiary volcanics and limiting factors on drawdown migration, such as the Bonito Lake stock, estimating the approximate regional extent of drawdown due to Village well pumping requires simplifying assumptions. Balleau Groundwater (2004) developed some

hypothetical cases for possible drawdown migration. One of those cases simulated the aquifer system with a line barrier boundary 1,100 feet northwest of the well field and a line recharge boundary (Eagle Creek) 5,000 feet southwest. Recharge and barrier boundaries were modeled to restrict north-south migration of the cone of influence. The aquifer was simulated with transmissivity of 1,250 feet per day, and it was assumed that there was no surface water capture. The well field was simulated to pump 570 acre-feet per year for 15 years. Resulting drawdown was about 40 feet at the well field at 15 years (Balleau Groundwater 2004).

In actuality, the Tertiary volcanics in the area of the Village well field along the North Fork of Eagle Creek are fractured, very heterogeneous, and the wells pump from different horizons within the volcanics. To develop an analytical model for estimating the regional effect of pumping on water levels in the volcanics requires the following assumptions: 1) the aquifer in the volcanics is homogenous and isotropic; 2) the Village wells pump from the same level in the volcanics and thus tap the same aquifer; and 3) the aquifer properties determined from pumping tests where radial flow was evident in some wells apply to all wells – thus ignoring the role of fracture flow. In addition, Balleau Groundwater (2004) assumed the volcanic aquifer was confined, when in fact it is unconfined.

Under current data conditions, analytical models of regional drawdown effects include a number of assumptions that produce different estimates of regional drawdown caused by the Village wells. From a data perspective, the U.S. Geological Survey made observations of drawdown during two separate occasions; these results are presented in figure 12, and have been projected on an area basis for this assessment in figure 13.

Although a projected drawdown is indicated on figure 12 and figure 13, it must be recognized that with the existing monitoring data and available modeling inputs, there are substantial uncertainties in predicting groundwater drawdown in this hydrologic system under various conditions of pumping and precipitation.

Based on the information available, the projection based on observed drawdown is of interest for ascertaining effects on springs, water available for riparian vegetation, and domestic well pumping. That drawdown is anticipated to remain within the Eagle Creek drainage.

Pumping drawdown may be more extensive than indicated in figure 12 and figure 13, based on results of predictive groundwater models (Balleau Groundwater 2004). However, if a projected 10-foot drawdown contour is accepted as reasonable sensitivity when making comparisons of pumping effects, then other existing modeling work indicates that the maximum extent of the 10-foot drawdown impacts due to Village well pumping is limited to the Eagle Creek drainage.

There are differences of opinion between investigators regarding the influence on water levels between regional (i.e., background) recharge versus induced (from pumping) recharge during monitoring. In addition, the monitoring that resulted in the ascertained cone of depression during the U.S. Geological Survey investigation took place after a major recharge period. Above-average precipitation occurred in the 2 years preceding the monitoring, and storms associated with Hurricane Dolly contributed to the flood of late July 2008. Monitored water levels continued to rise until winter in spite of continued pumping (Matherne et al. 2011). Then in March 2009, the stream channel was dry from a point just below Domestic Well #3 (DW-3) downstream to immediately above the Eagle Creek gage (Matherne et al. 2011).

Based on field surveys and monitoring measurements, the U.S. Geological Survey is reasonably certain that the North Fork gage is outside the zone of influence of well field pumping. A number of

other features, namely domestic wells, springs, and zones of existing or potential riparian habitat, occur outside the pumping drawdown identified in U.S. Geological Survey monitoring. The observed and projected pumping drawdown in figure 12 and figure 13 are thought to be appropriate for purposes of assessing impacts. The actual extent, depth, and timing of pumping drawdown are unknown. Other projections of potential drawdown shape and extent exist (e.g., Balleau 2004a), but all of these cases involve significant and somewhat differing sets of assumptions. As indicated on figure 13, two springs, one in Carlton Canyon and another in an unnamed tributary to the South Fork, occur within the projected drawdown based on the U.S. Geological Survey observations. As discussed previously, these features may be connected to a more general groundwater system, or may have relatively isolated perched sources. Additional study would be necessary to determine this at the various sites within the North Fork drainage.

Conditions before Pumping Began in 1988

Prior to the establishment of the North Fork Eagle Creek well field, the volume of water withdrawn for use in the North Fork drainage was minimal. No municipal groundwater pumping occurred on the North Fork prior to 1985, when water rights were exercised by the applicant to construct the well field.

Although actual data that characterized the prepumping conditions is limited to stream gage data at the Eagle Creek gage, there are multiple sources for personal accounts and anecdotal evidence to the conditions prior to installation of the North Fork Eagle Creek well field.

While flows were generally perennial in upper reaches above the North Fork gage historically, anecdotal evidence of the North Fork Eagle Creek stream conditions indicates that, prior to pumping, flows further downstream were inconsistent, that the stream has been a marginal fishery, and that surface water availability for domestic purposes above the well field has often been scarce (McGlothlin 2011, Medlock 2011). Typically the stream disappears into the alluvium for some distance, resurfacing as streamflow when an impermeable obstruction is reached.

The U.S. Geological Survey conducted studies from 2007 to 2009 to determine potential effects of the North Fork well field on streamflow in the Eagle Creek basin, and to provide data for the EIS. The U.S. Geological Survey report was released on October 21, 2010, and subsequently revised in November 2010. It concluded that, in parts of its upper reaches, the North Fork Eagle Creek is a perennial stream maintained by base flow from groundwater. It becomes intermittent in the 2 miles upstream from the Eagle Creek gage (Matherne et al. 2011). Without pumping, North Fork Eagle Creek would still be intermittent below the wells. About 1,600 feet downstream of the North Fork stream gage, streamflows sink into the channel alluvium and bedrock aquifer. As a result, this reach remains dry during dry periods, although water resurfaces from the alluvium in some downstream reaches (stretches ranging from 10 to 50 feet long). More extensive flow presence occurs along the stream during wet years or seasons. At other times, streamflow, when present, tends to occur in reaches where there are bedrock outcrops in the channel.

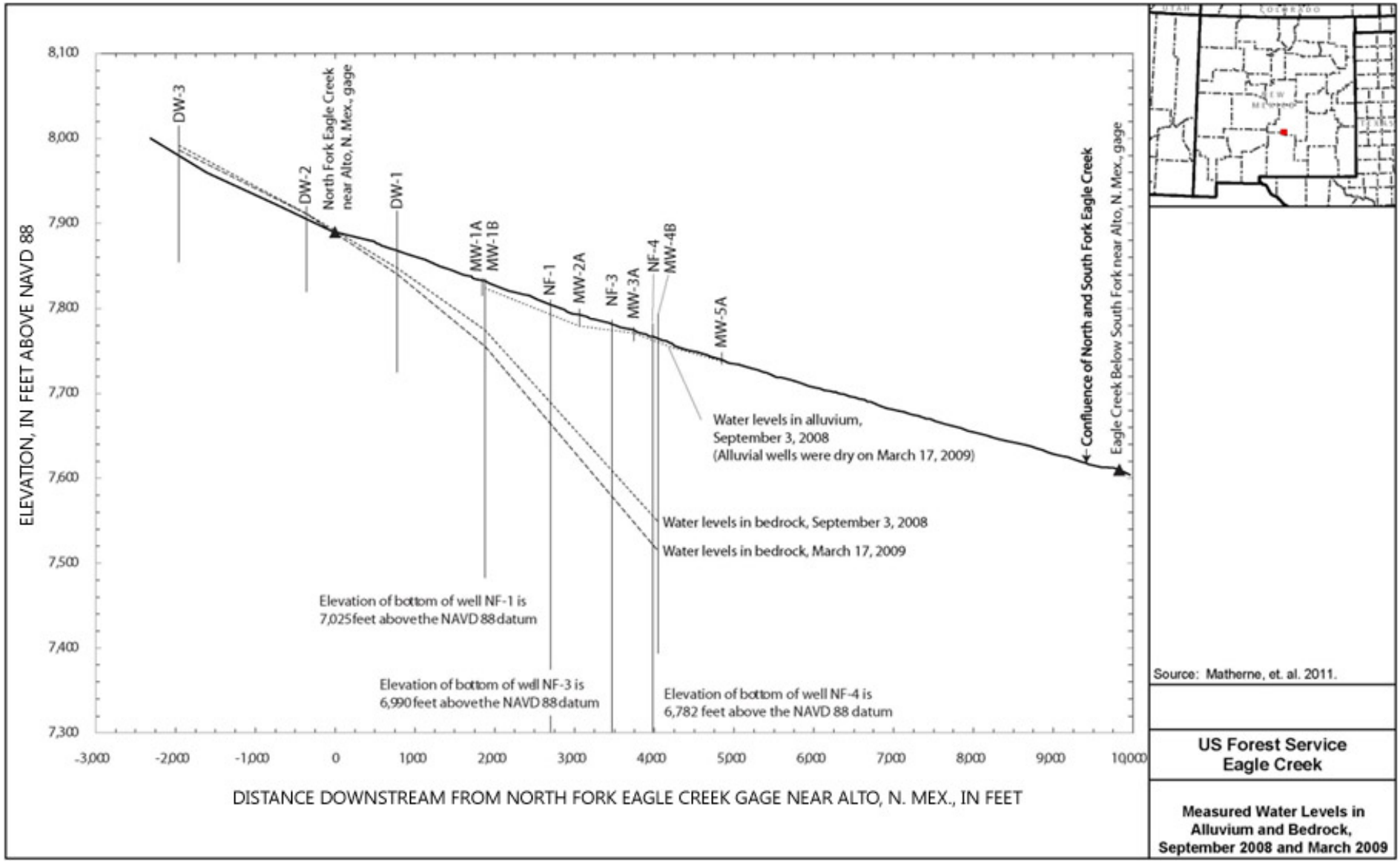

Figure 12. Measured water levels in alluvium and bedrock, September 2008 and March 2009

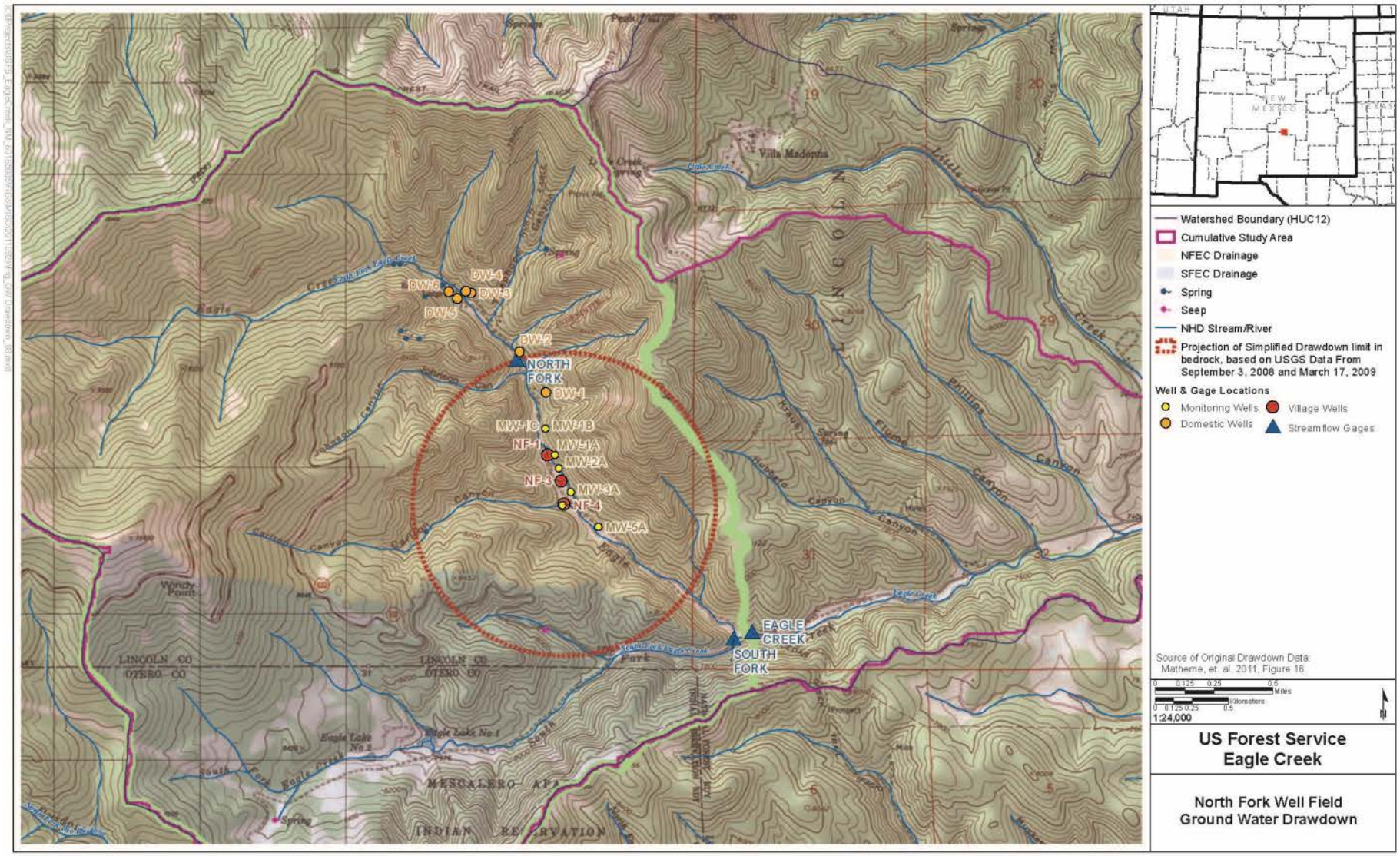

Figure 13. North Fork well field groundwater drawdown

As discussed previously in the "Surface Water" section, the Eagle Creek gage flow frequency was compared for two 10-year periods of similar precipitation, one during pre-pumping and one during post-pumping timeframes. Figure 14 depicts the flow frequency from 1971 to 1980 before pumping began, and figure 15 depicts the flow frequency from 1989 to 1998 after pumping had commenced. The frequency of a certain flow decreased from the pre-pumping to the post-pumping period. Flows of 1 cubic feet per second or greater were experienced in the pre-pumping period approximately 60 percent of the time, and flows of 0.1 cubic feet per second or greater were experienced approximately 98 percent of the time; flows exceeded 0.01 cubic feet per second 100 percent of the time. During the post-pumping period, flows of 1 cubic feet per second or greater, 0.1 cubic feet per second or greater, and 0.01 cubic feet per second or greater were experienced approximately 52 percent, 96 percent, and 98 percent of the time, respectively, at the Eagle Creek gage below the confluence of the North and South Forks. An analysis of flow conditions generally similar to these are summarized in table 5. It should be noted that other calculations of flow frequencies may vary depending on the time periods used and the flow rates compared. In addition, unknown factors discussed previously for the water balance comparisons also apply to flow frequency comparisons.

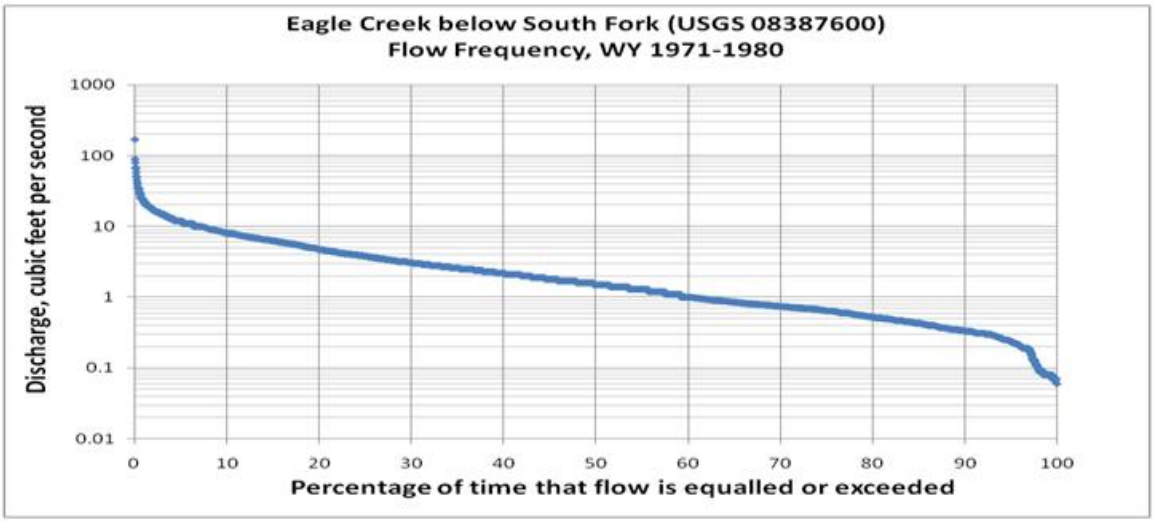

Figure 14. Flow frequency from 1971-1980 before pumping began

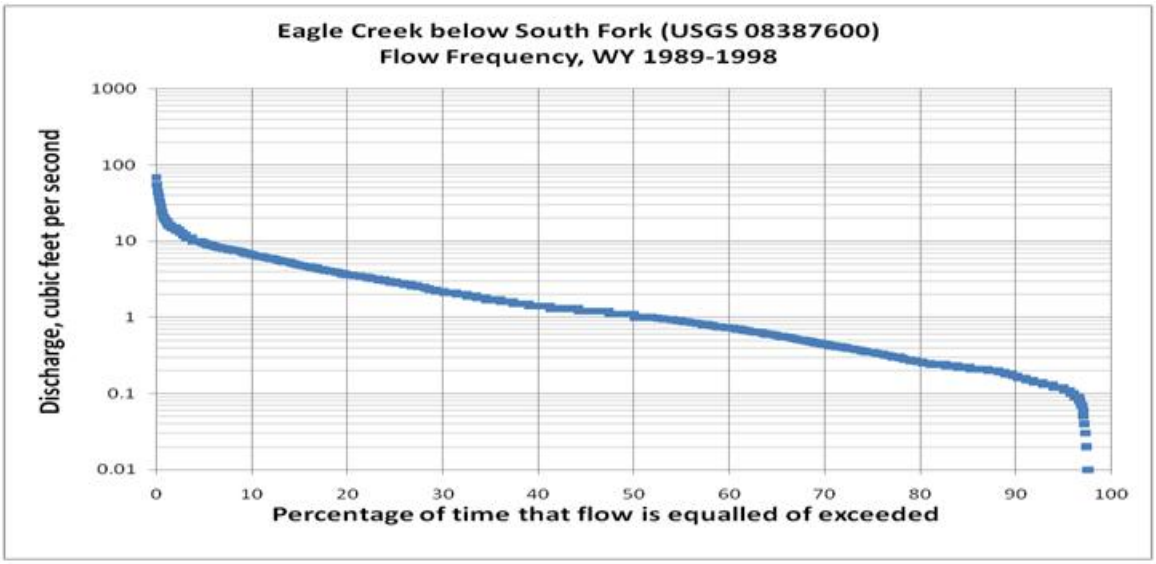

Figure 15. Flow frequency depicts the flow frequency from 1989-1998 after pumping had commenced

These results indicate that prior to well field pumping, mean daily flows consistently occurred at the Eagle Creek gage. The stream never went dry at that location, although it likely was dry at various locations upstream where extensive alluvial deposits absorbed flow. Flows greater than 1.2 cubic feet per second occurred approximately 57 percent of the time, or generally about 7 months of the year.

In a 10-year period having generally similar precipitation, but after the onset of pumping, the stream occasionally went dry at the Eagle Creek gage. This occurred about 2 percent of the time. The occurrence of flows in the lower range between 0.01 and 1.2 cubic feet per second increased somewhat, and the occurrence of flows above 1.2 cubic feet per second decreased somewhat from the prepumping period (table 5).

The later 10-year period of pumping (2000 through 2010) was characterized by precipitation swings between drought and above average amounts. Larger changes in overall flow conditions occurred at the Eagle Creek gage as pumping continued. Flows ceased at the gage approximately 22 percent of the time, and smaller flow rates occurred approximately 60 percent of the time. The general percentage of time that the larger flows (above 1.2 cubic feet per second) occurred at the gage, about 19 percent, continued to decline from previous 10-year periods.

Table 5. Streamflows measured at the Eagle Creek gage

Flow Measured at Eagle Creek Gage	Percent of Time	Months per Year
Prepumping 10-Year Period (1971 through 1980)		
Time dry (flow 0.01 cubic feet per second or less)	0	0
Flow greater than 0.01 to 1.2 cubic feet per second	43.4	5.2
Flow greater than 1.2 cubic feet per second	56.6	6.8
Early Pumping 10-Year Period (1989 through 1998)		
Time dry (flow 0.01 cubic feet per second or less)	2.5	0.3
Flow greater than 0.01 to 1.2 cubic feet per second	51.7	6.2
Flow greater than 1.2 cubic feet per second	45.8	5.5
Later Pumping 10-Year Period (2000 through 2010, without data for 2005)		
Time dry (flow 0.01 cubic feet per second or less)	21.6	2.6
Flow greater than 0.01 to 1.2 cubic feet per second	59.2	7.1
Flow greater than 1.2 cubic feet per second	19.2	2.3

From this analysis, it is clear that during average or above average precipitation periods, the effects of well field pumping are discernible but create generally minor differences from historical prepumping conditions at the Eagle Creek gage. Greater effects may or may not occur upstream. In less than average precipitation periods, however, the effects of pumping on streamflows are much more pronounced. The stream goes dry at the Eagle Creek gage for a substantial part of the time, and other flow rates are generally reduced below prepumping conditions. These effects translate into corresponding reductions of streamflow and near surface water availability up to and somewhat beyond the well field.

Information from the U.S. Geological Survey and other investigators (Finch et al. 2004, Balleau Groundwater 2004, Midkiff 2002) show that when groundwater is pumped from the North Fork Eagle Creek wells, a temporary decline in the water table results, creating a cone of depression around the

wells. This cone of depression deepens water levels in both the alluvium and underlying volcanics. Pumping and streamflow are related, in that pumping near a stream will deplete surface flows in a porous channel setting. This effect occurs within the North Fork. As a result, the intermittent (seasonal) flows or pools that historically occurred from a short distance above the well field downstream to the Eagle Creek gage have been reduced in magnitude and extent by pumping. These effects are more pronounced during dry seasons or dry years. As surveyed in combination, the North Fork and South Fork watershed condition classification on National Forest System lands has been listed at impaired function, exhibiting low geomorphic, hydrologic, and biotic integrity relative to natural potential conditions. However, the degree of these connections and the nature of groundwater flow paths are complex in the North Fork Eagle Creek study area and have not been fully characterized. For this reason, the actual extent of long-term drawdown from pumping is unknown, as are the details of pumping effects on streamflows and groundwater levels. We estimate these conditions through the investigations described above.

We conducted a further review exercise to compare, in a very general fashion, flow conditions at the Eagle Creek Gage to those of the Rio Ruidoso at Ruidoso (U.S. Geological Survey Gage 08386505). While there are differences between the drainages these gages represent (e.g. size, elevation ranges, aspects, geology, channel length, alluvial deposits, vegetation), both drainages are fairly high elevation, forested drainages next to each other on the east side of Sacramento Mountains/Sierra Blanca region. For the purposes of general comparison, flow frequencies were developed for both drainages over a common period of record represented by mean daily discharge data at the gages.

Results indicate that, in a general sense, unit-area discharges during a pumping period on Eagle Creek are substantially smaller than on the Rio Ruidoso, particularly in the lower flow ranges. For example, the Eagle Creek flow having a 50 percent chance of being equaled or exceeded in a recent year is approximately 0.065 inches per day per 100 acres. On the Rio Ruidoso, the flow at the same frequency is approximately 0.5 inches per day per 100 acres, almost an order of magnitude greater than on Eagle Creek. Flows essentially cease on Eagle Creek whereas they continue on the Rio Ruidoso. Although there are differences in these drainages and sources of error in the gaging data, the results indicate substantial differences in recent flows even after adjusting for differences in basin area. It is likely that some of these differences result from pumping in the North Fork Eagle Creek well field.

Climate Change

There appears to be a general consensus currently among climate specialists that, regionally, the Southwestern United States is experiencing a drying trend. Modeling indicates that this is expected to continue well into the latter part of the 21st century (USDA Forest Service 2010). A slight warming trend observed over the past 100 years is anticipated to continue, with the greatest warming expected during winter. Snowpack monitoring suggests that increasing temperatures have generated snowmelt progressively earlier in the year, causing streamflows to deliver water to storage and water users in larger volumes earlier in spring (USDA Forest Service 2010). In western North America regionally, there is later onset of winter, spring snowpack has declined, and snowmelt timing has come earlier in the year (Knowles et al. 2006; Mote et al. 2005; Cayan et al. 2001; Stewart et al. 2005). Shorter winters, and less snowpack, may also affect the timing of peak river flows. In addition, as snowpacks shrink, seasonal stream temperatures could increase (USDA Forest Service 2008).

Changes in overall precipitation are more difficult to predict than temperature changes, because precipitation is more variable in time and space. Added complexities such as topography and monsoonal timing complicate precipitation predictions in the Southwest (USDA Forest Service 2010). Southwestern precipitation may be reduced overall, and skewed toward fewer larger events. Increased

frequency of drought could occur by mid-century (Enquist et al. 2009). However, predictions vary as to effects on runoff caused by broad regional precipitation and temperature changes. These potential effects deserve more investigation, particularly for small, high elevation headwater basins where most runoff is generated (Christensen and Lettenmaier 2007).

Post-Little Bear Fire Affected Environment

Fire Extent and Severity

As summarized in chapter 1 and in figure 5, the Little Bear Fire burned approximately 35,300 acres within the Smokey Bear Ranger District on the Lincoln National Forest in June of 2012 (USDA Forest Service 2012b). Wildfire characteristics within the Eagle Creek watershed are summarized in table 6.

Table 6. Little Bear Fire conditions in the North Fork and South Fork, Eagle Creek Watersheds

Burn Severity	North Fork Eagle Creek, Acres (Percent of Total)	South Fork Eagle Creek[a] Acres (Percent of Total)
High	877 (25.9)	176 (9.8)
Moderate	877 (25.9)	63 (3.5)
Low	905 (26.8)	128 (7.1)
Unburned/Very Low	723 (21.4)	276 (15.3)
Area Outside Wildfire Perimeter	0 (0.0)	1,157 (64.3)
Totals	3,282	1,700

a - The South Fork listing includes the area between the South Fork and the streamgage at the confluence (U.S. Geological Survey Eagle Creek below the South Fork, #0387600).

Source: USDA Forest Service GIS information 2013.

The purpose of this section is to describe how hydrologic conditions have changed (or are expected to change) in the North Fork Eagle Creek project area and surrounding watersheds as a result of the wildfire. This Water Resources section is based on the detailed analysis provided in the supplemental Water Resources Report (AECOM 2015). This AECOM (2015) report, available in the project record, includes multiple tables, maps and figures to illustrate and support the information provided therein. Not all of these tables, figures and maps are included here in this section but are instead either referenced or the information summarized.

During and after the wildfire, Burned Area Emergency Response (BAER) efforts were undertaken by the Forest Service to characterize resource conditions within the wildfire perimeter. The BAER reports (USDA Forest Service 2012a, b) and additional information from existing research form the basis for much of this supplemental description of affected water resources within the study areas.

Extensive, damaging wildfire is widely acknowledged to be a major watershed disturbance, and to potentially create substantial changes in watershed dynamics and water balance factors. These modifications especially occur where large fires take place in coniferous mountain watersheds such as the Eagle Creek headwaters. Although the Little Bear Fire intensity varied over the study area watershed, BAER investigators identified water-repellent soils across intensity categories, and fires typically convert forest types on the Smokey Bear District. Hydrologic responses also vary according to complex relationships of slope and aspect, geology, and regional climate characteristics. In addition to information retrieved from the BAER reports, changes in hydrologic conditions are anticipated on the basis of research into large fires in the Southwest.

The following information focuses on the primary water balance factors affected by the Little Bear Fire, as determined from available data collections and ascertained from existing research. Other conditions that will likely affect water monitoring, mitigation and management also are considered.

Precipitation and Snow Accumulation/Ablation

Precipitation continues to be monitored at several established Federal and state sites within the region (Natural Resource Conservation Service 2013; Western Regional Climate Center 2013). In addition, the U.S. Geological Survey installed a number of rain gages in or near the Eagle Creek watershed after the Little Bear Fire. The purpose of the U.S. Geological Survey network is to provide information related to the potential for high runoff and flooding, erosion, and debris flow conditions in response to precipitation events (oral communication with Dr. A.M. Matherne, U.S. Geological Survey, November 12, 2013); data collection began on July 16, 2013 (U.S. Geological Survey 2013). Major rainfall events recorded at the Buck Mountain near Alto gage, at elevation 10,751 feet near the western divide of the study area watershed, occurred in roughly the second week of September. This also is reflected in other U.S. Geological Survey rain gages recently installed in the vicinity. Larger events recorded at Buck Mountain also included events in July, August, September and October 2013, as described in more detail in AECOM 2015. There is substantial variation in precipitation data including that discussed above and other data analyzed (variation from place-to-place, month-to-month, and year-to-year) and in many locations, data are missing.

Beyond these additional data, current and expected future conditions reflect the influence of the Little Bear Fire. Large severe fires affect water balance factors such as snow accumulation and ablation, infiltration, surface runoff and groundwater partitioning, and evapotranspiration. Potential changes in snow accumulation and ablation (collective processes of snow removal) are perhaps the most directly related precipitation effects from moderate to severe wildfires; these are discussed here, and effects on evapotranspiration and other factors are discussed subsequently.

A number of investigations have examined the effects of coniferous stand reductions (thinning, clearcutting, fire, beetle kill) on canopy interception, snowpack accumulation, and snow losses in the mountain west (Biederman and Brooks 2013; Harpold et al. 2013; Hibbert 1967; Pugh and Small 2011; Newton et al. 2012; Stednick 1996; Troendle 1983; Troendle and Meiman 1986). Early investigations into thinning or clearcutting effects indicated that, although snowpack in treated areas generally accumulated to greater depths, this was highly variable based on aspect and slope. In general, the peak water equivalent of the snowpack increased less than 12 percent in most studies based on small treatment plots. Larger treatments (up to 83 percent of stand reduction) in lodgepole pine resulted in a 20 percent increase in peak water equivalent within the snowpack (Wilm and Dunford as cited in Troendle 1983). For post-fire situations, there is good circumstantial evidence that greater accumulations of snow may occur following fires that remove *some* tree cover because of decreased interception of snow by the canopy. However, if the burned area exceeds about four times the height of surrounding cover, snow accumulation may decrease due to wind scour (Haupt 1979 in Clark 2001). Similarly, in watershed-scale studies after clearcutting, increased snowpack ablation losses in the cleared areas (through additional solar radiation, sublimation, and winter melt) resulted in no significant gains in total seasonal water equivalent (Troendle 1983).

Similarly, it is expected that in the study area there will be little or no additional water input from snow accumulation and melt after the wildfire. Recent studies in New Mexico indicate that after the Las Conchas Fire (southwest of Los Alamos), a single snow event generated much greater accumulation in the burned area compared to unburned coniferous forest (Harpold et al. 2013). For single snow events, generally 25 to 45 percent of the snow was intercepted by the coniferous canopy in the unburned area, compared to no interception in the burned area. However, over the longer term,

seasonal ablation in the burned areas reduced snowpack there. Ablation during the winter reduced the snowpack in the burned areas by 50 percent prior to the onset of melt (Harpold et al. 2012). Ultimately, there was approximately 10 percent greater water available for melt in the unburned areas. These investigators also concluded that topography played an important role in post-burn snow conditions. Another study at Valles Caldera indicated that vegetation structure played a major role in snowpack distribution, and noted both greater snow accumulation as well as ablation in open areas (Molotch et al. 2009). The duration of snowpack was greater under the forest canopy. That study suggested that snow accumulation (and water availability) under the forest canopy was less sensitive to weather variations between years than in the open areas.

These findings generally agree with investigations by Troendle and others. In summary, for cleared coniferous western forests, investigations indicate that snow losses from increased solar radiation and other factors will offset the potential snowpack gains and also accelerate melting of the remaining snow. There may be somewhat less water input from snow in the burned areas, and seasonal weather variations will have greater effect on water inputs from snow.

Vegetation Changes and Evapotranspiration

The North Fork Eagle Creek project area contains a variety of vegetation communities, including mixed conifer, ponderosa pine, pinyon-juniper, and grassland vegetation types (Kuhar 2013). All of these are interspersed with patches of oak brush (*Quercus* spp.). Forest Service monitoring during 2006 and 2007 in the adjacent Bonito watershed has lately been used to characterize pre-wildfire conditions in the North Fork Eagle Creek project area, which has similar elevations and vegetation types. On the sampled sites, grasses and forbs contributed to less than 50 percent of the total plot vegetation cover, and tree species were the dominant cover. The greatest proportions of grasses and forbs occurred in areas that had undergone large wildfires in the first half of the twentieth century (Kuhar 2013).

Research indicates that stem densities in southwestern forest stands have increased (Covington and Moore 1994; Johnson 1994; Kilgore 1981). Historically, dry upland sites had more open, park-like stands, while stands in protected, moist areas tended to have dense, closed canopies (Kuhar 2013 and summarized in the Vegetation section later in this chapter). Current densities range between 1,700 to 2,900 trees per acre in dry upland mixed conifer stands, about 3,900 trees per acre in ponderosa pine stands, and about 6,800 trees per acre in pinyon juniper stands (based on the Bonito watershed sampling). Over 90 percent of these trees are less than 5 inches in diameter (Kuhar 2013). The U.S. Geological Survey noted that pre-wildfire tree-canopy cover ranged from 0 to 100 percent in all of the elevation bands in the study area vicinity; the average pre-wildfire canopy cover in the North Fork Eagle Creek Basin was about 69 percent; in the South Fork Eagle Creek Basin, it was about 65 percent; and in the Eagle Creek-below-confluence contributing area, pre-wildfire canopy cover was about 83 percent (Matherne et al. 2011).

The timing of these changes in watershed vegetation is important to water balance characterization in the North Fork Eagle Creek hydrologic study area. Anecdotal information from Forest Service personnel indicate that the vast majority of this growth occurred in the last part of the 1800s and the first part of the twentieth century (written communication with Ms. Kim Kuhar, Lincoln National Forest, January 21, 2014). This would have been prior to streamgaging in the 1970s and the beginning of the Village well field utilization in the late 1980s. On this basis, since the 1970s, the most substantial changes in evapotranspiration and canopy interception within the study area watersheds are due to the Little Bear Fire.

The USDA Forest Service study in the area indicates that historically, topography did not limit fires to discrete vegetation types. This is documented from the 3,600-acre wildfire in 1935 that burned through ponderosa pine, mixed conifer, and some pinyon-juniper stands (Kuhar 2013). (This also is consistent with the Little Bear Fire, which burned through high-elevation mixed conifer to lower-elevation pinyon-juniper woodlands.) In addition, the study indicated that all larger fires were stand-replacing. Large-scale fires such as these on the Lincoln National Forest have typically converted coniferous forests to grass-shrubland associations. Based on both photographic evidence and monitoring data, these conditions can persist for multiple decades (Kuhar 2013). For example, a 3,000-acre wildfire in the nearby Bonito watershed in the 1930s converted the landscape to predominantly oak shrublands. Evidence of the wildfire could still be seen in 2002. Based on this local information, the wildfire-caused reduction in forest canopy and the shift to grass or grass-shrubland vegetation could modify evapotranspiration factors in the water balance of the North Fork Eagle Creek project area. Additional information about potential post-wildfire vegetation succession and fire return-interval is presented in the Fuels Specialist Report for the North Fork Eagle Creek EIS (Kuhar 2013).

A number of investigators have studied the effects of forest canopy reductions on watershed yield (Hibbert 1967; MacDonald and Stednick 2003; Troendle and Meiman 1986). Most of these authors addressed watershed yield as equivalent to streamflow, and provided little or no analysis of groundwater conditions. Nonetheless, fairly consistent findings indicate that reducing forest canopies increases water yield, increasing forest canopies reduces water yield, and the responses to treatments are highly variable (Hibbert 1967; Stednick 1996). Latitude and solar radiation, precipitation patterns, and treatment types and extents are some of the major influences on changes in water yield produced by manipulating vegetation.

General indications are that annual evapotranspiration rates in ponderosa pine stands range from about 10 to 20 inches, with more specific data indicating 17 inches annually in western interior ponderosa pine stands (Lull, section 6 in Chow 1964). Thompson (1974) indicated 19.4 inches per year in ponderosa pine on the Apache-Sitgreaves National Forests in Arizona, so it appears that 17 to 20 inches is a reasonable range for ponderosa pine evapotranspiration in the region. Evapotranspiration rates in western mixed conifer stands were estimated at 22 inches annually, and approximately 14.5 inches annually for pinyon-juniper woodland types (Lull, section 6 in Chow 1964). Over several years, Johnston et al. (1969) investigated evapotranspiration on Gambel oak types underlain by herbaceous vegetation near Ephraim, Utah. They found rates ranging from about 13 to 16 inches per year in those communities, with the higher values at higher elevations of about 7,900 feet. Soils were thin and underlain by fractured rock; measurements in oak communities were based on depths drilled to 6 feet. At 9,200 feet, the grass-herbaceous type had reasonably consistent evapotranspiration rates of approximately 11 inches per year (Johnston et al. 1969), substantially less than documented for the forest types.

In general, these findings indicate that there may be some net water gain in the long term in those parts of the North Fork Eagle Creek watershed that undergo stand conversion from forest types to grass-shrublands. Fires typically convert forest types to oak shrublands on the Sacramento and Smokey Bear Ranger Districts. This is evident on multiple fires since the 1970s, such as the Burgett, Patos, Cree, Scott Able, Walker, Penasco fires, as well as fires documented in the Bonito River Corridor from the 1930s to the 1950s (Kuhar 2012). If high and moderate severity burns convert vegetation types, this could occur on 52 percent of the North Fork watershed (table 6). The occurrence and maintenance of post-wildfire grassland types likely would further reduce annual evapotranspiration losses from the water budget. This would create additional water yield for an

unknown period of years, either as surface flow, or possibly as both surface flow and groundwater recharge.

In the southern Sacramento Mountains, preliminary results from ongoing hydrogeology studies related to the potential effects of tree thinning indicate that preferential flow paths in soils have a role in groundwater recharge (Newton et al. 2012a). This study examined the stable isotopic composition of soil water, and identified snowmelt water in soil storage that is slowly evaporated. In general, groundwater recharge and availability in the area heavily depends on snowmelt (Newton et al. 2012b). Research appears to indicate that in the spring, trees generally utilize this water in the soil. However, water in heavy monsoonal rains has a different isotropic signature, and infiltrates quicker and deeper through preferential flow paths. This water from exceptional monsoon events likely reaches underlying bedrock, and may recharge groundwater (Newton et al. 2012a). After the beginning of monsoons, at least 50 percent of the water taken up by trees comes from this deeper infiltrating water. After the monsoon season, trees return to using the shallower soil moisture (Newton et al. 2012a). Thus, although a decrease in trees may increase soil evaporative losses, and regrowth of grass-shrubland vegetation may or may not substantially reduce water uptake, there may be water budget benefits from tree removal if more groundwater recharge is available through preferential flow paths. Newton et al. (2012b) noted that water effects from reducing tree stands are site-specific and variable, and depend on a number of factors such as geology, climate, vegetation types, and hydrogeologic setting.

Surface Runoff and Streamflow Gaging Data

A frequent wildfire effect is the formation of water-repellent soils from the heating of organic resins, excessive drying, and changes in soil structure and pore space (Debano 1990; Luce 2005). Early characterization of this phenomenon was done in the 1940s by the USDA Forest Service in fire-prone chaparral watersheds in California. This effect also is known as “soil hydrophobicity”. Under such conditions, soils actually repel water (snowmelt, rainfall, overland flow) rather than infiltrating it. Coarse, sandy or gravelly soils tend to be more susceptible to water repellency than finer (silty or clayey) soils (Luce 2005). Surface runoff can be dramatically altered if fire-induced water repellency is extensive. Hydrologic responses such as reduced infiltration, irregular surface and subsurface wetting, preferential runoff pathways, and accelerated overland flow can result from soil hydrophobicity (Doerr and Moody 2004). In general, the hydrophobicity is broken up or is sufficiently washed away within 1 to 2 years after the wildfire (Robichaud 2000), but this is likely to vary considerably with site-specific factors. The BAER report and associated maps for the Little Bear Fire indicate that water repellent soils were inventoried in the North Fork Eagle Creek watershed (USDA Forest Service 2012a). Based on inspection of the fire severity/soil inventory maps, it appears that the severity of soil water repellency generally corresponds to fire severity for the Little Bear Fire overall. This is not entirely consistent, however. Within the North Fork Eagle Creek study area itself, the water repellency investigation plots and results are indicated in table 7. Investigators in Colorado found that strongly hydrophobic soils formed most commonly under moderate and severe fire intensities in ponderosa and lodgepole pine communities, they also occurred (but not as strongly) under low-intensity burns (Huffman, et. al. 2001). Statistically significant differences between fire intensities and soil hydrophobicity were not identified due to the large variability within and between sites.

Variation in soil hydrophobicity at different spatial scales appears to be linked to the amount of hydrophobic organic matter in the soil, and the variability of macropores (e.g., root channels) (Doerr and Moody 2004). Water repellency can occur at the surface, or at greater depths (usually less than 20 inches) in the soil (Doerr and Moody 2004; Ericksen and White 2008). Ponderosa pine, mixed conifer and spruce/fir ecosystems have larger and thicker duff layers when compared to pinyon pine/juniper

and grassland ecosystems. These heavier layers provide longer burn time, thereby enhancing the potential for hydrophobic soils (Clark 2001; USDA Forest Service 2012a). Soil and remaining ash layers above the water repellent layer can be more prone to erosion. Importantly, because of this and accelerated runoff conditions, erosion and sedimentation frequently increase under post-wildfire runoff conditions. This in turn reduces surface water quality. Runoff event modeling was conducted by the USDA Forest Service BAER team shortly after the Little Bear Fire (USDA Forest Service 2012b). The BAER hydrologists analyzed 25-year, 50-year, and 100-year recurrence interval storms with durations of 6 hours. Runoff simulations used storm duration inputs of 6 hours, to reflect typical late summer high intensity monsoonal events that are considered the principal threat from these fires. The extent of the monsoonal convective design-storm generally does not exceed 5 square miles (3,200 acres) (USDA Forest Service 2012b). Continued rainfall or consecutive days with light precipitation will fill the remaining soil pore space (that is left above hydrophobic layers), to the point where a subsequent event could generate substantial peak flow rates and runoff volume. BAER modeling predicts that the storm event peak flows in the Eagle Creek area are expected to increase as indicated in table 8.

Table 7. Water repellency classes in the North Fork Eagle Creek Basin

Site Id	Hydrophobicity (field points)	Burn Severity
CarltonCny_1	Low	Low
CarltonCny_2C	High	Moderate
BuckMtn_1	High	Unburned/Very Low
3_EagleCreek	Low	Low
Up_EagleCrk_1	Low	Moderate

Source: USDA Forest Service 2012a.

Table 8. Changes in storm event peak flows after the Little Bear Fire, Eagle Creek modeling locations

Watershed	Area, Square Miles	Pre-Burn/ Post-Burn 100-year, 6-hour peak, cubic feet per second	Change	Pre-Burn/ Post-Burn 25-year, 6-hour peak, cubic feet per second	Change
Upper North Fork	2.5	3,483/6,511	1.9x	2,007/4,468	2.2x
Lower North Fork	2.9	3,947/5,719	1.5x	2,378/3,774	1.6x
South Fork	2.8	3,388/4,911	1.5	1,966/3,202	1.6x
Confluence, North and South Forks	8.1	10,147/16,982	1.7x	5,949/11,088	1.9
Eagle Creek into Alto Lake	11.8	13,258/21,274	1.6x	7,523/13,751	1.8

Source: USDA Forest Service 2012b

From table 8, it is important to note that in general, the modeled peak flow rates expected after the Little Bear Fire are approximately 1.5- to 2-times the pre-burn estimates. Increases for more frequently expected storms such as the 10-year or 2-year, 6-hour storms, would likely be similar. These more frequent storms are more likely to occur in the period during which recovery of the watershed surface occurs. Other measurements in the Southwest indicate that post-wildfire peak flows from storms can be one or more orders of magnitude greater than pre-wildfire peak flows (Woodhouse 2004, Gottfried et al. 2003, Veenhuis 2002, Neary et al. 2012). In addition, the frequency of larger runoff events likely increases in response to wildfire, although precipitation inputs are not

modified (Veenhuis 2002). Further, research has found that the change in the unit-area peak discharge is greater for the more frequent, lower-intensity rainfall events than for the less frequent, higher-intensity rainfall events (Moody and Martin 2001). Southwestern investigators also found that measurements of post-wildfire changes in storm peak discharges (which had 1.45-fold to 870-fold increases) were much larger than measurements of post-wildfire changes in annual runoff (which had a 0.5-fold decrease to a 4.5-fold increase) (Moody and Martin 2001). These changes could occur in both severely-burned and moderately-burned watersheds (Neary et al. 2005).

A two- to 3-year period of vulnerability to debris flow occurrence on sideslopes within the study area watershed is estimated by the U.S. Geological Survey (Tillery and Matherne 2013). Soil hydrophobicity generally lasts 1 or 2 years, but may vary widely depending on fire and soil conditions. (Extreme durations of up to 6 years were recorded in DeBano 1981). Recovery of hillslope hydrologic conditions in the Little Bear Fire area may take 5 to 7 years (USDA Forest Service 2012b). On the basis of these estimates, hillslope hydrologic recovery may take as little as 2 to 5 years, or up to 6 or 7 years post-wildfire. For purposes of further discussion, an approximate period of 3 to 7 years is described as the post-wildfire hydrologic “short-term”. With this approximation, short-term effects on hillslope hydrology are anticipated to occur between the years 2012 to 2015, or possibly until 2019.

Large, damaging fires do not modify the occurrence of precipitation, but do modify hillslope hydrologic processes. Since the frequency of larger runoff events is likely to increase (Veenhuis 2002), incidental streamflows may increase over limited periods of several days or a couple of weeks. These flows will result from “flashy” runoff events - when flows increase and decrease, they will do so sharply. In general, however, given that there will be less infiltration and larger amounts of surface runoff during the 3 to 7 year period of transient post-wildfire hillslope recovery, less water from snowmelt and rain will be available to recharge the underlying aquifer zones, sustain low-flow period baseflows in the stream, and supply the well field. If the amount of precipitation input remains similar to pre-wildfire conditions, but more surface water runs off faster, the amount of water available to be partitioned to groundwater recharge will be less over the hydrologic short term. If groundwater recharge conditions lag hillslope conditions by a year, then overall hydrologic recovery to a resemblance of pre-wildfire conditions may take roughly 4 to 8 years or so post-wildfire, generally estimated as sometime between 2016 to 2020.

Current conditions at existing streamgages (illustrated in AECOM 2015 and also shown in some post-wildfire photos in appendix D) depicts between 4 to 6 feet of sediment infill. Repeated episodes of such infilling at the streamgages are anticipated for at least between 3 to 7 years after the wildfire, as the watershed slopes re-stabilize. In addition, sediment and debris (e.g., gravel, cobble, and wood) will be stored and routed through the North Fork valley over a considerable period of time. During that time, which may be several decades (oral communication with Mr. N.C. Myers, U.S. Geological Survey, November 12, 2013), the stream alluvium will be re-worked and the channel may migrate within its floodplain. These dynamics will repeatedly pile sediments in the approaches to the gages.

Without suitable flow approach conditions, streamgages are woefully inaccurate. Essentially streamgages measure the level of free-flowing open-channel flow in relation to a known datum, and then that level is converted to a discharge value through rating equation(s) specific to the measurement device. When sediment or debris collects in the gage approach or throat, what is actually measured is the water level within a porous medium with reduced cross-sectional area and additional energy losses. Although the water may be stagnant or nearly so, its level is still being measured and converted to an erroneous flow rate. Inaccuracies are particularly likely at high flows during scour and fill, and afterwards as new ratings need to be established.

Because of the unstable channel and gaging conditions at the North Fork and Eagle Creek (confluence) surface flow gages, alternative means of monitoring along the stream will be needed in order to implement effective adaptive management or simply to collect reliable data for a future use. In order to obtain more reliable data and provide for stabilization and potential recovery of the riparian system, the expanded use of monitoring wells is advised. Otherwise, frequent surface gage inspection and maintenance would be required to provide monitoring data, and this would be time-consuming and expensive. In addition, surface flow data collected between maintenance activities would be suspect in such an active channel environment. Further, the problem of underflow bypassing the gages through porous alluvium would continue to challenge data assessments, unless monitoring wells were established as the basis for an adaptive management program or reliable data collection effort.

As shown in figure 38 in the water resources specialist report, located in the project record, indicates much of the tributary flow from the North Fork and South Fork, respectively, that contributes to the Eagle Creek gage below the confluence. Figure 39 in the water resources specialist report, located in the project record, indicates the flows, however inaccurate, being measured on the mainstem of Eagle Creek below the South Fork (U.S. Geological Survey 08387600). Based on available U.S. Geological Survey data collected in early December 2013, flow measurements had ceased at the downstream gage (Eagle Creek below South Fork) in June 2013, and had been zero for a considerable period beforehand (9 months - since October 2, 2012). New U.S. Geological Survey data downloaded in mid-January 2014 indicates late-summer monsoonal moisture effects on streamflow. These new records may reflect recent site maintenance activities and the time required for data review and approval. Using available data, general comparisons were made between the amounts of runoff generated by pre-wildfire versus post-wildfire summer storms. The events and seasonal conditions were selected on the basis of reasonably discrete periods of rainfall (recorded at Cloudcroft and Ruidoso) and streamflows recorded at the North Fork (U.S. Geological Survey 083875500) and Eagle Creek below South Fork (U.S. Geological Survey 08387600).

Comparisons did not include the South Fork since wildfire damage was much more limited in that watershed. Each period was selected on the basis of little or no rainfall or streamflow for several days before and after the timeframes inspected. Differences in pumping are described in the discussions below. For a fairly short 9 day rain period in July 2011 (July 17 to 26, 2011), the total rainfalls at Cloudcroft and Ruidoso were approximately 1.0 and 0.8 inches, respectively. Total pre-wildfire streamflows over the period were approximately 0.6 acre-feet at the North Fork gage, and about 1.1 acre-feet at the Eagle Creek confluence gage. At the time, the Village of Ruidoso was pumping approximately 1.1 acre-feet per day from supply well NF-4. Over an 8-day post-wildfire event (July 1 to 8, 2012), the total rainfalls at Cloudcroft and Ruidoso were approximately 1.3 and 0.9 inches, respectively. Total post-wildfire streamflows over the period were approximately 9.6 acre-feet at the North Fork gage, and about 8.1 acre-feet at the Eagle Creek confluence gage. However, there was no pumping in July 2012 according to Village records, except 1.2 acre-feet pumped on July 26 from well NF-4.

So, for somewhat more precipitation over similar durations, the amount of water estimated at the gages increased by roughly an order of magnitude from pre-wildfire to post-wildfire conditions. In neither case was there an unusual, 1-day downpour. The greatest daily precipitation during the pre-wildfire timeframe was 0.44 inches (recorded at Cloudcroft). The greatest daily precipitation during the post-wildfire timeframe was 0.88 inches (also at Cloudcroft). However, there had been nearly constant well field pumping throughout July 2011, in comparison to essentially no pumping in July 2012.

Over a more lengthy pre-wildfire period (July 11 to September 11, 2011), the total rainfalls at Cloudcroft and Ruidoso were approximately 9.8 and 8.5 inches, respectively. (Several days of data were missing at Ruidoso.) Total pre-wildfire streamflows over the period were approximately 43.1 acre-feet at the North Fork gage, and about 3.5 acre-feet at the Eagle Creek confluence gage. Pumping records indicate that approximately 1.1 acre-feet per day were withdrawn in July, 1.06 acre-feet per day in August, and about 1.3 acre-feet per day in September.

Over a similar post-wildfire period (July 3 to September 12, 2012), the total rainfalls at Cloudcroft and Ruidoso were approximately 7.7 and 4.9 inches, respectively. (Again, several days of data were missing at Ruidoso.) Total post-wildfire streamflows over the period were approximately 93 acre-feet at the North Fork gage, and about 73 acre-feet at the Eagle Creek confluence gage. There was essentially no pumping in July or most of August, but about 1 acre-foot per day was withdrawn in the last 10 days of August and through September.

So, for even somewhat less post-wildfire precipitation over similar durations, the amount of water estimated at the gages increased by over a factor of two in the North Fork, and by a factor of roughly 20 at the confluence gage from pre-wildfire to post-wildfire conditions. The greatest daily precipitation during the pre-wildfire timeframe was 4.02 inches (recorded at Cloudcroft). The greatest daily precipitation during the post-wildfire timeframe was 1.85 inches (also at Cloudcroft). Flow conditions for these two periods are reflected in Figures 38 and 39 in the water resources specialist report. However, there were pumping differences between these periods, notably between the weeks in July and early August. There was continuous pumping in July and August 2011, but no pumping in July and the first 3 weeks of August, 2012.

While these events or timeframes generally indicate the effects of the Little Bear Fire on surface runoff, there are several uncertainties involved in reviewing them. Available pumping well information indicates that there were differences in pumping activities between these comparison periods. Also, precipitation fields vary in mountainous terrain, so there is no assurance that these short-term data for Cloudcroft and Ruidoso represent rainfall over the study area. They probably do serve as indications, however. (U.S. Geological Survey raingages in and near the North Fork Eagle Creek watershed were not activated until July 2013). In addition, the water balance is clearly not preserved between the North Fork gage (U.S. Geological Survey 08387550) and the Eagle Creek confluence gage (U.S. Geological Survey 08387600). For the short-term post-wildfire event (July 1 through 8, 2012), there is a loss of about 1.5 acre-feet (15 percent) from the North Fork to the Eagle Creek confluence gage even without pumping.

In the July to September 2011 period, there is a tremendous pre-wildfire difference (about 12x) between the North Fork flow and the much smaller flow downstream at the Eagle Creek mainstem. Pumping occurred throughout this period. In the post-wildfire July to September 2012 data, there are still approximately 20 acre feet lost (27 percent) between the gages. According to Village records, pumping occurred during approximately the last half of this period, and totaled approximately 20 acre-feet. Based on the shorter period of early July 2012, flow differences could also result from malfunctions at the surface water gages, seepage losses to groundwater, or both. Again, the expanded use of monitoring wells in a data collection program would resolve these issues in any future monitoring.

Erosion and Debris Flows

Investigations indicate that a major post-wildfire effect is the lack of effective ground cover, litter, and vegetation to intercept rainfall and attenuate overland flow. In general, erosion and runoff increase with a reduction in cover. This is true in the burned area (USDA Forest Service 2012a). In areas

investigated within the Little Bear Fire perimeter, a thin ash layer was common on areas of moderate and severe burns where high winds and vertically rotating columns of air (whirlwinds) within the steep canyons may have blown ash away. Experience has shown that, regardless of the degree of water repellency, areas in the southwest that have short duration, high intensity storms produce extreme runoff events. Ash and soil is lost if most of the vegetative cover has been removed.

The Forest Service BAER team estimated post-wildfire erosion losses and volumes using a standard approaches, the Water Erosion Prediction Project (WEPP) model and the Erosion Risk Management Tool (ERMiT). Within the Little Bear Fire perimeter in general, the average pre-wildfire erosion rate was less than 1 ton/acre. Near the project area, the average post-wildfire erosion rate for Ski Apache in high and moderate severity was estimated to be 114 tons/acre, and sediment delivery was estimated to be about 7,500 cubic yards per square mile (USDA Forest Service 2012a). In addition, past work indicates that post-wildfire erosion rates and sediment yields are underestimated from the WEPP model (USDA Forest Service 2012a). These projected losses can be considerably reduced by post-wildfire treatments, however, and treatments were applied in the North Fork Eagle Creek project area.

Sheet, rill and gully erosion of these magnitudes will form preferential overland flow paths that exacerbate flash flooding and greater rates of surface runoff. In addition to the suspended sediment and channel bedload from accelerated erosion, more severe debris flows are likely to occur within the project area and nearby.

Further review indicates that severe fire intensity in steep forested watersheds in the Southwest could establish rill and gully networks that alter hydrologic responses for much longer (Neary et. al. 2012). Severe fire intensity within the North Fork watershed occurred at only the highest elevations, and over about 26 percent of the drainage area. Severe fire also occurred at high elevations in the South Fork watershed, and occupies about 10 percent of that drainage. These extents are much less than the conditions investigated by Neary et. al. (2012) for the Schultz Fire near Flagstaff, but point to the possibility that severely burned, high-elevation portions of the Eagle Creek headwaters may continue to release sediment, debris, and accelerated runoff into the lower watershed for many years. Some of these areas will heal over time, so the contributing areas eventually could be smaller than the percentages indicated.

After the Little Bear Fire, the U.S. Geological Survey conducted debris flow probability modeling for lands within the wildfire perimeter (Tillery and Matherne 2013). Using a set of empirical hazard-assessment models, developed from data from recently-burned drainage basins throughout the intermountain West, general estimates of the probability and volume of debris-flows were made for selected drainage basins within the burn area. Several of the smaller sub-basins within the direct/indirect hydrologic study area watersheds were included in those selected for the U.S. Geological Survey analysis. The analysis indicates that debris flows are highly probable over much of the North Fork Eagle Creek study area, and also nearby over parts of the cumulative study area. Debris flow volume estimates were derived independently of the debris flow probabilities. Based on the empirical modeling, volume estimates indicate that the North Fork of Eagle Creek downstream of Telephone Canyon (i.e., downstream of a point about 0.2 miles upstream of the North Fork streamgage) is anticipated to receive over 100,000 cubic meters (at least 3.5 million cubic yards) of debris from the watershed sideslopes in response to a 2-year recurrence interval 30-minute rainfall accumulation of about 1 inch (Tillery and Matherne 2013).

Relative hazard rankings of post-wildfire debris flows were produced by summing the estimated probability and volume rankings to illustrate those areas with the highest potential occurrence of debris flows with the largest volumes (Tillery and Matherne 2013). The central part of the North Fork of Eagle Creek, from about 0.2 miles upstream of the North Fork streamgage to about 0.13 mile

downstream of Carlton Canyon, is ranked as one of the drainages having the highest combined probability and volume relative-hazard ranking for debris flows (Tillery and Matherne 2013). Below Carlton Canyon, the downstream segment of the North Fork to its confluence with the South Fork has the second highest combined relative-hazard ranking. In addition, most tributaries of the North Fork upstream of the summer home locale, including Telephone Canyon and others, also have the second highest combined relative-hazard ranking of debris flow probability and volume.

The significance of these conditions is that scour and fill, headcuts, and other channel modifications will occur over a considerable number of years in the North Fork and South Fork of Eagle Creek. The channel environment, and particularly the locations of surface flows, will be more dynamic than before the wildfire. Regular measurement of open channel flow over time, such as might be done in a monitoring program, will be much more expensive and less reliable. These factors will likely require revised approaches to water management for environmental purposes along the North Fork Eagle Creek.

Groundwater Recharge and Water Levels

Groundwater recharge in the Sacramento Mountains is heavily dependent on snowmelt (Newton et al. 2012b). Based on the discussions above, there are not likely to be additional inputs to the overall water balance, and particularly to aquifer recharge, from wildfire effects on snowpack due to increased ablation losses. Over the short-term transient post-wildfire recovery (i.e., generally 3 to 7 years), soil hydrophobicity and the removal of vegetation and litter are likely to increase surface water runoff and reduce infiltration and deeper percolation. In the longer term post-wildfire condition (i.e., 4 to 8 years or more), stand conversion from coniferous forest types to grass-shrublands in some parts of the study areas is likely to decrease evapotranspiration losses and encourage the movement of water to greater depths within soil, unconsolidated deposits, and fractured rock. Preliminary results from ongoing studies indicate that exceptional monsoonal moisture also may provide additional groundwater recharge in areas where tree cover is reduced (Newton et al. 2012a). Annually, the potential for increased recharge would be greater if evapotranspiration levels are substantially less in the grass and shrub types that are expected to be more extensive in the post-fire watershed, than they were in the pre-fire dense conifer forest.

Numerous investigations allude to increased water yield after forest treatments (e.g., thinning, logging) or wildfires (e.g., Troendle 1983, Troendle and Meiman 1986, Stednick 1996, Troendle and Reuss 1997, Stednick 1996, MacDonald and Stednick 2003, Woodhouse 2004). In almost all these investigations, “water yield” means surface water flow. Yield measurements have been typically short term (less than 5 years) and made at streamflow gages or as runoff estimates. Few investigations on the effects of forest stand reductions on groundwater recharge are available in published literature.

Possibly the most extensive review of the recharge topic within the Southwest coniferous region has been recently conducted by Wyatt (2013). After rigorously collecting references and a systematic screening effort, he found 37 references that addressed forest tree removal and its effects on hydrologic responses, specifically recharge. Data from individual studies suggested that reducing tree density increased water yield and groundwater recharge while reducing evapotranspiration (Wyatt 2013). Specifically, when 20 to 100 percent of a conifer-dominated watershed was treated, the literature showed a 0 to 40 percent increase in “water yield”.

However, although one study did show a correlation, there was no overall correlation for all studies between percent area treated and groundwater recharge. Results were shown to be highly variable, to

diminish within five to ten years for water yield increases, and even sooner (less than four years) for groundwater table heights (Wyatt 2013).

Then, using a groundwater-flow model with somewhat favorable recharge assumptions, it was estimated that over a proposed ten-year period of forest restoration treatment, a one percent increase in annual recharge to regional aquifers was estimated compared to years 2000 to 2005 conditions (Wyatt 2013). However, these increases were assumed to quickly decline after treatment due to regrowth of vegetation. The modelers assumed that groundwater recharge responded in a similar way to researched streamflow responses after tree removal in southwestern semi-arid, conifer-dominated ecosystems.

Available literature describes a high degree of variability in groundwater recharge response to coniferous forest removal in the West and Southwest. This results from different site-specific settings. There is substantial precipitation input in the upper Eagle Creek watersheds, and tree removal by the Little Bear Fire is extensive. There are likely to be post-fire vegetation shifts, and correspondingly, some degree of reduced evapotranspiration. Rapid herbaceous growth, which could be several times the pre-fire herbage production (Campbell et al. 1977), would utilize some precipitation input and somewhat offset evapotranspiration reductions. More frequent runoff, and evaporation from warmer denuded soil surfaces, would also reduce the amount of water available for groundwater recharge.

However, the North Fork channel occurs in a lower-elevation valley comprised of coarse colluvium and alluvium. All drainage and sediment from the higher hillslopes are routed through lower slopes and the broader valley floor. In addition to changed hillslope conditions, it is possible that channel braiding and seepage could help increase local groundwater recharge at lower elevations in the North Fork watershed. The magnitude, extent, and duration of such effects are unknown.

Water levels in monitoring wells along the North Fork of Eagle Creek have continued to be recorded by the Village of Ruidoso (written communication from Ms. C. Thompson, USDA Forest Service, November 26, 2013). Recent water level graphs from the monitoring wells are indicated in Figures 43 through 47 in the water resources specialist report, located in the project record. The deep wells (MW-1B, MW-1C, and MW-3A) show a more-or-less consistent springtime water level rise from late January through mid-April of 2013, with a steady rise from early March through mid-April. Substantial water level rises in these wells can be noted during the onset of monsoonal moisture in July 2013, corresponding to precipitation increases indicated in U.S. Geological Survey rain gages around the watershed, and at Cloudcroft and Ruidoso. The rapid water level rises in September 2013 likely correspond to the relatively large total precipitation (over 8 inches) during roughly the second week of that month, as also recorded by U.S. Geological Survey precipitation monitoring.

The shallower monitoring wells (MW-1A, MW-5A) appear to react more quickly to precipitation or snowmelt pulses. Monthly total precipitation values at the regional stations were generally less than average for the winter of 2012 and 2013, and daily air temperatures indicate melt was likely occurring sporadically throughout the winter and early spring. At MW-5A, the hydrograph in August 2012 is responding to a mid-month precipitation series that totaled about 3.9 inches at Cloudcroft and 3.0 inches at Ruidoso. Monitoring well MW-1A did not respond to that event. For the March 2013 water level rises at MW-1A and -5A, about 1.2 inches of precipitation fell in early March at Cloudcroft, but data at Ruidoso are missing, and the U.S. Geological Survey rain gages were not operating then. Given the mixed freeze-thaw temperatures at Cloudcroft, the March 2013 rises might have been a rain-on-snow or frozen ground event. The rapid water level rises in early September 2013 correspond to the greater total rainfall falling at that time, as discussed in chapter 2.

There is a substantial amount of missing data, but the record does extend through the 2012 rainfall series, with an essentially flat trend likely indicating that the pump was off. Pumping occurred sometime around May 2013, at roughly the same time as water level declines in the deep monitoring wells MW-1B, MW-1C, and MW-3A (Figures 44, 45, and 46, respectively in the water resources specialist report, located in the project record). These conditions may relate to pumping drawdown in bedrock, as water placed in storage (on the seasonal rising limb) is removed. Alternatively, the water levels in deeper wells may simply reflect seasonal precipitation changes, noting the rises following rainfall after July 2013. (Pumping conditions after May 2013 are unknown.) The recession lines at shallow monitoring well MW-5A are parallel between the August 2012 event (likely non pumping in NF-1) and the May 2013 period (likely pumping in NF-1). There also is a general surface flow decline indicated at the North Fork streamgage during the May 2013 period.

Water Quality

Large wildfires generally reduce surface water quality as a result of substantially increased sediment concentrations, ash and other organic materials, and nutrient changes. Often, concentrations of nitrogen, phosphorus, and other ions increase in streams after burning (Tiedemann et al. 1979 as cited in Clark 2001). Increases in bicarbonates, nitrates, ammonium, and organic nitrogen are common (Chandler et al. 1983 as cited in Clark 2001). These may contribute to eutrophication or algal blooms in downstream waterbodies.

Runoff water chemistry is typically modified in the first few storms after a large wildfire, and frequently returns to pre-burn characteristics after 1 or 2 years (Clark 2001). However, increased turbidity, sediment, and organic carbon loads may persist for much longer, depending on the stream network and transport through the watershed. Higher post-wildfire sediment concentrations, organic debris, and nutrient concentrations from hillslopes may reduce dissolved oxygen availability in streamflows. In combination, these changes would alter water quality for a period of years after the wildfire. Based on the BAER fire intensity mapping, the project area along the North Fork underwent low intensity to under-burn fire conditions. This indicates that the remaining overstory along the stream may be mostly green and have limited scorch, or may have been subjected to even less fire damage (USDA Forest Service 2012a, b). In addition, the low fire severity or under-burn areas along the North Fork may contain adequate remaining ground cover to help reduce accelerated sheet erosion from source areas within the stream corridor.

Along the North Fork and downstream in the Eagle Creek drainage, as well as in other watersheds, water quality has been severely impacted by the Little Bear Fire. These impacts are known to be extensive, but their anticipated duration is unknown. For this reason, post-fire considerations of water quality are not specifically addressed further in this document.

Climate Change

In the final draft of the pre-wildfire Water Resources Technical Report (dated November 9, 2011), the introductory text to the precipitation analysis done for preceding years of record is no longer necessary in the context of the current U.S. Geological Survey report version (Matherne et al. 2011). In their final report revision (also released in November 2011), the U.S. Geological Survey no longer described a shift in seasonal moisture as a factor in runoff patterns or baseflow conditions in the Eagle Creek watershed. Since a comparison of seasonal conditions had already been done for the project, indicating that precipitation shifts were unlikely, previous climate explanations for flow conditions are no longer presented in this technical report following the latest U.S. Geological Survey revision. Other discussion of the potential nature of long-term climate change is anticipated to apply to post-wildfire conditions.

Summary

Water resources effects from the Little Bear Fire are anticipated to generally follow the preceding discussions, which are based largely on collected research and USDA Forest Service post-wildfire investigations. Some research was conducted under different conditions than those in the study areas; however, on-site, local, or regional findings have been incorporated where available. These more-applicable investigations create a different perspective from some of the findings from other parts of the West. In general, ongoing and anticipated wildfire effects in the Eagle Creek study area watersheds and the North Fork project area can be summarized as indicated in table 9 below. It should be noted that the duration of some effects depends on the timing, extent, and nature of vegetation changes within the burned areas, as previously discussed. In addition, some processes interact to increase or decrease the overall effects.

Table 9. Summary of anticipated wildfire effects on water resources

Hydrologic Process	Type of Change	Specific Effect	Anticipated Duration of Effects[a]
1. Canopy Interception	Reduced	Reduced moisture storage in the canopy	Short-term, and possibly long-term
		Greater runoff in smaller storms	Short-term, and possibly long-term
		Temporarily increased surface water yields	Short -term
2. Litter Storage of Water	Reduced	Less water stored in litter	Short-term, and possibly long-term
		Overland flow increased	Short-term, and possibly long-term
3. Transpiration	Temporary elimination or possible long term reduction	Soil moisture increased	Possibly long-term
		Streamflow increased	Possibly long-term
		Recharge possibly increased from large monsoonal events	Possibly long-term
4. Infiltration	Temporarily reduced	Temporary increases in overland flow and erosion	Short-term
		Temporary increases in storm flows	Short-term
5. Surface Streamflow	Changed	Temporary increases in “flashy” responses to rainfall or rapid snowmelt	Short-term
		Seasonally maintained or decreased during snowmelt	Short-term and possibly long-term
		Water quality reduced	Short-term
6. Baseflow	Changed	Short-term decreases (less infiltration and recharge)	Short-term
		Long-term return to pre-burn conditions, or potential long-term increases due to reduced evapotranspiration and monsoonal recharge through preferential pathways	Long-term

Hydrologic Process	Type of Change	Specific Effect	Anticipated Duration of Effects[a]
7.Stormflow and Sediment/ Debris Yields	Increased	Event volumes and peak flow rates substantially greater for period of years	Short-term
		Volume “bulked” by sediment and debris	Short-term
		Time to peak shorter (“flashier”)	Short-term
		Greater flash flood frequency	Short-term
		Erosive power increased	Short-term
		Channel modification and transport of sediment/debris, over decades	Both short-term and long-term
8. Snow accumulation	Changed (Generally these factors offset each other)	Increased snow accumulation	Both short-term and long-term
		Increased or accelerated evaporation, sublimation, and melt	Both short-term and long-term

a - Short-term durations are estimated to range from three to seven years post-wildfire. Long-term durations are estimated to extend beyond that time-frame. Some long-term effects (particularly related to canopy, litter, and transpiration changes) are more or less likely depending on the nature and extent of any stand conversions that may occur.

Source: Modified from Neary et al. 2005.

Environmental Consequences

Alternative 1 - No Change (Continue Pumping at Historic Levels) Direct and Indirect Effects

Streamflow Quantity

Based on inferences from historical conditions, under alternative 1 (no change), the general duration of no surface flow days at the Eagle Creek gage would be approximately 1 to 2 weeks a year during average precipitation periods and approximately 8 to 10 weeks a year during drier periods. By themselves, impacts from no-flow conditions would be short term and local. According to the flow frequency analysis of pumping during approximately average precipitation, flows of 1.2 cubic feet per second or greater would occur approximately 46 percent of the time. This would be a reduction of at least 10 percent from prepumping conditions, when flows of 1.2 cubic feet per second or greater occurred about 57 percent of the time (table 5). During drier years, flows of 1.2 cubic feet per second or greater would occur approximately 19 percent of the time, a substantial reduction from the average prepumping conditions used to ascertain conditions under alternative 2 (no pumping).

The actual occurrence of no-flow or reduced-flow periods would heavily depend on pumping rates, timing, and precipitation. If it is assumed that historic conditions can be used to infer future conditions, then according to table 5, the combined periods of flows less than 1.2 cubic feet per second (below which alluvial groundwater is assumed to become limiting to riparian and aquatic communities) would average approximately 6.5 months of the year during years of generally average precipitation. This would be an average increase of approximately 1.3 months over the duration of these lower flows (5.2 months) during the prepumping period used to ascertain conditions under

alternative 2 (no pumping). During drier years, the period of flow below 1.2 cubic feet per second would be extended on average to approximately 9.7 months of the year. This would be an increase of approximately 4.5 months over the duration of these lower flows during the prepumping period (5.2 months), a long-term impact in relation to prepumping conditions. Over a 20-year period of permit authorization, years of these severely reduced flows would be likely.

Discontinuous intermittent streamflows at reduced levels would continue near and downstream of the well field, creating site specific and local adverse impacts on flow rates and extent. The availability of alluvial groundwater would continue to be locally limited. These adverse direct impacts would be short term to long term and moderate to severe, depending on background precipitation. Over a 30-year period of permit authorization, years of severe impacts from reduced flows would be likely, and opportunities for achieving management objectives would be limited.

Springs and Seeps

A number of springs or seeps are outside of the assumed pumping drawdown as depicted in figure 12 and figure 13. Based on this information, it is unlikely that these springs have or would experience impacts from the Village well field operations. A spring in Carlton Canyon and another in an unnamed tributary to the South Fork are likely to undergo flow reduction impacts from pumping based on U.S. Geological Survey drawdown observations and projections derived from them. The projections assume that these springs are not sourced from perched waterbearing zones, but are supplied by the basin-wide groundwater system. Given the general uncertainties associated with drawdown impacts, effects at those two sites would likely range from moderate to severe. Other existing groundwater modeling indicates that more extensive drawdown could occur (Balleau Groundwater 2004). Under those conditions, a number of other springs or seeps in the upper North Fork drainage could be similarly adversely affected.

Nearby Domestic Wells

The estimated drawdown encompasses or is immediately adjacent to two upstream domestic wells (DW-1 and DW-2). Water level measurements indicate that the nearest (DW-1) was within the actual cone of depression of the Village well field on September 3, 2008, and again on March 17, 2009 (Matherne, et. al. 2011). Under alternative 1, water levels would decline according to assumed drawdown approximations, creating long-term, site-specific adverse impacts on domestic water supplies. These impacts would be moderate to severe, depending on the existing depths and yields of individual wells, which vary between locations. Other existing groundwater modeling indicates that more extensive drawdown could occur (Balleau Groundwater 2004). Under those conditions, a number of other domestic wells in the upper North Fork drainage could be similarly adversely affected.

Anticipated Effects of Climate Change

Under alternative 1 (no change), streamflow quantities may decline from climate change effects. Quantifying these effects is not possible due to uncertainties in climate predictions. Qualitatively, the spatial extent and duration of no-flow conditions may increase along the North Fork. The presence of flows equal to or greater than 1.2 cubic feet per second may decline with drier climatic conditions, which could reduce water availability in the alluvium for plant growth and sustenance. Opportunities for maintaining or improving watershed condition on National Forest System lands in the upper Eagle Creek drainage would be limited. Improving resource conditions and achieving the management objectives described above would become qualitatively more difficult under drier conditions. This would be exacerbated by ongoing well field pumping.

Streamflow temperatures could increase beyond those expected under current conditions, due to decreasing snowpack accumulations, more rapid seasonal melt, and generally warmer and dryer conditions overall. Qualitatively, pumping under the no action alternative could intensify these adverse conditions. Reduced recharge to zones supplying water to springs, seeps, and nearby domestic wells could be further exacerbated by these same climatic effects. Springs, seeps, and nearby domestic wells could experience declining flows or water levels at an accelerated pace under anticipated climate changes. If they occur, these adverse effects would be long term, local to regional, severe impacts.

Updates to Direct and Indirect Effects from Alternative 1 Due to the Little Bear Fire

Over the short term (i.e., until watershed "recovery" in three to seven years, or until about 2019), pumping effects under Alternative 1 are likely to reduce streamflows and groundwater levels along the North Fork Eagle Creek. Based on table 9, reduced transpiration losses from vegetation have the potential to increase soil moisture and streamflow, but in the short term, these will likely be offset by substantially increased surface runoff rates from flashy events, greater runoff frequency, and reduced infiltration and groundwater recharge. In some locations, the accumulation of sediment and debris in the stream channel could physically increase the depth to saturated conditions below the new surface of the channel bed. This would be a natural impact resulting from the fire. Flows in intermittent parts of the North Fork Eagle Creek are understood to be related to shallower alluvial deposits over near-surface bedrock. In some locations, greater thickness of newly-deposited alluvium could naturally reduce the presence of surface flow or pooling. Pumping at historic levels under this alternative could then act in accord with fire impacts, and further reduce the occurrence of surface flow or pools under post-wildfire conditions. These impacts may be somewhat reduced by increased post-fire groundwater recharge, if it occurs.

There are post-fire channel changes along the North Fork. This is a result of accelerated erosion, sediment and debris accumulations, and greater runoff. Channel changes are likely to have long-term effects on the expression of surface flow versus alluvial underflow in the channel. Where channel aggradation or widening occurs, streamflow may be "buried" within a debris deposit or dispersed into many small surface flow branches. Where channel downcutting occurs or debris piles do not form, exposed flow would be more frequent. These conditions may migrate over time along the North Fork so that at any particular place and time, distinguishing pumping effects would be complicated by changing channel conditions. Additional monitoring measures have been developed to address this.

Over the long term, (after hillslope recovery), runoff conditions are expected to trend toward approximate pre-wildfire conditions. Severe storm runoff and sediment transport would still occur. Overall rates and frequencies of surface yield would still likely increase somewhat above the pre-fire condition due to less interception and ground cover. In general, though, large removals from the water balance by substantially increased surface runoff would eventually decline in comparison to the short-term post-fire flashy conditions. Runoff frequency would also decline from the short-term post-fire conditions. In addition, if large areas of conifer stands eventually convert to grasses or shrubs (Kuhar 2013), somewhat less evapotranspiration would improve overall watershed yield. If this occurs, it could also improve groundwater availability within the North Fork Eagle Creek.

If these longer-term post-wildfire effects occur, potential impacts from this alternative could be somewhat less than those described for the pre-wildfire assessment. If long-term additional recharge and water yield increases do not result from watershed recovery, then long-term impacts from this alternative would be expected to resemble those described in the pre-wildfire water resources assessment and DEIS (USDA Forest Service 2012). Impacts would be less than the pre-fire assessment if long-term changes in post-fire vegetation reduced evapotranspiration losses, and if

groundwater recharge eventually increased after the fire. These effects are likely to occur, although to an unknown degree. Reduced evapotranspiration losses are likely, and increased groundwater recharge may occur. Surface runoff may also increase somewhat over the long term, modifying the overall water balance. While pumping effects would still occur under alternative 1, they would be somewhat less over the long term than was described for the pre-fire assessment

However, without substantial long-term reductions in evapotranspiration, and enhanced groundwater recharge, the general durations of flow conditions would be similar to those described in the DEIS (USDA Forest Service 2012) and technical report developed before the Little Bear Fire. Under those conditions, based on inferences from historical conditions (see table 10 and "Eagle Creek Flow Patterns before the Little Bear Fire") the general duration of no-surface-flow days in the lower reaches of the North Fork Eagle Creek would be approximately 1 to 2 weeks a year during average precipitation periods. This could increase to approximately 8 to 10 weeks a year during drier periods. Streamflows of 1.2 cubic feet per second or more at the Eagle Creek gage location would be anticipated to occur about 10 percent less than under no-pumping conditions (alternative 2) during average precipitation periods, and about 40 percent less than the no-pumping condition during drier years. The two springs within the projected pumping drawdown would likely undergo flow volume and duration reductions. Similarly, water levels in domestic wells would likely decline. If climate changes occur, and drier conditions result, pumping under this alternative would likely further reduce streamflows and exacerbate adverse climatic effects on springs, seeps and domestic wells, in comparison to alternatives 2 or 3. Opportunities for improving riparian conditions along the North Fork Eagle Creek would be reduced in comparison to alternatives 2 or 3.

Cumulative Effects

Potential cumulative water resources impacts from alternative 1 (no action) would include additional adverse flow and water quality reductions in Eagle Creek, and continued groundwater drawdown in alluvial and bedrock aquifers throughout the cumulative impact area resulting from other village wells along Eagle Creek (figure 11). These combined adverse effects would largely result from the ongoing water supply withdrawals in the drainage. By far, near-term withdrawals would be dominated by the North Fork wells, based on pumping capacities and historical withdrawals, described in more detail in the "Socioeconomics" and "Water Rights" section of this chapter. Alternative 1 would continue these withdrawals. In turn, these could create adverse impacts to riparian vegetation, aquatic habitat, and other beneficial uses along the Eagle Creek corridor through reduced groundwater storage. These impacts would be long term and would likely extend beyond the North Fork watershed.

Future estimated water supply requirements by the village are estimated to be approximately 5,097 acre-feet per year, even with conservation. Existing water supplies and water rights as developed do not meet those needs. Current diversions along Eagle Creek and the Rio Ruidoso, as described in the "Affected Environment, Domestic and Municipal Water Use," are about 3,850 acre-feet per year. This leaves approximately 2,125 acre-feet per year yet to be obtained and developed to meet eventual demand. Given that the Eagle Creek water rights total approximately 2,539 acre-feet per year, a substantial amount of additional water supply infrastructure will be required in the Ruidoso region. Qualitatively, this will generate additional long term, regional impacts in the area. Some of these may occur along Eagle Creek in the cumulative impacts area.

Forest fuel reductions, prescribed burns, recreational developments, and wildfires (as listed in table 4) act to increase runoff and sedimentation in the cumulative impact area. Planned activities would be conducted using best management practices to avoid or minimize these impacts. Historically, wildfires have ranged from roughly 40 to 600 acres in size near the North Fork Eagle Creek. These are relatively small disturbances in terms of increasing runoff or sediment yields, and impacts to

surface water and groundwater availability would be local and minor. Occasional water quality impacts from turbidity and sediment concentrations may result from forestry operations or wildfires in the cumulative impact area.

Updates to Cumulative Effects from Alternative 1 due to the Little Bear Fire

Over the short term (three to seven years after the Little Bear Fire in mid-summer 2012), continued pumping under alternative 1 cumulatively would add to downstream water resources impacts from the wildfire as well as other water uses outside the forest boundary. An adverse effect of North Fork Eagle Creek pumping would be reduced downstream baseflows and groundwater levels. However, over the post-wildfire short term (until hillslope recovery), the adverse effects to streamflows outside the project area would be masked by accelerated surface runoff, erosion and debris flows, channel geometry changes, and reduced water quality resulting from the Little Bear Fire on a broader geographic scale. In addition, water users other than the Village of Ruidoso in the Eagle Creek system would affect surface runoff and groundwater levels. Those effects would be outside the control of either the Forest Service or the Village of Ruidoso. Depending on the timing and volumes of other water withdrawals and returns in the cumulative study area, all these factors would combine to largely obscure the downstream effects of North Fork Eagle Creek pumping in the short term.

Under alternative 1, anticipated long-term cumulative effects (four to eight years post-fire and beyond) would be similar to or somewhat less than those previously described above for the pre-wildfire cumulative assessment. In comparison to alternatives 2 or 3, these would generally include streamflow reductions in Eagle Creek, and continued groundwater drawdown in alluvial and bedrock aquifers throughout the cumulative study area. As discussed in the Water Rights section, applications by the Village of Ruidoso for additional points of diversion along Eagle Creek are pending at the New Mexico Office of the State Engineer. If wells are pumped at these points in combination with pumping of North Fork Eagle Creek wells, it could extend drawdown effects in comparison to alternatives 2 or 3. The occurrence and extent of off-site drawdown effects, if they occur, are unknown and likely beyond the scope of this EIS.

It also should be noted that potential cumulative effects on streamflows and groundwater resources would not be restricted to water uses by the Village of Ruidoso. A substantial number of individual domestic wells and other points of diversion exist within the Eagle Creek basin, within and downstream of the North Fork Eagle Creek drainage. Approximately 20 domestic wells (or more) occur within the Eagle Creek drainage below the North Fork Eagle Creek well field. Real estate developments and resorts particularly have points of diversion along the lower Eagle Creek drainage near Alto, as recorded by the New Mexico Office of the State Engineer (2014). All of these uses would contribute to moderate to major long-term cumulative water resources impacts, depending on the amount and timing of water withdrawals and the nature of measures implemented to control surface drainage and runoff water quality. Although the Village of Ruidoso implements water conservation measures and enacts water restrictions during periods of drought or other emergencies (such as the Little Bear Fire), the Village of Ruidoso is not the only water user in the region and has limited, if any, control over other water users. In addition to these considerations, the Little Bear Fire was widespread across several drainage basins, including Little Creek and the Rio Bonito. Widespread cumulative wildfire impacts on surface runoff, groundwater recharge, and water quality were described previously. The effects of forest fuel reductions, prescribed burns, and other activities would be the same as qualitatively described previously for the alternative 1 pre-wildfire cumulative assessment.

Conclusion

Under alternative 1, existing well field infrastructure (wells, pumping facilities, pipelines, and access) would remain in place and be used for operations. Spatially discontinuous, intermittent streamflows would continue at reduced levels near and downstream of the well field, creating site-specific and local impacts on flow rates and extent. The occurrence and extent of perennial flows or pools along the North Fork would be reduced in comparison to alternatives 2 or 3, but would be complicated by sediment deposition and long-term channel modifications from the Little Bear Fire. The availability of alluvial groundwater would continue to be reduced locally. These adverse direct impacts would be short-term to long-term and moderate to severe, depending largely on background precipitation, reductions in watershed evapotranspiration, and possible increases in local groundwater recharge. The two springs within the projected pumping drawdown would likely undergo flow volume and duration reductions. Adverse long-term, site-specific impacts to domestic water supplies would occur. These impacts would be moderate to severe, depending on the existing depths and yields of individual wells and any changes in hydrologic system responses long after the fire. All of these effects could be made more adverse in significance and duration by possible climate changes toward more extended drier conditions.

Cumulative water resources impacts from alternative 1 would involve ongoing reductions in flow along Eagle Creek within the cumulative impact study area. These could be adverse, long-term, more extensive impacts that would likely range in severity from moderate to severe. Additional water supply developments in the region, many of which are not controlled by the Village, could create further impacts to surface water, groundwater, and associated resources.

Alternative 2 - No Action (No Pumping)
Direct/Indirect Effects

Streamflow Quantity

Based on historical data for prepumping conditions, the lower portions of North Fork Eagle Creek would remain an intermittent stream during years of average precipitation. Upper reaches of the North Fork may have perennial flow durations. No-flow days would still occur at various locations along stream reaches where large alluvial deposits are located, generally starting in May, June or later. These flow conditions would occur because smaller streamflows would be absorbed by the alluvium. Without pumping, however, the magnitudes and extents of intermittent flows would increase above current conditions during pumping or those anticipated under alternative 1 (no change). Isolated perennial flows or pools may occur in some locations above the Eagle Creek gage. These would be beneficial long term, local impacts to current conditions with pumping, but would represent minimal or negligible changes from prepumping conditions. Opportunities for improving watershed condition and achieving other management objectives would improve.

If historical prepumping conditions are assumed to reflect alternative 2 (no-pumping), the occurrence of no-flow days would be eliminated downstream at the Eagle Creek gage (or its former location slightly downstream) during average or wetter years. According to the flow frequency analysis during the prepumping period of slightly above average precipitation (figure 12 and figure 13), flows of 1.2 cubic feet per second or greater would occur approximately 57 percent of the time (table 11). This would represent an absolute increase of about 10 percent beyond the occurrence of these flows anticipated under the no action alternative during average years. This would be a beneficial, long term local impact in comparison to current conditions with well field pumping.

Springs and Seeps

Under this alternative, there would be no groundwater drawdown due to village well field pumping, and springs and seeps would not be impacted by pumping the wells.

Nearby Domestic Wells

Similar to the reasoning for springs and seeps, because there would be no groundwater drawdown under this alternative, there would be no impact to nearby domestic wells from the village well field.

Anticipated Effects of Climate Change

Under alternative 2 (no action – no pumping), the potential climate change effects could still occur. Predicted changes in temperature, precipitation, and runoff conditions could continue to create long-term declines in North Fork flows, even without pumping. Water temperatures may rise overall; this would be particularly noticeable during summer low flows. Springs, seeps, and nearby domestic wells could eventually experience declines or go dry. Qualitatively, these effects would occur at a slower pace than under alternative 1 (no change). This would allow greater flexibility and time for resource management to adapt to changing conditions, if they occur.

Under alternative 2, there would be no groundwater drawdown due to pumping, and springs, seeps, and domestic wells would not be affected by Village of Ruidoso pumping. If climate change occurred and resulted in drier conditions, long-term reductions in North Fork flows would occur. Qualitatively, these effects would occur at a slower rate under alternative 2 than under alternative 1. This may allow more opportunity for resource management responses to climatic conditions.

Updates to Direct and Indirect Effects from Alternative 2 Due to the Little Bear Fire

Over the short-term (i.e., until watershed “recovery”), effects under alternative 2 would encourage the occurrence of streamflows and increased groundwater levels along the North Fork Eagle Creek. Large portions of the stream would remain intermittent during periods of average precipitation. In some locations, the accumulation of sediment and debris in the stream channel could physically increase the depth to saturated conditions below the new surface of the channel bed. Flows in intermittent parts of the North Fork Eagle Creek are understood to be related to shallower alluvial deposits over near-surface bedrock. In some locations, greater thickness of newly-deposited alluvium could reduce the presence of surface flow or pooling, even without pumping. If this occurs, under alternative 2 it would likely be less frequent or extensive than under alternatives 1 or 3.

Over the long term, post-wildfire hillslope and vegetation conditions are expected to return to approximate pre-wildfire conditions. If conifer stands convert to grasses or shrubs, somewhat less evapotranspiration may somewhat improve watershed yield and may contribute to groundwater recharge. If these conditions occur in the absence of pumping under alternative 2, aquatic habitats could be enhanced and additional opportunities for improving riparian conditions would result in comparison to alternatives 1 or 3.

There are post-fire channel changes along the North Fork. This is a result of accelerated erosion, sediment and debris accumulations, and greater runoff. Channel changes are likely to have long-term effects on the expression of surface flow versus alluvial underflow in the channel. Where channel aggradation or widening occurs, streamflow may be “buried” within a debris deposit or dispersed into many small surface flow branches. Where channel downcutting occurs or debris piles do not form, exposed flow or pooling would be more frequent and observable. These conditions may migrate over time along the North Fork, so that at any particular place and time, quantifying flow increases could be complicated by changing channel conditions.

Under alternative 2, there would be no groundwater drawdown due to pumping, and springs, seeps, and domestic wells would not be affected by Village pumping. If climate change occurred and resulted in drier conditions, long-term reductions in North Fork flows would occur. Qualitatively, these effects would occur at a slower rate under alternative 2 than under alternative 1. This may allow more opportunity for resource management responses to climatic conditions.

Cumulative Effects

If alternative 2 (no pumping) were implemented, additional groundwater would pass downstream from the well field area into the cumulative impact area. On this basis, combining the effects of alternative 2 (no pumping) with other past, present, and foreseeable future action would result in downstream migration of groundwater within the stream alluvium and/or bedrock. As a result, beneficial recharge effects to aquifers, springs and seeps, riparian condition, and possibly stream base flows may result. The magnitude and extent of these effects is unknown, since the village operates five additional water supply wells in the overall Eagle Creek drainage.

Implementing alternative 2 would effectively preclude the use of the existing well field for municipal water supply by the village. As such, it would conflict with part of the purpose of the action: authorizing the village under a special use permit to access and divert groundwater from its North Fork Eagle Creek wells. Alternative 2 would significantly reduce the existing Village water supply, and may create substantial adverse indirect effects on municipal services and finances. From a water resources standpoint, this would likely create additional demands by the Village of Ruidoso on other water sources downstream within the Eagle Creek drainage or in other drainages. These demands would most likely be met by groundwater supplies elsewhere, with associated aquifer withdrawals. Associated impacts would probably involve drawdown related reductions in stream base flows, nearby well water levels, and flow reductions at springs and seeps. The occurrence of these impacts would depend on the water sources used to meet the demand, whether or not new water wells were brought into service, and where and how pumping occurred. These additional water supply factors, interactions, and related impacts elsewhere would generally be the same as those qualitatively described for alternative 1 (no action).

Forest fuel reductions, prescribed burns, recreational developments, and wildfires would all act to increase runoff and sedimentation in the cumulative impact area. Controls on forest activities and the impacts of wildfires would be the same as qualitatively described under alternative 1.

Updates to Cumulative Effects from Alternative 2 Due to the Little Bear Fire

Over the short term (3 to 7 years after the Little Bear Fire in mid-summer 2012), the cessation of North Fork Eagle Creek pumping under alternative 2 would contribute to downstream baseflows and groundwater levels outside the forest boundary. Over the post-wildfire short term (until hillslope recovery), these beneficial effects would be masked by accelerated surface runoff, erosion and debris flows, channel geometry changes, and reduced water quality resulting from the Little Bear Fire. In addition, other downstream water users would affect surface drainage and groundwater levels. Depending on the timing and volumes of other water withdrawals and returns in the cumulative study area, these factors could obscure some of the beneficial effects of alternative 2 in the short term.

After longer-term watershed recovery in the basins affected by the Little Bear Fire, additional streamflow and groundwater would pass downstream from the North Fork Eagle Creek well field area into the cumulative study area under alternative 2. As a result, beneficial recharge effects to aquifers, some springs and seeps, riparian condition, and possibly stream baseflows may result. The magnitude and extent of these effects is unknown, due to the number of other water users in the area. Over the long-term, cumulative water resources impacts would be similar to those previously described for

alternative 2 in pre-wildfire assessments. The effects of forest fuel reductions, prescribed burns, and other activities would be the same as qualitatively described for alternative 1.

Implementing alternative 2 would effectively preclude use of the North Fork Eagle Creek well field for municipal water supply by the Village of Ruidoso. As described above for pre-fire conditions, shutting down the North Fork wells would most likely create additional demands and associated pumping drawdown effects on other water resources in the Eagle Creek drainage or nearby. As discussed in the Water Rights section, applications by the Village of Ruidoso for additional points of diversion along Eagle Creek are pending at the New Mexico Office of the State Engineer. It should be noted, however, that potential cumulative effects on streamflows and groundwater resources would not be restricted to water uses by the Village of Ruidoso, as mentioned above under alternative 1.

Conclusion

Under alternative 2 (no pumping), the upper portions and other isolated parts of the North Fork would be maintained as perennial reaches. Intermittent flows would occur from slightly above the well field downstream to the Eagle Creek gage, wherever alluvial deposits entirely absorb streamflows. On the basis of historical prepumping data, the occurrence of no-flow days at the Eagle Creek gage would be substantially reduced or eliminated. Similarly, without natural channel modifications, flows greater than 1.2 cubic feet per second could be expected to occur between 55 to 60 percent of the time under average precipitation. This would increase opportunities for watershed improvement, and allow increased water availability for other uses. This pre-fire flow duration estimate could increase under alternative 2 over time. Natural channel modifications are anticipated to continue for an unknown period. At any particular place and time along the North Fork, these could somewhat obscure the overall effects of alternative 2.

In comparison to alternatives 1 or 3, beneficial cumulative recharge effects to aquifers, springs and seeps, and possibly stream base flows may result under alternative 2 (no pumping) within parts of the broader Eagle Creek drainage. The magnitude and extent of these effects is unknown, since it is likely that the village would continue to exercise its water rights and make withdrawals elsewhere in the larger Eagle Creek system. Impacts from such cumulative activities are unknown, but in combination with other water users, they may offset beneficial impacts from no pumping at the North Fork Eagle Creek well field.

Alternative 2 would significantly reduce the existing Village water supply. In turn, this would likely create additional demands by the Village on other water sources downstream within the Eagle Creek drainage or in other drainages. Although outside the North Fork watershed, such demands and water supply adjustments would likely create other cumulative effects on water resources.

Alternative 3 - Adaptive Management
Direct/Indirect Effects

Streamflow Quantity

Under the adaptive management alternative, we would enact pumping restrictions when the no-flow day management trigger reached the prescribed thresholds. These restrictions would decrease the amount of water the village could withdraw by limiting the pumping rate to 50 percent of the streamflow reported at the North Fork gage or by undertaking other management actions.

Using the potential adaptive management triggers (monitoring indicators) described for alternative 3 (adaptive management) in chapter 2 of the EIS, we conducted a review of the hypothetical

implementation of the flow volume triggers, using historical flow conditions as data inputs. Table 10 displays the results of this exercise.

Based on an analysis of no-flow durations per year, we approximated the amount of time that pumping would be limited each year, assuming that pumping could resume without limitation once flow resumed at the Eagle Creek gage, but that the pumping limit would be imposed immediately if no flow occurred again in the water year. For this exercise, we assumed the management trigger reset every October 1 if there was flow on that date. If there was no flow on October 1, the pumping limit that was triggered the previous year was assumed to remain in effect until flow resumed. No-flow days that occurred during pumping limits of this type counted toward the new water year's trigger limit. Table 10 indicates the approximate total duration in each historical year when pumping would have been limited. Note that the estimated limitations would not necessarily have been continuous over the entire durations indicated.

Under the adaptive management strategy for alternative 3, it can be seen from table 10 that management triggers are most generally enacted during dry years. During average years, the triggers would be enacted much less frequently. The effects of this approach would be to generally maintain perennial streamflow conditions in the upper reaches of the North Fork, and to mitigate the potential adverse pumping impacts on intermittent flows from the well field downstream to the Eagle Creek gage. As a result, only minor, local, short-term impacts to streamflow magnitude and extent would occur in comparison to alternative 1. The Village of Ruidoso would be able to pump its municipal supply most of the time, and would be able to pump at reduced levels during some, but not all, of the restricted periods. From an impact perspective, it is estimated that the change in the occurrence of the 1.2 cubic feet per second streamflows (an impact metric) would be between 0 and 10 percent of the prepumping condition during average years. During dry years, adaptive management would improve flow conditions and reduce the amount of no-flow days at the Eagle Creek gage. An approximate middle ground between the prepumping (assumed to be equivalent to alternative 2) and pumping conditions (alternative 1) would be attained during average years. Pumping restrictions would mitigate adverse effects to surface waterflows and alluvial water availability during dry years.

Table 10. Historical perspective: durations of no surface flow and hypothetical pumping limitations using potential adaptive management triggers for flow volume

Water Year	Approximate No-flow Period (Weeks)	Potential Adaptive Management Trigger Enacted[a]	Approximate Weeks of Limited Pumping
Prepumping, approximately average precipitation conditions			
1971	0	None	0
1972	0	None	0
1973	0	None	0
1974	0	None	0
1975	0	None	0
1976	0	None	0
1977	0	None	0
1978	0	None	0
1979	0	None	0
1980	0	None	0
Period Average	0	NA	0

Water Year	Approximate No-flow Period (Weeks)	Potential Adaptive Management Trigger Enacted[a]	Approximate Weeks of Limited Pumping
Postpumping, approximately average precipitation conditions			
1989	<1	None	0
1990	3	None	0
1991	0	None	0
1992	0	None	0
1993	0	None	0
1994	0	None	0
1995	0	None	0
1996	8 to 9	30 d/y[a]	4 to 5
1997	0	None	0
1998	0	None	0
Period Average	1 to 2	n/a	<1
Postpumping, drought or fluctuating precipitation conditions			
2000	6 to 7	30 d/y	2 to 3
2001	10 to 12	30 d/y	6 to 7
2002	16 to 18	Both[c]	14 to 16
2003	18 to 20	Both	15 to 17
2004	20 to 22	Both	22 to 24[d]
2005	1 to 2	None	0
2006	18 to 20	30 d/y	14 to 16
2007	0	None	0
2008	3 to 4	None	0
2009	9 to 10	30 d/y	5 to 6
2010	4 to 5	20 d/y for 3 y[b]	4 to 5[d]
Period Average	10 to 12	n/a	8 to 10

a - “30 d/y”: This proposed adaptive management trigger would be enacted to restrict pumping where there are 30 or more no-flow days within 1 water year.

b - “20 d/y for 3 y”: This proposed adaptive management trigger would be enacted to restrict when there are 20 or more no-flow days over 3 consecutive water years.

c - “Both”: This indicates that both triggers were reached during the water year.

d - The no-flow period extended from the previous water year into the new, which did not allow the trigger to reset on Oct. 1.

By limiting pumping, the aquifer drawdown would decrease, and the proportion of volcanic aquifer recharge that would remain for water level recovery would increase. This would shorten aquifer water level recovery times, and decrease the duration of no-flow periods at the stream gage.

As described in detail in the alternative 3 (adaptive management) description in chapter 2, other management triggers, in addition to the trigger for no-flow days, would be used to manage pumping operations.

Springs and Seeps

As described under alternative 1, two springs occur within the drawdown projected from U.S. Geological Survey field observations. These and other springs in the watershed may be connected to the overall basin hydrologic system, or may have isolated, perched groundwater sources. Assuming that these springs are connected to the larger groundwater system, management under alternative 3 would somewhat decrease the duration and extent of drawdown, lessening impacts to springs and seeps in comparison to alternative 1. Compared to alternative 2, some drawdown impacts and springflow reductions would still occur over the approximated area of drawdown depicted in figure 12 and figure 13. These are anticipated to be local and to occur repeatedly over the long term, but be less than alternative 1 since some recovery could occur during wet periods and would be assisted by adaptive management during dry periods. As noted under alternative 1, additional springs and seeps occur within the North Fork watershed that could be affected by pumping if they are connected to the basin groundwater system and if drawdown is more extensive than currently projected. Adaptive management and monitoring would address impacts to springs and seeps if they become more extensive or severe.

Nearby Domestic Wells

The decreased drawdown and water level recovery times would also decrease the duration and extent of impacts to domestic wells in comparison to alternative 1. Potential impacts would be the same as those described for springs and seeps; local and long term, but minor to moderate. Adaptive management would address greater impacts to domestic wells if they occurred.

Anticipated Effects of Climate Change

Under the adaptive management alternative, the expected effects of climate change could still occur over the long run, as described for the other alternatives. However, adaptive management strategies would reduce the timing and severity of these effects to the extent possible. Increased temperatures, reduced snowpack, and accelerated snowmelt could require ongoing adjustments in adaptive strategies to maintain streamflows and groundwater availability. However, experience gained through adaptive management would allow more informed strategies to be developed for water resources management under changing climatic conditions, if they occur.

Updates to Direct and Indirect Effects from Alternative 3 Due to the Little Bear Fire

Under alternative 3, potential water resources impacts in the North Fork Eagle Creek over the short term (3 to 7 years) after the Little Bear Fire may be limited by the application of pumping restrictions. During this period, however, the impacts of natural post-wildfire watershed and channel adjustments will override some of the pumping impacts and some of the adaptive management effort. Even with stabilization efforts, watershed sideslopes will continue to erode for a period of years under the severe rainfall events common to the region. This will decline over time on sideslopes during the short-term recovery period, but a much longer period will involve active sediment and debris accumulation and transport through the valley, the North Fork Eagle Creek channel system, and downstream.

During the short-term, channel re-configuring processes will modify the locations and durations of open channel flow or pools. This will be most noticeable after severe rainfall events. Similarly, riparian conditions at a given point along the North Fork Eagle Creek will be modified through natural post-wildfire adjustments to the channel bed and banks. For this reason, periodic and spatially-distributed monitoring measures are described and recommended in chapter 2. Adaptive management practices have been re-oriented toward monitoring well placement and recording, in an effort to minimize the reliance on shifting channel and streamgage conditions. During the short term post-wildfire recovery period, pumping effects would be limited to the extent possible through an

iterative and adaptive approach as the landscape, stream channel, and groundwater recharge processes adjust to the wildfire disturbance.

Over both the short- and long-terms, management triggers would be most generally enacted during dry years. During average or wet years, management triggers would be enacted much less frequently. For this reason, measures for monitoring precipitation conditions, groundwater conditions, and employing computer simulations of surface- and groundwater interactions have been described and recommended in chapter 2.

Over the long-term, the Village of Ruidoso would be able to pump its municipal supply from the North Fork Eagle Creek most of the time, and would be able to pump at reduced levels during some, but not all, of the restricted periods. During dry years, adaptive management would improve flow conditions and reduce the amount of no-flow days along the North Fork Eagle Creek in comparison to alternative 1, but probably less than alternative 2. With respect to surface flows and alluvial groundwater levels, an approximate middle ground between alternative 1 (continued pumping at historic levels) and alternative 2 (no pumping) would be attained during average precipitation years under alternative 3. Drawdown effects may still occur at springs, seeps, and domestic wells, but are anticipated to be less than those expected under alternative 1. If climate changes to warmer and drier conditions occur, ongoing adjustments in management strategies to maintain streamflows, alluvial groundwater levels, and Village of Ruidoso water supplies would be required. Experience gained through adaptive management would allow more informed water resources strategies if climatic changes occur.

Over the long term, watershed conditions are expected to return to approximate pre-wildfire conditions. If conifer stands convert to grasses or shrubs, somewhat less evapotranspiration may slightly improve watershed yield. There may be additional groundwater recharge. If these conditions occur along with adaptive management of North Fork Eagle Creek pumping, other resource effects could occur. For example, habitats could be enhanced and additional opportunities for improving riparian conditions would result.

There have been post-fire channel changes along the North Fork. These are a result of accelerated erosion, sediment and debris accumulations, and greater runoff. Ongoing channel changes are likely to have long-term effects on the expression of surface flow versus alluvial underflow in the channel. Where channel aggradation or widening occurs, streamflow may be “buried” within a debris deposit or dispersed into many small surface flow branches. Where channel downcutting occurs or debris piles do not form, exposed flow or pooling would be more frequent and observable. These conditions may migrate over time along the North Fork. At any particular place and time, distinguishing pumping and management effects would be complicated by changing channel conditions. Additional monitoring measures have been developed to address this.

Cumulative Effects

Combining the effects of the adaptive management alternative with other past, present, and foreseeable future actions would result in potential cumulative water resources impacts that would include flow and water quality reductions in Eagle Creek within the cumulative impact area. Water supply pumping for the applicant is conducted at six water wells along lower Eagle Creek (figure 11), and the Village of Ruidoso diverts surface water from the stream a short distance below the Eagle Creek gage. As a result, groundwater recharge in downstream alluvial and bedrock aquifers would still be adversely affected, but to a lesser extent than under current conditions or alternative 1 (no action). The adaptive management alternative would have minor effects on these impacts, as pumping in the North Fork Eagle Creek would generally be permitted most of the time.

Implementing the adaptive management alternative would occasionally create temporary demands for other water sources on the part of the Village of Ruidoso. It is possible that the Village of Ruidoso would meet those demands by pumping groundwater supplies elsewhere or by constructing additional storage facilities, by enacting water use limitations, or some combination of these approaches. In addition, future water supply infrastructure and withdrawals would create additional water resources impacts as qualitatively described previously for alternative 1 (no action).

Forest fuel reductions, prescribed burns, recreational developments, and wildfires would all act to increase runoff and sedimentation in the cumulative impact area. Controls on forest activities and the impacts of wildfires would be the same as qualitatively described under alternative 1 (no action). The extent and effects of these potential activities are unknown.

Updates to Cumulative Impacts from Alternative 3 Due to the Little Bear Fire

Over the short term (3 to 7 years after the Little Bear Fire in mid-summer 2012), the management of North Fork Eagle Creek pumping under alternative 3 would contribute to downstream baseflows and groundwater levels outside the forest boundary. Over the post-wildfire short term (until hillslope recovery), these beneficial effects would be masked by accelerated surface runoff, erosion and debris flows, channel geometry changes, and reduced water quality resulting from the Little Bear Fire. In addition, other downstream water users would affect surface drainage and groundwater levels. Depending on the timing and volumes of other water withdrawals and returns in the cumulative study area, these factors could obscure some of the beneficial effects of alternative 3 in the short term. The effects of management under alternative 3 would likely range between the adverse (but obscured) effects of alternative 1 and the beneficial (but obscured) effects of alternative 2.

Over the long term, post-wildfire cumulative water resources impacts would be similar to those previously described for alternative 3 in pre-wildfire assessments (AECOM 2012, USDA Forest Service 2012, AECOM 2015). Implementing alternative 3 would occasionally create temporary demands by the Village of Ruidoso for other water sources. It is likely that the Village of Ruidoso would meet those demands by pumping groundwater supplies elsewhere, by additional leasing of existing water rights, by developing additional storage facilities, by enacting further water use limitations beyond its current practices, or some combination of these. As discussed in the Water Rights section, applications by the Village of Ruidoso for additional points of diversion along Eagle Creek are pending at the New Mexico Office of the State Engineer. If wells are pumped at these points, it could extend drawdown effects in combination with pumping of the existing wells.

It should be noted, however, that potential cumulative effects on streamflows and groundwater resources would not be restricted to water uses by the Village of Ruidoso, as mentioned above under alternative 1. The effects of forest fuel reductions, prescribed burns, and other activities (including other water uses besides Village of Ruidoso supplies) would be the same as qualitatively described for alternative 1.

Conclusion

Under the adaptive management alternative, the purpose and need for the action would be addressed in a manner that satisfies the municipal water supply demands of the village to the extent possible while providing for resource values on National Forest System lands. Surface water and groundwater availability in the North Fork would improve, and the intermittent flow durations in the stream would be generally similar to prepumping conditions. Perennial flow segments or pools would be more likely to occur. Adaptive management restrictions on pumping would mitigate impacts during dry periods. There would still be some drawdown impacts on springs, seeps, and domestic wells, but the extent and severity of these impacts would be reduced from current conditions.

Water supplies for the Village of Ruidoso would be reduced during periods of pumping restrictions (an adverse impact). Under alternative 3, these impacts would be less than under alternative 2. Ongoing water conservation efforts and other water management actions being taken by the Village could reduce the severity of these impacts, but under some conditions, pumping restrictions would still reduce water supplies from the North Fork. Adaptive management triggers and monitoring measures associated with alternative 3 have been developed to improve water resources management in the North Fork watershed, to provide some flexibility in the approaches taken, and to develop records of results.

Climate changes in the Southwest may occur, but their effects would be accommodated to the extent possible under the adaptive management approach. Cumulative impacts to surface water and groundwater availability would occur. Adaptive management under an approved permit authorization would help address cumulative impacts and water supply issues as they were identified.

Summary

As described in table 2, the alternatives differ in how they respond to the purpose and need for action related to protecting forest resources. Alternative 1 (no action) would not meet this need since allowing applicant operations to continue at current levels would continue to result in substantially more time when flows measured at the Eagle Creek gage are below 1.2 cubic feet per second. Alternative 2 (no pumping) would allow for natural conditions to return and groundwater pumping would cease. This would result in a return to natural conditions. Alternative 3 (adaptive management) would also meet this need since the change in the occurrence of 1.2 cubic feet per second streamflows would be between 0 to 10 percent of the prepumping condition during average years. During dry years, adaptive management would improve flow conditions and reduce the amount of no-flow days at the Eagle Creek gage; an approximate middle ground between the prepumping and pumping conditions would be attained during average years. Implementing a closely monitored adaptive management strategy with thresholds would minimize impacts of groundwater drawdown and provide increased groundwater and surface waterflow under alternative 3 (adaptive management). This increase would provide adequate flows for protecting water dependent ecosystems. Table 2 also provides a comparative summary of the effects of each alternative on each water resource measurement indicator.

Significant Issue: Aquatic and Fish Habitat

The fishery and aquatic habitat issues related to North Fork Eagle Creek well pumping include changes in the water table which may affect streamflow to varying degrees. Lowering streamflow may increase temperatures which can adversely affect fish. Quantity, quality, and waterflow availability that mirrors natural flow patterns are important for aquatic habitat and fish. Suitable water quality and temperatures, which are partially based on water depth and channel conditions, are necessary to support fish populations. Sufficient water supplies must also be available during summer months to provide water temperatures needed for survival of aquatic species.

We include a more detailed description of affected environment, methods, and environmental consequences for this project in the fish and wildlife report and biological evaluation (Bright 2015a). The supplemental fish and wildlife report and biological evaluation (Bright 2015 provides a more detailed description of affected environment, methods, and environmental consequences, considering the changes caused by the Little Bear Fire. These reports are incorporated by reference, discussed briefly below, and available in their entirety in the project record.

Methodology

The direct effects study area is the upper Eagle Creek drainage (figure 2) above the Eagle Creek gage. The cumulative impacts area extends through the Eagle Creek drainage to the location of the former U.S. Geological Survey stream gage named Eagle Creek near Alto, New Mexico (Eagle Creek near Alto, U.S. Geological Survey gage number 08387800) (figure 11). This area incorporates approximately 7 additional stream miles of Eagle Creek below the study area.

Baseline information used to assess impacts to aquatic habitat and fish was provided by Forest Service specialists using professional judgment. New Mexico Department of Game and Fish fisheries biologists were consulted for information regarding past and current fish management along the North Fork and levels of angler use. Forest Service records from the pre-well pumping period were searched for information related to aquatic habitat and fish management prior to well pumping. Other agency records, literature, and anecdotal information and photographs were also used where appropriate to assist in determining whether any changes have occurred to aquatic habitat and fish populations in the project since pumping began as well as to assist in determining effects of the alternatives on these important resources.

Well pumping may affect the quantity and quality of aquatic habitat, including temperature, (salmonids require summer water temperatures at or below 68 degrees Fahrenheit), and waterflow availability and seasonality (seasonal and year-long flows compared to expected flows without pumping). Alternatives were compared using the water resource streamflow quantity and quality indicators (see “Water Resources Methodology” in the previous section of this chapter).

The “Methodology” section at the beginning of this chapter describes the general approach used for cumulative effects analysis. Activities and projects summarized in table 4 and figure 4 were considered in the aquatic habitat and fish cumulative analysis.

Post-wildfire conditions were assessed to compare with the pre-wildfire conditions described in the DEIS. All post-wildfire reports including the BAER reports, field visit reports by resource specialists, wildfire impact assessments, and post-wildfire assessment maps were reviewed and cited in describing changes to fish and wildlife conditions. Literature relevant to wildfire effects on fish and wildlife habitats and resources were reviewed and cited where applicable to the Little Bear Fire situation.

Affected Environment

There are no federally listed, proposed, or candidate fish species, nor any Regional Forester sensitive species occurring in the North Fork Eagle Creek. Brook trout and rainbow trout are the only fish species currently documented in the portion of the North Fork between the North Fork gage and Eagle Creek gage. Persistent brook trout populations occur primarily in the perennial stretches and in the headwaters of the drainage in the White Mountain Wilderness (upstream from the North Fork gage), but during streamflow periods they have been found in some ponded sections of the North Fork in the Eagle Creek summer home area (upstream from the North Fork gage) and further downstream.

The New Mexico Department of Game and Fish records indicate that fish stocking has occurred along the North Fork as far back as 1896 with rainbow trout. There have been releases of nonnative brown trout, catfish, and brook trout and native Rio Grande cutthroat trout periodically through the 1960s as reported by Little (1960a, b) and Hansen (pers. comm. 2011).

Fish survey records from the 1960s through 2007 document the presence of brook trout in the North Fork (Little 1960a, Little 1960b, Little 1961, Hansen and Denny, personal communication 2011). As summarized in McGlothlin (2011) and in table 11, in the 1960s, brook trout were collected in a 100-foot section 1 mile below Eagle Creek Lodge (which is now in the present day Eagle Creek summer home area). Fish averaged about 4-5 inches in length and there were no other species besides brook trout collected. Water temperatures varied between surveys and ranged from 55 to 70 degrees Fahrenheit. These reports note: (1) very little fishing during the summer months because of low water conditions; (2) low densities of emergent and submerged aquatic vegetation (including algae and cattails); (3) ponderosa pine and spruce-fir as the dominate vegetation type; and (4) perennial reaches for the first 3.5 miles and then intermittent reaches downstream, except during periods of high runoff.

Medlock (2011) also provides insights into pre-well pumping stream conditions and fishing opportunities along the North Fork consistent with the summaries above.

Ross (1970) documents very good aquatic insect populations (the food source for trout) and an opinion that the North Fork has the capability of producing a quality cold water fishery, but notes that overall stream conditions were measurably better above the Eagle Creek summer home area than below. Patterson (1971) notes that the North Fork fishery is nearly nonexistent and that any improvement would be beneficial. Only brook trout were caught in the North Fork in 2007.

Table 11. Summary of past and present aquatic habitat and fish information for the North Fork Eagle Creek

Date	Source	Information
1920s - 1930s	Richard Hansen, New Mexico Department of Game and Fish (Hansen, pers. comm. 2011)	North Fork Eagle Creek stocked with brook trout and Rio Grande cutthroat trout in the 1920s and 1930s.
1959 - 1960	New Mexico Department of Game and Fish Basic Survey of Eagle Creek Report (Little 1960a)	Surveyed manmade pond areaa which is believed to be within the present day well field (T10S, R12E, Section 36), although there are differing opinions among agency biologists on this; rainbow trout and stunted brook trout observed in stream; noted that creek was shallow and narrow with the exception of two ponds; permanent water exists for 3.5 miles and then becomes intermittent except during periods of high runoff; boulders and rubble with some areas of sand and silt documented; water temperature varied from 55 °F to 66 degrees Fahrenheit. Recommends fish only be planted during years of adequate precipitation (except at manmade fish ponds); noted that stream is unsuitable for trout plantings except during high runoff from winter snows and noted little fishing during summer months.
1960	New Mexico Department of Game and Fish Basic Survey of Eagle Creek Report (Little 1960b and Little 1961)	Fish restricted to pools during low water; noted stream 6 feet wide and 3 feet deep; 37 fish sampled.
1963	Forest Service Upper Eagle Creek Watershed Analysis (USDA Forest Service 1963)	Notes that “the Eagle Creek water sinks and seeps away and is not delivered to the Rio Ruidoso or Rio Hondo system except during short periods of peak flow” and “records of the Eagle Creek drainage show some flood damage nearly every year with major floods occurring every 3 to 4 year intervals”.

Date	Source	Information
1970	Forest Service Report (Ross 1970)	Survey to determine if North Fork Eagle Creek has potential as a cold water fishery. Sampled three areas (above summer homes, below summer homes and near “old gravel borrow pit”); above summer home reach ranked highest for potential, but noted all three areas with potential; report author recommended stream improvements to enhance fish habitat; also noted “high amount of alluvium” in stream and recommended removing this alluvium (to provide gravel) in order to improve stream habitat.
1971	New Mexico Department of Game and Fish letter (1971)	Memo to Forest Service in response to Ross report stating the report gave good ideas; noted North Fork Eagle Creek has potential for “limited access fishing” and “present day fishing is nearly nonexistent.”

a - It is also well documented and understood that manmade ponds used to occur in the Eagle Creek summer home area and were stocked with fish.

The New Mexico Department of Game and Fish does not currently highlight the North Fork as a fishery with the public. They consider the North Fork a “self-sustaining brook trout fishery” (meaning they don’t stock it or otherwise encourage the fishery in this area, but it does have a population of brook trout that persists). The New Mexico Department of Game and Fish likely stopped investing in stocking it in the 1970s and 1980s due to fluctuating water levels and the quality of the habitat (Hansen, personal communication 2011). Over the last few years, the New Mexico Department of Game and Fish has moved fish from various isolated pools near road crossings upstream (presumably upstream of the North Fork gage) to where there was more consistent flow (Denny personal communication 2011).

As described in detail in the “Water Resources” section previously in this chapter (and documented in detail in AECOM (2015)), the North Fork streamflow has been affected by well pumping and is less now than it was prior to the onset of pumping in 1988; dry periods have increased and there are substantially more months per year when flow is less than 1.2 cubic feet per second.

An area below the confluence of the North and South Forks of Eagle Creek is listed by the New Mexico Environment Department as impaired because of reduced flows from well pumping (New Mexico Environment Department 2011a and 2011b). The department concludes that without improved management of the North Fork Eagle Creek well field, these conditions would be expected to persist or worsen.

Conditions before Pumping Began in 1988

Based on the compilation and evaluation of the best available data (summarized above), there is sufficient information to substantiate reduced flows, less fish presence, and decreased fishing recreation in the North Fork since the wells were authorized and began pumping in 1988. It appears that higher quality aquatic habitat and fishing opportunities existed in the North Fork before the North Fork Eagle Creek wells began pumping when compared to current conditions and fish populations (primarily brook trout) are substantially less now than they were before 1988. While many factors likely contribute to this shift (e.g. flood events, seasonal variations in precipitation and recreational use, loss of manmade fishing ponds due to flooding, variability in data collection and reporting, and reductions in direct New Mexico Department of Game and Fish fish stocking), it is likely that pumping is a one of the primary causes reducing the North Fork streamflow. However, as shown in table 11 and summarized above, the North Fork never provided a high quality trout fishery; conditions appear to always have been variable from year to year. Variations in seasonal flows in

many reaches of the North Fork can affect stream temperature (important for fish survival) and algae and aquatic insect habitat (trout prey base), and have likely done so since before 1988.

There is no concrete evidence to conclude whether North Fork Eagle Creek well pumping is affecting groundwater and surface water upstream from the well field and above the North Fork gage. Matherne et al. (2011) concluded the cone of depression created by well pumping did not extend further upstream than the North Fork gage, but, as described in the "Water Resources" section of this chapter, worst-case drawdown effects are possible above the gage (figure 12 and figure 13) extending into the Eagle Creek summer home area. For purposes of this analysis, it is assumed that, while effects to aquatic habitat and fish are possible above the North Fork gage, the majority of the most important North Fork aquatic habitat and brook trout habitat (occurring in the historically and currently perennial upper reaches and upstream of the summer home area) are not being measurably affected by North Fork Eagle Creek well pumping.

Therefore, while the North Fork, particularly below the North Fork gage, has always been a marginal trout fishery, the quality of trout habitat and recreational fishing experience it currently provides is lower today than it was in the late 1980s, and North Fork Eagle Creek well pumping has contributed to this decline.

Conditions after the Little Bear Fire

Cordova (2013) reported that three visits were made to the North Fork Eagle Creek drainage during the field season in 2013 that document post-wildfire conditions. Each visit to this drainage had a different emphasis (debris flow information, botany survey, college field trip). All three of these visits encompassed a review of the upper reaches of the drainage (Wilderness Area). During each of these visits (April, early July, late July) a cursory observation of pools where fish were seen historically was assessed. No fish were observed during these outings. He concluded that "I feel very confident in saying that the fish population in the North Fork Eagle Creek was extirpated by the floods that occurred after the Little Bear Fire". Cordova (2013a) reported that the riparian system is in excellent shape in the upper watershed! Once we get stability on the upper slopes we will have the opportunity to consider introducing fish back into the system, possibly Rio Grande cutthroat. The South Fork of the Bonito may be a better candidate due to 7.5 miles of riparian habitat. There is only a very small stretch of year round flow in the North Fork Eagle Creek (approx. 1.5 miles) (Cordova 2013a).

Dunham et al. (*in* University of Idaho 2007) showed that physical stream habitats can remained altered (e.g., stream temperatures) for many years following wildfire, but that native aquatic vertebrates can remain resilient. In a management context, this suggests that wildfire may be less of a threat to native species than human influences that alter the capacity of stream-living vertebrates to persist in the face of natural disturbance.

AECOM (2015) presents information directly relevant to the post-wildfire situation indicating that there is a potential to have perennial or near perennial stream flows reestablished from combined summer rain falls and increased surface runoff. However, the spikes in water flow will most likely be seasonal and of short duration instead of year-round which may not provide a perennial water flow. However, there should be a greater volume of water in the North Fork Eagle Creek as a result of the wildfire. The significance of erosion and debris flows will be to make the channel environment more dynamic than they were before the Little Bear Fire with the potential to rejuvenate fish habitat and overall conditions (AECOM 2015). This report indicates that post-wildfire water quality is likely to be affected for 1-2 years and turbidity impacts could last considerably longer than 2 years both in the wildfire area and downstream.

Environmental Consequences

Alternative 1 - No Change
Direct and Indirect Effects

The comparison and analysis of alternative 1is made using alternative 2, the no pumping alternative, as the baseline condition. The current level of effects to aquatic habitat and fish would continue. As shown above, there is sufficient information to substantiate reduced flows, less fish presence, and decreased fishing recreation in the North Fork since the North Fork Eagle Creek wells were authorized and began pumping in 1988. This trend would continue with implementation of alternative 1 (no action).

As described in the “Water Resources” section of this chapter, spatially discontinuous, intermittent streamflows would continue at reduced levels near and downstream of the well field under alternative 1 (no action), creating site specific and local impacts on flow rates and extent. The duration of excessively warm low-flow water temperatures would continue to be about 1 or 2 weeks longer per year than under prepumping conditions; an adverse effect on aquatic uses and fish. All of these effects could be exacerbated over the long term by possible climate changes toward more extended drier conditions, with resultant adverse effects to the quality of habitat for aquatic species and fish.

As stated previously, the majority of the most important North Fork aquatic habitat and brook trout habitat (occurring in the historically and currently perennial upper reaches further upstream from the North Fork Eagle Creek wells and the North Fork gage) are not being measurably affected by North Fork Eagle Creek well pumping and this would not change with implementation of alternative.

Cumulative Effects

As described in the water resources of this chapter, cumulative water resources impacts include ongoing reductions in flow and water quality along Eagle Creek within the cumulative impact area, due primarily to reduced groundwater recharge. Additional water supply developments in the region would create further impacts to surface water, groundwater, and associated resources.

Combining the direct and indirect effects to aquatic habitat and fish with other past, present, and foreseeable future actions with the larger drainage (as summarized in table 4 and figure 4) and for water resources above, implementation of alternative 1 (no change) would result in minor to moderate adverse cumulative effects to aquatic habitat and fish similar to those described for water resources.

The burn severity of the Little Bear Fire burn was high or moderate throughout 53 percent of the wildfire boundary. Bury et al. (no date) reports that some research on large, stand-replacing wildfires on lotic biota suggests that wildfire ultimately benefits aquatic invertebrates and fishes, even those species that are negatively affected by the disturbance in the short-term, immediately after the wildfire. For example, Lyon suggested that some aquatic invertebrates may decline immediately after a wildfire, then increase to levels above pre-wildfire conditions as a response to increased stream productivity. Large fires can have long-term effects on streams by: (1) reducing invertebrate diversity for a decade or longer; (2) changes in peak discharge, stream channel morphology, large woody debris inputs, and sediment loadings; and (3) elevated temperature and altered water chemistry. Also, the effects of wildfire on stream biota may be more pronounced in headwater streams than in mid-order or larger streams. McCormick, et.al.(2010) provide references that indicate that where native fish populations are naturally depauperate or have declined and become increasingly isolated because of anthropogenic activities, the effects on fish populations are more pervasive and long lasting.

Conclusion

Implementation of alternative 1 (no change) would result in a “may impact” determination to aquatic habitat and fish species (primarily nonnative brook trout and rainbow trout) and their habitat.

In some locations, the accumulation of sediment and debris in the stream channel due to the Little Bear Fire could physically increase the depth to saturated conditions below the new surface of the channel bed. Flows in intermittent parts of the North Fork Eagle Creek are understood to be related to shallower alluvial deposits over near-surface bedrock. In some locations, greater thickness of newly-deposited alluvium could reduce the presence of surface flow or pooling. Pumping at historic levels under this alternative could further reduce the occurrence of surface flow or pools under short-term post-wildfire conditions (AECOM 2015).

Reduced water flow in the North Fork Eagle Creek compared to no pumping would impact the ecology of many aquatic organisms including aquatic flora and fish. There are no listed, management indicator, or sensitive fish species in the North Fork of Eagle Creek. There will be no disturbance to aquatic and fish species from activities at the well sites including road maintenance, well house activities, maintenance of underground power line and pipeline, well operation, vehicle ingress and egress, and mechanical maintenance of the wells because there will be no soil movement into the stream because of conservation measures. There are no connected actions that would affect fisheries. Cumulative effects contributed to this determination.

Update to overall effects from Alternative 1 due to the Little Bear Fire:

No fish were observed in the upper perennial reaches (upstream of the North Fork gage) during surveys conducted in 2013 after the wildfire. Aquatic invertebrates typically decline immediately after a wildfire. In the short-term, reduced water quality, channel morphology changes, and deeper alluvial deposits due to the wildfire would continue to reduce the fish and aquatic habitat quality in the project area while the watershed is recovering. Pools and stretches of surface water may be reduced and this would affect aquatic habitat and fish presence. Continued pumping under alternative 1 during the short-term is expected to continue to limit the potential for fish and aquatic habitat improvement.

Over the long term, after post-wildfire recovery, watershed conditions are expected to return to approximate pre-wildfire conditions. Aquatic invertebrates could respond positively to increased stream productivity but the timeframe for this recovery is difficult to predict. Water yield and groundwater availability may improve as shown in the water resources analysis and debris flows could result in a more dynamic channel environment benefiting fish habitat. However, continued pumping would obscure some of these potential benefits. Therefore, adverse effects from implementing alternative 1 over the long term would be the same as, or slightly less than, the pre-wildfire assessment for alternative 1.

Alternative 2 - No Action (No Pumping)
Direct and Indirect Effects

The comparison and analysis of other alternatives were made using alternative 2, the no pumping alternative as the baseline condition.

Over the short term (i.e., until watershed recovery after the Little Bear Fire), effects under this alternative would encourage the occurrence of stream flows and increased groundwater levels along the North Fork Eagle Creek. Large portions of the stream would remain intermittent during periods of average precipitation. In some locations, the accumulation of sediment and debris in the stream channel could physically increase the depth to saturated conditions below the new surface of the

channel bed. Flows in intermittent parts of the North Fork Eagle Creek are understood to be related to shallower alluvial deposits over near-surface bedrock. In some locations, greater thickness of newly-deposited alluvium could reduce the presence of surface flow or pooling, even without pumping. If this occurs, it would be less frequent or extensive than under alternative 1(AECOM 2015).

As shown in the “Water Resources” section of this chapter, increased surface flows would result from implementation of alternative 2 (no pumping). Intermittent flows would occur from slightly above the well field downstream to the Eagle Creek gage, wherever alluvial deposits entirely absorb streamflows, as occurred before pumping began. On the basis of historical prepumping data, the occurrence of no-flow days at the Eagle Creek gage would be substantially reduced or eliminated. Similarly, flows greater than 1.2 cubic feet per second would occur approximately 57 percent of the time under average precipitation conditions. This would increase opportunities for watershed improvement and allow increased water availability for other uses.

Streamflow temperatures would still exceed 68 degrees Fahrenheit during part of the summer season, but this would occur for a total of about 4 weeks or so under average conditions and is thought to be within the normal range for this stream system historically. Climate change impacts could still occur, which have the potential to reduce flows and increase water temperatures over time, but there would be more flexibility and time available to select and implement climate change strategies for water resources management.

These improvements in streamflow quantity and quality would improve aquatic and fish habitat in the North Fork and provide for improved recreational fishing opportunities over the long term.

The most important North Fork Eagle Creek aquatic habitat and brook trout habitat (occurring in the historically and currently perennial upper reaches further upstream from the North Fork Eagle Creek wells and the North Fork gage) are not being measurably affected by North Fork Eagle Creek well pumping. However, by stopping all pumping, any potential for effects above the North Fork gage would be eliminated.

Cumulative Effects

Beneficial cumulative recharge effects to aquifers, springs and seeps, and possibly stream base flows may result under alternative 2 (no pumping) within parts of the Eagle Creek drainage. The magnitude and extent of these effects is unknown, since it is likely that the village would continue to exercise its water rights and make withdrawals elsewhere in the Eagle Creek system. Impacts from such activities could offset beneficial impacts from no pumping at the North Fork Eagle Creek well field.

Combining the direct and indirect effects to aquatic habitat and fish with other past, present, and foreseeable future actions within the larger drainage (as summarized in table 4 and figure 4) and for water resources above, implementation of alternative 2 (no pumping) has the potential to improve aquatic and fish habitat and recreational fishing in the larger Eagle Creek, but since the magnitude and extent of other water withdrawals in the larger drainage in the future is unknown, beneficial effects could be offset in the cumulative impact area.

The following discussion is relevant to the post-wildfire situation. Bury et al. (no date) reported that some research on large, stand-replacing wildfires on lotic biota suggests that wildfire ultimately benefits aquatic invertebrates and fishes, even those species that are negatively affected by the disturbance immediately after the wildfire. For example, Lyon suggested that some aquatic invertebrates may decline immediately after a wildfire, then increase to levels above pre-wildfire conditions as a response to increased stream productivity. Large fires can have long-term effects on streams by: (1) reduced invertebrate diversity for a decade or longer; (2) changes in peak discharge,

stream channel morphology, large woody debris inputs, and sediment loadings; and (3) elevated temperature and altered water chemistry. Also, the effects of wildfire on stream biota may be more pronounced in headwater streams than in mid-order or larger streams. McCormick, et al. (2010) provide references that indicate that where native fish populations are naturally depauperate or have declined and become increasingly isolated because of anthropogenic activities, the effects on fish populations are more pervasive and long lasting.

Conclusion

Implementing alternative 2 (no pumping) would result in a “beneficial impact” determination for aquatic and fish habitat.

Update to overall effects from Alternative 2 due to the Little Bear Fire:

In the short term, reduced water quality, channel morphology changes, and deeper alluvial deposits due to the wildfire would continue to reduce the fish and aquatic habitat quality in the project area while the watershed is recovering. The effects of no pumping, however, would encourage the occurrence of streamflow and increased groundwater levels (more so than under alternative 1) although large portions of the stream would remain intermittent during periods of average precipitation. Pools and stretches of surface water may be reduced and this would affect aquatic habitat and fish presence. Under alternative 2, the potential for fish and aquatic habitat improvement will continue to be limited but not as much as under alternative 1.

Over the long term, after watershed recovery, effects from no pumping would be the same as those described in the pre-wildfire assessment for alternative 2. Aquatic invertebrates could respond positively to increased stream productivity but the timeframe for this recovery is difficult to predict. Water yield and groundwater availability may improve as shown in the water resources analysis and debris flows could result in a more dynamic channel environment benefiting fish habitat. With the cessation of pumping, these potential benefits could be increased Therefore, beneficial effects from implementing alternative 2 over the long term would be the same as, or slightly more than, the pre-wildfire assessment for alternative 2.

Alternative 3 - Adaptive Management
Direct and Indirect Effects

The comparison and analysis of alternative 3 is made using alternative 2, the no pumping alternative as the baseline condition. As stated in the “Water Resources” section of this chapter, implementing alternative 3 (adaptive management), would result in improved surface water and groundwater availability in the North Fork Eagle Creek over current conditions, and intermittent flow durations in the stream would be generally similar to prepumping conditions; summer stream temperatures would also be roughly similar to those experienced historically. Because surface flow would improve, no-flow days would be reduced (but not eliminated) and there would be a reduction in the duration of stream temperatures above 68 degrees Fahrenheit; aquatic habitat and fishing potential would improve over current conditions; these changes would be less than those for alternative 2 (no pumping) but greater than those for alternative 1 (no action).

However, continued removal of water from the basin would affect fish habitat in the stream by continuing to reduce waterflows from historic prepumping conditions which would continue to create dry periods and the potential for extended durations of elevated water temperature. The adaptive management strategy as part of alternative 3 (adaptive management) would minimize impacts during dry periods and provide opportunities to reduce the potential for adverse effects to aquatic habitat and

fish. Over the long term, possible climate change effects could occur, but their effects would be accommodated to the extent possible under the adaptive management approach.

The most important North Fork aquatic and brook trout habitat (occurring in the historically and currently perennial upper reaches further upstream from the North Fork Eagle Creek wells and the North Fork gage) are not being measurably affected by North Fork Eagle Creek well pumping. With restrictions on pumping, any potential for effects above the North Fork gage would be minimized.

Under alternative 3, potential water resources impacts in the North Fork Eagle Creek over the short-term (three to seven years) after the Little Bear Fire may be limited by the application of pumping restrictions. During this period, however, the impacts of natural post-wildfire watershed and channel adjustments will override some of the pumping impacts and some of the adaptive management effort. Even with stabilization efforts, watershed side slopes will continue to erode for a period of years under the severe rainfall events common to the region. This will decline over time on side slopes during the short-term recovery period, but a much longer period will involve active sediment and debris accumulation and transport through the valley, the North Fork Eagle Creek channel system, and downstream action.

During the short term, channel re-configuring processes will modify the locations and durations of open channel flow or pools. This will be most noticeable after severe rainfall events. Similarly, riparian conditions at a given point along the North Fork Eagle Creek will be modified through natural post-wildfire adjustments to the channel bed and banks. Adaptive management practices have been re-oriented toward monitoring well placement and recording, in an effort to minimize the reliance on shifting channel and stream gage conditions. During the short term post-wildfire recovery period, pumping effects would be limited to the extent possible through an iterative and adaptive approach as the landscape, stream channel, and groundwater recharge processes adjust to the wildfire disturbance.

Effects would be similar to alternative 2 because surface flow would improve, no-flow days would be reduced (but not eliminated) and there would be a reduction in the duration of stream temperatures above 68 degrees Fahrenheit; these changes would result in improved aquatic habitat and fishing potential, but these changes would be less than those for alternative 2 but greater than those for alternative 1 (Table 3, chapter 2, Supplemental Information Report).

Cumulative Effects

There would be cumulative impacts to surface water and groundwater availability as described in the “Water Resources” section. Adaptive management under an approved permit authorization would help address cumulative impacts and water supply issues as they were identified. Ongoing water supply developments and activities on National Forest System lands, as described under alternative 1 (no action), would add to regional, long-term impacts to water resources and, thus, would have potential to adversely impact aquatic resources due to reductions in groundwater and surface water availability in the cumulative assessment area.

Combining the direct and indirect effects to aquatic habitat and fish with other past, present, and foreseeable future actions within the larger drainage (as summarized in table 4 and figure 4) and for water resources above, implementation of alternative 3 (adaptive management) has the potential to result in cumulative effects to aquatic and fish habitat and recreational fishing in the larger Eagle Creek drainage due to reductions in surface water and groundwater availability. However, implementation of adaptive management would help to minimize cumulative impacts.

In June of 2012, the Little Bear Fire burned approximately 35,300 acres of National Forest System Lands on the Smokey Bear Ranger District of the Lincoln National Forest, with a total burn area 44,330 acres as of June 28, 2012. The burn severity was high or moderate throughout 53 percent of the wildfire. Bury et al.(no date) report that some research on large, stand-replacing wildfires on lotic biota suggests that wildfire ultimately benefits aquatic invertebrates and fishes, even those species that are negatively affected by the disturbance immediately after the wildfire. For example, Lyon suggested that some aquatic invertebrates may decline immediately after a wildfire, then increase to levels above pre-wildfire conditions as a response to increased stream productivity. Large fires can have long-term effects on streams by: (1) reducing invertebrate diversity for a decade or longer; (2) changes in peak discharge, stream channel morphology, large woody debris inputs, and sediment loadings; and (3) elevated temperature and altered water chemistry. Also, the effects of wildfire on stream biota may be more pronounced in headwater streams than in mid-order or larger streams. McCormick, et al.(2010) provide references that indicate that where native fish populations are naturally depauperate or have declined and become increasingly isolated because of anthropogenic activities, the effects on fish populations are more pervasive and long lasting. There are no connected actions that would add to the cumulative effects.

Conclusion

Implementation of alternative 3 (adaptive management), may impact aquatic habitat and fish habitat (primarily nonnative brook trout and rainbow trout habitat) including habitat for many aquatic organisms and aquatic plants when compared to a no pumping situation; continued pumping would prohibit full recovery to pre-pumping conditions, but closely monitored pumping, as described for alternative 3 (adaptive management), would be an improvement over existing conditions.

There would be no disturbance to aquatic or fish species' habitat from activities at the well sites including road maintenance, well house activities, maintenance of underground power line and pipeline, well operation, vehicle ingress and egress, and mechanical maintenance of the wells because there would be no soil movement into the stream and because of implementing conservation measures.

Update to overall effects from Alternative 3 due to the Little Bear Fire:

In the short term, reduced water quality, channel morphology changes, and deeper alluvial deposits due to the wildfire would continue to reduce the fish and aquatic habitat quality in the project area while the watershed is recovering. During the short term post-wildfire recovery period, pumping effects would be limited to the extent possible through an iterative and adaptive approach as the landscape, stream channel, and groundwater recharge processes adjust to the wildfire disturbance. Under alternative 3, the potential for fish and aquatic habitat improvement would continue to be limited but not as much as under alternative 1.

Over the long term, during dry years, adaptive management would improve flow conditions and reduce the amount of no-flow days along the North Fork Eagle Creek. With respect to surface flows and alluvial groundwater levels, an approximate middle ground between alternative 1 and 2 would be attained during average precipitation years under alternative 3.

In the long term (after post-wildfire recovery), watershed conditions are expected to return to approximate pre-wildfire conditions. If conifer stands burned at moderate to high severity convert to grass or shrubs, less evapotranspiration could improve water yield and groundwater availability. If this occurs with adaptive management of North Fork Eagle Creek pumping under alternative 3, aquatic habitats could be enhanced and additional opportunities for improving riparian conditions

could result. Therefore, beneficial effects from implementing alternative 3 over the long-term would be the same as the pre-wildfire assessment for alternative 3.

Summary

Implementation of alternative 2 (no action) and alternative 3 (adaptive management), would both achieve the second need statement for this project which is “protecting natural resources on the national forest by maintaining adequate surface and groundwater flows to sustain or improve the riparian and aquatic ecosystems that may be affected by groundwater drawdown from the pumping of these wells”; alternative 2 (no action) would likely improve aquatic and fish habitat while alternative 3 (adaptive management) would likely sustain aquatic and fish habitat. Because both alternatives would either sustain or improve aquatic habitat quality, both alternatives meet this need. However, alternative 2 (no action), would move the project area toward desired conditions quicker than alternative 3 (adaptive management). Alternative 1 (no change) does not meet this need statement since long-term adverse impacts to streamflows and aquatic habitat and fish are predicted, particularly when combined with long-term shifts in climatic conditions.

Significant Issue: Riparian Vegetation

Relevant forest plan direction related to riparian vegetation in this project is included in chapter 1. We used this direction to guide the analysis of the effects of the alternatives to riparian resources.

We include a more detailed description of affected environment, methods, and environmental consequences for this project in the riparian report (Miller 2012a and Miller 2015a). The supplemental riparian report (Miller 2015) provides a more detailed description of affected environment, methods, and environmental consequences, considering the changes caused by the Little Bear Fire. These reports are incorporated by reference, discussed briefly below, and available in their entirety in the project record.

Methodology

In order to determine existing conditions, we conducted riparian vegetation surveys in 2010 and 2011 in order to characterize the vegetation along the North Fork Eagle Creek (North Fork) and provide a comparison for future monitoring to determine changes over time. The field protocol we used was created by the Stream Systems Technology Center (Merritt and Dwire 2008). We collected tree composition, stem density, basal area, frequency, dominance, and importance at each plot and elevation above the channel and we calculated distance from the active channel from survey data and through use of 2009 National Agriculture Imagery Program aerial imagery using ArcGIS 9.3. Merritt and Dwire (2008) and Miller (2012a) provide detailed field methods, preliminary results, and photographs. Analysis and interpretation of this baseline riparian vegetation data is provided in Merritt and Bevan (2011) and Miller (2012a) and summarized in this section.

In order to determine the conditions of riparian vegetation before North Fork Eagle Creek well pumping began in 1988 and whether North Fork riparian vegetation has changed as a result, qualitative differences in vegetation along the North Fork Eagle Creek and South Fork Rio Bonito were made through use of photographs taken in July 2011 (Merritt and Bevan 2011), as described in more detail in the next section. We explored other methods to assist in describing pre-well pumping riparian conditions and these are summarized in the next section and provided in detail in Merritt and Bevan (2011) and Miller (2012a).

Well pumping results in changes in the water table which may affect streamflow to varying degrees. These water quantity changes could indirectly affect the quantity and quality of riparian vegetation along the stream corridor. Alternatives are compared using the following indicators:

Canopy Cover: Predicted qualitative shifts in canopy cover for trees over time, based on implementing each alternative.

Species Composition: Predicted qualitative shifts in communities over time, based on implementing each alternative.

The analysis of the alternatives presented in this section is qualitative and predicts the effect of proposed actions on riparian vegetation and riparian tree species within the North Fork Eagle Creek. We characterize short-term effects as 1 to 10 years and long-term effects as 10 to 20 years. We selected the North Fork Eagle Creek drainage area (figure 2) as the spatial effects boundary it contains the area of predicted direct/indirect effects from projected drawdown (figure 12 and figure 13). Accordingly, the cumulative effects boundary matches the largest area of indirect effects.

Analysis emphasis was put on the North Fork below the North Fork gage since this area is within the cone of depression as identified by Matherne et al. (2011) and within the area of drawdown as depicted in figure 12 and figure 13 meaning that this area is the most likely to show changes to riparian vegetation due to changes in hydrology. Cumulative effects were determined using Lincoln National Forest shapefiles of past project areas and considered past, present, and foreseeable future actions as described in table 4 and figure 4. Baseline information used to assess impacts to riparian vegetation was provided by USDA Forest Service specialists using professional judgment.

While the area has been examined during the Burned Area Emergency Response effort and some quantitative work has been done (Kuhar 2012 and 2013), the original transects that established the 2010 riparian vegetation condition were not sampled again.

Incomplete and Unavailable Information

There is minimal information and data regarding the condition and extent of riparian vegetation along the North Fork prior to well pumping. We have no baseline vegetation monitoring or any photo sampling prior to the initiation of North Fork Eagle Creek well pumping in 1988. Because of this, we attempted to establish a reference reach (another physically and hydrologically similar stream that might emulate prepumping conditions along the North Fork). We initially considered several areas (South Fork Eagle Creek, North Fork Eagle Creek upstream from the wells and above the North Fork stream gage, Eagle Creek below the Eagle Creek gage, Turkey Canyon, Bear Creek, upper watershed of South Fork Rio Bonito, Bonito Creek, Cedar Creek and South Fork of Rio Bonito). With the exception of South Fork Rio Bonito, none of these other reaches met the criteria for a suitable reference reach based on various rigorous GIS analyses of physical conditions, opinions from local district staff familiar with these areas, and/or field visits. South Fork Rio Bonito seemed the most similar to the North Fork Eagle Creek based on physical attributes and we field checked it in 2011. This field check concluded that, while the reach had similar characteristics, it was different enough than the North Fork Eagle Creek in several factors that it raised doubt about whether it would provide a suitable comparison. For purposes of this analysis, we did not pursue a quantitative comparison for these reasons. However, detailed photos were taken along South Fork Rio Bonito during 2011 and were used to provide some qualitative generalized comparisons to riparian vegetation potential along the North Fork Eagle Creek. Merritt and Bevan (2011) provide more details regarding this comparison and the results.

We obtained prepumping aerial images of the North Fork Eagle Creek and they showed significant flooding in 1986 and 2007/2008 between photographic periods (prepumping images from 1987; postpumping images from 1994 and 2009) and this likely obscured any changes in channel form that might have been attributable to upstream groundwater pumping and depletion of surface flow and groundwater levels. Changes attributable to altered groundwater levels and streamflow can include channel narrowing or channel widening depending upon the type of alteration and the setting; we could not ascertain this from the aerial photo analysis.

Affected Environment

Current Conditions

Riparian vegetation along the North Fork is comprised largely of upland, xeric species. This is indicative of riparian areas adjacent to streams with intermittent flow and water tables sufficiently deep to exclude many phreatophytes[5] and plants with high water requirements.

There are seven primary community types represented but the most frequently occurring plant community type is the creeping bentgrass/orchard-grass/fringed brome community, followed by the marsh muhly/wheatgrass community.

Seven species in all the sampled quadrats[6] were facultative wetland plant species[7] (occurring in wetlands 67 to 99 percent of the time), as shown in table 12, and these facultative wetland species make up only 13 percent of all species sampled. With the exception of marsh muhly, none of these species were community dominants and none occurred in more than three quadrats. All of the facultative wetland species were native to New Mexico with the exception of common sheep sorrel and curly dock. There were no obligate wetland species[8] (occuring in wetlands 99 percent of the time) in any sampled quadrat. Rooting depths for these species are also noted in table 12.

Table 12. Species classified as facultative wetland plants (Reed 1988) occurring in the North Fork Eagle Creek sampled quadrats

Common Name Species	Species	Number of Quadrats	Minimum Rooting Depth (inches)[a]
boxelder	*Acer negundo*	2	40
Parry's thistle	*Cirsium parryi*	1	Not applicable
largeleaf avens	*Geum macrophyllum*	1	12
marsh muhly	*Muhlenbergia racemosa*	13	8
cutleaf coneflower	*Rudbeckia laciniata*	3	12
common sheep sorrel	*Rumex acetosela*	3	Not applicable
curly dock	*Rumex crispus*	3	Not applicable

a - From USDA Natural Resources Conservation Service, 2012: http://plants.usda.gov

We recorded four tree species in sampled plots and we used their relative density, dominance, and frequency to develop an importance value (as described in more detail in Merritt and Bevan (2011)

[5] A plant with a deep root system that draws its water supply from near the water table.
[6] A quadrat is a square (of either metal, wood, or plastic) used in ecology and geography to isolate a sample, usually about $1m^2$ or $0.25m^2$. The quadrat is suitable for sampling plants, slow moving animals (such as millipedes and insects), and some aquatic organisms.
[7] Facultative wetland species usually occur in wetlands (estimated probability 67–99 percent), but are occasionally found in nonwetlands.
[8] Obligate wetland species occur almost always (estimated probability 99 percent) under natural conditions in wetlands.

and Miller (2012a)). These species, ranked from most important to least important, are as follows: white fir, ponderosa pine, boxelder, and Mexican white pine.

Boxelder is the only species on this list that is considered a riparian species due to its dependence on shallow groundwater. Boxelder ranked below or nearly equal to the upland species occurring on the valley bottom, indicating that it is no more abundant in the North Fork riparian areas than drought tolerant upland species. Both Pacific willow and Wooton's hawthorn (a Forest Service sensitive species) occur along the sampled North Fork reach, but none were sampled in the inventory. Pacific willow is a riparian species dependent upon shallow water tables (with a minimum rooting depth of 10 inches) and Wooton's hawthorn is a riparian species indicative of relatively shallow groundwater; because this species is a Forest Service sensitive species, it is discussed further in the "Vegetation" section later in this chapter, under "Threatened, Endangered and Sensitive Species."

The presence of willow, Wooton's hawthorn and seven facultative wetland species indicates that the North Fork Eagle Creek maintains some moister microhabitats with sufficiently shallow groundwater and or soil moisture to support such species.

Conditions before Pumping Began in 1988

Data relating to the pre-well pumping riparian vegetation in the project area is sparse. Fish survey reports from the 1960s (Little 1960a, b; Little 1961) include notes regarding vegetation in the project area (shoreline vegetation was ponderosa pine with various grasses and forbs) and include photos at sampling stations that closely resemble current vegetation, with ponderosa pine and grass along streambanks. Range reports (Edwards 1963, Edwards 1964) include notes that the area was comprised of several vegetation types including mixed conifer, ponderosa pine, mountain bunchgrass and bluegrass bottom and that the area had "deteriorated" to a Kentucky bluegrass, forb type with an increase in erosion. Medlock (2011) provides a compelling case for the lower half of the North Fork being intermittent prior to pumping. Included in his report is an historical photo of the area showing vegetation similar to current vegetation in the area above the well field in 1947. Of particular note in this photo is the lack of obligate wetland species one would associate with a riparian community along a perennial stream (e.g. willow and cottonwood in the overstory).

Though we do not know the prepumping condition of North Fork riparian vegetation, we do know there has been reduced water availability along the North Fork since the North Fork Eagle Creek wells began pumping, as described in more detail in the "Water Resources" section of this chapter. Reduced water availability can affect riparian vegetation. Reduced water availability for plants can also be influenced by flood deposited alluvium in the valley bottom of the North Fork which raises the flood plain and channel, and causes the stream to flow below the alluvium. Either of these factors could explain the existing conditions and composition of the riparian vegetation along the North Fork. Figure 16 illustrates a typical reach of the North Fork during the 2011 survey. We did note significant changes in the aerial extent of coarse alluvium and channel widening in aerial images taken after major flooding in 1986 and in 2007/2008. For comparison, figure 17 illustrates a typical reach along South Fork Rio Bonito during the 2011 field visit. While we determined that, based on the current level of information, South Fork Rio Bonito may not provide a suitable reference reach from which to establish a baseline survey and quantitatively compare to survey results from the North Fork Eagle Creek, it provided a useful tool for visual comparison and inferences about riparian potential along the North Fork if there were more sustained elevated water tables.

Figure 16. North Fork Eagle Creek showing channel and adjacent vegetation (photographs taken by Terry Miller in July 2011)

The upper and lower left frames of figure 16 show a dry streambed, with vegetation on either side of a barren channel. A solitary *Salix lucida*, shown in the left lower frame, looks to be in poor condition either from drought stress or browsing. The lower right frame shows a quadrat (R2T1P1) that is dominated by *Sprorobolus cryptandrus* and follows into the community of the same name. The plot also contains *Artemisia ludoviciana* and *Muhlenbergia racemosa*.

The riparian vegetation in figure 17 appears roughly similar in composition with the North Fork Eagle Creek, but with higher abundance than seen in figure 16. This may be indicative of more sustained elevated water tables along the South Fork Rio Bonito compared to the North Fork.

Figure 17. South Fork Rio Bonito showing various degrees of intermittent to perennial flows (photographs taken by Terry Miller in July 2011)

Conditions Following the Little Bear Fire

The Little Bear Fire burned throughout the analysis area. Burn intensities in the riparian area (200 feet on each side of Eagle Creek) were low in general. Approximately 82 acres (47 percent of total riparian) were underburned, 93 acres (53 percent of total riparian) burned at low intensity and 1 acre (less than 1 percent of total riparian) burned at moderate intensity.

A field visit on November 19, 2013 revealed that most of the riparian vegetation in the sampling area looked minimally unaffected by the wildfire and related indirect effects such as flooding. Some sites showed signs overland flow of sediment where vegetation was buried at the time of the field visit. Most transects were missing at least one of the rebar pieces marking the beginning or end of the transect. Bank erosion had scoured away at least five meters of bank at Reach 3 Transect 1. Additionally, neither piece of rebar was located at this transect. Larger and more durable transect markers will have to be placed using GPS and photos from the monitoring report. The area most affected (in the reaches where riparian monitoring took place) by the flooding following the wildfire is at the confluence of the north and south forks of Eagle Creek. Deep cobble dominates the area from Reach 4, Transect 2 to Reach 4, Transect 1, which totals approximately 400 feet (700 feet from the gage at the road).

Environmental Consequences

Alternative 1 - No Change
Direct and Indirect Effects

There are no direct effects to riparian vegetation from continuing current pumping operations under alternative 1 (no action). However, indirect effects are likely. Indirect effects would occur when water table drawdown limits available moisture to riparian vegetation and creates sustained water tables below the minimum rooting depths for facultative wetland species (table 12). This can cause poor growth, reduced seed production, and in severe enough cases, the death of individual plants, loss of species, and vegetation change.

As described in the “Water Resources” section earlier in this chapter, the general duration of no surface flow days at the Eagle Creek gage is approximately 1 to 2 weeks during average precipitation periods and approximately 8 to 10 weeks during drought periods. Streamflow quantities are anticipated to decline over the long term from climate change effects, with the spatial extent and duration of no-flow conditions increasing along the North Fork. The presence of flows equal to or greater than 1.2 cubic feet per second would decline, which would reduce water availability in the alluvium for plant growth and sustenance. Opportunities for maintaining or improving watershed condition on National Forest System lands in the upper Eagle Creek drainage would become severely limited.

If groundwater levels were lowered below present levels for a sustained period of time and surface flow was to become less frequent, it is very likely that vegetation change would occur. This shift would likely include a decrease or loss in those species dependent upon shallow groundwater (table 12), and an increase in xeric, upland plant species. Factors that distinguish riparian areas from uplands include the presence of shallow groundwater and periodic flood-related disturbance (Merritt et al. 2010).

Though groundwater pumping would likely have no effect on periodic high flows and related fluvial processes, reductions in groundwater levels could cause riparian areas to become compositionally similar to adjacent uplands. Shifts in vegetation along riparian areas correspond to the degree of hydrologic change. Minor changes (e.g., small reductions in groundwater levels) could result in a shift in species to lower elevations closer to the water table and nearer the active channel. Such shifts are common along streams in response to the availability of water (Merritt et al. 2010). However, once groundwater levels (and subsequent vadose zones[9] and seasonal soil moisture) fall below the threshold of the water requirements of a species, those species will not persist in the system. The vadose zone extends from the top of the ground surface to the water table.

If groundwater were depleted and surface flow were reduced from its current state along the North Fork, one might initially expect boxelder, Pacific willow, and other phreatophytic shrubs and trees to temporarily show signs of drought stress and reduced canopy cover. Shifts and losses of the primary community types along the North Fork would likely occur as well. Chronic reduction in groundwater levels during the growing season would likely result in the loss of phreatophytes, and conversion to upland forest and meadow, and the potential for communities not currently represented along the North Fork to become established. In such a scenario, communities in and along the channel may be

[9] Vadose water is located in the pore spaces of a rock or soil, in the zone of soil or rock between the ground surface and the water table.

well represented by ruderal species[10], generalists, and those natives adapted to periodically disturbed, dry conditions.

Species Composition:

Although most of the North Fork riparian vegetation is well adapted to dry periods, maintaining diversity in the riparian area relies on retaining the facultative wetland species and the communities in which they live. While elements of these species and communities would probably remain in microsites, it is likely that vegetation would shift toward the channel and to lower elevations nearer the water table under alternative 1 (no action).

Riparian Tree Species Canopy Cover:

Boxelder would likely remain in the North Fork Eagle Creek riparian area at its currently low levels in even the most extreme drawdown scenarios due to the widespread nature of the species and the continued recruitment of new generations. However, only nine individual Pacific willow plants were identified and there appears to be no recruitment of younger age classes even though the adult plants looked healthy.

Updates to Direct/Indirect Effects of Alternative 1 Due to the Little Bear Fire

The Little Bear Fire will likely result in a shifting of sediment and cobble around as seen in the area between Reach 4, Transect 2 to Reach 4, Transect 1(AECOM 2015). The instability of the channel could result in some riparian areas being buried and an increase in alluvium that would reduce surface flow in the short term. However, these effects could be offset by the opportunity for species such as willows to colonize new areas. Water availability to riparian vegetation is not likely to be greatly changed as a result of the Little Bear Fire in the long term. One possibility is that there might be a slight increase in water availability if large portions of the upland vegetation convert to shrub species (AECOM 2015). While possible, this conversion is not a forgone conclusion. However, nearby burned areas have converted from upland vegetation to shrub species (Kuhar 2013).

Cumulative Effects

Implementing past, present, and future activities within the North Fork drainage area (figure 2 and table 4) with implementing alternative 1 (no action) would result in no more than minor cumulative impacts to riparian vegetation because these activities do not typically take place in the riparian corridors or would have effects that are so small in magnitude as to be irrelevant.

Streamside riparian vegetation outside of the North Fork drainage area was not included in the cumulative effects boundary (based on the definition and rationale for spatial boundaries we present in the “Methodology” section) but we did qualitatively consider it using the results of the water resources evaluation in this larger area. As stated in the “Water Resources” section, cumulative water resources impacts would involve ongoing reductions in flow and water quality along Eagle Creek within the larger upper Eagle Creek cumulative impact area, due primarily to reduced groundwater recharge. These would be adverse, long term and regional impacts that would range in severity from moderate to severe. Additional water supply developments in the region would create further impacts to surface water and groundwater; these impacts would also likely result in adverse impacts to associated resources, like streamside riparian vegetation. The level of site-specific effect to riparian vegetation further downstream and outside the North Fork Eagle Creek project area cannot, however, be predicted with certainty.

[10] A ruderal species is a plant species that is first to colonize disturbed lands.

Updates to Cumulative Impacts from Alternative 1 Due to the Little Bear Fire

The Little Bear Fire was widespread across several drainage basins, including Little Creek and the Rio Bonito. Widespread cumulative wildfire impacts on surface runoff, groundwater recharge, and water quality were described in the water resources report (AECOM 2015). Riparian vegetation downstream and outside the North Fork Eagle Creek drainage area could experience greater cumulative impacts since the footprint of effects from the Little Bear Fire is so large.

Conclusion

Implementing alternative 1 (no change) could result in the loss of Pacific willow, which is an important component of the North Fork riparian vegetation diversity. However, based on the best available information, this stretch of the North Fork was intermittent before the wells began pumping and exhibited periodic stretches of no flow regardless of pumping. Pacific willow, then, has probably never been a major component of the vegetation in this area, but is well represented in the perennial portion of the North Fork upstream from the wells. This upstream area would not be affected by implementation of alternative 1 (no change), as described in more detail in the “Aquatic Habitat and Fish” section earlier in this chapter.

Implementing alternative 1 (no change), then, would either marginally maintain current riparian vegetation condition in the project area in the short term or result in some declines due to continued reductions in water availability. Over the long term, however, climate change induced shifts toward drier conditions, as described in the “Water Resources” section of this chapter, would result in additional stress to riparian vegetation and would experience adverse effects. Therefore, alternative 1 (no change) may be in compliance with the forest plan over the short term, but would not achieve the purpose and need for action or project objectives and would not move the project area toward desired conditions over the long term.

Update to overall effects from Alternative 1 due to the Little Bear Fire:

In the short-term, wildfire effects are likely to result in a shifting of sediment and cobble. This channel instability could result in some riparian areas being buried and an increase in alluvium that would reduce surface flow. However, these adverse effects to riparian tree species and communities could be offset by the opportunity for species such as willows to colonize new areas.

Over the long term, water yield and groundwater availability may improve as shown in the water resources analysis, benefiting riparian habitat. However, continued pumping would obscure some of these potential benefits. Therefore, adverse effects from implementing alternative 1 over the long term would be the same as, or slightly less than, the pre-wildfire assessment for alternative 1.

Alternative 2 - No Pumping

Direct and Indirect Effects

Implementing alternative 2 (no pumping) would result in direct adverse effects to a small portion of the riparian vegetation because of ground disturbance related to removing pumps. This could result in plants being uprooted, crushed, and killed. Due to the size of area of disturbance and implementation of project design features, this effect would be minor and short term.

Indirect beneficial effects from alternative 2 (no pumping) would result from an increase in available moisture for riparian vegetation. While surface flow would remain consistent with an intermittent stream, increases in surface flow and groundwater and subsequent moisture available for plant growth would provide an opportunity for riparian vegetation expansion.

Species Composition:

Facultative wetland species would be beneficially affected by implementing alternative 2 (no pumping). Increases in communities featuring facultative wetland species would likely occur due to increased water availability, but the magnitude of change would likely be relatively minor. Over the long term, these positive changes could be affected by climate change and may be less widespread with shifts toward drier conditions, as described in the "Water Resources" section of this chapter.

Riparian Tree Species Canopy Cover:

Boxelder would remain relatively constant or would increase somewhat under implementation of alternative 2 (no pumping), and Pacific willow would likely increase due to improved moisture for seedling establishment. Over the long term, these positive changes could be affected by climate change and may be less widespread with shifts toward drier conditions, as described in the "Water Resources" section of this chapter.

There are no anticipated changes in effects to riparian vegetation as a result of the Little Bear Fire in alternative 2.

Cumulative Effects

Implementing past, present, and future activities within the North Fork drainage area (figure 2 and table 4), in addition to implementing alternative 2 (no pumping), would result in no more than minor cumulative impacts to riparian vegetation because these activities do not typically take place in the riparian corridors or would have effects that are so small in magnitude as to be irrelevant.

Streamside riparian vegetation outside of the North Fork Eagle Creek drainage area was not included in the cumulative effects boundary (based on the definition and rationale for spatial boundaries we present in the "Methodology" section) but we did qualitatively consider it using the results of the water resources evaluation in this larger area. As stated in the "Water Resources" section, beneficial cumulative recharge effects to aquifers, springs and seeps, and possibly stream base flows may result within parts of the Eagle Creek drainage. The magnitude and extent of these effects is unknown, since it is likely that the Village of Ruidoso would continue to exercise its water rights and make withdrawals elsewhere in the Eagle Creek system. Impacts from such activities could offset beneficial impacts from no pumping at the North Fork Eagle Creek well field. These impacts could result in beneficial impacts to associated resources, like streamside riparian vegetation. The level of site-specific effect to riparian vegetation further downstream and outside the North Fork Eagle Creek project area cannot, however, be predicted with certainty.

Conclusion

Implementing alternative 2 (no pumping) would at least maintain and possibly improve riparian vegetation condition in the project area. Therefore, it would be in compliance with riparian direction in the forest plan and would achieve the purpose and need for action and project objectives. Implementation of alternative 2 (no pumping) would move the project area toward desired conditions more so than either alternative 1 (no change) or alternative 3 (adaptive management).

Update to overall effects from Alternative 2 due to the Little Bear Fire:

In the short term, wildfire effects are likely to result in a shifting of sediment and cobble. This channel instability could result in some riparian areas being buried and an increase in alluvium that would reduce surface flow. However, these adverse effects to riparian tree species and communities could be offset by the opportunity for species such as willows to colonize new areas. The effects of no pumping would encourage the occurrence of streamflow and increased groundwater levels (more so

than under alternative 1) although large portions of the stream would remain intermittent during periods of average precipitation. Pools and stretches of surface water may be reduced and this could affect riparian habitat. Under alternative 2, the potential for riparian habitat improvement will continue to be limited but not as much as under alternative 1.

Over the long term, after watershed recovery, effects from no pumping would be the same as those described in the pre-wildfire assessment for alternative 2.

Alternative 3 - Adaptive Management
Direct and Indirect Effects

There are no direct effects as a result of implementing alternative 3 (adaptive management), since no ground-disturbing activities would occur. Indirect effects would be more similar to those from the no pumping alternative 2, than to the no action alternative 1. Beneficial effects would result from an increase in available moisture for riparian vegetation. While surface flow would remain consistent with an intermittent stream, and no-flow days would not be eliminated, increases in surface flow and groundwater and subsequent moisture available for plant growth would provide an opportunity for limited riparian vegetation expansion.

Species Composition:

Facultative wetland species would be beneficially affected by this alternative compared to implementing alternative 1 (no action) but less so than for alternative 2 (no pumping). Increases in communities featuring facultative wetland species would likely occur due to increased water availability, but the magnitude of change would be relatively minor and less than that expected for alternative 2 (no pumping). Over the long term, positive changes could be affected by climate change and may be less widespread with shifts toward drier conditions, as described in the “Water Resources” section of this chapter.

Riparian Tree Species Canopy Cover:

Boxelder and Pacific willow would remain relatively constant under implementation of alternative 3 (adaptive management), although some willow recruitment would be possible if climatic conditions are favorable. Over the long term, any changes could be affected by climate change and may be less widespread over the long term with shifts toward drier conditions, as described in the “Water Resources” section of this chapter.

Updates to Direct and Indirect Effects from Alternative 3 Due to the Little Bear Fire:

Change in effects are expected to be the same as those described in alternative 1, except that any positive benefit from increased availability of water to riparian vegetation would be greater in magnitude in alternative 3.

Cumulative Effects

Implementing past, present, and future activities within the North Fork drainage area (figure 2 and table 4) in addition to implementing alternative 3 (adaptive management), would not result in more than minor cumulative impacts to riparian vegetation because these activities do not typically take place in the riparian corridors or would have effects that are so small in magnitude as to be irrelevant.

Streamside riparian vegetation outside of the North Fork Eagle Creek basin was not included in the cumulative effects boundary (based on the definition and rationale for spatial boundaries we present in the “Methodology” section) but we did qualitatively consider it using the results of the water resources evaluation in this larger area. As stated in the “Water Resources” section, cumulative water

resources impacts would include flow and water quality reductions in Eagle Creek within the cumulative impact area. Water supply pumping for the applicant is conducted at six water wells along lower Eagle Creek, and the village diverts surface water from the stream a short distance below the Eagle Creek gage. As a result, groundwater recharge in downstream alluvial and bedrock aquifers would still be adversely affected, but to a lesser extent than under alternative 1 (no action). Implementing alternative 3 (adaptive management) would have minor effects on these impacts, as pumping in the North Fork Eagle Creek would generally be permitted most of the time. These impacts could result in impacts to associated resources, like streamside riparian vegetation. The level of site-specific effect to riparian vegetation further downstream and outside the North Fork Eagle Creek project area cannot, however, be predicted with certainty.

Conclusion

Implementing alternative 3 (adaptive management), would maintain and likely improve riparian vegetation condition in the project area, although not to the level expected under alternative 2 (no pumping). Therefore, it would be in compliance with riparian direction in the forest plan and would achieve the purpose and need for action and project objectives. Implementing alternative 3 (adaptive management) would move the project area toward desired conditions but likely at a slower pace than alternative 2 (no pumping).

Update to overall effects from Alternative 3 due to the Little Bear Fire:

In the short-term, wildfire effects are likely to result in a shifting of sediment and cobble. This channel instability could result in some riparian areas being buried and an increase in alluvium that would reduce surface flow. However, these adverse effects to riparian tree species and communities could be offset by the opportunity for species such as willows to colonize new areas.

During the short term post-wildfire recovery period, pumping effects would be limited to the extent possible through an iterative and adaptive approach as the landscape, stream channel, and groundwater recharge processes adjust to the wildfire disturbance. Under alternative 3, the potential for riparian habitat improvement will continue to be limited but not as much as under alternative 1.

Alternative 3 would encourage the occurrence of streamflow and increased groundwater levels (more so than under alternative 1) although large portions of the stream would remain intermittent during periods of average precipitation. Pools and stretches of surface water may be reduced and this could affect riparian habitat.

Over the long term, during dry years, adaptive management would improve flow conditions and reduce the amount of no-flow days along the North Fork Eagle Creek. With respect to surface flows and alluvial groundwater levels, an approximate middle ground between alternative 1 and 2 would be attained during average precipitation years under alternative 3. Over the long term, after watershed recovery, effects from implementing an adaptive management strategy would be the same as those described in the pre-wildfire assessment for alternative 3.

Summary

Implementing the no pumping alternative 2 or alternative 3 (adaptive management), would achieve the second need statement for this project which is “protecting natural resources on the national forest by maintaining adequate surface and groundwater flows to sustain or improve the riparian and aquatic ecosystems that may be affected by groundwater drawdown from the pumping of these wells.” Because both alternatives would either sustain or improve riparian vegetation in the North Fork Eagle Creek drainage area, both alternatives meet this need. However, alternative 2 (no pumping) would

move the project area toward desired conditions more quickly than alternative 3 (adaptive management). Alternative 1 (no change) does not meet this need statement since long-term adverse impacts to streamflows and riparian habitat are predicted, particularly when combined with long-term shifts in climatic conditions.

Implementation of alternative 1 (no change) would either marginally maintain current riparian vegetation condition in the project area in the short term or result in some declines due to continued reductions in water availability. Over the long term, however, climate change induced shifts toward drier conditions, as described in the "Water Resources" section of this chapter, would result in additional stress to riparian vegetation and would experience adverse effects. Therefore, alternative 1 (no action) may be in compliance with the forest plan over the short term, but would not achieve the purpose and need for action or project objectives and would not move the project area toward desired conditions over the long term.

Effects compared to pre-pumping conditions

The effects of all alternatives compared to pre-pumping conditions are uncertain because baseline vegetation monitoring was not undertaken prior to the development of the well field. Alternative 1 has likely led to a shift in riparian community to drier conditions as illustrated in figure 16. Alternative 2 would result in an increase of available moisture for riparian vegetation Riparian vegetation should increase in quality and expand away from the channel. The drainage would remain an intermittent stream in the lower area near the well field, which would limit expansion of riparian vegetation. Alternative 3 would maintain riparian vegetation at the current state, but without baseline monitoring it's not possible to determine the shift in riparian vegetation that has occurred since pumping began.

Significant Issue: Socioeconomics

The level of North Fork Eagle Creek well pumping has the potential to affect local social and economic conditions. Defining features of every area influence and shape the nature of local economic and social activity. Among these are unique area natural amenities and features provided by the Lincoln National Forest. Changes to these features in turn can affect local social and economic conditions. For example, the quality of recreation experience may be affected by changes in the quantity and quality of surface flow in Eagle Creek. In addition, limitations on groundwater withdrawals under this EIS could affect the supply of water available for diversion for the Village of Ruidoso.

We include a more detailed description of affected environment, methods, and environmental consequences for this project in the socioeconomics report (Eichman 2015) and includes a more detailed description of affected environment, methods, and environmental consequences, considering the changes caused by the Little Bear Fire. These reports are incorporated by reference, discussed briefly below, and available in their entirety in the project record.

Methodology

Groundwater withdrawal limitations may affect the supply of water available for diversion by the applicant. Well pumping may result in changes to groundwater and surface water availability which has the potential to affect streamside recreation use (public use of streams for streamside recreation, fishing, and wildlife viewing) and private land (availability of water for domestic wells). In addition, impacts to quality of life and environmental justice effects were of concern. Consequently, the following social and economic indicators are used to compare the effects of each alternative.

Where updates are necessary due to the Little Bear Fire, these are noted in the following text for this section.

Municipal Water Supply:

Estimates of potential forgone water diversion from groundwater withdrawal limitations are used to measure the potential for change to historic North Fork Eagle Creek well diversion. Effects of groundwater withdrawal limitations are examined on historic North Fork Eagle Creek well diversion (average annual), diversion for Alto Creek and Grindstone Reservoirs (average annual) and projected demands from the 40-year water plan. In addition, effects of groundwater withdrawal limitations are examined on historic North Fork Eagle Creek well diversion during the 5-month summer resort period (high demand on water use) from May to September. These estimates also consider effects to village diversion from additional indirect diversion attributable to North Fork Eagle Creek wells from the 50 percent return flow credit[11].

Municipal water supply indicators examine the effect of groundwater withdrawal limitations using an estimate of potential forgone water diversion over estimates of pumping restriction durations. The Village of Ruidoso anticipates that it will be a period of years before attenuation of wildfire effects will allow a resumption of the full use of Eagle Creek surface water, groundwater and the diversion credits for the return flow credit (Atkins 2014). This analysis assumes this attenuation will occur as stated in the water resources section: “After approximately four to eight years following the Little Bear Fire, long-term post-wildfire conditions are expected to more generally resemble the pre-wildfire hydrologic setting” (page 100 of “Water Resource” section). Thus the pre-wildfire data characterizing historic municipal water supply sources are an accurate depiction of a post-wildfire baseline useful for analysis of groundwater withdrawal limitations. Historic data on surface flow indicate that, had similar restrictions been implemented historically, pumping would have been limited over a broad range of time (from 0 weeks in most years, to 2 to 3 weeks in water year 2000, and approximately 20 weeks in water year 2004) (AECOM 2012). Restrictions would decrease the amount of water the village could withdraw by limiting the pumping rate to 50 percent of the streamflow reported at the North Fork gage. Using historic data of surface flow during years where restrictions would have occurred provides a frame of reference for forgone water diversion (50 percent of streamflow) during these periods. During water years 2000, 2003, and 2004 half of the average daily surface flow was 0.219 cubic feet per second, based on data in the Water Resources Report, appendix A (AECOM 2012). Over periods ranging between 2 to 22 weeks, restrictions would have amounted to approximately 3.3 to 33.5 cubic feet per second of forgone water diversion in some water years between 2000 and 2010. Converting to acre feet per day indicates that restrictions, when they might have occurred historically, would have ranged from approximately 6.5 acre-feet over 2 to 3 weeks up to approximately 66.5 acre-feet over 20 to 22 weeks in a water year.

Loss of North Fork Eagle Creek well diversion has occurred as a result of the Little Bear Fire in June of 2012. The Village of Ruidoso anticipates that it will be a period of years before attenuation of wildfire effects will allow a resumption of the full use of Eagle Creek surface water, groundwater and the diversion credits for the return flow credit (Atkins 2014). This analysis assumes this attenuation will occur. Thus the pre-wildfire data characterizing historic municipal water supply sources are an

[11] The village receives a 50 percent return flow credit for all water produced from the North Fork well field. The return flow credit is the result of at least 50 percent of the water diverted from the North Fork well field being returned to the Rio Ruidoso via the village’s wastewater treatment plant. The return flow credit allows the village to divert 50 percent of the total quantity of water produced from the North Fork well field from other wells outside of the Eagle Creek watershed or surface water from the Rio Ruidoso.

accurate depiction of a post-wildfire baseline useful for analysis of groundwater withdrawal limitations.

Over the long term, post-wildfire vegetative transitions in the watershed may slightly improve groundwater availability within the North Fork Eagle Creek (North Fork Eagle Creek drainage on and off Federal land) (see water resources section). If this occurs, contributions to municipal water supply could be slightly greater throughout the year and during the 5-month summer resort period. Consequently, reliance on North Fork Eagle Creek well pumping may be less than depicted above. Effects on measures of dependency presented above can be considered an upper bound of potential effects. Thus, this should be considered a maximum reduction to municipal water supply contributions.

Streamside Recreational Use:

Streamside recreational use indicators are used to measure the potential for change to the quality of recreation experience from streamflow quantity and riparian vegetation associated with springs and seeps (as described in the "Water Resources" section earlier in this chapter).

As stated on page 128 of the water resource report, the former streamflow water quality indicator is not likely to apply either to short-term or long-term post-wildfire conditions, since the North Fork Eagle Creek channel will transport and re-work sediment and debris for a considerable number of years. In the short term, additional nutrient content in surface flows may enhance aquatic habitat conditions for some species. As stream deposits are reworked over the long term, additional turbidity and suspended organic carbon and silt will likely increase surface water temperatures and reduce oxygen availability, as a result of the wildfire. This reworking will likely occur periodically over the long term, due to intense rainfall or snowmelt events. During relatively stable interim periods, however, parts of the channel could reflect water quality similar to that before the fire. These areas would be pools and riffles that form and change over time as the channel geometry adjusts." Thus conclusions about effects to the quality of recreation experience, from changes to water quality, are difficult to make. If oxygen availability is reduced significantly, then impacts to recreation could be negative. However, if additional nutrients enhance the habitat for fish, recreation experiences could improve. Regardless, the streamflow quantity and springs and seeps indicators are sufficient for analysis of effects to the recreation experience.

Availability of Domestic Well Water and Water for Irrigation:

Availability of domestic well water indicators are used to measure the potential for change to private land water supply using an estimate of water drawdown similar to the springs and seeps indicator used above (as described in the "Water Resources" section earlier in this chapter). The availability of surface water for irrigation uses employs the streamflow quantity indicator (estimated durations of no surface flow and estimated occurrence of flows equal to or greater than 1.2 cubic feet per second during a year of average precipitation; Water Resources Report; AECOM 2012 and 2015).

Financial Efficiency (PNV)

Financial efficiency provides information relevant to the future financial position of the community if the project is implemented. Financial efficiency considers anticipated costs and revenues that are part of monetary transactions. According to OMB Circular A-94, PNV is the standard criterion for deciding whether a project is economically justifiable. Financial efficiency analysis is not intended to be a comprehensive analysis that incorporates monetary expressions of all known market and non-market benefits and costs. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited financial efficiency framework. These

non-market benefits and costs associated with the project are discussed throughout the Final SEIS and other specialist reports.

The analysis of financial efficiency is a comparison of those costs and benefits that can be quantified in terms of actual dollars spent or received in the analysis area. As the Forest Service Handbook 2409.18 indicates, this analysis provides a comparison of anticipated costs and revenues that are part of Forest Service monetary transactions. Given the information provided, financial efficiency measures are calculated in this analysis to provide a means of comparing the financial efficiency of alternatives. This analysis offers a consistent measure for comparison of alternatives. However, it should not be viewed as a complete answer. The financial efficiency measures discussed below, along with social, ecological or other non-market values discussed throughout the document, provide a complete comparison of the alternatives.

The alternatives are compared using a financial efficiency measure called present net value (PNV). This measure is generated with use of a technique called discounting which is based on a principle called the "Time Value of Money." The idea is that money received now is worth more than the same amount received in the future. This makes sense since the money received now could be put to some advantageous use or interest could accrue until the future date. Using this concept, costs occurring in the future must be discounted back to represent their current value. A 4-percent discount rate is commonly used for evaluations of long-term investments and operations in land and resource management by the Forest Service (FSM 1971.21). This discount rate is used in the calculation of present net value.

According to OMB Circular A-94, present net value is the standard criterion for deciding whether a project is economically justifiable. Present net value is a way of comparing all monetarily valued costs, and is calculated by subtracting the discounted sum of costs from the discounted sum of benefits. A positive present net value suggests the discounted sum of benefits is greater than the discounted sum of costs, and a negative present net value suggests the opposite. Since the benefit, in terms of maintained streamflow, water quality, and riparian habitat are not quantifiable the present net value represents the discounted sum of costs. These benefits are described qualitatively in the indicated sections of this document and supporting specialist reports in the project record.

The financial efficiency analysis is specific to the monitoring measures identified in Chapter 2. Costs include those listed in table 13. All costs, timing, and amounts were developed by the specialists on the project's interdisciplinary team with assistance from the Village of Ruidoso and John Shoemaker & Associates. Indirect effects on financial efficiency, associated with lease or purchase of additional water rights, are not considered under this analysis since these effects are not reasonably foreseeable under the alternatives. As discussed under cumulative effects, the village has taken actions to secure additional rights and diversion that would accommodate anticipated reductions in diversion under the alternatives. Thus analysis of potential costs of transfer or purchase of water rights is not reasonably foreseeable.

Table 13. Average annual costs used in financial efficiency analysis

Monitoring Measure (pages 44 to 48)	Description	Average annual cost
Monitoring Measure 1	Monitoring of existing monitoring wells (including maintenance)	$30,000
Monitoring Measure 1	Transducer maintenance	$3,000
Monitoring Measure 1	New Wells (3 total)	$66,000
Monitoring Measure 1	Fencing around wells	$16,000
Monitoring Measure 2	Slug tests/aquifer pumping tests	
Monitoring Measure 2	Slug test - low estimate	$20,000
Monitoring Measure 2	Slug test - high estimate	$30,000
Monitoring Measure 2	Aquifer pumping test - low estimate	$600,000
Monitoring Measure 2	Aquifer pumping test - high estimate	$1,000,000
Monitoring Measure 3	Monthly water quality field measurements at surface flow gages	$18,000
Monitoring Measure 4	Surface gage monitoring and maintenance	$17,160
Monitoring Measure 5	Monitoring springs and seeps	$78,000
Monitoring Measure 6	Monitoring Stream gradient, planform, and stability indicators	$12,000
Monitoring Measure 7	Install of weather station for Monitoring snowpack and precip. at one gage	$20,000
Monitoring Measure 7	Annual cost of weather station	$2,250
Monitoring Measure 8	Analyzing/modeling adaptive management triggers	
Monitoring Measure 8	Adaptive management triggers – low estimate	$175,000
Monitoring Measure 8	Adaptive management triggers – high estimate	$300,000
Monitoring Measure 9	Surface gage monitoring by USGS, USFS or other parties	$16,000
Riparian Vegetation Monitoring	Baseline riparian vegetation survey (every five years)	$3,170
Riparian Vegetation Monitoring	Interim annual riparian veg surveys	$317

Values, Beliefs, and Attitudes:

The values, beliefs, and attitudes of area communities are presented to address social considerations: where economic or other effects on area communities cannot be quantified, a qualitative discussion of nonmarket and social values has been added. Direction provided in 40 CFR 1502.23 and Forest Service Handbook 1909.15 (July 6, 2004) and 22.35 (January 14, 2005) provides for qualitative analysis to evaluate the effects of nonmarket values. Therefore, the alternatives' nonmarket aspects are discussed qualitatively where appropriate and are described in other resource sections of the EIS.

Accordingly, the values, beliefs, and attitudes of area communities are presented to address social considerations.

Environmental Justice:

Executive Order 12898, issued in 1994, orders Federal agencies to identify and address environmental justice effects, which are any adverse human health and environmental effects of agency programs that disproportionately impact minority and low income populations.

In order to accurately portray local social and economic conditions above and potential effects under the alternatives, the geographic scope of analysis must be defined. The social and economic relationships and effects extend beyond the immediate vicinity of the project area. The role of actions under the EIS within the larger county must be addressed while not masking potential change within communities in the area. Thus area information is presented at two geographic scales based on available data: county and census county subdivision. Characteristics of Lincoln County are presented alongside characteristics of Ruidoso census county subdivision given economic linkages between the county and the census county subdivision containing the Village of Ruidoso and the project area. Environmental justice is examined at both the county and census county subdivision level.

When we look at the social effects of land management actions, the most critical impacts may be to small, rural communities (Rudzitis and Johnson 2000, pg 5). Consequently, geographically defined communities are an important and relevant level for social assessment. However, not all social scientists agree that the geographically based community is always the appropriate level of analysis. The Northwest Forest Plan's Federal Ecosystem Management Advisory Team (FEMAT 1993, pg VII-35) makes the point that this view "only refers to physical or political boundaries and not to the relationships among people who reside within such boundaries." Consequently, social relationships are examined regardless of geography in the section on values, beliefs, and attitudes.

This analysis examines effects of groundwater withdrawal limitations on projected demands from the 40-year water plan. Projections that consider water utility use reductions indicate 5,097 acre-feet per year will be required in 2045; however, existing water supplies and water rights as developed do not meet these needs. Consequently a number of other water supply alternatives need to be discussed as part of the plan for future Ruidoso water supply and water rights needs (Wilson and Company 2005, pp. 1–53).

Baseline information used to assess impacts to social and economic resources was provided by USDA Forest Service specialists, literature, and professional judgment.

The primary differences between the content of the DEIS and the SDEIS was in reference to the Little Bear Fire. In this updated Socioeconomics report for the SDEIS, additional literature review was conducted, new information from the Village of Ruidoso was sought (Atkins 2014), and the analysis was modified to reflect changes to the water resources report. The Atkins (2014) data outlined that the Village of Ruidoso anticipates that it will be a period of years before attenuation of wildfire effects will allow a resumption of the full use of Eagle Creek surface water, groundwater and the diversion credits for the return flow credit (Atkins 2014). In addition to the six existing and operating wells that are supplemental to the North Fork Eagle Creek wells in the Eagle Creek basin, there are an additional 7 supplemental wells in the cumulative impact analysis area off of National Forest System lands that the Village has applied for and that could also divert the Eagle Creek water right in the future (Office of the State Engineer, personal communication, 2014). The water resources report provides updated underlying assumptions for the socioeconomics analysis (e.g. post-wildfire estimated to have eight year full attenuation period).

Incomplete Information

Post-wildfire socioeconomic information is not available, so this analysis relied on assumptions based on conclusions in water resources report (AECOM 2015) which are summarized at the beginning of this chapter. This analysis assumes the attenuation of wildfire effects will occur as stated in the water resources section: “After approximately four to eight years following the Little Bear Fire, long-term post-wildfire conditions are expected to more generally resemble the pre-wildfire hydrologic setting” (page 100 of “Water Resource” section). Thus the pre-wildfire data characterizing historic municipal water supply sources are an accurate depiction of a post-wildfire baseline useful for analysis of groundwater withdrawal limitations.

Affected Environment

History

The Mescalero Apaches were some of the first to inhabit the area. They hunted and fished in the Sacramento Mountain area surrounding the Village of Ruidoso and were only occasionally visited by Spanish explorers who ventured into the Rio Bravo Valley. Trappers followed the Spanish and were then followed by traders, merchants, and their families (Village of Ruidoso 2010). The Ruidoso area was first settled in the 1850s, with mining and ranching among the primary draws. The settlement, originally called “Dowlins Mill,” thrived on logging, hunting, and the mill (Wilson and Company 2005).

By the end of the 19th century, the Village of Ruidoso was a small settlement, known for its associations with Billy the Kid and other historic figures of the West. In the beginning of the 20th century the Village of Ruidoso became increasingly known as a vacation destination for its natural amenities; its elevation and resulting cooler temperatures provided refuge from the heat in New Mexico and west Texas. After World War II, the Village of Ruidoso’s reputation as a resort destination grew with construction of Ruidoso Downs. Tourism began to flourish in 1962, when the Sierra Blanca Ski area (now Ski Apache) was opened (Village of Ruidoso 2010). The town grew dramatically in the 1970s with an influx of retirement homes, second homes, resort related cabins, town homes, and motels (Wilson and Company 2005).

The expansion seen in the 1970s provided the first challenge for the Village of Ruidoso’s water utility. Individual utility systems were constructed for the developments and subdivisions. These systems were often stand-alone, in difficult terrain, with waterline sizes that were insufficient for community needs such as fire protection. In the mid-1970s water system improvements were undertaken, under the first water master plan, to address system inadequacies across the entire Village of Ruidoso. Under the plan, a number of improvements were recommended including storage at Alto Crest and a new treatment plant at Eagle Creek (Wilson and Company 2005).

Population Change

Population in Lincoln County increased by 12,897 people (61 percent) between 1969 and 2010 (figure 18). Growth in the county over this period was outpaced by the State (100 percent) and exceeded growth in the Nation (52 percent). Population within Ruidoso census county subdivision increased by 7,298 people (100 percent) between 1990 and 2010 which, in terms of growth, outpaced the Nation (24 percent), the State (35 percent) and Lincoln County (67 percent) over these 2 decades of available data (U.S. Department of Commerce 2011). Population projections suggest Lincoln County and the State of New Mexico will increase in the next 15 years. Projections suggest that between 2010 and 2025, Lincoln County will increase by 20 percent (4,021 persons) while the State will increase by 36 percent (648,578 persons) (State of New Mexico 2008).

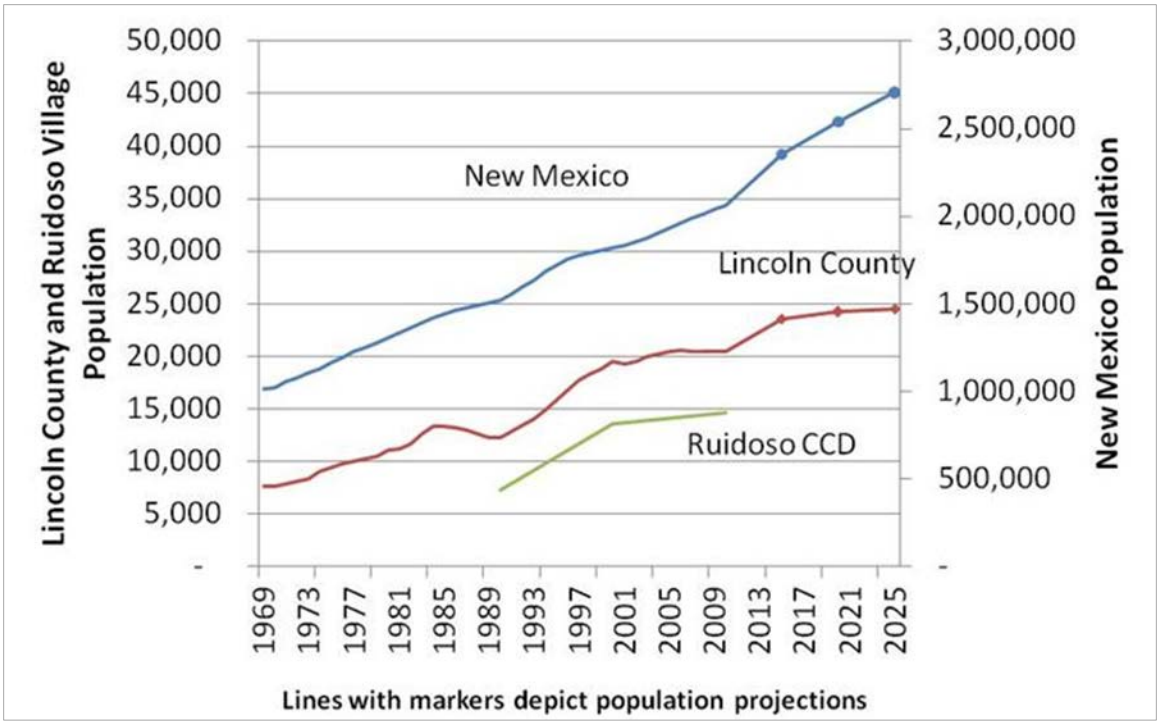

Figure 18. Population change for the Village of Ruidoso, Lincoln County and the State of New Mexico (U.S. Department of Commerce 2011, State of New Mexico 2008)

The 10-year historical trend of full-time resident population growth is not considered dependable by the Village of Ruidoso (Village of Ruidoso 2010). Using data from the "Village of Ruidoso Comprehensive Plan," village officials have accepted the use of population growth scenarios that range from 2 to 3.5 percent growth per year (Village of Ruidoso 2010). This range coincides with the rate of growth calculated for the 40-year water use plan of 2.63 percent per year; which was based upon existing water usage data, from the years 1997 through 2004 (Wilson and Company 2005).

Conditions before Pumping Began

By the time pumping of North Fork Eagle Creek wells had started in 1988, the Village of Ruidoso had established itself as a resort destination community and had also made water system upgrades to accommodate the expansion of the community (Wilson and Company 2005). In the mid-1980s, employment and population declined along with construction and related sectors. However, growth resumed in the early 1990s (figure 18) and water diversion from North Fork Eagle Creek wells became part of the Village of Ruidoso water supply.

The importance of the North Fork Eagle Creek to community well-being and quality of life was apparent long before pumping began. Summer homes in the area benefited from the stream, its vegetation, and dependent wildlife. Dispersed recreational use of the area was common and included hiking, wildlife viewing, and some fishing.

Per Capita Water Use

Standard measures of per capita water use for the applicant do not reflect true individual residential water use, as the actual number of persons using water is far higher than the per capita figure, due to the presence of part-year residents and tourists. The 40-year water plan notes that full-time resident population figures for the village, from the 2000 U.S. Census, account for only 30 to 45 percent of

occupancy and, thus, do not reflect the number of persons present in the Village of Ruidoso using water (Wilson and Company 2005). Since water use information is unavailable for this unaccounted population, the data on per capita water usage for the Village of Ruidoso presented below only provides a frame of reference for comparison with other cities.

Village of Ruidoso per capita water use is obtained from the 40-year water plan, which is the most current information available, and metered water use data. This data yields an estimate of 136 gallons per capita per day (Wilson and Company 2005). While this figure is not directly representative of Village of Ruidoso water use, as has been stated, it provides a comparison with other New Mexico cities in the area. Compared to the Village of Ruidoso, the cities of Albuquerque and Las Cruces had higher gallons per capita per day (185 an d189 per capita per day, respectively) while Rio Rancho and Santa Fe's use were similar (140 gallons per capita per day). The combination of climate, altitude, and surrounding forest moderates outdoor water use in the Village of Ruidoso in comparison to surrounding towns and villages. Thus, the water usage per person is likely lower in the Village of Ruidoso compared to other communities (Wilson and Company 2005).

Trends in Water Use

As a year-round mountain destination resort and a hub for regional recreation, the Village of Ruidoso has several unique and distinguishing characteristics that influence both water use growth (instead of population growth) and total water usage. The first characteristic influencing water usage is that full-time residents make up less than half of the water usage of the village (Wilson and Company 2005). Historical water data shows that water use is heavily impacted by the size of the part-time, resort related population. The 1998 Water Master Plan indicated the metered water total for the 5-month summer resort period (May through September) served an average of 14,000 persons while the census estimated population in 1998 at 6,500 persons. The Village of Ruidoso's 40-year water plan estimates that less than half of the total water is comsumed by this permanent population (Wilson and Company 2005).

Metered water, is that water represented from reading the water meters of billed customers, and for the Village of Ruidoso, includes ONLY totals of residential and commercial metered water. Existing metered water records for summer months (from May and September) and by year (from 1991 through 2004) are utilized for examining water consumption. The peak related summer months are used to identify resort related variations and demonstrate the degree of water use during the summer season related to total metered water use per the convention used by Wilson and Company (2005).

Total metered water use per year in figure 19 below shows an increase early in the period examined; from 1,100 acre feet in 1991 to 1,360 in 1998. The decrease in 1996 likely occurred as a result of adopting a policy focusing on water conservation planning efforts, system-wide utility use reductions, and leak reduction efforts. From 1999 to 2004 a decrease in total metered water use to 1,200 acre feet occurred as a result of per person water conservation, system-wide reductions in water losses, and village enforced restrictions on water use (Wilson and Company 2005). The adoption of restrictive water rate ordinances in 1998 and revisions in 2000 and 2002 likely had the negative effects on consumption depicted in figure 19 below. In addition, the decreases seen from 1999 through 2004 are due, in part, to village efforts to reduce leakage and conserve water, but also, due to the ongoing drought during which outdoor watering enforced restrictions were instituted from 2001 through 2003. In addition, local forest fires in 2000, 2001, and 2002 kept many part-time residents and visitors away, further reducing use (Wilson and Company 2005).

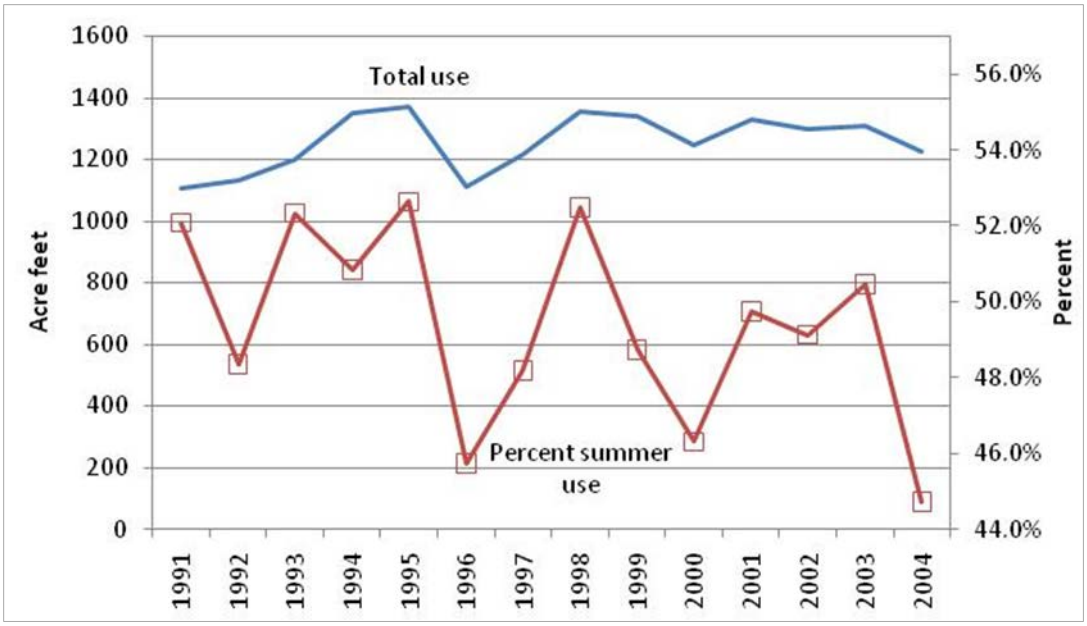

Figure 19. Total metered water use and the percent of use occurring in summer months (Wilson and Company 2005)

Recreation use and the resort related population vary depending on factors such as national and regional economies, weather issues (drought and snowfall), and fires (noted above). Summer use (the sum of consumption in summer months) as a percent of total metered water use increased slightly over the same period as above (from 52 percent in 1991 to 53 percent in 1998) and correspondingly decreased to 45 percent in 2004. While summer recreation use may be increasing, policies to reduce consumption and drought have likely resulted in the observed reduction in the share of consumption over the summer months.

The Importance of the North Fork Eagle Creek Wells Relative to Water Supply for the Village of Ruidoso

The water supply for the Village of Ruidoso is derived from surface and ground water sources in the Rio Ruidoso and Eagle Creek drainages which are within the Hondo Basin, in the upper reaches of the Pecos River watershed. In water supply terminology, total water production is sometimes used interchangeably with the term total water diversion, to mean the total water produced or withdrawn from surface or groundwater for a water supply system. The two terms do not mean the same thing, and the recorded amounts are not always equal, thus, use of these terms interchangeably is not accurate.

Water production is always measured at the end of a treatment system, prior to release to the public as potable water. Water diversions may be measured at any number of locations: lake or stream intake structures, interim raw water meters, or at the raw intake meter at the beginning of a treatment plant. Measurement differences between the two terms include process uses through the plants, including backwash water and other uses between the measurements. Also, depending upon location of the raw water meter, losses due to reservoir water evaporation, or reservoir leakage (which is significant for Grindstone Reservoir), or delivery line leakage (for diverted water transmission lines such as the Eagle Creek line), may also account for differences between the water as measured for diversion and the water as measured for production (Wilson and Company 2005).

Since the share of production from the North Fork Eagle Creek wells cannot be determined, their importance is measured relative to total water diversion. As discussed above, water diversion estimates depend upon the location of measurement and are subject to variation based on leakage and other losses. Therefore, diversion as reported and adjusted diversion estimates are presented below in order to establish a range of values for use in estimating the contribution from the North Fork Eagle Creek wells to total water diversion for the applicant.

Adjusted diversion estimates are available from Wilson and Company 2005. They report values adjusted for volume adjustments in Grindstone and Alto Reservoirs due to net filling or withdrawal from raw water reservoirs. In addition their adjusted estimates consider unaccounted leakage through Grindstone Dam. Figure 20 shows that over the period of available data from 1998 to 2004, adjusted diversion ranged from a high of 2,656 acre-feet in 1999 to a low of 1,901 in 2003 and averaged 2,248 acre-feet.

Estimates of diversion as reported are also available from Wilson and Company 2005. Figure 20 shows that over the period of available data from 1998 to 2004, diversion as reported from Wilson and Company ranged from a high of 2,842 acre-feet in 2001 to a low of 1,793 in 2003 and averaged 2,261 acre-feet.

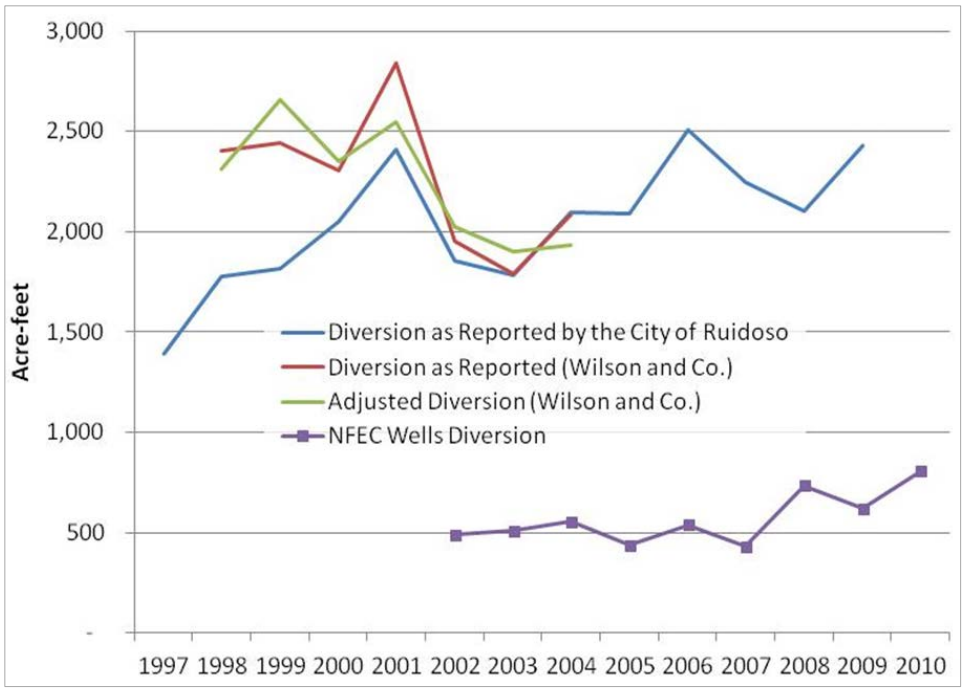

Figure 20. Diversion estimates

A second source of diversion as reported was made available by the Village of Ruidoso for the period from 1997 to 2009. Figure 20 shows that over this period, diverted water ranged from a high of 2,506 acre-feet in 2006 to a low of 1,394 in 1997 and averaged 2,043 acre-feet.

Diversion data specific to the North Fork Eagle Creek wells are available for the period from 2002 to 2010, based on data obtained in preparation of the Water Resources Report (AECOM 2015). Over this period diversion from these wells has averaged 569 acre-feet per year, has not fallen below 433 acre-feet per year, and has not exceeded 807 acre-feet per year. The 3 years of North Fork Eagle

Creek well diversion data that overlap total diversion estimates for the Village of Ruidoso (from 2002 to 2004; figure 20) give insight on the importance of North Fork Eagle Creek wells diversion to the applicant water supply. North Fork Eagle Creek well diversion as a share of total diversion for the Village of Ruidoso varies depending on the source of total diversion data used. North Fork Eagle Creek wells diversion as a share of adjusted diversion ranges from 24 percent in 2002 to 29 percent in 2004. North Fork Eagle Creek wells diversion as a share of diversion as reported (Wilson and Co. 2005) ranges from 25 percent in 2002 to 27 percent in 2004. Lastly, North Fork Eagle Creek wells diversion from diversion as reported by the Village of Ruidoso ranges from 26 percent in 2002 to 27 percent in 2004. Considering these three sources of total diversion for the Village of Ruidoso, North Fork Eagle Creek wells diversion has contributed from 24 to 29 percent of Village of Ruidoso water supply over the period of available data (2002 to 2004). In addition, indirect diversion attributable to North Fork Eagle Creek wells from the 50 percent return flow credit[12] adds to the Village of Ruidoso water supply contribution. Accounting for these additional indirect contributions, North Fork Eagle Creek wells has provided 36 to 43 percent of Village of Ruidoso water supply.

Wilson and Company characterize the 5-month summer resort period as May through September in order to examine water consumption during this period. This period typically has a pattern of higher streamflows from spring snowmelt, followed by low flows in June and July, and then higher streamflows again in August and September from monsoonal rains. The recent monthly diversion data for North Fork Eagle Creek wells (from the Village of Ruidoso) indicates that from 38 to 58 percent (in 2006 and 2004, respectively) of total annual diversion from the well field has been pumped during this 5-month summer resort period. Accounting for the additional indirect contributions from the return flow credit indicates that from 57 to 87 percent of total annual diversion can be attributable to the North Fork Eagle Creek wells during the 5-month summer resort period. For the overlapping years with total municipal diversion data (2002 through 2004), the well field pumping during the 5-month summer resort period represents 11 percent (2002) to 16.6 percent (2004) of the total municipal adjusted diversion for the year.

Future Village of Ruidoso demand for adjusted diversion is projected in the 40-year water plan and considers water utility use reductions. These projections indicate 5,097 acre-feet per year will be required in 2045 and exceed existing supplies and rights, thus, additional water supply sources will be necessary (Wilson and Company 2005).

Loss of North Fork Eagle Creek well diversion has occurred as a result of the Little Bear Fire in June of 2012. The Village of Ruidoso anticipates that it will be a period of years before attenuation of wildfire effects will allow a resumption of the full use of Eagle Creek surface water, groundwater and the diversion credits for the return flow credit (Atkins 2014). This analysis assumes this attenuation will occur as stated in the “Water Resources” section: “After approximately four to eight years following the Little Bear Fire, long-term post-wildfire conditions are expected to more generally resemble the pre-wildfire hydrologic setting” (page 100 of “Water Resources” section). Thus the pre-wildfire data characterizing historic municipal water supply sources are an accurate depiction of a post-wildfire baseline useful for analysis of groundwater withdrawal limitations.

[12] The village receives a 50 percent return flow credit for all water produced from the North Fork well field. The return flow credit is the result of at least 50 percent of the water diverted from the North Fork well field being returned to the Rio Ruidoso via the village’s wastewater treatment plant. The return flow credit allows the village to divert 50 percent of the total quantity of water produced from the North Fork well field from other wells outside of the Eagle Creek watershed or surface water from the Rio Ruidoso.

Values, Beliefs, and Attitudes

The "Village of Ruidoso's 2010 Comprehensive Plan" lauds the area's natural amenities such as beautiful mountains and green pines. It notes that its most important attributes are "Ruidoso's diversity, friendliness, and quality of life for future generations" (Village of Ruidoso 2010). In addition, in 2012 the Village council reached an agreement on a slogan that represents the vision for Ruidoso: "Ruidoso… Living in Nature's Playground." Thus, quality of life can certainly be considered linked to area natural amenities managed in part by the Lincoln National Forest.

A range of values were evident from public scoping comments received as part of the public involvement process for this EIS. The value of present and future water supply for the applicant was expressed. In addition, the importance of the quality of streamside recreation experience was also expressed. Specific recreational opportunities include activities such as fishing, wading, dispersed camping, and wildlife viewing, as discussed briefly in the "Recreation and Scenery" section in chapter 1. The quality of life of private landowners in the area with domestic wells potentially affected by surface water changes also deserves consideration. This range of values indicates where shared values exist and where values may conflict among community members. This information is a fundamental part of the USDA Forest Service's social impact analysis process; it enables Agency staff to address these values (USDA Forest Service 2009).

Environmental Justice

Executive Order 12898 requires Federal agencies to "identify and address the disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low income populations." According to the Council on Environmental Quality's (CEQ) Environmental Justice Guidelines for NEPA (1997) "minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis . . . a minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above stated thresholds." Thus, the ethnic and racial composition of New Mexico, Lincoln County, and Ruidoso census county subdivision are of interest. The shares of 2000 population by race and ethnicity are displayed in table 14.[13] In the year 2010, the share of population described as white was greater than the state in Lincoln County and Ruidoso census county subdivision. In Ruidoso census county subdivision, the shares of American Indian and Alaska Natives, Asians, and Pacific Islanders were slightly greater than Lincoln County in 2010 (U.S. Department of Commerce 2010). Since the difference in shares between the different geographies is small, these differences may not be considered "meaningful" as defined by the Council on Environmental Quality. However, populations of minority groups that live outside these geographies or live within this area at different spatial scales may use the Lincoln National Forest within the project area. Thus, while the data may not reflect the presence of environmental justice populations as defined by the Council on Environmental Quality they still may exist in the area or use national forest lands in the project area. Consequently, the potential for disparate or adverse effects to minority groups are examined under socioeconomic effects of the alternatives.

[13] Race and ethnicity shares do not add to 100 percent because Hispanics can be of any race.

Table 14. Population by race and ethnicity (2010)

Region	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic (of any race)
United States	72.4%	12.6%	0.9%	4.8%	0.2%	6.2%	2.9%	16.3%
New Mexico	68.4%	2.1%	9.4%	1.4%	0.1%	15.0%	3.7%	46.3%
Lincoln County	85.1%	0.5%	2.4%	0.4%	0.0%	9.2%	2.5%	29.8%
Ruidoso CCD[a]	85.0%	0.5%	2.9%	0.5%	0.1%	8.9%	2.3%	29.6%

Source: U.S. Department of Commerce 2010
a – CCD = Census County Division

In addition to race, concentrations of people living under the poverty level are of interest when considering the environmental justice implications of the proposed action. Council on Environmental Quality guidance on identifying low income populations states “agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.” In 2012, the percent of people living in poverty in the Village of Ruidoso (13.6 percent) was less than shares in Lincoln County and the State (14.7 and 19.5 percent, respectively) (U.S. Department of Commerce 2013). Thus, the census data indicate that low income populations, as defined by the Council on Environmental Quality may not exist. However, low income populations that live outside these geographies or live within this area at different spatial scales may use the Lincoln National Forest within the project area. Thus, while the data may not reflect the presence of environmental low income populations as defined by the Council on Environmental Quality, they still may exist in the area or use National Forest System lands in the project area. Consequently, the potential for disparate or adverse effects to low income groups are examined under socioeconomic effects of the alternatives.

Environmental Consequences

Alternative 1 – Preferred Alternative - No Change
Direct and Indirect Effects

Municipal Water Supply

Without limitations on groundwater withdrawal, municipal water supply, as it relates to North Fork Eagle Creek wells diversion, would not be affected under the no change alternative. Over the short term (i.e., until watershed “recovery”) contributions would remain uncertain during the transitional wildfire recovery period. Over the long term (i.e., after the wildfire recovery period) watershed conditions are expected to return to approximate pre-wildfire conditions (“Water Resources” section beginning on page 100); thus, average annual contributions from North Fork Eagle Creek wells could continue to provide from 24 to 29 percent of the Village of Ruidoso water supply (see discussion above) if current trends in total diversion and North Fork Eagle Creek wells diversion continue. In addition, past trends in North Fork Eagle Creek wells diversion during this 5-month summer resort period could continue (38 to 58 percent of well field pumping in 2006 and 2004, respectively). Consideration of additional indirect contributions attributable to North Fork Eagle Creek well

diversions from the 50 percent return flow credit indicate that North Fork Eagle Creek wells would continue to provide 36 to 43 percent to the municipal water supply overall, and 57 to 87 percent during the 5-month summer resort period. Based on recent available data, well field pumping during this 5-month period would represent between approximately 11 to 16.6 percent of total municipal pumping for the year. In addition, over the long-term, post-wildfire vegetative transitions in the watershed may slightly improve groundwater availability within the North Fork Eagle Creek (North Fork Eagle Creek drainage on and off Federal land) (see "Water Resources" section beginning on page 100). If this occurs, contributions to municipal water supply could be slightly greater throughout the year and during the 5-month summer resort period.

Future demand for diversion outlined in the 40-year water plan (5,097 acre-feet per year) exceed existing supplies and rights, thus, additional water supply sources are necessary (Wilson and Company 2005) regardless of actions under this EIS (for more detail see the discussion of cumulative effects under the action alternatives and mitigation measures identified below). As noted above, current levels of North Fork Eagle Creek wells diversion could continue under this alternative and if recent average annual diversion from these wells continues, they would contribute 11 percent of the projected diversion demand for the year 2045.

Using available data from 2002-2010, annual diversion from the North Fork wells averaged 569 acre-feet per year. Using the most recent data available for 2008-2010, annual diversion averaged 721 acre-feet per year and ranged from 622 acre-feet per year in 2009 to 807 acre-feet per year in 2010 (table 16) (Water Resources Report, appendix A; AECOM 2015).

Streamside Recreation Use

Under the no change alternative, it is anticipated that over the short term (i.e., until watershed "recovery") the quality of recreation experience would remain uncertain during the transitional wildfire recovery period with uncertainty in water quantity and quality. Over the long term (i.e., after the wildfire recovery period) watershed conditions are expected to return to approximate pre-wildfire conditions ("Water Resources" section beginning on page 100); thus, streamflow quantity would be the same as experienced by recreationists in the recent past. At the Eagle Creek Gage the general duration of no surface flow days would continue to be approximately 1 to 2 weeks during average precipitation periods and approximately 8 to10 weeks during drought periods. Flows of 1.2 cubic feet per second or greater would occur between approximately 10 to 40 percent of the time (see "Water Resources" section v). Continuation of these conditions could support a lower quality streamside recreation experience compared to alternative 2 (no pumping) and alternative 3 (adaptive management) since flows under these alternatives are greater than the no change alternative.

Over the long-term, springs, seeps and dependent riparian vegetation important to the quality of recreation experience would be the same as pre-wildfire conditions if current management continues under this alternative. Two springs are within the area of projected drawdown, as depicted in figure 12 and figure 13, and could be affected. Other existing groundwater modeling indicates that more extensive drawdown could occur and therefore, a number of springs and seeps in the upper North Fork drainage could be similarly affected (see water resources section earlier in this chapter). As noted in the riparian report, the instability of the channel could result in some riparian areas being buried. However, these effects could be offset by the opportunity for species such as willows to colonize new areas. In addition, the riparian report notes that water availability to riparian vegetation is not likely to be greatly changed as a result of the Little Bear Fire. This suggests that impacts to springs and seeps and the quality of recreation dependent on associated riparian vegetation could occur. Consequently alternative 2 (no pumping) and alternative 3 (adaptive management) provide less

of a possibility of major effects to the quality of recreation experience from impacts to springs, seeps and associated riparian vegetation.

Availability of Domestic Well Water and Water for Irrigation

Two domestic wells are within the area of projected drawdown, as depicted in figure 12 and figure 13, and could be affected (see water resources section earlier in this chapter). Since there would be no groundwater drawdown under alternative 2 (no action) and less groundwater drawdown under alternative 3 (adaptive management) than the no change alternative, the potential for adverse effects to the availability of domestic well water are greatest under this alternative.

Under the no change alternative, it is anticipated that over the short term (until watershed "recovery") the availability of water for irrigation would remain uncertain during the transitional wildfire recovery period. Over the long term (after the wildfire recovery period) watershed conditions are expected to return to approximate pre-wildfire conditions (water resources section); thus, streamflow quantity would be the same as experienced by agriculture users in the past. At the Eagle Creek Gage the general duration of no surface flow days would continue to be approximately 1 to 2 weeks during average precipitation periods and approximately 8 to10 weeks during drought periods. Flows of 1.2 cubic feet per second or greater would occur between approximately 10 to 40 percent of the time (see "Water Resources" section beginning on page 100).

Financial Efficiency

As discussed above, the present net value is the discounted sum of costs associated with each alternative. This analysis is not intended to be a comprehensive benefit-cost or present net value analysis that incorporates a monetary expression of all known market and non-market benefits and costs that is generally used when economic efficiency is the sole or primary criterion upon which a decision is made. Many of the values and costs associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework. Therefore, they are not described in financial or economic terms for this project, but rather are discussed in other sections of this document and other specialist reports; for example effects on riparian vegetation and watersheds resources. When evaluating trade-offs, the use of efficiency measures is one factor of many used by the decision maker in making the decision.

Table 15 summarizes the discounted present value of costs and present net value for each monitoring measure. A 4 percent discount rate was used over the 20 year life of a permit. Under alternatives 1 and 3 the present net value would range from $4.6 to $7.2 million dollars. Under these alternatives the Village of Ruidoso would pay for all monitoring measures except riparian vegetation monitoring (which would be covered by the forest) thus their present net value would be slightly less than the total present net value. While less financially efficient than alternative 2 the village would benefit from ongoing use of wells for municipal water supply. In addition, benefits from maintained instream flow and improved riparian condition would be realized.

Table 15. Discounted present value of costs and present net value of the alternatives

Monitoring Measure	Alternatives 1 and 3	Alternative 2
Monitoring Measure 1	$541,912	$-
Monitoring Measure 2		
Slug test - low estimate	$19,231	$-
Slug test - high estimate	$28,846	$-
Aquifer pumping test - low estimate	$576,923	$-
Aquifer pumping test - high estimate	$961,538	$-
Monitoring Measure 3	$244,626	$-
Monitoring Measure 4	$233,210	$-
Monitoring Measure 5	$1,060,045	$-
Monitoring Measure 6	$53,422	$-
Monitoring Measure 7	$49,809	$-
Monitoring Measure 8		
low estimate	$2,378,307	$-
high estimate	$4,077,098	$-
Monitoring Measure 9	$-	$217,445
Riparian Vegetation Monitoring	$12,683	$-
Low estimate of PNV	$4,593, 245	$217,445
High estimate of PNV	$7,234,343	$217,445

Values, Beliefs, Attitudes

The “Village of Ruidoso’s 2010 Comprehensive Plan” notes that the Village’s most important attributes are “Ruidoso’s diversity, friendliness, and quality of life for future generations” (Village of Ruidoso 2010). In addition, the slogan for the Village of Ruidoso’s vision is: “Ruidoso… Living in Nature’s Playground.” Thus, quality of life can certainly be considered linked to area natural amenities managed in part by the Lincoln National Forest.

As discussed above, municipal water supply, as it relates to North Fork Eagle Creek wells diversion, would be unaffected under the no change alternative over the long term. Thus, quality of life as it relates to municipal water supply would remain unchanged under this alternative. In addition, quality of life associated with the quality of recreation experience and the availability of domestic well water would remain unchanged under this alternative. Thus, under this alternative, the Lincoln National Forest would continue to support quality of life at levels experienced currently.

Environmental Justice

The no change alternative is not expected to have a disproportionately high and adverse human health or environmental effect on minority or low income populations. As noted above, quality of life as it relates to municipal water supply, recreation opportunities, and the availability of domestic well water would remain unchanged under this alternative. Consequently, there would be no environmental justice effects.

Cumulative Effects

The Village of Ruidoso’s 40-year plan has shown that future needs for water supply and water rights exceed existing supplies and rights. Future water usage projections show that the Village of Ruidoso

will require 5,097.2 acre-feet per year diversion, even with existing and future utility use reductions and conservation. Existing water supplies and water rights as developed do not meet these needs (Wilson and Company 2005, pp. 1–53). With water supply uncertainty following the Little Bear Fire the Village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). In addition to the six existing and operating wells that are supplemental to the North Fork Eagle Creek wells in the Eagle Creek basin, there are an additional 7 supplemental wells in the cumulative impact analysis area off of National Forest System lands that the Village has applied for and that could also divert the Eagle Creek water right in the future (Office of the State Engineer, personal communication, 2014). On October 23, 2014, the Office of the State Engineer issued a permit to the Village of Ruidoso allowing the transfer of 700.83 acre feet per year from H-1979 to the surface point of diversion at Eagle Creek and Alto Lake[14]. In addition, the Village of Ruidoso has several pending applications with the Office of the State Engineer (State of New Mexico, Office of the State Engineer, personal communication, September 2014) that could affect groundwater and surface water withdrawal along Eagle Creek. These applications are listed in the water resources report (water resources report page 7). If all these pending applications are approved by the Office of the State Engineer, it would enable the village to access their water rights (for both surface and groundwater) from approximately 16 wells and two surface diversions along Eagle Creek (water resources report page 7). Thus, once conditions allow for North Fork Eagle Creek well pumping to resume at pre-wildfire levels it is likely that the Village of Ruidoso will have made water supply adjustments in order to meet water supply demand. Consequently reliance on North Fork Eagle Creek well pumping may be less than depicted above. Effects on measures of dependency presented above can be considered an upper bound of potential effects. There are additional domestic wells and points of diversion for real estate developments and resorts, along the Eagle Creek drainage below the North Fork Eagle Creek well field, off of National Forest System land. Consequently the potential cumulative effects on streamflows and groundwater resources are not restricted to water uses by the Village of Ruidoso. More information on this uncertainty can be found in the water resources section under the “Cumulative Effects” section and the section “Additional Impact Information”.

If the Village of Ruidoso resumes pre-wildfire levels of groundwater withdrawal, the potential for adverse cumulative effects to municipal water supply would be less under this alternative than the other alternatives. These effects would accrue in addition to effects from other actions identified in table 4. However, the potential for adverse cumulative economic effects to the quality of recreation experience provided by streamflow quantity, springs, and seeps would be more under this alternative than the other alternatives. Similarly, the potential for adverse cumulative economic effects to nearby domestic wells would be higher under this alternative than under the other alternatives.

Conclusion

Over the long term (after the wildfire recovery period), average annual water diversion from North Fork Eagle Creek wells could continue to provide historic contributions to the Village of Ruidoso water supply under this alternative. However, a lower quality streamside recreation experience is anticipated compared to alternative 2 (no pumping) and alternative 3 (adaptive management) since additional surface flow, and improved spring and seep conditions are anticipated under alternative 2 (no pumping) and alternative 3 (adaptive management). In addition, the potential for adverse effects to the availability of domestic well water are greatest under this alternative since there would be no groundwater drawdown under alternative 2 (no pumping) and less groundwater drawdown under

[14] The permit severed the adjudicated rights to H-1979. However, the Village of Ruidoso’s municipal rights pertaining to PBU, in the amount of 350.42 af/yr, remain provable at H-1979.

alternative 3 (adaptive management). The discounted present value of costs is greater than alternative 2 however, the village would benefit from ongoing use of wells for municipal water supply.

Alternative 2 - No Action (No Pumping)
Direct and Indirect Effects

Municipal Water Supply

Without groundwater withdrawal, the North Fork Eagle Creek wells would not provide their pre-wildfire share of Village of Ruidoso water supply (from approximately 24 to 29 percent of direct water supply and 36 to 43 percent of total water supply that considers indirect contributions from the 50 percent return flow credit; see discussion above). In addition, larger contributions from North Fork Eagle Creek wells during the 5-month summer resort period would also discontinue (38 to 58 percent in 2006 and 2004, respectively of direct water supply and 57 to 87 percent of water supply that considers indirect contributions from the 50 percent return flow credit). Additionally, without groundwater withdrawal, North Fork Eagle Creek wells could not contribute toward future Village of Ruidoso demand for diversion (5,097 acre-feet in 2045; Wilson and Company 2005).

As shown in table 16, alternative 2 would not provide any water to the applicant for municipal water supply.

Streamside Recreation Use

Under alternative 2 (no pumping), it is anticipated that over the short term (until watershed “recovery”) the quality of recreation experience would remain uncertain during the transitional wildfire recovery period with uncertainty in water quantity and quality. Over the long term (after the wildfire recovery period) watershed conditions are expected to return to approximate pre-wildfire conditions (see water resources section); thus, streamflow quantity would be greater than experienced by recreationists in the recent past. At the Eagle Creek gage the occurrence of no-flow days would be limited and during average or wetter years, there may be continuous flow. Flows of 1.2 cubic feet per second or greater would occur approximately 60 percent of the time (AECOM (2015) located in the project record). These conditions could support a higher quality streamside recreation experience compared to alternative 1 (preferred alternative, continue pumping at historic levels) and alternative 3 (adaptive management) since flows under these alternatives would be less than under alternative 2 (no pumping).

Over the long term, springs, seeps, and dependent riparian vegetation important to the quality of recreation experience would at least be maintained, and could be improved, over pre-fire conditions under this alternative, as described in more detail in the water resources and riparian vegetation sections earlier in this chapter. In addition, in the absence of pumping, post-wildfire vegetative transition could result in enhanced aquatic habitats and additional opportunities for improving riparian conditions (“Water Resources” section beginning on page 100). Thus, alternative 2 (no pumping) provides the least possibility of detrimental effects to the quality of recreation experience from impacts to springs, seeps, and associated riparian vegetation since no withdrawals would occur.

Availability of Domestic Well Water and Water for Irrigation

Two domestic wells are within the area of projected drawdown, as depicted in figure 12 and figure 13, and could be affected (see water resources section earlier in this chapter). Since there would be no groundwater drawdown under alternative 2 (no pumping), there would be no adverse effects from pumping on the availability of domestic well water.

Under alternative 2 (no pumping), it is anticipated that over the short term (until watershed "recovery") the availability of water for irrigation would remain uncertain during the transitional wildfire recovery period. Over the long term (after the wildfire recovery period) watershed conditions are expected to return to approximate pre-wildfire conditions ("Water Resources" section beginning on page 100); thus, streamflow quantity would be greater than experienced by agriculture users in the past. At the Eagle Creek Gage the occurrence of no flow days would be limited and during average or wetter years, there may be continuous flow. Flows of 1.2 cubic feet per second or greater would occur approximately 60 percent of the time (Water Resources Report; AECOM 2015). These conditions could support a higher quantity of water for irrigation uses compared to alternative 1 (preferred alternative, continue pumping at historic levels)and alternative 3 (adaptive management) since flows under these alternatives would be less than under alternative 2 (no pumping).

Financial Efficiency

Table 15 summarizes the discounted present value of costs and present net value for each monitoring measure. A 4 percent discount rate was used over the 20 year life of a permit. Under alternative 2 the only cost that would be incurred would be the cost of surface gage monitoring that would be incurred by the U.S. Geological Survey, USDA Forest Service or other parties. This alternative is more financially efficient, in terms of cost evaluated, than alternatives 1 and 3, however the village would not benefit from use of wells for municipal water supply. In addition, under this alternative, benefits from maintained instream flow and improved riparian condition would be realized. These benefits are not described in financial or economic terms for this project, but rather are discussed in other sections of this document and other specialist reports; for example effects on riparian vegetation and watersheds resources.

Values, Beliefs, Attitudes

As discussed above, North Fork Eagle Creek wells diversion would no longer contribute to municipal water supply under alternative 2 (no pumping). Thus, quality of life as it relates to municipal water supply would be less than experienced before the wildfire under the no change alternative and less than under alternative 3 (adaptive management). However, quality of life associated with the quality of recreation experience and the availability of domestic well water would be greater than the other alternatives. Thus, under alternative 2 (no pumping), the Lincoln National Forest would continue to support quality of life to the area community but less than supported before the wildfire from municipal water supply and more in terms of the quality of recreation experience and the availability of domestic well water.

Environmental Justice

Alternative 2 (no pumping) is not expected to have a disproportionately high and adverse human health or environmental effect on minority or low income populations. While adverse effects to total municipal water diversions are anticipated, they are expected to be distributed amongst all segments of the Village of Ruidoso population since water diversion from the North Fork Eagle Creek wells cannot be attributed to supply certain areas of the Village of Ruidoso. Consequently, effects to these communities cannot be considered disparate since effects would occur to communities regardless of racial, ethnic, or poverty status. However, low-income populations are more vulnerable to total municipal water diversions due to possible increases in the financial cost of water.

Cumulative Effects

Regardless of pumping restrictions under this EIS, the Village of Ruidoso 40-year plan has shown that future Ruidoso needs for water supply and water rights exceed existing supplies and rights. Future water usage projections show that the Village of Ruidoso will require 5,097.2 acre-feet per

year diversion, even with existing and future utility use reductions and conservation. Existing water supplies and water rights as developed do not meet these needs (Wilson and Company 2005 pp. 1–53). With water supply uncertainty following the Little Bear Fire the Village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). In addition to the six existing and operating wells that are supplemental to the North Fork Eagle Creek wells in the Eagle Creek basin, there are an additional 7 supplemental wells in the cumulative impact analysis area off of National Forest System lands that the Village has applied for and that could also divert the Eagle Creek water right in the future (Office of the State Engineer, personal communication, 2014). On October 23, 2014, the Office of the State Engineer issued a permit to the Village of Ruidoso allowing the transfer of 700.83 acre-feet per year from H-1979 to the surface point of diversion at Eagle Creek and Alto Lake[15]. In addition, the Village of Ruidoso has several pending applications with the Office of the State Engineer (State of New Mexico, Office of the State Engineer, personal communication, September 2014) that could affect groundwater and surface water withdrawal along Eagle Creek. These applications are listed in the water resources report (water resources report page 7). If all these pending applications are approved by the Office of the State Engineer, it would enable the village to access their water rights (for both surface and groundwater) from approximately 16 wells and two surface diversions along Eagle Creek (water resources report page 7). Thus, , once conditions allow for North Fork Eagle Creek well pumping to resume at pre-wildfire levels it is likely that the Village will have made water supply adjustments in order to meet water supply demand. Consequently reliance on North Fork Eagle Creek well pumping may be less than depicted above. Effects on measures of dependency presented above can be considered an upper bound of potential effects. There are additional domestic wells and points of diversion, for real estate developments and resorts, along the Eagle Creek drainage below the North Fork Eagle Creek well field, off of National Forest System land. Consequently the potential cumulative effects on streamflows and groundwater resources are not restricted to water uses by the Village of Ruidoso. More information on this uncertainty can be found in the water resources section under the cumulative effects section (page 8) and the section “Additional Impact Information” (“Water Resources” section page 100).

Without groundwater withdrawal, the potential for adverse cumulative effects to municipal water supply would be greater under this alternative than the other alternatives. These effects would accrue in addition to effects from other actions (as identified in table 5). However, the potential for adverse cumulative economic effects to the quality of recreation experience provided by streamflow quantity, springs, and seeps would be less under this alternative than the other alternatives. Similarly, the potential for adverse cumulative economic effects to nearby domestic wells would be less under this alternative than under the other alternatives.

Conclusion

Without groundwater withdrawal, the North Fork Eagle Creek wells would not continue to provide their pre-wildfire share of Village of Ruidoso water supply (from approximately 24 to 29 percent of direct water supply and 36 to 43 percent of total water supply that considers indirect contributions from the 50 percent return flow credit; see discussion above). In addition, larger contributions from North Fork Eagle Creek wells during the 5-month summer resort period would also discontinue (38 to 58 percent in 2006 and 2004, respectively, of direct water supply and 57 to 87 percent of water supply that considers indirect contributions from the 50 percent return flow credit). Additionally, without groundwater withdrawal, North Fork Eagle Creek wells could not contribute toward future Village of

[15] The permit severed the adjudicated rights to H-1979. However, the Village of Ruidoso’s municipal rights pertaining to proof of beneficial use, in the amount of 350.42 acre-fee per year, remain provable at H-1979.

Ruidoso demand for diversion (5,097 acre-feet in 2045; Wilson and Company 2005). However, the potential for adverse effects to the quality of recreation experience provided by streamflow quantity, springs, and seeps would be less under this alternative than the other alternatives. Similarly, the potential for adverse effects to nearby domestic wells would be less than under the other alternatives. The discounted present value of costs is less than the other alternatives however, the village would not benefit from ongoing use of wells for municipal water supply.

Alternative 3 - Adaptive Management
Direct and Indirect Effects

Municipal Water Supply

Over the short term (until watershed "recovery") management triggers would be most generally enacted during dry years under this alternative. During average or wet years, management triggers would be enacted much less frequently. The exact effect on contributions to municipal water supply is uncertain since the Village of Ruidoso anticipates that it will be a period of years before attenuation of wildfire effects will allow a resumption of the full use of Eagle Creek surface water, groundwater and the diversion credits for the return flow credit (Atkins 2014).

Over the long term (after the wildfire recovery period) watershed conditions are expected to return to approximate pre-wildfire conditions ("Water Resources" section beginning on page 100). With restrictions on groundwater withdrawal under this alternative, the North Fork Eagle Creek wells would not provide their pre-wildfire share of Village of Ruidoso water supply (from approximately 24 to 29 percent of direct water supply and 36 to 43 percent of total water supply that considers indirect contributions from the 50 percent return flow credit; see discussion above). Restrictions under this alternative would decrease the amount of water the village could withdraw by limiting the pumping rate to 50 percent of the streamflow reported at the North Fork gage. Using pre-wildfire data of surface flow during years where restrictions would have occurred provides a frame of reference for forgone water diversion (see methods discussion above). As an example using recent historical data, over the range of restrictions, the forgone water diversion due to withdrawal restrictions could reduce the contribution of North Fork Eagle Creek wells to approximately 23 to 25 percent of the recent total Village of Ruidoso diversions under alternative 3 (adaptive management). Consideration of additional indirect contributions attributable to North Fork Eagle Creek well diversions from the 50 percent return flow credit indicate that North Fork Eagle Creek wells would continue to provide 34.5 to 37.5 percent to the municipal water supply.

Over the long term, if restrictions occurred during the 5-month summer resort period, the share of summer contributions from total annual diversion from North Fork Eagle Creek wells (38 to 58 percent of annual well field pumping in 2006 and 2004, respectively, of direct water supply and 57 to 87 percent of water supply that considers indirect contributions from the 50 percent return flow credit) would also be less. Over the range of hypothetical pre-wildfire restrictions, the forgone water diversion due to withdrawal restrictions could reduce the share of summer resort contribution to between 25 and 57 percent of total annual well field withdrawal under alternative 3 (adaptive management). Consideration of additional indirect contributions attributable to North Fork Eagle Creek well diversions from the 50 percent return flow credit indicate that North Fork Eagle Creek wells would continue to provide 37.5 to 85.5 percent during the 5-month summer resort period.

Restrictions on groundwater withdrawal from North Fork Eagle Creek wells would minimally reduce contributions toward future Village of Ruidoso demand for diversion (5,097 acre-feet in 2045; Wilson and Company 2005). Based on recent data, for example, the forgone water diversion due to

withdrawal restrictions would negligibly reduce contributions to projected annual demand by 0.1 to 1.3 percent.

In order to determine generalized impacts to average annual diversion from implementing alternative 3 (adaptive management) compared to alternative 1 (no change), pre-wildfire data available (from September 2007 to November 2011) were used. Based on this analysis, as shown in table 16, annual diversion from the North Fork wells in the future would likely be less under alternative 3 (adaptive management) than that provided under alternative 1 (no change). If the adaptive management approach proposed under alternative 3 (adaptive management) were applied to the years 2008–2011, annual diversion under alternative 3 (adaptive management) would have ranged from 300 acre-feet per year (or more) to less than 50 acre-feet per year; this would have varied by year due to whether it was a wet or dry year and how the adaptive management triggers were implemented. Annual diversion from the North Fork wells in the future would be the least under alternative 2 (no pumping).

Table 16. Summary of available water (acre-feet per year) per alternative, based on available past data (for alternative 1, this is actual pumping data)

Year	Alternative 1 (no change)	Alternative 2 (no action)	Alternative 3 (adaptive management)[a]
2008	735	0	300
2009	622	0	300
2010	807	0	300
2011	not currently available	0	47
Average	721 (2008-2010) 569 (2002-2010)	0	236
Contribution to existing average annual Village of Ruidoso diversion	100%	0%	88–98 percent if only no-flow day triggers used, as described on page 125 8–53 percent if no-flow day and pumping volume triggers used, as shown above 42 percent average

a – It is important to note that the adaptive management triggers in alternative 3 (adaptive management) are written to provide flexibility in implementing restrictions on pumping; this analysis used the 900 acre-feet per year over 3 years or 300 acre-feet per year trigger as its starting point. If only the no-flow days trigger was used, these volumes would likely have been substantially higher and would only have reduced pumping volume from 6.5 to 66.5 acre-feet per year compared to alternative 1; projecting these results into the future should be viewed as a maximum reduction; available water to the applicant may be higher.

Based on implementing the no-flow day restriction at the pre-wildfire Eagle Creek gage under alternative 3 (adaptive management), pumping reductions would likely range from 6.5 acre-feet per year to 66.5 acre-feet per year, if similar conditions occurred in the long term as the pre-wildfire years used in the analysis (see “Water Resources” section of this chapter for more information); or would provide approximately 88–98 percent of the applicant’s current average annual diversion (using a 569 acre-feet per year average for current levels). This is considered a reasonable range of estimated reductions from implementing the flow condition triggers, which are the primary proposed management tool under alternative 3 (adaptive management).

However, there may be further reductions based on cumulative pumping volumes and water table triggers, as described in the “Adaptive Management” section of the alternative 3 (adaptive management) description in chapter 2. Under adaptive management, these reductions would likely vary over time according to USDA Forest Service review, different pumping strategies, monitoring results, and hydrologic conditions. Under some circumstances, additional triggers could be applied to

maintain the flow system, whereas under other conditions only the flow triggers (the primary management tool) would be applied.

Assuming the 300 acre-feet per year adaptive management trigger was implemented combined with the flow condition triggers (or 900 acre-feet per year over 3 years) during 2008–2011, average annual diversions would have been reduced over actual diversions (table 16); under this scenario, alternative 3 (adaptive management) would have contributed an average of 236 acre-feet per year, or between 8 and 53 percent (42 percent average) to the applicant's average annual diversion.

As shown, if available pre-wildfire data are indicative of future years, implementing alternative 3 (adaptive management) could measurably limit the water available for applicant pumping through implementation of adaptive management triggers, and these limits would likely be greatest during dry years (such as 2011). However, all of the adaptive management triggers proposed are designed to be used in concert with each other and to be flexible so that a balance between providing water and protecting resources is met. In addition, over the long term, post-wildfire vegetative transitions in the watershed may slightly improve groundwater availability within the North Fork Eagle Creek (North Fork Eagle Creek drainage on and off National Forest System land) (see "Water Resources" section beginning on page 100). If this occurs, contributions to municipal water supply could be slightly greater throughout the year and during the 5-month summer resort period. This should be considered a maximum reduction scenario, based on limited data available from pre-wildfire years, and should therefore be used with caution. It is possible that available water could be higher than shown here.

Streamside Recreation Use

Under alternative 3 (adaptive management), it is anticipated that over the short term (i.e., until watershed "recovery") the quality of recreation experience would remain uncertain during the transitional wildfire recovery period with uncertainty in water quantity and quality. Over the long term (i.e., after the wildfire recovery period) watershed conditions are expected to return to approximate pre-wildfire conditions ("Water Resources"section beginning on page 100); thus, streamflow quantity would be greater than pre-wildfire levels. In addition, streamflow quantity under this alternative would be less than under no pumping alternative. By limiting pumping the aquifer water level recovery times would decrease leading to a decrease in the duration of no surface flow periods (Water Resources Report; AECOM 2015). Consequently, these conditions could support a higher quality streamside recreation experience compared to the no change alternative but lower quality than alternative 2 (no pumping).

Over the long-term springs, seeps and dependent riparian vegetation important to the quality of recreation experience could be improved over pre-fire conditions under this alternative. Two springs are within the area of projected drawdown, as depicted in figure 12 and figure 13 and could be affected. However, the decreased drawdown and shorter water-level recovery times predicted under this alternative would also decrease the potential for impacts to springs and seeps, compared to alternative 1 (see water resources section earlier in this chapter). In addition, post-wildfire vegetative transition along with pumping restrictions could result in enhanced aquatic habitats and additional opportunities for improving riparian (water resources section). Thus, alternative 3 (adaptive management) provides the less detrimental effects to the quality of recreation experience from impacts to springs, seeps and associated riparian vegetation than the no-change alternative but more detrimental effects than alternative 2 (no pumping). According to the riparian report, change in effects are expected to be the same as those described in alternative 1, except that any positive benefit from increased availability of water to riparian vegetation and therefore recreation would be greater in magnitude in alternative 3.

Availability of Domestic Well Water and Water for Irrigation

Two domestic wells are within the area of projected drawdown as depicted on figures 7a and 7b, and could be affected. However, the decreased drawdown and shorter water-level recovery times predicted under this alternative would also decrease the potential for impacts to these wells, compared to alternative 1 (see water resources section beginning on page 100). The potential for adverse effects are still greater though, than under alternative 2 (no pumping).

Under alternative 3 (adaptive management), it is anticipated that over the short term until watershed "recovery") the availability of water for irrigation would remain uncertain during the transitional wildfire recovery period. Over the long term (after the wildfire recovery period) watershed conditions are expected to return to approximate pre-wildfire conditions (see "Water Resources" section page 100); thus, streamflow quantity would be greater than pre-wildfire levels. In addition, streamflow quantity under this alternative would be less than under the no pumping alternative. By limiting pumping the aquifer water level recovery times would decrease leading to a decrease in the duration of no surface flow periods (Water Resources Report; AECOM 2015). Consequently, these conditions could support a higher quantity of water for irrigation uses compared to the no-change alternative but lower quantity than alternative 2 (no pumping).

Financial Efficiency

Table 15 summarizes the discounted present value of costs and present net value for each monitoring measure. Under alternatives 3 the present net value would range from $4.6 to $7.2 million dollars depending on a range of costs based on professional opinion in the face of uncertainty (see Table 15). Under this alternative the Village of Ruidoso would pay for all monitoring measures except riparian vegetation monitoring (which would be covered by the Forest) thus their present net value would be slightly less than the total present net value. While less financially efficient than alternative 2 the village would benefit from ongoing use of wells for municipal water supply. In addition, benefits from maintained instream flow and improved riparian condition would be realized. These benefits are not described in financial or economic terms for this project, but rather are discussed in other sections of this document and other specialist reports; for example effects on riparian vegetation and watersheds resources.

Values, Beliefs, Attitudes

As discussed above under alternative 3 (adaptive management), it is anticipated that North Fork Eagle Creek wells diversion would contribute less to municipal water supply than currently. Thus quality of life as it relates to municipal water supply would be less before the wildfire. However, quality of life associated with the quality of recreation experience and the availability of domestic well water would increase under this alternative relative to the current situation. Thus, under this alternative, the Lincoln National Forest would continue to support quality of life to the area community; less than supported before the wildfire from municipal water supply and more in terms of the quality of recreation experience and the availability of domestic well water.

Environmental Justice

Alternative 3 (adaptive management) is not expected to have a disproportionately high and adverse human health or environmental effect on minority or low income populations. While adverse effects to total municipal water diversions are anticipated, they are expected to be distributed amongst all segments of the Village of Ruidoso population since water diversion from the North Fork Eagle Creek wells cannot be attributed to supply certain areas of the Village of Ruidoso. Consequently, effects to these communities cannot be considered disparate since effects would occur to communities

regardless of racial, ethnic, or poverty status. However, low-income communities could be more adversely affected if rates for water increase.

Cumulative Effects

Regardless of pumping restrictions under this EIS, the Village of Ruidoso 40-year plan has shown that future Ruidoso needs for water supply and water rights exceed existing supplies and rights. Future water usage projections show that Ruidoso will require 5,097.2 acre-feet per year diversion, even with existing and future utility use reductions and conservation. Existing water supplies and water rights as developed do not meet these needs (Wilson and Company 2005 pp. 1–53). With water supply uncertainty following the Little Bear Fire the Village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). In addition to the six existing and operating wells that are supplemental to the North Fork Eagle Creek wells in the Eagle Creek basin, there are an additional 7 supplemental wells in the cumulative impact analysis area off of National Forest System lands that the Village has applied for and that could also divert the Eagle Creek water right in the future (Office of the State Engineer, personal communication, 2014). On October 23, 2014, the Office of the State Engineer issued a permit to the Village of Ruidoso allowing the transfer of 700.83 acre-feet per year from H-1979 to the surface point of diversion at Eagle Creek and Alto Lake[16]. In addition, the Village of Ruidoso has several pending applications with the Office of the State Engineer (State of New Mexico, Office of the State Engineer, personal communication, September 2014) that could affect groundwater and surface water withdrawal along Eagle Creek. These applications are listed in the water resources report (water resources report page 7). If all these pending applications are approved by the Office of the State Engineer, it would enable the village to access their water rights (for both surface and groundwater) from approximately 16 wells and two surface diversions along Eagle Creek (water resources report page 7). Thus, once conditions allow for North Fork Eagle Creek well pumping to resume at pre-wildfire levels it is likely that the Village of Ruidoso will have made water supply adjustments in order to meet water supply demand. Consequently effects on measures of dependency presented above can be considered an upper bound of potential effects. There are additional domestic wells and points of diversion, for real estate developments and resorts, along the Eagle Creek drainage below the North Fork Eagle Creek well field, off of National Forest System land. Consequently the potential cumulative effects on streamflows and groundwater resources are not restricted to water uses by the Village of Ruidoso. More information on this uncertainty can be found under the “Cumulative Effects” and “Additional Impact Information” headings in the “Additional Impact Information” section.

With restrictions on groundwater withdrawal under this alternative, the potential for adverse cumulative economic effects to municipal water supply would be greater under this alternative than under the no change alternative but less than alternative 2 (no pumping). These effects would accrue in addition to effects from other actions identified in table 5 of the EIS. The potential for adverse cumulative economic effects to the quality of recreation experience provided by streamflow quantity, springs, and seeps would be less under this alternative than under the no change alternative but more than alternative 2 (no pumping). In addition, the potential for adverse cumulative economic effects to nearby domestic wells would be less under this alternative than under the no change alternative but more than alternative 2 (no pumping).

[16] The permit severed the adjudicated rights to H-1979. However, the Village of Ruidoso’s municipal rights pertaining to proof of beneficial use, in the amount of 350.42 acre-fee per year, remain provable at H-1979.

Conclusion

With restrictions on groundwater withdrawal under alternative 3 (adaptive management), the North Fork Eagle Creek wells would not provide their pre-wildfire share of Village of Ruidoso water supply (from 24 to 29 percent of direct water supply and 36 to 43 percent of total water supply that considers indirect contributions from the 50 percent return flow credit; see discussion above). As an example using pre-wildfire data, over the range of restrictions, the forgone water diversion due to withdrawal restrictions could reduce the contribution of North Fork Eagle Creek wells to approximately 23 to 25 percent of the recent total Village of Ruidoso diversions under alternative 3. Consideration of additional indirect contributions attributable to North Fork Eagle Creek well diversions from the 50 percent return flow credit indicate that North Fork Eagle Creek wells would continue to provide 34.5 to 37.5 percent to the municipal water supply. The potential for effects to forgone water diversion is greater during the 5-month summer resort period (38 to 58 percent of annual well field pumping in 2006 and 2004, respectively of direct water supply and 57 to 87 percent of water supply that considers indirect contributions from the 50 percent return flow credit). Over the range of hypothetical pre-wildfire restrictions, the forgone water diversion due to withdrawal restrictions could reduce the share of summer resort contribution to between 25 and 57 percent of total annual well field withdrawal. Consideration of additional indirect contributions attributable to North Fork Eagle Creek well diversions from the 50 percent return flow credit indicate that North Fork Eagle Creek wells would continue to provide 37.5 to 85.5 percent during the 5-month summer resort period. Municipal water supply would be greater under this alternative than the no pumping alternative and streamflow quantity under this alternative would be less than under the no pumping alternative.

Over the long term, post-wildfire vegetative transitions in the watershed may slightly improve groundwater availability within the North Fork Eagle Creek (North Fork Eagle Creek drainage on and off National Forest System land) (see “Water Resources” section). If this occurs, contributions to municipal water supply could be slightly greater throughout the year and during the 5-month summer resort period. In addition to the six existing and operating wells that are supplemental to the North Fork Eagle Creek wells in the Eagle Creek basin, there are an additional 7 supplemental wells in the cumulative impact analysis area off of National Forest System lands that the Village has applied for and that could also divert the Eagle Creek water right in the future (Office of the State Engineer, personal communication, 2014). On October 23, 2014, the Office of the State Engineer issued a permit to the Village of Ruidoso allowing the transfer of 700.83 acre-feet per year from H-1979 to the surface point of diversion at Eagle Creek and Alto Lake[17]. In addition, the Village of Ruidoso has several pending applications with the Office of the State Engineer (State of New Mexico, Office of the State Engineer, personal communication, September 2014) that could affect groundwater and surface water withdrawal along Eagle Creek. These applications are listed in the water resources report (water resources report page 7). If all these pending applications are approved by the Office of the State Engineer, it would enable the village to access their water rights (for both surface and groundwater) from approximately 16 wells and two surface diversions along Eagle Creek (water resources report page 7). Thus, once conditions allow for North Fork Eagle Creek well pumping to resume at pre-fire levels, it is likely that the Village will have made water supply adjustments in order to meet water supply demand. Consequently reliance on North Fork Eagle Creek well pumping may be less than depicted above. Effects on measures of dependency presented above can be considered an upper bound of potential effects. Thus, this should be considered the maximum reduction to municipal water supply contributions. Under this alternative the village would be required to incur costs associated with monitoring activities required under their permit. The discounted present value

[17] The permit severed the adjudicated rights to H-1979. However, the Village of Ruidoso’s municipal rights pertaining to proof of beneficial use, in the amount of 350.42 acre-fee per year, remain provable at H-1979.

of these costs is greater than alternative 2 however, the village would benefit from ongoing use of wells for municipal water supply that would not be realized under alternative 2.

The potential for adverse effects to the quality of recreation experience provided by streamflow quantity, springs, and seeps would be less under this alternative than under the no change alternative but more than alternative 2 (no pumping). In addition, the potential for adverse effects to nearby domestic wells would be less under this alternative than under the no change alternative but more than alternative 2 (no pumping).

Summary

Implementing alternative 1 (preferred alternative, continue pumping at historic levels) or alternative 3 (adaptive management) would both achieve the first need statement for this project which is "authorizing, under a special use permit, the applicant's ability to access and divert groundwater from its North Fork Eagle Creek wells on National Forest System land, as a substantial component of the municipal water supply system that Ruidoso residents and visitors rely upon." Because both alternatives would continue to provide water to the Village of Ruidoso and would, therefore, continue to contribute to the municipal water supply, they meet the intent of this need statement. However, alternative 3 (adaptive management) may not provide the pre-wildfire share of water as would alternative 1 (preferred alternative, continue pumping at historic levels) (from approximately 24 to 29 percent of direct water supply and 36 to 43 percent of total water supply that considers indirect contributions from the 50 percent return flow credit; see discussion above). Regardless the discussion above notes that when additional indirect contributions attributable to the 50 percent return flow credit are considered under alternative 3, North Fork Eagle Creek wells would continue to provide 37.5 to 85.5 percent of municipal water supply during the 5-month summer resort period. Alternative 2 (no pumping) does not address this need statement and would not provide any contribution to the municipal water supply. Over the long term, post-wildfire vegetative transitions in the watershed may slightly improve groundwater availability within the North Fork Eagle Creek (North Fork Eagle Creek drainage on and off National Forest System land) (see "Water Resources"section page 100). If this occurs, contributions to municipal water supply could be slightly greater throughout the year and during the 5-month summer resort period. In addition to the six existing and operating wells that are supplemental to the North Fork Eagle Creek wells in the Eagle Creek basin, there are an additional 7 supplemental wells in the cumulative impact analysis area off of National Forest System lands that the Village has applied for and that could also divert the Eagle Creek water right in the future (Office of the State Engineer, personal communication, 2014). Once conditions allow for North Fork Eagle Creek well pumping to resume at pre-wildfire levels it is likely that the Village of Ruidoso will have made water supply adjustments in order to meet water supply demand. Consequently reliance on North Fork Eagle Creek well pumping may be less than depicted above. Effects on measures of dependency presented above can be considered an upper bound of potential effects. Thus, this should be considered a maximum reduction to municipal water supply contributions.

While the short-term effects of implementing alternatives 1, 2 and 3 to other aspects of the socioeconomic analysis (streamside recreational use; domestic wells and water for irrigation; values, attitudes and beliefs; and environmental justice) are uncertain during the watershed recovery period following the Little Bear Fire, the long-term effects are the same as those described above for each alternative for the pre-wildfire assessment.

The socioeconomic principles and goals listed above illustrate the need for the Lincoln National Forest to adopt a management alternative that adequately responds to changing human conditions and demands while also supporting multiple uses and sustained yield. Alternative 3 (adaptive management) moves towards the above forest plan goals to the greatest extent, compared to the other

alternatives. The no change and no pumping alternatives (1 and 2) do not address the intent of the forest plan as well as the adaptive management alternative. Alternative 2 (no pumping) meets the second goal to "Secure and provide an adequate supply of water for the protection and management of the Forest" but does not go as far towards meeting the forest plan as the adaptive management alternative in regards to other goals to "Use land ownership adjustment to accomplish resource management objectives and respond to public needs" and "Provide opportunities to satisfy local demand for Forest resources" (USDA Forest Service 1986).

Significant Issue: Water Rights

The purpose of this section is to discuss the applicant's water rights in the context of the proposed alternatives. The issues related to reissuance of a special use permit to the applicant to continue pumping from wells located on National Forest System lands includes the beneficial use of the Village of Ruidoso's adjudicated water rights. This section provides a brief overview of the Village of Ruidoso's existing water rights and discusses water rights in the context of each alternative.

Methodology

Well pumping results in changes in the dynamics of groundwater and surface water. Surface water and groundwater availability are linked and are limited not only by accessible available quantities of water, but also by available water rights. Limiting access to groundwater pumping has the potential to alter municipal water supply and affect beneficial use of the Village of Ruidoso's total adjudicated water rights.

The North Fork Eagle Creek wells along Eagle Creek draw water in the amounts associated with the right that is attributable to each well. Changes to the amount of groundwater withdrawal by the North Fork Eagle Creek wells could potentially impact the Village of Ruidoso's timely beneficial use of the water rights tied to each well. The alternatives will be compared using the following measurement indicator:

- Beneficial use of the Village of Ruidoso's adjudicated water rights

Affected Environment

The "Water Rights Report" (Thompson 2015) is available in the project record and includes an overview of water rights in New Mexico and a detailed history of the Village of Ruidoso's water rights. This report is incorporated by reference, discussed briefly below, and available in its entirety in the project record. The glossary also provides some of the more commonly-used terms related to water rights.

Except for Federal Reserved Rights, the Federal Government defers to state law in the allocation of water on public lands. The Federal government recognizes those water rights on public lands that were perfected according to state law [California Oregon Power Co. v. Beaver Portland Cement Co. (S.Ct.1935)].

New Mexico follows the prior appropriation doctrine. Central to New Mexico's definition of prior appropriation is that all appropriated waters must be put to beneficial use, and that priority shall give the better right. Beneficial use is the basis, the measure, and the limit of the right. The state's water law is found in New Mexico Statutes Chapter 72. The Office of State Engineer, appointed by the Governor and confirmed by the State Senate has broad authority over New Mexico's distribution of the State's water. The State Engineer is responsible for supervising the state's water resources through the appropriation and distribution of all of the state's surface and groundwater. The State Engineer is

also secretary for the Interstate Stream Commission, which is responsible for investigating, protecting, conserving, and developing New Mexico's water supply.

Water rights in New Mexico can be held by any entity except by the State Engineer. A water right can be severed from the land through an application to the Office of the State Engineer. Water rights can also be transferred from one entity to another, but a change application must be filed and approved by the Office of the State Engineer. Water rights are also considered real property and may be bought or sold and can be conveyed as part of a piece of real property or it can be severed from the land and sold separately. New Mexico's surface water code was created in 1907 and when it became a state in 1912, the new constitution adopted the prior appropriation doctrine. Any appropriation of surface water initiated on or after March 19, 1907 requires a valid permit issued by the State Engineer. Since March 29, 1907, New Mexico has considered most surface water in the state to be fully appropriated, so most recent water rights are attributable to groundwater.

The New Mexico groundwater code was enacted in 1931. The groundwater code specifies the administrative procedures for processing any application of new groundwater, to change the place of use or purpose of use of an existing groundwater right, to change the location of a well, to add a supplemental well, or to drill a replacement well. However, groundwater use and development can only be administered by the Office of the State Engineer in basins that have been declared to have reasonably ascertainable boundaries. The Office of the State Engineer can close declared basins in order to limit future use and prevent impairment of existing uses.

Surface and groundwater can be hydrologically connected. Conjunctive water use recognizes this typical connection and tries to utilize it to more efficiently manage the water supply. Conjunctive management of both surface water and groundwater has been established by judicial affirmation in a case known as City of Albuquerque v. Reynolds (1962). The New Mexico Supreme Court recognized the statutory authority of the State Engineer to conjunctively administer hydrologically connected surface and groundwater.

In 2010, a consent order was negotiated with the Village of Ruidoso and the Office of the State Engineer to more accurately define the Village of Ruidoso's water rights in Eagle Creek. This subfile order adjudicates the groundwater rights wells (H-1979 through H-1982) in the total combined amount of 1,692.88 acre-feet per year at each respective point of diversion and also recognizes the Village of Ruidoso's right to place an additional 846.46 acre-feet per year into use subject to filing of proof of beneficial use by December 31, 2024. This consent order is the Village of Ruidoso's adjudicated water rights as of 2014. This water rights summary is shown in table 17 and in figure 11 earlier in this chapter.

The 2010 Consent Order also discusses the Village of Ruidoso's surface rights along Eagle Creek (located off National Forest System lands and adjudicated in subfile R.33) and the separate relationship with the North Fork wells (table 18). The surface diversion can be combined with supplemental water pumped from the North Fork wells to satisfy the Village of Ruidoso's surface water rights along Eagle Creek. This surface water right and supplemental groundwater pumped from the North Fork wells is in addition to and separate from the Village of Ruidoso's groundwater rights discussed in the previous section. Therefore, an additional 761.12 acre-feet per year could be pumped from the National Forest System wells as supplemental to the Village of Ruidoso's surface water rights. This combined surface diversion and groundwater from the North Fork wells is illustrated in the following table.

Table 17. 2010 Consent order between the applicant and Office of the State Engineer for the four North Fork Eagle Creek wells, updated with recent information from 2014.

Well Number	2009 Final Adjudication and Recent Permit	Applicant's Municipal Right[a] to Additional af/yr Subject to Proof of Beneficial Use on 12/31/2024[b]	Total af/yr Combined Final Adjudication and Municipal Right Still Subject to Proof of Beneficial Use[c]
H-1979 (North Fork Well 1)	0.00	350.42	350.42
H-1980 (North Fork Well 2)	46.77	23.39	70.16
H-1981 (North Fork Well 3)	550.71	275.36	826.07
H-1982 (North Fork Well 4)	394.57	197.29	591.86
TOTAL	992.05	846.46	1,838.51

a – NMSA 72-1-9 allows municipalities a water use planning period not to exceed 40 years, in which water rights can be developed based on the water development plan.

b – The applicant can pump this amount now or wait to pump as long as they show beneficial use before December 31, 2024.

c – This is the maximum amount the applicant can ever pump from each well.

Table 18. 2010 Consent Order Surface and Groundwater Rights Combined. (The surface diversion and supplemental groundwater can be combined at any rate by any withdrawal method (surface or ground)

Diversion	Amount[a]	Location
Surface Diversion	combined	Off National Forest System lands
Surface Diversion	combined	Off National Forest System lands
H 1497	combined	Off National Forest System lands
H 1497-S	combined	Off National Forest System lands
H-1979	combined	North Fork Eagle Creek -National Forest System lands
H-1980	combined	North Fork Eagle Creek -National Forest System lands
H-1981	combined	North Fork Eagle Creek -National Forest System lands
H-1982	combined	North Fork Eagle Creek -National Forest System lands
H-1979-S	combined	Off National Forest System lands
H-1979-S2	combined	Off National Forest System lands
H-1979-S3	combined	Off National Forest System lands
H-1979-S7	combined	Off National Forest System lands
Total	761.12	

a - Withdrawal is based on priority, but the amounts can be diverted from any combination of surface or groundwater. There is not an attributable amount to each individual withdrawal method (surface or groundwater).

The priority dates for the surface diversion listed in table 18 are shown below:

Priority and Amount

1882 for 91.435 af/yr

1883 for 257.01 af/yr

1884 for 21.72 af/yr

1885 for 94.115 af/yr

1887 for 10.86 af/yr

1894 for 39.82 af/yr

1895 for 50.675 af/yr

1896 for 47.055 af/yr

1902 for 36.2 af/yr

July 9, 1913 for 112.23 af/yr

On October 23, 2014, the Office of the State Engineer issued a permit to the Village of Ruidoso allowing the transfer of 700.83 acre-feet per year from H-1979 to the surface point of diversion at Eagle Creek and Alto Lake. The permit severed the adjudicated rights to H-1979. However, the Village of Ruidoso's municipal rights pertaining to proof of beneficial use, in the amount of 350.42 acre-feet per year, remain provable at H-1979 (table 18). In addition, the Village or Ruidos has several pending applications with the Office of the State Engineer (State of New Mexico, Office of the State Engineer, personal communication, September 2014) that could affect groundwater and surface water withdrawal along Eagle Creek. These applications are enumerated below:

- The Village of Ruidoso filed an application to make wells H-1497 and H-1497-S supplemental to H-1979, H-1980, H-1981 and H-1982. In that application, the Village requested that pumping from H-1497 and H-1497-S be limited to 300 acre-feet per year for each well.
- The Village of Ruidoso then filed an application to add wells H-1979-S-10, H-1979-S-11, H-1979-S-12, H-1979-S-13 and H-1979-S-14 as additional supplemental wells to H-1979, H-1980, H-1981 and H-1982. In this application, the Village requested that pumping from H-1979-S-10, H-1979-S-11, H-1979-S-12, H-1979-S-13 and H-1979-S-14 be limited to 400 acre-feet per year for each well.
- Next, the Village of Ruidoso filed an application to add wells H-1979-S-5 and H-1979-S-6 as supplemental wells to H-1979, H-1980, H-1981 and H-1982. In this application, the Village requested that the combined pumping from H-1979-S-5 and H-1979-S-6 be limited to 400 acre-feet per year.

If all these pending applications are approved by the Office of the State Engineer, it would enable the applicant to access their water rights (for both surface and groundwater) from approximately 16 wells and two surface diversions along Eagle Creek (see also figure 4 and figure 5). This allows the applicant to diversify extraction methods based on water availability.

The Village of Ruidoso has also entered into a memorandum of agreement with the Rio Hondo Land and Cattle Company. Both parties agreed to the following:

- The Village of Ruidoso only has 1,624.51 acre-feet per year in the North Fork Eagle Creek wells (a loss of 68.37 acre-feet per year from the 2009 consent order).
- The Village of Ruidoso will not attempt to change the diversion for any of its rights outside the Eagle Creek basin. The Eagle Creek basin is defined as the basin lying west of the north/south quarter line of Section 36 Township 10S, Range 13E, NMPM.
- The Village of Ruidoso will cancel all excess rights pertaining to the proof of beneficial use.

To our knowledge as of August 2014, this agreement between the two parties has not been acknowledged by the Office of the State Engineer. If an updated consent order from the Office of the State Engineer including this agreement is issued, the USDA Forest Service will recognize the updated consent order as the most current description of the applicant's water rights. Until that time, the USDA Forest Service will use the 2009 final adjudication and recently approved permits as the Village of Ruidoso's water rights in the North Fork Eagle Creek. The alternatives presented in this document for analysis would not be affected by implementation of this memorandum of agreement.

Water Distribution

To summarize, the Village of Ruidoso has groundwater rights in North Fork Eagle Creek on National Forest System lands. In addition to the four North Fork Eagle Creek wells, the Village of Ruidoso also has water rights for other water diversions in other parts of the Eagle Creek basin (and off of National Forest System land) that include a surface diversion, four supplemental wells to the North Fork Eagle Creek wells, and both the brown and green wells (totaling six additional wells and one surface diversion) in the Eagle Creek drainage off of National Forest System lands; and 2,561.57 acre-feet in water rights (figure 11 and table 19). Table 19 lists the water rights associated with each of these diversions in the larger Eagle Creek drainage.

Table 19. Eagle Creek drainage summary of water rights, updated with recent information from 2014 (see also figure 11)

State Engineer File Number and Name	Annual Historic Maximum (acre-feet per year)
0173, 187: Eagle Creek Surface Diversion	761.12
H-1979 North Fork 1 (NF-1) H-1980 North Fork 2 (NF-2) H-1981 North Fork 3 (NF-3) H-1982 North Fork 4 (NF-4) H-1979-S "Alto Lake well" H-1979-S-2 "River well" H-1979-S-3 "Ball Field Concession well" H-1979-S-7 "Below Alto Lake well" 1979 Series Total Water Right	992.05
Municipal Right for H-1979 series wells subject to PBU in 2024	**846.46**
H-1497 "Green well" H-1497-S "Brown well" H-1497 Series Total Water Right	107.57
Total Eagle Creek Water Rights	**2707.28**
Total North Fork Wells Water Rights	**1838.51**

Eagle Creek Surface Supply:

This water right is the Village of Ruidoso's share (one half) of the now-dissolved Eagle Creek Inter-Community Water Supply Association, which was originally established in 1954. These water rights have priority dates ranging from 1882 to July 9, 1913. Wilson and Company (2005) report that the average annual streamflow available for diversion is approximately 1,600 acre-feet per annum or 2.21 cubic feet per second (992 gallons per minute) at the Eagle Creek diversion point. Streamflow data shows occasions during drought periods when very little or no flow is available for diversion on Eagle Creek (Wilson and Company 2005).

Brown and Green Wells:

The H-1497 series wells near the Eagle Creek point of diversion are commonly known as the Brown and Green (or Woodpecker) wells. These wells have priority dates of 1869 and 1923 and are adjudicated for 59.61 acre-feet per year. Additionally, water rights were transferred to these wells in the amount of 77.76 acre-feet per year with a priority date of 1867. The total volume of finalized water rights associated directly with these two wells is 137.37 acre-feet per year, of which half may be consumptively used while the other half must be return flow. These wells also may be used to supplement the diversion of surface flows from Eagle Creek (Wilson and Company 2005).

Groundwater is combined with surface water at Alto Lake Reservoir and piped to the Alto Crest Water Treatment Plant (WTP 3) and treated before being pumped into the system. Potable water production from Alto Crest WTP 3 varies depending upon water demands from the system, averaging as much as 2.3 million gallons per day (7.06 acre-feet per day), or as little as 0.5 million gallons per day (1.53 acre-feet per day) for water supply (Wilson and Company 2005).

Once treated, the water removed from the Eagle Creek drainage is then pumped into two large tanks that sit at the top of the drainage boundary that divides the Eagle Creek drainage and the Rio Ruidoso drainage. The water from the North Fork wells leaves the Eagle Creek drainage and enters the Village of Ruidoso's distribution system that supplies its customers in the Rio Ruidoso drainage. After the water is used by the customers, it is collected via the sewer system and sent to the wastewater treatment plant. Once treated, the effluent is then discharged into the Rio Ruidoso. Because some of the discharged effluent is actually water from the Eagle Creek drainage, the Village of Ruidoso receives an effluent credit. Based on this, the Village of Ruidoso is able to divert surface water from the Rio Ruidoso in an amount equal to what portion of the discharged effluent leaving the wastewater treatment plant is attributable to what is pumped out of the Eagle Creek drainage.

Rio Ruidoso Water Supply

We describe above the applicant's water rights associated with one part of the applicant water supply system, the Devils Canyon (Eagle Creek) portion. The other part of the Village of Ruidoso water supply comes from the Upper Rio Ruidoso watershed, through surface water diversion and groundwater pumping. These two subwatersheds are both part of the larger Pecos River basin and administered by the Office of the State Engineer. Upper Rio Ruidoso water is diverted as both pumped groundwater and through a river intake. Groundwater is treated at the wellhead and fed directly into the distribution system. Surface water is collected at Grindstone Reservoir and treated at the Grindstone Water Treatment Plant before being fed into the distribution system. Grindstone Reservoir storage capacity is 1,520 acre-feet (488 million gallons). Combining Eagle Creek and Upper Rio Ruidoso together consists of 2 raw water reservoirs, 2 surface water treatment plants, and 18 permitted wells, of which 11 are active wells, capable of together producing peak capacity of approximately 6 million gallons per day (Wilson and Company 2005).

The 2012 Little Bear Fire halted the production of both surface and groundwater diversions along Eagle Creek due to water quality and debris flow issues. This not only impacted water production, but also affected the Village of Ruidoso's ability to access the return flow credits along the Rio Ruidoso. The shift from the Eagle Creek watershed to the Rio Ruidoso watershed has created a temporary redistribution of water rights along the Rio Ruidoso (also impacted by water quality from the Little Bear Fire). Approved on an emergency basis by the Office of the State Engineer, the Village of Ruidoso received a temporary additional point of diversion, at the confluence of the Rio Ruidoso and Carrizo Creek to the south, to provide water to the Grindstone Dam for use in the municipal supply. This redistribution is anticipated to be short-term in nature and historic water rights and allocation will remain as defined in the 2010 Consent Order.

The Village of Ruidoso also has several pending applications with the Office of the State Engineer (State of New Mexico, Office of the State Engineer, personal communication, September 2014) that could affect groundwater and surface water withdrawal along Eagle Creek, as described earlier. If all of these pending applications are approved by the Office of the State Engineer, it would enable the Village to access their water rights (for both surface and groundwater) from approximately 16 wells and two surface diversions along Eagle Creek. This would allow the Village to diversify extraction methods based on water availability.

Environmental Consequences

Alternative 1 – Preferred Alternative - No Change

There are no effects under alternative 1 (preferred alternative, continue pumping at historic levels) since the Village of Ruidoso would be able to put to beneficial use their adjudicated water right at the current point of diversion, which total 1,838.51 acre-feet per year and provide, on average, a direct contribution to the Village of Ruidoso water supply ranging from 24 to 29 percent. When indirect annual contributions are added to direct contributions (based on factoring in diversions from return flow credits, described in more detail in chapter 1 and in chapter 3), this increases to 36 to 43 percent. During the summer months, data show that 57 to 87 percent of total direct and indirect annual diversions can be attributable to the North Fork wells.

Lack of diversion due to emergency circumstances created by the Little Bear Fire in 2012 is not expected to have a direct effect on the beneficial use of the Village of Ruidoso's adjudicated water rights.

Alternative 2 – No Action (No Pumping)

Without groundwater withdrawal at the current location, the Village of Ruidoso would have the option to file application with the Office of the State Engineer to transfer the point of diversion of their water rights. This is a State of New Mexico process that does not involve the USDA Forest Service. The process to transfer water rights can be time consuming. The Village of Ruidoso would need to file an application to transfer water rights with the Office of the State Engineer. After the application is filed, a notice of intent to change the right's use or place of use is published in the newspaper of record where the rights are located. Anyone who objects to the proposed transfer files a formal protest with the Office of the State Engineer. Protests must be based on a claim that the transfer will impair existing rights, be contrary to the conservation of water, or be detrimental to public welfare. If no protest is filed, the Office of the State Engineer could approve the transfer if it finds the transfer compatible with State law. If however, there is a protest, the Office of the State Engineer holds a formal hearing on issues set out in the protest and decides the case. If either party is

dissatisfied with the Office of the State Engineer's decision, an appeal can be made to district court. These hearings can take months or years to complete.

Alternative 3 – Adaptive Management

With the potential for limits to be placed on the amount of groundwater withdrawn from the North Fork well field, dependent on implementation of the adaptive management strategy under alternative 3 (adaptive management), the Village of Ruidoso would have the option to file an application with the Office of the State Engineer to transfer the point of diversion of a portion of their water rights. This is a State of New Mexico process that does not involve the USDA Forest Service, but as described above for alternative 2 (no pumping), can be time consuming and lengthy; the Office of the State Engineer has authority to approve or disapprove an application for transfer of water rights.

Update to overall effects due to the Little Bear Fire:

The wildfire halted the production of both surface and groundwater diversions along Eagle Creek due to water quality and debris flow issues. This impacted water production and the Village of Ruidoso's ability to access the return flow credits along the Rio Ruidoso. The shift from the Eagle Creek watershed to the Rio Ruidoso watershed created a temporary redistribution of water rights along the Rio Ruidoso (also impacted by water quality from the Little Bear Fire). Approved on an emergency basis by the Office of the State Engineer, the Village of Ruidoso received a temporary additional point of diversion, at the confluence of the Rio Ruidoso and Carrizo Creek to the south, to provide water to the Grindstone Dam for use in the municipal supply. This redistribution is anticipated to be short-term in nature. Lack of diversion due to emergency circumstances created by the Little Bear Fire in 2012 is not expected to have a direct effect on the beneficial use of the Village of Ruidoso's adjudicated water rights.

Over the long term, historic water rights and allocation will remain as defined in the 2009 Consent Order. Therefore, the effects of implementing alternatives 1, 2 and 3 to the beneficial use of the Village of Ruidoso's water rights is the same as that described in the pre-wildfire assessment above.

Vegetation (Except Riparian Vegetation)

Vegetation (except riparian vegetation) is not a significant issue and we will only briefly discuss it here.

This analysis focuses on three different aspects of vegetation: upland vegetation; threatened, endangered, and sensitive plant species; and nonnative invasive plants. In the next section, we discuss the relationship between forest density and water yield.

A more detailed description of affected environment, methods, and environmental consequences for this project can be found in the vegetation report (Miller 2012b). The supplemental vegetation report (Miller 2014 and Kuhar 2014 and Miller 2015) provides a more detailed description of affected environment, methods, and environmental consequences, considering the changes caused by the Little Bear Fire. These reports are incorporated by reference, discussed briefly below, and available in their entirety in the project record.

Methodology

Baseline information used to assess impacts to vegetation was provided by specialists with the Forest Service, literature, and professional judgment. Upland vegetation was analyzed in Arcmap 10.1 using the terrestrial ecosystem unit inventory dataset clipped to the North Fork Eagle Creek drainage boundary (figure 2). North Fork Eagle Creek was buffered by 200 feet to designate the riparian area.

This riparian area was then excluded from analysis for upland vegetation. Cumulative effects were determined using Lincoln National Forest shapefiles of past, present and future project areas (table 4).

Threatened, endangered, and sensitive plants were analyzed in Arcmap 10.1 using the rare plant forest inventory dataset clipped to the North Fork Eagle Creek drainage area. North Fork Eagle Creek was buffered by 200 feet to designate the riparian area. Cumulative effects were determined using Lincoln National Forest shapefiles of past, present and future project areas (table 4). Existing populations of rare plants were examined in the field in 2010 and 2011. Much of the project area was surveyed for threatened, endangered, and sensitive plants as part of the Eagle Creek project in 1996 and 2002.

Nonnative invasive plants were analyzed in Arcmap 10.1 using the corporate nonnative invasive plant forest inventory dataset clipped to the North Fork Eagle Creek drainage area. Cumulative effects were determined using Lincoln National Forest shapefiles of past, present and future project areas (table 4).

Temporal effects boundaries are 1 to 10 years for short-term effects and 10 to 20 years for long-term effects. The North Fork Eagle Creek drainage boundary (figure 2) was chosen as the spatial boundary because it contains the area of predicted direct/indirect impacts from projected drawdown, as described in more detail in the water resources section of this chapter and shown in figure 12 and figure 13.Accordingly, the cumulative effects boundary matches the largest area of direct and indirect effects.

Well pumping results in changes in the dynamics of groundwater (groundwater drawdown and water table) and surface water (streamflows, wetlands, springs, and seeps). Surface water and groundwater availability are linked and limited by accessible available quantities of water. These changes have the potential to indirectly affect water available for recruitment, growth, and maintenance of upland vegetation, depending on the extent of possible water table drawdown and rooting depth. The alternatives are compared using the following indicators:

Upland Vegetation: extent and duration of possible water table reduction and proximity to upland vegetation communities.

Threatened, Endangered, and Sensitive Plants: proximity and timing of proposed actions and possible water level changes to habitat for threatened, endangered, and sensitive species.

Nonnative Invasive Plants: possibility for increasing the spread of nonnative invasive plants.

Affected Environment

Upland Vegetation

Vegetation in the North Fork Eagle Creek project area, described prior to the Little Bear Fire in 2012, consists of mixed conifer, ponderosa pine, high grass, and mid-grass vegetation types. Mixed conifer is the most prevalent and makes up approximately 88 percent of the project area. Forest density is discussed separately in the “Conifer Density, Fire Regime, and Water Yield” section.

Upland vegetation in the project area burned in the Little Bear Fire with a mix of burn severities. Most grass, ponderosa pine and mixed conifer communities burned at low intensity or less. However, each of these vegetation types did experience some moderate and severity burn severity, as shown in more detail in Miller 2015. The areas in the drainage that burned with severe intensity were generally located in the wilderness area. These areas could potentially undergo a type change from forest to shrub types as seen after fires on the forest (Kuhar 2013). Stand data collected in 2012 to assess

wildfire effects showed that areas in the perimeter of the Little Bear Fire that had previous fuels treatments were burned at low severity or less (Kuhar 2013).

Threatened, Endangered, and Sensitive Plants

We reviewed the Lincoln National Forest sensitive species list (USDA Forest Service 2007) to determine what threatened, endangered, and sensitive plant species are either known to occur or have potential to occur in the project area based on habitat preferences. We consulted the United States Fish and Wildlife Service Web site (on November 10, 2011 and again on February 4, 2014) to determine endangered and threatened species for Lincoln County (https://ecos.fws.gov/ipac/wizard). There is one endangered species, Kuenzler's hedgehog cactus (*Echinocereus fendleri var. kuenzleri*), that is listed for the county, but does not occur nor have the potential to occur in the project area, based on habitat preferences. For these reasons, this species would not be affected by proposed actions and was not considered further.

We also considered 23 other plant species on the Lincoln National Forest sensitive species list for this project, as described in more detail in Miller (2012b), but only two of these have the potential to be affected by proposed actions. The focus of this analysis, then, is on Wooton's hawthorn (*Crategus wootoniana*) and Sierra Blanca cliff daisy (*Ionactis elegans*) because they are known to occur in the project area. The other 21 species considered either do not occur in the project area, do not have habitat in the project area, or have potential habitat in the project area but that would not be affected by proposed actions.

There are four known populations of Wooton's hawthorn in the project area. This species often occurs near the banks of Eagle Creek; its preferred habitat is canyon bottoms and openings in lower montane coniferous forest. All populations occur greater than 750 feet upstream of the wells (the nearest is 750 feet from the wells and the farthest is about 0.5 mile from the wells). Populations were delineated and censused by Dr. Richard Worthington and T. Nicolet in 2001. The earliest record of this species in the project area dates from an herbarium record collected in 1899. Other specimens were collected in 1984 and 1997 (Dr. Tim Lowrey, pers. comm. 03/08/2011).

All four occurrences were burned in the Little Bear Fire (table 4). Twenty eight percent of the occurrences were underburned and 72 percent were burned at low intensity; there were no populations burned at moderate or severe intensity. Field surveys by TEAMS and Lincoln National Forest personnel determined that populations have increased since the initial survey work in 2001, with the exception of one population that was affected by the Little Bear Fire due to erosion following a flooding event.

There are six known populations of Sierra Blanca cliff daisy in the project area. All populations occur more than 1.25 miles upstream of the wells and in cliffs (the nearest is 1.25 miles and the farthest is 2.5 miles from the wells and in the cliffs). Their preferred habitat is igneous rock faces in montane coniferous forest at 7,600–9,500 feet in elevation.

All six occurrences were burned in the Little Bear Fire (table 4). Eight percent were underburned, 59 percent were burned at low intensity and 33 percent at moderate intensity.

Nonnative Invasive Species

Through Executive Order 13112 (which was signed in 1999) the National Invasive Species Council was established to ensure that Federal programs and activities to prevent and control invasive species are coordinated, effective, and efficient. Invasive species are those that are not native to the ecosystem under consideration and that cause or are likely to cause economic or environmental harm or harm to

human, animal, or plant health. For policy purposes, invasive species are those whose negative impacts outweigh their beneficial effects (Invasive Species Advisory Committee 2006).

The term “noxious weed” refers to a legally defined category of nonnative invasive species. Legally, a noxious weed is any plant designated by a Federal, state, or county government as injurious to public health, agriculture, recreation, wildlife, or property (Sheley, Petroff, and Borman 1999). The current New Mexico Noxious Weed List (Gonzales 2009) includes 37 species that have the potential to negatively impact the State’s environment or economy. The list also includes eight species designated as watch list species that have the potential to become problematic in the State. The Lincoln National Forest list of nonnative invasive species known to occur on the forest (Stewart 2011) was also reviewed. The only nonnative invasive plant species from these lists that has been observed in the North Fork Eagle Creek effects analysis area is musk thistle (*Carduus nutans*). It was detected in riparian monitoring plots five times and was observed occasionally throughout the area, outside of established plots. We have identified approximately 62 acres of musk thistle in the project area, located primarily along North Fork Eagle Creek and along Ski Run Road to the west.

Musk thistle is a biennial member of the sunflower family that grows to 6 feet tall. In one growing season a single plant can produce over a 100,000 seeds. Therefore, it can increase from a single plant to a rather large infestation within 2 to 3 years. The seeds can remain viable in the soil for roughly 15 years, which necessitates intensive monitoring of sites and repeat treatments. Musk thistle does best in disturbed areas, such as along roadsides, grazed pastures, and old fields, but it can also invade deferred pastures and native grasslands. It can occur in almost all habitats except dense forest, high mountains, deserts, and frequently cultivated farmland. Musk thistle is one of the most widespread and problematic invasive species on the Lincoln National Forest.

All the musk thistle populations were burned in the project area. BAER guidance assumes that a 25-30 percent increase in area occupied by weeds would be an acceptable rate (White Paper Noxious Weeds, BAER Guidance and Direction. March 17, 2001). It is likely that musk thistle occurrences have increased as a result of the Little Bear Fire. Seeding was undertaken following the Little Bear Fire to reduce further noxious weed spread (USDA Forest Service 2012).

Environmental Consequences

All Alternatives
Direct and Indirect Effects

Upland Vegetation

Neither alternative 1 (preferred alternative, continue pumping at historic levels) or alternative 3 (adaptive management) propose any new substantial ground disturbance and, therefore, would not result in any direct effects to upland vegetation. Any minor amounts of ground disturbance associated with routine maintenance and monitoring needs under alternative 1 (preferred alternative, continue pumping at historic levels) would be negligible and minimized by project design features. Under the worst case drawdown scenario (figure 12 and figure 13) for alternative 1 (preferred alternative, continue pumping at historic levels), indirect effects of water drawdown would reach into the North Fork Eagle Creek drainage area and could reduce available moisture for new growth. Upland vegetation is not as sensitive to water fluctuation as riparian vegetation and would be resistant to changes. Upland species have colonized dry soils with only natural precipitation as a water source. These species would be marginally affected by groundwater withdrawal and any associated groundwater decline. Growth of individual trees may be stunted, but vegetation is expected to survive these impacts; while individual plants could be affected, this would not result in measurable affects to

upland vegetation across the project area as a result of implementing alternative 1 (preferred alternative, continue pumping at historic levels). Because alternative 3 (proposed action) proposes an adaptive management strategy that would reduce the level of drawdown and would result in increases in water availability, the potential indirect effects would be similar to alternative 1 (preferred alternative, continue pumping at historic levels) and could be of less magnitude.

Because alternative 2 (no pumping) would eliminate pumping entirely, there would be no drawdown and the possibility for adverse effects to upland vegetation would be eliminated. Alternative 2 (no pumping) would result in ground disturbance through removal of wells and well facilities; this has the potential to directly affect vegetation, but this potential effect would be minimized by project design features and would be negligible.

Update to overall effects due to the Little Bear Fire:

Upland vegetation burned by the wildfire is likely to experience additional stress due to effects from wildfire damage and therefore could be adversely impacted from reduced water availability due to drawdown from well pumping. Therefore, the potential for adverse impacts from alternative 1 and 3, as described above, could be somewhat greater than predicted above, post-wildfire. Because upland vegetation is less sensitive to groundwater drawdown effects from pumping than vegetation in the riparian zone, these differences between pre-wildfire and post-wildfire effects are likely negligible to minor.

Threatened, Endangered, and Sensitive Plants

Sierra Blanca cliff daisy is a shallow-rooted small plant that prefers rocky substrates in canyons. It does not occur within the vicinity of the well field and would, therefore, not be affected by any ground-disturbing actions under any of the alternatives (routine maintenance and monitoring activities for alternatives 1 and 3 or well facility removal under alternative 2). This species is not dependent on groundwater and would not be directly or indirectly affected by well pumping. Therefore, implementation of alternative 1 (preferred alternative, continue pumping at historic levels) would not result in either direct or indirect effects to this species.

Wooton’s hawthorn is found along the North Fork near the creek and within the riparian area but also ranges further upslope to the top of flat benches; it has been observed in dry, steep gravelly slopes on the edge of ponderosa pine forest. In other locales, populations are found in dry roadcuts away from water. Wooton’s hawthorn observations along the North Fork over the last 7 years indicate stable or increasing populations (Cordova, personal communication 2011). Surveys by Richard Worthington in 2001 found that one of the occurrences in North Fork Eagle Creek had 20 plants, matching an herbarium record from 1984 (prepumping period). Monitoring undertaken in 2010 and 2011 found population sizes that matched those of Worthington. Post-wildfire monitoring found that all except one population exceeded the population sizes noted by Worthington. Post-wildfire monitoring found that one population had been affected by a flooding event where a large amount of the streambank was scoured away. Populations contained all age classes: seedlings, saplings, and mature shrubs. There is every indication that Wooton’s hawthorn occupies a wide enough ecological amplitude to be unaffected by pumping.

For these reasons, there would be “no effect” to either Wooton’s hawthorn or Sierra Blanca cliff daisy with implementation of alternative 1, 2, or 3.

Update to overall effects due to the Little Bear Fire:

The impacts to Wooton’s Hawthorn and Sierra Blanca cliff daisy are the same as those described for the pre-wildfire assessment above.

Nonnative Invasive Species

Nonnative plant invasions can cause undesirable, irreversible changes. They have a variety of mechanisms that give them a competitive advantage over native species. Invasive plants often produce abundant seed, have extensive root systems, establish and spread in a wide range of habitats, grow rapidly, initiate growth earlier or later in the season than native plants, exploit water and nutrients better, and have no native enemies. According to Sieg et al. (2003), invasive species can displace native plants, out-cross with native flora, alter nutrient cycling and other ecosystems functions, and even change the flammability of an ecosystem. Many invasive plant species thrive in North America because they were introduced from other continents and have no natural controls here such as insect predators, plant pathogens, competing plants, and herbivores.

Neither alternative 1 (preferred alternative) nor alternative 3 (adaptive management) propose any new substantial ground disturbance and, therefore, would not result in any direct effects to upland vegetation; while some minor effects are possible from ground disturbance associated with the installation and operation of new alluvial wells (estimated to be less than 0.25 acres of disturbance) and the maintenance of existing facilities and routine maintenance and monitoring activities under these alternatives, project design features would minimize the potential for more than negligible effects. Therefore, possible effects are limited primarily to the indirect effects from water drawdown. Because musk thistle has a wide ecological amplitude and occurs in many types of habitats, it would neither be beneficially nor detrimentally affected by changes in water depth under any of the alternatives. For these reasons, there would be no indirect effects from implementing any of the alternatives and there would be minimal direct effects from implementing alternative 1 (preferred alternative) or 3.

Alternative 2 (no pumping) would result in ground disturbance through removal of wells and well facilities, which has the potential to directly affect musk thistle. Although the area of the disturbance would be relatively small, the disturbance would still contribute to the increased likelihood of nonnative plant spread. This potential would be minimized through implementation of project design features and would be minor and short term.

Update to overall effects due to the Little Bear Fire:

All musk thistle populations were burned in the project area and increases in occurrences in the project area are likely as a result of the wildfire. Native seeding was undertaken following the Little Bear Fire to reduce further noxious weed spread (USDA Forest Service 2012). Project design features are part of the action alternatives to minimize spread. Therefore, the impacts to invasive plants are the same as those described for the pre-wildfire assessment above.

Cumulative Effects

Because the direct and indirect effects from implementing any of the alternatives on upland vegetation, threatened, endangered, and sensitive plant species, or nonnative invasive plants are quite minimal, the possibility for cumulative effects is, therefore, also minimal. Combining the effects from alternative 1 (preferred alternative), 2 (no action), or 3 (adaptive management) with other past, present and foreseeable future actions (as shown in table 4 and figure 4) within the North Fork Eagle Creek drainage area would not result in any measurable effects to these vegetation resources; Sierra Blanca cliff daisy and Wooton’s hawthorn populations would continue to persist; project design features would be implemented to reduce the spread of nonnative invasive plants on other projects in the North Fork Eagle Creek drainage area; and upland vegetation effects would be negligible. The relationship between conifer density and water yield is discussed in the next section.

Conclusion

The direct, indirect, and cumulative effects from implementing any of the alternatives on upland vegetation, threatened, endangered, and sensitive plant species, or nonnative invasive plants would be minimal because they are not measurably affected by changes in water levels, and possible effects from ground-disturbing activities would be minimized through project design features.

Effects compared to pre-pumping conditions

Alternative 1 effects for upland vegetation are minimal compared to the pre-pumping conditions, because this vegetation type is not as sensitive to changes in moisture regime as riparian vegetation. However, less available moisture could exacerbate other environmental stressors on individual trees or shrubs in the drawdown area. This could result in the loss of more individual plants than would be found in the absence of pumping. Alternative 2 effects would be nearly identical to pre-pumping conditions with the exception of slight ground disturbance associated with removal of pumps. Alternative 3 would be similar to those of alternative one compared to pumping, however any effects would occur with less intensity and duration.

None of the alternatives affect rare plants. There is no difference for these species under any of the alternatives compared to the pre-pumping condition.

<u>The effects from all alternatives to non-native invasive species are from associated ground disturbance. These effects are expected to be minimal due to the small footprint of disturbance in each alternative. Water fluctuations are expected to have a negligible effect on non-native invasive species present in the project area. Therefore, all effects from all alternatives compared to the pre-pumping condition are expected to be minimal.</u>

Implementing any of the alternatives would be consistent with forest plan direction for upland vegetation, threatened, endangered, and sensitive plant species, and noxious weeds. The alternatives are compliant with the Endangered Species Act, Forest Service Manual 2670 (Threatened, Endangered, and Sensitive Species), Executive Order 13112 (Invasive Species) and Forest Service Manual 2900 (Invasive Species).

Conifer Density, Fire Regime, and Water Yield

As documented in detail in the Fuels Report for this project (Kuhar 2013), surveys conducted by the Ecological Restoration Institute in 2007 in the adjacent Bonito Creek drainage on the Lincoln National Forest indicate that tree stem densities were considerably less in pre-settlement conditions of the late 1800s than they are now. For mixed conifer, ponderosa pine, and pinyon-juniper woodlands, landscapes affected by frequent fire intervals, stem densities ranged from 10 to 30 trees per acre. Landscapes tended to be more heterogeneous, supporting multiple seral states where dry upland sites had open, park-like stands, while stands in protected, moist areas tended to have dense, closed canopies.

Based on data collected in the North Fork project area in 1998, tree density averaged over 2,700 trees per acre and 94 percent of this density was comprised of trees five inches or less in diameter. Following thinning treatments in this area between 2003 and 2009, tree density was reduced to 479 trees per acre in 2012 and 87 percent of this density was comprised of trees five inches or less in diameter. When data were collected following the Little Bear Fire in 2012, tree density was further reduced to 350 trees per acre and 76 percent of this was comprised of trees less than five inches in diameter.

Photographic evidence combined with local wildfire scar data indicates that the project area has experienced a short return interval of mixed severity wildfire that has included both stand-replacement and surface fire activity. Current evidence shows stand replacement occurred at 100-3,000-acre patches that affected all vegetation types within the project area. The last large wildfire (prior to the Little Bear Fire) was about 650 acres in size and occurred in 1989. Wildfire scar data suggest a fire return interval of 26 years with a range of 12-55 years between fires. Fires potentially affected all vegetation types in a single occurrence. This is evident in a 3,600 acres wildfire that occurred in 1935 which burned through ponderosa pine, mixed conifer and some pinyon-juniper stands.

Typically stand replacement fires have resulted in type conversions to shrub and grassland. This is evidenced on both the Smokey Bear and Sacramento Ranger District where fire scars can be found today and with grass-forb-shrub the dominant cover. These vegetative associations can persist for multiple decades as displayed in both photographic evidence and monitoring data.

Post-Little Bear Fire Monitoring Results

Multiple plots were established within the Little Bear Fire perimeter immediately after the passage of the wildfire and were then monitored post-monsoon season in both 2012 and 2013 to assess species composition and trends. Areas which did not burn or burned at low severity remained a combination of mixed conifer, ponderosa pine, oak species, and pinyon-juniper. It is predicted that grass and forbs will dominate the vegetative cover and species composition in areas burned in the first few years post-wildfire. As time progresses and at ten years out and later, shrubs are likely to replace grass and forbs as the dominant cover type.

Regionally

Current forest and rangeland conditions in the Southwest indicate that these systems are not functioning properly, due in part to unnaturally high tree densities (USDA Forest Service, Southwestern Region – Regional Strategic Action Plan 2003 and Dahms and Geils 1997). By the early 1900s, fire exclusion began altering forest structure and fire regime (Covington et al. 1994). Forests with high stem density and fuel loading combined with extreme fire weather conditions have led to severe and large wildfires (Graham et al. 2004). This situation has been the impetus for the creation of, among other things, the National Fire Plan, the Healthy Forest Restoration Act (HFRA 2003), and the Southwestern Region's National Forests' Central Priority Strategy (USDA Forest Service 2004). This "Central Priority" is intended to help restore ecological functionality of wildfire to fire-adapted ecosystems in the Southwestern Region, which includes the Lincoln National Forest.

It is estimated that 145 million cubic feet of biomass is added yearly to New Mexico's forests through growth (USDA Forest Service 2004) and this added forest density puts these forests at heightened risk of high severity wildfire and insect outbreaks. It is the central priority of the Forest Service in the Southwestern Region to thin these forests (USDA Forest Service 2004).

Changes in forest density, due to vegetation management activities such as thinning or fuels treatments, can influence water yield. The Water Resources section of this chapter summarizes the anticipated effects of the Little Bear Fire on hydrologic factors in the North Fork study area. In general, however, it is well accepted that forest density can influence water yield, in addition to fire severity. If forest cover is reduced, increases in water yield or runoff can result. Forests also affect the water budget by transpiration loss, the transfer of water from the soil to the atmosphere through the tree roots, trunk, and leaves (Allen 2001, MacDonald 1987, Urie 1966).

Dahms and Gils (1997) state that "probably the largest effect on forest health in Southwestern ponderosa pine is due to the increase in the density of the trees . . ." The authors go on to state that this increased density results in lower water yields, which has a negative impact on riparian areas. Stednick (1996) and Grant et al. (2008) found that reducing forest cover by 20–25 percent could result in changes in annual water yield but reductions less than this may not result in water yield changes. Grant et al. (2008) documents that although any disturbance that reduces the density of live vegetation cover will locally increase runoff from forested watersheds; flow increases are generally not measurable until about 25 percent of the basal area of a forested watershed has been harvested.

The Gila National Forest (based in Silver City, New Mexico) prepared a briefing paper recently related to the potential for increasing water yield (USDA Forest Service 2009). This paper cites Neary et al. (2008) for a summary of past research efforts to increase water yield from watersheds in the Southwest as well as factors that determine whether increases would be viable in these watersheds. The key conclusion from Neary et al. (2008) that is discussed in this paper is that Southwestern forested watersheds offer minimal potential for increases in water yield due to:

1. low and variable precipitation and high rates of evapotranspiration and sublimation found in the Southwest;
2. while high elevation mixed conifer forests and more mesic forests have the best potential for sustainable increases in water yield compared to other forested sites, this forest type is limited in the Southwest; is often difficult to access; and requires meticulous management to maintain its natural multiaged stand structure; and
3. any water yield increases would be difficult to measure and to store.

Garrett evaluated forest restoration opportunities on the Lincoln National Forest in 2001 (Garrett 2001). This report documents an increase in forest density from an average of 20–70 trees per acre before European settlement to an average of 200–250 trees currently. This evaluation notes that more water was likely available for springs, seeps, and streams in pre-European settlement conditions than is provided currently due to the more open nature of forested stands. This report also projects the effects of returning ponderosa pine and mixed conifer stands on the Smokey Bear Ranger District to presettlement conditions over 50 years and projects substantial increases in water yield and other benefits.

Has increased forest density since pre-European settlement affected water yield in the North Fork Eagle Creek drainage area?

Based on the available data summarized above, mixed conifer and ponderosa pine forests on the Smokey Bear Ranger District and within the upper Eagle Creek drainage have increased in density since the early 1900s, similar to most forests across the Southwest. It is also likely that this increased forest density has contributed to a reduction in water yield in this drainage over the last century, particularly when combined with periods of drought. There are no data available to discern the level of influence forest density has played in available surface flow and groundwater in the North Fork Eagle Creek drainage area (figure 1), particularly in the time period since the wells began operating in 1988. It is assumed that the majority of this change occurred in the 80–90 years between the turn of century and the late 1980s when the North Fork wells began pumping; how much of a influence forest density has had on water yield since 1988 (when the wells began operating) is unknown. Additional site-specific research would be necessary to determine this level of effect and how this could influence water yield over time.

See the discussion of expected changes in water resources due to the Little Bear Fire earlier in this chapter for a specific evaluation of the North Fork Eagle Creek study area.

Would the implementation of past, present, and foreseeable future actions, combined with implementing alternative 1 (preferred alternative, continue pumping at historic levels), alternative 2 (no action/no pumping) or 3 (adaptive management), result in measurable changes in conifer density and resultant changes in water yield?

Efforts have been undertaken to reduce forest density and decrease the risk of high severity fire. As described in more detail in the vegetation report (Miller 2015b) and the fuels report (Kuhar 2013), within the 3,400-acre North Fork Eagle Creek drainage area (figure 1) prior to the Little Bear Fire, past efforts (Eagle thinning and prescribed burning projects in 2003, 2004, and 2007 as shown in table 4) focused on thinning smaller diameter trees and reducing understory ladder fuels. The Ski Run wildfire in 2003 affected approximately 7 percent of the North Fork Eagle Creek basin and removed overstory trees and created openings. These past actions combined, prior to the Little Bear Fire, totaled approximately 10 percent of the North Fork Eagle Creek drainage. Since the Little Bear Fire, forest density in the Eagle Creek basin has decreased. The “Water Resources” section earlier in this chapter summarizes the impacts of the Little Bear Fire on hydrologic conditions in the watershed, over the short- and long-term. This is also detailed in the supplemental Water Resources Report in the project record (AECOM 2015).

As shown in table 4, past, current and future activities, combined with reduced forest density due to wildfires, contribute to increases in water yield (Bosch and Hewlett 1982, Grant et al. 2008); how substantial of an effect this might be is unknown, particularly when combining this possible benefit with the current level of water diversion from municipal water supply wells and domestic wells (approximately 30 wells) in this larger upper Eagle Creek drainage, as described in more detail in AECOM (2015).

Wildlife (Except Aquatic Habitat and Fish)

Wildlife (except aquatic habitat and fish) is not a significant issue and we will only briefly discuss it here.

This analysis focuses on three different aspects of wildlife: management indicator species, threatened, endangered, and sensitive wildlife species, and neotropical migratory birds.

A more detailed description of affected environment, methods, and environmental consequences for this project can be found in the fish and wildlife report and biological evaluation and the wildlife biological evaluation (Bright 2015a and 2015b, located in the project record). The supplemental wildlife report and biological evaluation (Bright 2015) provides a more detailed description of affected environment, methods, and environmental consequences, considering the changes caused by the Little Bear Fire. These reports are incorporated by reference, discussed briefly below, and available in their entirety in the project record.

Methodology

The use of a management indicator and special interest species approach is consistent with forest direction (forest plan, p. 31 and 105) and from the forest plan environmental impact statement (pgs. 108, 109, 161-163, and 309-312) and serves as the basis for this management indicator species assessment. Selected management indicator species reflect general habitat conditions needed by other species with similar habitats. Management indicator species were included in this analysis if they were known to occur in the project area.

Executive Order 13186 places emphasis on conservation of migratory birds. Migratory birds were assessed by determining important bird areas or important overwintering areas occur in the project

area. The list of migratory bird species protected by the Migratory Bird Treaty Act appears in Title 50, section 10.13 of the Code of Federal Regulations (50 CFR 10.13). The memorandum of understanding between the Fish and Wildlife Service and Forest Service (USDI Fish and Wildlife Service and USDA Forest Service 2008) provides direction to the Forest Service on the preservation and reduction of take associated with migratory birds.

The effects of the proposal on selected bird species were determined primarily through coarse filter analyses, using the species' primary habitat. These are focus vegetative community types for which properly functioning conditions and desired future conditions have been identified across the forest.

Well pumping results in changes in the dynamics of groundwater (groundwater drawdown and water table) and surface water (streamflows, wetlands, springs, and seeps). Surface water and groundwater availability are linked and limited by accessible available quantities of water. These changes can directly affect water availability for wildlife species and indirectly affect the quality of wildlife habitat. In order to compare alternatives, the following measurable indicators have been developed:

- Changes in habitat quality and population trends for management indicator species in ponderosa pine, mixed conifer, woodlands, and aspen;
- Changes in habitat quality and population trends for threatened, endangered, and sensitive species; and
- Changes in vegetation community types that are primary habitats for neotropical migratory birds, regionally important species listed by Partners in Flight, important bird areas or important overwintering areas, and migratory birds.

Baseline information used to assess impacts to wildlife was provided by specialists with the USDA Forest Service, literature, and professional judgment.

The "Methodology" section at the beginning of this chapter describes the general approach used for cumulative effects analysis. Activities and projects summarized in table 4 and figure 4 were considered in the wildlife species cumulative analysis.

Affected Environment

Management Indicator Species

Five management indicator species are known to occur within the project area or have habitat in the project area, as listed below. Habitat and populations trends for these species were assessed on the forest in 2006 (Salas 2006), and these conclusions are also listed. No management indicator species that represent riparian habitats occur within the project area. However, under the 10th Circuit Court (UEC v. Bosworth, 2004), the USDA Forest Service is required to analyze all management indicator species for which habitat is present within the project area Unless the forest has actual survey information to show that the species in question is absent from the area.

Pygmy nuthatch – ponderosa pine; an indicator of snags and large trees; also uses mixed conifer. Trends in habitat quality are downward forestwide, but population trends are stable.

Hairy woodpecker – aspen; an indicator of aspen snags. Trends in habitat quality are downward forestwide, but population trends are stable.

Mule deer – piñon-juniper woodlands; an indicator of browse and dense canopy (scrubby cover, browse species, and closed landscapes). Trends in both habitat quality and populations are stable.

Elk – mixed conifer; an indicator of high quality mixed conifer and mountain meadows. Trends in habitat quality are upward and population trends are stable.

Ruidoso red squirrel – mixed conifer; an indicator of high quality mixed conifer with interlocking crowns and trees of cone-bearing age. Trends in both habitat quality and populations are stable.

While impacts from the Little Bear Fire to non-riparian management indicator species or habitat are not known with certainty, it is likely that populations of these species were affected to some degree, at least in the short-term. Ponderosa pine, mixed conifer, pinyon-juniper (and interspersed aspen) did experience wildfire, ranging from very low to high severity. Because the majority of the North Fork project area affected by the Little Bear Fire burned at moderate or low intensity, it is assumed that the habitat conditions for which these species are indicators, were not adversely impacted over the long-term. Over the short-term, it is possible that habitat quality could increase in the project area for these species due to an increase in snags (hairy woodpecker), an increase in shrubs and browse (mule deer), and an increase in grasses and forbs (elk).

Disturbance to upland vegetation would likely not be measurable, as described in more detail in the riparian vegetation section of this chapter. None of the management indicator species that represent riparian habitat occur within the project area. There would be no habitat type conversion as a result of this project. Miller (2015) concluded that facultative wetland species are likely to be beneficially affected by alternative 3 compared to the current condition (alternative 1). Slight increases in vegetation shifts favoring communities featuring facultative wetland species may occur, but gains would likely be moderated by the continued drying trends of climate change over the long-term time frame of this analysis. Therefore, there adverse impacts to management indicator species that inhabit or rely upon riparian habitats would range from negligible to minor, with the opportunity for slight improvement in riparian habitat conditions over the long-term under alternatives 2 and 3.

Threatened, Endangered, and Sensitive Species

We consulted the United States Fish and Wildlife Service Web site to determine endangered and threatened animal species for Lincoln County (http://www.fws.gov/southwest/es/NewMexico/SBC_view.cfm?spcnty=Lincoln). This list (queried March 2012 and again in July 2014) fulfills the requirements of the US Fish and Wildlife Service to provide a current species list pursuant to section 7 of the Endangered Species Act. Seven animal species (New Mexico meadow jumping mouse, black-footed ferret, Mexican spotted owl, northern aplomado falcon, whooping crane, mountain plover, and Rio Grande cutthroat trout) are listed for Lincoln County, New Mexico. We also reviewed the Forest Service Southwestern Region Regional Forester's threatened, endangered and sensitive species (USDA Forest Service 2013) and the Lincoln National Forest Sensitive Species List (USDA Forest Service 2012 (which were derived in part from the Lincoln County list of federally listed species) in order to determine which threatened, endangered, or sensitive wildlife species are either known to occur or have potential to occur in the project area vicinity based on habitat preferences. According to this information, the Mexican spotted owl is the only federally listed threatened or endangered species that is included in this analysis. No other federally listed species, or their suitable habitat or designated critical habitat, occur in the project area or that could potentially be affected by continuation of North Fork well operations. Out of the 38 species on the Lincoln National Forest Sensitive Species List (USDA Forest Service 2012) that were considered, only the following 4 species are included in this analysis, as described in more detail in Bright (2015a):

- Mexican spotted owl
- Northern goshawk
- Ruidoso red squirrel
- Sacramento Mountains salamander

Mexican spotted owls inhabit mixed coniferous and pine/oak forests, canyons, desert caves, and riparian areas throughout the Southwest and within the Lincoln National Forest (Ganey et al. 2011). The three main prey food species are wood rats, deer mice, and voles (Ward et al. 1995, Stokes 1997). Canopy cover and herbaceous ground cover are important prey habitat conditions.

There are three protected activity centers in the vicinity of the project area (Carlton, Krause and Eagle protected activity centers), with the Carlton Canyon protected activity center being the nearest of the three; its boundary is adjacent to the action area surrounding the wells, but its nesting area ("no touch zone") is approximately 0.75 mile outside the action area and is separated by steep topography. This protected activity center has produced young every year except 1995, 2000, and 2011 (Cordova, pers. comm. 2011). The Eagle protected activity center is located in the upper headwater reaches of North Fork Eagle Creek and the Krause protected activity center is almost entirely outside the 3,400-acre North Fork Eagle Creek drainage to the east of the North Fork Eagle Creek action area.

Based on monitoring results from 2011, there was no documented reproduction in any of these protected activity centers during the 2011 breeding season. All three protected activity areas were burned in the Little Bear Fire with varying levels of severity. The Carlton protected activity center burned at mostly low and very severity, the Krause protected activity center at mostly moderate and low protected activity center and the Eagle Creek protected activity center at mostly high and moderate severity. While the long-term effects from the wildfire on these owls are unknown, it is clear that the wildfire adversely impacted suitable nesting habitat within each protected activity center (USDA Forest Service 2012d).

Northern goshawks prefer large tracts of mature, closed canopy, deciduous, coniferous and mixed forests with an open understory. There are two established post-fledging areas within the vicinity of the project area. The Krause post-fledging area is approximately 0.20 mile from the 5-acre action area surrounding the wells. The Telephone post-fledging area (established in 2010), has a known nest that is about 0.10 mile from the well sites. No goshawks were found in either post-fledging area during 2011 surveys (Cordova, pers. comm. 2011). There would be a breeding season mitigation measure included in any new permit issued for any new construction or mechanized activity. This measure would prohibit construction or mechanized activity within 0.25 mile of the post-fledging areas from March 1 through September 30.

Northern goshawk habitat within these two post-fledging areas burned at moderate to high severity in the Little Bear Fire (USDA Forest Service 2012d).

The project area contains very marginal habitat for Sacramento Mountain salamanders. In 2001 an extensive survey was conducted as part of another project (Cordova, pers. comm. 2012). Surveys were conducted in areas above 8,000 feet in elevation. In all cases, salamanders were found above 8,600 feet and documented in the upper reaches of Eagle Creek within the wilderness area and the upper reaches of Carlton and Johnson Canyons. Salamanders were documented in Telephone Canyon in 2002 during a separate effort. The closest known salamander occurrence is approximately 0.4 mile from the 5-acre project area along Johnson Canyon.

While no data are currently available on direct effects to the closest salamander occurrence in Johnson Canyon, it is possible that this site and other areas of potential habitat in the upper reaches of Eagle Creek were adversely impacted by the Little Bear Fire. Salamanders could experience direct mortality and habitat loss due to post-wildfire threats (USDA Forest Service 2012). Salamanders can be negatively impacted by opening up of shady mature forest and by destruction or removal of downed logs in a post-wildfire situation (USDA Forest Service 2012d).

The Ruidoso red squirrel is a mixed conifer associated species. Based on the small size of the 5-acre project area, suitable habitat is limited; there are no known populations within the vicinity of the well field (Cordova, pers. comm. 2011).

Migratory Birds (Species Protected by the Migratory Bird Treaty Act)

The evaluation of effects to migratory birds uses the Forest Service Southwestern Region's protocol that focuses on migratory birds included on the New Mexico Partners in Flight's Highest Priority Species list, along with considering effects to important bird areas and important overwintering areas for migratory birds (New Mexico Partners in Flight 2007). The proposed project design and evaluation complies with the 2001 Executive Order 13186 regarding responsibilities of Federal agencies to protect migratory birds.

Based on a course filter analysis using species' primary habitats; regionally important species listed by Partners in Flight; important bird areas; and important overwintering areas, four migratory birds were considered further for this analysis, as follows:

- Virginia's warbler
- Grace's warbler
- Flammulated owl
- Red-faced Warbler

There are no designated important bird areas or important overwintering areas (large wetlands) on the Smokey Bear Ranger District where they would be expected to be impacted by activities proposed for this project.

Nesting habitat for these species are likely to have been adversely effected by the Little Bear Fire, at least in the short-term, due to the loss of heavy brush understory and some over story in mixed conifer and ponderosa pine vegetation types.

Environmental Consequences

All Alternatives
Direct and Indirect Effects

Management Indicator Species

There would be no direct or indirect effects to mule deer, elk, hairy woodpecker, pygmy nuthatch, or Ruidoso red squirrels or their habitat from implementation of any of the alternatives. The potential for disturbance during routine maintenance and repair of the wells and associated facilities would be minimal for alternative 1 (preferred alternative, continue pumping at historic levels) and alternative 3 (adaptive management); disturbance related to shutting the wells down under alternative 2 (no pumping) would also be minimal. Disturbance to upland vegetation would likely not be measurable (Miller 2015b). None of the management indicator species that represent riparian habitat occur within the project area. There would be no habitat type conversion as a result of this project.

The trends for management indicator species as reported in the most recent forestwide management indicator species assessment update (Salas 2006) would not be changed from the actions described in the alternatives for this project because there would be no habitat type conversions. There would be no new ground-disturbing activities or habitat type conversions and the baseline conditions would be maintained. Management indicator species habitats within the project and action areas would be less than 1 percent of the total acres on the forest. Even with the change in management indicator species

habitat due to the Little Bear Fire, the implementation of the alternatives is not expected to appreciably alter this changed condition to the positive or negative.

The population and habitat trends listed previously for each management indicator species are forestwide and the project area is too small in size to create a measurable change in any of these trends. In addition, the potential effects are not measurable. Population trends for elk, mule deer, hairy woodpecker, pygmy nuthatch, and red squirrels are stable on the forest in spite of drought conditions. Habitat trends are down for pygmy nuthatch and hairy woodpecker, but proposed actions would not contribute to any habitat type conversions for these species in the project area. There are no data that suggest that populations are being affected by well site activities or water use in the North Fork Eagle Creek project area.

Threatened, Endangered, and Sensitive Species

There would be no direct or indirect effects to the Mexican spotted owl or its designated critical habitat associated with any of the alternatives. There is no suitable nesting or roosting habitat and no designated critical habitat within the project area. The nearest owl protected activity center (Carlton) is adjacent to the 5-acre action area where the wells are located, but the nesting area ("no touch zone") is 0.75 mile away from this action area across steep topography and dense forest cover. There is no line of sight between the nearest known nest and action area. Owl surveys (USDA Forest Service 2003 – Biological Analysis Supplement) and more recent annual protected activity center monitoring (current as of 2011) have not detected owl presence within the 5-acre project area. The current annual operating plan for well maintenance and operations, as well as alternative 1 (preferred alternative, continue pumping at historic levels) and alternative 3 (adaptive management) include a mitigation/conservation measure to avoid construction or mechanized equipment use during the breeding season (March 1–August 31) within 0.25 mile of the protected activity center boundary (to mitigate the potential for disturbance due to noise). Alternative 2 (no pumping) also includes a mitigation measure to avoid construction or mechanized equipment activities associated with shutting the wells down during the breeding season. Therefore, any disturbance would be virtually the same for all alternatives. There is no evidence of effects to Mexican spotted owl occurrence or reproduction from disturbance related to past well operations including maintenance of National Forest System Road 127 going into the well sites, which is 0.75 mile from the protected activity center boundary. Both the Carlton and Eagle PACs were occupied in 2014. Generally, spotted owl reproduction across the District increased in 2014 (Cordova 2014) following the fire.

There would be no direct or indirect effects to the three sensitive species (northern goshawk, Sacramento Mountains salamander, or Ruidoso red squirrel) or their habitat associated with implementing any of the alternatives. Any facility maintenance and repairs, including road maintenance, would be routine and minimal, including work on approximately ¾ mile of the spur leading into the well site from the main road (National Forest System Road 127). While goshawks are known to occur in the project vicinity (the nearest nest site is 0.10 mile from the project area), upland vegetation would not be measurably affected by proposed actions (Miller 2012b). No surveys have detected Sacramento Mountains salamanders within the project area. No populations of Ruidoso red squirrels have been documented in the project area, and no upland vegetation would be measurably impacted by the project (Miller 2015b).

Update to overall effects due to the Little Bear Fire:

Based on monitoring results from 2011, there was no documented reproduction in any Mexican spotted owl protected activity centers during the 2011 breeding season. All three protected activity centers were burned in the Little Bear Fire with varying levels of severity. While the long-term effects from the wildfire on these owls are unknown, it is clear that the wildfire adversely impacted suitable

nesting habitat within each protected activity center (USDA Forest Service 2012d). Northern goshawk habitat within two known post-fledging areas burned at moderate to high severity (USDA Forest Service 2012a). No data are available on possible wildfire impacts to salamander habitat. Salamanders can be negatively impacted by opening up of shady mature forest and by destruction or removal of downed logs in a post-wildfire situation (USDA Forest Service 2012d). Even with these changes in threatened, endangered and sensitive species habitat, implementation of any of the alternatives post-wildfire would not contribute to any additional direct or indirect adverse impacts. The effects from implementing alternatives 1, 2 and 3 are the same as those described above for the pre-wildfire assessment.

Migratory Birds

There would be no direct or indirect effects to any migratory bird species or their habitat associated with any of the alternatives. The potential for noise or direct disturbance from ground disturbance during routine maintenance and repair of the wells and associated facilities would be minimal for alternative 1 (preferred alternative, continue pumping at historic levels) and alternative 3 (adaptive management); disturbance related to shutting the wells down under alternative 2 (no pumping) would also be minimal. Disturbance to upland vegetation would likely not be measurable (Miller 2015b). There would be no habitat type conversion as a result of this project. There would be no unintentional take of adults, eggs, and/or chicks and no ground or habitat disturbance from any of the alternatives for migratory birds. There would be no conversion of habitat during this project.

Update to overall Effects due to the Little Bear Fire:

Migratory bird nesting habitat for these species are likely to have been adversely effected by the Little Bear Fire, at least in the short term, due to the loss of heavy brush understory and some over story in mixed conifer and ponderosa pine vegetation types. Even with these changes in migratory bird species habitat, implementation of any of the alternatives post-wildfire would not contribute to any additional direct or indirect adverse impacts. The effects from implementing alternatives 1, 2 and 3 are the same as those described above for the pre-wildfire assessment.

Cumulative Effects

The cumulative effects area for wildlife is the project area. Because the direct and indirect effects from implementing any of the alternatives on management indicator species, threatened, endangered, and sensitive wildlife species, and migratory birds are quite minimal, the possibility for cumulative effects is, therefore, also minimal. Combining the effects from alternative 1 (preferred alternative, continue pumping at historic levels), 2 (no action), or 3 (adaptive management) with other past, present, and foreseeable future actions (as shown in table 4 and figure 4) within the project area would not result in any measurable effects to these wildlife resources. While these projects and past changes such as the Little Bear Fire, forest management practices, disease, insects, and climate change have affected trends for these wildlife species and their habitats across the forest and in the Southwest, the minor effects from this project on a relatively small area would not cumulatively add to these larger trends.

Conclusion/Determination of Effect

Mexican Spotted Owl

There would be no direct or indirect (disturbance) to Mexican spotted owls, owl habitat, or prey species as a result of implementing any of the alternatives. All alternatives would have “no effect” on the Mexican spotted owl or its suitable or designated critical habitat.

Regional Forester Sensitive Wildlife Species

The current annual operating plan for well maintenance and operations, as well as alternative 1 (preferred alternative, continue pumping at historic levels) and alternative 3 (adaptive management) include a mitigation/conservation measure to avoid construction or mechanized equipment use within 0.25 mile of any northern goshawk post-fledging area during the breeding season (March 1–August 31). Alternative 2 (no pumping) also includes a conservation/mitigation measure to avoid construction or mechanized equipment activities associated with shutting the wells down during the breeding season. Therefore, any disturbance would be virtually the same for all alternatives. There is no evidence of effects to goshawk occurrence or reproduction from disturbance related to past well operations including maintenance of National Forest System Road 127 going into the well sites.

Past well pumping and related activities have also not resulted in any known or documented impacts to Ruidoso red squirrels or Sacramento Mountains salamander individuals or their habitat; implementation of any of the alternatives would not measurably effect upland vegetation (Miller 2015b) or alter the intermittent nature of North Fork Eagle Creek.

While differences in available surface water and minor changes in riparian vegetation are possible under implementation of the alternatives (AECOM 2015 and Miller 2015a), these changes would not result in changes in habitat for northern goshawks, Ruidoso red squirrels or Sacramento Mountains salamanders. Therefore, well pumping alternatives would have “no impact” on any sensitive species or their habitat.

Management Indicator Species

Forest management practices, disease, insects, and global climate change have affected trends for all management indicator species and their habitats. Climate changes have affected specific plant communities as well as the migratory habits of some species to the point that they are using areas different from those where they have been surveyed in the past. The proposed alternatives would not create any habitat type conversions. There have been no population declines of any of the management indicator species attributable to North Fork well site activities or water withdrawals. Permit reissuance and subsequent well pumping alternatives would have “no impact” on any management indicator species or their habitat.

Migratory Birds

The current annual operating plan for well maintenance and operations, as well as alternative 1 (preferred alternative, continue pumping at historic levels) and alternative 3 (adaptive management) include a mitigation/conservation measure to avoid construction or mechanized equipment use within 0.25 mile of any northern goshawk post-fledging area during the breeding season (March 1–August 31) or within 0.25 mile of any Mexican spotted owl protected activity center. There are no planned activities within this buffer zone. Alternative 2 (no pumping) also includes a conservation/mitigation measure to avoid construction or mechanized equipment activities associated with shutting the wells down during these breeding seasons. The above mitigation measures would protect any migratory bird species during the nesting season and would prevent any unintentional take of birds, nests, eggs, or chicks. There would be no habitat disturbance and, thus, no habitat conversion.

While maintenance activities would occur under alternatives 1 and 3, these activities (driving existing roads to the well sites and checking well conditions, water conditions in the wells) are not ground disturbing actions and would not result in effects to migratory bird species. Past well operations have not shown any evidence of impacts to migratory bird species, nesting, or reproduction, even during drought periods. There have been no known or suspected population declines of any of the above species attributable to well site activities or water withdrawals. There would be no unintentional take

on migratory bird populations. Well pumping alternatives would have “no impact” on any migratory bird species or their habitat, or any designated important bird areas.

Short-term Uses and Long-term Productivity

The National Environmental Policy Act requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

If the short-term use of the water resources in the North Fork is defined as the well field permit authorization period of up to 20 years, with stipulations for review and verification of the permit terms and conditions at least every 5 to 10 years, then long-term productivity would extend at least that far into the future. Under alternative 1 (preferred alternative, continue pumping at historic levels), surface water and groundwater available for forest management (including watershed condition, riparian and aquatic habitat, and recreation) would be limited to the existing conditions or further reduced. Under alternative 2 (no pumping), there would be no short-term uses of the water supply, and long-term productivity on forest lands would have substantial near-term opportunities for improving condition. Under alternative 3 (adaptive management), a moderated condition would be attained that would allow maintenance of some of the applicant’s existing water supply, while providing opportunities for improving existing water resources conditions.

Unavoidable Adverse Effects

The adaptive management alternative includes implementation of adaptive management, project design features, and best management practices (chapter 2) intended to avoid, minimize the extent of, or reduce the potential for adverse effects on the environment. Each section of chapter 3 describes the spatial and temporal context for unavoidable adverse effects predicted from alternatives 1, 2 and 3.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

There are no irreversible commitments of forest resources under the adaptive management alternative (alternative 3) or either alternative 1 (no action) or 2 (no pumping). Under any of these management actions, the presence and uses of surface water or groundwater resources eventually could be returned to a prior state through subsequent management actions, subsequent precipitation and runoff, and groundwater recharge. An irretrievable commitment of water resources would occur under alternative 2 (no pumping) from the standpoint of the loss of municipal water supply on the part of the village. That loss could conceivably be reversed by other decisionmaking on the part of the forest at some remote point in time. However, alternative 2 (no pumping) does not represent a total “loss” of water resources for beneficial use. It is common in water resources management to have conflicting demands from different beneficial uses. In the case of alternative 2 (no pumping), the irretrievable loss of municipal use would allow greater use by other resource objectives. Similarly, under alternative 1 (no action), ongoing substantial withdrawals by the village for municipal supply would

represent irretrievable losses for other uses. For both alternatives, water resources and their uses could be eventually retrieved under changing management conditions.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with other environmental review laws and executive orders.”

Alternatives 2 and 3 comply with the following Federal laws and regulations:

- Endangered Species Act
- Clean Water Act
- Clean Air Act
- Migratory Bird Treaty Act
- National Historic Preservation Act
- National Forest Management Act

There are no conflicts between alternatives 1, 2 and 3 and the objectives of Federal, regional, State, and local policies and plans.

Chapter 4. Consultation and Coordination

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during development of this EIS. We specifically list the project role and qualifications for those members of the IDT that prepared sections of this document. Others that were consulted throughout the project for input, advice, and review are listed separately.

Core ID Team Members

AECOM

Robert C. Berry, PhD – Hydrogeologist/Geochemist - Water Resources Analysis (Groundwater and hydrogeology): PhD, Geology/Geochemistry, Princeton University; Prof. Degree, Hydrogeology, Colorado School of Mines; BS, Geology, University of Hawaii; 36 years of experience.

Dr. Berry is a groundwater hydrologist and geochemist responsible for hydrogeological evaluation of groundwater basins, aquifer testing and evaluation, aqueous geochemistry and geochemical modeling, and groundwater flow and transport modeling. He is also experienced in modeling entire groundwater basins, investigating mining hydrology issues, and water supply evaluations. Dr. Berry is an experienced field geologist with mapping experience throughout the western U.S., in rocks ranging from Archean metasediments to Quaternary alluvial deposits.

James K. Burrell, EIT – Engineering Hydrologist - Water Resources Analysis (Surface water): MS, Civil Engineering and BS, Forest Management, Colorado State University; 21 years of experience.

Mr. Burrell is a hydrologist specializing in surface water hydrology, open-channel hydraulics, stream and watershed stabilization, and related erosion and sediment transport issues. His engineering background includes fieldwork and computer modeling for rainfall/runoff, channel discharges and flood hydraulics, stream stability and scour, and sediment transport and retention structures in the U.S. and overseas. He also spent several years developing and calibrating river basin-scale continuous rainfall/runoff models as a contractor to the National Weather Service (Office of Hydrology).

David Fetter – Surface Water Hydrologist - Water Resources Analysis (water resources): BS, Watershed Science, Colorado State University; 8 years of experience.

Mr. Fetter specializes in surface water hydrology. His responsibilities have included working directly with government agencies while acting as a state permit coordinator, conducting detailed hydrologic investigations and researching, writing and editing environmental sections for permits and project documents. His project work includes National Environmental Policy Act (NEPA) report preparation for the Bureau of Land Management and Federal Energy Regulatory Commission. Prior to joining AECOM, Mr. Fetter worked for the Wyoming State Engineer's Office, and also supported interdisciplinary studies of wetland ecology within Rocky Mountain and Yellowstone National Parks.

U.S. Forest Service – TEAMS Enterprise Unit

Larry Bright – Biologist - Aquatic Habitat, Fish and Wildlife Analysis: Graduated from Oregon State in 1964 with a B.S. in Fish and Wildlife Management. Worked 28 years with Oregon

Department of Fish and Wildlife and retired while serving as the wildlife research program manager. Worked 10 years with the U.S. Forest Service, serving as the forest Fish and Wildlife Biologist on two National Forests, after 3 years of ranch work and developing a fee fishery for a ranch in Washington.

Henry Eichman – Economist - Socioeconomic Analysis: B.A. in Biology from Colorado College and a M.S. in Agricultural and Resource Economics from Oregon State University. From 2000 to 2004, Henry worked with Federal and state agencies on raptor research efforts in Colorado and Arizona. Prior to joining TEAMS in 2007, Henry worked as an economist for BLM's Prineville District in Oregon.

Vickey Eubank – GIS Specialist - GIS analysis and maps: Associate of Science in Science and Business from Labette County Community College. Vickey is very experienced in using multiple GIS applications. She excels in creating or revising complex GIS processing to facilitate analysis, modeling, programming, and creating GIS tabular, statistical, spatial, and mapping products for an array of projects. Vickey has accomplished a variety of complex GIS assignments including: an oil and gas leasing environmental impact statement (EIS); classification of satellite imagery; developing range capability models; forest plan revision; and fireshed modeling. Prior to her tenure with TEAMS, Vickey worked for the Custer National Forest as a GIS specialist and for the Kootenai National Forest as a transportation planner. Vickey has worked with TEAMS since 2004.

Deborah McGlothlin – Environmental Coordinator - Interdisciplinary Team Leader and Document Preparation: Graduated from Northern Arizona University in 1992 with a BS in Biology and from Arizona State University in 1996 with a MS in Environmental Resource Management. Worked for the Tonto National Forest as a wildlife biologist from 1990 to 2000; for Grand Canyon National Park as an environmental coordinator from 2000 to 2008 and for U.S. Forest Service-TEAMS enterprise as an environmental coordinator since 2008.

Terry Miller – Botanist - Riparian Vegetation and Botany Analysis: Graduated from Southern Illinois University - Carbondale with a BA in Plant Biology and a MS in Forest Resources from the University of Idaho - Moscow. Worked with the Forest Service since 2001 including positions such as a SCEP student on the Fishlake National Forest in Utah, a district botanist on the Plumas National Forest in California, and as a forest botanist on the Hiawatha National Forest in Michigan. Terry has worked for TEAMS since October of 2008. He has experience working on a variety of projects including timber management, fuels treatment, noxious weed treatment, watershed restoration, grazing management, travel management, and a variety of special use projects. Terry has experience with rare plant habitat enhancement, rare plant monitoring, rare plant surveys, noxious weed treatment, grant proposal writing, native plant restoration, and NRIS.

Kristin Whisennand – Writer/Editor - Document Editing: Bachelor of Arts in Anthropology from Dartmouth College and a Bachelor of Science in Resource Conservation Management from the University of Montana, graduate study in archaeology and paleontology at the University of Montana. Kristin works as a technical writer/editor with TEAMS preparing environmental and technical documents. Prior to TEAMS, she worked for 5 years as a team leader with the Forest Service Content Analysis Team and for 9 years as an archaeologist with the Lolo National Forest. Kristin has been with TEAMS since 2002.

U.S. Forest Service – Centralized National Operations

Roger Congdon, PhD – Hydrogeologist - Water Resources Oversight: Bachelor of Science in Geology from Portland State University in 1983, Master of Science in Geology from the University

of Utah in 1987, Doctor of Philosophy in Geology from Johns Hopkins University in 1991. Worked with the U.S. Geological Survey in Reston, Virginia, from 1991 to 1994; with the Bureau of Land Management in Elko, Nevada, from 1994 to 2002; with the Fish and Wildlife Service in Vero Beach, Florida, from 2002 to 2005; with the Fish and Wildlife Service in Las Vegas, Nevada, from 2005 to 2007; with the U.S. Forest Service from 2007 to the present. Supplemental training included hydrogeology at the University of Maryland in 1992 and miscellaneous short courses in groundwater modeling, aquifer testing, karst hydrology, and watershed modeling. He has experience with mine dewatering issues, well siting, groundwater modeling, and has been project manager for the Newmont Gold Quarry expansion EIS in Nevada. Roger is a member of the Washington Office hydrogeology team in the U.S. Forest Service.

U.S. Forest Service – Lincoln National Forest

Christina Thompson – District Recreation and Lands Staff - Water Rights Analysis: Graduated from the University of New Mexico in 2004 with a BA in Geography and from the University of New Mexico in 2006 with a Master of Water Resources with an emphasis in water policy and management. She has worked for the Lincoln National Forest (NF), Smokey Bear Ranger District as the recreation/lands/minerals assistant from 2006 to 2009; from 2009 to 2011 as the Gila and Lincoln NFs zone lands/minerals specialist; 2011–present as the Smokey Bear Ranger District recreation/lands staff.

Supporting IDT Members

April Banks	Lincoln National Forest Hydrologist	Water resources input and oversight
Linda Cole	Lincoln National Forest GIS Coordinator	Forest data layers and shape files
Rebecca Cross	Forest Service Southwestern Region Assistant Group Leader for Lands Special Uses	Special use permitting input and oversight
Larry Cordova	Smokey Bear Ranger District Biologist	Wildlife, fisheries, and botany input and oversight
Ron Hannan	Lincoln National Forest Planning Staff Officer	NEPA input and oversight; project management
Kim Kuhar	Smokey Bear Ranger District Fire Ecologist	Fuels analysis and post-wildfire monitoring results and interpretation
Kristen Loughery	TEAMS Enterprise Unit Economist	Socioeconomic analysis input and review
Diane Prather	Lincoln National Forest Archaeologist	Cultural resource input and tribal consultation
Peg Sorensen	Acting Lincoln National Forest Planning Staff Officer	NEPA input and oversight

Eric Turbeville	Smokey Bear Ranger District Recreation Specialist	Recreation input and oversight; district project coordination
Patti Turpin	Lincoln National Forest NEPA Coordinator	NEPA input and oversight; PALS data entry and updates
Dave Warnack	Smokey Bear District Ranger	Overall project direction and coordination; liaison with forest supervisor
Gary Ziehe	Lincoln National Forest Natural Resources Staff Officer	Overall resource input/oversight

Federal, State and Local Agencies, Tribes and Others

In February 2011, we released the notice of intent and proposed action and mailed a scoping letter with a detailed purpose and need and proposed action description to 174 stakeholders including private landowners, agencies, organizations, and tribes. We also posted information on the Lincoln National Forest Web site and published a news release in the Ruidoso News on February 15, 2011. We held a public open house at the Ruidoso Middle School on February 17, 2011, to provide project information and answer questions. As of November 2011, prior to release of the DEIS in 2012, we had received a total of 102 comment letters from you, the public—including agencies, organizations, individuals and elected officials—in response to our request for input.

We received comments from the following Federal, State, and local agencies, tribes and groups. We also received many additional comments from local citizens and private landowners and business owners. These scoping comments received and how we used them in preparation of both the 2012 DEIS and this document is described in appendix A.

- Alto Lakes Water and Sanitation District
- County of Lincoln
- Eagle Creek Conservation Association
- Eagle Creek Summer Home Association
- New Mexico Environment Department
- Pew Trusts
- Stevan Pearce, Congressman
- Upper Hondo Soil and Water Conservation District
- Village of Ruidoso
- Ysleta del sur Pueblo

We released the North Fork Eagle Creek Wells Special Use Authorization Project Draft Environmental Impact Statement (DEIS) on May 25, 2012. The notification of its availability for public comment was published in the Federal Register, a legal notice was published in the Ruidoso News, and email and letter notifications were distributed to all those on the project mailing list. Comments were requested by July 9, 2012. We received several requests for extensions to the comment period and Forest Supervisor Trujillo granted an additional 60-day extension, requesting all comments be submitted no later than September 9, 2012.

The Little Bear Fire started on June 4, 2012 and encompassed approximately 98 percent of the project area. Because of the substantial impact this wildfire had on the project area analyzed in the DEIS,

Forest Supervisor Trujillo decided to stop the comment period on the DEIS and begin the process to prepare a supplemental DEIS (SDEIS) that would address the changed conditions in the project area. This was published in the Federal Register on July 20, 2012. While we discontinued the formal comment period on the DEIS, we did invite any comments on the changed conditions in the project area by September 7, 2012.

We received comments from the following Federal, State, and local agencies, tribes and groups prior to the discontinuation of the comment period.

- Village of Ruidos Mayor
- Congressman Stevan Pearce
- Office of the State Engineer
- United States Geological Survey
- Environmental Protection Agency
- US Department of the Interior Office of Environmental Policy and Compliance

Appendix C and E include summaries of the all comments that we received and how they were used in preparing this document.

Throughout the development of this project and EIS, we have met multiple times with the applicant, the Eagle Creek Conservation Association, and the United States Geological Survey. We have also had discussions with the Office of the New Mexico State Engineer, the New Mexico Game and Fish Department, and members of Congress from the State of New Mexico.

List of Agencies, Organizations and Persons to Whom Copies of the EIS Were Sent

This environmental impact statement has been distributed to individuals who specifically requested a copy of the document. In addition, copies have been sent to the following Federal agencies (or agencies otherwise notified of availability), federally recognized tribes, State and local governments, and organizations:

- Advisory Council on Historic Preservation
- Alto Lakes Water and Sanitation District
- APHIS
- Chief of Naval Operations
- County of Lincoln
- Department of Energy
- Eagle Creek Conservation Association
- Eagle Creek Summer Home Association
- Federal Aviation Administration
- Federal Highway Administration
- Hopi Tribal Council
- Hopi Cultural Preservation Office
- Mescalero Apache Tribe
- National Agricultural Library
- National Oceanic and Atmospheric Administration Fisheries Service – Southwestern Office

- Natural Resource Conservation Service
- New Mexico Environment Department
- New Mexico Department of Game and Fish
- OEPC
- Pew Trusts
- Pueblo of Zuni
- Stevan Pearce, Congressman
- United States Environmental Protection Agency
- United States Fish and Wildlife Service
- United States Army Corps of Engineers
- United States Coast Guard
- Upper Hondo Soil and Water Conservation District
- Village of Ruidoso
- Ysleta del sur Pueblo

Glossary of Hydrology and Water Rights Terminology

Acre-foot – Volume of water required to cover 1 acre to a depth of 1 foot; equivalent to a volume of 43,560 cubic feet, approximately 325,829 gallons, or approximately 7,758 barrels of water.

Adjudication – A legal process that can settle the rights of two water right holders with respect to one another or it can settle all the rights to water within a particular water system. This process does not create new water rights, it only confirms existing rights. The completion of adjudication results in a court decree outlining the priority, amount, purpose (determination of use), periods, and place of water use.

Alluvial – Pertaining to material or processes associated with transportation or deposition of soil and rock by flowing water (e.g., streams and rivers).

Alluvium – Unconsolidated or poorly consolidated gravel, sands, and clays deposited by streams.

Andesitic – Consisting of a gray, fine-grained volcanic rock.

Appropriate – To take the legal actions necessary to create a right to take water from a natural stream or aquifer for application to beneficial use.

Appropriation – The right to take water from a natural stream or aquifer for beneficial use at a specified rate of flow, either for immediate use or to store for later use. Usually confirmed by a water court decree.

Aquifer – A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

Aquifer test - An aquifer test (or a pumping test) is conducted to evaluate an aquifer by "stimulating" the aquifer through constant pumping, and observing the aquifer's "response" (drawdown) in observation wells. Aquifer testing is a common tool that hydrogeologists use to characterize a system of aquifers and flow system boundaries.

Base flow – The volume of flow in a stream channel that is not directly derived from surface runoff.

Basin yield – The amount of water that will flow from a drainage or catchment area in a given time.

Bedrock – A general term for solid rock that lies beneath soil, loose sediments, or other unconsolidated material.

Beneficial use of water – The use of water by man for any purpose which benefits are derived, such as domestic, municipal, irrigation, livestock, industrial, power development, and recreation. Under the New Mexico Constitution beneficial use is the basis, the measure, and the limit of the right to use water; therefore, beneficial use of public water diverted or impounded by manmade works is an essential element in the development of a water right.

Borehole – The wellbore itself, including the open hole or uncased portion of the well. Borehole may refer to the inside diameter of the wellbore wall, the rock face that bounds the drilled hole.

Change (Water Right) - Process by which a water right is changed with respect to the point of diversion, place of use or nature of use.

Confined aquifer – An aquifer containing water between two relatively impermeable boundaries. The water level in a well tapping a confined aquifer stands above the top of the confined aquifer and

can be higher or lower than the water table that may be present in the material above it. In some cases the water level can rise above the ground surface, yielding a flowing well.

Confluence – The act of flowing together; the meeting or junction of two or more streams; also, the place where these streams meet.

Conjunctive Water Use - Combined use of ground water and surface water.

Cretaceous – The geologic span of time between 145 and 65 million years ago.

Double-mass analysis – A technique where the cumulative volume is plotted to reveal changes in the slope of the line, which indicates a change in conditions.

Drainage – A region or area of no particular scale bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.

Drawdown – The lowering of the elevation of the groundwater level from pumping wells. At the well, it is the vertical distance between the static and the pumping level.

Effluent – The water leaving a water or wastewater treatment plant.

Effluent exchange – The practice of using wastewater effluent as a replacement source for diversion of water upstream.

Evapotranspiration – The portion of precipitation returned to the air through evaporation and plant transpiration.

Flow frequency – statistical analysis that results in the percentage of time that specified discharges are equaled or exceeded. These results are often graphed in the form of an exceedance curve.

Formation – A body of rock that is sufficiently distinctive and continuous that it can be mapped. In stratigraphy, a formation is a body of strata of predominantly one type or combination of types; multiple formations form groups, and subdivisions of formations are members.

Groundwater – Generally, all subsurface water as distinct from surface water; specifically, that part of the subsurface water in the saturated zone (a zone in which all voids, large and small, ideally are filled with water under pressure equal to or greater than atmospheric).

Hydrograph – A graph showing stage, flow, velocity, or other hydraulic properties of water with respect to time for a particular point on a stream.

Intermittent stream – A stream that flows only part of the time or during part of the year.

Mitigate, mitigation – To cause to become less severe or harmful; actions to avoid, minimize, rectify, reduce or eliminate, and compensate for impacts to environmental resources.

Municipal Water - May come from either ground water or surface water. Once water has entered a municipal water system, it will be considered municipal water.

Nested wells – Multiple wells completed in a group that extend to differing elevations below the ground surface.

Perennial stream – A stream or reach of a stream that flows throughout the year.

Permeability – The capacity of soil, sediment, or porous rock to transmit water; the property of soil or rock that allows passage of water through it.

Point of Diversion (POD) - Point specified in a water right from which water is diverted from a source.

Porosity – The ratio (usually expressed as a percentage) of the volume of openings in rock or soil material to the bulk volume of the material. With respect to water, porosity is a measure of the water-bearing capacity of a formation.

Prior appropriation – The water law doctrine that confers priority to use water from natural streams based upon when the water rights were acquired. Water rights are confirmed by court decree; holders of senior rights have first claim to withdraw water over holders who have filed later claims.

Priority Date - Date of establishment of a water right.

Recharge – The introduction of surface water or groundwater to replenish groundwater storage in an aquifer.

Riparian – Pertaining to the banks of a river, stream, waterway, or other typically flowing body of water as well as to plant and animal communities along such bodies of water.

Runoff – That part of precipitation that appears in surface streams; precipitation that is not retained on the site where it falls and is not absorbed by the soil.

Slug test - A slug test is a particular type of aquifer test where water is quickly added or removed from a groundwater well, and the change in hydraulic head is monitored through time, to determine the near-well aquifer characteristics. It is a method used by hydrogeologists and civil engineers to determine the transmissivity/hydraulic conductivity and storativity of the material the well is completed in.

Storage coefficient – A measure of the volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head or water level.

Supplemental well (from New Mexico Office of the State Engineer 1978) - The owner of a water right may drill and use a supplemental well upon making application but prior to the publication and hearing set out in Section 72-12-3 NMSA 1978, if:

(1) the supplemental well is drilled into the same and only the same underground stream, channel, artesian basin, reservoir or lake as the well being supplemented; and

(2) the supplemental well does not increase the appropriation of water to an amount above the existing water rights; and

(3) an emergency situation exists in which the delay caused by publication and hearing would result in crop loss or other serious economic loss; and

(4) the state engineer, after a preliminary investigation, finds that the supplemental well does not impair existing water rights, and grants him a permit authorizing the drilling and use of the supplemental well prior to publication and hearing.

Surface Water - All waters whose surface is naturally exposed to the atmosphere (e.g., rivers, streams, lakes, reservoirs, impoundments, ponds, springs).

Syenite – A light colored, coarse-grained igneous rock consisting mainly of feldspar.

Tertiary – The geologic span of time between 65 and 3 to 2 million years ago.

Unconfined aquifer – An aquifer containing water that is not under pressure; the water level in a well is the same as the water table outside the well.

Watershed – A drainage defined by the Watershed Boundary Dataset (NRCS et al. 2010) and identified by a 10-digit Hydrologic Unit Code (HUC-10).

Water diversion – May be measured at any number of locations: lake or stream intake structures, interim raw water meters, or at the raw intake meter at the beginning of a treatment plant.

Water production – Is always measured at the end of a treatment system, prior to release to the public as potable water.

Water Right - The right to use a specific quantity of water occurring in a water supply, on a specific time schedule, at a specific place and putting it to a specific beneficial use.

Water year – The 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends. Therefore, the 2000 water year ended on September 30, 2000.

Well - Horizontal or vertical excavation or opening into the ground made by digging, boring, drilling, jetting or driving for utilizing or monitoring underground waters.

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Appendix A – Public Scoping Results

Responses to Scoping

Contact (Letter No.)	Last Name	First Name	Organization
1, 2, 13, 14, 47, 60, 69, 99, 101	Midkiff	Bill	Eagle Creek Conservation Association
3, 41	Sugarman	Steve	Attorney, Eagle Creek Conservation Association
4	No name given		Pew Trusts
5	Kennedy	John	
6	Ibarra	Tomas	
7	Rodgers	Jimmy	
8	Rosky	Ivonne	
9	Bryant	Dan	Attorney, Village of Ruidoso
10	Peery	Roger	
11, 59	Hutchens	Terrell	Eagle Creek Summer Home Association
12	Loera	Javier	Ysleta del sur Pueblo
15	Medlock	Justin	
16	Rehfeld	Debbie	
17	Maue	Lisa	
18	Taylor	Clark	
19	Tam	Joseph	
20	Foster	Ron	
21	Hardeman	Ron	
22	Hill	Larry and Dorothy	
23	Adamy	Earl	Alto Lakes Water and Sanitation District
24, 27	McMaster	Terry (8 others signed onto this letter)	
25	Roybal	Julie	New Mexico Environment Department
26	Elliott	Criss	
28	Potter	Frank	
29	Hamilton	Stacy	
30	Carpenter	Clark	
31	Loddy	Rushie	
32, 42, 52, 100, 102a	Alborn Lee Jones	Ray Debbie Alvin	Village of Ruidoso Village of Ruidoso Attorney, Village of Ruidoso
33, 53, 57	Rice	Steve	
34	Sarber	Mrs. Greg	
35	Hoyle	Anita and Lynn	

Contact (Letter No.)	Last Name	First Name	Organization
36	Sedillo	Eileen (3 other board members signed this letter)	County of Lincoln
37	Sawinski	B.	
38	Davenport	Martin	
39	Mussers	Larry and Barbara	
40	Pearce	Stevan	Member of Congress, 2nd District, NM
43	Brunells	Bert	
44	Pippen	Bill	
45	Richardson	Donda	
46	Ruddle	Rick	
48	Arrowsmith	Janet	
49	Brown	Dixie	
50	Karn	William	
51	No name provided		Upper Hondo Soil and Water Conservation District
54	Davis, Jr.	Lloyd	
55	Sayner	Franklin	
56	Galaska	Henry and Rita	
58	Johns	John	Prudent Associates
61	Cassels	Kelly	Attorney, SBCandW law
62	Murphy	Bob and Lorraine	
63	Hulme	Phyllis and Bernie	
64	Hiser	Tom and Eloise	
65	Salas	Rafael R.	
66	Salues	James and Amy	
67	Myers	Frank and Kathe	
68	Mauldin	Michael and Victoria	
69	Mayfied	Marlene	
70	Smith	Janet	
71	Townsend	John and Theresa	
72	Yankee	William and Dot	
73	Hoats	Dennis	
74	Plymale	Allen and Linda	
75	McCullough	Harold	
76	Newsom	Glenda and Charlie	
77	Rivers	The	
78	Roberson	Max and Marilyn	
79	Hancock	Flloyd and Joe Alice	
80	Mimoso	Nancy and JE	
81	Beaty	Brett (8 others signed this letter)	

Contact (Letter No.)	Last Name	First Name	Organization
82	Calhoun	Roland and Sydney	
83	Sawyer	Mary	
84	Wittenger	Bernie	
85	Buckley	Verna	
86	Kirkman	Sue	
87	Lutrell	Johnnie and Tom	
88	St. John	Don	
89	Barnett		
90	Enlol	Terrie	
91	Swier	EV	
92	Kinyon	Bill	
93	Perry	Kenneth	
94	Hickman	Fred and Betty	
95	Johnson	Bob	
96	Borthomyger	Richard A	
97	Beyer	Lucy P	
98	Montgomery	Weldon	

a – Letter 102 came from Alvin Jones, Henninghausen & Olsen, LLP, attorney for the Village of Ruidoso and enclosed comments from Roger Peery (John Shomaker and Associates hydrogeologist) and Jackie D. Atkins, P. E. (Atkins Engineering and Associates)

Categorized Scoping Comments and Responses

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
55	1	Alternative	As the large majority of the water supply of Ruidoso is derived from Eagle Creek rights I think it is extremely important the Village continue to pump the well fields on Upper Eagle Creek. Please give strong consideration to the continuation of the ability of the Village of Ruidoso to pump from Forest Service land.	5.1 Suggestion	The range of alternatives for detailed analysis in the EIS, as described in chapter 2 includes a no action (no change) alternative (continuation of pumping with no change in existing well pumping operations) as well as the proposed action (pumping but with implementation of adaptive management options to minimize effects and two other alternatives that address the key issues.
26	1	Misc. - Thank you for your comment	I'm just an everyday citizen who with his wife moved full time to Ruidoso last year. We had a summer home here for over ten years and decided this was where we would retire and live out our remaking years. We still love the small village, our many friends, the mountains and forest. But the pettiness between village and county government is disappointing over the issue of water. Yes, this has been a continuous issue for many years but our governments must work together for the common good of all its citizens and reach compromise that we can all live with. To say "to hell with your stream" or "just learn to live with 25% of your current water supply" is an insult to common sense. I don't have a solution to this issue but I do hope we can get our leaders to lead together and represent all of our citizens for our common good and put aside egos and personal agendas.	5.1 Suggestion, comment or procedural concern	See response to commenter 55, comment 1 above. The purpose and need for taking action and the management objectives developed for this project include achieving a balance between the need for the municipal water supply and protecting forest resources.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
18	9	Alternative 1 No Action (con with rationale)	The no action alternative of issuing a permit with no changes in the existing operation is not a solution to the problems identified by the available science provided in the reports by USGS, Finch and Balleau. This alternative is not viable to the economy of the area nor the required environmental management of the Eagle Creek drainage as provided in the Forest Service manual.	3.1 Alternatives	We recognize that the no action (no change) alternative (continuation of pumping with no change in existing well operations) does not fully address the purpose and need for action. Our purpose and need for action recognizes that a change from the current situation is necessary to provide a balance between protection of forest resources and providing water. Having the no action (no change) alternative in the range of alternatives is important for comparison of the effectiveness of the other alternatives in addressing the key issues and the purpose and need. The EIS includes a detailed analysis of effects of all alternatives on the key issues, including natural resources and socioeconomics.
51	10	Alternative 1 No Action (con with rationale)	The no action alternative of issuing a permit with no changes in the existing operation should not be considered as a solution to the problems provided in the reports by USGS, Finch and Balleau. This alternative is not sustainable to the economy of the area or the required environmental management of the Eagle Creek drainage.	3.1 Alternatives	See response above.
4	5	Alternative 2 No Pumping (pro with rationale)	None of these accommodations should be made unless Ruidoso immediately takes actions in other ways to preserve water. No action by Forest Service should take place unless Ruidoso shows action on their part to conserve water.	3.1 Alternatives	We considered suggestions for additional water conservation measures and these are described in chapter 2.
38	2	Alternative 2 No Pumping (pro with rationale)	As a homeowner in Eagle Creek Canyon I see the damage to an aquatic ecosystem caused by overly aggressive groundwater pumping. I favor surface water over aggressive urban growth. Until the Village seriously implements infrastructure improvements, conservation measures, and rainwater catchments, I encourage the FS to implement Alternative 1 – No Pumping.	3.1 Alternatives	We considered suggestions for additional water conservation measures and these are described in chapter 2. The forest supervisor will review and consider all the findings presented in the EIS before he selects an alternative for implementation.
4	4	Monitoring	None of these accommodations should be made unless Ruidoso immediately takes actions in other ways to preserve water. This plan should be reviewed every 4 years mandatorily.	3.1 Alternatives	See response above.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
4	1	Misc. - Outside the Scope	None of these accommodations should be made unless Ruidoso immediately takes actions in other ways to preserve water. All gray water must be reused.	3.1 Alternatives	See response above.
4	2	Misc. - Outside the Scope	None of these accommodations should be made unless Ruidoso immediately takes actions in other ways to preserve water. No more golf courses to be built or developed and some should close down. They are big users of water for no purpose at all.	3.1 Alternatives	See response above.
4	3	Misc. - Outside the Scope	None of these accommodations should be made unless Ruidoso immediately takes actions in other ways to preserve water. Prohibit new development if there is no water available. NJ had to do this some time back. Just prohibit new building.	3.1 Alternatives	See response above.
17	1	Misc. - Outside the Scope	I believe that until the Village of Ruidoso fixes its pipes, enacts conservation and catchment measures, and proves that it is willing to work with individuals and other agencies that the Forest Service should concentrate on the health of the forest in and around Eagle Creek which is also suffering.	3.1 Alternatives	See response above.
1	11	Alternative New Suggested	Bill stated that if the Village built additional storage capacity, they could continue to pump during periods of high flow and store the water. The Village should take water when nature provides it and then store it.	3.1 Alternatives	We considered this suggestion for additional storage capacity and this is described in chapter 2.
18	15	Alternative New Suggested	The natural fluctuation precipitation and snowmelt runoff would allow the Village of Ruidoso to obtain a controlled amount of municipal water from the Eagle Creek drainage without impacting the surface flow if the Village of Ruidoso had additional storage capacity. (Contact 18, Comment 5)	3.1 Alternatives	See response above.
11	2	Alternative New Suggested	If an alternative source of fresh water is not available, a viable alternative would be for the Village of Ruidoso to construct a water purification plant allowing the Village to reclaim wastewater. Perhaps grants from the Federal Government are available for such projects. Many other cities in arid areas including El Paso, Texas, have water purification plants for this purpose. This would allow the Village of Ruidoso to reclaim much of its wastewater and greatly reduce or eliminate the demand for groundwater from the North Fork Eagle Creek wells.	3.1 Alternatives	We considered this suggestion for a new water purification plant and this is described in chapter 2.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
37	1	Alternative 2 (pro with rationale)	I own several lots in the Enchanted Mesa subdivision and my well is deep and does not produce enough water. I object to the idea of the Village obtaining water rights and a special use permit since they have not managed well what they got. Perhaps my opposition as a landowner will be considered.	5.1 Comment	The Forest Service does not have jurisdiction over water rights; this is under the jurisdiction of the State of New Mexico. The applicant currently owns water rights and this is outside the scope of this analysis. The decision whether to issue the applicant a new special use permit for operation of the North Fork wells will be made following the detailed analysis presented in the EIS.
5	1	Alternative 2 No Pumping (pro with rationale)	I strongly urge the Forest Service to select the no pumping alternative in this matter. The Ruidoso municipality has a poor record of only operating the wells in Eagle Creek in accordance with the permits that it has held in the past. As a residence in the Eagle Creek watershed, I have noticed a dramatic reduction in the surface water of Eagle Creek as well as reduction in the groundwater by way of drying water wells owned by myself and neighbors. This reduction of waterflow in the watershed coincides with the Village of Ruidoso's stepped up draw on its wells in the Eagle Creek watershed.	3.1 Alternatives	The EIS includes a detailed analysis of the no pumping alternative and will compare this to the other alternatives under consideration. Chapter 3 describes the potential effects of all alternatives to forest resources, including water resources. The forest supervisor will review and consider all the findings presented in the EIS before he selects an alternative for implementation.
35	1	Alternative 2 No Pumping (pro with rationale)	I believe that Eagle Creek wells should not be authorized for city use. They have been over pumping and lowering the level at all our private use wells.	3.1 Alternatives	See response above.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
18	14	Alternative 3 Proposed Action (con with rationale)	The Village has environmentally degraded this area of public lands. Manual 2541 limits the actions available to the U.S. Forest Service when there is evidence of degrading the natural resources of the stream. The allowance in the monitor indication section in the proposed action to allow no-flow days should not be considered. No-flow days during the period of 1988 to 2009 has affected the North Fork tributary and its associated riparian area and its ability of a cold water fishery since the North Fork wells were put in operation. The degradation of riparian condition is evidenced by the comparison of the riparian vegetation upstream of the North Fork Eagle Creek wells. I feel that the threshold of 20 days per year of no surface flow or more that 30 no-flow days within a single water year will be adverse to the established and improvements of the riparian vegetation between the North Fork wells and the Eagle Creek stream gauge.	3.1 Alternatives	We considered suggestions for eliminating no-flow days from the proposed action and have discussed this is chapter 3. The EIS includes a detailed analysis of effects of well pumping on aquatic habitat, fish, and riparian vegetation. The methods we use to evaluate riparian condition changes over time are described in chapter 3 of the EIS in the “Riparian” section.
14	2	Alternative 3 Proposed Action (pro with rationale)	The ECCA agrees that a new permit, if issued, should include additional terms and conditions for adaptive management (monitoring, evaluation, and modification) to insure management objectives are met.	3.1 Alternatives	Details of the alternative that is ultimately selected for implementation will become part of the terms of any new permit issued. This includes any mitigation measures, monitoring, or adaptive management actions developed through the EIS process.
45	1	Alternative 3 Proposed Action (pro with rationale)	I cannot believe that this is coming down now. We all need to work together to keep our water and our town. The Forest Service would even be cut if Ruidoso had no water.	3.1 Alternatives	Thank you for your comment. The purpose and need for taking action and the management objectives developed for this project include achieving a balance between the need for municipal water supply and protecting forest resources.
1	12	Alternative 4 Stream Augmen-tation (con with rationale)	ECCA does not like the stream augmentation alternative. There is a different chemical makeup of groundwater pumped to the surface (more dissolved solids, etc.) and this does nothing to maintain saturated bedrock.	3.1 Alternatives	We carefully considered whether stream augmentation should be carried forward into detailed analysis in the EIS. We considered how well the alternative addresses the purpose and need for action and its potential for effects to forest resources, among other criteria. We have addressed this in chapter 2.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
14	12	Alternative 4 Stream Augmen-tation (con with rationale)	We agree with the first two of the three adaptive management alternatives plus the ones we have proposed. The ECCA strongly resists even considering flow augmentation. Flow augmentation can only occur by diverting groundwater into the stream, further exacerbating the cone of depression. The USGS and Balleau and Finch (Peery) have all discussed the degradation of natural resources that result from the cone of depression.	3.1 Alternatives	See response above.
14	13	Alternative 4 Stream Augmen-tation (con with rationale)	The other factor to consider is that groundwater contains more dissolved chemicals than the natural stream water. Any attempt to augment surface flow with imported water from other locations, especially if such water should be brackish, would have a very deleterious effect.	3.1 Alternatives	See response above.
14	35	Alternative 4 Stream Augmen-tation (con with rationale)	The ECCA encourages the Forest Service to conduct a thorough and adequate review to completely rebut the flow augmentation proposal based on the three geohydrologic reports that predict extensive degradation to downstream resources from an expanding cone of depression. These three reports are by the USGS, Finch (Peery), and Balleau.	3.1 Alternatives	See response above.
14	35	Alternative 4 Stream Augmen-tation (con with rationale)	We resist authorization of surface flow augmentation because it further exacerbates the degradation of downstream resources as we have previously discussed.	3.1 Alternatives	See response above.
18	6	Alternative 4 Stream Augmen-tation (con with rationale)	The alternative that allows pumping of the North Fork wells and thereafter providing surface flow augmentation is not a viable management alternative. This will only contribute to an excessive cone of depression and reduction of surface flow in its natural condition. To pump water from the wells and deposit the water so the stream gauge indicates a minimum amount of flow will not negate the fact that the pumping is exceeding the threshold required for sustained surface flow.	3.1 Alternatives	See response above.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
24	2	Alternative 4 Stream Augmen-tation (con with rationale)	I am deeply opposed to the Village of Ruidoso being allowed to draw water from Eagle Creek wells at any time when the water is not already freely flowing in Eagle Creek! I am deeply opposed to water being pumped from Eagle Creek underground aquifer to the above ground stream in order to have water flowing in Eagle Creek because this will put an even worse strain on the underground aquifer that is already negatively affected!	3.1 Alternatives	We considered suggestions for eliminating no-flow days from the proposed action and have addressed it chapter 2. The EIS includes a detailed analysis of the effects of well pumping on aquatic habitat, fish, and riparian vegetation. See response above regarding consideration of stream augmentation.
27	3	Alternative 4 Stream Augmen-tation (con with rationale)	I am deeply opposed to pumping water from underground to the stream above ground.	3.1 Alternatives	See response above regarding consideration of stream augmentation.
36	16	Alternative 4 Stream Augmen-tation (con with rationale)	Lincoln County strongly and totally resists any consideration of flow augmentation. Flow augmentation can only occur by pumping groundwater into the stream, further expanding the cone of depression. The USGS has discussed the degradation of natural resources that result from the cone of depression.	3.1 Alternatives	See response above regarding consideration of stream augmentation.
51	7	Alternative 4 Stream Augmen-tation (con with rationale)	The alternative that allows pumping of the North Fork wells and thereafter providing surface flow augmentation is not a viable management alternative. This will only contribute to an excessive cone of depression and reduction of surface flow in its natural condition. To pump water from the wells and deposit the water so the stream gauge indicates a minimum amount of flow will not negate the fact that the pumping is exceeding the threshold required for sustained surface flow.	3.1 Alternatives	See response above regarding consideration of stream augmentation.
52	13	Alternative 4 Stream Augmen-tation (pro with rationale)	Stream augmentation by groundwater discharge to the stream from the Village wells during a drought could be beneficial to the riparian vegetation in U.S. Forest lands.	3.1 Alternatives	See response above regarding consideration of stream augmentation.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
52	8	Alternative New Suggested	Pilot testing of stream augmentation with groundwater discharge to North Fork below the well field area should be included in the proposed action and performed early in the initial period after special use permit approval to determine the feasibility of this option.	3.1 Alternatives	We carefully considered whether stream augmentation should be carried forward into detailed analysis in the EIS. We considered how well the alternative addresses the purpose and need for action and its potential for effects to forest resources, among other criteria. We have addressed this in the “Alternatives” section of chapter 2.
1	2	Alternative New Suggested	ECCA has concern with the 30-year term for the permit, as proposed. What about a 10-year term with opportunities for review and renewal every 10 years instead?	3.1 Alternatives	We considered different variations on the term of the permit to determine if they should be carried forward into detailed analysis in the EIS. We have addressed this in the “Alternatives” section of chapter 2.
1	8	Alternative New Suggested	Install new gage just upstream of the North Fork and South Fork confluence on North Fork - this would minimize the need to rely on math calculations to subtract out flow from South Fork at the Eagle Creek gage.	3.1 Alternatives	We considered installing a new gage in the location suggested, as a component of a new alternative. We have addressed this in the “Alternatives” section of chapter 2.
1	9	Alternative New Suggested	When flow is below 1.2 cfs at the new gage, stop pumping. Whenever 1.2 cfs is maintained at this new gage, continue to pump.	3.1 Alternatives	We considered this as a component of a new alternative. We have addressed this in the “Alternatives” section of chapter 2.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
1	10	Alternative New Suggested	Bill confirmed there is precedence for this type of approach; it is being used currently on the Rio Ruidoso (when a certain flow is achieved, the pumps continue to pump; when it is below a certain flow, the pump automatically shut off). This would eliminate the need for a 3-year running average. If the switches were installed, when the water level is below the 1.2 cfs, the pump is shut off.	3.1 Alternatives	See response above for the 1.2 cfs suggestion. In regards to management of the Rio Ruidoso, we recognize that the applicant is managing for a minimum instream flow. Grindstone Reservoir was built to store an adequate municipal water supply for the growing Village of Ruidoso. Prior to instituting this new management, the entire flow in Rio Ruidoso was being diverted at times into the reservoir via an underground gravity-fed pipe. The Ruidoso River Association and the Village of Ruidoso reached an agreement to maintain a minimum instream flow through town in order to protect tourism and water quality. Using CWA 319 funds, the group installed an automatic gate at the diversion that is operated via telemetry to a USGS gage upstream. When the flow at the gage drops below 6 cfs, the diversion to Grindstone is closed so the entire 6 cfs is allowed to flow through town and, thus, provide aquatic habitat and aesthetic value. The primary difference between North Fork Eagle Creek management and Rio Ruidoso management is that the Forest Service has no jurisdiction over the Rio Ruidoso (in this particular area) and had no reason to be involved in that agreement and subsequent management. In the case of North Fork Eagle Creek, we have jurisdiction over the special use permitting of wells on National Forest System lands, but do not have the authority to require this same type of system in New Mexico (as described in more detail in the separate “Manual Direction Summary” document and the scoping outcome summary). If the Eagle Creek Conservation Association and the applicant voluntarily came to an agreement regarding identifying and maintaining a minimum instream flow on North Fork Eagle Creek, we could authorize the agreement through the special use permitting process (assuming it would provide for the protection of forest resources and provide adequate municipal water supply). We could authorize the minimum instream flow management

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					plan if it met Forest Service needs, since it would be a proposal coming to us from the applicant. In the current situation, however, we do not have the authority to mandate a minimum instream flow and so considering this type of alternative in our EIS is outside our authority and does not meet the purpose and need.
13	12	Alternative New Suggested	All of the three hydrological studies seem to agree on a volume of annual groundwater recharge in the vicinity of 300 acre-feet. The ECCA does not find fault with the number, only the time of diversion. If the water flowing at the North Fork gage is only 1 cfs, then any pumping that would lower the level of bedrock saturation would cause surface water to flow into the bedrock aquifer rather than flowing along the surface. The two conditions the ECCA proposes that will protect the stream are cut-off switches to the Village wells that are activated immediately when (1) flow in the North Fork drops below the USFS determined minimum in-stream flow, and (2) when saturation of bedrock drops below the bedrock surface or below the USFS determined safe level. If these conditions become stipulations for the operation of the wells, the ECCA will not oppose allowing the Village to operate their wells to supplement water diverted for storage during periods of higher than baseline surface flow.	3.1 Alternatives	We considered these suggestions as components of a new alternative. We have addressed them in the “Alternatives” section of chapter 2.
1	1	Monitoring	...they have confidence in the overall plan but have concern in its implementation and its heavy reliance on monitoring. What are the assurances that this level of monitoring will occur, especially considering the past history of this permit? ECCA proposes electronic monitoring instead of the labor-intensive and time-consuming monitoring proposed by the Forest Service.	3.1 Suggested Alternative	See response above.
1	7	Monitoring	Install electronic monitoring switches.	3.1 Alternatives	See response above.

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14	30	Monitoring	"Every 5 years that the permit is in effect, or when triggered by exceeding the water level threshold described above, the Forest Service would evaluate and document monitoring results to determine effectiveness of the adaptive strategy and determine whether an adjustment to the parameters of this adaptive management strategy are warranted." We have already discussed our belief that using the water level threshold proposed by the Forest Service will not be effective in maintaining surface flows. We believe most certainly that such is the case. We feel confident that staff promotions in the USFS will occur quickly enough that there will be no continuity in the personnel conducting each successive 5-year review. As an alternative to monitoring by the USFS field staff, we suggest that data be electronically delivered daily and evaluated at monthly intervals. If these data demonstrate that a prospectively determined number of violations occur in a time period prospectively defined, adaptive management adjustment shall be undertaken immediately. We also suggest at least one direct visual examination of conditions on the North Fork be conducted and recorded weekly, unless violations are observed, in which case adaptive management adjustments shall be undertaken immediately.	3.1 Alternatives	See response above.
13	13	Alternative New Suggested	If the Village will construct additional storage facilities, our proposal will allow the Village to divert all of their surface water rights and up to an additional 300 acre-feet of groundwater rights. The result may be more water for the Village than the average annual diversion from the North Fork during the last 10 years.	3.1 Alternatives	We considered additional water storage and we have addressed this in the "Alternatives" section of chapter 2.
14	7	Alternative New Suggested	The Forest Service should not authorize use of Well Number 2 that has never been equipped or used. It should be declared abandoned and properly decommissioned in accordance with the SEO water well regulations. It is reportedly filled with rocks and other debris that could pose a contamination hazard.	3.1 Alternatives	We considered not authorizing well 2 and have addressed it in the "Alternatives" section of chapter 2.

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18	1	Alternative New Suggested	The Forest Service proposed action should be changed to the authorization the existing wells that are in operation (NF well 1 and NF well 4) and require the plugging and abandonment of the two wells that are not presently in use and have not been in use for a significant period of time. The validity of authorizing four municipal water wells when two wells have not been used in many years and the two wells presently in production have the ability to withdraw more ground water than the 300 acre-feet per year stated in the "Well Pumping Volume" section of the proposed action. NF Well 2, for example, is filled with beer bottles as a result of its location being a party place and the damaged protective cover allowed open access. According to personal communication with city water employee, NF Well 3 has an obstruction or separated casing that prevents the installation of a pump to the full depth of the well.	3.1 Alternatives	We considered not authorizing well 2 and well 3 and have addressed it in the "Alternatives" section of chapter 2.
36	12	Alternative New Suggested	The Forest Service should not authorize use of Well Number 2 that has never been equipped or used. It should be declared abandoned and properly decommissioned in accordance with the SEO water well regulations.	3.1 Alternatives	See response above.
51	1	Alternative New Suggested	The Forest Service proposed action should authorize the existing wells in operation (NF well 1 and NF well 4) and require the plugging and abandonment of the two wells that are not presently in use. The validity of authorizing four municipal water wells would allow the ability to withdraw more ground water than the 300 acre-feet per year stated. NF Well 2, for example, is filled with beer bottles as a result of its location being a party place and the damaged protective cover allowed open access, and apparently NF Well 3 has damages that prevent installation of a pump to the full depth of the well.	3.1 Alternatives	See response above.
14	8	Alternative New Suggested	The ECCA resists issuing a permit for more than 10 years, and that only with considerable stipulations for operation, monitoring, and adaptive management by the Forest Service.	3.1 Alternatives	We considered different variations on the term for the permit to determine if they should be carried forward into detailed analysis in the EIS. We have addressed this in the "Alternatives" section of chapter 2.

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14	9	Alternative New Suggested	We suggest that operational data including depth-to-water and quantity and rate of diversions be relayed electronically, directly from the wells to a Forest Service office where it is automatically and continuously recorded. We request that the Forest Service make easily available monthly updates and summaries that are easy to interpret by lay persons.	3.1 Alternatives	We considered electronic monitoring and have addressed it in the “Alternatives” section of chapter 2.
14	10	Alternative New Suggested	“Thresholds would be established for streamflows, water table depths, and riparian vegetation”... Adaptive management options currently under consideration include limitations on groundwater withdrawal rates; cessation of pumping for short periods; and/or surface flow augmentation. The ECCA recommends that a continuous minimum in-stream flow be required as a condition any time pumping is occurring. At any time flow measured at the downstream reach of the North Fork, near its confluence with the South Fork, drops below a minimum instream flow agreement, determined by the Forest Service, an automated switch will cut off power to all of the pumps. The pump switch shall not reactivate until the minimum instream flow is recovered.	3.1 Alternatives	We considered this suggestion as a component of a new alternative and have addressed it in the “Alternatives” section of chapter 2. The separate “Manual Direction Summary” document also includes consideration of minimum instream flow.
14	11	Alternative New Suggested	The ECCA recommends that a similar switching system be connected to a depth-to-water agreement. This switch should operate the same as the minimum instream flow switch. Our recommendation is to instrument the bedrock for saturation in lieu of a depth-to-water threshold. The USGS has reported than when surface bedrock is not saturated, surface water is diverted downward to recharge the dry bedrock.	3.1 Alternatives	We considered this suggestion as a component of a new alternative and have addressed it in the “Alternatives” section of chapter 2. The separate “Manual Direction Summary” document also includes consideration of minimum instream flow.

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14	17	Alternative New Suggested	Therefore, the ECCA suggests construction of a dedicated flow measurement gage that will measure flow (and no-flow) in the down-stream-most stretch of the North Fork. We encourage the Forest Service to proceed directly to their proposed fall-back position and allow the Village to pump at half the rate of flow (in gallons per minute) that is simultaneously being measured at the North Fork gage. Also, we encourage an absolute minimum instream flow requirement that must be sustained downstream on the North Fork before power to the pumps is permitted. These recommendations will result in huge manpower savings by the Forest Service personnel assigned to adaptive management duty.	3.1 Alternatives	We considered this suggestion as a component of a new alternative and have addressed it in the “Alternatives” section of chapter 2. The separate “Manual Direction Summary” document also includes consideration of minimum instream flow.
14	38	Alternative New Suggested	Second, we have discussed how the safe, annual well diversions must be established with respect to the surface flow at the time of the diversion. Even a 50 percent reduction in the initial allotment can be destructive to the stream if taken during periods of low flow. A minimum instream flow is a critical prerequisite to any pumping.	3.1 Alternatives	We considered this suggestion as a component of a new alternative and have addressed it in the “Alternatives” section of chapter 2. The separate “Manual Direction Summary” document also includes consideration of minimum instream flow.
16	1	Alternative New Suggested	I own two properties in Alto area 3/4 mile west of TR’s and Phillips 66 gas station. They both are on wells. I have cleared (thru logging program) both properties and feel this has helped water tables increase. My neighbors west of me have not and feel that many properties in this area should be asked to clear or thin for water table increases and fire control. If you are going to draw more water out you should assist and require properties in projected well area be thinned, perhaps using logging program reimbursement dollars. This would help fire control and water levels. Please consider this as part of requirements for further well drilling for Ruidoso.	3.1 Alternatives	We considered clearing vegetation on private land and have addressed it in the “Alternatives” section of chapter 2.

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18	13	Alternative New Suggested	The volume of the ground water pumping should be restricted so that the surface flow in the North Fork Eagle Creek can be maintained. This is indicated in the 2541 Manual of the Forest Service which limits the adverse affects of national forest resources. The Village of Ruidoso can pump on limited bases the North Fork Eagle Creek wells and maintain surface flow in the North Fork. The Village of Ruidoso can thereafter remove addition water through the surface water just east of the Forest Service boundary for additional municipal supply. The Village of Ruidoso has always had this option but has elected to ignore the local watershed management required for a stream with limited and fluctuating precipitation.	3.1 Alternatives	The proposed action includes provisions to both improve surface flow and allow pumping. We describe how manual direction will be met for this project in the separate “Manual Direction Summary” document. This is summarized in chapter 1 of the EIS.
36	15	Alternative New Suggested	Lincoln County recommends that a continuous minimum instream flow be required as a condition any time pumping is occurring. At any time flow measured at the downstream reach of the North Fork, near its confluence with the South Fork, drops below a minimum instream flow agreement as determined by the Forest Service, an automated switch will cut off power to all of the pumps. The pump switch shall not be reactivated until the minimum instream flow is recovered.	3.1 Alternatives	We considered this suggestion as a component of a new alternative and have addressed it in the “Alternatives” section of chapter 2. The separate “Manual Direction Summary” document also includes consideration of minimum instream flow.
36	23	Alternative New Suggested	Lincoln County resists issuing a permit for more than 10 years, and that only with considerable stipulations for operation, monitoring, and adaptive management by the Forest Service.	3.1 Alternatives	We considered different variations on the term for the permit to determine if they should be carried forward into detailed analysis in the EIS. We have addressed this in the “Alternatives” section of chapter 2.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
41	5	Alternative New Suggested	The documentation released thus far indicates that the USFS's alternatives analysis may be unnecessarily and illegally constrained. Perhaps most importantly, the USFS appears poised to consider only a 30-year permit in connection with the North Fork well field. Of course, the USFS has the discretion and the authority to issue a much shorter permit. Particularly in light of the complexity of the technical issues that attend your decision – together with the fact of climate change which creates an uncertain background and context for future pumping – it would be far more prudent for the USFS to consider issuing a short-term permit for North Fork well field pumping. Your failure to have identified such an alternative is troubling, but is easily rectified at this stage of the USFS's NEPA analysis.	3.1 Alternatives	See response above.
51	5	Alternative New Suggested	We agree with the USGS final report that indicates that when groundwater is pumped from the NF wells, it causes a temporary decline in groundwater which lowers the water table and creates an expanding cone of depression around the wells. The effects can be seen upstream and downstream. The volume of the groundwater pumping should be restricted so that the surface flow in the North Fork Eagle Creek can be maintained as indicated in the 2541 Manual of the Forest Service which limits the adverse affects of national forest resources. The Village of Ruidoso can pump on limited bases the North Fork Eagle Creek wells and maintain surface flow in the North Fork. The Village of Ruidoso can thereafter remove additional water through the surface water just east of the Forest Service boundary for additional municipal supply. The Village of Ruidoso needs to utilize this option, rather than degrade a stream with limited and fluctuating precipitation.	3.1 Alternatives	The proposed action includes provisions to both improve surface flow and allow pumping. We considered eliminating no-flow days from the proposed action as described in the "Alternatives" section of chapter 2. The "Manual Direction Summary" document describes how manual direction applies to this project. We summarize this direction in chapter 1.

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18	5	Laws, Regulations, and Policy	I agree with the USGS final report that indicates that when ground is pumped from the NF wells, it causes a temporary decline in groundwater which lowers the water table and creates an expanding cone of depression around the wells. Go to the area today and you can see the effects are far reaching, both upstream and downstream. The volume of the groundwater pumping should be restricted so that the surface flow in the North Fork Eagle Creek can be maintained. This is indicated in the 2541 Manual of the Forest Service which limits the adverse affects of national forest resources. The Village of Ruidoso can pump on limited bases the North Fork Eagle Creek wells and maintain surface flow in the North Fork. The Village of Ruidoso can thereafter remove addition water through the surface water just east of the Forest Service boundary for additional municipal supply. The Village of Ruidoso has always had this option but has elected to ignore the local watershed management required for a stream with limited and fluctuating precipitation. The Village has environmentally degraded this area of public lands. Manual 2541 limits the actions available to the U.S. Forest Service when there is evidence of degrading the natural resources of the stream.	3.1 Alternatives	We discuss effects to water resources in detail in chapter, including the cone of depression and the water table. The “Manual Direction Summary” document describes how manual direction applies to this project. We summarize this direction in chapter 1. In the “Alternatives” section of chapter 2 we address eliminating no-flow days and completing and establishing a minimum instream flow.
14	32	Alternative Range	“No Pumping Alternative: The Forest Service would not issue a new permit...” “No Action (No Change) Alternative: The Forest Service would issue a new permit ... with no change in existing ... operations.” The ECCA acknowledges that consideration of both of these alternatives is required by the rules for creating of an EIS.	3.1 Alternatives	Thank you for your comment.
14	33	Alternative Range	Additional alternatives: We remind the Forest Service of the additional legal agreement with the ECCA which requires that the NEPA analysis include “all reasonable alternatives (and no less than one alternative) that leave downstream flows in the same state they would be in absent the pumping of the North Fork wells.”	3.1 Alternatives	The no action (no pumping) alternative meets this requirement. We have also addressed this in the “Alternatives” section of chapter 2, where we considered whether there are any other alternatives that would meet this requirement.
47	1	Alternative Range	Are you aware of, do you have a copy of, and do you plan to add the following alternative to the alternatives listed in the NOI? Same as above quote.	3.1 Alternatives	Yes, we have a copy of the stipulation agreement. See above response.

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38	1	Alternatives	Building a gauging station on the North Fork below the present wells and before the South Fork would more accurately assess the effects of non-pumping. After a sufficient amount of time for the aquifer to recharge, a new permit along the lines of alternative 3 could be issued. I see no reason, other than turbidity issues (that can be fixed) or the Village's need to hang on to water rights, why Eagle Creek cannot be allowed to flow free into Alto Reservoir and then pumped to Alto Crest treatment station. Water rights may be about the money, but Eagle Creek is about keeping surface water alive in an arid landscape.	3.1 Alternatives	We considered installing a new gage as described in the alternatives section of the scoping outcome summary. There is a surface diversion located downstream of National Forest System land on Eagle Creek which is operated by the applicant. There are also other municipal and domestic wells before Eagle Creek enters Alto Reservoir. The Forest Service has no jurisdiction over these diversions.
49	1	Alternatives 1 No Action (pro with rationale)	Yes, it would be a perfect world if we had lots of running streams in our area. Our village depends on water for our present and future. Cutting this water source off makes no sense. Should we just pack up and move so that Eagle Creek can run year round? How can this even be debated?	3.1 Alternatives	Thank you for your comment. The purpose and need for taking action and the management objectives developed for this project, as we describe in chapter 1 of the EIS, includes achieving a balance between the need for municipal water supply and protecting forest resources. The range of alternatives under consideration includes ones that allows pumping to continue.
36	18	Best Available Science	Lincoln County strongly urges the Forest Service to authorize the USGS to place these data on a timeline for all of the years for which data are available.	5.1 Suggestion	Thank you for your comment. We agree that this timeline would be helpful to the analysis. We discuss this in more detail in the "Water Resources" section of chapter 3.
12	1	Cultural Resources	We believe that this project will not adversely affect traditional, religious, or culturally significant sites of our Pueblo and have no opposition to it; However, we would like to request consultation should any human remains of artifacts unearthed during this project be determined to fall under NAGPRA guidelines.	4.1 Non-Key	Thank you for your comment. There is a project design feature requiring consultation if any human remains or artifacts are discovered. We include this design feature in chapter 2 of the EIS.

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11	1	Fisheries	It is time for the Lincoln National Forest and the applicant to make some tough decisions about the village wells on North Fork Eagle Creek. The association is concerned that the pumping of water from these wells since they were put into service in 1988 has reduced the streamflow to zero from approximately ¼ mile above the wells to New Mexico Hwy. 532 and below for 95% of the year. The zero streamflow has destroyed the habitat that prior to the village wells was beaming with fish. The wildlife that relied upon Eagle Creek for water have had to move toward town and other populated areas to find water.	1.1 Key – Aquatic Habitat and Fish	We agree that the potential for effects of well pumping on aquatic habitat and fish is a key issue for this project. We describe and analyze these effects in detail in chapter 3. We will also address this issue in the wildlife resource report and biological evaluation.
13	9	Fisheries	The ECCA has evidence that the North Fork of Eagle Creek supported trout and the sport of trout fishing prior to pumping. A trout fishery was located adjacent to the North Fork. The North Fork is still shown to be a fishable stream in maps and literature available from the USFS and the NM Game and Fish Department. In 2004, the New Mexico Environment Department issued an Integrated List of Impaired Surface Waters. Ref. NMED 303(d)/305(b) showed the designated use of Alto Lake and Eagle Creek (Alto Reservoir to Mescalero Apache bnd) to be High Quality Coldwater Fishery. The attainments for both were “not supporting.” The assessed date was 1/1/1998.	1.1 Key – Aquatic Habitat and Fish	Thank you for this information. We will consider this in preparation of the EIS. We agree that the potential for effects of well pumping on aquatic habitat and fish, including trout, is a key issue for this project. We describe and analyze these effects in detail in chapter 3. We also address this issue in the wildlife resource report and biological evaluation.
14	1	Fisheries	We resist the notion that any trout stream in New Mexico should be sacrificed for municipal growth.	1.1 Key – Aquatic Habitat and Fish	See above response.
1	3	Lands	ECCA would like to see penalties (not necessarily financial) for non-conformance with the terms of the permit, but recognizes this is outside the scope of the EIS.	4.6 Non-Key	Specific details regarding permit administration are outside the scope of the EIS, as we explained in the “Alternatives” section of chapter 2.
1	15	Laws, Regulations, and Policy	ECCA also requests that an action plan be developed that shows how FSM direction is being met.	4.5 Non-Key	We describe how FSM direction applies to this project in the separate “Manual Direction Summary” document. We summarize this in chapter 1 of the EIS.

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25	2	Laws, Regulations, and Policy	There are no known conflicts with requirements under NMED laws and regulations. The proposed project falls under the authority of the Safe Drinking Water Act or the New Mexico Drinking Water Regulations (NMDWR). However, review of the public water supply engineering and construction will NOT be required pursuant to NMDWR 20.7.10.200(3)(g). There are no known deficiencies or inaccuracies in the information provided.	4.1 Non-Key	Thank you for your information.
36	4	Laws, Regulations, and Policy	Relevant to the water right issues is the Forest Service Manual, 2541.34- Water Rights and Uses for Other Purposes. "If the projected water requirements conflict with existing or potential Forest Service uses and rights or will adversely affect national forest resources, the potential permittee must seek alternative water sources or develop mitigation plans acceptable to the Forest Service." Item 2541.34 would appear to limit the action available to the USFS for meeting the item (1) objective, purpose, and need for action.	4.1 Non-Key	The purpose of the EIS is to evaluate in detail alternatives for achieving the purpose and need for action and the management actions identified. These include achieving a balance between providing municipal water and protecting forest services. We describe how well each alternative addresses these factors in chapter 3. Details of the alternative that is ultimately selected for implementation will become part of the terms of any new permit issued. This includes any mitigation measures, monitoring, or adaptive management actions developed through the EIS process that would be necessary to minimize adverse effects to forest resources.
36	7	Laws, Regulations, and Policy	The Forest Service Manual (FSM 2500, Chapter 2540) requires that impacts of water withdrawals from aquifers underlying National Forest System lands be quantified with a groundwater waterflow model approved by the Forest Service (p. 11 of the scoping document), or by a controlled aquifer test. No such model or controlled test is in the present plan.	4.5 Non-Key	This requirement applies to proposals for new wells, but the proposed action would authorize existing wells. However, we agree that a controlled aquifer test or model would be valuable for future management, and we discuss this in more detail in the EIS.
1	17	Misc. - Literature Citations	ECCA suggests the FS review the Watershed Report (prepared by Stream Dynamics) – Nora sent this to George this morning – it contains valuable information and aerial photos regarding streams in this watershed.	5.1 Suggestion	Thank you for providing this document. It is available to the IDT and they have reviewed it for applicability to this project.
13	5	Misc. - Literature Citations	The ECCA requests the inclusion and use of the Finch (Peery) Report, the Balleau Reports (all referred to in the USGS report), and The Killing of Eagle Creek in the preparation of the EIS.	5. 1 Suggestion	These documents are available to the IDT and they have reviewed them and use them, as applicable, in the preparation of the EIS.

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13	7	Misc. - Literature Citations	Peter Balleau has prepared several documents including the Mountain-front Hydrology of Eagle Creek and Rio Ruidoso tributaries of Rio Hondo (Ref 2004a) Analysis of North Fork Well field and Effects on Eagle Creek (Ref 2004b), both referenced in the USGS Proposal and Final Report.	5.1 Comment	These documents are available to the IDT and they have reviewed them and use them, as applicable, in the preparation of the EIS
6	1	Misc. - Thank you for your comment	He asked if any new wells or facilities, like pipelines, were being proposed. He also asked if it was near Ski Apache. I told him no new facilities, just an evaluation of the effect of existing wells and facilities is being analyzed. I also mentioned that it was in proximity of the reservation and he could see this on the map. He was not concerned and did not have any specific comments, but asked to remain on the mailing list.	5.1 Suggestion, comment, or procedural concern	Thank you for your interest in this project.
8	1	Misc. - Thank you for your comment	… I received the materials but do not understand what the project pertains to and how it would affect me.	5.1 Suggestion, comment, or procedural concern	Thank you for your interest in this project. We apologize for not being able to return your phone call as no phone number was left on the message.
54	1	Misc. - Thank you for your comment	1913 - State of New Mexico grants permit to railroad for 6 sec cf of water. (Basically the flow of Eagle Creek except flood times.) 1914 - Eagle Creek pipeline built; 1946 - applicant incorporated beginning many water rights purchases in Rio Ruidoso. 1954 - Eagle Creek Assn. formed and with Capitan Boys the railroads water rights and 1, 000 plus acres in Eagle Creek and Little Creek. 1988 - Forest Service and Ruidoso Village agreement for North Eagle Wells.	5.1 Suggestion, comment, or procedural concern	Thank you for this information.
14	18	Monitoring	The new operating condition we propose would be, “groundwater withdrawals would be limited to no more than 50 percent of the volumetric rate (gallons per minute) of surface flow at the North Fork gage.” Our proposal provides for immediate response to real-time conditions. Accordingly, we resist using the monitoring described further in this category. We cannot support using Forest Service manpower in the manner proposed, knowing that the results will not be responsive to the need for providing operational controls on pumping while maintaining instream flow in the North Fork.	3.1 Alternatives	We considered these suggestions, and we have addressed them in the “Alternatives” section of chapter 2.

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14	31	Monitoring	"Adaptive management adjustments currently under consideration include: Limitation on groundwater withdrawal rates; cessation of pumping for short periods; and/or surface flow augmentation." The ECCA recommends that limitations on withdrawal rates be tied to real-time measurements of instream flow at the North Fork gage. We recommend that cessation of flow for operation violations last long enough for artesian conditions to resaturate the bedrock. … The ECCA encourages the Forest Service to consider the solutions we have recommended because they are responsive to the environmental resources for which the Forest Service is responsible.	3.1 Alternatives	We considered these suggestions and have addressed them in the "Alternatives" section of of chapter 2.
14	37	Monitoring	First, the proposal continues to use zero-flow days in the South Fork as an indicator of instream flow conditions on the North Fork. How are the 300 no-flow days per year in the North Fork to be restored during the proposed 5-year study that is based on no-flow days in the South Fork? Only with continuous flow in the North Fork will restoration occur and such flow can only be measured with a gage dedicated to measuring flow in the lower North Fork.	3.1 Alternatives	The Eagle creek gage, minus the South Fork gage, serves as a surrogate for measuring flow in the North Fork. The proximity of the two gages to each other makes this acceptable. We describe this in more detail in the "Alternatives" section of chapter 2.

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15	1	Monitoring	The USFS proposal seems to ignore the geology of the area as noted in the USGS report, "The Hydrology of Eagle Creek Basin and Effects of Groundwater Pumping on Streamflow, 1969-2009," where it states: "The 19-month record for the North Fork gaging station indicates that, even without the North Fork wells pumping, streamflow in the North Fork might not be continuous in the well-field reach because of the thickness of the alluvium and channel deposits." There is simply no evidence that, even if the Village Wells reduced water withdrawal by 50% (of the North Fork gage), that this would allow surface water to flow. This monitoring indicator will be impossible to attain and it seems to set the Village up for failure.	3.1 Alternatives	We recognize that this stretch of North Fork Eagle Creek has always had areas where flow is sub-surface, due to the thickness of the alluvium. We developed our purpose and need and management objectives to achieve a balance between providing municipal water and protecting forest resources. We have addressed this in more detail in the separate "Manual Direction Summary" document and in the "Alternatives" section of chapter 2. We are not striving to manage for a minimum instream flow. Instead, we are concerned about providing flow through the alluvium and ensuring groundwater resources are maintained. The proposed action also includes a monitoring and adaptive management strategy so that we can apply, test, and monitor the initial thresholds and parameters. If adjustments are needed over time, there are provisions for making these adjustments. We discuss in detail the effects of each alternative on socioeconomic resources in chapter 3.
18	5	Monitoring	The allowance in the monitor indication section in the proposed action to allow no-flow days should not be considered. No-flow days during the period of 1988 to 2009 has affected the North Fork tributary and its associated riparian area and its ability of a cold water fishery since the North Fork well were put in operation.	3.1 Alternatives	We considered these suggestions, and addressed them in the "Alternatives" section of chapter 2.
18	5	Monitoring	I feel that the threshold of 20 days per year of no surface flow or more that 30 no-flow days within a single water year will be adverse to the established and improvements of the riparian vegetation between the North Fork wells and the Eagle Creek stream gauge.	3.1 Alternatives	We discuss the effects of all alternatives on riparian vegetation in chapter 3.

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18	2	Monitoring	I agree with the adaptive management strategies and feel that the adaptation should be on a five (5) year rotation. According to the USGS study, (Scientific Investigations Report 2010-5205) there was zero no surface flow days prior to the pumping of the North Fork Eagle Creek wells. I hope through this evaluation process that we can realistically correct the past errors in management by establishing parameters by which the applicant can pump a limited amount of water for their needs but also provide surface waterflow in the stream bed.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.
18	7	Monitoring	The monitoring of the thresholds should not be left up to the applicant. This avenue is like letting the “fox guard the hen house.” Threshold monitoring should be electronic where possible and available for all to see via Web sites to facilitate the proposed adapted management strategy.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.
18	8	Monitoring	I fully support an adaptive management strategy that allows for management adjustments with limitations on ground water pumping, cessation of pumping for short periods, and feel that electronic monitoring should activate these adapting management adjustments by electronic shutting off pumping facilities when monitoring indicators of surface flow volume, water table depth, and water pumping volume are met via electronic monitoring.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of the scoping outcome summary.
18	3	Monitoring	I support the mandatory base line of three hundred acre feet of pumped groundwater threshold, but, it is evident that in the past the Lincoln National Forest has violated the public trust by the following: (1) allowing the applicant to dry up what was once a beautiful cold water fishery stream; and (2) by allowing the applicant to continue unrestricted pumping without a permit since 1995. How long is the Forest Service going to allow this atrocity to continue? Who is going to be responsible to the public to make sure the environment is restored?	4.5 Non-Key	The purpose and need for taking action and the management objectives developed for this project, as we describe in chapter 1, include achieving a balance between the need for the municipal water supply and protecting forest resources.
36	3	Monitoring	Lincoln County agrees that a new permit, if issued, should include additional terms and conditions for adaptive management (monitoring, evaluation, and modification) to insure management objectives are met. • Lincoln County does not believe that the applicant should be responsible for their own monitoring. The Forest Service or the State Engineer’s Office should be charged to do that.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
36	6	Monitoring	The Forest Service proposes (p. 7 of the scoping document) to monitor water table depth at the well field for purpose of establishing a threshold depth that the applicant would be required to maintain. The proposed threshold reflects post-well development conditions already impacted by the well field. Restoring the stream may instead require groundwater conditions to be at or near pre-well development baseline levels.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.
36	13	Monitoring	Lincoln County resists any monitoring done by the applicant. The Forest Service or the State Engineer’s Office should do all monitoring.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.
36	14	Monitoring	Lincoln County suggests that operational data including depth to water and quantity and rate of diversions be relayed electronically, directly from the wells to a Forest Service office where it is automatically and continuously recorded. We request that the Forest Service make easily available monthly updates and summaries that are easy to interpret by laypersons.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.
36	17	Monitoring	The applicant has been monitoring and maintaining the Eagle Creek stream gage up to this point. It is always jammed up with debris and other materials. They have not been successful in properly monitoring this gage and the Forest Service needs to make sure this monitoring gage is clear.	4.5 Non-Key	Thank you for your comment. The Eagle Creek gage is managed and maintained by the U.S. Geological Survey. While we think this gage has been operational, we will forward your comment to the USGS.
36	18	Monitoring	The Eagle Creek gage, alone, does not provide an accurate measurement of surface flow exiting the North Fork. Lincoln County requests the Forest Service oversight to insure that accurate measurements are continuously delivered electronically to a Forest Service office. We suggest the pump power cutoff switch be located in a tamperproof box at this flow gage.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.
36	18	Monitoring	Lincoln County is concerned how authorizing pump operations at a 5-year average water table depth will protect or restore streamflow. Allowing continued operation with no restriction on depth to water for 5 more years will make the problem worse.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
36	20	Monitoring	The county supports a minimum initial threshold of 300 acre-feet per year. There are valid reasons explaining why additional thresholds, such as minimum instream flows and saturated bedrock, should be met. If the diversions are taken under excess surface flow conditions, the continuous flow of the stream will not be interrupted.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.
36	21	Monitoring	The County is supportive of the paragraph: “If analysis results indicate that current thresholds and mitigations are not sufficient to maintain surface resource conditions, management of groundwater withdrawals would be adjusted to provide additional protections against further degradation.”	5.1 Comment	Thank you for your comment.
41	6	Monitoring	Just as the USFS appears poised not to consider reasonable alternatives, the USFS also appears poised not to consider a broad range of monitoring and mitigation conditions which would assure that impacts of North Fork well field pumping are minimized. In brief, the USFS should assure that monitor-ing and mitigation conditions are based on the most relevant gage readings and minimize all downstream effects in the event that undue adverse effects are determined. As currently configured, the monitoring and mitigation conditions appear likely to allow undue adverse effects–once identified – to con-tinue unabated for an unnecessarily long period of time. ECCA encourages you to assure that the monitoring and mitigation plan is robust, aggressive, and responsive in “real-time” to observed impacts of pumping in the North Fork well field.	4.5 Non-Key	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2. We feel that the proposed action with its proposed monitoring and adaptive management plan is responsive to the issues, implementable, and addresses the purpose and need for action. In the EIS, we fully evaluate all alternatives and describe how well each one addresses the key issues and the purpose and need for action.
51	2	Monitoring	We agree with the adaptive management strategies and feel that the adaptation should be on a five (5) year rotation. According to the USGS study, (Scientific Investigations Report 2010-5205) there was zero no surface flow days prior to the pumping of the North Fork Eagle Creek wells. Through this evaluation process we are hopeful realistic parameters will be established by which the applicant can pump a limited amount of water for their needs but also provide surface waterflow in the streambed.	4.5 Non-Key	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
51	8	Monitoring	The monitoring of the thresholds should not be left up to the applicant. Threshold monitoring should be electronic where possible and available for all to see via Web sites to facilitate the proposed adapted management strategy.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2.
51	3	Monitoring	We support the mandatory base line of three hundred acre feet of pumped groundwater threshold, provided that is upheld.	5.1 Comment	Thank you for your comment.
51	9	Monitoring	We fully support an adaptive management strategy that allows for management adjustments with limitations on groundwater pumping, cessation of pumping for short periods and feel that electronic monitoring should activate these adapting management adjustments by electronic shutting off pumping facilities when monitoring indicators of surface flow volume, water table depth, and water pumping volume are met via electronic monitoring.	3.1 Alternatives	We considered these suggestions as described in the “Alternatives” section of chapter 2.
52	9	Monitoring	When implementing the monitoring indicator of surface flow of Eagle Creek at Eagle Creek below South Fork Gage, the use of 20 no-flow days per year over a 3-year period or 30 no-flow days within a single year to trigger a reduction in groundwater diversion does not take into account the intermittent nature of North Fork during drought conditions. Reducing Village pumping during an extended drought would cause additional hardship on the Village in providing sufficient water to the Village municipal water system. A more equitable procedure could be derived which considered the measured annual precipitation and projected streamflow such that the Village is not required to suspend or reduce pumping because of the effects of an extended drought.	3.1 Alternatives	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2. We evaluate the effects of all alternatives on socioeconomics in chapter 3, including effects during drought conditions over time.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
52	10	Monitoring	The use of the average 5-year water level of the deeper aquifer as a monitoring indicator does not take into account the water level declines caused by extended drought and lack of recharge associated with said droughts. The intermittent nature of North Fork would not be improved by attempting to maintain an average water level in the deep aquifer. As discussed in item 1 above, during abundant precipitation events the aquifer storage recovers significantly and can recover to pre-North Fork Wells levels. Given this recharge condition which is apparent across the entire Hondo Basin (by inspection of USGS and State Engineer water level records), there is no evidence of a continually expanding cone of depression reaching outside of U.S. Forest lands.	3.1 Alternatives	We agree that during an extended drought it would not be possible to have perennial flow merely by raising the water table some percentage of the way to the surface. However, the less storage depletion there is, the less time it would take to recharge the loss. We discuss whether implementing the alternatives will result in an expanding cone of depression in chapter 3.
52	12	Monitoring	The use of well pumping volume limited to 900 cumulative acre-feet over a 3-year period or 300 acre-feet per year is based on the annual groundwater recharge rate of 490 acre-feet per annum as calculated by the chloride mass balance approach as described in item 4 above and which may be too low as discussed by USGS. The well pumping volume could just as well be based on the annual groundwater recharge rate of 1,950 acre-feet per annum as calculated by USGS using the basin yield method. Using the annual groundwater recharge rate as computed by the basin yield method would indicate that the allowable pumping volume should continue at least equivalent to the November 1, 2009, to October 31, 2010, water year of 738.01 acre feet. The groundwater diversions should be accounted for coincidentally with the State Engineer administered water years being from November 1 of each year to October 31 of the next year. Also the 5-year accounting of the State Engineer as required by the court adoption of the Hondo Basin “Duty of Water” special master report should be implemented in the adaptive management strategy. Allowance should be made in special use permitting for North Fork groundwater diversions to continue at the 2009-2010 water year amount at least until such time as the Village had accomplished approved water right move permitting to allow for sufficient diversion of the municipal water rights off of U.S. Forest lands.	3.1 New Alternative Suggested	We considered these suggestions and addressed them in the “Alternatives” section of chapter 2. We recognize that the recharge rates from the USGS report are only a starting point. We intend to revisit each threshold identified in the proposed action after we reanalyze the data (as discussed at the hydrology technical meeting in April 2011), to ensure they are still accurate based on the best available information. We discussed this in more detail in the “Alternatives” section of chapter 2. In the proposed action, we also acknowledge that adjustments may be necessary over time as monitoring continues. If the existing recharge rates are too conservative based on additional monitoring (particularly from the shallow monitoring wells), then we would adjust them.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
			The monitoring indicators listed above and the use of streamflow augmentation by groundwater discharge may indicate in future years that there need be no reduction at all in North Fork well diversion.		
1	14	Monitoring - Mitigation	FSM 2541.34 states that a mitigation plan is necessary also. ECCA has not seen this, despite requests for information.	5.1 Comment	Details of the alternative that is ultimately selected for implementation will become part of the terms of any new permit issued. This includes any mitigation measures, monitoring, or adaptive management actions developed through the EIS process that would be necessary to minimize adverse effects to forest resources. The selected alternative will then be identified as the “mitigation plan” in the permit.
14	23	Monitoring - Riparian Vegetation	“This metric would provide an indicator of the effects of groundwater withdrawal on the condition and trend of surface resources in and downstream from the NFEC basin.” We believe that such an objective can be met with the changes we propose but not using the metric as currently proposed in this notice of intent.	3.1 Alternatives	We agree that we should be using a reference reach to help identify changes in riparian conditions over time. We will be collecting this data during the summer of 2011 so we can incorporate that information into the riparian monitoring strategy in this EIS. We specifically address this in chapter 3. The purpose and need for taking action and our management objectives include maintaining or improving riparian health over time; but not specifically re-creating a riparian condition on North Fork Eagle Creek that may have existed before the wells began pumping. Once we review the best available science (including data collected from a reference reach), if we see indications that riparian conditions have changed over time due to well pumping, we will review the monitoring indicators to ensure they remain valid (see the “Alternatives” section of chapter 2 for more detail).

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
14	24	Monitoring - Riparian Vegetation	"The Forest Service would fund annual or biannual monitoring of riparian vegetation in the project area to include the approximately 2-mile section between the wells and the Eagle Creek stream gage." The ECCA fully supports this effort. We feel it is important to point out that the riparian vegetation now evident in this section of Eagle Creek is the result of over 25 years of the North Fork being mostly dry. Historical descriptions of such vegetation or the method described below would provide a more reasonable baseline for determining the change attributable to a reduced- to absent- instream flow.	3.1 Alternatives	See response above.
14	25	Monitoring - Riparian Vegetation	"This would provide a baseline so that any future changes in riparian vegetation in this area would be apparent with future monitoring." The ECCA suggests that the proper baseline should be established from riparian areas that have been served by streams that actually flowed for the last 25 years, such as the South Fork of Eagle Creek and Bonito Creek. George Douds, the acting Smokey Bear Ranger could probably shed some light on establishing a meaningful baseline.	3.1 Alternatives	See response above.
14	14	Monitoring - Riparian Vegetation	The ECCA would like to expand the phrase "maintain or improve existing riparian vegetation conditions" to include "aquatic ecosystems," especially "fish and fish habitat," as described in the Purpose and Need for Action and in the Forest Service Manual.	6.1 Document specific comments or corrections	We agree with this suggestion and have made this change in the "Monitoring" section of the "Proposed Action" description.
14	19	Monitoring - Water Table Depth	"The applicant would continue to maintain monitoring well MW-1B and collect data on changes in the water table levels." The ECCA suggests that it would be reasonable for the Village to continue monitoring and reporting depth-to-water in NF-1, NF-3, and NF-4 as they agreed to in the settlement agreement. A better resolution would be to have these data electronically transferred directly to the Forest Service from the wells.	3.1 Alternatives	We agree that the data from these other wells should be used in addition to MW-IB as discussed in the "Alternatives" section of chapter 2. This change has been made in the "Monitoring" section of the "Proposed Action" description.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
14	20	Monitoring - Water Table Depth	"Water table depth data (feet below surface) would be collected and stored in the USGS database." The ECCA suggests that data collected and stored is useless until it has been plotted on an easy-to-interpret timeline. The raw data in tabular form and the plotted data should be readily obtainable at any time, for any timeframe, to the public or other interested parties. We strongly urge the Forest Service to authorize the USGS to place these data on a timeline for all of the years for which data are available.	5.1 Suggestion	Thank you for your suggestion. We use various ways of discussing this type of data in our analysis in the "Water Resources" section of chapter 3 of the EIS.
14	21	Monitoring - Water Table Depth	"Once 5 years of monitoring data from this well have been collected, including the 2 years of data collected prior to developing this EIS, the Forest Service would evaluate this data, and use the 5-year average water table depth to establish a threshold for average water table depth." The ECCA observes that the Forest Service could have contracted with the USGS to plot, on the same timeline, all of the data available from the Village depth-to-water and Eagle Creek water diversion records, the USGS measurements of flow at the Eagle Creek gage, and precipitation data. Data are available beginning 2 years before the hydrological study actually began. The Forest Service could have evaluated these data prior to the time that the USGS study was actually conducted. According to our review of this visual display of same-time events, the data would show that the water table is controlled by the pump level. Pumping is discontinued when the water table no longer covers and cools the pumps. We believe cavitation and pump burnout to be a recurring event. We believe that use of these data, plotted on a common timeline, will ensure a balanced EIS. The ECCA does not understand how authorizing pump operations at a 5-year average water table depth will protect or restore streamflow. Allowing continued operation with no restriction on depth-to-water for 5 more years makes even less sense to us.	3.1 Alternatives	See response above. We considered your suggestion not to use a 5-year average water table depth in the "Alternatives" section of of chapter 2. We agree that waiting until a decision is made on this project to begin collecting the additional 3 years of data is not ideal. We are committed to collecting this information now and using the sum of the years of data collected before implementation to base the average water table depth on. We discuss this in more detail in chapter 2.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
			Our hypothesis is that when dry days in the North Fork are examined against depth-to-water on the same day, a causal and quantifiable relationship will be observed that is far more useful than waiting 5 more years to determine an average water table depth. In our opinion, the USGS can, and should, determine the dry days in the North Fork mathematically from existing gage measurements.		
14	22	Monitoring - Water Table Depth	"The applicant would be required to maintain an average water table depth that is equal to or above this threshold over 3 consecutive water years." We know that "the average water table depth" resulted in over 300 dry days in the North Fork each year. The USGS reports that when the bedrock is not saturated, surface water is redirected down to recharge the aquifer, resulting in a dry streambed. We resist any further plans to use a 3- or 5-year average water table depth as a monitoring indicator or operational control.	3.1 Alternatives	We considered these suggestions in the "Alternatives" section of chapter 2.
14	27	Monitoring - Well Pumping Volume	"The applicant would continue daily monitoring and recording of groundwater withdrawals through the North Fork wells (pumping volumes in acre feet). Combined with precipitation and streamflow records over time, this metric would be used to develop an additional reliable indicator for modeling anticipated effects of groundwater withdrawals on surface resources within the NFEC basin." Along with the condition that depth-to-water be added to the above three variables discussed in the above paragraph, the Forest Service has defined the data the ECCA most strenuously encourages the Forest Service to rely upon. We cannot be more emphatic that these data, available from 1969 to the present, should be evaluated as soon as possible. We recommend that well operating parameters be based on the relationships observed in evaluating these data in addition to data developed prospectively by the USGS. Of prime consideration is how these conditions relate to whether the North Fork is wet or dry. Pump operating parameters based on the above two paragraphs would be very defensible and would protect the surface flows and water-dependent systems described as part (2) of the Forest Service objectives.	3.1 Alternatives	See response above regarding timeline.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
14	28	Monitoring - Well Pumping Volume	"An initial threshold of 900 cumulative acre feet over 3 consecutive water years (300 acre feet per year) would trigger a review by the Forest Service of the current thresholds and mitigations at maintaining or improving surface resource conditions." The ECCA is delighted to support a minimum initial threshold of 300 acre feet per year. As discussed earlier, there are valid reasons explaining why additional thresholds, such as minimum instream flows and saturated bedrock, should also be met. Our position is that the stream can probably survive the proposed, initial quantities of diversion without degrading the stream, if the diversions are taken under excess surface flow conditions so that the continuous flow of the stream will not be interrupted.	3.1 Alternatives	We considered these suggestions in the "Alternatives" section of chapter 2.
14	29	Monitoring - Well Pumping Volume	"If analysis results indicate that current thresholds and mitigations are not sufficient to maintain surface resource conditions, management of groundwater withdrawals would be adjusted to provide additional protections against further degradation of riparian and other surface resources within the NFEC basin." The ECCA is supportive of this paragraph. In fact, if combined with the additional thresholds we have suggested, we feel comfortable that the necessity of subsequent adjustments in management of water withdrawals is unlikely.	5.1 Comment	We considered these suggestions in the "Alternatives" section of chapter 2.
52	7	Water Rights	More diversion of groundwater may be required by the Village over and above the proposed 300 acre-feet per annum during the initial years of the special use permit period to prevent extreme hardship to the Village in producing sufficient water for the Village municipal system.	1.1 Key – Water Resources (water rights)	We evaluate all the alternatives and their potential for impacts to municipal and private water supply in chapter 3 of the EIS. As we stated in the proposed action, this particular threshold is not a stand-along trigger for change, but would be used in combination with the other thresholds to determine if we need to adjust pumping restrictions. The proposed action is one alternative out of the several that we will analyze in detail in the EIS. Our analysis describes how each alternative addresses the key issues and the purpose and need for action.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
4	7	Municipal Water Supply System	None of these accommodations should be made unless Ruidoso immediately takes actions in other ways to preserve water. There are a whole litany of ways for water challenged areas to cope. Before giving any forest land help, all of us in this nation want to know what Ruidoso is doing to help its own situation. Many other communities have faced this same issue. Some have made water out of sea water. What is Ruidoso doing to help itself. It has a duty and obligation to take steps within itself to help itself. Or are they looking for welfare help?	3.1 Alternatives	We considered these suggestions for conserving water in the “Alternatives” section of chapter 2.
5	2	Municipal Water Supply System	The City of Ruidoso should consider tapping the majority of its needed water supply where the majority of the city exists, in the Rio Ruidoso watershed.	3.1 Alternatives	This suggestion is outside the scope of this analysis.
13	11	Municipal Water Supply System	Prior to the Village wells going into operation, the Village used surface diversion from both the diversion dams and Alto Reservoir. The water treatment plant located above Alto Reservoir was constructed for the purpose of treating this surface water. Records of surface water diverted to the surface-water treatment plant, prior to the wells, show that the Village diverted an increasing quantity of water each year, as its needs grew. The year before the wells were put into operation was the year of the greatest municipal diversion the Village has made. Never, during the years the pumps were operating, was the Village able to divert as much combined surface and groundwater from the North Fork as they did the year before the pumps went on line.	5.1 Comment	Thank you for this information.
22	1	Municipal Water Supply System	I think the public should be told what the average daily use of water in gallons is for Ruidoso, and then everyone and Village Hall think about how long can Eagle Creek water basin continue to furnish 60 to 70% of your supply.	5.1 Comment	We discuss this topic in chapter 3 of the EIS in the “Socioeconomics” section, where we will consider the community dependence on Eagle Creek as the municipal water supply.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
23	4	Municipal Water Supply System	The district's overriding concern in this endeavor is to protect its ability to provide water service to homes and businesses within the district. Thus upstream users must not be allowed to take water in such quantities as to impair our ability to serve them. With this the district asks that the Lincoln National Forest in its preparation of the EIS take into consideration the possible impacts this project potentially has on the ability of the district to be able to rely on a sustainable water supply to continue serving its customers.	1.1 Key - Socioeconomics	See response above.
24	3	Municipal Water Supply System	It is not right for Ruidoso to wastewater on golf courses, swimming pools, and never ending development of subdivisions while taking water from surrounding county private well owners. I ask the Forrest Service to listen to not just the wealthy developers in Ruidoso but also to the many county residents that are negatively impacted by the outright theft of our water supply. I realize that many in Ruidoso want to see it turn in to an Aspen like community but what they fail to realize is that Aspen has the water to be the size they are and Ruidoso does not. Aspen has the great rocky mountains to draw from and Ruidoso has one "1" mountain with limited moisture. Ruidoso has to get a grip on the fact that they cannot continue to grow unless they bring a water source in from somewhere else. Ruidoso also has to give back the water they currently draw from the Eagle Creek aquifer which rightfully belongs to ALL county residents. Gavilan Canyon Creek runs through the back of my property and it was never considered a year round flow but I can tell you that it has also been negatively impacted by the draw on Eagle Creek by the Village. Gavilan Creek is spring fed. The springs on Gavilan Creek are all but dried up for several years now due to Ruidoso illegally over pumping North Fork wells.	3.1 Alternatives	We include information on Ruidoso per capita consumption compared to other cities in New Mexico in chapter 3 of the EIS. A complete analysis of actions that affect applicant water consumption and demand is outside the scope of this project, but our cumulative impact analysis considers city consumption.
31	1	Municipal Water Supply System	Suggesting the USFS cuts off 70% of Ruidoso's municipal water supply is just ludicrous. The thru village operated wells on the North Fork of Eagle Creek were in fact drilled just for this purpose - to supply Ruidoso with water.	5.1 Comment	The purpose and need for taking action and the management objectives we developed for this project, include balancing the need for a municipal water supply and protecting forest resources. We explain this in chapter 1 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
39	1	Municipal Water Supply System	We realize that the city needs water for the residents, but we believe they need to find another source of getting water, rather than relying so much on the water from Eagle Creek. If they don't have enough water, why don't they stop all the new building that depletes the water supply? What are they going to do in the future, if they run out of water?	3.1 Alternatives	We consider these suggestions for restricting new construction in chapter 2 of the EIS.
1	13	NEPA - Effects Analysis	ECCA believes that the FS needs to determine the quantity of water needed to maintain forest resources, as outlined in FSM 2541. This should be included in the EIS.	4.1 Non-Key	In the separate "Manual Direction Summary" document, we have described what manual direction applies to this project. We will also summarize this in chapter 1 of the EIS. The purpose and need for taking action and the management objectives we developed for this project, include balancing the need for a municipal water supply and protecting forest resources. We explain this in chapter 1 of the EIS.
10	1	NEPA - Effects Analysis	How can limitations be placed on pumping from the village's North Fork wells when no impacts to vegetation, or wildlife have been documented?	4.1 Non-Key	In chapter 3 of the EIS we describe existing vegetation and wildlife conditions including what we know, based on the best available information, regarding changes over time since the wells began pumping. The alternatives evaluated in the EIS range from no restrictions on pumping (no change in current management) to no pumping at all.
13	2	NEPA - Effects Analysis	We support adopting the USGS definition for the North Fork to be the same as the study area, the approximately 2-mile stretch of streambed from the North Fork gage to the streambed confluence with the South Fork, and the strata below this stretch.	6.1 Document specific comments or corrections	The way in which our project area is described is consistent with your suggestion: "The North Fork of Eagle Creek (NFEC) between the North Fork stream gage and the Eagle Creek stream gage, totaling approximately 2 stream miles, is the emphasis of this environmental analysis (attachment 2)."
13	14	NEPA - Effects Analysis	Among other things, Balleau's timelines of depth-to-water and well production are incredibly useful in understanding the interplay of the various "metrics." The USGS assured the ECCA that a more complete presentation of these data with more current information added would be a part of their report. We are sorry this omission has occurred and we encourage the Forest Service to compile and incorporate these data in their EIS preparation and review.	6.1 Document specific comments or corrections	Thank you for your suggestion. We use a timeline with the most current and complete data in our analysis of water resources.

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41	8	NEPA - Effects Analysis	As noted above, the dataset acquired by the USGS in this matter leads to the conclusion that pumping in the North Fork well field has led to intermittent stream conditions in which “no-flow events” are observed in the stream. These events did not occur prior to the onset of pumping in the North Fork well field. Therefore, the biological impacts of your decision must be carefully analyzed. As noted above, as a result of climate change the impacts of pumping in the North Fork well field are likely to be exacerbated by diminishing base flow. ECCA encourages you to comprehensively and objectively evaluate the full range of impacts that your decision will have on natural ecosystems – including fish and wildlife – prior to issuance of your record of decision. As I am sure you can appreciate, your decision is likely to have a very significant impact on aquatic and riparian resources in the Lincoln National Forest. Given the tremendous incalculable value of these very precious resources, the ongoing NEPA process should incorporate a careful impacts analysis as to these issues.	Key – Aquatic Habitat and Fish	Our intent with the EIS is to comprehensively and objectively evaluate the potential effects of the alternatives on forest resources based on the key issues. We analyze and discuss biological resources—specifically aquatic habitat and fish and riparian vegetation—in chapter 3 of the EIS, the specialist report, and the biological evaluation (BE).
14	34	NEPA - Issues	“The main issue to be addressed is the effect that the proposed continuation of well pumping may have on hydrologic resources (surface water and groundwater) in the North Fork Basin, including potential cumulative effects downstream in the larger Eagle Creek watershed. Other issues identified thus far include effects of well pumping on aquatic habitat and fish (particularly brook trout), downstream recreational use (public use of streams for stream-side recreation, fishing, and wildlife viewing), riparian vegetation condition, and municipal water supply.” The ECCA applauds and supports the above statement as an excellent description of the issues. We endorse this description as if it were our own.	4.1 Non-Key	Thank you for your comment.

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36	1	NEPA - Issues	"The main issue to be addressed is the effect that the proposed continuation of well pumping may have on hydrologic resources (surface water and groundwater) in the North Fork Basin, including potential cumulative effects downstream in the larger Eagle Creek watershed. Other issues identified thus far include effects of well pumping on aquatic habitat and fish, downstream recreational use (public use of streams for stream side recreation, fishing, and wildlife viewing), riparian vegetation condition, and municipal water supply." (see Federal Register Volume 76, No. 23, Page 6116) Lincoln County would like to emphasize that the issues presented impacts the health of the entire watershed and all Lincoln County residents, not just municipal water supplies. The upper reaches of this watershed maintain the health of the whole system.	Key – Water Resources	We will evaluate the effects of the alternatives on all of these key issues in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
3	1	NEPA - Lawsuit-Stipulation of Dismissal USGS Report	As you might know, the April 17, 2006, Stipulation of Dismissal of the above captioned lawsuit provided for the preparation of an independent watershed and geo-hydrologic study of Eagle Creek and the North Fork wells. Pursuant to the stipulation, the U.S. Geological Survey conducted the contemplated study and issued a report entitled "Hydrology of Eagle Creek Basin and Effects of Groundwater Pumping on Streamflow, 1969-2009." The Stipulation of Dismissal further provides that ECCA shall be provided "an opportunity to submit comments to the USFS" on the report. ECCA commissioned Mr. Pete Balleau of Balleau Groundwater, Inc. to conduct a scientific peer review of the USGS report…… According to Mr. Balleau, the USGS report simply "does not directly address the effect of the well field in isolation from other influence on streamflow" in Eagle Creek and the streams to which Eagle Creek is tributary. Finally, Mr. Balleau concludes that the data acquired by the USGS for the purposes of its report lead directly – and exclusively – to the conclusion that pumping in the North Fork well field has resulted in a diminution of flow in Eagle Creek and downstream. In short, the USGS did some excellent groundwork here in the acquisition of critical data needed to assess the geo-hydrologic impacts. However, the USGS's efforts seemed to stall there, and the USGS never directly addressed itself to the specific purpose of the study which was to assess the interaction of groundwater and surface water with pumping in the North Fork well field. If the USGS had directly addressed the specific issue which it was charged to address in the report, it would have determined – as did Mr. Balleau – that pumping in the North Fork well field has a significant adverse effect on the geo-hydrology of the region.	5. 1 Suggestion	Any questions or concerns regarding the contents of the USGS report should be directed to the USGS. We used the best available data in evaluating the potential impacts of the alternatives to all key issues. This includes using the USGS report, as well as other relevant studies and reports. We also objectively evaluated all available data and ensure that our conclusions are based on existing data (not necessarily just analysis or conclusions reached in any one study or report). This was discussed at the April 26 technical meeting. We also, following our reanalysis of the data and preparing the EIS, make recommendations for future monitoring, such as an extended aquifer test or pumping test.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
			In light of its significant inadequacies, the USFS cannot rely on the USGS report – as currently drafted – in support of its National Environmental Policy Act ("NEPA") analysis of a special use permit application. One of NEPA's primary purposes is to ensure that an "agency, in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts" of a proposed action. Robertson v. Methow Valley Citizens Council, 109 S.Ct. 1835, 1845 (1989). As part of its obligation to consider "detailed information" concerning proposed actions, agencies are obligated to provide a "meaningful response to serious and considered comments by experts" such as those provided by Mr. Balleau in this case. Western Watersheds Project v. Kraayenbrink, ___ F.3d ___, 2011 WL 149363 at *16 (10th Cir. 2011). In this case, there is no doubt but that the USFS's reliance on the USGS report—as currently flawed—would taint the NEPA compliance process and vitiate the analysis and conclusions associated with the USFS's consideration of the request for a special use permit for pumping in the North Fork well field…... Insofar as the USGS report in particular is concerned, Mr. Balleau has made it very clear to the USGS that he is willing to remain involved with the drafters of the USGS report if they desire to rectify the various errors that they made in the preparation of their report. On behalf of ECCA, I extend the same offer to the USFS as it proceeds to consider the application for a special use permit in connection with the North Fork well field; that is, Mr. Balleau is available to discuss the technical aspects—including the environmental impacts—of pumping in the North Fork well field at the convenience of the USFS. Particularly in light of Mr. Balleau's conclusion that the USGS data supports a finding that pumping in the North Fork well field has a direct and adverse consequence on the surface waterflow within the region, I urge you to seek corrections from the USGS in connection with its report before the USFS relies on the analysis therein during the upcoming decisionmaking process.		Comment is continuation of previous row. See response above.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
9	1	NEPA - Public Involvement	You have not fulfilled your contractual obligations to provide participation and input to the village. Stop this process and meet with us as agreed to.	4.1 Non-Key	We recognize the importance of continued applicant communication and participation in the EIS process and have provided multiple opportunities for review and input. Please contact Christina Thompson at the Smokey Bear Ranger District if you would like to discuss this further.
10	3	NEPA - Public Involvement	When will a formal presentation be held that has an open forum for submitting comments from interested parties?	4.1 Non-Key	We held a public open house on February 17 at the Ruidoso Middle School during the public scoping period to gather input and hear concerns regarding this project. Once we prepare the draft EIS, there will be another opportunity for you to comment which may include another public meeting. We expect the draft EIS to be released October 2011.
41	3	NEPA - Public Involvement	As you are aware, the impetus of the ongoing NEPA process was a lawsuit filed against the USFS by ECCA which has a significant interest in this matter, which interest is subject to injury and impairment by USFS decisions based on a flawed process. I have previously spoken by telephone with Ms. Debbie McGlothlin concerning the ongoing NEPA process, and I have encouraged Ms. McGlothlin to assure that this process is as open and as transparent as possible. In particular, I spoke with Ms. McGlothlin about ECCA's interest to participate in a meeting at which the experts retained by all interested parties may discuss the scientific issues which are central to USFS decisionmaking. By means of this letter, I again encourage the USFS to convene a meeting of the specialists in order to provide assurances that the relevant technical matters are comprehensively and objectively developed in a manner that will provide USFS decision makers with a sound scientific and legal basis for their decision.	4.1 Non-Key	This technical meeting took place on April 26, 2011.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
41	4	NEPA - Public Involvement	From the scoping notice, it is apparent that the USFS intends to circulate for comment a draft EIS in this matter – as it is legally required to do – prior to issuance of a final EIS and Record of Decision. However, ECCA encourages you to exceed the minimum requirements of NEPA in connection with the North Fork well field decision by providing ample opportunities for all interested parties to assure that the USFS's analyses and decisions are scientifically and legally sound, and in compliance with all pertinent Federal and State law. As I am sure you can appreciate, your decision in this matter will be extremely controversial and implicates USFS compliance with the National Forest Management Act, the Multiple Use-Sustained Yield Act, the Federal Lands Policy and Management Act, and New Mexico water law. A careful balancing of the competing interests affected by your decision will be best achieved by conducting a NEPA process during which there are frequent opportunities for communications and feedback between the USFS and affected parties.	4.1 Non-Key	We are aware that there is a high level of interest in this project and we will ensure the NEPA process is open and transparent and that everyone has opportunities to contribute.
1	18	NEPA - Purpose and Need	ECCA thinks that management objective 1 as stated in the NOI is outside the mission of the Forest Service.	4.3 Non-Key	Thank you for your comment. We believe both objectives meet our Agency's intent to protect forest resources.
13	8	NEPA - Purpose and Need	Balleau's depictions of his modeled cone of depression and area of influence provide a powerful visual impact. We think it appropriate for the Forest Service to conduct further dialogues with Balleau on this topic.	5.1 Suggestion	We invited Peter Balleau to the technical meeting held on April 26 to ensure full understanding of all available data.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
14	6	NEPA - Purpose and Need	We further applaud the continuing articulation, “If the cone of depression continues to expand, it can impact water dependent resources outside the stream corridor.” We think however, that beginning this sentence with “When” rather than “If” is more accurate. Both the reports of Finch (Peery) and Balleau agree with this paragraph. The ECCA believes the following sentence to be an accurate, non-ambiguous, non-subjective observation of the condition of the North Fork prior to pumping. “There were no days of zero flow recorded at the Eagle Creek gage from 1969-1980.” The rest of the paragraph describes conditions on the North Fork based on flow measurements at the Eagle Creek gage between 1988 and 2008. “It is important to note that the Eagle Creek gage measures flow from both North Fork and South Fork tributaries.” We believe the following to be more accurate: “It is important to note that the North Fork was dry the majority of the period from 1988 to 2008. The only flow being measured at the Eagle Creek gage, most of the time, was the South Fork.” The South Fork is not the focus of our litigation or of the EIS. The causal relationship of the cone of depression and the dry North Fork riverbed has not been addressed.	6.1 Document specific comments or corrections	Thank you for this suggestion but we disagree that this change from “if” should be made. Our analysis in the EIS will include predictions about whether the alternatives would result in an expanding cone of depression. We will use the cone of depression as one indicator in the water resources analysis to compare and contrast alternatives. We also do not agree with your suggestion to change the statement about the Eagle Creek gage and the South Fork gage. This is simply an excerpt from the USGS report. Our water resources analysis in the EIS will be based on an objective analysis of all available data (as discussed at the April 2011 technical meeting); this is where interpretations will be made about flow in the North Fork, among other things.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
36	22	NEPA - Purpose and Need	The Desired Conditions (pp. 3-4 of the scoping document) seek to reduce no-flow days at the Eagle Creek gage by half (down to 20 to 30 days per year), but does not explicitly re-state the goal of leaving downsteam flows as they would be absent the North Fork wells. That goal is specified in the stipulation agreement. We note that the U.S. Geological Survey (SIR 2010- 5205) reports no record of zero-flow days in the decade before the North Fork wells were drilled.	6.1 Document specific comments or corrections	The 2006 stipulation agreement (modified in 2009) includes a requirement that the Forest Service "shall include an analysis of all reasonable alternatives (and no less than one alternative) that leave downstream flows in the same state that they would be absent the pumping of the North Fork wells." This means that we need to evaluate at least one reasonable alternative in the EIS that leaves downstream flows in the same state they would be if the North Fork wells were not pumping. This is separate from the purpose and need for the project or our desired conditions. The stipulation agreement does not require that this be part of our management objectives or our desired conditions. We evaluate the no action (no pumping) alternative in detail and compare the other pumping alternatives to this to illustrate the effects of pumping and not pumping on surface and groundwater resources and other forest resources. This comparison will then be used by the forest supervisor in selecting an alternative for implementation.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
52	2	NEPA - Purpose and Need	The discussion of possible adverse effects to "water-dependent resources outside the stream corridor" discussed in the background section of the notice and found in the purpose and need statement is not supported by the USGS hydrology report since the report only addresses the hydrology in U.S. Forest lands within the Eagle Creek drainage.	6.1 Document specific comments or corrections	This statement in the "Purpose and Need" document is as follows: "When groundwater is pumped from the North Fork wells, a temporary decline in groundwater lowers the water table and creates an expanding cone of depression around the wells. If the cone of depression continues to expand, it can impact water-dependent resources outside the stream corridor. This situation is exacerbated by location of the wells within the stream channel, together with the low storage capacity of the aquifer." The last two sentences related to the possibility for an expanding cone of depression and its potential for effects to water dependent resources is an interpretation we have made based on the information provided in the USGS report. You are correct that this is not an excerpt or quote directly from the USGS report. This will be clarified in the EIS.
52	3	NEPA - Purpose and Need	The last statement in the section "Factors Affecting Eagle Creek Discharge" of the USGS report on page 51, describing the correlation between North Fork well pumping and stream discharge, reads as follows: "This correlation indicates that, whereas pumping and streamflow are related, any interaction between the two parameters is likely to be complex and to involve additional variables and processes that have not yet been quantified." This statement has been completely omitted from the published notice and from the draft purpose and need and proposed action statement.	6.1 Document specific comments or corrections	We intend to use the best available data in evaluating the potential impacts of the alternatives to all key issues. This includes using the USGS report, as well as other relevant studies and reports. We also intend to objectively evaluate all available data and ensure that any conclusions we reach are based on existing data (not necessarily just analysis or conclusions reached in any one study or report). This was discussed at the April 26 technical meeting. We agree that the quote you refer to above is not currently included in the Purpose and Need document. This is clarified in the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
32	1	NEPA - Request for extension of comment period	I write with a formal request to extend the public comment period for the Lincoln National Forest New Mexico North Fork Eagle Creek Well Special Use Authorization EIS comment period presently set to close on March 21st , 2011. For the reasons indicated below I request a forty five (45) day extension of the formal comment period….. ….As indicated in the final Draft of Purpose and Need and Notice of Intent with regard to the North Fork Wells Special Use Application, the North Fork of Eagle Creek is hydrologically complex and the water rights permitting issues are likewise formidable. First and foremost, the North Fork of Eagle Creek is a vital and integral part of the Village's wet water supply. The Village's NFEC water right permitting structure is crucial to the ability of the Village to meet the needs of its residents. …	5.1 Suggestion, comment, or procedural concern	We welcome comments regarding this project at any time during the NEPA process. There will be another formal opportunity for comment after we release the draft EIS.
40	1	NEPA - Request for extension of comment period	I write with a formal request to extend the public comment period for the Lincoln National Forest New Mexico North Fork Eagle Creek Well Special Use Authorization EIS comment period presently set to close on March 21st, 2011….This request for extension is made on behalf of the people of the Village of Ruidoso and the business community in the Ruidoso Valley. I understand that other local government entities and NGOs will also be submitting a similar request for extension of the comment period. As indicated in the final Draft of Purpose and Need and Notice of intent with regard to the North Fork Wells Special Use Application, the North Fork of Eagle Creek is hydrologically complex, and the water rights permitting issues are likewise formidable….	5.1 Suggestion, comment, or procedural concern	See response above.
18	4	NEPA - USGS Report	The USGS study and others have provided the science to provide some common sense management to an area of known environment degradation. The natural streamflow that existed in the past can again be there if the Forest Service will do what's right.	5.1 Comment	We include a detailed evaluation of all alternatives and the potential for effects to water resources and water-dependent natural resources in the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
41	1	NEPA - USGS Report	My letter to you of February 2, 2011, addressed at length the critical inadequacies of the report prepared by the USGS to serve as the scientific basis for the USFS's decisionmaking process in connection with the North Fork well field project: "Hydrology of Eagle Creek Basin and Effects of Groundwater Pumping on Streamflow, 1969-2009." As I stated in that letter, the USGS report is not responsive to ECCA's concerns about the effects of North Fork well pumping on the regional geo-hydrology. According to Mr. Pete Balleau—ECCA's expert in this matter—"[t]he main flaw in the report comes from the study design which excludes the necessary counterfactual 'with pumping' and 'without pumping' analyses" in an effort to ascertain the specific geo-hydrologic effect associated with pumping in the North Fork well field. Based on the data acquired by the USGS in its preparation of the report, Mr. Balleau concludes that that pumping in the North Fork well field has resulted in a diminution of flow in Eagle Creek and downstream. Indeed, the USFS appears to acknowledge that pumping in the North Fork well field is directly linked to a diminution in flow and further acknowledges that pumping has led to intermittent conditions in Eagle Creek which did not exist prior to the onset of pumping. Of course, the foregoing conclusions—which are clearly supported by the dataset acquired by the USFS in this matter—lie at the heart of the USFS's ongoing NEPA analysis. The flaw in the USGS report—if not rectified—will lead to a fatally flawed NEPA analysis that cannot legally support a decision with respect to the North Fork well field pumping. ECCA urges you to assure that your NEPA process be based on the best possible scientific information and a complete and comprehensive assessment of the observed hydrological impacts of pumping. Unfortunately, this scientific analysis is not to be found in the current iteration of the USGS report.	5.1 Suggestion	Any questions or concerns regarding the contents of the USGS report should be directed to the USGS. We agree that the flow record in the USGS report appears to show diminished flow in the latter period, post-well pumping. The wells are adjacent to the stream (which exacerbates the potential for effects to the stream) and the chemistry shows a mix of old and young water. We also agree that we need to reanalyze all the available data to ensure the conclusions we make in the EIS are based on the best available information. As we discussed at the April 26 hydrology technical meeting, we intend to use the best available data in evaluating the potential impacts of the alternatives on all key issues. This includes using the USGS report, as well as other relevant studies and reports. We also intend to objectively evaluate all available data and ensure that any conclusions reached are based on existing data (not necessarily just analysis or conclusions reached in any one study or report).

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
41	2	NEPA - USGS Report	Mr. Balleau has previously provided extensive criticism—to both USFS and USGS—of the inadequacies which flaw the USGS report. Furthermore, Mr. Balleau has made himself available—and continues to make himself available—to both USFS and USGS staff to correct analytical errors in the USGS report and to conduct the cause-and-effect/before-after analysis that the USGS failed to perform. As noted above and as noted in my letter to you of February 2, 2011, the main charge given to the USGS when it was commissioned to prepare its report was to assess the effects of pumping in the North Fork well field on the regional geo-hydrology. As Mr. Balleau has explained, the USGS did not complete this task, and the analyses which it did perform are—in some respects—scientifically flawed. ECCA encourages you to respond to Mr. Balleau's credible scientific criticism in a comprehensive and objective fashion.	5.1 Suggestion	See response above.
42	3	NEPA - USGS Report	Eagle Creek crosses the Ruidoso Fault Zone approximately 2 miles east of Alto Reservoir. The recent State Engineer and USGS Eagle Creek Below Alto Reservoir Seepage Study established that all flow up to 5 cfs is lost to the subsurface across the fault zone and recharges the deeper aquifer system.	5.1 Comment	Thank you for this information.
51	4	NEPA - USGS Report	The USGS study and others have provided the science to provide some common sense management to an area of known environment degradation. The natural streamflow that existed in the past can again be there if the Forest Service will do what's right.	5.1 Comment	We include a detailed evaluation of all alternatives and the potential for effects to water resources in the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
52	1	NEPA - USGS Report	The lowering of the water levels in the deep aquifer while pumping the wells is a temporary condition which is reversed by higher precipitation events with recharge to the deeper system. The recharge can result in recovery of the water levels back to the pre-well pumping water levels as shown during the USGS study period. This is discussed in the "North Fork Eagle Creek Groundwater Response" section of the USGS report on pages 37 through 39. This discussion does not support the "continuing expanding cone of depression" discussed in the background information as published in the notice and as listed in the draft purpose and need statement.	6.1 Document-specific comment	We agree that it seems the water table recovers quickly However, the lower it is, the longer it will take to recover. This quick recovery is also an indicator that there isn't much storage capacity in the rock. In the background section of the "Purpose and Need" document we state that "if the cone of depression expands, then…." This was not intended to say that the cone of depression is expanding only that the pumping alternatives evaluated in the EIS could result in expansion. Our detailed analysis in chapter 3 of the EIS includes predictions about whether the cone of depression would or would not expand based on implementation of the proposed alternatives. Our analysis is based on the objective evaluation of all available data, as discussed at the April 26 hydrology technical meeting.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
52	4	NEPA - USGS Report	The average annual groundwater recharge rate listed in the draft purpose and need and proposed action statement was 490 acre-feet per annum. This value was calculated by the chloride mass balance approach which the USGS acknowledges may be too low. The statement by USGS in the last sentence of the "Chloride Mass Balance Method" section on page 27 of the USGS report reads as follows: "The amount of recharge probably varies from year to year, depending on climate conditions, and may well be larger than the value calculated by using the chloride mass-balance approach." The basin yield method for determining groundwater recharge indicates a direct computation of 1,950 acre-feet per annum as shown on table 9, page 26 of the USGS report. The USGS points out in the report, within the last two sentences of the section entitled "Basin Yield Method," on page 24 of said report that the cumulative error for the estimate of recharge was estimated at plus or minus 1,380 acre-feet per annum. This indicates that recharge computed by the basin yield method falls within the range of 570 to 3,300 acre-feet per year. The midrange would be 1,950 acre-feet per annum which is substantially higher than the 490 acre-feet per annum chloride mass balance approach. The 490 acre-feet per annum annual recharge rate appears to be the basis for limiting the well diversions to 300 acre-feet per annum.	6.1 Document specific comment	There is no doubt that the magnitude of recharge will vary from year to year and the estimates we use may not be entirely accurate. John Bredehoeft (2007) wrote that actual recharge is difficult if not impossible to accurately determine. Monitoring of groundwater and surface flow is critical. Bear in mind that just because we come up with a number for recharge (and assuming it is correct), this doesn't mean we would be free to pump that much. Whatever is pumped would induce recharge, which would deplete water somewhere on the surface (from less evapotranspiration or surface flow, for example). Otherwise, the water is mined from the aquifer and never fully replaced. We are left with the task of determining an acceptable proportion of the recharge that could be pumped and still provide forest resource protection. Also remember that the initial threshold of 900 cumulative acre feet over any 3 consecutive water years (300 acre feet per year) in the proposed action is not a stand-alone threshold. As we stated in the proposed action description, hitting this threshold would trigger a review by the Forest Service of the other thresholds and mitigations for maintaining or improving surface resource conditions. At that point, we would decide, based on evaluation of all monitoring indicators, if changes were needed. As we recognized in the "Alternatives" section of the Scoping Outcome Summary, the 300 afy threshold is only a starting point based on the best available information at the time we developed the proposed action. Based on additional reanalysis of all available information (as recently discussed at the hydrologist technical meeting held in April 2011), we may refine that number.

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					We will revisit each threshold in the proposed action after we reanalyze the data to ensure these numbers are accurate and supported by the best available science. In the proposed action, we also include adaptive management strategies that would allow for additional monitoring results to be used to continually review and refine these thresholds based on new information.
52	5	NEPA - USGS Report	The USGS report indicates that there is no strong correlation between well pumping and stream discharge for the 19-month North Fork Gage record and the 20-year-old Eagle Creek Below South Fork Gage record in the first sentence following the section “Effects of Pumping on Continuous Flow in North Fork Eagle Creek” on page 57 of the hydrology report. Also, in the section “Discharge Required to Sustain Continuous Flow in North Fork Eagle Creek,” pages 56 and 57 of said USGS report, up to 2.2 CFS at North Fork Gage would be required to maintain surface flow through North Fork. The 2.2 CFS was equaled or exceeded only 2 percent of the time during the study period from September 2007 through March 2009, which indicates that North Fork would have been intermittent 98 percent of the time with the available flow recorded at the North Fork gage.	5. 1 Comment	Thank you for your comment. Based on additional reanalysis of all available information (as recently discussed at the hydrologist technical meeting held in April 2011), we will draw some conclusions in the EIS regarding flow patterns on North Fork Eagle Creek before and after pumping began and also use this to predict the effects of the alternatives on streamflow.
18	10	Recreation	The Village of Ruidoso has proclaimed and promoted the business of tourism in the area but has ignored an integral part of tourism by the environmental degradation of the Eagle Creek drainage and its cold water fishery that drew campers, fisherman, and naturalists to a drainage located on the national forest. VOR has completely eliminated fishing from Alto Lake. This lack of overall tourism management is an economic component that the Village of Ruidoso has chosen to ignore because of poor management and lack of concern for the natural resources that surround the village.	1.1 Key - Socioeconomics	We discuss the impacts to socioeconomics in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
41	9	Recreation	Likewise, ECCA encourages you to comprehensively and objectively consider the impact of your decision on recreational values in the Lincoln National Forest. Opportunities for water based recreation in the Lincoln National Forest are limited, and your decision should not impair these opportunities.	1.1 Key - Socioeconomics	We discuss impacts to socioeconomics, including streamside recreation users, in chapter 3 of the EIS.
51	11	Recreation	If the Village of Ruidoso promotes the business of tourism they need to address the degradation of the Eagle Creek drainage and its cold water fishery that once attracted campers, fisherman. This negatively impacts fishing in Alto Lake. This is an economic component that the Village of Ruidoso has chosen to ignore either because of lack of knowledge or concern for the natural resources that surround the Village.	1.1 Key - Socioeconomics	We discuss impacts to socioeconomics, including streamside recreation users, in chapter 3 of the EIS.
13	10	Riparian	Trees suffered a drastic impact and hundreds of fine old cottonwood and oak trees along the streambed died.	1.1 Key – Riparian Vegetation	We discuss the impacts to riparian vegetation in chapter 3 of the EIS.
18	5	Riparian	The degradation of riparian condition is evidenced by the comparison of the riparian vegetation upstream of the North Fork Eagle Creek wells.	1.1 Key – Riparian Vegetation	We discuss the impacts to riparian vegetation in chapter 3 of the EIS.
33	1	Riparian	Virtually all of the cottonwood trees along the creekbed have died in the last decade. Some dead trees in back of my house are 16" diameter and larger.	1.1 Key – Riparian Vegetation	We discuss the impacts to riparian vegetation in chapter 3 of the EIS.
39	3	Riparian	Down in the creek bottom there are many trees that are dying, I believe, because of lack of water. All along the creekbed there are dead oak trees now, that used to be pretty when leafed out, but are now dead. There is a huge cottonwood tree that is dead, and is now cut down. Some of the neighbors that live on the creek tell us that the creek used to run most of the time, and that they used to even fish in it. It is a shame that any entity should be able to cause this sort of hardship on the environment.	1.1 Key – Riparian Vegetation	We discuss the impacts to riparian vegetation in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
42	4	Riparian	There has been no diminution of riparian vegetation in the Eagle Creek basin over the past 50 years. In fact, forest growth has dramatically increased and is the primary cause of any decline in streamflow. Restoration of forest density to what it was 50 years ago will dramatically increase streamflow, even in drought years. This will also reduce the danger of catastrophic wildfire which will destroy streamflow for use as a water source. If a wildfire occurs, water supply will have to rely completely on ground water.	1.1 Key – Riparian Vegetation	We describe existing riparian conditions in chapter 3 of the EIS. We will include a summary of any changes in riparian vegetation along North Fork Eagle Creek that have occurred since the wells began pumping. We will use the best available information; comparing existing conditions to those prior to well pumping in 1988. In the EIS we will also discuss whether forest density in the watershed has increased over time, and if so, if this has contributed or could cumulatively contribute to the effects of the alternatives on streamflow over time. Our initial experience with the effects of forest density on water availability indicates that this effect is often quite small and localized. However, we agree that it makes sense to take a look at this potential effect as part of the cumulative effects analysis in the EIS.
48	1	Riparian	In 2003, I had to remove 3 large cottonwood trees from along the dry Eagle Creek streambed. They were beautiful trees, probably 60 or 70 feet tall, but had died over the 7 years we'd lived here. It is clear that the trees had flourished until recently.	1.1 Key – Riparian Vegetation	Thank you for this information. We discuss the impacts to riparian vegetation in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
51	6	Riparian	Manual 2541 limits the actions available to the U.S. Forest Service when there is evidence of degrading the natural resources of the stream. The allowance in the monitor indication section in the proposed action to allow no-flow days should not be considered. No-flow days during the period of 1988 to 2009 has affected the North Fork tributary and its associated riparian area and its ability of a cold water fishery since the North Fork wells were put in operation. The degradation of riparian condition is evidenced by the comparison of the riparian vegetation upstream of the North Fork Eagle Creek wells. The threshold of 20 days per year of no surface flow or more that 30 no-flow days within a single water year will be adverse to the riparian vegetation between the North Fork wells and the Eagle Creek stream gauge. The natural fluctuating precipitation and snowmelt runoff would allow the Village of Ruidoso to obtain a controlled amount of municipal water from the Eagle Creek drainage without impacting the surface flow if the Village of Ruidoso had additional storage capacity.	3.1 Alternatives	We considered eliminating no-flow days completely and discuss this in chapter 2 of the EIS. We discuss the impacts to riparian vegetation in chapter 3 of the EIS.
53	1	Riparian	Along with many of my neighbors, I have a number of large, dead cottonwood trees along the creekbed. These trees are decades old and obviously environmental conditions have changed during fairly recent time.	1.1 Key – Riparian Vegetation	Thank you for this information. We discuss the impacts to riparian vegetation in chapter 3 of the EIS.
52	11	Riparian Vegetation	Riparian vegetation monitoring used as an indicator would necessitate the establishing of the present baseline condition for the intermittent North Fork stream reach. There has been no apparent riparian vegetation change documented or known for the pre-North Fork wells conditions to the present conditions. Since the stream is intermittent, the comparison should be made to other existing intermittent stream riparian vegetation conditions in the Lincoln National Forest. The proposed implementation of stream augmentation to surface waterflows in North Fork should improve riparian vegetation conditions, but this improvement should not be required as a condition in special use permitting.	1.1 Key – Riparian Vegetation	We will describe existing riparian conditions in chapter 3 of the EIS, including any changes over time based on the best available information. In the “Riparian Vegetation Methodology” section we describe how baseline conditions were assessed and how we will evaluate changes over time.
7	1	Social and Economics	His concern is the Village of Ruidoso could pump so much water that any well he drills on his land will be dry. Dry well on his land, renders his land worthless.	1.1 Key - Socioeconomics	We discuss impacts to socioeconomics, including the potential effects to private landowners, in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
19	1	Social and Economics	I would also point out that with increased pumping from Eagle Creek many of our neighbors have had to redrill their wells.	1.1 Key - Socioeconomics	Thank you for this information. See response above.
19	2	Social and Economics	I would suggest, that, if the village needs the water from the Eagle Creek basin and that when that use results in a loss to those who rely on that same water then the village should compensate those who need to put in new wells.	1.1 Key - Socioeconomics	We discuss impacts to socioeconomics, including the potential effects to private landowners, in chapter 3 of the EIS. Whether or not the village should compensate private landowners is outside the scope of this EIS.
21	1	Social and Economics	The loss of this water would be devastating to Ruidoso, its citizens, businesses, and tourists. That loss would be a huge threat to health, safety, and welfare. It would put the Village at even more risk in our ability to fight a catastrophic fire. Remember that the Village's biggest neighbor is the Lincoln National Forest. It is likely that if the Village loses a substantial part of our water supply due to an administrative decision within the USFS, many thousands of people will be adversely affected. Citizens of Ruidoso will know that few will benefit from this decision. However, many will be negatively impacted and threatened by that decision.	1.1 Key - Socioeconomics	Effects of well pumping on municipal and private land water supply is discussed in chapter 3 of the EIS. We recognize the need for providing for the applicant's ability to access this groundwater as an important component of the municipal water supply and the need to protect forest resources, as stated in our purpose and need for action. We will be carefully evaluating the potential effects of each alternative on each key issue, including socioeconomics, in the EIS.
23	3	Social and Economics	Because we have seen impairment in the past because of pumping of Village wells in times of drought, any permit issued for the future must be conditioned so that the Village must curtail its pumping so as to protect downstream users from impairment.	1.1 Key - Socioeconomics	We discuss impacts to socioeconomics, including the potential effects to private landowners, in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
24	1	Social and Economics	I live South of the North Fork Wells "just one hill top over" in the next valley to the south of the North Fork wells on North Gavilan Road or in the old Blood Ranch Area "West side of Highway 48." My parents live approx. 1 mile East of me on Gavilan Canyon "East side of Highway 48." We are both on water well systems mine being a private well and my parents being community well system with 5 homes on it. We have both been greatly impacted by the Villages use of the North Fork wells as it has drawn down the underground aquifer to a point that I had to drill a new deeper well 1.5 years ago. My parents only have 2 people that live here full time using the community water well and it hardly produces enough water to supply the two full time residents and we have no idea what will happen when or if all 5 residents are here at the same time as there will not be enough water to go around at that point. There used to be plenty of water for 5 residents in my parents water well located on Gavilan Canyon Road but not now. Everyone around my parents use community water wells and everyone has been having problems with their wells for several years now. Eagle Creek used to run full time year round with trout in it because I fished it as a kid and now for years it has been dry and without fish. The use of the North Fork wells has negatively impacted the residents of Eagle Creek water wells, the flow of Eagle Creek and negatively affected the recharge of ground aquifer for many miles and areas to the Hondo Valley. In my personal opinion Ruidoso is thieving water from others to satisfy their never ending thirst for unencumbered growth.	1.1 Key - Socioeconomics	Thank you for this information. We discuss impacts to socioeconomics, including the potential effects to private landowners, in chapter 3 of the EIS.
27	1	Social and Economics	My water well and my parents have been greatly impacted in a negative way by the village pumping North Fork wells.	1.1 Key - Socioeconomics	Thank you for this information. We discuss impacts to socioeconomics, including the potential effects to private landowners, in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
28	1	Social and Economics	Recently the Office of the State Engineer, by court order issued 2,539 acre-feet of groundwater from the North Fork Eagle Creek wells, The village historical use has been 1,000–1,600 per anum. The Village also has 760 acre-feet of surface rights on Eagle Creek. Ruidoso received approximately 50% effluent credit on an instantaneous or accrual basis from Eagle Creek which is applied to the diversion of Rio Ruidoso to the Grindstone plant or reservoir. In a nut shell the Village of Ruidoso by purchase and transfer from the Railroad Company owns all of the water rights on Eagle Creek with the exception of the Alto Village and Kokopelli wells, which are located below Alto Lake. The Moran report of 1906 refers to Eagle Creek as an intermittent stream. Recent USGS studies and Village of Ruidoso historical records indicate the same. The proposed draft issued by the USFS reduces the Village of Ruidoso to 50% of the volumetric rate of surface flow with a maximum of 300 acre-feet annually. If successful this will result in the diminution of diverting water from the Rio Ruidoso and Eagle Creek creating inadequate fire protection during fire season as well as curtailing commerce within the village and our inability to meet peak demand production.	1.1 Key - Socioeconomics	From 2009 to 2010, the applicant utilized wells NF-1 and NF-4. The combined average for that period was roughly 740 acre feet per year. The highest use during this period occurred between March and September, ranging from a combined total of 60 to 117 acre feet per month. As stated in some previous responses, remember that the initial threshold of 900 cumulative acre-feet over any 3 consecutive water years (300 acre-feet per year) in the proposed action is not a stand-alone threshold. As we stated in the proposed action description, hitting this threshold would trigger a review by the Forest Service of the other thresholds and mitigations for maintaining or improving surface resource conditions. At that point, we would decide, based on evaluation of all monitoring indicators, if changes were needed. As we recognized in the “Alternatives” section of chapter 2, the 300 afy threshold is only a starting point based on the best available information at the time we developed the proposed action. Based on additional reanalysis of all available information (as recently discussed at the hydrologist technical meeting held in April 2011), we may refine that number. We will revisit each threshold in the proposed action after we reanalyze the data to ensure these numbers are accurate and supported by the best available science. In the proposed action, we also include adaptive management strategies that would allow for additional monitoring results to be used to continually review and refine these thresholds based on new information. The effects of all alternatives on socioeconomics is discussed in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
33	1	Social and Economics	The original owners of my residence had a second well drilled after the water level in the first well dropped to the pump intake in 2008. I understand that a number of residents in the lower canyon have had to re-drill or deepen their wells in the last 10 years due to lowering of the water table. In summary, my neighbors in the lower canyon are concerned about a continuing drop in the water table level and further environmental degradation if the Village is allowed to continue unregulated pumping. I think only the most die hard opponents of pumping want to completely shut down the Village well field, but limitations need to be put in place.	1.1 Key - Socioeconomics	Thank you for this information. We discuss impacts to socioeconomics, including the potential effects to private landowners, in chapter 3 of the EIS.
34	1	Social and Economics	Irregardless of who is to blame for allowing a special use permit to expire back in 1995 or why citizens filed a lawsuit resulting in unintended consequences for all of us today. . . .the bottom line is HOW ARE WE TO SURVIVE if you cut off up to 70% of our water supply? I moved to this little village from Chicago nearly 6 years ago, seeking a bucolic paradise to grow old in. . . .this situation has quickly turned my dreams into a nightmare. Please find your compassion and humanity and issue us another special use permit, albeit with some reasonable changes to keep everyone happy.	1.1 Key - Socioeconomics	Our purpose and need for taking action and the management objectives we developed for this project, as we explain in chapter 1 of the EIS, include achieving a balance between the need for municipal water supply and protecting forest resources.
39	2	Social and Economics	Many of the residents of Eagle Creek have already had to go deeper with water wells in order to get water. Two years ago we had to go without water for a day and a half, because the water table, I guess, was too low.	1.1 Key - Socioeconomics	Thank you for this information. We discuss impacts to socioeconomics, including the potential effects to private landowners, in chapter 3 of the EIS.
39	5	Social and Economics	We, the people of Eagle Creek, think it is about time the city of Ruidoso starts to think forward a bit on how the city can conserve water by cutting down on new building, that will further impact the water usage, or come up with another way to get water. We feel that if Ruidoso keeps using the water from Eagle Creek, they should be held responsible for the drilling of new wells for the residents of Eagle Creek, if our present wells go dry.	1.1 Key - Socioeconomics	We will discuss impacts to socioeconomics, including the potential effects to private landowners, in chapter 3 of the EIS. Whether or not the Village should compensate private landowners is outside the scope of this EIS.

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42	5	Social and Economics	Lincoln County over the last several years has approved numerous subdivisions with hundreds of lots. Instead of mandating water systems for these subdivisions, the county approved them utilizing individual private domestic wells that were allowed 3 acre-feet per year each. Many of these lots are located in the Eagle Creek basin. These wells take water from the basin thus diminishing the water available to senior water rights holders such as the Village.	1.1 Key - Socioeconomics	We discuss impacts to socioeconomics, including the potential effects to private landowners, in chapter 3 of the EIS. Whether or not the village should compensate private landowners is outside the scope of this EIS.
43	1	Social and Economics	We have been in business since 1942. I would not want the USFS to do anything detrimental to our water resources in Eagle Creek. Our water supply is vital to our health, safety, and welfare. Recreation is limited in the Lincoln National Forest at its best. No more negative impacts are accepted.	1.1 Key - Socioeconomics	We will discuss impacts to socioeconomics, including the potential effects to private landowners, in chapter 3 of the EIS.
44	1	Social and Economics	I'm a 50 + year resident of Ruidoso, water for Ruidoso is an important thing in my existence in my business not to mention the existence of Ruidoso as a resort to thousands of visitors.	1.1 Key - Socioeconomics	We discuss impacts to socioeconomics in chapter 3 of the EIS.
46	1	Social and Economics	As a multiple business owner I object to any new programs that may have a negative impact on residents or tourists.	1.1 Key - Socioeconomics	We discuss impacts to socioeconomics in chapter 3 of the EIS.
48	1	Social and Economics	The house I live in was built in 1978 and the well was at 125 feet. I don't have data on the waterflow, but it was sufficient for 21 years, until November 1999 when we began to shower in muddy water. I got an emergency drilling permit and doubled the depth of the well, to 250 feet. Apart from sulfur smells in late spring, before the rainy season, the output has been satisfactory.	1.1 Key - Socioeconomics	Thank you for this information. We discuss impacts to socioeconomics in chapter 3 of the EIS.
53	1	Social and Economics	My house was built in 2004. There was a second water well that was installed on the property a few years later due to sedimentation in the first well. I honestly don't know if the well problem was caused by a decline in the groundwater level as others have suggested.	1.1 Key - Socioeconomics	Thank you for this information.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
56	2	Social and Economics	Around 20 years ago we paid high dollar for a property on Lower Eagle Creek and spent our life savings building a home. At the time Eagle Creek was flowing at least half of each year. A few years ago, when we tried to sell the home, several potential buyers gave questions and remarks that expressed their concern about the well problems people here are having, and about the dry creek. The home did not sell. Also, in the period since we built the home in 1995, the city of Ruidoso has approved the construction of a number of new high occupancy hotels, apparently without giving thought to a permanent water source, and with total disregard for permanent residents and wildlife along Eagle Creek.	1.1 Key - Socioeconomics	Thank you for this information. We discuss impacts to socioeconomics and wildlife in chapter 3 of the EIS.
1	4	Water	ECCA wants to get back to a minimum flowing stream.	3.1 Alternatives	Our purpose and need for taking action and the management objectives we developed for this project, as we explain in chapter 1 of the EIS, include achieving a balance between the need for municipal water supply and protecting forest resources.
1	5	Water	Maintain saturated bedrock.	3.1 Alternatives	We considered these suggestions as components of a new alternative which we will describe in chapter 2 of the EIS.
1	6	Water	Use 1.2 cfs for minimum base flow.	3.1 Alternatives	We considered these suggestions as components of a new alternative which we describe in chapter 2 of the EIS.
1	16	Water	ECCA requests a depth to water timeline from USGS, as a supplement to their report.	5.1 Suggestion	Thank you for your suggestion. We have used a timeline display as part of the water resources analysis.
11	3	Water	The Eagle Creek Summer Home Association has a vested interested in the waterflow of Eagle Creek and fears that within the near future the depleting of groundwater will further drain Eagle Creek, empty the aquifer, destroy the local ecosystem, and eliminate the availability of groundwater for use by the Village of Ruidoso.	1.1 Key – Water Resources	We will evaluate effects to forest resources in chapter 3 of the EIS, including the potential for effects to water resources, riparian vegetation, aquatic habitat and fish, and socioeconomics.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
13	1	Water	The North Fork of Eagle Creek has been changed from a perennial, fishable trout stream into a dry streambed. The reduction of flow downstream to Alto Lake and further to lower Eagle Creek and ultimately to the Hondo River has resulted in damage to natural resources that affects homeowners, farmers and ranchers, and the environment, both within and without the Lincoln National Forest. The ECCA attributes this reduction in flow to the Village's operation of the North Fork wells.	1.1 Key – Water Resources	We evaluate effects to forest resources in chapter 3 of the EIS, including the potential for effects to water resources, riparian vegetation, aquatic habitat and fish, and socioeconomics.
13	3	Water	Neither "intermittent" nor "perennial" accurately describes the historical nature of the stream. We accept that surface flow may have gone subsurface for short stretches because the height of river rock exceeded the water table in places. We are in agreement with the USGS that new river rock has been deposited, perhaps as much as 4 feet, as a result of recent floods. These new deposits further contribute to intermittently visible surface flow. We resist the notion that the stream was intermittently, completely dry for the entire 2-mile stretch prior to pumping. No historical documentation exists that says the North Fork was intermittently, completely dry prior to pumping the wells. The NEPA document, Smokey Bear RD, May, 26, 1984, including a questionable categorical exclusion, describes Eagle Creek as a "perennial, high quality creek which is used for municipal water by the Village of Ruidoso." The ECCA agrees with the USGS report describing the North Fork as perennial as far downstream as the North Fork gage. Just downstream from the North Fork gage, however, when the Village is operating their pumps, the streambed now stays mostly dry. The dry streambed, most of the time, is a new condition since the Village began operating their pumps.	1.1 Key – Water Resources	Thank you for your comment. Based on our reanalysis of all available information (as recently discussed at the hydrologist technical meeting held in April 2011), we will draw some conclusions in the EIS regarding flow patterns on North Fork Eagle Creek before and after pumping began and use this to also make predictions regarding the effects of the alternatives on streamflow.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
13	4	Water	In 2004, the ECCA completed the 2-year compilation of information describing the changing conditions on Eagle Creek, "The Killing of Eagle Creek, an Environmental Tragedy." We would like to present one excerpt relevant to both the term "intermittent" and to fishing in Eagle Creek. We have selected part of a signed affidavit from Mike Davalos, the project engineer for drilling the North Fork wells, later employed as the Village engineer. "I was working with Atkins and Landfair who was drilling the wells and it only after they were finished drilling the wells then did I start working for the Village of Ruidoso. It (the creek) was an intermittent stream. I recall clearly because it was during the time that my son was growing up and I had taken him fishing up there to go fishing in the creek and we would go and walk the stream and there were parts of the stream that were flowing fairly well, it would support fish, and then the stream would go back underground and then come up some distance down the stream. That was pretty much the nature of the stream when I was working up there."	1.1 Key – Water Resources	Thank you for this information.
13	6	Water	The Village of Ruidoso hired John Shomaker and Associates, Inc. (represented by Roger Peery) to prepare the Finch Report (2004), referenced in the USGS report. The correct title is "Water-Resource Evaluation of Eagle Creek Watershed, Village of Ruidoso, New Mexico." It states: "Approximately 20 years ago, prior to ground-water pumping, the original water levels in the North Fork wells were at or near the land surface." "The cone of depression around the North Fork wells captures the streamflow in the well field area except during periods of relatively high runoff." "The average estimated recharge to the ground-water system prior to development of the North Fork wells was 295 ac-ft/year." "pumping from the North Fork wells, rather than variations in precipitation, are primarily responsible for decreased streamflow." Additional related presentations by Roger Peery, one of the contributors to the Finch Report and consultant to the Village, can be found in The Killing of Eagle Creek and the 40-Year Water Plan for the Village of Ruidoso, Appendix B, Hydrogeology	1.1 Key – Water Resources	Thank you for this information.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
13	10	Water	Beginning around the year 2000, the Alto Reservoir dried up and remained dry for approximately 5 years. This required that very little surface flow would get past the diversion dams. During this period, a great many of the homeowners along Eagle Creek, below Alto Reservoir, suffered. Water in the upper aquifer was no longer being replenished. Numerous domestic wells failed and homeowners had to drill into a deeper strata for water. The dry Alto Reservoir is part of the 10 years in which no-flow days were measured at the Eagle Creek gage in 8 of 10 years. The Village operating practice during that period might have created a causal relationship with the no-flow days.	1.1 Key – Water Resources	Thank you for this information.
14	4	Water	Item (2) of the objectives states, “Minimizing impacts of groundwater drawdown from this well field to maintain surface flows and protect water-dependent ecosystems.” If “the impacts of groundwater drawdowns” only refers to the impacts of those drawdowns we have experienced during the last 25 years of pumping, we are in complete agreement with the objective. If it reflects a decision the USFS has already made that drawdowns to past levels will continue, we see such position as incompatible with the rest of the objective, “to maintain surface flows and protect water-dependent ecosystems.” Item (2) of the Purpose and Need for Action, “protecting natural resources on the national forest by maintaining adequate surface and groundwater flows to sustain or improve riparian and aquatic ecosystems that may be affected by groundwater drawdown from the pumping of these waters.” If “may be affected by groundwater drawdown” means “may be determined to have been affected by historical events” we concur. If the phrase indicates a foregone decision by the USFS that such drawdown will continue unregulated, then the rest of the purpose and need cannot be satisfied. We fail to understand how surface flow can be sustained with a void of unsaturated bedrock, hundreds of feet deep, directly underneath the streambed.	6.1 Document specific comments	Thank you for your comment. We recognize that as written, the second management objective is not entirely clear. Our intent, as written in one of our purpose and need statements is to protect “natural resources on the national forest by maintaining adequate surface and groundwater flows to sustain or improve the riparian and aquatic ecosystems that may be affected by groundwater drawdown from the pumping of these wells.” This does not mean drawdown would continue unregulated. Our proposed action is detailed; ensuring municipal water is available while also protecting forest resources through monitoring and adaptive management. We have clarified this management objective in the EIS to be more consistent with the above purpose and need statement to minimize confusion: “Minimizing impacts of groundwater drawdown from this well field by maintaining adequate surface flows and protecting water dependent ecosystems.”

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
14	5	Water	The ECCA takes exception with "Findings show that during the study period there was less available sustained base flow than there was before the wells began pumping in 1988" as a stand-alone statement. The USGS implies or states that this reduction in base flow was climate related. The finding did not quantify the effect the depth-to-water and the cone of depression had on the reduction in base flow. The ECCA supports the probability that the cone of depression was the major influence on the findings. "When groundwater is pumped from the North Fork wells, it causes a temporary decline in groundwater which lowers the water table and creates an expanding cone of depression around the wells." The ECCA applauds the USGS for articulating this condition. We take exception to the unqualified use of the word "temporary." Depth-to-water records show that during the period of flood conditions prior to the "great flood," the water table rose from 500 feet below the surface to artesian or near-artesian conditions over a 3-month period of continuous recharge. When surface flow dropped, the Village resumed pumping and created a 500-foot drawdown in only 2 months. Other than the "great flood," this was the quickest recovery of the "temporary" lowering of the water table we have observed by reviewing depth-to-water records. We have no way of knowing if the bedrock was completely saturated when the water table reached the surface.	1.1 Key – Water Resources	Thank you for your comment. Based on our reanalysis of all available information (as recently discussed at the hydrologist technical meeting held in April 2011), we will draw some conclusions in the EIS regarding the cone of depression and water table patterns before and after pumping began and use this to make predictions regarding the effects of the alternatives on these conditions.
14	26	Water	The ECCA has observed that much of the devastation of the aquifer and trees downstream from the Alto Reservoir occurred during the 5 years Alto Reservoir and Eagle Creek upstream from the reservoir remained dry. A saturated streambed and a full Alto Reservoir are vital to downstream resources. We resist a Forest Service conclusion that does not restore riparian vegetation by keeping the Eagle Creek streambed and reservoir wet.	1.1 Key – Water Resources	Thank you for this information.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
18	5	Water	The natural fluctuation precipitation and snowmelt runoff would allow the Village of Ruidoso to obtain a controlled amount of municipal water from the Eagle Creek drainage without impacting the surface flow if the Village of Ruidoso had additional storage capacity.	3.1 Alternatives	We considered this suggestion for additional storage capacity in the “Alternatives” section of chapter 2.
18	5	Water	I agree with the USGS final report that indicates that when ground is pumped from the NF wells, it causes a temporary decline in groundwater which lowers the water table and creates a expanding cone of depression around the wells. Go to the area today and you can see the effects are far reaching, both upstream and downstream.	5.1 Suggestion, comment, or procedural concern	Thank you for this information.
20	1	Water	Not much can be done in the immediate future to restore the wildlife, however, its not too late to restore some water to Eagle Creek.	5.1 Suggestion, comment, or procedural concern	Our purpose and need for taking action and the management objectives we developed for this project, as described in the Purpose and Need document (which will also be summarized in chapter 1 of the EIS), include achieving a balance between the need for municipal water supply and protecting forest resources.
23	2	Water	The USGS report titled, Hydrology of Eagle Creek Basin and Effects of Groundwater Pumping on Streamflow, 1969-2009 (Revised November 2010) on page 63, Summary, indicates that “no days of zero flow were recorded for the 11-year period 1970–80. Beginning in 1989, however, no-flow days were recorded in 11 of 20 years.” The Village of Ruidoso North Fork wells began pumping in 1988, therefore, this data indicates that the pumping of these wells has a substantial negative effect on streamflow.	1.1 Key – Water Resources	Thank you for this information. We include a detailed evaluation of water resources in chapter 3 of the EIS.
23	5	Water	History has shown that when Eagle Creek is completely dry, the static water levels in the district’s wells located near Eagle Creek decline: In 2005 and 2006 a period when no flow was noted in Eagle Creek, static well levels declined substantially. The average static water level decline during this period was 65 feet in the three district wells located near Eagle Creek, with two wells showing declines in static water level of 75 feet and 76 feet. A saturated streambed and full Alto Reservoir are vital to all life, plant, animal, and human dependent on Eagle Creek.	1.1 Key – Water Resources	Thank you for this information. We include a detailed evaluation of water resources in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
25	1	Water	Eagle Creek from Alto Reservoir to the Mescalero boundary which includes the segment below the confluence of North Fork Eagle Creek and South Fork Eagle Creek, and South Fork Eagle Creek is recognized in New Mexico's Nonpoint Source Management Program Plan as impaired due to reduced flow (Category 4C). In the 2010-2012 State of New Mexico CWA §303(d)/§305(b) Integrated Report South Fork of Eagle from Eagle Creek to the Mescalero Boundary is listed as not meeting its designated use for high quality coldwater aquatic life with a probable source on impainnent low flow alterations (Category 4C). The wells are located within the streambed. The scoping document mentions that streamflow loss caused by pumping ranges between 0.5-0.8 cfs or between 23% to 36% of the necessary flow (2.2 cfs) to maintain streamflow. It is clear that the introduction of these wells into the system has had negative impacts to the system. Without improved management of the North Fork Eagle Creek well field these conditions would be expected to persist of worsen.	1.1 Key – Water Resources	Thank you for this information. We include a detailed evaluation of water resources in chapter 3 of the EIS.
27	2	Water	I am deeply opposed to the continued use of Eagle Creek by Ruidoso unless there is active flow of Eagle Creek stream above ground.	5.1 Suggestion, comment, or procedural concern	We considered this suggestion (establishing a minimum instream flow) as a component of a new alternative in the "Alternatives" section of chapter 2. We also discuss this in the separate "Manual Direction Summary" document.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
33, 57	1	Water	There is at least one fairly recent sinkhole adjacent to the creekbed on my property. The residence directly west of my house also has a sinkhole next to the creek. My neighbor to the south has informed me that he filled in 2 sinkholes on his property in the last 10 years. These sinkholes are at least 5' to over 20' in diameter. Most commonly, sinkholes occur when subsurface voids collapse due to a loss of supporting buoyancy when the water table drops.	1.1 Key – Water Resources	Thank you for this information. Based on a very cursory evaluation of the photos submitted by our project hydrologists, we doubt that these are actually sinkholes in the strict sense of the word – having to do with karst features. Sinkholes won't typically form in volcanics. It appeared that the features were actually "pipes" opening up along the streambank as the water level drops or the channel erodes down. Usually piping is formed by silty materials eroding out along a weak zone of seepage/drainage. We recognized that some of these features were pretty sizeable. We will continue to consider this concern during the water resources data reanalysis phase, prior to beginning the effects analysis of the alternatives. If any new information comes available, we discuss this in the "Water Resources" section of chapter 3 of the EIS.
56	1	Water	Included are photos to show some of the results of the depleted water resources on our property. The largest of 7 sinkholes…the natural creek bank went from where the person is standing over to the tree on the right foreground. The sinkhole is probably 12 feet deep. We are afraid to get in it to measure. Three more sinkholes have been filled in. The largest was about 10 to 12 feet deep, 10 feet in diameter, with a bottle-necked top. It took two truck-loads of stone to fill these in. In the foreground, the fill stone sank and we added mulch to the top. Two additional sinkholes were filled with stone and mulch. The filling was done to keep us and wildlife from falling in. On one of these, when I was checking for more sinkholes, the ground gave way under me and I fell in. Luckily the hole was only about 4 feet deep and I was able to get out. When these sinkholes appeared we tried to call several people/agencies about what was happening, and no one was interested.	1.1 Key – Water Resources	Thank you for this information. See response above.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
36	19	Water	Lincoln County residents have observed that much of the devastation of the aquifer downstream from the Alto Reservoir occurred during the 5 years Alto Reservoir and Eagle Creek upstream from the reservoir remained dry. A saturated streambed and a full Alto Reservoir are vital to downstream resources. We resist a Forest Service conclusion that does not restore riparian vegetation by keeping the Eagle Creek streambed and reservoir wet.	1.1 Key – Water Resources	We considered this suggestion (establishing a minimum instream flow) as a component of a new alternative in the "Alternatives" section of the Scoping Outcome Summary. We also discussed this in the separate "Manual Direction Summary" document. We include a detailed evaluation of water resources and riparian resources in chapter 3 of the EIS.
36	11	Water	Lincoln County agrees with the articulation, "If the cone of depression continues to expand, it can impact water dependent resources outside the stream corridor."	5.1 Suggestion, comment, or procedural concern	Thank you for your input.
36	5	Water	Purpose and Need for Action (p. 3 of the scoping document) states that the 2006 stipulation agreement requires the Forest Service to analyze "... all reasonable alternatives (and no less than one alternative) that leave downstream flows in the same state that they would be absent the pumping of the North Fork wells." However, the proposed action does not quantify what the flows would be, but for the North Fork well field. An analysis of baseline streamflow without the wells is needed, ideally with a groundwater model as provided in Forest Service Manual 2500, Chapter 2540.	6.1 Document specific comments or corrections	There is no way to quantify North Fork Eagle Creek baseline streamflow prior to well pumping because the Eagle Creek gage was measuring both South Fork and North Fork contributions; the South Fork gage was not installed until after the wells began pumping. However, after we reanalyze all the available information (as recently discussed at the hydrologist technical meeting held in April 2011), we will draw some conclusions in the EIS regarding flow patterns before and after pumping began and use this to make predictions regarding the effects of the alternatives on these conditions. The FSM requirement for a groundwater flow model applies to proposals for new wells; but the proposed action would authorize existing wells. We do agree that a controlled aquifer test or model would be valuable for future management. We discuss this topic in more detail in the EIS.
53, 57	1	Water	Also, I have observed sinkholes along the creekbed, one sinkhole on my property has a live 6 foot pine tree in it. The pine tree is tilted at an angle, suggesting it was growing on level ground when the sinkhole occurred. My next door neighbor has told me that he has filled in 2 small sinkholes in his back yard in the last 10 years. Typically, sinkholes occur when subsurface voids collapse due to a loss of buoyancy caused by a drop in the groundwater level.	1.1 Key – Water Resources	Thank you for this information.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
10	2	Water Rights	How can the USFS limit the pumping from wells that have state adjudicated rights?	5.1 Suggestion, comment, or procedural concern	We acknowledge the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right.
10	4	Water Rights	What will the USFS do to make up, or move, the village's water right and associated production to locations off USFS lands.	5.1 Suggestion, comment, or procedural concern	The Forest Service cannot interfere with the applicant's water rights and/or associated transferability off National Forest System lands. However, we can provide incentives, such as limiting access to the rights on Forest Service lands through permit conditions and the annual operating plan to encourage the movement of the applicant's water rights off Forest Service lands.
14	3	Water Rights	We observe that the Forest Service has put themselves in an interesting dilemma with the particular objectives they have picked. Item (1) of the Summary includes "Providing water management flexibility and ... incentives..., in a way that does not foreclose opportunities to transfer a portion of their water rights for these wells to locations off of National Forest System land." The concept of transferring water rights means that there is no right possible, forever, to the water from which the right was transferred. This is a very serious decision. This law was adopted when New Mexico was a territory and was patterned on Spanish precedent. Today, the concept of transferring water rights creates questions that may not have been apparent centuries ago. The ECCA cannot endorse transferring water rights off of the National Forest System. Item (1) of the Purpose and Need for Action repeats this theme, "authorizing ... the Village of Ruidoso's legal right to access and divert water from its North Fork Eagle Creek wells... ."	1.1 Key – Water Resources (water rights)	The Forest Service defers to the Office of the State Engineer for allocation, adjudication, and transferability of water rights. Item (1): see comment above Item (2): we agree with you. We are using the EIS process to develop a mitigation plan as part of the permit. Item (3): The Forest Service defers to the Office of the State Engineer for proof of beneficial use.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
			Relevant, we think, is the portion of the Forest Service Manual, 2541.34 - Water Rights and Uses for Other Purposes. "If the projected water requirements conflict with existing or potential Forest Service uses and rights or will adversely affect National Forest resources, the potential permittee must seek alternative water sources or develop mitigation plans acceptable to the Forest Service." Item 2541.34 would appear to limit the action available to the USFS for meeting the item (1) objective, purpose and need for action. In addition, it is our understanding of NM water law, that proof of beneficial use is the measure of a right. We see no way the Village can make beneficial use of any more water than they already have without further degrading downstream natural resources.		
18	12	Water Rights	I take exception to the fact that the Forest Service indicates that the Village of Ruidoso has 5,648 acre feet per year (AFY) of water rights attached to the NEC wells. This amount of water has never been proven up on nor is that volume available as per USGS study. I also object as stated in the Federal Register of the manage objective that states "Providing water management flexibility and water conservation to the Village of Ruidoso in a way does not foreclose opportunities to transfer a portion of their water rights of these wells to location off of National Forest System lands." The Forest Service has no jurisdiction over water rights! The state engineer has this jurisdiction over water rights so I question why this is a management objective of the Forest Service.	1.1 Key – Water Resources (water rights)	Please refer to the "Water Rights" section of our "Purpose and Need" document where we address the 5,648 afy amount and discuss the current consent order between the village and the Office of the State Engineer. The Forest Service defers to the Office of the State Engineer in the allocation of water. However, we can determine reasonable access to a state-issued water right and can provide incentives to encourage the transfer of water rights off of National Forest System lands.
23	1	Water Rights	The district provides water service to approximately 1,268 homes and commercial business. The district has the right to 613.94 acre-feet of groundwater downstream from this project.	5.1 Suggestion, comment, or procedural concern	Thanks for this information.
29	1	Water Rights	The attempt to steal the village water rights will leave no alternative except a lawsuit.	5.1 Suggestion, comment, or procedural concern	The Forest Service defers to the Office of the State Engineer in the allocation of water, even on public lands. See response above on our authority to limit access.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
30	1	Water Rights	Do you really want to cut water off for the people of Ruidoso?	5.1 Suggestion, comment, or procedural concern	Our purpose and need for taking action and the management objectives we developed for this project, as described in the "Purpose and Need" document (which is summarized in chapter 1 of the EIS), include achieving a balance between the need for municipal water supply and protecting forest resources.
36	2	Water Rights	Lincoln County supports the measures necessary to restore, sustain or improve aquatic habitat and fish, streamside recreation, fishing and wildlife viewing, riparian vegetation and municipal water supply on the Eagle Creek basin. Lincoln County agrees with the Forest Service on the issues identified. However, the county questions the authority of the Forest Service as it related to water rights transfers to other parts of Eagle Creek or to other stream systems.	Document Specific Comment	The Forest Service defers to the Office of the State Engineer in the allocation, adjudication, and transferability of water, even on public lands.
36	8	Water Rights	The Forest Service Manual requires that impacts on all downstream appropriated water rights be assessed. That assessment should be added to the scope of the environmental impact statement. The Upper Hondo watershed has been fully adjudicated and its findings were that all waters in that watershed have been fully appropriated with senior rights as far back as the 1850s. The Eagle Creek rights were created in 1984 and have not yet been proven up. The state engineer (through consent order 20294 and 22600 Exhibit 1) has recently removed a portion of the Eagle Creek rights due to their failure to prove up the rights. The Forest Service Manual requires that impacts on all downstream appropriated water rights be assessed and it is a fact that all downstream waters are fully appropriated and have been since 1907. The Forest Service has no authority pursuant to the Forest Service Manual to put any precedence whatsoever on transfers of water rights either transferred elsewhere in Eagle Creek or to another stream. The water rights in question should never be able to be transferred by the applicant or anyone else until: (a) 100 percent proven up where they were originally claimed in the Eagle Creek watershed (b) Only if the transfer does not adversely impact water rights with a seniority date prior to 1984.	1.1 Key – Water Resources (water rights)	The Forest Service defers to the Office of the State Engineer in the allocation, adjudication, and transferability of water, even on public lands.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
36	9	Water Rights	Additionally, the water rights should never be transferred outside of the Eagle Creek watershed, as the founding reasons of these rights from the beginning was that they were sole and separate from the Upper Hondo watershed.	1.1 Key – Water Resources (water rights)	The Forest Service defers to the Office of the State Engineer in the allocation, adjudication, and transferability of water, even on public lands.
36	10	Water Rights	The Forest Service has no authority over water right transfers whatsoever and should remove that language completely from their findings. Any transfer of these rights would severely impact the rest of the Upper Hondo watershed as it has been fully appropriated and adjudicated and can take no new diversions at any point on the current system. In addition, according to New Mexico water law, proof of beneficial use is the measure of a right. We see no way the applicant can make beneficial use of any more water than they have up to this point without further degrading downstream natural resources.	1.1 Key – Water Resources (water rights)	The Forest Service defers to the Office of the State Engineer in the allocation, adjudication, and transferability of water, even on public lands.
36	24	Water Rights	The 1984 Eagle Creek Rights were based on the assumption that the underground system where the well fields lie are separate from the Upper Hondo watershed. That has proven to be an untrue statement (see OSE consent order 20294 and 22600 attached as exhibit 1). A large part of the underground watershed that some Lincoln County residents depend on for their way of life is put at risk by the pumping of wells that the Forest Service has allowed to date. Due to the Village of Ruidoso's approach, past history, and recent statements about water, Lincoln County feels that the applicant is putting the whole area's investments at risk. Both the Village of Ruidoso's as well as the county's economies are dependent on the health of the Eagle Creek watershed. A large part of the growth of this area was based on the water right numbers which have proven to be erroneous (see OSE consent order 20294 and 22600 attached as exhibit 1). Due to the lack of infrastructure planning by the Village of Ruidoso for the past 20+ years, they have put the whole area in a precarious position.	1.1 Key – Water Resources (water rights)	Thank you for your comment.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
39	4	Water Rights	Didn't the city of Ruidoso have a time lease on the water rights usage?	5.1 Suggestion, comment, or procedural concern	Please refer to the "Water Rights" section of our "Purpose and Need" document where we dis-cuss the adjudicated water rights owned by the applicant and the current consent order between the applicant and the Office of the State Engineer. This is also discussed in chapter 3.
41	7	Water Rights	ECCA encourages you to comply with all Federal and State law and policy concerning the protection and non-impairment of existing water rights. To the extent that pumping in the North Fork well field may impair the beneficial use of existing water rights—both surface water rights and ground water rights—it should not be permitted as a matter of law and policy. To this end, ECCA expects that your decision will be based on a careful analysis of the extent to which your decision will affect existing water rights. The USFS should not permit the Village of Ruidoso to pump in the North Fork well field if that pumping has an adverse impact on the beneficial use of water of others with valid and existing water rights.	1.1 Key – Water Resources (water rights)	Thank you for this information. We include a detailed evaluation of water resources in chapter 3 of the EIS.
42	1	Water Rights	Approximately 75% of water delivered to Ruidoso customers, including some located outside the Village in the county, comes from the Eagle Creek drainage and Eagle Creek drainage credits. The Forest Service does not have jurisdiction over water rights. Jurisdiction over water rights in New Mexico is the purview of the Office of the State Engineer. Therefore, the Forest Service has no authority to regulate the Village's operation of the wells, other than through the special use permitting process. The Village of Ruidoso originally obtained water rights from the railroad in 1954 and currently owns or leases 99% of all groundwater and surface water rights in the Eagle Creek basin west of the Alto Dam and Reservoir.	1.1 Key – Water Resources (water rights)	The Forest Service acknowledges the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
42	2	Water Rights	In 1984, the Village drilled exploratory wells in the Eagle Creek watershed on Forest Service land (North Fork well field). The wells were located outside the then declared boundaries of the Hondo Underground Water Basin. The Village receives approximately 50% return flow credit from Eagle Creek drainage which is applied to the diversion of Rio Ruidoso water and Rio Ruidoso drainage wells. The Village has attempted to transfer water rights out of the North Fork area and has been protested by the same group that filed suit against the Forest Service in 2005, which resulted in this EIS process. The Village is currently spending approximately $1,200,000 to deepen an existing well in the Eagle Creek basin near the Alto Reservoir.	1.1 Key – Water Resources (water rights)	Thank you for this background information.
50	1	Water Rights	The Village of Ruidoso under New Mexico law (water) drilled the wells with Forest Service permission on Eagle Creek. Water rights were created under New Mexico water law and the state engineer extended the then limits of the water basin to include the Eagle Creek wells. The Eagle Creek never ran year round and many times would be dry for an entire year.	5.1 Suggestion, comment or procedural concern	Thank you for this information.
51	12	Water Rights	Under management objectives the Federal Register states “Providing water management flexibility and water conservation to the Village of Ruidoso in a way does not foreclose opportunities to transfer a portion of their water rights of these wells to location off of National Forest System lands.” Ultimately the state engineer has jurisdiction over water rights, the Forest Service does not. This should not be a management objective for the Forest Service.	1.1 Key – Water Resources (water rights)	The Forest Service cannot interfere with the applicant’s water rights and/or associated transferability off National Forest System lands. However, we can provide incentives, such as limiting access to the rights on Forest Service lands, through permit conditions and the annual operating plan to encourage movement of their water rights off National Forest System lands.
51	13	Water Rights	The Forest Service indicates that the Village of Ruidoso has 5,648 acre-feet per year (AFY) of water rights attached to the NEC wells. To our knowledge this amount of water has never been proven up on nor is that volume available as per USGS study. Thank you for the opportunity to comment.	1.1 Key – Water Resources (water rights)	Please refer to the “Water Rights” section of our “Purpose and Need” document where we discuss the adjudicated water rights owned by the applicant and the current consent order between the applicant and the Office of the State Engineer.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
52	6	Water Rights	The Village of Ruidoso water rights in the North Fork wells have been adjudicated in a consent order under Subfile R. 203, Chaves County Cause No. 20294 and 22600 Consolidated, filed with the District Clerk on May 4, 2010. The total water right was authorized at 2,539.34 acre-feet per annum for municipal use with 1,692.88 acre-feet per annum vested and 846.46 acre-feet per annum to be proven by the filing of Proof of Beneficial Use prior to Dec. 31, 2024. Since the filing of the Subfile Order, the Village has vested an additional 220.68 acre-feet per annum with the filing of Proof of Beneficial Use with the State Engineer on December 27, 2010. Presently there are 1,913.56 acre-feet per annum vested and the additional 625.78 acre-feet per annum to be proven for the adjudicated total of 2,539.34 acre-feet per annum authorized to be diverted from the North Fork wells.	1.1 Key – Water Resources (water rights)	Thank you for this comment. Please refer to the “Water Rights” section of our “Purpose and Need” document where we discuss the adjudicated water rights owned by the applicant and the current consent order between the applicant and the Office of the State Engineer.
52	7	Water Rights	The State Engineer has the sole authority to administer water rights in the State of New Mexico through the Statutes and through Rules and Regulations promulgated by the State Engineer. Water right applications have been filed with the State Engineer to move a portion of the water rights downstream and off of the U.S. Forest lands, and said applications to relocate water rights are fully supported by the USFS in the draft statement of purpose and need and proposed action. Additional time may be required to accomplish the proposed water right moves which may extend into the period of time after issuance of the special use permit.	1.1 Key – Water Resources (water rights)	We continue to discuss these actions with the applicant and the Office of the State Engineer and their applicability to the NEPA process.
14	15	Wells and Associated Facilities	The Eagle Creek gage, alone, does not provide an accurate measurement of surface flow exiting the North Fork. The ECCA recommends construction of a dedicated gage just for the lower reach of the North Fork. We request Forest Service oversight to insure that accurate measurements are continuously delivered electronically to a Forest Service office. We suggest the pump power cutoff switch be located in a tamperproof box at this flow gage.	3.1 Alternatives	We considered these suggestions as components of a new alternative in the “Alternatives” section of chapter 2.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
14	16	Wells and Associated Facilities	"If there are more than 20 days per year of no surface flow (less than 0.01 cfs) over a period of three consecutive water years at the Eagle Creek gage, or more than 30 no-flow days within any single water year ... the applicant must reduce groundwater withdrawal rates from these wells. If either of these thresholds is exceeded, then groundwater withdrawals from the North Fork wells would be limited to 50 percent of the volumetric rate of surface flow at the North Fork gage (which is upstream from the wells) until surface flow at the Eagle Creek gage resumes." The ECCA sees merit in the Forest Service intent. We have already commented on the fact that, most of the time, flow measured at the Eagle Creek gage is only from the South Fork. The USGS report did not show no-flow days in the North Fork, downstream from the wells. The use of 20 and 30 no-flow days is a reflection of USGS data that describes the South Fork, not the North Fork. The South Fork is not the focus of our litigation or of the EIS.	3.1 Alternatives	We considered these suggestions as components of a new alternative in the "Alternatives" section of chapter 2.
4	6	Wildlife	None of these accommodations should be made unless Ruidoso immediately takes actions in other ways to preserve water. What provisions are in this plan for wildlife and birds to get to water. If all of it goes to Ruidoso that means the rest of the environment suffers. We don't want that to happen to national land. This is nationally owned, nationally supported land and we are sick of so many locals towns out west thinking they have the right to welsh and live off national taxpayers.	3.1 Alternatives	We considered these suggestions as components of a new alternative in the "Alternatives" section of chapter 2.
18	11	Wildlife	The North Fork of Eagle Creek is a known habitat for the Mexican spotted owl. I am not well versed in the habit or range of this species but feel certain that if the riparian area that has had environment degradation caused by the excessive pumping of the North Fork well were to recover, more prey base for the owl would result.	4.1 Non-Key	We address potential impacts to Mexican spotted owls in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
48	1	Wildlife	This canyon is so dry that the elk are approaching my horses over hay in the paddock. Am attaching a photo of a young bull elk alongside my corral fence. I am heartily in favor of returning streamflow to Eagle Creek. A former neighbor from across the road told me that when they moved on Eagle Creek Canyon Road in the early 1970s, the creek ran continuously and was musical at night.	4.1 Non-Key	Thank you for this information.
58	1	Water Resources	To pull 75% of all the Village's needs from one creekbed is poor management of the Village's interests regardless of the legality. The wildlife and property owners are suffering from this over-depletion of water from a single source but when, not if, the Eagle Creek wells fail, the Village of Ruidoso will be a ghost town. Sound management obviously means not putting all of your eggs (WELLS) in one basket (water source). The Village sucks over 230 MILLION GALLONS of water from this single source. Prudent management dictates pulling water from numerous diversified sources. The proposed 300 acre-feet is still a large percentage of the Village's needs. It provides water and hopefully allows for replenishment. The Village should reconsider their position for the people of Ruidoso's sake if not for the future of everyone's future water needs.	1.1 Key – Water Resources	Thank you for this information. We include a detailed evaluation of water resources in chapter 3 of the EIS.
58	2	Water Resources	I have held property on or near Eagle Creek since the mid-80s. Furthermore, I held and operated the USFS Eagle Creek Cattle Permit/Allotment from the 80s thru the early 90s. This forest permit has the Eagle Creek running through its entire length, approximately 10 miles. During my tenure on Eagle Creek, I have seen dramatic changes for the worse in its flow. In the mid-80s the Creek ran almost year round. Today it only runs in times of extreme snowmelt or rain. Vegetation and climatic cycles have contributed to the lack of flow, but the Village's pumping of 700 acre-feet of water, equivalent to 228,095,700 gallons every year, is the obvious cause. If the cause was environmental and or climatic then other area streams and rivers would be dry.	1.1 Key – Water Resources	Thank you for this information. We include a detailed evaluation of water resources in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
58	3	Water Resources	Mr. Camp's observation of water flowing underground during the test draining of the Alto Lake serves as an example of what is going on in the Eagle Creek basin. Before the wells, water ran regularly over the area Mr. Camp describes. Furthermore, it ran freely over my property as well. Now, when the Creek flows it disappears into a recent sink hole on my property in Eagle Creek for the first few days. Then when the water table recovers, the stream continues on down through the national forest. Today whenever the stream runs, our well water turns brown because of the rapid replenishment of the water. This well is over 150 feet from the Eagle Creek bed. The disappearance and then reappearance of the creek water is so rapid and complete neighbors downstream have investigated to see if I had built a dam! My well, completed in approximately 1985, has had to be deepened and replaced since the Village wells came into operation stopping the Creek's flow and drawing the water table down.	1.1 Key – Water Resources	Thank you for this information regarding observations of flow along stretches of Eagle Creek. We include a detailed evaluation of possible changes over time along North Fork Eagle Creek since the wells began pumping. This is described in chapter 3 of the EIS.
58	4		Furthermore, before the Village started drawing 75% of all of their water from the Eagle Creek basin, the stream served the wildlife well. Today, however, the management of the sole water source for the animals in this area has turned its back on the critical protection afforded to Eagle Creek by The Wetlands Act which made it a crime to dry-up surface water in the United States.		Our purpose and need for taking action and the management objectives we developed for this project, as described in the "Purpose and Need" document (which is summarized in chapter 1 of the EIS), include achieving a balance between the need for municipal water supply and protecting forest resources.
58	5	Alternatives	The proposed 300 acre-feet of water for the Village, approximately 100 million gallons, is far better for the Village from a stewardship perspective as well as ensuring water is available to the Village for many years to come.	3.1 – Alternatives	Thank you for your support for the proposed action.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
59	1	Social and Economics	In 2007 the Forest Service required Eagle Creek Summer Home Association members to drill water wells to supply cabins with water. Six wells were drilled. Now, just 3 ½ years later, one of the wells has gone dry. It is the well that is approximately ¾ mile upstream from the closest Village of Ruidoso water well. This leaves one family with no water supply. Our concern is that if the Village continues to pump water from the Eagle Creek basin at the present rate, the rest of the wells will soon be dry also. Is the Village going to supply the cabins with water as the wells dry up or pay to have deeper wells drilled?	1.1 Key – Socioeconomics	Thank you for this information regarding wells in the summer home area. We discuss impacts to socioeconomics, including the potential effects to the summer home area, in chapter 3 of the EIS.
59	2	Water Resources	The association is not disputing the Village of Ruidoso's legal rights to water along North Fork Eagle Creek. We are concerned about the humanitarian rights of the association cabin owners and residents along Eagle Creek as well as the wildlife and trout that rely on the surface water to survive. The Village has pumped an average of 550 to 700 acre-feet of water per year for the last 5 years. So much water has been pumped from beneath the streambed it has caused a cone of depression that has sucked the water away from the surface. This cone of depression has already reached one of our wells and we believe it is only a matter of time before the rest of our wells run dry	1.1 Key – Water Resources	Chapter 3 of the EIS includes a detailed evaluation of impacts of well pumping on water resources (including a discussion of the cone of depression), wildlife and aquatic resources, and impacts on social and economic resources (including wells).
59	3	Alternatives	Is there a solution for the Village? Yes. Water can be drilled under Alto Lake to supply some water. The dam on Grindstone Lake can be repaired so the lake can be filled more than 50%. The Village can invest in a gray water recovery treatment plan that renders city wastewater potable. With these things in place the Village water use from Eagle Creek basin could be reduced to the annual recharge rate of 300 acre feet. It is clear to me and this association that there is a real water problem on Eagle Creek. It is also clear that there are viable solutions that will restore the creek for trout habitat, survival of wildlife, and usable water for families along the creek.	3.1 Alternatives	Thank you for your suggestions. The "Alternatives" section of chapter 2 includes consideration of a water treatment plant and increasing storage capacity.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
60	1	Water Rights	The Village has legally combined all of their groundwater and surface water rights in the Eagle Creek basin, totaling 2,523 acre-feet/annum. That is: 1,624.51 AFY in the North Fork Wells Rights, 761.12 AFY in the Surface Water Right, and 137.37 AFY in the Brown/Green Well Rights. These rights are combined into a common pool that can be withdrawn from any of the Village wells in the Eagle Creek basin. In addition to the 4 North Fork wells, at least 7 more Village wells are located downstream from the Lincoln National Forest. I have a small map depicting the description in the agreement that I will hand deliver. The Eagle Creek basin extends essentially from the gate to the summer cabins to the back gate of the Eagle II subdivision. The Village has agreed to irrevocably transfer all excess North Fork well rights to the Interstate Stream Commission. The Village has agreed not to attempt to change the place of diversion for any of its Eagle Creek rights to any location outside of the Eagle Creek basin. The Eagle Creek basin is defined to mean the Eagle Creek drainage basin lying east of the north/south quarter line of Section 36, Township 10 South, Range 13 East, NMPM. Furthermore, those the Village has agreed to forfeit its right to an additional 846.46 AFY subject to filing of Proof of Beneficial Use by December 31, 2014.	1.1 Key Issue – Water Resources (water rights)	Thank you for sharing this July 26, 2011, Memorandum of Agreement (MOA) reached between the applicant and the Rio Hondo Land and Cattle Company, L.P. regarding applicant water rights. We have added this to our project record and shared with forest staff and the project interdisciplinary team.
60	2	Water Rights	The Eagle Creek Conservation Association interprets the agreements as eliminating all justification for Management Objective (1) in the USFS Notice of Intent published Thursday, February 3, 2011, in the Federal Register, Vol. 76, No. 23. “Providing water management flexibility and water conservation incentives to the Village of Ruidoso, in a way that does not foreclose opportunities to transfer a portion of their water rights for these wells to locations off the National Forest System land.” All the transferring that is possible has already been accomplished. The Eagle Creek Conservation Association observes that Management Objective (2) is rightfully the only objective remaining. “Minimizing impacts of groundwater drawdown from this well field to maintain surface flows and protect water-dependent ecosystems.”	6.1 - Document-specific comment	Thank you for your comment. We do not agree, however, that the contents of the MOA are in conflict with management objective 1, as described in the NOI and also included in chapter 1 of the EIS. As clarified in comment 61-1 below, the village still has the flexibility to move its water rights off of NFS land provided that they stay within the Eagle Creek basin, as defined in the MOA. For this reason, we do not feel management objective 1 (providing flexibility and water conservation incentives) should be removed or changed.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
61	1	Water Rights	1. The Village is not required to combine its agreed rights in Eagle Creek. The Village rights will remain as agreed in the several separate listed files and their points of diversion are not combined or made joint and several in any fashion, there is no common pool from which they all will produce. The Village rights remain unchanged except as specifically changed by the agreement; 2. The Village still has the option of moving its water rights out of the USFS and into other areas of the Eagle Creek basin as defined by the memorandum of agreement. 3. There will be a new order entered by the adjudicating court that will amend the consent order in accord with the agreement. I did not want the parties to act under any misapprehension of the facts. The agreement speaks for itself and should not be interpreted too broadly.	1.1 Key – Water Resources (water rights)	Thank you for sharing your interpretations and clarifications of the July 26, 2011, MOA reached between the applicant and the Rio Hondo Land and Cattle Company, L.P. regarding applicant water rights.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
62, 63, 64, 65, 66, 68, 69, 70, 71, 73, 74, 76, 77, 78, 79, 80, 81, 82, 83, 84, 86, 87, 89, 90, 91, 93, 94, 96, 97, 98	1	Alternative 1 No Action (continue pumping - pro with rationale)	Please continue to allow the Village of Ruidoso to continue to pump water from their wells. This is part of the mission of the Forest Service to provide for the needs of present and future generations. Sufficient water is vital to the residents who live here and to our property values. The Village has gone to great expense to monitor the impact on the environment and has presented evidence of little adverse impact.	3.1 Alternatives	Thank you for your comment. The purpose and need for taking action and the management objectives developed for this project, as described in chapter 1 of the EIS, includes achieving a balance between the need for municipal water supply and protecting forest resources. The range of alternatives under consideration includes ones that allows pumping to continue.
67	1	Water	We are very concerned with the Village of Ruidoso using water from this area. We have seen areas around us that always had water go dry over the last few years and we do not want to see this get worse. We do not want to see the Village of Ruidoso affect the water availability of those of us who live in this area.	1.1 Significant Issue – Water Resources	Thank you for this information. We include a detailed evaluation of water resources and socioeconomics in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
72	1	Water	The Village of Ruidoso's permit should be renewed. Even if Eagle Creek flowed in the past there is currently sufficient pumping from private wells to stop that flow, even should the Village be taken out of the equation. Take Gavilan Creek. It flows up until about 20 years ago. No Village pumping caused this to occur; only private pumping for domestic wells. The same is likely the fact with Eagle Creek. The very folk who want fish in the creek are the ones who take water from the aquifer and keep it from flowing again (if it ever did).	1.1 Significant Issue – Water Resources	Thank you for this information. We include a detailed evaluation of water resources and socioeconomics in chapter 3 of the EIS and we include an evaluation of continuing current pumping at current levels.
75	1	Fish	To claim that North Fork Eagle Creek is a high quality fishery is absurd. To deprive thousands of citizens of water because of this contention is absurd.	1.1 Significant Issue – Aquatic Habitat and Fish	We include a detailed evaluation of aquatic habitat and fish in chapter 3.
85	1	Alternatives	Suggestion: turn water wells off every day for several hours. Other countries do it. Stop building new structures of every kind which use water. Continue to force restaurants to install systems which catch grease. Everyone has been paying $35 extra on water for this new installation so I say people who do not cooperate could have their life giving water turned off.	3.1 – Suggested Alternative	This is outside the scope of this analysis.
88	1	Alternatives	I request that you put some pumping limitations on the wells if that is possible. I have property along Cedar Creek. When I bought the property everyone said it flowed to one extent or another basically year round. A few years later, the creek dried up completely and I found out that the creek drying up and Ruidoso's drilling in the North Fork coincided. I remember a few years ago there was some controversy over the permit and Ruidoso had to stop pumping. Within a few weeks, the creek started flowing again. When the permit problem was cleared up and they started pumping again, the creek dried up again.	3.1 - Alternatives	Thank you for this information. The proposed action includes adaptive management triggers that would limit pumping when necessary to maintain adequate flows.
92	1	Water	We have property that backs up to the Ruidoso River so we know of the ups and downs of the waterflow. We are also aware that Eagle Creek flows are pretty rare. We do not know of the needs of wildlife from Eagle Creek but we doubt that the creek provides much. We love and appreciate wildlife and fish. We believe extreme care should be taken before wells are affected for Ruidoso.	Alternatives	We discuss effects to wildlife and fish in chapter 3.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
95	1	Municipal Water Supply	I am nearing my 81st birthday and have lived on Upper Eagle Creek for almost 15 years and enjoyed its cool waters for many, many years before that. The fact is, I have a movie of my brother and me playing in the North Fork in 1934. The creek was running. I have ridden horseback and walked beside it immeasurable times and had always wanted to retire and spend the rest of my life beneath the canopy of its beautiful cottonwoods and pines. I would like to to clear up some misconceptions: The village alludes that 70% of its water comes from Eagle Creek and that shutting off the North Fork wells would spell disaster for the Village. Nothing could be further from the truth. The Village has three wells; the Brown, the Green, and the 2 Domenici south and east of the North Fork wells about a mile and on Village land. In addition, they have other wells located near Alto Lake. They also have surface rights to many cubic feet of Eagle Creek water that is transported from its diversion dams, by this large pipeline, photo attached, to their plant located above Alto Lakes. The lake also retains what water passes these wells and flows over the diversion dams. The question then can be asked - Why do they need the North Fork wells in the first place, and spend all that money pumping and maintenance of the wells when several hundred feet below they can harvest almost just as much for much less expense? I have documents that backs up these questions but this is neither the time or place to dwell into that.	1.1 Significant Issue – Water Rights	Thank you for this information. We describe the contributions the North Fork Eagle Creek wells make to the municipal water supply in chapter 3 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
95	2	Water	Is or is not Eagle Creek an intermittent stream? I believe the question irrelevant. Of course on occasion it goes dry and one can cherry pick their way through history and find many instances where it did go dry. But so can one find that on any stream in New Mexico. See enclosed photo of the Rio Ruidoso. I have seen it dry up and would go with my Grandfather to either the spring on Cedar Creek or the spring on Little Creek, just below the Mt. Jeau Lookout, to fill containers with water when his cistern dried up. Even this year had the rains waited another week the Ruidoso would have been a dry stream. The Little Creek spring no longer flowed after the North Fork well's cone of depression expanded to its watershed. I have also seen, many times, the Pecos River completely dry on its surface where Hwy. 70 crosses it between Portales and Roswell. Would one dare call the Pecos an intermittent river?	1.1 Significant Issue – Water Resources	We describe the intermittent nature of North Fork Eagle Creek in the "Water Resources" section of chapter 3.
95	3	Water	A few weeks ago I drove up to your Oak Grove Campground and noticed that you were hauling water there to your summer caretaker. In my book titled, "The Killing of Eagle Creek An Environmental Tragedy" I quote Bob Scribner who probably knew more about Eagle Creek than any other person. The exception of course would be the Hightower clan, many who were born, raised and still live on upper Eagle Creek and fished it until the North Fork Wells were put on line. Bob told me that he would help his neighbors, who had the summer forest allotment for that area, drive their cows up to Oak Grove which had a spring for the cattle to water and turn them loose. The spring, which was on the Carlton Canyon watershed went dry when the well on the North Fork and the mouth of Carlton Canyon was put on line. I visited this week with Richard Rowley 11. A very prominent attorney in Clovis, New Mexico. His family has owned one of the summer cabins on the North Fork for many, many years. He told me that up until the North Fork wells were put on line that he had not seen the creek in front of their cabin dry over a half a dozen times, and even then they would just remove a few rocks and get water. Not so after the wells were pumping. They used to cross the creek five times to reach their cabin.	1.1 Significant Issue – Water Resources	Thank you for this information.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
95	4	Fish	Was Eagle Creek a fishable stream? Please refer to my above mentioned book or talk to the Rowleys or any of the Hightower clan. Marti Davenport told me that in April of this year he walked up the North Eagle Creek Trail above the summer cabins and found pools that were still inhabited with trout.	1.1 Significant Issue – Aquatic Habitat and Fish	We discuss aquatic habitat and fish in chapter 3 of the EIS.
95	5	Maintenance and Operations	An observation; the Village has a propensity to defer maintenance. As you can see in the photo, Eagle Creek is gradually undercutting the large water line between the diversion dams and Alto Lake. I wonder if the heavy concrete line full of water was designed to be a free standing span. Guess we will see after a couple more mini-floods that mountain streams are noted for.	4.6 Non-Significant Issue – Outside the Scope	This is outside the scope of this analysis but we will pass this comment along to the VoR.
99	1	NEPA Process	The ECCA observes that the key elements (that contain glaring flaws) of the proposed outcome remain unchanged from the original proposed action in the NOI of January 27, 2011, and the scoping document of January 28, 2011. It appears now that the review process that followed the NOI was merely a show to satisfy the required process and put the stamp of science and public inclusion on the pre-determined outcome.	5.1 Procedural Concern	We received approximately 100 comment letters throughout the scoping process and have thoroughly reviewed and used these comments in preparation of chapters 1 and 2. This thorough process of review is documented in the September 2011 Scoping Outcome Summary (which has been shared with you and is posted online) and then summarized in chapter 1 of the draft EIS. An updated version of the table of comments and our responses (showing all comments received, including those received after the Scoping Outcome Summary was distributed) will be included as an appendix to the EIS. We have also carefully reviewed each parameter of the proposed action since the NOI was issued and following the hydrology data reanalysis phase, to ensure that it is based on the best available science and meets the purpose and need for action.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
99	2	NEPA Process	The USFS and USGS have repeatedly promised to plot the existing depth to water data and pumping diversion data along with other available data such as EC gage data and precipitation data on a common timeline and that this would be used to interpret the effect of pumping on surface flow.	5.1 Procedural Concern	Our AECOM hydrologists conducted the analysis for this project and documented their work in the final draft water resources report (AECOM 2011), which is being used for preparation of chapter 3 of the EIS. The data identified in the April 2011 hydrology meeting were carefully analyzed during preparation of the technical report. Plots of depths to water in the pumping and monitoring wells, stream discharges at the three gages, pumping quantities, and precipitation were completed and reviewed. The AECOM staff feels this was a valuable suggestion and exercise, but it is only one approach to addressing pumping impacts. Unfortunately, graphing all these data makes for a very busy plot, or even sets of plots. Simplified versions of similar data are shown in figures 6, 26-A, and 26-B of the final draft water resources technical report. A critical issue for the EIS has been to determine the effects of pumping on surface flow. The recommended plots are only one approach to addressing this important concern. Several alternative approaches were also undertaken and described for the water resources technical report. All results are consistent, in that pumping has adversely affected flows in the North Fork.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
99	3	NEPA Process	The failure of the USFS to generate, study, and incorporate these data into the EIS is an affront to the credibility of the EIS process. Unfortunately, as we have pointed out, the preferred alternative was already selected before the NOI was ever issued.	5.1 Procedural Concern	We have not failed to generate, study, or incorporate these data; they simply do not logically belong in chapters 1 and 2 of the EIS. As discussed above, all available data were used and carefully analyzed as documented in the final draft water resources report AECOM (2011) (which was recently provided to you upon completion) and will be used in preparation of chapter 3 of the EIS. The proposed action was developed prior to issuing the NOI, as is required. This alternative has not been identified as the Agency preferred alternative at this point, only our proposed action, which will be analyzed in detail, along with the other two alternatives in chapter 3 of the EIS. We have revisited the proposed action parameters and made adjustments and refinements as needed based on internal scoping, public scoping, and the results of the hydrology data reanalysis, as described in the response above.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
99	4	Water	Despite ECCA protests that the statement "It is important to note that the Eagle Creek gage measures flow from both North Fork and South Fork" is misleading and our clarification that "flow in the NFEC" downstream from the wells can only be validated visually or by calculation using flow measured at all three gages simultaneously, the USFS has failed to rectify their erroneous attempt to measure NFEC flow using only EC gage data.	1.1 Significant Issue – Water Resources	The statement is not misleading—the gage configurations are accurately and impartially reported. There is no hidden intent or meaning behind the statement. The overriding objective of the reanalysis of the USGS program, as discussed in the hydrology group meeting in April 2011, was to identify and clearly state the effects of pumping on the North Fork. The Eagle Creek gage provides the only available baseline (i.e., prepumping) information that can serve as a benchmark. We have identified the EC gage as critical to determining trends in pumping effects because it is the only gage that has been in place since before pumping began. We recognize the value of data from the NF gage and the SF gage but they have only been in place for a few years, and only since pumping began. All available data were used to determine flow in the North Fork Eagle Creek and the effects of pumping, as described in great detail in the final draft water resources report (AECOM 2011). We recognize that information from the Eagle Creek gage is not well suited to managing pumping operations (should they be approved). It should be noted that if an alternative that allows pumping is ultimately selected by the forest supervisor, some sort of flow monitoring immediately downstream of the well field may need to be specified This and other measures are recommended in draft form in the water resources technical report, and will be further discussed and refined as the EIS progresses.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
99	5	Water	Most of the time, the only flow reaching the EC gage comes from the South Fork. We expect the USFS to verify this observation through calculations using simultaneous flow data from the NFEC gage, the SFEC gage and the EC gage. That is, we expect the only data used to interpret flow in the North Fork, downstream from the wells shall be those data that reflect the portion of flow contributed from the NFEC to the EC gage.	1.1 Significant Issue – Water Resources	We would generally like to agree with the first statement here, which we feel should particularly be true during periods when low runoff, low recharge, and substantial pumping occur simultaneously. However, John Shomaker and Associates present conflicting information immediately after pumping in 2003. In order to compare nonpumping conditions to pumping conditions, a long period of overlapping record is needed. Secondly, the relationships between precipitation, streamflow, and groundwater levels are not simple, are serially correlated, and vary with time. Pumping rates vary. The creek responds quickly to snowmelt and rainfall, but there is a lag for groundwater responses and streamflow gains or losses. We don't have a gage immediately downstream of the well field. These factors complicate the manipulation and interpretation of EC gage readings. For these reasons, the stated conclusions about pumping effects in the final draft water resources report (AECOM 2011) are left fairly qualitative. Impact assessments in the water resources report are based on comparisons between long periods of time, when all the hydrologic variables are somewhat smoothed out and broad generalizations can be made. All of these conclusions are conditioned on available data and interpretations. We make comparisons between the three gages on page 47 and in figures 23, 24, and 25 of the final draft water resources technical report. Other analyses and confirmations of flow losses in the North Fork due to pumping are also presented in the report. If a pumping alternative is selected, additional monitoring and mitigation measures may be developed to help measure, report, and interpret flow conditions in the North Fork, beyond just using the EC gage.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
99	6	Cumulative Effects	The ECCA respectfully requests that the USFS continue to honor its consideration for the damage suffered by downstream property owners due to the effects of an unsaturated watershed, even though our property is out of the study area.	1.1 Significant Issue – Water Resources	Private property downstream of Alto Lake is within the water resources cumulative impact analysis area; please see the cumulative impact analysis in the final draft water resources report (AECOM 2011) for these findings. Cumulative effects to riparian vegetation will be discussed in the "Riparian Vegetation" section and socioeconomic effects in the "Socioeconomics" section.
99	7	Water	The USGS report states, "Based on the discharge record at the EC gage, given alluvium and channel configurations similar to those described in this study, streamflow in some part of the stream channel between NF and EC gages was likely discontinuous during part of the year during both time periods." The ECCA can accept this description and encourages the USFS to acknowledge it along with the ECCA definition of intermittent.	5.1 Suggestion/ Comment	The final draft water resources report (AECOM 2011) discusses the overall conclusions regarding North Fork Eagle Creek streamflow prior to pumping based on the best available data, with definitions for intermittent and perennial. We will consider this comment and the conclusions of the water resources analysis to determine if any revisions are needed to the way in which we describe streamflow in the "Desired Condition" statement in chapter 1 of the EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
99	8	Alternatives	This desired condition cannot be sustained by the proposed alternative that prescribes some average depth-to-water as an operating condition. It is not possible to maintain adequate surface flow when the bedrock becomes unsaturated as a result of pumping. In addition, when a measurable cone of depression is created by pumping, all flow measured at the EC gage comes from the SF. There is no scientific basis for using an average water table depth threshold. This would be averaging flood conditions with dry or base-flow conditions when the pumps are on.	3.1 Alternatives	We appreciate this input. If a pumping alternative is selected, additional monitoring and mitigation measures may be developed to help measure, report, and interpret results. Examples of recommended measures are contained in the final draft of the water resources technical report. The threshold for water table depth will be discussed in light of these recommendations and could change as the EIS develops. The overall intent of the proposed action is summarized in the sentences below, which describe the involvement and flexibility of the management approach under the proposed action: The adaptive management strategy would take into consideration the dynamic nature of groundwater systems by establishing a feedback process to guide the management of groundwater withdrawal rates over time. Thresholds would be established for streamflows, water table depths, and riparian vegetation, as described below. The proposed action would require the applicant and Forest Service to work in partnership, with assistance from the USGS, to conduct monitoring and adaptive management of groundwater and surface water resources.
99	9	NEPA Process	The ECCA hopes the USFS can see how not significant the streamflow quantity indicator is (1.2 cfs measured at the EC gage). Since only the South Fork would have been measured, what would the USFS do with the information gathered?	5.1 Suggestion/ Comment	The measurement indicator was developed strictly as a tool to identify potential impacts to flows, using data that go back sufficiently in time to assess a no pumping alternative, and then compare it to other alternatives. See the response above.
99	10	Riparian Vegetation	We suggest you add “and streamside trees and vegetation” to the socioeconomic issue statement for private land.	6.1 Document-specific corrections	Streamside trees and vegetation is riparian vegetation and riparian vegetation is really outside the scope of the socioeconomics analysis. However, riparian vegetation is evaluated in chapter 3 and makes some qualitative predictions about riparian vegetation in the larger cumulative impact analysis area

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
99	11	Socio-economics	We suggest you add language (underlined below) to the socioeconomic indicators as follows: Availability of domestic well water (private land water supply): Predicted qualitative assessment of the effects of the alternatives on domestic wells based on proximity to NFEC wells, watershed saturation, location within the cone of depression, and well depth (shallow wells versus deeper wells). Streamside recreational use: qualitatively predict the effects of the alternatives on streamside recreational use, including fishing.	6.1 Document-specific corrections	"Watershed saturation" is not a good tool for impact assessment, nor would it be for management of any of the alternatives. A saturated watershed is one where the moisture state of the soil/substrate column has reached saturation (i.e., water occupies 100 percent of the pore space) throughout the entire watershed. This probably does occur in the North Fork watershed, but is not a common condition with or without pumping. Fishing is more adequately addressed in the aquatic habitat and fish evalation in chapter 3; streamside recreational use as a component of socioeconomics is addressed in chapter 3 but the aquatic habitat and fish analysis provides more details regarding fishing potential under each alternative.
99	12		Permitting a cone of depression to be created and maintained is in conflict with the goal of improving or maintaining the watershed, which your forest plan directs you to do.		The purpose and need for taking action and the management objectives developed for this project include achieving a balance between the need for the municipal water supply and protecting forest resources. Water supply as available through the state system of water rights administration is also part of Forest Service responsibilities. These issues are all being considered in the alternatives assessments, and in the decisionmaking, monitoring and mitigation measures, and special use authorizations that follow them.
99	13	Implementation	We see an unfunded mandate in the description of the proposed action and its monitoring and reporting requirements, no plan as to whom in the USFS will have responsibility for oversight of the data, and no format for presentation of the data. Without having developed a template for presentation of these data in a form that is immediately useful, and that can be added to continuously, or at least with a monthly report, the USFS will never use these data, for adaptive management, not even once.	5.1 Procedural Concern	We share this concern. Additional monitoring and mitigation recommendations are being developed along these very lines, as part of the EIS process, with the intent of developing a detailed implementation plan based on the alternative ultimately selected for implementation at the conclusion of the NEPA process. A draft set of recommended measures is included in the final draft water resources technical report that will be our starting point for this implementation plan.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
99	14	Alternatives	Any violation of permitted operating condition must be detectable immediately and the pumps shut off immediately, preferably with an automatic trigger. Without such a plan in place and funded, with penalties in place for failure of oversight, then no permit that allows continuation of a cone of depression is defensible.	3.1 Alternatives	We agree that violation of permitted operating conditions must be detected immediately. Part of the purpose of the adaptive management program under the proposed action is to monitor and prevent such occurrences. If a special use authorization is renewed, its operating plan and/or implementation plan would specify the factors outlined in this comment, under Forest Service Manual directives as identified in chapter 2.
99	15	Alternatives	We suggest you add language (underlined below) to the adaptive management triggers in the proposed action, as follows: If either of these adaptive management triggers (thresholds) is exceeded, then groundwater withdrawals from the North Fork wells would be limited to 50 percent of the volumetric rate of surface flow at the North Fork gage (which is upstream from the wells) until surface flow at the Eagle Creek gage in the NFEC resumes.	3.1 Alternatives	The adaptive management triggers are based on continued use of the Eagle Creek gage, for the reasons described in the description of the proposed action.
99, 101	16	Alternatives	The ECCA proposes a simplified plan that eliminates the cone of depression, satisfies the mandate of the USFS to maintain adequate surface and groundwater flow, permits the VoR to pump 300 acre feet per year, maintains or improves surface flow conditions, and contributes to maintaining a saturated watershed. The VoR is permitted to pump up to 50 percent of the volumetric rate of surface flow greater than 1.2 cfs, up to 300 acre feet per year, measured at the North Fork gage (which is upstream from the wells). This solution allows the VoR to divert water when nature provides it. Flowing surface water in the NFEC, as measured by its contribution to the flow measured at the EC gage, will be restored, most of the time. The burden of oversight will be dramatically reduced to a level that appropriate performance by the USFS to protect forest resources is probable.	3.1 Alternatives	Thank you for your suggestion. We carefully considered this recommended alternative as described in the “Alternatives” section of chapter 2 to determine if it would meet the criteria needed for an alternative to be analyzed in detail in an EIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
100	1	Process	The Village of Ruidoso demands that all references to the 2009 supplement to the 2006 stipulation agreement along with its requirement that an analysis of all reasonable alternatives (and no less than one alternative) that leave downstream flows in the same state that they would be absent the pumping of the North Fork wells, be removed from the EIS. The Village takes the position that this two-party 2009 supplement is legally insufficient to modify the three-party 2009 stipulation agreement. The Village also takes the position that the parties' actions in entering into the stipulation without informing the Village, as well as their concealment of the supplement from the Village were both fraudulent and illegal.	6.1 Document-specific corrections	According to our Office of General Counsel, the applicant was not legally required to be a party to the 2009 supplement; efforts were made at that time to keep the applicant informed of these updates.
101	2	Alternatives	Areas not yet considered: 1. At what depth can the pumps be safely permitted? When surface flow exceeds 1.2 cfs, the pumps only need to be deep enough for the water to cool the pumps. We suggest pump depth, consistent with the need to protect surface flows, be one of the stipulations of the special use permit. 2. A saturated stream corridor should result in double to triple the surface flow measured at the Eagle Creek gage. 3. We suggest a pumping moratorium be required until the "temporary decline in water table" has been restored to artesian or near artesian conditions and the pumps have been raised to near surface levels such that they will not create an expanding or destructive cone of depression. When the wells were drilled, the belief was widely accepted that they would not affect surface flows. That was not the case. A dry streambed was the unintended consequence. While (our suggested) alternative 4 is not a perfect solution, it meets the needs of all parties involved.	3.1 Alternatives	Please take note of the monitoring section in chapter 2 of the DEIS as well as the triggers identified in the adaptive management strategy of the proposed action.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	1	Riparian	Abstract - Second Sentence, Item 2 This item indicates that the proposal addresses the need for "2) protecting natural resources on the national forest by maintaining adequate surface and groundwater flows to sustain or improve the riparian and aquatic ecosystems that may be affected by groundwater drawdown from the pumping of these wells." Unfortunately, the USDA Forest Service has not documented or otherwise categorized historic changes in the forest in the subject area, nor has the Forest Service documented any adverse affects on riparian vegetation or aquatic ecosystems. It is unreasonable for the applicant (Village of Ruidoso) to be required to improve the riparian habitat, particularly due to the fact that there are no data pertaining to the management of the forest in order to maintain the forest and watershed health, or any documented data of any adverse impacts to the forest health or aquatic ecosystems.	1.1 Significant Issue - Riparian	This need statement includes the phrase "sustain or improve the riparian and aquatic ecosystems…" This means that we are striving for riparian and aquatic ecosystems in the NFEC project area to either stay in their current condition (no reduction in these resources over time due to pumping) or to improve. Chapter 3 of the DEIS provides a detailed analysis of effects of each alternative on aquatic habitat and fish and riparian vegetation.
102	2	Stream Augmenta-tion	Third Sentence This sentence makes reference to the mitigation of potential adverse impacts. In fact, the draft EIS considers only one mitigation strategy that either reduces or eliminates the applicant's pumping. Other strategies such as augmenting streamflow from groundwater produced during pumping were offered by the applicant but were not considered.	3.1 Alternatives	The adaptive management strategy of the proposed action is described in chapter 2 of the DEIS and is the proposed mitigation strategy, in combination with the mitigation and monitoring measures identified separately in their respective sections of chapter 2. It is based on the implementation of several management triggers that would be used together to determine if restrictions on pumping should be enacted; only if certain conditions are met over time, based on careful monitoring, would the applicant be required to reduce or eliminate pumping for short periods. We carefully considered the applicant's suggestion to augment streamflow, as an option for mitigation; this is described in the "Alternatives Considered but Eliminated from Detailed Study" section of chapter 2 of the DEIS. We are not aware of any other mitigation strategies suggested by the applicant other than stream augmentation.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	3	Special Use Permit	Summary - First Paragraph, Fourth Sentence This sentence indicates that the new authorization would be similar to the expired permit, with a number of other caveats that in fact make the new permit significantly different from the expired permit. Most importantly, the proposed draft EIS would significantly reduce the applicant's access to water using its water rights as administered by the State of New Mexico.	3.1 Alternatives	This statement regarding similarity to the expired permit has been revised in the DEIS.
102	4	Process	Fourth Paragraph, First Sentence This sentence, in part, states that the environmental effects of authorizing the special use permit will be studied. With the exception of assessing the interaction of the surface water that can result from pumping the applicant's wells, no other environmental effects were studied. The fact that no other environmental effects were studied may be the rationale for the recurring use throughout the draft EIS of the concept "sustain or improve the riparian and aquatic ecosystems that may be affected by groundwater drawdown from the pumping of these wells." The concept of "sustain or improve" is again presented in the last sentence of the paragraph.	5.1 Procedural Concern	Chapter 3 of the DEIS provides a detailed analysis of all of the environmental factors that we studied, including water resources, aquatic habitat and fish, riparian vegetation, socioeconomics, water rights, upland vegetation, wildlife, recreation, and scenery.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	5	Water	Fifth Paragraph, Sixth Sentence This sentence refers to a number of "significant issues" including pumping effects on water resources, aquatic habitat and fish, riparian vegetation, water rights, and socioeconomics. As noted by the U.S. Geological Survey (USGS) (Scientific Investigations Report 2010-5205, Revised November 2010) and as indicated on the 1963 USGS topographic map, the North Fork of Eagle Creek below the North Fork gage that is located above the North Fork Well Field is intermittent. The New Mexico Environment Department (NMED) Surface Water Quality Bureau, Water Quality Standards for Interstate and Intrastate Surface Water, as provided under Title 20, Chapter 6, Part 4.97 A. lists the designated uses for intermittent water as "livestock watering, wildlife habitat, marginal warmwater aquatic life and primary contact." No provision or mention of "fish" is provided for in the designated uses for intermittent surface waters. Therefore, any mention of fish in the draft EIS should be removed. Based on the fact that there are no documented impacts to riparian habitat, it appears that a primary goal of the Forest Service through the EIS process is to develop instream flows in North Fork Eagle Creek without having water rights.	1.1 Significant issue - Water	The DEIS acknowledges that NFEC was an intermittent stream prior to pumping; we document and discuss this in several areas of the DEIS including pages 4, 6, 50 and in multiple places in chapter 3, particularly in the surface water section of the "Water Resources" section. We provide more details on past and current fish populations in NFEC and Eagle Creek, including stocking histories and angler survey results, in the "Aquatic Habitat and Fish" section of chapter 3. The "Agency Direction" section of chapter 1 of the DEIS provides details on the agency direction we used as a framework for the EIS (Lincoln Forest Plan and Forest Service manual and handbook direction); while the NMED water quality standards are important and relevant information to us in managing water resources on Forest Service land, they are not the only information used; we have our own direction for managing stream systems, as documented in chapter 1 of the DEIS.
102	6	Process	Chapter 1. Purpose and Need for Action: Document Structure Page 1, First Paragraph, Second Sentence The facts are contrary to the statements alleged in this sentence. References cited by the Forest Service in the draft EIS do not support the Forest Service claim that direct, indirect, and cumulative impacts from the proposed action have been studied. The Forest Service has invested little effort, or resources, in assessing impacts to vegetation and wildlife, and instead has focused on impacts from pumping on surface-waterflow.	5.1 Procedural Concern	We have conducted an extensive study of the direct, indirect and cumulative effects of each alternative on forest resources. This is described in chapter 3 of the EIS and summarized in DEIS Table 2 and Table 3.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	7	Water Rights	Chapter 1. Purpose and Need for Action: Background Page 4, First Paragraph The quantity of water provided by the applicant's North Fork Eagle Creek well field (North Fork well field) provides an incorrect assessment of the quantity of water provided to the applicant (Village) from the North Fork well field. The Forest Service does not recognize the fact that the Village receives a 50 percent return flow credit for all water produced from the North Fork well field. This is because the Village has a right to consume 100 percent of the water diverted from the well field. The return flow credit is the result of at least 50 percent of the water diverted from the North Fork well field being returned to the Rio Ruidoso via the Village's wastewater treatment plant. The return flow credit allows the Village to divert 50 percent of the total quantity of water produced from the North Fork well field from other wells outside of the Eagle Creek watershed or surface water from the Rio Ruidoso. Therefore, using the quantity of water diverted from the North Fork well field as provided in the subject paragraph, the Village actually obtained approximately 46.5 percent to more than 75 percent of its water supply from North Fork well field diversions.	1.1 Significant Issue – Water Rights	These estimates came directly from the applicant in their 2006 special use permit application. However, we've added a clarifying sentence to this section of the DEIS as follows: Based on recent information from the VoR, 46 percent to 75 percent of its water supply can be attributed to NFEC well diversions (VoR 2012).

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102	8	Water	Page 4, Fourth and Fifth Bullet Point The subject bullet point makes references to changes in Eagle Creek streamflow at the Eagle Creek gage after the North Fork wells began pumping and the change in runoff patterns. The Eagle Creek gage is located below the confluence of the North and South Forks of Eagle Creek. The evaluation of effects on streamflow at the Eagle Creek gage did not include an evaluation of impacts from surface water and groundwater diversions in the South Fork of Eagle Creek. Diversions that can affect streamflow in the South Fork of Eagle Creek include surface diversions to fishing ponds, and pumping from large capacity wells for snow making at Ski Apache. New wells were drilled in the 2000s for snow making at Ski Apache. These surface water and groundwater diversions may affect streamflow at the Eagle Creek gage but were not evaluated by the Forest Service as part of the draft EIS. Also see comments provided below related to proposed alternative 3 related to changes in streamflow.	1.1 Significant Issue - Water	Thank you for pointing out potential sources of diversion along upper South Fork Eagle Creek. All of the snow making wells for Ski Apache are in the Rio Ruidoso watershed. Based on information available from the Office of the State Engineer (personal communication 2/3/12), there are six wells in the area and four of these (drilled between 1963 and 1965) provide water to Ski Apache; three of these are located on Forest Service land and one is on the Mescalero Apache Reservation. All of these wells are located in the Rio Ruidoso watershed; two of these wells are no longer in operation. According to the OSE, most of the water used for snow making comes from a pond located on the Apache Reservation and this pond is also located in the Rio Ruidoso watershed and not in the Eagle Creek drainage. The headwaters of the Rio Ruidoso are at Ski Apache. While it is possible that there may be interbasin transfer (based on the nature of the fractured volcanic aquifer), the fact that these wells are outside the Eagle Creek watershed reduces the likelihood that this water diversion has affected streamflow at the Eagle Creek gage. The fishing ponds on the South Fork within the Mesaclero Apache Reservation are quite small, and while diversions to them are unknown, we feel the ponds are not likely to have a substantive effect on flows at the Eagle Creek gage, particularly over the timeframes used for the EIS analysis. For all of these reasons, we do not believe that water uses along the upper South Fork have effects at the Eagle Creek gage that would substantially alter our general conclusions.

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					Even with all the data collections and studies conducted by various parties over the past few years, we have acknowledged and disclosed that there are unknowns and sources of error involved in detailed quantification of the behavior of this hydrologic system. Continued monitoring of the data from the South Fork and Eagle Creek gages over time should provide better information regarding these relationships.
102	9	Vegetation	Page 5, Second Paragraph after the Bullet Points The statement in the first sentence that indicates water-dependent resources outside of the stream corridor can be affected by pumping of the subject wells is not based on any data or facts. The “water-dependent resources outside of the stream corridor” are not identified in the draft EIS. The depth to groundwater in the North Fork Eagle Creek watershed is relatively great in all areas outside of the stream corridor and even in the absence of pumping from the North Fork well field would most likely not be available to the “water-dependent resources” that exist in the North Fork watershed.	1.1 Significant Issue - Water	We recognize that the potential for effects from groundwater pumping are greatest within the stream corridor. However, this statement in the DEIS implies that there is potential for effect further from the stream corridor, depending on the cone of depression. The potential for effects outside the stream corridor are discussed in chapter 3 of the DEIS.
102	10	Water Rights	Chapter 1. Purpose and Need for Action: Water Rights Absent from the background information provided related to water rights is the fact that 612.69 acre-feet (ac-ft) of water rights associated with the North Fork well field pre-date the creation of the Lincoln National Forest.	1.1 Significant Issue – Water Rights	Even though a portion of the VoR’s water rights pre-date the creation of the Lincoln National Forest, access to those rights is still subject to reasonable regulation under 36 CFR Parts 251 and 261.
102	11	Process	Chapter 1. Purpose and Need for Action: Purpose and Need for Action - Page 6, Paragraph 1, First Sentence Neither the 2006 stipulated agreement, nor the 2009 supplement, included the provision of an analysis that would leave downstream flows in the same state that they would be in the absence of pumping from the North Fork well field as indicated in the subject sentence. The Village was not a party to the 2009 supplement.	4.1 Nonsignificant Issue	According to our Office of General Counsel, the applicant was not legally required to be a party to the 2009 supplement; efforts were made at that time to keep the applicant informed of these updates.

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102	11	Process	Chapter 1. Purpose and Need for Action: Purpose and Need for Action; Desired Condition - Page 6 A desired condition is not provided in the subject section. Rather, a summary of streamflow of very limited portions of available streamflow, and a general comparison of the North Fork Eagle Creek watershed to other undefined watersheds is provided. Desired conditions should include those related to the applicant.	6.1 Document-specific comment/ correction	This section of the DEIS describes the information we used to develop the desired condition description. It also includes in the first paragraph: "The applicant's North Fork wells, authorized under a special use permit, are managed as a substantial component (attributable, at times, to providing up to 75 percent of the municipal water supply) of the Ruidoso municipal water supply."
102	12	Water	Page 6, Third Paragraph of Subject Section, Fourth Sentence No evidence is provided in the draft EIS or the related references that the groundwater along North Fork of Eagle Creek provides water to springs and seeps. No springs or seeps are shown along or near the intermittent channel of North Fork of Eagle Creek on the USGS 1963 map or subsequent USGS 7 5-minute topographic map. Springs alleged to be present above the North Fork well field have not been catalogued with respect to seasonal flow rates and water quality, nor have they been documented to have been impacted by pumping.	1.1 Significant Issue - Water	Springs and seeps are discussed in more detail in the "Water Resources" section of chapter 3 of the DEIS. By definition, springs and seeps are groundwater reaching the soil surface, although we acknowledge that they could be associated with a perched aquifer. Please see responses to comments 102-22 and 102-25 for more information related to how the DEIS discusses possible effects to springs and seeps.
102	13	Vegetation	Page 6, Third Paragraph of Subject Section, Fifth Sentence This sentence does not provide a desired condition, but only a statement that riparian habitat is present along North Fork of Eagle Creek, and general comparison of the area to similar but undefined and unnamed intermittent streams at similar elevation. No supporting documentation related to the similarities of other intermittent streams is provided. During a meeting with the Forest Service earlier this year, the Forest Service told the Village that it was unable to find a similar intermittent stream system in this watershed or the nearby Rio Bonito watershed.	1.1 Significant Issue – Riparian	This section of the desired condition description has been revised; reference to a comparable stream has been removed. The use of a reference reach is discussed in more detail in the "Riparian" section of chapter 3 of the DEIS.

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102	14	Process	Page 6, Third Paragraph of Subject Section, Seventh Sentence The sentence may be intended to indicate a desired condition that a threshold for average water depth should be maintained. No data are provided in the draft EIS that indicate the minimum groundwater depth requirements for wildlife or riparian habitat. All natural systems are dynamic, and this "desired condition" implies the need for a static system. The Forest Service should define variability in both the natural system and the riparian needs in an inherently and naturally dynamic system. Groundwater pumping would not affect the vadose zone that the ecosystem relies upon.	1.1 Significant Issue – Riparian	This sentence has since been revised as follows: "The thresholds for average or median water table depth annually or seasonally (based on monitoring) is maintained." We recognize the dynamic nature of the system and discuss this in the adaptive management strategy of the proposed action and in other sections of chapter 3 of the DEIS. The vadose zone includes the capillary fringe; that part of the unsaturated ground above the water table that is saturated due to tensional forces or capillary rise. In fine-grained sediments, it can rise fairly high, providing water to root zones. The finer the sediments, the higher the capillary fringe rises.
102	15	Process	Chapter 1. Purpose and Need for Action: Purpose and Need for Action; Existing Condition - Page 6, Second Paragraph, Second and Third Sentences As mentioned above, studies relied upon for the draft EIS did not consider the impacts on surface flow at the Eagle Creek gage from surface water and groundwater diversions that occur in the South Fork of Eagle Creek. Therefore, the impacts from pumping the North Fork well field on surface waterflow at the Eagle Creek gage are likely overestimated. The fact that the Eagle Creek gage was located farther downstream of its current location on a reach in the channel that was on bedrock during the period of 1969 to 1980 has not been addressed. The current location is in an area with a significant amount of alluvium and subsurface groundwater flow below or around the current gage location is possible.	1.1 Significant issue - Water	See response to comment 102-8 for a discussion of the South Fork influence on the Eagle Creek gage. We recognize that the current Eagle Creek gage was not in place until 1988, after pumping began, and that the prepumping data the USGS analyzed in their report came from gage data from a nearby, but different location. We confirmed this with USGS via phone on 1/30/12. We understand that the old gage location was blown out during a flood event and reconstructed in its new location. The location of the previous gage is not well documented; there are differing opinions and no official record of this previous location. For this reason, we cannot ascertain whether the present location has "significant alluvium underflow" compared to the previous location. We recognize that this situation (the prepumping data coming from another gage location) is not ideal and allows for some error in comparing pre- and postpumping periods.

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					However, we do not think that there were likely substantial differences in the number of no-flow days calculated due to this potential underflow. Based on a comparison of no-flow days in the prepumping period using the suggested 0.16 cfs as the definition of no-flow resulted in only 3 years during the prepumping period (1970, 1973, and 1975) that would have had days that met this definition of no flow. Because the no-flow adaptive management trigger is based on reducing the number of no-flow days experienced since pumping began "roughly in half" as described in this section of the proposed action description, we feel that this still meets the intent of this trigger. Therefore, due to the fact that the original gage location is unknown and we have no way of quantitatively comparing its level of underflow to the level at the present gage location plus the fact that a cursory comparison using the suggested 0.16 cfs did not result in substantial differences, we feel that the no-flow day trigger as part of the proposed action is sound. Keep in mind that, as with all of the adaptive management triggers, this would be a starting point for management and would be refined over time with the results of additional monitoring under the proposed action. We recognize the fact that we do not have all the data to answer all the questions needed; this is the reason that we propose additional monitoring and an adaptive management approach that can adjust management over time based on more information.
102	16	Vegetation	Page 7, First Paragraph This paragraph clearly indicates that no adverse impacts to riparian vegetation and habitat from historic North Fork well field pumping can be documented. Therefore, the proposed reduction in pumping as set forth in the Proposed Action section of the draft EIS (page 7) and the Alternative 3 – Proposed Action – Adaptive Management section of the draft EIS (pages 20–23) are unnecessary and not supported by any data.	1.1 Significant issue - Riparian	The "Riparian" section of chapter 3 of the DEIS provides more detail on riparian vegetation prepumping and postpumping. The adaptive management strategy of the proposed action is not based solely on whether we can document changes in riparian vegetation as a result of pumping.

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102	17	Vegetation	Chapter 1. Purpose and Need for Action: Purpose and Need for Action; Need for Action - Page 7, Second Bullet Point This section once again draws upon the concept of "sustaining or improving the riparian and aquatic ecosystems that may be affected by groundwater drawdown from the pumping of these wells." However, as mentioned in the first paragraph of page 7 of the draft EIS, no adverse impacts to the riparian or aquatic ecosystems resulting from pumping associated with the North Fork well field have been documented. The "sustaining or improving" concept is unsupported by data and would limit the applicant's pumping. Soil moisture content and water available for riparian vegetation have been severely limited as a result of the Forest Service allowing the tree density and forest canopy to become too great throughout the watershed, resulting in significant increases in evapotranspiration and the interception of precipitation that would have otherwise been available for increasing soil moisture, groundwater recharge, and surface waterflow. The Forest Service must take an active role in reducing tree density and canopy cover in order to help sustain or improve the riparian habitat.	1.1 Significant issue - Riparian	See response to comment 102-1 related to sustaining or improving riparian and aquatic ecosystems. The DEIS discusses the relationship between conifer density and water yield in chapter, including a discussion of agency efforts to reduce tree density and the potential for high severity fire.

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102	18	Water Rights	Chapter 1. Purpose and Need for Action: Purpose and Need for Action; Management Objectives - Page 7, First Bullet Point The stated management objectives of providing "water management flexibility and water conservation incentives" to the applicant do not coincide with what the Forest Service has indicated to the applicant is its preferred alternative proposed in the draft EIS (alternative 3). The Forest Service preferred alternative severely reduces the ability of the applicant to utilize its water rights and provide water to the Village and, therefore, severely reduces water management flexibility. The applicant has the right to pump a maximum of 2,385.63 acre-feet per year (ac-ft/yr) from the well field, and the proposed preferred alternative reduces the maximum allowable pumping to 300 ac-ft/yr, with the ability to eliminate pumping altogether. It should be noted that the Village has pumped more than 1,000 ac-ft in a single year, and has pumped an average of more than 500 ac-ft/yr since the North Fork well field was put into service, and without any documented adverse impacts to riparian habitat or aquatic ecosystems. The Forest Service proposed limitation is even less than the 612.69 ac-ft of NMOSE permitted water rights associated with the well field that pre-date the creation of the Lincoln National Forest. The applicant already has a water conservation plan in place and conservation measures are routinely implemented. The draft EIS provides no suggestions for water conservation measures that would reduce the Village's water demand. This management objective should be eliminated from consideration given the fact that Village has in place a water conservation plan.	1.1 Significant issue – Water Rights	The Forest Service has not yet identified a preferred alternative. As described in the adaptive management strategy of the proposed action in chapter 2: "An initial adaptive management trigger (threshold) of 900 cumulative acre-feet over any 3 consecutive water years (300 acre-feet per year) would trigger a review by the Forest Service of the current thresholds and mitigations at maintaining or improving surface resource conditions." As discussed in this section of the DEIS, this is not a stand-alone threshold (and therefore does not necessarily "cap" annual diversions; the intent is to use this threshold in combination with the other thresholds and the results of careful monitoring to determine if pumping restrictions would be necessary. We recognize that this management objective may be misleading or misunderstood; we have revised the wording of this objective in the DEIS for clarity, as follows: Recognizing the importance of the well field to municipal water supply by providing water to the applicant while also encouraging water conservation, management flexibility, and opportunities for transferring water rights to locations off of NFS land.

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102	19	Process	Page 7, Second Bullet Point The rationale for the objective of minimizing groundwater drawdown is not supported in the draft EIS. No adverse impacts to riparian vegetation, wildlife, or aquatic ecosystems have been documented, nor has the Forest Service provided specific groundwater depths that are needed for riparian vegetation, wildlife, or aquatic ecosystems. Therefore, this objective should be eliminated from consideration.	5.1 Procedural Concern	Chapter 3 of the DEIS describes the effects of implementing each alternative on these resources.
102	20	Process	Chapter 1. Proposed Action - Page 7, First Paragraph of Section, Last Sentence The proposed new authorization is not similar to the expired permit as this sentence would lead one to believe. For example, the proposed authorization caps the maximum annual diversion to 300 acre-ft/yr (900 ac-ft in 3 years), and with the "adaptive management strategies" the Forest Service can reduce annual diversions to zero. Additionally, this sentence makes reference to mitigating potential adverse impacts to surface water and groundwater resources from the applicant's pumping when no adverse impacts have been documented to date.	3.1 Alternatives	See response to comment 102-3. As described in the adaptive management strategy of the proposed action in chapter 2: "An initial adaptive management trigger (threshold) of 900 cumulative acre-feet over any 3 consecutive water years (300 acre-feet per year) would trigger a review by the Forest Service of the current thresholds and mitigations at maintaining or improving surface resource conditions." As discussed in this section of the DEIS, this is not a stand-alone threshold (and therefore does not necessarily "cap" annual diversions); the intent is to use this threshold in combination with the other thresholds and the results of careful monitoring to determine if pumping restrictions would be necessary. Chapter 3 of the DEIS describes the effects of implementing each alternative on resources.

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102	21	Water	Page 8, First Paragraph High elevation groundwater systems such as the North Fork of Eagle Creek are inherently dynamic. Groundwater depths and surface waterflows are closely related to annual precipitation. The Forest Service "adaptive management strategy" appears to be based on the desire to limit the applicant's pumping and not on any documented adverse affects from pumping the North Fork well field. It is not possible to develop threshold "triggers" based on groundwater depths or surface waterflow to be protective of nonexistent impacts to riparian habitat and aquatic ecosystems. The adaptive management strategy and related "triggers" would apparently be based on subjective desired conditions and not adverse impacts to riparian vegetation or aquatic ecosystems have been documented.	3.1 Alternatives	Chapter 3 of the DEIS describes the effects of implementing each alternative on resources. We agree that this is a dynamic system and that groundwater depths and surface waterflows are closely related to precipitation. It is established in the literature that there are maximum groundwater depths needed for riparian plants to survive. The adaptive management strategy is based on continued monitoring and provides the framework to incorporate future monitoring results into management and adjustments to the triggers, if necessary. The current triggers were developed based on the best available current information.
102	22	Process	Chapter 1. Significant Issues: Water Resources - Page 8, First Paragraph of Section, First Sentence The statement, that well pumping results in changes in wetlands, springs, and seeps as a result of pumping the North Fork Well Field, is false. No documentation has been provided in the draft EIS or references related thereto that support this claim. The subject statement should be removed.	5.1 Procedural Concern	This sentence refers to groundwater pumping in general and is not specifically stating that groundwater pumping in NFEC is affecting springs and seeps. It is followed up in the next paragraph with the sentence "Well pumping may affect the quantity and quality of streamflow, groundwater, wetlands, springs, and seeps." The "Water Resources" section of chapter 3 of the DEIS discusses the potential for impacts to springs and seeps.

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102	23	Water	Chapter 1. Significant Issues: Measurement Indicators - Page 9, First Paragraph, First Sentence This sentence indicates that well pumping "may affect" streamflow quantity, streamflow quality, wetlands, and seeps and springs. It is not possible for pumping from the North Fork well field to adversely affect surface water quality, because the quality of North Fork Eagle Creek surface water is significantly better than groundwater in the North Fork well field (October 2004, Finch, Peery, and McCoy, Water-Resources Evaluation of Eagle Creek Watershed, Village of Ruidoso, New Mexico). During periods of above average precipitation, the groundwater system in the well field area can become artesian wherein groundwater flows upward into the alluvial sediments and possibly contribute to surface waterflow, in turn adversely affecting surface water quality.	1.1 Significant Issue - Water	You are correct that this sentence indicates that well pumping may affect these resources (and does not say that it would affect these resources). The "Water Resources" section of chapter 3 of the DEIS discusses water quality.
102	24	Process	Page 9, Third Bullet Point Measurement indicators are not based on the NMED, Surface Water Quality Bureau standards for intermittent surface water bodies, nor on any data provided in the draft EIS. The measurement indicators are arbitrary and should be removed.	5. 1 Procedural Concern	Chapter 3 of the DEIS uses each indicator to compare the effects of each alternative; these indicators are not arbitrary and were developed to provide a reasonable basis for comparison between the alternatives in chapter 3. They are being used in the DEIS for comparison between the alternatives only and do not need to be based on NMED water quality standards.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	25	Water	Page 9, Fourth Bullet Point The referenced model (Balleau, 2004) is out of date and does not take into account current data collected by the USGS in its report prepared for the subject draft EIS (Scientific Investigations Report 2010-5205, Revised November 2010) or the report prepared by AECOM for the subject draft EIS (North Fork Eagle Creek, Water Resources Report, Final Draft, November 9, 2011). These data include updated calculations of groundwater recharge and watershed yield, which are both critical aspects that need to be included in an updated groundwater flow model that can be used to accurately simulate impacts. Furthermore, the model does not account for dynamic recharge to the groundwater system and assumes that recharge remains constant each year, when in fact recharge to the system is dynamic The USGS estimated recharge to range from 570 to 3,330 ac-ft/yr. Further evidence of the dynamic nature of recharge to the groundwater system is that recharge in a single year can be great enough to cause the groundwater system to be present under flowing artesian conditions, as documented at the applicant's North Fork Well 4 by the USGS in May of 2007. The AECOM report clearly indicates that the Balleau model incorporates a number of simplifying assumptions that are known not to be correct including simulating the aquifer as a confined aquifer (resulting in greater drawdown than would occur in an unconfined aquifer), model not accounting for the fact that the aquifer has different "horizons," a "line barrier boundary 1,100 feet northwest of the well field," and that all Village wells pump from the same portion of the aquifer. There are numerous other simplifying assumptions in the Balleau groundwater-flow model, and the AECOM report (page 71) justifiably states, "Allowing for these foregoing assumptions, analytical modeling of regional drawdown effects produces the worst case scenario for regional drawdown caused by the Village wells."	1.1 Significant Issue - Water	We recognize that the Balleau model relies on a number of assumptions; these are clearly stated and discussed in the "Water Resources" section of the DEIS and in the AECOM water resources report (2011). We also discuss the relevant information from the USGS report in this section. There is a level of uncertainty in using the Balleau model for predicted drawdown but it is the best available information for this use. The DEIS clearly states we consider this a maximum effect (since the aquifer is treated as fully confined) and that pumping effects could be less. Keep in mind that the modeled drawdown as shown in Figure 6 of the DEIS simply displays drawdown and its relationship to known locations of domestic wells and springs/seeps; the analysis does not predict effects to these wells or springs but simply acknowledges that there may be effects based on their proximity to the wells. For springs and seeps, additional monitoring is suggested to determine if they are being affected by drawdown (as discussed in the "Monitoring" section of chapter 2). For purposes of comparison, we conducted a Theis analysis (which also assumes a confined aquifer) to compare the cone of depression to the Balleau model. The Theis analysis assumed pumping at 300 afy for 1 year, transmissivity at 1,200 ft2/day and a storage coefficient of 0.02. The results showed that most springs/seeps and domestic wells upstream from the NFEC wells are in an area of predicted drawdown between 6 feet and 2 feet. These results are similar to the Balleau model which predicted these wells and springs are in an area of predicted drawdown between 10 feet and 5 feet.

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			The AECOM report (page 75) further acknowledges the limitations of trying to estimate drawdown in the statement, "For this reason, the actual extent of long-term drawdown from pumping is unknown, as are the details of pumping effects on streamflows and groundwater levels." Therefore, any drawdown, streamflow impacts, or impacts to springs and seeps simulated by the Balleau model are inaccurate because the model overpredicts drawdown and, therefore, overpredicts potential impacts on wells of other ownership, springs, and the aquatic ecosystem. Reference to the model prepared by Casey W. Cook of Balleau Groundwater, Inc. (Balleau, 2004) and the use of the model to assess pumping affects should be eliminated from the draft EIS.		
102	26	Water	Page 9, Fifth Bullet Point Climate change does have the potential to increase or decrease streamflow and groundwater recharge. Heavy monsoon precipitation in 2006 and 2008 caused severe flooding in the area. Conversely, a resident at the seasonal cabins above the North Fork well field indicated that during the drought of the 1950s, no surface water was present above the cabins (USGS Scientific Investigations Report 2010-5205, Revised November 2010). Natural variations in the system should be expected and potential affects related thereto should not be the responsibility of the applicant.	1.1 Significant Issue - Water	The "Water Resources" section of chapter 3 of the DEIS discusses climate change and how this could affect the implementation of the alternatives over time. This is simply a way to compare alternatives and does not identify applicant responsibilities. An analysis of the effects of climate change is an Agency requirement.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	27	Fish	Chapter 1. Aquatic Habitat and Fish - Page 9 No fish are present in the area of concern. As previously mentioned, the North Fork of Eagle Creek is an intermittent surface water body, and was prior to the drilling of the North Fork well field, as document on USGS 7.5-minute topographic map. All references of impacts to fish in the draft EIS should be removed. The draft EIS does not list or categorize the often referenced “aquatic habitat” that may rely on the intermittent surface water system. Therefore, it is not possible for a determination of water temperature, duration of flow, channel depth, or other requirements to be made. References to required water temperatures and channel depth for aquatic habitat should be removed from the draft EIS.	1.1 Significant Issue – Aquatic Habitat and Fish	Aquatic habitat and fish was identified as a significant issue for this project based partly on the results of public scoping; many people raised concerns that NFEC well pumping may be affecting the quality of fish habitat and fishing opportunities. We are using the EIS process to determine if this is in fact the case (based on the best available information) and then to determine what impacts implementing each of the alternatives would have on aquatic habitat and fish. This is discussed in more detail in chapter 3 of the DEIS. Fish do occur upstream of the NFEC wells and in Eagle Creek. The relationship of these areas to the NFEC project area is discussed in chapter 3 of the DEIS.
102	28	Fish	Chapter 1. Aquatic Habitat and Fish: Measurement Indicators Page 9, First Sentence of Section, and Second Bullet Point on Page 10 No fish are present in the well field area and the reference to the presence of salmonids and any required flow, channel depth, and temperature should be deleted from the draft EIS. The draft EIS appears to be trying to make a case for a condition that has not existed in the well field area and below to the Eagle Creek gage. This approach and its subsequent desire to protect the area for fish in this intermittent surface water system incapable of supporting fish are unreasonable and ultimately bias the Forest Service preferred alternative (alternative 3).	1.1 Significant Issue – Aquatic Habitat and Fish	See response for comment 102-27.

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102	29	Water	Page 10, First Bullet Point The streamflow quantity measurement indicator of 1.2 cubic feet per second (cfs) at the Eagle Creek gage is unreasonable and generally not physically possible based on historic surface water data available prior to the development of the North Fork well field. USGS gage data from the Eagle Creek gage indicate flows as low as 0.06 cfs (27 gallons per minute (gpm)), and frequently below 1.2 cfs prior to the development of the well field. This measurement indicator should be removed because it is generally unobtainable and would dramatically curtail the applicant's pumping.	1.1 Significant Issue - Water	This is a measurement indicator only and is not being used as a management trigger or threshold. What this means is that it is one of several indicators discussed in this section of chapter 1 that are used in chapter 3 to compare and contrast the effects of each alternative; it is a comparison tool only and is not a proposed management action. Table 3 of the DEIS summarizes the effects of each alternative using these indicators, and chapter 3 of the DEIS describes these in detail. The "Water Resources" section of chapter 3 also discusses why this measurement indicator was selected.
102	30		Chapter 1. Riparian Vegetation - Page 10, Second Sentence of Section The Forest Service has been unable to document adverse impacts to riparian vegetation after more than 2 decades of pumping from the North Fork well field. The presentation of the idea that pumping "could" affect riparian habitat appears to be intended to provide an avenue to arbitrarily limit the applicant's pumping to a quantity that is significantly less than historic pumping.		Riparian vegetation is discussed in more detail in chapter 3 of the DEIS. This section describes what we know of riparian conditions prepumping and postpumping, and the effects of implementing each alternative on riparian vegetation over time.

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102	31	Vegetation	Chapter 1. Riparian Vegetation: Measurement Indicators Page 10, First Bullet Point The only documented shifts in canopy cover since the forest was declared is a substantial increase in canopy cover and tree density throughout the forest (Garrett, L.D., and Garrett, P.J., Evaluating Forest Restoration Opportunities on the Lincoln National Forest, September 2001). Mismanagement by the Forest Service over nearly a century has allowed the tree canopy to increase to a point that the Lincoln National Forest is concerned about the potential for severe fire to occur (2011 personnel communication with David Warnack, District Ranger, Smokey Bear Ranger District). The increase in tree density and canopy cover also severely reduces the opportunity for precipitation to reach the ground surface because precipitation is intercepted by the canopy. Increased tree density increases evapotranspiration losses and reduces soil moisture, groundwater recharge, and surface water runoff. The tree density and canopy cover of the Lincoln National Forest in the subject area has reduced available water supplies for the applicant, public use, and riparian habitat. Absent in the draft EIS is any mention of the affects of the increased tree density and canopy cover on watershed yield. The Forest Service should perform required work to return the watershed to a healthy watershed. Therefore, impacts related to canopy cover should be removed from the draft EIS and not considered until such time that the watershed has been restored to a healthy condition. The draft EIS should quantitatively evaluate the additional benefits to the riparian habitat, groundwater recharge, and surface water runoff that will occur from reducing canopy cover.	4.4. Nonsignificant Issue – Upland Vegetation	Conifer density and its potential for effect to water yield is discussed in chapter 3 of the DEIS.
102	32	Process	Page 10, Second Bullet Point The Forest Service has no data related to vegetative changes in species composition over time, and attempting to reduce the applicant's pumping until such time that the Forest Service can collect data to assess changes in species composition is arbitrary and unreasonable.	5.1 Procedural Concern	See response to comment 102-29; these measurement indicators are for comparison purposes only and are not used to reduce the applicant's pumping.

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102	33	Fish	Chapter 1. Socioeconomics - Page 10, Third Sentence As mentioned previously, fish have not been, and are not, present in the intermittent reach of the stream in the area below the North Fork gage. It is not within the purview of the Forest Service to assess the water rights implications from pumping the North Fork well field on wells of other ownership. This fact aside, unlike the water rights that are associated with the applicant's wells, domestic wells do not have water rights associated with them, but rather are permitted to pump groundwater. Water rights in New Mexico are property rights.	1.1 Significant Issue – Aquatic Habitat and Fish	The Forest Service develops a list of significant issues to analyze in an EIS based on the results of public scoping (as described in response to comment 102-27) and on the potential for cause-effect relationships between an action and a resource (see Scoping Outcome Summary, posted to the forest Web site, for more details on how significant issues were developed for this project). Many people who responded during scoping were concerned with their own private domestic wells and whether NFEC well pumping may be a reason some have gone dry or have required deepening. For this reason, effects to private wells is used in the DEIS to compare alternatives (as shown in chapter 3 of the DEIS); these measurement indicators are for comparison purposes only and are not used to reduce the applicant's pumping. We recognize that we have no jurisdiction over the applicant's water rights (as discussed in the "Water Rights" section of chapter 3) or over domestic wells or private land uses.
102	34	Water Rights	Chapter 1. Socioeconomics: Measurement Indicators - Page 10, First Sentence and Second Bullet Point The subject sentence and bullet point indicates that private land water supply may be affected. It should be understood that water rights in New Mexico are based on prior appropriation. The fact that groundwater or surface water may be present on or below private land does not entitle a landowner the use of the water. There are no water rights holders in the North Fork of Eagle Creek except the applicant. The domestic wells referred to in the draft EIS only have a permit to use water but do not have water rights. Ample aquifer thickness exists in the area for domestic wells to be completed to greater depths should the need arise. References to private land water should be deleted from the draft EIS.	1.1 Significant Issue - Water	See response to comment 102-33.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	35	Recreation	Page 11, First Bullet Point on Page As mentioned above, no adverse impacts have been documented as a result of the applicant's pumping. Additionally, the term "streamside" is misleading for the subject area because it has historically been an intermittent surface water body, and a different term, such as "forest" recreational use should be used.	1.1 Significant Issue - Socioeconomics	See previous responses above regarding how significant issues are developed. While we recognize that NFEC is intermittent, it is still a stream and does provide a different type of recreational opportunity than an upland area (away from a stream) would; there are informal camping areas along NFEC and documented recreational use along NFEC. This is discussed in more detail in the "Socioeconomics" and "Recreation" sections of chapter 3.
102	36	Soils	Chapter 1. Non-Significant Issues: Soil Quality - Page 11, Soil Quality This section indicates that soil quality is not a significant issue. This is true because groundwater pumping does not affect the soil moisture that riparian vegetation relies upon. This is further evidence that riparian vegetation would not be adversely impacted by the applicant pumping its allowable water right.	5.1 Comment	Thank you for your comment.
102	37	Eagle Creek Summer Homes	Chapter 1. Non-Significant Issues: Recreation and Land Use Page 12, First Paragraph of Section This section should be revised and remove potential affects to the summer homes located above the North Fork well field. As previously mentioned, any potential pumping effects on domestic wells is limited to the jurisdiction of the NMOSE. Furthermore, the surface water in the area of the summer homes has only been reported to have dried up during the drought of the 1950s (USGS Scientific Investigations Report 2010-5205, Revised November 2010), but not during the period since the North Fork well field has been in operation, indicating the extended periods of extreme drought have a greater impact on surface waterflow above the well field than pumping from the well field.	1.1 Significant issue - Water	The potential effects to the Eagle Creek Summer Home area are discussed in chapter 3 of the EIS under domestic water supply in the "Water Resources" and "Socioeconomics" sections. Domestic water supply was identified as a significant issue as described in our response to comment 102-33.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	38	Springs and Seeps	Page 12, Seventh Bullet Point This bullet point references potential affects to springs and seeps in the "larger watershed." This reference should be removed as it presumably refers to the out-of-date Balleau model (Balleau, 2004) previously mentioned on page 9 of the draft EIS. Prior to the development of the draft EIS, the Forest Service had agreed that the limit of EIS studies would be to the Eagle Creek streamflow gage immediately below the confluence of the North and South Forks of Eagle Creek. Both the draft EIS and the November 2011 AECOM report expand the study area to include private land farther downstream. It should be understood that the Village purchased all surface water rights on Eagle Creek downstream of the Eagle Creek gage including the expanded study area. The expanded study area as provided for in the AECOM report (November 2011) negates the potential affects on the surface water and groundwater system resulting from pumping by Alto Lakes Water Cooperative, domestic well owners, and surface water diversions by the Village. All references to the "larger watershed" and areas outside the originally defined area of concern should be removed from the draft EIS and the AECOM report.	1.1 Significant Issue - Water	The use of the Balleau model is discussed in our response to comment 102-25. Page iii of Summary describes the NFEC project area and states that "North Fork Eagle Creek between the North Fork stream gage and the Eagle Creek stream gage, totaling approximately 2 stream miles, is the emphasis of this environmental analysis" This is reflected in the analysis of effects for each resource shown in chapter 3 of the DEIS. While this is the area for which we emphasized our analysis (particularly for direct/indirect effects), we are obligated under our Agency direction and NEPA to also consider cumulative effects. We describe the reasons we chose this larger watershed area for cumulative impact analysis at the beginning of chapter 3 and again in the "Water Resources" section of chapter 3. Watershed boundaries are commonly used in determining cumulative effects to water resources and are often larger than the project area, due to the potential for actions occurring in the upper portions of a watershed to affect resources downstream. The cumulative effects are discussed qualitatively and in a general sense for this larger area.
102	39	Process	Chapter 1. Consistency with Management Direction Page 13, Paragraph Two, Last Sentence The applicant was not a party to the referenced stipulation and, therefore, the sentence is untrue. In all meetings held between the applicant and the Forest Service where this issue was discussed, the EIS study area was limited to the Forest Service lands ending immediately below the USGS gage below the confluence of the North and South Forks of Eagle Creek. Reference to the stipulated agreement should be removed.	5.1 Procedural Concern	See responses to comment 102-38 and 102-11.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	40	Vegetation	Chapter 1. Lincoln National Forest Plan (1986, as amended) Page 13, Bullet Points One through Three As previously mentioned, the tree density has significantly increased and as a result has decreased the renewable water supplies to the watershed. If the Forest Service objective is truly focused on "maintaining water quality and quantity," it should take immediate corrective action to reduce tree density and canopy cover. The most favorable flows can be obtained when the Forest Service takes corrective action.	1.1 Nonsignificant Issue – Upland Vegetation	Conifer density and water yield is discussed in chapter 3 of the DEIS. Other actions taken in the watershed to reduce tree density and the potential for high severity fire are also described; these are mapped in Fiugre 4.
102	41	Vegetation	Page 13, Bullet Point Four There has been little effort and few expended resources in managing vegetation in the North Fork of Eagle Creek watershed. The Forest Service has the sole authority to manage the forest to obtain optimum vegetation and ecological diversity, but has taken little to no action to do so, with the current exception of trying to reduce pumping by the applicant.	4.1 Nonsignificant Issue – Upland Vegetation	See response to comment 102-40.
102	42	Riparian	Page 13, Second Set of Bullet Points The Forest Service has not provided or referenced any studies that address existing riparian habitat, historical riparian habitat, or actions required to "protect and enhance riparian habitat." Fish habitat does not exist within the North Fork well field area or downstream. No current or historic data have been presented that document impacts from pumping on areas where fish habitat may exist. Fish habitat areas have not been presented in the draft EIS. Bullet point three of the subject section indicates that the Forest Service is to "Update water rights inventory, maintain and protect existing water rights." The Village is the only water rights owner in the North Fork of Eagle Creek, and the Forest Service preferred alternative (alternative 3) seeks to prevent the Village from exercising its water rights without compensation. Alternatives 2 and 3 of the draft EIS are not consistent with the Lincoln National Forest plan. The subject special use permit meets the criteria as a necessary public utility.	1.1 Significant Issue – Riparian	Aquatic habitat and fish and riparian habitat are all discussed in detail in these sections of chapter 3 of the DEIS. We recognize that the applicant owns water rights in the area and we discuss possible effects to water rights in the DEIS; we do not believe that this is in conflict with the forest plan. We also recognize the applicant as providing municipal water and that this is a necessary utility. We do not believe this is in conflict with the forest plan; effects to socioeconomics, water rights and other natural resources are discussed fully in the DEIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102		Process	Chapter 1. Lincoln National Forest Plan (1986, as amended): FSM 2800, Chapter 2880-Geologic Resources, Hazards and Services Page 13, Bullet Point One Item one, this section, requires the Forest Service to analyze "the location function and value of groundwater-dependant resources." The draft EIS and supporting documentation do not provide the required analysis.	5.1 Procedural Concern	Chapter 3 of the DEIS analyzes water resources (groundwater and surface resources), aquatic habitat, and fish and riparian vegetation, among other resources, using the best available information. This meets the intent of this manual direction.
102	43	Water	Water Resource Management - Page 14, First Bullet Point The reference to objectives in FSM 2530 and FSM 1920 in Item 1 are not consistent, and not applicable to the draft EIS. The objective provided in FSM 2530 is to control nonpoint source pollution. The Village is not performing any activity that could be construed to be associated with point source pollution. The objective provided in FSM 1920 does not address water quality. Item 1 should be removed from the draft EIS. Item 2 of the subject section should be removed from the draft EIS because there are no Forest Service drinking water systems in the study area. FSM 7420 is only applicable to Forest Service drinking water systems.	1.1 Significant Issue – Water	This first bullet is excerpted from FSM 2800 and states: "In analyzing land management activities, consider: …" and lists six items for the Agency to consider for analysis. The "Water Resources" section of chapter 3 of the DEIS discusses the aspects of groundwater resources with the potential to be affected; this section includes a discussion of water quality. Water quality is also mentioned in the "Monitoring" section of chapter 2. These FSM references to 1920 and 7420 are actually included within FSM 2530 and were not edited out for this project; these are excerpts from FSM 2530. We recognize that implementing any of the alternatives would not have measurable affects to water quality although stream temperature (as an aspect of water quality) is discussed in the "Water Resources" and "Aquatic Habitat and Fish" sections of chapter 3.
102	44	Process	Page 14, Second Bullet Point Noticeably absent from the FSM 1950 reference as provided for under Section 1950.2-Objectives is the requirement for the Forest Service to "fully consider the impacts of Forest Service proposed actions on the physical, biological, social, and economic aspects of the human environment." The draft EIS has not considered the social and economic aspects of the proposed action on the applicant or those relying on water produced by the applicant.	5.1 Procedural Concern	Chapter 3 of the DEIS includes a detailed analysis of each alternative on all significant and nonsignificant issues, including socioeconomics.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	45	Process	Chapter 1. Lincoln National Forest Plan (1986, as amended): FSM 2500, Chapter 2540-Water Uses and Development-FSM 2541.34-Water Uses and Development-National Forest System Water Rights-Water Rights and Uses for Other Purposes - Page 14 The applicant's pumping from the North Fork well field does not conflict with existing Forest Service uses. The Forest Service has not indicated any potential uses; therefore, the pumping does not affect proposed uses. Although the Forest Service has no existing or known proposed uses, the Village did submit a mitigation plan to the Forest Service and that plan was not accepted. No technical rationale for the refusal of a mitigation plan was provided.	5.1 Procedural Concern	Chapter 3 of the DEIS presents the analysis of effects of each alternative on forest resources; this includes forest uses such as recreational use, fishing, other social factors, and other natural resource factors like available water and vegetation. The only mitigation plan we received from the applicant was a proposal to conduct stream augmentation; we considered stream augmentation carefully as described in the "Alternatives Considered but Eliminated from Detailed Study" section of chapter 2 of the DEIS.
102	46	Spring and Seeps	Chapter 1. Lincoln National Forest Plan (1986, as amended): FSM 2500, Chapter 2540-Water Uses and Development-FSM 2541.35-Region 3 Supplement - Page 14, First Bullet Point No evidence has been provided regarding the hydrogeology at the referenced springs and seeps. Flows from springs and seeps are not necessarily related to groundwater or surface water sources, and it is not reasonable to assume that this relation exists in the subject study area. The Forest Service has not collected any baseline data documenting flows or water quality from the alleged springs and seeps.	1.1 Significant Issue – Water	We recognize that there is little data available for springs and seeps in the project area, as discussed in the "Water Resources" section of chapter 3. There is no question that spring flow comes from groundwater. The bulleted item on page 14 only states FSM direction.
102	47	Process	Page 15, Second Bullet Point A Forest Service approved model does not exist, so it is inappropriate for the draft EIS and the AECOM report to reference use of the Balleau Groundwater, Inc. model. As appropriately noted in the subject section, the State of New Mexico has the jurisdiction to determine allowable impacts from the applicant's pumping on junior water rights. As such, the NMOSE recognizes that the Village has a right to pump a maximum of 2,385.63 ac-ft from the North Fork well field, and that 612.69 ac-ft of this amount has a priority date prior to the creation of the Lincoln National Forest.	1.1 Significant Issue – Water	The use of the Balleau model is discussed in our response to comment 102-25.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	48	Process	Page 15, Third Bullet Point The applicant has offered to perform mitigation, even though the Forest Service has been unable to document any areas where riparian habitat has been adversely affected. The Forest Service dismissed the applicant's offers to mitigate.	5.1 Procedural Concern	See response to comment 102-45.
102		Water rights	Page 16, First Bullet Point This item should be deleted because the applicant has water rights permitted by the NMOSE.	6.1 Document-Specific Comment	We do not see a conflict with this statement from FSM 2541.35 and this project. We recognize the applicant's water rights for the NFEC wells and discuss this in the DEIS.
102	49	Process	Chapter I. Lincoln National Forest Plan (1986, as amended): FSM 2716.12-Special Use Authorizations-Review before Reissuance Page 16, First Bullet Point The applicant has made requests to clean out and rehabilitate the subject wells, but has been prevented from doing so during the EIS process.	5.1 Procedural Concerns	Per the annual operating plan, the VoR must submit work orders to conduct work on the wells. All submitted work orders that pertained to maintenance were approved. Work orders relating to clean out, deepening, pump changes, etc…had to be approved by the Plaintiff's and the Plaintiff's attorney would not approve changes to the status quo.
102	50	Alternatives	Chapter 2. Alternatives, Including the Proposed Action: Alternative 1-No Action (No Change)-Continue Pumping at 2009-1010 Levels - Page 19 No change in the applicant's pumping would be to allow the applicant to pump water in accordance with its water rights. At minimum, a no change alternative should allow the Village to pump up to the maximum quantity historically produced from the well field.	3.1 Alternatives	We recognize that the intent of the no change alternative is to allow the applicant to pump without restriction, in accordance with their water right; this is how the NFEC well operations are currently managed under the original permit and the annual operating plans. This has been clarified in the description of the no change alternative in chapter 2 of the DEIS, as follows: We would issue a new permit with no change in existing well pumping operations. Pumping would continue at historic levels with no restrictions on use, in accordance with the applicant's water rights. The new permit would be issued with similar terms, conditions, and history of water use that has been in operation since 1988.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	51	Monitoring	Page 19, First Bullet Point Water levels for monitoring purposes should include collection of water levels at a minimum frequency of once per month for specified wells in the North Fork of Eagle Creek. It would be more beneficial to have selected wells equipped with transducers and data loggers such that measurements could be collected more frequently (daily). Data could be collected by the applicant, applicant's consultant, or possibly the USGS. Wells outside of Forest Service lands including Village Wells H-1497, H-1497-S, H-1979-S, H-1979-S-10, and H-1979-S-14 should not be included in any monitoring activities associated with the permit. These wells are located on land owned by the Village, and in some cases are many miles away from wells on Forest Service lands. Water levels in wells outside of Forest Service lands are impacted by pumping from other users including Alto Lakes Water Cooperative and domestic wells and, therefore, would not be representative of conditions in the North Fork of Eagle Creek. Furthermore, the Village has a surface water diversion point a few hundred feet below the confluence of the North and South Forks of Eagle Creek and at Alto Reservoir. The Village has a right to divert up to 6 cfs of surface water from these points of diversion. The uppermost diversion point is above all of the Village's wells in Eagle Creek that are completed on private land.	3.1 Alternatives	This first bullet point came directly from the applicant's signed 2008–2011 annual operating plans. However, we recognize this section should be updated to be more reflective of desired monitoring. It has been rewritten in the DEIS as follows: Well static/pumping water levels: Water levels (static and pumping) would be collected at least once a month from the following wells within and upstream of the project area: MW-1A, B, C; MW-2A; MW-3A; MW-4B, C; and MW-5A (see DEIS figure 3). Where possible, data would be collected electronically via transducers and data loggers that would provide daily measurements.
102	52	Alternatives	Page 19, Second Bullet Point This bullet point should be removed as it attempts to limit the applicant's pumping. Historically, during peak periods the applicant has had to pump one or two wells constantly to meet demands. The Village should be allowed to operate its wells as needed to meet demands.	3.1 Alternatives	This second bullet point came directly from the applicant's signed 2008-2011 annual operating plans. However, we recognize this section should be updated to be more reflective of desired applicant operations. For this reason, we have removed this second bullet statement from the description of the no change alternative.
102	53	Monitoring	Page 19, Third Bullet Point The subject water meters are equipped to record pumping in gallons per minute. It is not usual or customary for meters on groundwater supply wells to record in cubic feet per minute. Metering requirements are the jurisdiction of the NMOSE. It is likely that Forest Service personnel can make any required unit conversions they may need.	3.1 Alternatives	We have made this change to the third bullet statement.

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102	54	Alternatives	Page 20, Second Paragraph This item conflicts with early portions of the draft EIS. Specifically, page 7 in chapter 1 makes reference to the applicant needing a water conservation plan, while the subject paragraph acknowledges the Village implements stringent water conservation measures. The draft EIS should be modified as necessary to rectify these inconsistencies.	6.1 Document-Specific Corrections	See response to comment 102-18.
102	55	Water Rights	Chapter 2. Alternatives, Including the Proposed Action: Alternative 2-No Pumping-Discontinue all Pumping - Page 20 This alternative is contrary to the Village's water rights as well as adverse to the social, economic, and human needs. It would also constitute a takings issue related to the applicant's water rights, wells, and related infrastructure.	3.1 Alternatives	We recognize that the no pumping alternative would not provide municipal water and would affect the applicant's water rights; however, it provides a way to compare and contrast the effects of pumping on forest resources and socioeconomics. This comparison between alternatives is shown in Table 2 and Table 3 and in chapter 3 of the DEIS.
102	56	Riparian Vegetation	Chapter 2. Alternatives, Including the Proposed Action: Alternative 3-Proposed Action-Adaptive Management Page 20, First Paragraph, Last Sentence The sentence makes reference to mitigating potential adverse impacts to surface and groundwater. The fact the surface waterflows may be reduced by pumping does not constitute an adverse impact to aquatic habitat or riparian vegetation. The Forest Service has not provided any data or documentation that indicates any adverse impacts have occurred to aquatic habitat or riparian vegetation. This alternative would attempt to maintain instream flows in North Fork without having water rights.	1.1 Significant Issue – Aquatic Habitat and Fish	The proposed action does not establish a minimum instream flow; alternatives that would have been dismissed from detailed analysis as described in chapter 2. By definition, a minimum instream flow is a level below which the amount of flow in a specified stream should not drop. We do not believe that requiring a maximum number of days of no flow per year or over 3 years (that could be adjusted over time based on monitoring results) meets this definition. Chapter 3 describes the effects of each alternative on resources, including aquatic habitat and riparian vegetation and whether these effects are adverse or not.
102	57	Alternatives	Page 20, Second Paragraph Paragraph is vague arbitrary as to its intent and as such should be revised or deleted.	6.1 Document-Specific Corrections	We recognize this paragraph is vague. We have revised this as follows: The applicant would prepare an annual operating plan in consultation with us. We would require the applicant to prepare monthly reports, preferably electronic reports in spreadsheet format, with the following information:

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102	58	Alternatives	Page 20, Third Paragraph, First Bullet Point This is the same proposed monitoring plan as provided in alternative 1. Comments related to this monitoring have been addressed above. Monitoring of wells outside of the Forest Service should be deleted for reasons previously provided.	3.1 Alternatives	See response to comment 102-51.
102	59	Alternatives	Page 20, Third Paragraph, Second Bullet Point This is the same proposed pumping schedule as provided in alternative 1. This provision should be deleted such that the applicant can pump its wells as needed to meet demands.	3.1 Alternatives	See response to comment 102-52.
102	60	Process	Page 21, Second Paragraph Contrary to the statements in this paragraph, the proposed adaptive management strategy does not take into consideration the dynamic nature of the groundwater system. The Forest Service has not provided data that document the minimum groundwater level required to maintain aquatic ecosystems or riparian habitat. It is reasonable for the Forest Service to provide evidence for the minimum groundwater depth required for the various aquatic ecosystems and riparian habitat, including identifying the specific timing and duration for groundwater depths required for each aquatic ecosystem and riparian vegetation. The Forest Service should also provide a complete catalog for each species that has been documented to have been impacted.	3.1 Alternatives	The riparian section of the DEIS includes the average groundwater depths required for each of the facultative wetland species that occur along NFEC and a detailed analysis of effects by alternative. Riparian vegetation composition and canopy cover (the measurement indicators we use in the DEIS to analyze the alternatives) in the Southwest differ between intermittent and perennial streams; reducing the number of no-flow days under either the no pumping alternative or the proposed action would contribute to either sustaining or improving riparian conditions along NFEC, as discussed in the DEIS.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	61	Process	Page 21, Third Paragraph Any thresholds established by the Forest Service to maintain streamflows and depth to groundwater are arbitrary because no impacts to aquatic ecosystems or riparian habitat have been documented. Controlling the applicant's pumping to maintain streamflow and depth to water at arbitrarily selected thresholds is unreasonable. The last sentence of this paragraph provides additional evidence that the Forest Service does not want any reduction in streamflow, and is using the EIS process to try and develop instream flow rights.	5.1 Procedural Concern	Chapter 3 of the DEIS includes a detailed analysis of the effects of each alternative on forest resources. The thresholds identified as part of the proposed action are aimed at achieving a balance between providing municipal water and protecting forest resources. The DEIS shows that NFEC surface water and groundwater are connected. Pumping creates a cone of depression and lowers the water table; the deeper the water table at any point, the greater the extent of the cone of depression and the longer the stretch of stream that is disconnected from local groundwater. Integral to the implementation of the adaptive management thresholds of the proposed action is continued monitoring; the results of this future monitoring would be used to adjust the thresholds (up or down).
102	62	Monitoring	Page 21, Fourth Paragraph The USGS should continue to collect data from the streamflow gages. Water-level monitoring could be collected by the applicant, applicant's consultant, or the USGS. If transducers and data loggers are used, the data could be provided electronically to the Forest Service, including applicable graphs of the data.	5.1 Suggestion	We agree with these suggestions and that data provided electronically would be beneficial; this is discussed in more detail in the "Monitoring" section of chapter 2.
102	63	Process	Chapter 2. Alternatives, Including the Proposed Action: Alternative 3-Proposed Action-Adaptive Management: Adaptive Management Triggers (Monitoring Indicators)-North Fork Surface Flow Volume - Page 21, First Paragraph, First Sentence As previously mentioned, the Forest Service has provided no data that document any adverse impacts to existing riparian or aquatic ecosystems. If the applicant's pumping has not created any adverse impacts, then continuing to allow the applicant to pump water in accordance with its water rights as administered by the State of New Mexico should be allowed. Forest Service references that state or imply that adverse impacts to existing riparian or aquatic ecosystems have occurred should be removed from the draft EIS.	1.1 Significant Issue – Aquatic Habitat and Fish	Chapter 3 of the DEIS provides a detailed analysis of the predicted effects of implementing each of the alternatives, including the methods, data, and assumptions used in the analysis. These effects are summarized in Table 2 and Table 3 in chapter 2.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	64	Water Rights	Page 21, Second Paragraph This proposed approach provided limits the applicant's pumping based on streamflow at the Eagle Creek gage. The proposed limitation seeks to limit the applicant's water rights and develop instream flows for the forest. The proposed number of no-flow days at the Eagle Creek gage that would trigger reductions in the applicant's pumping is not based on any threshold required for aquatic ecosystems or riparian habitat and are, therefore, arbitrary. The Forest Service has not provided data related to the timing (monthly, or daily) or quantity of water required for aquatic ecosystems and riparian habitat. The limitations on streamflow do not recognize impacts that may occur from activities within and near the South Fork of Eagle Creek: primarily ponds that intercept streamflow and pumping from large capacity wells at Ski Apache. Neither the draft EIS nor the AECOM report provide an analysis of potential impacts on surface flow at the Eagle Creek gage from diversions in and near the South Fork of Eagle Creek. The draft EIS incorrectly presupposes that all reductions in streamflow at the Eagle Creek gage are the result of pumping from the applicant's North Fork wells, and not other water users or long-term drought conditions. The draft EIS must consider diversions within the South Fork of Eagle Creek and large-scale pumping for snow making at Ski Apache, in addition to other possible diversion in the South Fork and the related impact on streamflow at the Eagle Creek gage.	1.1 Significant Issue – Water	See response to comment 102-56 related to minimum instream flows. See response to comment 102-60 related to minimum groundwater depths for riparian vegetation. The AECOM water resources report (2011) also discusses our initial attempts to develop a measurement indicator based on water table requirements for riparian vegetation (page 79 of the report) as follows: Initially, groundwater levels in the alluvial deposits monitored at the well field were reviewed with respect to pumping. It was hoped that an alluvial well water level could be used as a measurement indicator, particularly as it might influence riparian vegetation. However, no clear cause-and-effect relationship between these parameters was ascertained from available data. The reasoning behind the use of the no-flow day triggers in the proposed action is described in the alternative 2 description in the DEIS. See response to comment 102-8 related to South Fork water uses. We did not assume that all reductions in streamflow at the Eagle Creek gage were from changes in the North Fork; other factors such as drought were looked at, as discussed in the "Water Resources" section of chapter 3. We also recognize the value in the data from the South Fork gage in the future compared to data from the Eagle Creek gage; however, it has not been in place long enough to help us ascertain prepumping conditions.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	65	Water	Page 22, First Bullet Point Contrary to the statement in this bullet point, using a 3-year running average does not account for natural fluctuations in precipitation, runoff, or drought cycles. Likewise, this statement is not supported by either the USGS or AECOM reports. Precipitation records for the Sierra Blanca SNOTEL station begin in 2002, and the "commonly-applied weighted averaging approach to estimating point data (Searcy and Hardison, 1960), using values from at least three of the nearby stations" (AECOM, November 9, 2011, p. 31) was used by AECOM to reconstruct a precipitation record for the Sierra Blanca station for the period 1971 through 2001. It is not known which nearby stations were used to reconstruct the Sierra Blanca record, but the next highest station in the region (Cloudcroft) is 1,580 ft lower in elevation, and all other stations are at least 3,340 ft lower in elevation, raising the question of whether or not the weighted-averaging approach can be applied for sites of such different elevations. Reconstruction of the Sierra Blanca record is further called into question by the lack of trend in monthly proportion of precipitation, and median monthly precipitation, over time among nearby stations, as presented in tables 5 and 6 of the AECOM report. The report states, "There are substantial differences in monthly median precipitation between time periods, but these do not appear to be consistent at stations or between stations." The 3-year running average should be eliminated from the alternative based on the lack of evidence and data to support the approach.	1.1 Significant Issue – Water	Using a 3-year running average provides a reasonable time period that can be used for management (without excessive smoothing of data in contrast to a longer period) while recognizing periodic fluctuations due to precipitation and runoff. The AECOM water resources report (2011) provides the methods and assumptions used for the precipitation analysis. Averaging was done on separate periods by linear regression as shown in the report. The strong association between increasing precipitation and increasing elevation is well documented by other investigators such as the NRCS and the USGS (which used the same higher elevation stations as the water resources report (AECOM 2011). The climate trend investigation in the AECOM water resources report was reviewing an earlier USGS hypothesis that a seasonal shift in precipitation has created changes in streamflows. The USGS has since disavowed that hypothesis, and the AECOM water resources report (2011) simply investigates this.

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102	66	Water	Page 22, Bullet Points Two and Three Limiting the applicant's pumping based on streamflow at the Eagle Creek gage is not supported by data provided in the draft EIS or the AECOM report. The conclusion in the AECOM report (page 47) that "well field pumping appears to substantially reduce streamflows during such low flow periods" is based solely on a comparison of daily mean streamflow, in cubic feet per second, in one pre-pumping year (1971) and one pumping year (2004). Analysis of additional years, prior to and during pumping, would be necessary to draw this broad conclusion. For example, 1971 was preceded by one year of below average precipitation, whereas 2004 was preceded by 6 years of below-average precipitation, based on data from the Ruidoso weather station. The AECOM study found no statistically-significant relationship between North Fork well field pumping and streamflow at the North Fork gage in the 2-year overlapping record, and found no statistically significant relationship between North Fork well field pumping and streamflow at the Eagle Creek Gage in the 9-year overlapping record, considering lag times of 0 to 90 days (AECOM, 2011, p. 51). The statement on page 51 of the AECOM report, "Generally, periods of no flow (considered as less than 0 01 cfs) over this 9-year period follow within several months of periods of high pumping (greater than 400 gpm), and/or periods of low precipitation," directly follows the AECOM statement that no statistically significant relationship was found between streamflow and pumping, considering lag times of 0 to 90 days. This would suggest that there is too much variability in the datasets to establish a relationship, if one exists. The variability is likely due to the numerous factors involved at local and regional scales. Thus, the discussion of possible relationships on page 54 of the AECOM report is conjecture.	Significant Issue – Water	As described in the AECOM water resources report, these selected low-flow years are simply additional examples of streamflow conditions, presented in addition to the results of other analyses. Although a longer period of low precipitation preceeded the latter year (2004) at the Ruidoso monitoring station, such was not the case at stations representing higher elevations within the North Fork watershed. In addition, we used commonly accepted flow frequency analysis (as documented and used by USGS), as well as other physically based, deterministic approaches. We recognize there is a lot of variation in the system, especially at short timesteps; this is why we used the 10-year periods to derive generalizations. All three approaches (water balance, frequencies, Rio Ruidoso) resulted in similar general conclusions about the effect of pumping on streamflow; caveats are spelled out in the water resources report (AECOM 2011). The lack of statistical significance between pumping and streamflow documented in the AECOM report is based on a review done at daily timesteps and incorporated various daily lag times. Given the complexity of the hydrologic system, this outcome, on a daily basis, is not unexpected. Statistical significance is not the end-all of investigations or the only means of deriving sound conclusions, as numerous published researchers have acknowledged. What statistical tests analyze, i.e., how they are set up and which data are used, is important to the outcomes. In addition, the error level of 0.05 suggested is arbitrary; other levels (such as 0.1 or 0.2 or more) could certainly be applied and may give other results.

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			The statement on page 54 of the AECOM report, "In general, at the well field and downstream, the North Fork of Eagle Creek flowed intermittently in most years prior to pumping" is followed by, "The extent and duration of surface flow has since been reduced along the North Fork by pumping." No statistically significant evidence has been presented in the report to support this second statement. The AECOM study (p. 55) compares the periods 1971–1980 (prepumping) and 1989–1998 (pumping) and states "the latter period (with pumping) shows somewhat reduced overall streamflow, reduced average base flow, and an increase in total estimated average recharge plus pumping." JSAI review of USGS annual discharge and base flow for the Eagle Creek gage (08387600; Matherne et al., 2010) for the two periods, and statistical analysis using the Mann-Whitney rank-sum test, found that the null hypothesis (there is no difference between discharge, base flow, or base flow as a percentage of discharge) cannot be rejected at the 0.05 significance level. JSAI analysis of USGS annual discharge and base flow for the Eagle Creek gage (08387600; Matherne et al., 2010) for the period 2000-2008 (pumping), as compared to the earlier periods 1971-1980 (pre-pumping) and 1989-1998 (pumping), and statistical analysis using the Mann-Whitney rank-sum test, found that the null hypothesis (there is no difference between discharge, base flow, or base flow as a percentage of discharge) can be rejected at the 0.05 significance level. Discharge, base flow, and base flow as a percentage of discharge, all appear to be reduced in the period 2000-2008 compared to the earlier periods. Page 55 of the AECOM study states: "In general, some reduction in streamflows and increases in recharge factors result on the North Fork from pumping during average to wet years. These effects are somewhat moderated during multiple years of average or greater precipitation. During drought years or extended dry periods, pumping effects on North Fork streamflows and groundwater conditions are more noticeable."		Other analytical methods, as presented in both the USGS report and the AECOM report, indicate differences in streamflows. We conclude that there are zero-flow days, flow frequency differences, and other comparisons between the pre- and post-pumping periods that indicate effects from pumping. Similarly, it should be noted that both Finch, Peery & McCoy (2004, on page 19 and figure 15) and Balleau (2010, regarding water budgets on attachment 9), show discontinuity at the Eagle Creek gage attributed to pumping. On the basis of these analyses, the relationship between streamflow and pumping is not conjecture.

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			The claimed relationship between streamflow and pumping appears to be based on the fact that the period 2000–2010 had significantly lower discharge and base flow than 1971–1980, and the fact that pumping was occurring in the period 2000–2010. The claimed relationship also appears to be based on observations of data trends in specific instances between 2000 and 2010. The claimed relationship is conjectural because there are numerous climatologic, ecologic, and hydrologic factors at play on many different time scales.		
102	67	water	Page 22, Fourth Bullet Point As previously mentioned, neither the draft EIS nor the AECOM report attempt to assess changes in available streamflow from the South Fork of Eagle Creek that may have resulted from pumping large capacity groundwater supply wells at Ski Apache or changes in storage and evaporation from ponds in the South Fork watershed.	1.1 Significant Issue – Water	See response to comment 102-8.
102	68	Process	Chapter 2. Alternatives, Including the Proposed Action: Alternative 3-Proposed Action-Adaptive Management: Adaptive Management Triggers (Monitoring Indicators)-Water Table Depth Page 22 This section would require that the applicant monitor groundwater levels so that an adaptive management trigger could be selected in the future. Prior to the implementation of the groundwater monitoring plan, the Forest Service should be required to document the rooting depths, soil moisture requirements and timing for required moisture, depth to groundwater requirements and timing for requirements, for all riparian habitat that have the potential to be impacted. Prior to the implementation of the groundwater monitoring plan, the Forest Service should also be required to document the streamflow and groundwater requirements in terms of timing, quality, and duration for all aquatic ecosystems in the intermittent portion of Eagle Creek. This will eliminate the potential for an arbitrary minimum groundwater depth requirement to be forced on the applicant by the Forest Service.	1.1 Significant Issue – Riparian	The water table depth threshold description has been revised somewhat since the final draft of chapters 1 and 2 were prepared, as shown in this section of the DEIS. Please see response to comment 102-60 related to rooting depths. The monitoring measures for the no change and the proposed action alternatives in chapter 2 of the DEIS includes continued monitoring of groundwater depths in recognition of riparian vegetation rooting depths to assist in further refining this threshold over time.

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102	69	Riparian	Chapter 2. Alternatives, Including the Proposed Action: Alternative 3-Proposed Action-Adaptive Management: Adaptive Management Triggers (Monitoring Indicators)-Riparian Vegetation - Pages 22 and 23 This metric is arbitrary and doesn't account for other potential adverse affects on riparian habitat or canopy cover. The use of "obligate tree species (e.g. willows)" to act as an indicator species for detecting short-term changes in canopy cover is inappropriate because there are no base line data prior to 2010. The monitoring indicators assume any adverse changes to be the result of the applicant, rather than any other possible sources, including management of the tree density and canopy which thereby reduces groundwater recharge and watershed yield. It is also possible that bark beetles will attack trees within the North Fork watershed because of the high tree density, as is currently occurring throughout many of the forests in Colorado. All riparian vegetation indicators used by the Forest Service should account for all potential actions within the forest that may be considered adverse, rather than simply assuming all adverse impacts are the result of the applicant's pumping.	1.1 Significant Issue – Riparian	There is a vast body of literature to support the use of willow as a good indicator of changes in groundwater levels. This threshold is written so that no triggers would be implemented related to riparian vegetation until at least 3-5 years from the time of the baseline survey conducted in 2010; because this 2010 survey is therefore the baseline, we intend to use it to detect changes over time. If changes are detected based on future monitoring results compared to baseline monitoring results, and the no-flow trigger has been reached, then the Forest Service may require reduced diversions (as described in detail in this description in the DEIS); in other words this trigger is written with flexibility in mind and recognizes that data related to riparian vegetation is lacking. The riparian adaptive management trigger is one of several triggers that would be used, with careful monitoring, to manage pumping. We recognize there are other factors that could affect riparian vegetation but we also conclude that available water is the most influential.
102	70	Water Rights	Adaptive Management: Adaptive Management Triggers (Monitoring Indicators)-Well Pumping Volume - Page 23 The proposed reduction in pumping severely limits the ability of the applicant to put its water rights to beneficial use. Pumping limitations would reduce the applicant's water rights without just compensation. The draft EIS, the AECOM report, and USGS report do not provide any technical rationale for selecting a maximum pumping volume of 300 ac-ft/yr. The proposed limitation is arbitrary.	3.1 Alternatives	We state the reasons for selecting the pumping volume trigger in the description of the proposed action; its selection is not arbitrary. It is also not a stand-alone trigger and would not be used by itself to limit pumping. Here is how this is described in chapter 2: An initial adaptive management trigger (threshold) of 900 cumulative acre feet over any 3 consecutive water years (300 acre feet per year) would trigger a review by the Forest Service of the current thresholds and mitigations at maintaining or improving surface resource conditions. We describe in this adaptive management section and also in the "Monitoring" section that this pumping volume is a starting point only and would be adjusted over time, if needed, based on the results of monitoring.

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102	71	Alternatives	Chapter 2. Alternatives, Including the Proposed Action: Alternative 3-Proposed Action-Adaptive Management: Adaptive Management Triggers (Monitoring Indicators)-Adjustments in Management of Water Withdrawals Page 23, First Bullet Point This bullet point indicates that the Forest Service may relax or further restrict specific parameters related to the permit. However, all previous portions of the draft EIS indicate that the Forest Service will only further restrict the applicant's pumping once it has additional data. Alternative 3 and related portions of the EIS should be revised to allow for pumping rates greater than 300 ac-ft/yr or 900 ac-ft in 3 consecutive years, if the monitoring indicates no adverse impacts.	3.1 Alternatives	The intent described in the adaptive management strategy is to restrict pumping if needed, based on triggering the thresholds. If the thresholds are not triggered, there would be no restrictions on pumping. In addition, future monitoring results would be used to update/revise the triggers if needed to be more reflective of site-specific conditions. This has been clarified in the DEIS.
102	72	Water Rights	In paragraph 1, page 4, the Village of Ruidoso percentages of water supply obtained by Ruidoso from the North Fork well field actually should be multiplied by 1.5 since a return flow credit of 50% is derived from the North Fork water used in the Village municipal system. Therefore, during a drought over 75% of total monthly Village municipal diversions was derived from the North Fork well field and the additional return flow diversion authorized from the Rio Ruidoso as a result of the North Fork diversions.	1.1 Significant Issue – Water Rights	See response to comment 102-7.

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102	73	Water	In the fourth bulleted paragraph on page 4, it should be mentioned that the prior Eagle Creek Below South Fork Gage with surface flow data during years 1969-1980 was located approximately 360 feet downstream from the present location with surface flow data since 1989. The prior downstream location was within a stream reach that, by field inspection of AEAI and according to figure 29 of the USGS report, was on bedrock with little if any alluvium. It should be noted that there would be basically no alluvium underflow at the prior gage location, whereas the present gage location would have significant alluvium underflow of up to 0.16 CFS referring to figure 29. The no flow days tabulated for both the prepumping period and the postpumping period are not tabulated from the same gage location and are not comparable due to the difference in stream underflow conditions. The no-flow days are greatly exaggerated for the postpumping period as compared to the prepumping period by using the present different location of the gage.	1.1 Significant Issue – Water	See response to comment 102-15.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	74	Water	The first bulleted paragraph on page 5 indicates that the groundwater recharge was estimated to average 490 acre-feet per year. This value was calculated by the chloride mass-balance method which has questionable accuracy according to the USGS report and the AECOM report. The basin yield method used by the USGS indicates a midpoint recharge value of 1,950 acre-feet per annum which equates to basin yield minus direct runoff. The 490 acre-feet per annum is not compatible in any nature with and does not correlate with basin yield, measured surface water out-flow, direct runoff or base flow of Eagle Creek. The 490 acre-feet per annum is substantially less than the mean annual base flow of 819 acre-feet per annum computed independently by the WHAT analysis of the measured surface water outflow. This is not possible since recharge is the sum of base flow and groundwater outflow. Obviously the 490 acre-feet recharge value is erroneous.	1.1 significant issue – water	As stated in the “Alternatives Considered but Eliminated from Detailed Study” section of chapter 2, we believe the chloride mass-balance method is a valid method, as used by USGS and provides a reasonable basis for determining the water table depth threshold in the proposed action: The 300 afy threshold per year was based on the 500 afy recharge for the North Fork basin as determined by the chloride balance method described in the USGS report. The recharge rate from the chloride balance method was used instead of the rates calculated using the basin yield because of less certainty in evapotranspiration estimation. The chloride balance method also gives a maximum value for recharge because the rocks may contribute chlorine. We do not agree that calculating the recharge rate and then the acceptable well pumping threshold based on the basin yield method is appropriate since the proposed action includes adaptive management to achieve the desired conditions. The use of the recharge rate determined by chloride balance is a safe starting point because it should represent a maximum groundwater recharge rate method. That being said, the initial threshold of 900 cumulative acre-feet over any 3 consecutive water years (300 acre-feet per year) is not a stand-alone threshold. As stated in the proposed action, hitting this threshold would trigger a review by the Forest Service of the other current thresholds and mitigations at maintaining or improving surface resource conditions. The Forest Service would decide, based on evaluation of all monitoring indicators, if changes would be needed.

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					It should be noted also that the WHAT analysis showed a 417 afy base flow for the 1989 to 2008 record. The USGS included this Web-based tool, with reference in their report, but no discussion as to its accuracy or precision. Like the mass balance method used, it is another tool, and gives another answer subject to its own assumptive errors. The 490 afy figure is presented as a minimum, with the reasons stated.
102	75	Water	The second bulleted paragraph on page 5 states erroneously that sustained flows of 2.2 CFS (consisting of 1.2 CFS to saturate the alluvium and 1.0 CFS bedrock loss) are needed to maintain continuous flow in North Fork. The USGS report indicates that from 0.6 to 1.2 CFS (depending on permeability) is needed to saturate the alluvium at the widest alluvium section on North Fork in the vicinity of the NF-1 well and from 0.7 to 1.0 CFS flow is lost to bedrock above the well field. Referring to figure 29 of the USGS report, the value of 0.6 to 1.2 CFS flow to saturate the alluvium diminishes drastically down to 0.2 to 0.1 CFS or less needed for continuous surface flow for the majority of the stream reach below the North Fork wells down to the Eagle Creek Below South Fork Gage. The use of 1.2 CFS flow needed to saturate the alluvium is greatly overstated and is an incorrect application of the USGS report information.	1.1 Significant Issue – Water	This second bullet statement was taken from the USGS report, but we have revised this statement somewhat with additional information from the USGS report to address your concern.
102	76	Water Rights	In the first paragraph under water rights on page 5, the information should be corrected to state that the Village was originally adjudicated a total of 5,648 acre-feet per annum from the North Fork wells subject to beneficial use. In June 2007, the Village filed Proof of Beneficial Use with the State Engineer which was used as a basis for a 2010 consent order adjudicating a total of 2,539.34 acre-feet per annum with 846.46 acre-feet per annum subject to beneficial use to be filed on or before Dec. 31, 2024.	1.1 Significant Issue – Water Rights	We have made this change to this section of the DEIS.

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102	77	Process	The first paragraph on page 6 is written incorrectly and should be corrected to state that the Village agreed to a 2006 stipulated settlement requiring the completion of an environmental study but was not a party to the 2009 supplement suggesting an alternative that would leave downstream flows completely undisturbed. All other references to the 2009 supplement within the EIS should be corrected to state that the Village was not a party.	5.1 Procedural Concern	See response to comment 102-11.
102	78	Water	The second bulleted paragraph on page 9 below "Measurement Indicators" entitled "Streamflow Quantity" indicates that 1.2 CFS flow in Eagle Creek at the Eagle Creek Below South Fork Gage should be used as an streamflow impact indicator. This is not a correct value for Eagle Creek flow to saturate alluvium for the reasons as discussed in Comment No. 4 above. A much smaller value should be derived and used, possibly in the range of 0.25 CFS or less. This smaller number should be related to riparian vegetation water requirements and not derived from saturated alluvium flow requirements.	1.1 Significant Issue – Water	Keep in mind that these measurement indicators are not used as management triggers, as described in our responses to comments 102-24, 102-29, and 102-32. The rationale for using the 1.2 cfs indicator is described in the "Water Resources" section of chapter 3.
102	79	Springs and Seeps	The fourth bulleted paragraph on page 9 below "Measurement Indicators" entitled "Springs and Seeps" relies on a Technical Memorandum of May 12, 2004 from Casey W. Cook, Balleau Groundwater, Inc. to identify springs and seeps that may be affected by pumping. Relying on the technical memorandum requires a multitude of erroneous assumptions related to aquifer conditions (as described in detail on page 71 of the AECOM Water Resources Report) such that the adverse results are greatly exaggerated to the worst case scenario. To rely on this Balleau Groundwater, Inc. work for any purpose would not be acceptable and would lead to erroneous results.	1.1 Significant Issue – Water	We acknowledge the assumptions used in the Balleau model and describe these in detail in the "Regional Extent of Pumping Drawdown" section in the "Water Resources" section of chapter 3; we recognize these estimates for water drawdown are likely high and state that these results are being used to conservatively estimate possible effects. Additional monitoring of spring and seeps is recommended to address the need for more site-specific information.
102	80		The section entitled "Aquatic Habitat and Fish" located at the bottom portion of page 9 is not correct as relating to fish populations in the intermittent reach of North Fork of Eagle Creek. Fish should be omitted from this discussion and should not be considered in alternative comparisons since prepumping conditions would not support fish populations due to the intermittent nature of the stream.		See responses to comments 102-5 and 102-27 regarding aquatic habitat and fish; chapter 3 details the effects of each alternative on this issue.

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102	81	Domestic Wells	On page 10 under "Socioeconomics" the mention of availability of water for domestic wells should be omitted due to the following reasons: No data or information has been assembled or correlated to determine any effects to domestic wells on private land off of forest land and the Village holds all of the existing water rights to divert Eagle Creek surface water with senior priority dates as compared to the domestic permitted wells. The domestic wells upstream from the well field on forest land are all junior in priority to the Village wells on forest land and cannot relate the priority of the domestic wells back to the date of the illegal surface water diversions previously used by the cabin owners. The domestic wells could be deepened by the well owners if needed in the future.	1.1 Significant Issue – Water	See response to 102-33.
102	82	Recreation	At the top of page 11 under "Streamside Recreational Use" this discussion should be deemphasized and moved to the nonsignificant issues and not included in the alternative comparison discussion. The intermittent nature of the prepumping stream removes any streamside recreational use since the stream historically has no consistent streamflow.	1.1 Significant Issue – Socioeconomics	Streamside recreation and fishing opportunities are noted in the DEIS as the only types of dispersed recreation that would be affected (see "Recreation" and "Scenery Affected Environment" section of chapter 3). Streamside recreational use was just one aspect of the socioeconomics issue analyzed and it provides a valuable comparison between the alternatives. See responses to comments 102-27 and 102-33 for an explanation of significant issues and how they were selected. This factor within socioeconomics is discussed in chapter 3 and shown in Table 3 in chapter 2.

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102	83	Process	In the last paragraph, page 21, the "Manual Direction Summary" document (USDA Forest Service 2011) concludes that the USFS has no authority in New Mexico to establish a minimum instream flow. Requiring no more than 30 no-flow days per year or no more than 20 no-flow days per year in a 3-year period would not be consistent with these conclusions. The no-flow days for the postpumping period are greatly exaggerated as compared to the prepumping period due to the previous location for the gage being approximately 360 feet downstream from the present gage location. The previous location was within a bedrock section of Eagle Creek with little or no underflow. (See AEAI discussion within Comment No. 2 of chapter 1 of the DEIS).	3.1 Alternatives	See response to comment 102-56; we do not agree that the proposed action establishes a minimum instream flow; alternatives that proposed a minimum instream flow have been dismissed from detailed analysis, as described in chapter 2 of the DEIS. By definition, a minimum instream flow is a level below which the amount of flow in a specified stream should not drop. We do not believe that requiring a maximum number of days of no flow per year or over 3 years (that could be adjusted over time based on monitoring results) meets this definition. See response to comment 102-73 regarding the possibility for underflow at the current Eagle Creek gage.
102	84	Water	In the second paragraph under "Well Pumping Volume" on page 23 the 300 acre-feet per year or 900 acre-feet per 3-year period is based on 500 acre-feet per year recharge as determined by the chloride mass-balance method. The chloride mass-balance method has questionable accuracy according to the USGS report and the AECOM report. The basin yield method used by the USGS indicates a midpoint recharge value of 1,950 acre-feet per annum which equates to basin yield minus direct runoff. The 490 acre-feet per annum recharge computed by the chloride mass-balance method is not compatible in any nature with and does not correlate with basin yield, measured surface water out-flow, direct runoff or base flow of Eagle Creek. The 490 acre-feet per annum is substantially less than the mean annual base flow of 819 acre-feet per annum computed independently by the WHAT analysis of the surface water outflow. This is not possible since recharge is the sum of base flow and groundwater outflow. Obviously the 490 acre-feet recharge value is erroneous.	1.1 Significant Issue – Water	See response to comment 102-74. We discuss the rationale for using this well pumping volume in the description of the proposed action in chapter 2. We also discuss the comparison to the basin yield method in the "Alternatives Considered but Eliminated from Detailed Study" section of chapter 2; this section also elaborates on the fact that this trigger is only a starting point and is intended to be updated or revised as needed based on future monitoring results. It is also not a stand-alone threshold, as discussed in response to comment 102-3.

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102	85	Stream Augmentation	Referring to the discussion related to the NPDES permit within the third paragraph from the top of page 31, the North Fork of Eagle Creek is intermittent and described under 20.6.4.98 NMAC as "All non-perennial unclassified waters of the state, except those ephemeral waters included under 20.6.4.97 NMAC." This water body has not had a use attainability analysis (UAA) performed which triggers full protection of swimmable/fishable. This means that since there has been no UAA, then under EPA review, the strictest standard is applied without any regard for the existing onsite conditions.	3.1 Alternatives	Thank you for this information.
102	86	Stream Augmentation	Referring to the discussion within the third paragraph from the top of page 31, related to the lengthy permitting for the NPDES "eliminating the opportunity to conduct a pilot test," the pilot test could be accomplished as a monitoring parameter and data could be collected after issuance of the SUP with the collected data being useful in future adaptive management strategies and adjustments in the administration of the permit. Application to the EPA Region 6 Office for the NPDES permit to conduct the pilot test has been accomplished by the Village of Ruidoso with the initial filing on October 27, 2011, and final filing on November 28, 2011, with all of the water sampling results attached. Approval of the NPDES permit by the EPA could well occur prior to completion of the EIS.	3.1 Alternatives	Based on all of the best available current information, we have determined that the stream augmentation alternative does not meet the purpose and need for action or the other criteria needed to consider it in detail in the EIS (as described in detail in the "Alternatives Considered but Eliminated from Detailed Study" section of chapter 2 of the DEIS). However, if the applicant approaches us in the future with a new proposal for stream augmentation or a pilot test of stream augmentation, the deciding official could consider it further at that time, pending additional NEPA analysis.
102	87	Stream Augmen-tation	Within the first and second paragraphs of page 32 relating to stream augmentation, if a stream augmentation pilot test were incorporated in SUP approval as a data collection process, then the data collected could be analyzed and used in adaptive management strategies for managing the SUP.	3.1 Alternatives	See response to comment 102-86.
102	88	Process	Referring to the discussion under "Suggestions for New Alternatives" and the discussion on the stipulated agreement, on page 32, the Village agreed to a 2006 stipulated settlement requiring the completion of an environmental study but was not a party to the 2009 supplement suggesting an alternative that would leave downstream flows completely undisturbed.	5.1 Procedural Concern	See response to comment 102-11.

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102	89	Storage Capacity	The entire discussion on page 33 under "Add more storage capacity to the system" should be deleted. The information is not correctly done using sound engineering principles and should be completely omitted or treated in the same way as the suggestion for a water purification plant.	3.1 Alternatives	The suggestion to add more storage to the system was suggested by the public during scoping and we are obligated to consider it; we recognize these calculations may be rough but they were used to provide a generalized comparison of needed storage to cost; it illustrates that costs would likely be prohibitive. If the applicant would like to provide additional information on storage capacity estimates for use in this section, please feel free to provide it and we can insert it into this section.
102	90	Water	On page 34, all of the information related to the 1.2 CFS flow rate being supported by the USGS should be further clarified with additional discussion considering the following information: The USGS report indicates that from 0.6 to 1.2 CFS (depending on permeability) is needed to saturate the alluvium at the widest alluvium section on North Fork in the vicinity of the NF-1 well and from 0.7 to 1.0 CFS flow is lost to bedrock above the well field. Referring to figure 29 of the USGS report, the value of 0.6 to 1.2 CFS flow to saturate the alluvium diminishes drastically down to 0.2 to 0.1 CFS or less needed for continuous surface flow for the majority of the stream reach below the North Fork wells down to the Eagle Creek Below South Fork Gage. The use of 1.2 CFS flow needed to saturate the alluvium is greatly overstated and is an incorrect application of the USGS report information.	1.1 Significant Issue – Water	See response to 102-75.

Letter No.	Comment No.	Subject	Comment	Classification Code[a]	Response
102	91	Water	On page 36 the USGS discussion on the chloride mass-balance method for calculating recharge needs to include the following information: The chloride mass-balance method has questionable accuracy according to the USGS report and the AECOM report. The basin yield method used by the USGS indicates a midpoint recharge value of 1,950 acre-feet per annum which equates to basin yield minus direct runoff. The 490 acre-feet per annum recharge computed by the chloride mass-balance method is not compatible in any nature with and does not correlate with basin yield, measured surface water out-flow, direct runoff or base flow of Eagle Creek. (See Comment No. 2 to chapter 2 of the DEIS above). The derivation of the 300 acre-feet per year pumping threshold is not based on correct recharge information and should be reconsidered.	1.1 Significant Issue – Water	See response to 102-84.
102	92	Water Rights	On page 36, referring to the second paragraph from the bottom, containing the discussion on the 1,600 acre-feet per annum being the current water right; this written information is incorrect. The adjudicated water right for the NFEC wells includes 761.12 acre-feet per annum supplemental groundwater rights and 2,539.34 acre-feet per annum groundwater rights. By memorandum of agreement between the Village of Ruidoso and Rio Hondo Land and Cattle Company, the groundwater diversion would be limited to 1,624.51 acre-feet per annum. The supplemental groundwater right remained unaffected by the agreement, resulting in a total diversion right of 2,385.63 acre-feet per annum for the NFEC wells.	1.1 Significant Issue – Water Rights	The current water rights associated with H1979 et al. are 1,692.88 afy plus an additional 846.46 afy subject to NMSA 72-1-9 for a total of 2,539.34 afy. The 761.12 (or up to 6 cfs/yr) is a surface water right and can be pulled from supplemental groundwater wells (H-1497-S et al.) Neither the surface diversion nor the supplemental wells are located on NFS lands. In addition, the USFS currently recognizes the 2009 adjudication not the MOU between the VoR and Rio Hondo Land and Cattle Co.
102	93	Alternatives	On page 37, in the last paragraph referring to the OSE water diversion reporting the following suggestion is offered: The USFS needs to attempt to keep the 5-year evaluations of adaptive management strategy coincidental with the State Engineer 5-year accounting periods for the Hondo basin. This would allow for adjustments in diversion limits to be made at the end of each accounting period and allow for easier diversion administration by the State Engineer.	5.1 Suggestion	Thank you for this suggestion; this statement has been added to the DEIS as follows: Based on the 5-year evaluations, the Forest Service may relax or further restrict specific parameters of this adaptive management strategy, with modification to the permit. These 5-year evaluations would coincide, if possible, with the State Engineer 5-year accounting periods for the Hondo basin.

Appendix B - North Fork, South Fork and Eagle Creek Photos

Figure B 1. Eagle Creek Gage (November 2010)

Figure B 2. North Fork Gage (November 2010)

Figure B 3. South Fork Gage (November 2010)

Figure B 4. North Fork Eagle Creek (during wet spring of 2008)

Figure B 5. North Fork Eagle Creek along road (November 2010)

Figure B 6. Eagle Creek near Eagle Creek gage – dry conditions versus wet conditions (courtesy of USGS: left picture was taken by Nathan Myers on May 30, 2006, and right picture was taken by Nathan Myers on September 28, 2006).

Figure B 7. Confluence of South Fork and North Eagle Creek (November 2010)

Figure B 8. North Fork Eagle Creek lower end (November 2010)

Figure B 9. North Fork Eagle Creek upstream of the North Fork wells (Nov 2010)

Figure B 10. North Fork Eagle Creek upstream from the North Fork wells (Nov 2010)

Figure B 11. Eagle Creek diversion dam downstream of Eagle Creek gage (Nov 2010)

Figure B 12. Eagle Creek downstream of diversion dam (November 2010)

Figure B 13. Eagle Creek downstream of Alto Lake (November 2010)

Figure B 14. North Fork Well 3 (August 2011)

Figure B 15. North Fork Well 4 (November 2010)

Figure B 16. North Fork Well 1 (November 2010)

Appendix C – Summary of Public Comments Received Since 2012 DEIS

Introduction

We (USDA Forest Service, Lincoln National Forest) released the North Fork Eagle Creek Wells Special Use Authorization Project Draft Environmental Impact Statement (DEIS) on May 25, 2012. The notification of its availability for public comment was published in the Federal Register, a legal notice was published in the Ruidoso News, and email and letter notifications were distributed to all those on the project mailing list. Comments were requested by July 9, 2012. We received several requests for extensions to the comment period and Forest Supervisor Trujillo granted an additional 60-day extension, requesting all comments be submitted no later than September 9, 2012.

The Little Bear Fire started on June 4, 2012 and encompassed approximately 98 percent of the project area. Because of the substantial impact this wildfire had on the project area analyzed in the DEIS, Forest Supervisor Trujillo decided to stop the comment period on the DEIS and begin the process to prepare a supplemental DEIS (SDEIS) that would address the changed conditions in the project area. This was published in the Federal Register on July 20, 2012. While we discontinued the formal comment period on the DEIS, we did invite any comments on the changed conditions in the project area by September 7, 2012.

This document includes a summary of the comments that were received and how they are being used in preparation of the Supplemental Information Report and the SDEIS.

We also received comments from primary stakeholders in 2014 while developing this SDEIS and these comments are summarized here as well.

DEIS Commenters

The following table includes all comments (email, letters, or phone calls) that were either received on the DEIS before the suspension of the comment period, or on the request for information on changed conditions due to the Little Bear Fire, or during subsequent stakeholder coordination efforts in 2014 while preparing this SDEIS.

Table C 1. Listing of comments that were received on the DEIS or on the request for information on changed conditions in the North Fork Eagle Creek Project Area

Number	Date	Name	Affiliation	Type
1	June 1, 2012	Ray Alborn, Mayor	Village of Ruidoso	Request for comment period extension
2	June 12, 2012	Todd Willens, Chief of Staff	Congressman Stevan Pearce	Request for comment period extension
3	June 13, 2012	Steven Sugarman, Attorney	Eagle Creek Conservation Association	Request for comment period extension
4	June 20, 2013	Alan Cuddy, Hydrology Bureau	Office of the State Engineer	Information Request
5	June 22, 2012	Ray Alborn, Mayor	Village of Ruidoso	Request for supplemental DEIS preparation

Number	Date	Name	Affiliation	Type
6	June 25, 2012	Ann Marie Matherne	United States Geological Survey	Phone call record – monitoring well vandalized
7	July 2, 2012	Deborah Rehfeld		DEIS comment
8	July 3, 2012	Scott Verhines, New Mexico State Engineer	Office of the State Engineer	Request for supplemental DEIS preparation
9	July 4, 2012	Jean Public		DEIS comments
10	July 5, 2012	Rhonda Smith, Chief, Office of Planning and Compliance	Environmental Protection Agency	DEIS comments
11	July 9, 2012	Ray Alborn, Mayor	Village of Ruidoso	Supporting information (Daniel B. Stephans and Associates, Inc) submitted - request for supplemental DEIS preparation
12	July 12, 2012	Meeting between Lincoln NF and Eagle Creek Conservation Association members	Meeting notes	DEIS comments and project status update
13	August 29, 2012	Jackie D. Atkins, PE, Atkins Engineering	Consultant for Village of Ruidoso	Comments on Changed Conditions
14	August 30, 2012	Don Stockstill, President and others	Eagle Creek Conservation Association	DEIS comments
15	September 4, 2012	Stephan Spencer, Regional Environmental Officer	USDI Office of Environmental Policy and Compliance	DEIS review – no comments
16	September 6, 2012	Paul Cassidy, Aquatic Consultants, Inc.	Consultants for the Village of Ruidoso	Comments on changed conditions
17	September 6, 2012	Roger Peery, John Shomaker & Associates, Inc.	Consultants for the Village of Ruidoso	Comments on changed conditions (also includes review of the WHAT modeling technique)
18	September 17, 2012	Steven Sugarman, Attorney	Attorney for Eagle Creek Conservation Association	Comments from Balleau Groundwater, Inc. (consultants to Eagle Creek Conservation Association) on DEIS and on changed conditions
19	September 12, 2012	Alvin Jones, Attorney	Attorney for Village of Ruidoso	Comments from Parametrix, Inc. (consultants to Village of Ruidoso) on DEIS and changed conditions

Comments Received in 2014

We received input from Balleau Groundwater, Inc. in May and June 2014; Village of Ruidoso (with attached written comments from Alvin Jones, Atkins Engineering Associates, and John Shomaker and Associates, Inc.) in June 2014; and U.S. Geological Survey in June 2014 in relation to the preparation of the SDEIS. These comments were shared with the Interdisciplinary Team, discussed at an Interdisciplinary Team meeting on July 30, and considered while preparing this document.

Comment Consideration

We reviewed each comment letter and categorized them into subjects, highlighting the overall key concern, issue or suggestion made, as shown below. We paid particular attention to those comments that suggested new alternatives or provided specific comments on the existing range of alternatives presented in the DEIS. We provided all original letters to all members of the interdisciplinary team so each resource specialist could review comments related to their particular analysis and use them in preparation of their revised analyses for the supplemental DEIS. Each specialist paid particular attention to comments on changed conditions so these could be used in preparation of revised existing condition analyses in the project area following the wildfire.

Because we will be providing the supplemental DEIS to all stakeholders and those on our project mailing list (including all those listed here who commented on the DEIS or provided comments on changed conditions), we did not go through the detailed process of coding each of these 19 letters to identify each individual comment/concern with a detailed response. We will however, use this more structured and detailed process following the comment period on the SDEIS and prior to preparation of the Final EIS and the draft Record of Decision.

Comment Summary

Comments on the DEIS

Background

1. Acknowledge that the Eagle Creek gage used to be located approximately 360 feet downstream from its present location and this has an impact on the pre- and post-pumping comparisons on streamflow.

Purpose and Need

1. The SDEIS should include a revised purpose and need for action; the existing one is not sufficiently defined to determine the degree to which any of the alternatives would meet it. The SDEIS should include a valid and sufficient case for the proposed action, since the existing DEIS does not do this.
2. The management objectives should be reconsidered. The first objective, “Recognizing the importance of the well field to municipal water supply by providing water to the applicant…”, is flawed, subjective, and carried greater weight during the analysis than the second objective, “minimizing impacts of groundwater drawdown…and protecting water dependent ecosystems.”
3. The need statement related to the contribution of the North Fork wells to municipal water supply is overstated.

Alternatives and Adaptive Management Strategies

1. The SDEIS must include a presentation of effects as a difference from the baseline involving no continued pumping. The baseline used (current condition following 25 years of pumping) is not valid.
2. The SDEIS should acknowledge that the proposed alternative 3 would severely reduce streamflow and lower groundwater. It is misleading to state otherwise. It does not contain an effective adaptive management strategy.
3. Alternative 3 should not be selected; it will not result in improved flow.
4. Eagle Creek gage data should not be used in any adaptive management strategy.
5. Provide scientific credibility for use of average depth to water as a trigger and that this results in a cone of depression from pumping.
6. Consider clear the land through thinning to help improve the water table.
7. Consider that the proposed action did not line up with specialist reports and scientific evidence with some evidence being dismissed.
8. Consider our previous comments on the threshold triggers under the adaptive management strategy – these comments were dismissed by the ID team without rigorous review and without scientific basis.
9. The SDEIS should not characterize the continuation of current well pumping as a ‘no action’ alternative; this is not legally a no-action alternative and distorts the analysis.
10. The SDEIS should not include use of the Eagle Creek gauge as a proxy for North Fork flows. This is a flawed assumption since this gauge reflects flow in the North and South Forks.
11. The SDEIS should consider in detail alternatives on non-Forest Service land and outside the North Fork watershed.
12. The SDEIS should include a revised adaptive management strategy that monitors bedrock saturation (not depth to groundwater) and ensures a more immediate response time between a discontinuation of pumping and amelioration of the adverse impacts associated with pumping.
13. The SDEIS should include a revised adaptive management approach that is based on the model provided to the Forest Service that quantifies the relationship between pumping and streamflow.
14. The SDEIS should be based on the results of the aquifer tests described in the adaptive management strategy so that the results can be used in modeling the permeability of the alluvial underflow. The deeper zone bedrock aquifer tests called for by Forest Service are less pertinent.
15. The Forest Service should solicit the comments from the U.S. Geological Survey on the adaptive management strategy, particularly the use of the 300 acre-feet per year threshold. There can be no confidence that 300 acre-feet per year is stable or sustainable by simple comparison to recharge amounts.
16. The preferred Alternative 3 from the DEIS was flawed for a number of reasons including the fact that the adverse impacts on surface and groundwater resources that resulted from increased vegetation density in the North and South Forks of Eagle Creek were not considered. The DEIS and supporting documents wrongly assumed that all adverse impacts to surfacewater flow were the result of the applicant's pumping.

17. The alternatives must also consider future USDA Forest Service actions needed to keep the forest watershed healthy by managing vegetation density and fuels that will in tum maintain favorable supplies of water.
18. Discard adaptive management and propose a modeled level of impact acceptable to Forest Service.
19. Remove trigger 1 since it would establish a minimum instream flow which the USDA Forest Service has no authority to do in New Mexico.
20. Remove or change trigger 3 related to riparian vegetation. Reductions in pumping have been shown to have no effect on alluvial water levels.
21. The SDEIS should consider stream augmentation (at least a pilot program as part of the Special Use Permit) and correct errors in the discussion of the National Pollutant Discharge Elimination System permit process in chapter 2.
22. The SDEIS should remove the discussion of added storage capacity since it was done incorrectly.
23. Remove reference to Monitoring Wells MW4-B and C. This is the well that was vandalized. Both well casings were filled with gravel and fence posts. Some efforts were made to recover the wells, but this wasn't successful, so these wells are no longer operational.
24. The SDEIS should consider in detail the Eagle Creek Conservation Association-suggested alternative that allows the Village of Ruidoso to operate the North Fork pumps when the bedrock in the streambed is fully saturated:
    - Install new gage on North Fork Eagle Creek above the confluence with South Fork Eagle Creek
    - Install electronic monitoring switches on pumps and gages
    - Establish a minimum instream flow (we suggest 1.2 cubic feet per second based on the U.S. Geological Survey study)
        - When flows are below the minimum instream flow measured at the new gage, stop pumping (the switches on the pumps will automatically shut off)
        - When flow is greater than the minimum instream flow, continue pumping
    - Add storage capacity to the system so that more water can be pumped and stored during high flows
    - Authorize for a 10-year permit term with options for renewal
25. The SDEIS should include an analysis of this alternative:
    - Allow the Village of Ruidoso to pump up to 70 percent of the annual quantity of groundwater recharge that will occur post-wildfire. The calculation of groundwater recharge must not be performed using the chloride mass-balance method, nor be based on the hydrophobic soil conditions that will exist for the several years. This is essentially the same percentage of recharge that the USDA Forest Service selected for its preferred Alternate 3 using the low-end recharge value calculated using the chloride mass-balance method as previous described.
    - Monitoring would include streamflow, groundwater levels, surface-water quality, and riparian vegetation as provided below.
    - Monitor groundwater levels in North Fork monitoring wells MW-1A, MW-1B, MW-1C, MW-3A, and MW-5A, and North Fork production wells H-1979 (North Fork 1), H-1981 (North Fork 3), and H-1982 (North Fork 4). Modifications will need to be made to North Fork production wells to allow water levels to be collected.

  - Monitoring frequency: hourly
  - Reporting frequency: quarterly
- Monitor streamflow at North Fork Eagle Creek gage (08387550), South Fork Eagle Creek gage (08387575), and Eagle Creek below South Fork (08387600).
  - Monitoring frequency: real time data as currently performed by U.S. Geological Survey
  - Reporting frequency: as currently provided on U.S. Geological Survey website
- Monitor surface-water quality above and below the cabins upstream of the North Fork Well field.
  - Monitoring frequency: annually
  - Reporting frequency: annually
- Monitor riparian vegetation survey in the historically intermittent reach below the cabins.
  - Monitoring frequency: every 5 years
  - Reporting frequency: every 5 years

Analysis

General

1. Too many assumptions and much of the analyses were based on qualitative evidence and opinions rather than quantitative scientific evidence. Modeling should be used to predict impact of alternatives.
2. The SDEIS should include larger project areas for both direct and indirect impacts and cumulative impacts. Those identified in the DEIS are too small and incorrectly drawn to account for where effects would be noticed. The cumulative effects study area must be revised to extend much farther east, at least to Picacho and Snowy River Cave BLM land, than shown on DEIS Figure 4.
3. The SDEIS must be based on the best available scientific data and all available credible science.
4. The EIS should be revised to follow the guidance of the best modern science and to become more quantitative by using a model simulation acceptable to Forest Service as recommended by U.S. Geological Survey and directed in the Forest Service Manual.
5. A proper impact analysis must isolate the action effects from the baseline of “no action conditions”. Climate change is not part of the impacts of the Forest Service action, and should not be presented in the section on environmental consequences of “action” effects.
6. The SDEIS should not include any conclusions drawn from the effects of future climate changes related to pumping and riparian vegetation; they are not well understood.
7. Remove discussion of climate change as a consequence of each alternative, and put a discussion in the baseline description of future conditions unaltered by Forest Service action. State the allowance in changed aquifer water levels and stream flow that will be acceptable to Forest Service for this special use.
8. Follow CFR and FSM on treatment of incomplete and unavailable information including evidence that contraindicates the proposed action.

Hydrology

1. Acknowledge that bedrock is dry due to the cone of depression.
2. Acknowledge that the North Fork Eagle Creek remains dry most of the time and that it is the only dry stream in Lincoln County, most of the time.
3. Provide for the protection of water sources for wildlife.
4. Correlate depth to water in National Forest System lands wells with the day of no flow in North Fork Eagle Creek.
5. Quantify available stream flow for use by the Village of Ruidoso.
6. Acknowledge the requirement for saturated bedrock as a prerequisite for surface flow.
7. Acknowledge that absence of flow in North Fork Eagle Creek results in no contribution to the flow measured at the Eagle Creek gage.
8. Complete additional hydrologic analyses including calculating “dry days” for the last 10 years (this information is documented but not previously reported) and if possible, determined how long artesian flows last.
9. The SDEIS should include revised Tables 2 and 11 with added columns showing the net change in available water among the alternatives. Available models have better numbers and quantify the transition from aquifer storage to stream depletion sources supplying the well field.
10. The SDEIS should include updated references to the most current version of the U.S. Geological Survey report. The DEIS must be revised to cite the correct U.S. Geological Survey report version. Any climate-change findings that depend on that out-of-date version must be reconsidered and rewritten.
11. The SDEIS should be based on controlled testing, quantitative modeling and priority analysis, as required by Forest Service Manual Guidance. Modeling results are available and should be used.
12. The SDEIS should include a revised Figure 4 showing the greater extent of modeled groundwater drawdown; the existing figure is not based on all data and modeling provided to the Forest Service by Balleau Groundwater, Inc.
13. The SDEIS should contain actual historic flow data for North Fork and available modeling data. It should be based on efforts to characterize actual flow in the North Fork, a central issue in the settlement agreement.
14. The SDEIS should not focus exclusively on the upstream direct impacts of the proposed project and should address the direct impacts downstream, as required in the settlement agreement.
15. The SDEIS should not conclude that the cone of depression caused by pumping has anything to do with the lack of riparian species recruitment; there may be a number of reasons unrelated to pumping.
16. The historic and current condition of the South Fork of Eagle Creek is also important to consider because surface-water flow was perennial in 1963 (U.S. Geological Survey 1963), but was not during the time the DEIS was being prepared.
17. The failure to assess the adverse impacts on watershed basin yield from increased vegetation in the North and South Fork Eagle Creek watersheds was arbitrary, and unfortunately led U.S. Geological Survey to develop alternative 3 of the DEIS, which was based on the premise that the watershed remains static, with the exception of pumping from the Village of Ruidoso’s wells.

18. Use of the Web GIS-Based Hydrograph Analysis Tool (WHAT) model as part of the hydraulic analysis for the DEIS was inappropriate.
19. The watershed conditions as classified by the USDA Forest Service "Watershed Condition Framework" and as included in the DEIS are no longer valid as a result of the Little Bear Fire. In fact, the watershed was impaired prior to the development of the DEIS as a result of the USDA Forest Service fire exclusion policy and the USDA Forest Service exclusion of thinning or timber harvesting projects.
20. Calculations of pumping drawdown from the applicant's wells and impacts on springs and seeps must be updated to include changes in the watershed basin yield. Drawdown impacts will ultimately be reduced as a result of increased basin yield (surface-water flow and groundwater recharge).
21. For the Supplemental Information Report and SDEIS, any model used to simulate effects from pumping the Village of Ruidoso's wells must developed to address the inadequacies of the existing Balleau model (2004) as identified by AECOM (2015). Additionally, a new model must take into account dynamic recharge to the groundwater system including leakage from the ephemeral channel of the North Fork of Eagle Creek to the well field area, and increased surface-water flows and increased recharge that will occur as a result of the Little Bear Fire. This modeling can be readily accomplished using the MODFLOW code that is readily available and commonly used by hydrologists and hydro geologists.
22. The trade-off of reduced diversions from North Fork wells and increased diversions from Eagle Creek surface water should be recognized.
23. Use a quantitative model to evaluate hydrologic conditions and changes in terms of projected volumes and rates due to the special use authorization. Discard the discussion of subjective qualitative effects.
24. Describe quantitatively the projected effects on downstream well and surface water rights due to the special use authorization.
25. Complete the field tests of alluvial aquifer permeability as a basis for quantifying flow to be routed via that material, expected to be a minor fraction of 1.2 cubic feet per second.
26. Discard the discredited idea that pumping a certain fraction of basin recharge is a “safe starting-point” in terms of drawdown and stream depletion.
27. Correct erroneous numbers on diversions, worst case scenarios, commitment of resources, and misstatements of the content of Balleau Groundwater references.
28. Remove reliance of the Balleau-modeled draw down contour for determining which springs and seeps may be affected

Wildlife and Aquatic Habitats

1. The SDEIS should acknowledge our specific review comments on the aquatic habitat section and the biological analysis (Letter 16, Aquatic Consultants, Inc.). Monitoring parameters on post wildfire perennial systems in the southwest (e.g., precipitation, stream profile, runoff, suspended sediment, water temperature, and pH) are long term in nature (up to ten years), and typically compiled to determined when systems can be re-populated. Aquatic Consultants, Inc. believes that these parameters can only be applied to perennial stream systems and any management triggers associated with the SDEIS should only be applied to perennial waters as intermittent waters are not viable fisheries.

2. Omit fish from the list of significant issues since pre-pumping conditions would not support fish due to the intermittent nature of the stream.

Riparian

1. The SDEIS should not be based on the assumption that pumping at current levels will result in a reduction of vegetation cover and species diversity; there is no evidence to support this. The existing record of pumping over the last 25 years has demonstrated conclusively that current pumping levels have not adversely affected riparian vegetation in the project area.
2. The SDEIS should not be based on any connections between riparian vegetation and pumping from the well field until this connection is firmly established. This can only be done with a multi-year survey that establishes baseline conditions of the riparian habitat in the project area, but also demonstrates measurable trends in vegetation density and diversity that correlate to annual pumping volumes.
3. The USDA Forest Service was asked to address the rooting depths of riparian vegetation adjacent to the intermittent and perennially portions of the North Fork Eagle Creek, vegetation need and timing for soil moisture, minimum groundwater depth for plant survival, and any other specific requirements needed for the survival of the riparian vegetation along the stream channel. The Supplemental Information Report and the SDEIS need to include all of the aforementioned specific requirements needed for riparian vegetation. Presumably the USDA Forest Service would have a qualified expert to provide this information. The Supplemental Information Report and SDEIS should note that after more than 20 years of pumping from the applicant's North Fork Eagle Creek wells that no adverse impacts to riparian vegetation were documented.

Socioeconomics & Water Rights

1. The SDEIS water rights analysis should be expanded to the area of cumulative impact seen in approved models in terms of drawdown contours and stream depletion, at least to the stream reach of plaintiff's diversions at Picacho. A priority analysis of impacts on all senior water users, plus effects on the Pecos River Compact, due to Forest Service authorizing access to the conditional junior-most right on the Rio Hondo must be included.
2. The SDEIS must address the impacts on the Gerald Ford and Eagle Creek Conservation Association concerns about comprehensive rights.
3. The SDEIS should not understate the significance of adverse environmental and socioeconomic impacts and overstate the impacts on water supply and only selectively uses credible science.
4. The SDEIS needs to evaluate effects to environmental resources as well as senior water rights holders, and make distinctions between junior and senior water rights holders. This should be abdicated to the Office of the State Engineer.
5. The SDEIS should consider impacts to irrigation water supply.
6. The Supplemental Information Report and SDEIS must evaluate existing water rights and existing wells in more detail if the SDEIS intends to continue to address potential impacts from the applicant's wells in the cumulative impacts area outside of National Forest System lands. As previously mentioned by John Shomaker and Associates, Inc. and the applicant to the USDA Forest Service, most of these data are readily available at the New Mexico Office of the State Engineer website http://www.ose.state.nm.us/.
7. The SDEIS should correct errors in the reported current water right for the Village of Ruidoso.

8. The Forest Service, through the SDEIS should not establish a minimum instream flow because this is under the jurisdiction of the New Mexico State Engineer.
9. The SDEIS should not include an analysis of impacts to domestic wells since no data have been assembled or correlated, they are junior water rights holders.
10. The SDEIS should remove reference to streamside recreational use as a significant issue.

Comments on Changed Conditions

Resource Analysis

1. The Little Bear Fire has clearly altered the surface hydrology of the North Fork Eagle Creek basin, and to the extent surface hydrology is connected to groundwater hydrology, also altered the groundwater hydrology.
2. The effects of the Little Bear Fire are likely to further complicate the natural hydrological processes in the North Fork Eagle Creek basin, and therefore, further diminish the validity and usefulness of the DEIS.
3. The effects of the Little Bear Fire will make it nearly impossible to interpret the cause of near-term effects to riparian vegetation in the project area if changes are made to pumping levels during the next five to ten years. This is particularly true since no other sufficiently similar riparian habitats were found in the region to use as a reference or control.
4. The effects of the Little Bear Fire will result in reduced actual evapotranspiration from moist soil and from the riparian shallow water table. An increase in basin yield via surface runoff and water-table recharge is expected for the period until vegetation recovers to evapotranspiration levels associated with normal canopy volume.
5. The effects of the Little Bear Fire will include an increase in burn-associated ash and sediment that can affect surface diversions and reservoirs. Fire effects on the applicant, however, are relatively short-term and are not a suitable basis for deciding on this long-term special use authorization.
6. Adverse impacts the wildfire has had on the applicant's ability to use its surface water and groundwater. The applicant's ability to exercise its surface-water rights has been adversely impacted as a result of the wildfire and the applicant must rely more heavily on its groundwater wells, both on and off National Forest System lands, to meet the demands of the community. These alternatives must account for the changes that will continue to occur in the watershed as the watershed begins to stabilize.
7. The Little Bear Fire destroyed a significant amount of the vegetation in the North and South Fork watersheds of Eagle Creek.
8. It is well documented that surface-water runoff and soil erosion dramatically increase after a wildfire such as the Little Bear Fire (DeBano et al., 1998; USDA, March 2003; USDA, 2005; Tillery et al., 2011; USDA Forest Service, 2012; Moody and Martin, 2004). USDA Forest Service BAER Team (2012) estimates a surface-water increase of 128 percent for the upper portion of the North Fork of Eagle Creek, and a 70- to 80-percent increase in runoff near the Eagle Lakes on the South Fork of Eagle Creek assuming only a 25-year 1-hour storm event. Runoff estimates in the lower portions of the watersheds below these points were not provided by the BAER Team (USDA Forest Service 2012).
9. Surface-water quality has been impaired due to the production of large quantities of ash and sediment (USDA Forest Service, 2012), and other constituents. The BAER Team report (USDA

Forest Service, 2012) estimated a pre-wildfire soil erosion rate of 1 ton per acre and that the post-wildfire soil erosion will be up to 97 tons per acre.

10. The BAER Team (USDA Forest Service, 2012) indicates that geologic conditions within the burned area have already experienced changes. Changes identified (USDA Forest Service, 2012) include "gravitational slumping, soil movement, rock falls, and debris/mud flows." The BAER Team report (USDA Forest Service, 2012) also indicates that many areas are in jeopardy of mass wasting as indicated below. Areas within the North and South Forks of Eagle Creek are within the "cited areas" mentioned below.
11. The BAER Team report (USDA Forest Service, 2012) indicates significant risks are expected to riparian habitat including vegetation and channel morphology. The report also indicates that warming of the surface waters as a result of the loss of shade along the creek will have adverse "impacts to or loss of aquatic habitat for fish and macro-invertebrates."
12. The BAER Team report (USDA Forest Service, 2012) also indicates that there may be adverse impacts to wildlife, fish, and the habitat which the Threatened (Mexican Spotted Owl) and Sensitive (Northern goshawk and bald eagle) species rely upon.
13. The Supplemental Information Report and SDEIS must consider the effects of the fire on springs and seeps.
14. The cumulative effects from pumping the applicant's North Fork Well field are clearly masked by the cumulative effects of the Little Bear Fire. The Supplemental Information Report and SDEIS should acknowledge this fact and clearly define the cumulative effects of the fire on the North and South Fork watersheds and downstream users so that the effects from the wildfire can be analyzed separately from the applicant's pumping. The cumulative effects analysis should clearly document the wildfire impacts on the applicant's surface and groundwater supplies in the Eagle Creek basin and the adverse impacts on the applicant's right to put its surface and groundwater rights to beneficial use.
15. Aquatic Consultants, Inc. would suspect that the brook trout population has been eradicated, or will be shortly, in the creek due mainly to the ash, sediment loads, and debris torrents from post fire flood events. Based on Aquatic Consultants, Inc. study of post fire effects to fish and fish habitats in New Mexico, we believe that the majority of these same effects will be experienced in the North Fork Eagle Creek.
16. The monthly calibrated Balleau Groundwater model remains available for use as offered in 2011. It is suitable for simulating watershed burn scenario
17. The water resource analysis should be updated since accessible available quantities of water changed.
    - Estimated duration of no flow conditions at Eagle Creek Gage changed.
    - Estimated occurrence of flows equal to or greater than 1.2 cubic feet per second at Eagle Creek Gage changed.
    - Water quality based on temperature: Anticipated occurrence of periods when midday streamflow temperatures during May-October would exceed 68 degrees Fahrenheit at the Eagle Creek Gage would change.
    - Impacts (if any) to springs, seeps and domestic wells based on drawdown would change.
    - Cumulative effects within the cumulative impact area would change.

18. The aquatic habitat and fish analysis should be updated since increased basin yield and recharge would result in changes in drawdown and less adverse effects to the water table and to streamflow conditions, resulting in less impact on aquatic habitat and fish.
19. The riparian vegetation analysis should be updated since increased streamflow as a result of increased basin yield would result in fewer impacts to riparian vegetation along the stream corridor.
20. The socioeconomics analysis should be updated because municipal diversions could possibly be substantially increased as a result of increased basin yield. The section of the EIS predicting future municipal water diversions availability based on the past streamflow gage data would be completely out of date and not applicable.
21. The water right analysis should be updated. Due to increased basin yield the Village of Ruidoso should be able to divert more municipal water for beneficial use. The increase in basin yield and increase in recharge is not predictable from the past Eagle Creek Gage data due to the changed evapotranspiration rates and could not be finally determined until the North Fork of Eagle Creek drainage area conditions stabilized after a number of years.
22. Due to the dynamic and changing nature of the basin yield, recharge and stream runoff and base flow conditions during the initial unstable condition in the North Fork drainage area, no realistic predictions can be made until the drainage area becomes somewhat stable. The time frame for evaluation of the changed water resources conditions necessary for the supplemental DEIS would need to extend into the final more stable conditions of basin yield and recharge/discharge conditions for the North Fork of Eagle Creek drainage area. Therefore, all of the other contemplated re-analysis of resources reports would also need to wait until the water resources report update in the future.

Purpose and Need & Alternatives

1. Given the changes in the watershed, the USDA Forest Service should eliminate existing Alternative 3 and develop new alternatives. As will be explained in more detail below, the management triggers (monitoring indicators) developed by the USDA Forest Service as part of Alternative 3 that would be used to limit pumping from the Village's North Fork well field are no longer applicable.
2. Nearly all aspects of the current DEIS need to be updated because of fire-related damage to the watershed.
3. The Supplemental Information Report and SDEIS must consider post-wildfire changes to streamflow quantity, and the fact that streamflow will continue to change as vegetation is re-established in the watershed. Changes in the streamflow will include initial quick peak flow responses to precipitation events (including flash flooding) with little baseflow for a period of time following the wildfire, and in fact, this has already occurred. The Supplemental Information Report and SDEIS must consider streamflow changes over time as the watershed begins to stabilize. Any alternative that uses minimum streamflow conditions as management triggers as a rationale to reduce the applicant's pumping are not appropriate until such time that watershed conditions stabilize and post-wildfire streamflow conditions can be evaluated.
4. The stream gauges are no longer reliable. The fact that the gages have not accurately represented streamflow in the Eagle Creek watershed must be taken into consideration as alternatives and associated management triggers are developed for the SDEIS.
5. Any comparisons to groundwater and surface-water conditions before pumping began in 1988 are now irrelevant. This is because the watershed has been severely altered by the Little Bear Fire and

surface-water runoff and groundwater recharge will be vastly different than prior to the fire. As previously mentioned, it will take years before hydraulic conditions in the watershed begin to stabilize. The Supplemental Information Report and SDEIS will need to acknowledge this fact and develop other methods for assessing current and future conditions as mentioned in previous sections of this letter. Any triggers related to streamflow quantity or groundwater depths are inappropriate at this time.

6. Surface water temperatures proposed in the Draft EIS are no longer valid and must be reevaluated.
7. Surface water quality has been negatively impacted by the ash and increased sediment load (turbidity).
8. The post-wildfire impacts to water quality, including increased water temperatures, sediment load, ash, and other contaminants will adversely affect their ability to survive. The SIR and SDEIS must address these issues. Any management triggers related to water quality and water temperature must be removed from the SDEIS.
9. The purpose and need for action should be revised or changed based on the effects of the Little Bear Fire.
10. Monitoring parameters on post wildfire perennial systems in the southwest (e.g., precipitation, stream profile, runoff, suspended sediment, water temperature, and pH) are long term in nature (up to ten years), and typically compiled to determined when systems can be re-populated. Aquatic Consultants, Inc. believes that these parameters can only be applied to perennial stream systems and any management triggers associated with the SDEIS should only be applied to perennial waters as intermittent waters are not viable fisheries.

References Provided

Harris and Lindquist 2000. Harris, Richard R. and Donna Lindquist, Riparian vegetation establishment and survival on Caples Creek and Kirkwood Creek, Summer, 2000, October, 2000, online URL: http://www.project184.org/doc_lib/documents/2011/RVRMP-FINAL.pdf

BGW groundwater flow model files, with explanations, provided to the Forest Service in 2011

USGS Report Revision History from 2010

FSM 2540

Multiple references cited in Comment Letter 17 (Shomaker and Associates)

New Mexico Fish and Game Department fish stocking report data

2001 – 2012 North Fork Well production records with percent of total diversion

Revised State Engineer List of Rio Hondo-Bonito-Ruidoso Stream Surface Water Right Priorities (1987)

The interdisciplinary team used all of these comment letters, cited literature, and this summary provided here as important information in preparing the Supplemental Information Report (January 2014), revising individual resource reports and preparing the SDEIS. Meetings with both the Village of Ruidoso and Eagle Creek Conservation Association representatives continue to discuss overall project status and to gather any additional data or information they may be aware of that would inform our analysis in the SDEIS.

Next Steps

Once the SDEIS is released for the 45-day public comment period (expected fall 2014) and all comments are received, we will conduct a thorough comment analysis process at that time, coding, categorizing and providing a written response to all individual comments received by the end of the comment period. These comments will be used in preparation of the Final EIS and the draft Record of Decision. We anticipate continued contact and communication with project stakeholders throughout this process as the SDEIS and then the subsequent FEIS are prepared.

Appendix D – Photos of Post-Little Bear Fire Conditions

Figure D 1. The crossing of the North Fork of Eagle Creek near monitoring well MW-1 looking north (August 22, 2012)

Figure D 2. Just south of the North Fork crossing, above the North Fork gage, looking southeast (August 22, 2012)

Figure D 3. Looking southeast to the North Fork crossing upstream of the North Fork gage (August 22, 2012)

Figure D 4. View to the northeast of the North Fork, above the North Fork gage - the view is of debris in an unnamed drainage (August 22, 2012)

Appendix E – Forest Service Response to Public Comments on the Supplemental Draft Environmental Impact Statement

Introduction

We (USDA Forest Service, Lincoln National Forest) released the North Fork Eagle Creek Wells Special Use Authorization Project Supplemental Draft Environmental Impact Statement (SDEIS) on November 14, 2014. The notification of its availability for public comment was published in the Federal Register, a legal notice was published in the Ruidoso News, and email and letter notifications were distributed to all those on the project mailing list. Comments were requested within 45 days. We received several requests for extensions to the comment period and Forest Supervisor Moseley granted two additional 15-day extensions, requesting all comments be submitted no later than January 28, 2015.

We received 23 responses during the 75-day public comment period for the SDEIS. All of the comments received were analyzed in detail. We coded and categorized all of the comments in these letters. This appendix includes a summary of all comments received and the Forest Service response. Table 20 lists the commenters by individual letter number and table 21 lists each of the individual comments associated with each letter and the Forest Service response, indicating how they were used to prepare this Final Environment Impact Statement (FEIS). The number in the first column of table 21 is the letter number, which corresponds to the letter number in table 20. The number in the second column of table 21 identifies the individual comments within each of the 23 letters received. There were a total of 309 individual comments within the 23 total submissions. The quantity of individual comments within each letter is shown in table 20.

SDEIS Commenters

The following table includes all comments (email, letters, electronic submissions, faxes) that were received on the SDEIS during the comment period.

Table 20. Listing of comments that were received on the SDEIS

Letter No.	Last Name	First Name	Organization	Quantity of Comments within Letters
1, 14	Balleau	Peter	Balleau Groundwater, Inc.	6
2, 16	Sugarman	Steven		18
3	Blaine	Tom	Office of the State Engineer	5
4, 12	Midkiff	William		23
5	Pearce	Stevan	Congress	6
6	Public	Jean		4
7	Stucky	Marie	Environmental Protection Agency	5
8	Battin	Tom	Village of Ruidoso	5
9	Loera	Javier	Ysleta del Sur Pueblo	1
10, 11, 20	Keus	Ab	Eagle Creek Conservation Association	12
13	Cassidy	Paul	Aquatic Consultants, Inc.	11
15	Spencer	Stephen	U. S. Department of the Interior	1

Letter No.	Last Name	First Name	Organization	Quantity of Comments within Letters
17	Johnson	Laura	Upper Hondo Soil & Water Conservation District	7
18	Taylor	Clark		22
19	Johnson	Bob		1
21, 23	Jones Sharp	Alvin Susie	Hennighausen & Olsen, L.L.P	171
22	Linden	Chris	State of New Mexico	11
Total: 23				Total: 309

Response to Comments

Table 21. Public comments on the SDEIS and Forest Service Responses

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
12	5	Adaptive Management	The USFS adaptive management program proposes to monitor conditions in the North Fork utilizing the EC gage that only receives flow from the South Fork, most of the time. The USFS has refused to document each day that the North Fork is dry, which is most of the time. **Response:** The proposed adaptive management strategy under Alternative 3 would use several additional monitoring measurement locations besides the Eagle Creek confluence gage. This is described in Table 2 of the EIS, and in the Monitoring Measures section of the Water Resources Report. The EIS compares a discontinuation of pumping (Alternative 2) to continuing historic pumping (Alternative 1) to the adaptive management strategy as part of Alternative 3. The water resources analysis compares no-pumping and pumping conditions, generally using long-term pre-fire data. This was done to reduce the influence of other less-defined watershed and climatic variables that are more significant over short periods. The South Fork gage only began operation in late 2007; those flows were not measured for equivalent comparisons in the pre-pumping period. The relationship between South Fork gage data and Eagle Creek confluence data is not consistently defined; this is also true during the shorter no-pumping periods in the recent record. The USFS has not refused to document each day that the North Fork is dry; that information is based on available data. Pre-fire flow comparisons (such as Table 7 in the Water Resources Report) include no-flow days, flow-frequency analyses, and others. Post-fire flow comparisons in the EIS are necessarily qualitative due to the altered watershed, channel, and gaging conditions and the relatively short time since the fire. See also response to letter 12, comment 12

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
12	13	Adaptive Management	Rejecting influence from Clark Taylor and Richard Carlson, the USFS has dragged out a million dollar EIS study for ten years, focusing on a pre- determined outcome, to justify the issuance of a virtually unchanged SUP and to add an administrative layer called "adaptive management" that does not contribute to the health of the North Fork. **Response:** The Forest Service has worked through a broad spectrum of alternatives, data, and information, and considered extensive public input throughout the EIS process. The agency has not yet made any decisions. Three alternatives are analyzed in detail in the EIS and were developed to address the purpose and need for action, project objectives, and significant issues. These are described in chapter 1 of the EIS and include protecting natural resources. The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions.
14	1	Adaptive Management	I have another point to raise for clarification, which is the role of the cumulative pumping volumes at 900AF over the first 3 years as an adaptive management trigger. The text initially describes this on page 32 as a firm trigger that "would trigger a review of thresholds and mitigation...", but later at page 182 it is stated that "there may be further reductions based on cumulative pumping volumes". Please confirm for me in the response to this comment that the 900AF volumetric trigger is a definite requirement for examination in the fourth year of the permit and subsequently, not a conditional, optional or an alternative trigger that 'may' or may not be applied. The complete set of hydrologic comments provided to USFS on this action have been based on the expectation of the volumetric pumping limit being applied. That trigger should not be relaxed at the late stage of permitting. **Response:** The cumulative pumping volume trigger proposed as part of Alternative 3 would be a definite adaptive management tool under that alternative, as described on page 32 of the SDEIS [Well Pumping Volumes under Adaptive Management Triggers (Monitoring Indicators)]. The text on SDEIS page 182 begins with reference to the no-flow day trigger, and expands on that to identify that other triggers and reviews would also play a role in the proposed overall program.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
16	9	Adaptive Management	While the USFS is to be commended for making improvements to the adaptive management framework which was initially proposed for the NFEC Project, the USFS has still not gone far enough to assure the protection of all national forest resources. **Response:** The Forest Service has worked through a broad spectrum of alternatives, data, and information, and considered extensive public input throughout the EIS process. The agency has not made any decisions. Three alternatives are analyzed in detail in the EIS and were developed to address the purpose and need for action, project objectives, and significant issues. These are described in chapter 1 of the EIS and include protecting natural resources. The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions.
16	10	Adaptive Management	In the Draft SEIS, the USFS has clarified that the adaptive management program – the monitoring, the "triggers," and the "responses" – is a component part of the proposed action. That is, the USFS's decision-making process for the NFEC Project is premised on the assumption that all aspects of the adaptive management program will be implemented by either the USFS and/or the Village of Ruidoso. Implementation of the adaptive management program is not discretionary, but mandatory. However, the adaptive management program is still flawed in certain critical respects. **Response:** The Forest Service has worked through a broad spectrum of alternatives, data, and information, and considered extensive public input throughout the EIS process. The agency has not made any decisions. Three alternatives are analyzed in detail in the EIS and were developed to address the purpose and need for action, project objectives, and significant issues. These are described in chapter 1 of the EIS and include protecting natural resources. The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions. You are correct that the adaptive management program described for Alternative 3 is a critical component of this alternative and would not be discretionary if this alternative is selected. The Record of Decision will line out all of the non-discretionary components of the selected alternative, including any adaptive management provisions, any mitigations or project design features, and required monitoring.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
16	12	Adaptive Management	The adaptive management program is not designed to protect natural surface flows in the North Fork of Eagle Creek. Instead, the adaptive management program contemplates that the Village of Ruidoso's withdrawals from the North Fork wells will be allowed to result in no-flow conditions on 30+ days annually. As discussed above, any management program which fails to restore and protect natural surface flow in the North Fork of Eagle Creek is inherently flawed and must be rejected. **Response:** The adaptive management strategy that is an integral part of Alternative 3 was developed to address the purpose and need for action and project objectives (which include protecting forest resources and providing municipal water to the Village of Ruidoso). We acknowledge the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right. Purpose and need and project objections are described in chapter 1 of the EIS. The No Pumping alternative and the No Change alternative provide a comparison of the differences between the alternatives, for the Responsible Official to use in making his decision on the alternative to select for implementation. The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision.
16	13	Adaptive Management	Second, and consistent with the discussion in the immediately preceding paragraph, the adaptive management "triggers" are irrational as they contemplate authorization of a Special Use Authorization that will result in the de- watering of the North Fork of Eagle Creek. **Response:** The water resources analysis presented in chapter 3 of the SDEIS (pages 88-139) and summarized in SDEIS table 3 starting on page 57 concludes that the duration of no-surface- flow conditions would decrease under implementation of Alternative 3 when compared to the current condition, particularly in dry years. The adaptive management triggers proposed as part of Alternative 3 are based on currently-available data. Additional data collection, interpretation, and management are incorporated into Alternative 3 (SDEIS chapter 2 pages 27-36 and summarized in table 2) to provide flexibility based on new information.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
16	14	Adaptive Management	Third, the Draft SEIS appears to equivocate with respect to whether or not the "pumping volume" triggers of the adaptive management program are a mandatory component part of the adaptive management program. Draft SEIS at 183. The USFS should clarify that the pumping volume "triggers" are mandatory, because failure to implement those triggers will eviscerate the adaptive management framework which the USFS intends to pursue in connection with the NFEC Project **Response:** You are correct that the adaptive management program described for Alternative 3 is a critical component of this alternative and would not be discretionary if this alternative is selected. The Record of Decision will line out all of the non-discretionary components of the selected alternative, including any adaptive management provisions, any mitigations or project design features, and required monitoring.
17	1	Adaptive Management	The adaptive management approach to correcting the environmental atrocity that has occurred on Eagle Creek over the last 40 years is a logical approach by the science provided by the USGS study. **Response:** Thank you for your comment.
18	5	Adaptive Management	I agree with the adaptive manage strategies and feel that the adaptation should be on a five (5) year rotation. **Response:** Thank you for your comment. The adaptive management strategy included in Alternative 3 would be reviewed at least every five years (EIS, page 32), if this alternative is selected.
18	6	Adaptive Management	According to the USGS study, (Scientific Investigations Report 2010-5205) there was zero- no surface flow days prior to the pumping of the North Fork Eagle Creek wells. I hope through this evaluation process that we can realistically correct the past errors in management by establishing parameters by which the Village of Ruidoso can pump a limited amount of water for their needs but also provide surface water flow in the stream bed. **Response:** The adaptive management strategy that is an integral part of Alternative 3 was developed to address the purpose and need for action, project objectives, and significant issues. These are described in chapter 1 of the EIS and include protecting natural resources and providing municipal water to the Village of Ruidoso. The water resources analysis presented in chapter 3 of the SDEIS (pages 88-139) and summarized in SDEIS table 3 starting on page 57 concludes that the duration of no-surface- flow conditions would decrease under implementation of Alternative 3 when compared to the current condition, particularly in dry years. This alternative would also provide between 23-25 percent to the municipal water supply, as discussed in more detail in the socioeconomic section of the EIS (pages 163-188) and summarized in SDEIS table 3 starting on page 66.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
18	15	Adaptive Management	I fully support an adaptive management strategy that allows for management adjustments with limitations on ground water pumping, cessation of pumping for short periods and feel that electronic monitoring should activate these adapting management adjustments by electronic shutting off pumping facilities when monitoring indicators of surface flow volume, water table depth, and water pumping volume are met via electronic monitoring. **Response:** We agree that electronic monitoring may have value as part of alternative 3. An automated control system as described could be used in combination with other operator-activated controls. Such systems can fail or improperly activate, however, so interactive staff communications should remain the overriding approach. **We have added clarification to the description of these alternatives in the EIS to account for the potential use of automated controls**. However, as also stated on SDEIS page 40, exactly how monitoring data are relayed and used, once a decision is made, is outside the scope of the SDEIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	127	Adaptive Management	In the last paragraph, page 27 and the first paragraph, page 28, under Trigger No. 1of the Adaptive Management Triggers, the Manual Direction Summary Document (USDA Forest Service 2011) concludes that the USFS has no authority in New Mexico to establish a minimum in-stream flow. Requiring no more than 30 no flow days per year or no more than 20 no flow days per year in a three year period would not be consistent with these conclusions. The no flow days for the post pumping period are greatly exaggerated as compared to the pre-pumping period due to the previous location for the gage being approximately 360 feet downstream from the present gage location. The previous location was within a bedrock section of Eagle Creek with little or no underflow. (See AEAI discussion within Comment No.1of Chapter 1of the Supplemental DEIS). **Response:** We disagree that the implementation of the adaptive management strategy is outside the jurisdiction of the Forest Service. Except for Federal reserved water rights (which do not apply in this case), in New Mexico, the Office of New Mexico State Engineer has sole authority to apportion water, even on Federal land. However, the Forest Service has authority to determine what is reasonable access (i.e. the amount of water that is appropriate for removal via well, pump, and pipeline) to the applicant's water right, while protecting surface resource (SDEIS, page 3). The SDEIS states that the objective is not to insure a continuous flow, but rather to minimize the number of dry days. As stated on page 24 of the SDEIS, Alternative 3 was developed to address the purpose and need for action and management objectives and provides a balance between providing municipal water to the Village of Ruidoso while also ensuring maintenance or improvement of water-dependent resources. As also stated on page 37, Alternative 3 proposes to reduce the number of no-flow days to an average of 20–30 days or less per year, roughly half of the average number of no-flow days experienced between 1989 and 2011. This would allow pumping to occur under a closely monitored adaptive management strategy designed to ensure protection of forest resources while providing needed municipal water to the Village of Ruidoso. The matter of the previous gage location being "better" is impossible to verify. USGS does not move a gage without good reason. The reason in this case has been lost to history; we have been unable to verify the reason behind the relocation. We recognize that subsequent information received about the re-location of the Eagle Creek gage does add uncertainty to all of these analyses, and that has been clearly documented in the EIS (page 2, 29, 93) and the Water Resources Report.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	129	Adaptive Management	Under "Trigger #3 - Riparian Vegetation", discussion on pages 30 and 31, uses benchmark elevations at the two gages EC Below South Fork and NF of EC and establishes rooting depths of 30 to 34 inches below the benchmark elevations as measured through monitor wells at the two gage locations. These rooting depths are used as triggers to reduce pumping to 50% of North Fork Gage, which obviously would be a pumping rate of zero. Reduction in pumping of the North Fork wells has been shown to have no effect on alluvial water levels which are declined due to drought. To reduce pumping during a drought with no response shown in alluvial monitor wells makes no scientific sense and the alluvial water level monitoring should be omitted as a trigger. **Response:** Proposed Trigger #3 is cross-referenced to proposed Trigger #1 and the flow rate at the upper North Fork streamgage. It is possible that flow conditions at that gage could be zero when Trigger #3 would be activated. However, consultation and flexibility is written into management responses that could be taken from the triggers. The EIS team collected and reviewed available data, including additional data and information resulting from a lengthy and expensive project-specific data collection effort. Multiple outside sources of information clearly stated that alluvial water levels decline due to pumping, not just due to drought. Further analysis, impartially conducted and based on available data and resources, confirmed those existing investigations. Uncertainties in all of the analysis have been discussed and disclosed in text. Recommended triggers and monitoring measures are tailored to addressing public concerns and reducing uncertainty.
21	132	Adaptive Management	Referring to the discussion related to the NPDES permit within the third paragraph of page 45, the North Fork of Eagle Creek is intermittent and described under 20.6.4.98 NMAC as "All non-perennial unclassified waters of the state, except those ephemeral waters included under 20.6.4.97 NMAC". This water-body has not had a use attainability analysis (UAA) performed which triggers full protection of swimmable/fishable. This means that since there has been no UAA, then under EPA review, the strictest standard is applied without any regard for the existing on-site conditions. This strictest standard application does not make sense in this intermittent stream. **Response:** This standard is an EPA standard and is not a Forest Service standard. The EPA administers this standard. Intermittent streams are a natural occurrence in nature and do support appropriate riparian ecosystems and associated flora and fauna. The NFEC is capable of performing as both intermittent and perennial functions depending on water flow conditions throughout the system.
21	133	Adaptive Management	Within the discussion on page 45 relating to pilot testing of stream augmentation, if a stream augmentation pilot test were incorporated in SUP approval as a data collection process, then the data collected could be analyzed and used in adaptive management strategies for managing the SUP. **Response:** This was considered but was dismissed from further detailed analysis, as described at the top of page 46 in the EIS

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
12	2	Alternative - General	Permitting either of the 2 alternatives for a Special Use Permit, as proposed, will maintain a cone of depression of devastating size. **Response:** A cone of depression will occur with groundwater pumping. It is likely that groundwater drawdown will reduce streamflow in the North Fork at some locations some of the time. Some pumping may create no-flow conditions. The extent and severity of natural resource impacts would vary between pumping alternatives, and further, the conditions under which pumping would occur. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions.
18	13	Alternative - General	The alternative that allows pumping of the North Fork wells and there after providing surface flow augmentation is not a viable management alternative. This will only contribute to an excessive cone of depression and reduction of surface flow in its natural condition. To pump water from the wells and deposit the water so the stream gauge indicates a minimum amount of flow will not negate the fact that the pumping is exceeding the threshold required for sustained surface flow. **Response:** Flow augmentation was initially considered as a streamflow management tool, and was revisited again later during the EIS. That review is discussed in the EIS in accordance with disclosure requirements. As stated on SDEIS page 45, flow augmentation has not been proposed in any of the alternatives further considered and analyzed by the Forest Service in the EIS, or in its supporting reports.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	74	Alternative - General	The Supplemental Water Resources Report (SWRR) of the Supplemental Draft Environmental Impact Statement (SDEIS) provides a thorough summary of existing data and reports for the upper Eagle Creek watershed before the Little Bear Wildfire. The objective of the SDEIS was to evaluate changed conditions within the watershed post Little Bear Wildfire. Unfortunately, the report assumes that either now, or within the next few years, the watershed will have the same hydrologic conditions over the entire permit period as those prior to the Little Bear Wildfire. This assumption is unfounded and not based on United States Department of Agriculture, Forest Service (USFS) reports (i.e., General Technical Report RMRS-GTR-42-Volume 4, September 2005) or other published documents. This erroneous assumption results in essentially the same alternatives being presented with respect to pumping or not pumping of the Village wells, as those proposed in the original AECOM (2011). **Response:** The EIS does not assume that the watershed will have the same hydrologic conditions over the entire permit period; in fact, revised monitoring recommendations incorporate checking potential post-fire changes along the North Fork. An extensive literature review of wildfire effects on forested southwestern U.S. watersheds was conducted and referenced for the supplemental EIS after the Little Bear Fire. The review focused on water balance factors, and is summarized in the Supplemental Water Resources Report and related parts of the EIS. Those sources that discuss the duration of wildfire effects support the EIS documentation. For example, one indicates that, depending on fire severity, water yield recovery took generally 5 to 15 years after fires in southwestern pinyon-juniper and ponderosa pine (General Technical Report RMRS-GTR-42- Volume 4, September 2005). That is within a 20-year permit period. Fire-effects literature was particularly selected for its western U.S. application, and was impartially reviewed and summarized in supporting text and tables in the supplemental water resources report. Discussion with Lincoln National Forest specialists indicated that “stand converting” conditions (e.g., forest to grass) were generally unlikely in the study area, except perhaps for a few patches of oakbrush succession. Other factors are discussed in the EIS and SWRR documents as identified from the literature.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	4	Alternative General	With Alternative1 continue pumping current amounts, the well diversion by the Village of Ruidoso from wells on Forest lands would average an estimated 740 acre-feet per annum. Under Alternative 3, the Village diversion on Forest lands would average an estimated 300 acre-feet per annum, being the same quantity of water per year as the trigger point in adaptive management plan Alternative 3, if exceeded. This could result in a loss of 440 acre-feet per year of consumptive use (CU) water diversion for the Village. This amount of consumptive use diversion of water for municipal use would have to be made up by purchasing additional diversion on the Rio Ruidoso. Within the Rio Ruidoso there are very few if any junior water rights that could be moved into the Village municipal diversions. The water rights available to make up the 440 acre-feet per annum consumptive use are senior irrigation water rights with priorities in the 1800's and with a consumptive irrigation requirement (CIR) of 1.44 acre-feet per acre per annum. Using the court ordered irrigation CIR of 1.44 acre-feet per acre per annum, then an equivalent 440 acre feet per acre using the court order of 1.44 CIR would amount to 305.56 acres of irrigation water rights needed to be purchased (440 acres divided by 1.44 CIR per acre).2 The value of senior priority irrigation water rights within the Rio Ruidoso drainage presently is approximately $23,000 per acre which would equate to a total present cost for 305.56 acres at $23,000 per acre which totals to $7,027,880.3 **Response:** Recent changes in the VoR's water rights include a permit issued to the Village transferring the 700.83 acre feet from EC well H-1979 to the surface point of diversion at EC and at Alto Reservoir. The permit severed 700.83 acre feet from EC well H-1979 and transferred the right to the surface point of diversion on EC and at Alto Reservoir. **This new information has been incorporated into the Final EIS as well as estimated cost implications of the implementation of each alternative. See the socioeconomic and water rights sections of the FEIS for updated information related to water rights and economic implications.**
12	10	Alternative 1	Alternative 1 - No Change - Continue Pumping at Historic Levels Pg. 126 (6) The use of Continued Pumping at Historic Levels has been documented as having degraded the environment by creating and maintaining a cone of depression that prevents surface flow of the NFEC across the study area. Surface flow recovery, except for rare, fast-moving water events, is prevented. The degradation of surface flow caused by continued pumping at historic levels does not satisfy the desired condition **Response:** The alternatives analyzed in detail in the FEIS do not address the purpose and need for action or the project objectives to the same degree and this is described in the FEIS. The maintenance of current riparian conditions is likely to occur under alternative 1 as a result of the long-term water extraction and a rebalancing of riparian area ecological dynamics of water availability and biotic responses. Each alternative in the EIS is compared and contrasted to each other to provide the public and the Responsible Official with a full understanding of the differences between alternatives, including how well they address the purpose and need for action and move the area toward desired conditions (as documented in chapter 3 and summarized in table 2)

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
17	2	Alternative 1	This lack of natural resource management has to stop, therefore, Alternative 1 – No Change should not be considered as a viable option.[...]The status quo is in violation of the Forest Service's own 2500 policy **Response:** The Forest Service is obligated to consider the applicant's proposal under 36 CFR Part 251. In addition, NEPA requires federal agencies to consider a reasonable range of alternatives. The Responsible Office (Lincoln National Forest Supervisor) will decide whether to issue a new permit or not, and if so, under what terms and conditions (EIS, page 9). The alternatives analyzed in detail in the FEIS do not address the purpose and need for action or the project objectives to the same degree and this is described in the FEIS. Each alternative in the EIS is compared and contrasted to each other to provide the public and the Responsible Official with a full understanding of the differences between alternatives, including how well they address the purpose and need for action and move the area toward desired conditions
18	16	Alternative 1	The no action alternative of issuing a permit with no changes in the existing operation is not a solution to the problems identified by the available science provided in the reports by USGS, Finch and Balleau. This alternative is not viable to the economy of the area nor the required environmental management of the Eagle Creek drainage as provided in the Forest Service manual. **Response:** The alternatives analyzed in detail in the FEIS do not address the purpose and need for action or the project objectives to the same degree and this is described in the FEIS. Each alternative in the EIS is compared and contrasted to each other to provide the public and the Responsible Official with a full understanding of the differences between alternatives, including how well they address the purpose and need for action and move the area toward desired conditions The predicted effects of implementing the alternatives to the local economy and to natural resources are described in detail in EIS chapter 3.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	9	Alternative 1	10.2 Alternative 1 - No Change The potential impacts from Village pumping to the number of flow or no flows days at the Eagle Creek gage is based on pre-fire conditions and is no longer applicable. The Village has no control over diversions by others within the Eagle Creek watershed. All diversions of surface water and groundwater are under the jurisdiction of the NMOSE. **Response:** The comparison of flow or no-flow days was done, in part, at the specific request of other participants in the NEPA public process. The evaluation is applicable to the overall EIS effort, in that it helps to clarify potential pumping impacts on streamflow. Granted, watershed and channel conditions have changed due to the Little Bear Fire. The entire supplemental EIS effort attests to the fact that current conditions differ substantially from pre-fire conditions. Based on relevant literature reviews, the supplemental EIS characterizes the post-fire changes and anticipated implications over both the short-term and long-term. Uncertainty in that characterization is disclosed. Other diversions within the Eagle Creek watershed, and the fact that the Village has no control over them, have been noted and are documented in the supplemental water resources report and elsewhere, particularly in the cumulative impact analysis sections of the water resources section of the EIS. The Forest Service defers to the Office of the State Engineer in the allocation of water. However, the decision-maker can determine reasonable access to a state-issued water right and have the ability to transfer of water rights off of National Forest System lands should they choose to do so.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	19	Alternative 1	Eliminate the proposed action and return to alternative 1 and continue with the current policy. There do not appear to be sufficient benefits to changing to Alternative 3to justify the large costs that will be incurred by the Village of Ruidoso and its residents. The actual impacts of the Little Bear Fire burn on vegetation and stream flows are not known and will not be known for several years. The DSEIS assumes that conditions will return to pre-fire conditions in 7 to 10 years. The stream flows should[...] be monitored during the expected recovery period to see if stream flows actually increase because of the fire. The expected recovery period is nearly half of the duration of the proposed action time frame while the DSEIS is based on the assumption of pre-fire burn conditions. Why incur the substantial costs to the Village when the information in the DSEIS does not support justifying the costs? **Response:** The commenter's inputs are noted. Fire effects were projected based on a careful review of site-specific and regional investigations. The expected channel effects were based on a more local USGS debris and sedimentation study. There is uncertainty about the effects of the Little Bear Fire on the hydrologic system; that has been acknowledged in documentation. While intensive, the adaptive management and monitoring measures described in the SDEIS for Alternative 3 and the monitoring measures identified for Alternative 1 would create additional information valuable in managing multiple uses of the water resource on Forest Service lands. With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village.

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			Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FSEIS.
12	11	Alternative 2	Alternative 2 - No Action (No Pumping) Pg. 130 (6) Alternative 2 (no-pumping) has been shown during the monitoring period from March 8, 2007 to June 14, 2007 to allow surface flow to eventually recover in the North Fork of Eagle Creek, including the 2-mile study area, to pre-pumping conditions. Over time, the cone of depression will fill with water and remain full. Water flow along the surface and in the creek channel will extend from the North Fork gage to the Eagle Creek gage most of the time. The desired condition will be satisfied. **Response:** Thank you for your comment. EIS chapter 3 discloses that implementing the No Pumping alternative would result in improved surface flow, and eliminated or reduced no-flow days (also summarized on page 62).
12	12	Alternative 3	Alternative 3 - Proposed Action (Adaptive Management) Pg. 133 (6) The use of Adaptive Management as described will predictably result in the continued presence of a cone of depression of similar dimensions to the cone of depression created by Alternative 1. The NFEC in the study area will be pumped dry and surface flow recovery, except for rare, fast- moving water events, will be prevented. The USGS has the audacity to propose, as part of adaptive management, the use of flow measurements at the EC gage to interpret flow from the dry NFEC. The predictable and continued degradation of surface flow in the North Fork that will be perpetuated by the proposed adaptive management of pumping does not satisfy the desired condition **Response:** A cone of depression would occur during and after pumping under Alternative 3. At times this would reduce or eliminate flows at locations along the North Fork. Alternative 3 seeks to minimize those effects through a set of hydrologic adaptive management triggers that would improve streamflow and watershed conditions above those anticipated under Alternative 1 (No Change – Continue Pumping at Historic Levels). Proposed monitoring would further inform management, and would include monitoring wells, surveys, and other gages as described in the Supplemental Water Resources Report and the EIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
16	8	Alternative 3	Even if the USFS does not defer its decision-making in connection with the NFEC Project, it should assure that its final decision complies in all respects with NFMA and NEPA. Alternative 3 does not accomplish this purpose. **Response:** The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions.
17	1	Alternative 3	The UHSWCD supports Alternative 3 in the SDEIS. **Response:** Thank you for your comment

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	10	Alternative 3	10.3 Alternative 3 - Proposed Action-Adaptive Management Alternative 3 attempts to create an instream flow right. However, the USFS has no water rights and no jurisdiction over such rights in New Mexico. The attempt to create the instream flow has essentially remained unchanged since the initial DEIS. It is interesting to note that this preferred alternative is part of the USFS policies for water (USDA, 2000) and is not based on documented adverse impacts to riparian habitat or aquatic ecosystems, but rather a desired condition. The effects of post-fire on the depth and width of sediments in the North Fork Eagle Creek channel on surface water flow has not been assessed. The Village has senior water rights that allow the Village under State law to impact other wells completed after its wells. Effects of pumping Village wells on other wells are properly under the jurisdiction of the NMOSE. **Response:** We acknowledge the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right. We disagree that the implementation of the adaptive management strategy is outside the jurisdiction of the Forest Service. Except for Federal reserved water rights (which do not apply in this case), in New Mexico, the Office of New Mexico State Engineer has sole authority to apportion water, even on Federal land. However, the Forest Service has authority to determine what is reasonable access (i.e. the amount of water that is appropriate for removal via well, pump, and pipeline) to the applicant's water right, while protecting surface resource (SDEIS, page 3). The SDEIS states that the objective is not to maintain a certain volume of water within the stream continuously, which is what is meant by maintaining a minimum in-stream flow. Even with the adaptive management plan, there will be dry days where there is no instream flow. The objective is only to minimize the number of dry days. As stated on page 24 of the SDEIS, Alternative 3 was developed to address the purpose and need for action and management objectives and provides a balance between providing municipal water to the Village of Ruidoso while also ensuring maintenance or improvement of water-dependent resources. The consideration of pre-pumping aquatic and riparian conditions and the effect pumping has had on these forest resources is discussed fully in the riparian and aquatic habitat sections of chapter 3 and is summarized in EIS table 2.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	68	Alternative 3	Alternative 3, the Proposed Action, is essentially unchanged from previous pre-drafts and draft EIS documents. No adverse impacts to riparian habitat or aquatic ecosystems were documented by the USFS to have occurred as a result of pumping by the Village. Unfortunately, the USFS continues to ignore this fact. **Response:** Alternative 3 was revised since the DEIS was issued. These changes are summarized on page 4 of the EIS. Where changes were made to the adaptive management triggers, these changes are also discussed, by trigger, on EIS pages 27 -33. The EIS discusses fish habitat prior to the start of pumping and concludes that “Therefore, while the North Fork, particularly below the North Fork gage, has always been a marginal trout fishery, the quality of trout habitat and recreational fishing experience it currently provides is lower today than it was in the late 1980s, and North Fork Eagle Creek well pumping has contributed to this decline.” (EIS, page 143). The EIS riparian analysis (pages 154-156) and states that “we do not know the pre-pumping condition of riparian vegetation along NFEC Though we do not know the prepumping condition of North Fork riparian vegetation, we do know there has been reduced water availability along the North Fork since the North Fork Eagle Creek wells began pumping, as described in more detail in the “Water Resources” section of this chapter. Reduced water availability can affect riparian vegetation. Reduced water availability for plants can also be influenced by flood deposited alluvium in the valley bottom of the North Fork which raises the flood plain and channel, and causes the stream to flow below the alluvium. Either of these factors could explain the existing conditions and composition of the riparian vegetation along the North Fork.’” It goes on to discuss information related to comparing NFEC to a reference reach.

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21	69	Alternative 3	The preferred alternative attempts to develop instream flow rights in the absence of USFS water rights. The triggers as set forth in the alternative could eliminate pumping for months and jeopardize the ability of the Village to provide adequate supplies of water. The alternative does not consider the fact that a deeper and wider alluvial channel will result in less surface water and this must be factored into the analysis. The changed channel conditions are the result of the Little Bear Wildfire. **Response:** Please refer to previous responses regarding the USFS jurisdiction and our conclusion that implementing Alternative 3 would not be establishing an instream flow water right. We acknowledge the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right. The adaptive management strategy proposed as part of Alternative 3 describes tools and steps that could be implemented if that alternative is selected. By definition, additional flexibility is incorporated into that alternative to allow ongoing consideration of future conditions, data, and management tools. Changed channel conditions from the fire are recognized in the EIS, and have prompted the incorporation of additional tools and metrics in the adaptive management proposal under Alternative 3. As stated in the 2011 Manual Direction summary (project record #415b), we do not consider this 2 mile stretch of NFEC as a high priority stream on the Forest for non-consumptive stream flow. However, we do recognize NFEC as an important tributary to Eagle Creek and the water-dependent values it provides (include aquatic and riparian habitat and recreational opportunities such as camping and seasonal fishing) it provides as an intermittent stream.
21	76	Alternative 3	The USFS preferred alternative appears to be based in part on U.S. Department of Agriculture, Forest Service policies (USDA, 2000) that promote instream flows, even though the Forest Service has no surface or groundwater rights in the subject area. **Response:** Please refer to previous responses regarding USFS jurisdiction and our conclusion that implementing Alternative 3 would not be establishing an instream flow water right. See also the 2011 Manual Direction Summary (project record #415b) that explains USFS jurisdiction related to this project. We acknowledge the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	77	Alternative 3	The USFS preferred alternative, Alternative 3, remains little changed from that proposed during the Pre-Draft Environmental Impact Study, or the AECOM (2011), with the exception that extremely onerous monitoring requirements and structures have been added that would be quite expensive to perform and for which there are no baseline data for comparison and justification. **Response:** Alternative 3 was revised since the DEIS was issued. These changes are summarized on page 4 of the EIS. Where changes were made to the adaptive management triggers, these changes are also discussed, by trigger, on EIS pages 27 -33. The monitoring measures were developed based on a thorough review of all available information and are described more fully in the Water Resources Report. We recognize, however, that there are costs associated with implementation of all of the alternatives. **Cost information has been added to the FEIS in response to this concern.**
21	78	Alternative 3	The USFS persists in supporting its originally preferred alternative (Alternative 3) regardless of the changed watershed conditions by not including or evaluating recent data and the changed hydrologic conditions. This is certainly unfortunate for the Village, but more importantly is an unscientific approach to a process that is presumed to be based on scientific methods and analysis. **Response:** The Forest Service has not made any decisions on which alternative to implement at this stage. A preferred alternative will be identified in the FEIS and the draft Record of Decision will identify a selected alternative and the rationale for that selection. The changed conditions since the Little Bear Fire were in fact considered. The effects of the fire are discussed in detail in each supplemental resource report in the project record and throughout the supplemental EIS. Changed and changing watershed conditions due to the Little Bear Fire have not invalidated streamflow and water supply issues. We fully considered additional available data provided by the Village and others and did investigate changed watershed conditions, as described in detail in the water resources report and throughout the EIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	3	Alternative 3	This report will demonstrate that the DSEIS is flawed and there is insufficient justification for reducing the water to the Village as proposed under Alternative 3. **Response:** The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions. We recognize the differences in scientific conclusions regarding the effects of pumping on forest resources along NFEC, based on uncertainties related to limited data. We have carefully collected and analyzed data. Uncertainties associated with the data and the assessments are stated in the SDEIS and its supporting documentation

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	18	Alternative 3	Summary of Costs Likely to Impact the Village of Ruidoso with Implementing Alternative 3. Description of Activity Current Dollars Purchase Replacement water rights $7, 180,660 Litigation fees $152,780 Monitoring & Measurement Costs $1,010,760 Loss of Value for inchoate water rights $5,000,000 Weather Station Exclusive of Annual Operating Expenses $20,000 Total $13,346,200 The total cost of nearly of $13.4 million to the Village of Ruidoso for accepting the proposed action plan for a special use water authorization can hardly be considered trivial and judged not worthy of inclusion in the Draft Environmental Impact Statement in the discussion under the socioeconomics impacts section. This incursion of these costs will likely require the Village to sell municipal bonds and to either increase property taxes or increase water utility rates (or both) as a source of funds to retire the bonds. This increased debt load will curtail the capacity of the Village to provide other needed services to its residents. Given that 12 percent of the people living within the Village had incomes below the poverty level in 201216 according to US Census Bureau data; the proposed action would create an inequity issue (Environmental Justice). Those living below poverty level would have decreased capacity to pay increases in city taxes and fees (through increased property taxes or rent or water costs) and would likely eliminate purchases other necessary items in their budget to survive whereas the higher income groups would have more discretionary funds available to cover increases in property taxes and increases in utility fees **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). **Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FEIS**.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
18	12	Alternative New	The natural fluctuation precipitation and snow melt run off would allow the Village of Ruidoso to obtain a controlled amount of municipal water from the Eagle Creek drainage without impacting the surface flow if the Village of Ruidoso had additional storage capacity. **Response:** As stated in the SDEIS, adding storage is outside the scope of this project.
21	59	Alternative New	Recommended Preferred Alternative: The Village would be allowed to pump up to 80 percent of the average annual quantity of groundwater recharge that will occur post-wildfire based current canopy density, vegetation type and distribution, and soil moisture requirements. Recharge estimates after 10 years can be recalculated and should be based on actual USFS forest management performed and USFS financial assurances related to maintaining a healthy watershed. The calculation of groundwater recharge must not be performed using the chloride mass-balance method for reasons previously described. Village monitoring would include those provided below:) **Response:** Thank you for this suggestion. We carefully considered this alternative but have dismissed it from further detailed analysis. The rationale for this is provided in the FEIS in the Alternatives Considered But Dismissed section of chapter 2.
21	134	Alternative New	Referring to the discussion under "Suggestions for New Alternatives" and the discussion on the Stipulated Agreement, on page 46, the Village agreed to a 2006 Stipulated Settlement requiring the completion of an environmental study but was not a party to the 2009 supplement suggesting an alternative that would leave downstream flows completely undisturbed. **Response:** As described in our response to this concern during the scoping period (DEIS appendix A page 287), according to our Office of General Counsel, the applicant was not legally required to be a party to the 2009 supplement; efforts were made at that time to keep the applicant informed of these updates.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	124	Aquatic - Fisheries	The section entitled "Aquatic Habitat and Fish" located at the middle portion of page 10 is not correct as relating to fish populations in the intermittent reach of North Fork of Eagle Creek. Fish should be omitted from this discussion and should not be considered in alternative comparisons since pre-pumping conditions would not support fish populations due to the intermittent nature of the stream. **Response:** Table 11 and the narratives from Pages 140-143 adequately document fish populations in the stream prior to well pumping. We disagree that consideration of fish populations should be omitted from discussion and consideration. As stated in the DEIS on page 297 when this concern was brought up during the scoping period, aquatic habitat and fish was identified as a significant issue for this project based partly on the results of public scoping; many people raised concerns that NFEC well pumping may be affecting the quality of fish habitat and fishing opportunities. We are using the EIS process to determine if this is in fact the case (based on the best available information) and then to determine what impacts implementing each of the alternatives would have on aquatic habitat and fish. This is discussed in more detail in chapter 3 of the EIS.
23	15	Aquatic - Fisheries	The importance of fishing in the project area below the wells is not supported with sufficient evidence. The Bright report (Table 9) list the number of angler days and fish caught in Eagle Creek based on mail survey data from anglers beginning in the 1975-76year through 2007-2008. He compares the average angler days and fish caught from 1975-76 through 1988-89, a period before pumping began, with the period beginning 1990-91 through 2007-08 after pumping began. The average number of angler days dropped from 717 to 320 and fish caught from 3,220 to 890. This is a substantial drop. Bright acknowledge that it is not a scientific study and the data were based on the entire length of the Eagle Creek including the South Fork as well as areas below the confluence of the North and South Forks rather than limited to the study area. The study area comprises only a small part of Eagle Creek but including a discussion on fishing for the entire Eagle Creek is not germane to the evaluation of the impacts of pumping by the Village wells in the small project area. However, including these conclusions in the SDEIS report tends to be misleading and clouds the issue leaving the reader to conclude that fishing impacts are important to the EIS analysis **Response:** See response above regarding the reasoning behind detailed consideration of aquatic habitat and fish in the EIS. However, we agree that the information provided in the EIS on angler days may be misleading; **this has been removed from the FEIS**.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	16	Aquatic - Fisheries	The reduction in angler days and fish caught could be related to lower stream flows and water temperatures but there are several other factors that might also be considered as drivers. To begin, the New Mexico Fish and Game Department no longer stocks Eagle Creek. The last historical stocking records show that the last stocking was 512 Rainbow trout in 1969. Their records are for the entirety of Eagle Creek as Fish and Game does not specify which part of creek they stocked. Also, the historical stream flow data indicates that the project area was not conducive for supporting fish populations because of no flow days during periods of droughts prior to pumping by the village. **Response:** See response above regarding the reasoning behind detailed consideration of aquatic habitat and fish in the EIS. However, we agree that the information provided in the EIS on angler days may be misleading; **this has been removed from the FEIS.**
13	17	Aquatic - Fisheries	Post fire stream surveys have not documented any fish in the upper reaches of North fork eagle Creek. A formal fish survey was documented on the nearby Bonito Creek which was also affected by the wildfire and no fish were observed **Response:** This comment relates to a direct effect of the fire and does not preclude fish populations from becoming reestablished in future years as the system recovers. As discussed on page 164 of the SDEIS, Dunham et al. (in University of Idaho 2007) showed that physical stream habitats remained altered (e.g., stream temperatures) for many years following wildfire, but that native aquatic vertebrates can remain resilient. In a management context, this suggests that wildfire may be less of a threat to native species than human influences that alter the capacity of stream-living vertebrates to persist in the face of natural disturbance.
17	3	Climate Change	The sections in the SDEIS on climate change should be taken out. It provides no factual analysis of the Eagle Creek drainage and the pumping that has depleted the stream flow. **Response:** As discussed in responses to earlier scoping comments (DEIS page 297) The “Water Resources” section of chapter 3 of the DEIS discusses climate change and how this could affect the implementation of the alternatives over time. This is simply a way to compare alternatives and does not identify applicant responsibilities. An analysis of the effects of climate change is an Agency requirement. The climate change references used and cited in the EIS and the supplemental water resources report are the most scientifically supportable that could be found in order to address agency-wide NEPA guidance. While not specifically factual to the Eagle Creek drainage, the assessment is largely based on regional western climate change research and U.S. Forest Service research for the southwest. It is true that “down-scaling” from regional research to local watersheds is a common difficulty in current climate change research. Uncertainty surrounding climate change is clearly stated in the EIS and supporting report.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
12	3	Decision Process	The million-dollar, ten-year study padded with delays has been a transparent masquerade that resembles the required EIS process except that it fails to thoroughly expose and discuss the causal relationship between the cone of depression, the dry North Fork streambed and pumping of the North Fork wells. **Response:** The EIS and its accompanying project record are based on a thorough compilation and analysis of the best available information related to the past effects of pumping on streamflow, and the predicted effects under each alternative considered in detail.
12	7	Decision Process	Please do us a favor. Conclude this phony, prolonged process. Quit stalling and make your decision. **Response:** The Responsible Official's decision will be documented in a draft Record of Decision, scheduled to be released in Spring/Summer 2015.
21	6	Decision Process	On November 14, 2014 the Forest Service gave notice of the availability of the SDEIS dated October 2014. Clearly, between the date of the issuance of the SIR and the SDEIS, there simply wasn't enough time to adequately analyze and consider all of the circumstances noted in the SIR as requiring analysis and review. **Response:** The EIS and its accompanying project record are based on a thorough compilation and analysis of the best available information related to the past effects of pumping on streamflow, and the predicted effects under each alternative considered in detail. It considers the effects of the Little Bear Fire and documents this in chapter 3, in the project record, and in summary form in chapter 2.
11	2	Decision Process -Laws, Policies, Courts	the ECCA is aware of the possibility that other interests and legal aspects of this controversy may prevail in the decision making process of this permit application. **Response:** The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
16	3	Decision Process -Laws, Policies, Courts	As I have noted in my previous correspondence – and as other commenters have noted – the NEPA analysis for the NFEC Project is hindered by the USFS's failure to strive for restoration and protection of natural surface flow in the North Fork of Eagle Creek. Pursuant to the National Forest Management Act ("NFMA"), the USFS must manage the water resources on national forest lands in a manner that does not impair surface water, groundwater, and water-dependent ecosystems. Alternative 3 of the Draft SEIS fails to comply with the requirements of NFMA's substantive provisions regarding water resource – and water-dependent resource – protection. **Response:** The adaptive management strategy that is an integral part of Alternative 3 was developed to address the purpose and need for action, project objectives, and significant issues. These are described in chapter 1 of the EIS and include protecting natural resources and providing municipal water to the Village of Ruidoso. Two other alternatives, including No Pumping, are also fully analyzed in the EIS and provide three alternatives for the Responsible Official to choose from (see EIS chapter 1, page 9 for a description of the decision framework).
16	5	Decision Process -Laws, Policies, Courts	The core importance of careful groundwater management to the conservation of multiple resource values on national forest lands is highlighted by the USFS's recent proposed directive on groundwater resource management. 79 Fed.Reg. 25815 (May 6, 2014). That proposal recognizes that there are USFS certain policies now in place that provide a modicum of protection to the national forests' valuable water resources. For example, the USFS's existing policy is to discourage the use of on-forest water resources for off-forest use when there are alternatives available, except in certain limited circumstances which are not present here.[...]However, the proposed directive also recognizes that current USFS policy does not go far enough, and that the USFS requires additional authorities – including permitting authorities – to protect surface water, groundwater, and water-dependent ecosystems. For example, and of particular importance here, the proposed directive provides USFS line officers with the authority to impose terms and conditions on Special Use Authorizations necessary to provide assurances against degradation to both surface water and groundwater resources. FSM 2563.7. This authority would include the authority to impose Special Use Authorization terms and conditions to ensure the restoration and protection of natural surface flows. Id. Additionally, and also of particular importance here, the proposed directive provides USFS line officers with the authority to require Special Use Authorization holders to provide Water Supply Development and Operation Plans and to develop water conservation strategies for limiting total water withdrawals from national forest lands. FSM 2562.1, 2563.5. **Response:** We are aware of the proposed new groundwater directives. The brief discussion of the draft groundwater directives as proposed in May 2014 is included in the EIS; however, the proposed groundwater directives were put on hold in December 2014 and formally withdrawn in a June 2015 federal register notice pending further discussions with states and tribes. It is premature and speculative to attempt to apply the proposed groundwater directives to this project. If the directives are finalized prior to a decision being made on this project, the Forest Service will review, and where appropriate, incorporate their direction in the final EIS and project decisions**.**

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18	20	Decision Process -Laws, Policies, Courts	I also object as stated in the federal register of the manage objective that states "Providing water management flexibility and water conservation to the Village of Ruidoso in a way does not foreclose opportunities to transfer a portion of their water rights of these wells to location off of national forest system lands." The Forest Service has no jurisdiction over water rights! The state engineer has this jurisdiction over water rights so I question why this is management objective of the Forest Service. **Response:** The Forest Service defers to the Office of the State Engineer in the allocation of water. However, we can determine reasonable access to a state-issued water right and encourage the ability of water rights holders to transfer of water rights off of National Forest System lands as a means to address concerns about access and management requirements on National Forest System lands. See also the 2011 Manual Direction Summary (project record #415b) that explains USFS jurisdiction related to this project.
21	5	Decision Process -Laws, Policies, Courts	With regard to the North Fork Eagle Creek Wells Special Use Authorization as previously noted, a determination was made on July 16, 2012 that the Little Bear wildfire constituted such a circumstance by reason of the impacts on 99 percent of the North Fork Eagle Creek drainage. This determination was ratified in the Supplemental Information Report (SIR) for the North Fork Eagle Creek Wells Special Use Authorization Project, which determined that new circumstances were created by the Little Bear wildfire requiring that significant issues be analyzed and the components of alternatives reviewed in detail. **Response:** Thank you for your comment. The EIS describes the changed circumstances due to the Little Bear Fire, based on the findings in the SIR.

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21	70	Decision Process -Laws, Policies, Courts	To date the USFS has failed to manage the forest in manner that meets its mission statement as provided in the Organic Administration Act of 1897 with respect to "securing favorable conditions of water flows." The USFS must provide financial assurances that it will maintain the watershed in a healthy manner in order for potential impacts from Village pumping to be fairly and scientifically analyzed **Response:** Vegetation management is outside the scope of this EIS, but certainly well within the mission of the National Forest System. The Lincoln National Forest continues to implement the Lincoln National Forest Plan and other guiding laws (such as the Organic Act), regulations and policy through a wide variety of actions and planning. Other applicable Forest Service past, present, and reasonably foreseeable future actions within the project area and cumulative impact analysis area were considered and are described in the EIS at the beginning of chapter 3. The impacts of these other proposed actions within the watershed were considered along with the implementation of the proposed alternatives as part of cumulative impact analysis. In addition, we also considered the density of conifers in the watershed and this influence on water yield (EIS pages 201-204), as part of cumulative impact analysis. The Forest Service is not under any obligation to provide financial assurances regarding future forest management; we as a federal agency, work within our Congressionally allocated budgets annually, to implement our guiding laws, regulations, and policies. “Securing favorable conditions of water flows” under the Organic Act of 1897 is among the many guiding laws that shape management activities. Once the Responsible Official selects an alternative for implementation, this will be documented in a Record of Decision. This ROD will describe the rationale for the decision and all the information considered in arriving at the decision. It will also document the components of the alternative selected, potentially including any adaptive management, monitoring, and mitigation. Once documented in the ROD, these aspects of the decision are non-discretionary
22	5	Decision Process -Laws, Policies, Courts	The State of New Mexico, and this Office, also addressed these concerns in its October 3, 2014 comment letter ("Comment Letter") to the Forest Service's Proposed Directive on Groundwater Resource Management ("Proposed Directive") pertaining to groundwater lying underneath Forest Service land. As addressed therein, the Forest Service's actions with regard to the Village, and groundwater in general, fails to acknowledge, and in some ways threatens to contradict, a century of well-established federal statutory and United States Supreme Court case law that requires federal deference to state water law in the West. **Response:** The process the Forest Service is undertaking to revise the groundwater directives is separate from this project. As we have acknowledged in the EIS, the Forest Service defers to the Office of the State Engineer in the allocation of water. However, we can determine reasonable access to a state-issued water right and encourage the ability of water rights holders to transfer of water rights off of National Forest System lands as a means to address concerns about access and management requirements on National Forest System lands. See also the 2011 Manual Direction Summary (project record #415b) that explains USFS jurisdiction related to this project.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
22	11	Decision Process -Laws, Policies, Courts	In light of well-established federal law that requires deference to and protection of water rights developed under state laws, as well as the express directive by the Supreme Court that water rights for wildlife purposes must be obtained in the same manner as any other appropriator, the Forest Service is prohibited from obtaining water for wildlife purposes by forcing non-federal entities to reduce the exercise of their state law water rights. **Response:** Please refer to previous responses regarding USFS jurisdiction and our conclusion that implementing Alternative 3would not be establishing an instream flow water right. See also the 2011 Manual Direction Summary (project record #415b) that explains USFS jurisdiction related to this project. We acknowledge the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right. The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision.
22	8	Decision Process -Laws, Policies, Courts	Under New Mexico law, the State Engineer is charged with the supervision of all waters, including groundwater, within the boundaries of the State and the measurement, appropriation and distribution thereof. For over a century, the State Engineer has developed a comprehensive administrative scheme that includes sophisticated technical hydrological analyses. This administrative process requires the State Engineer to exercise his expertise in hydrology to determine with as much scientific precision as possible how much water is available for appropriation and how use of that water will affect existing valid water rights. Once the administrative process is completed, the State Engineer's determination as to a water right, such as the Village's, is final **Response:** See response above
22	9	Decision Process -Laws, Policies, Courts	Federal law requires that the Forest Service maintain and protect water right owners, such as the Village, in the exercise of their water rights obtained pursuant to state law, even on Forest Service lands. **Response:** See response above
1	11	Decision Process -Laws, Policies, Courts Clarification/Edits	I ask that you edit the document to be consistent with the CFR guidance on comparison to the baseline of no action before the Final document is released **Response:** Changes have been made to the EIS in response to this comment

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
16	4	Decision Process -Laws, Policies, Courts Clarification/Edits	In connection with the NFEC Project, the USFS should defer a final decision until the proposed groundwater directives are finalized. At that time, the USFS should re-assess the NFEC Project planning documents to assure that they are consistent with the language and the intent of the new regulations, as well as with the mandatory requirements of NFMA and NEPA. **Response:** We are aware of the proposed new groundwater directives. The brief discussion of the draft groundwater directives as proposed in May 2014 is included in the EIS; the proposed groundwater directives were put on hold in December 2014 and formally withdrawn in a June 2015 federal register notice pending further discussions with states and tribes. A new proposal will eventually be published and available for public comment. It is premature and speculative to attempt to apply the proposed groundwater directives to this project. If the directives are finalized prior to a decision being made on this project, the Forest Service will review, and where appropriate, incorporate their direction in the final EIS and project decisions.
16	6	Decision Process -Laws, Policies, Courts Clarification/Edits	In my October 2, 2014 letter to Ms. McGlothlin, I emphasized the importance of deferring a decision on the NFEC Project until after the USFS finalizes its new guidance on conjunctive water management on national forest lands. As discussed in that letter – and as discussed immediately above – the USFS has embarked on the development of this new guidance precisely because it recognizes that it currently lacks the regulatory tools to protect national forest resources from impairment associated with the withdrawal of groundwater resources. **Response:** See the response above regarding the proposed groundwater directives.
16	7	Decision Process -Laws, Policies, Courts Clarification/Edits	That is, the new conjunctive management directive – and the authorities provided therein – in be specifically tailored, in part, to address the exact sort of problem that is posed by the Village of Ruidoso's over-withdrawals of groundwater from the North Fork of the Eagle Creek. It is simply irrational for the USFS to proceed with a final decision on the NFEC Project in the current circumstances. As a result of the on-going rule-making procedure, the USFS is on the verge of (1) making substantive changes to policy that will result in additional protections for national forest resources and (2) authorizing greater latitude to line officers to impose conditions on Special Use Authorizations to ensure against resource degradation. To take advantage of these important developments, the[...] USFS should defer decision-making in connection with the NFEC Project until such time as the conjunctive use regulations are final **Response:** See response above regarding the proposed groundwater directives.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
16	11	Decision Process -Laws, Policies, Courts Clarification/Edits	In short, the Draft SEIS represents a modest improvement over the USFS's prior approach to the NFEC Project. However, more importantly, the USFS's decision-making process is still not focused on compliance with NFMA's substantive requirements or NEPA's procedural requirements. Most specifically, the USFS's decision-making process and proposed decision in connection with the NFEC Project will not assure adequate protection of the national forest's surface water resources and water-dependent ecosystems. These failures and legal shortcomings would be disappointing under any set of circumstances, but are especially so in light of the fact that the USFS has now recognized the importance of careful groundwater management and has proposed to adopt a regulatory regime that will provide the USFS with the additional authorities to protect surface waters and water-dependent ecosystems on national forest lands **Response:** The Record of Decision will document the alternative selected for implementation and the rationale for the decision. It will also document consistency with laws, regulations and policy and how the selected alternative addresses the purpose and need for action.
5	3	Decision Process Coordination / Consultation	The leadership of the Village believes that they were not properly consulted in the drafting of the DSEIS as promised. The Village states in their letter that they were included in one meeting on June 11, 2014, but were not informed of any subsequent meetings before the DSEIS was released. **Response:** Since the Little Bear wildfire occurred, our record shows several meetings and written communications with the Village of Ruidoso related to the preparation of the SDEIS, between 2012 and 2014. These include several meetings, written monthly updates, email communications and written six-.month notices. We have also consulted with Roger Peery of your staff in preparation of the SDEIS. As outlined in the stipulation agreement we have provided final drafts of each of the resource reports prepared for the SDEIS to the Village and provided the SDEIS 2 weeks prior to the official release.
5	4	Decision Process Coordination / Consultation	Our government works better when we include local governments and constituencies in decision-making. I believe that we can craft a reasonable policy by including the public and the Village, as well as other local governmental entities, in this process. **Response:** We agree and value the input of local governments, the Village and the public in this process that informs decision-making, however, by law, the actual decision is made by the delegated Forest Service official, in this case the Forest Supervisor for the Lincoln National Forest.

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5	6	Decision Process Coordination / Consultation	It is imperative that your agency include those who rely on the hydrological systems providing the water these communities rely on in any decision-making process **Response:** We agree and value the input of local governments, the Village and the public in this process and feel that all of these constituencies have been provided multiple opportunities to participate in the NEPA process for this project.
9	2	Decision Process Coordination / Consultation	While we do not have any comments on the SDEIS (EIS No. 2014328) and believe that this project will not adversely affect traditional,religious or culturally significant sites of our Pueblo and have no opposition to it: we would like to request consultation should any human remains or artifacts unearthed during this project be determined to fall under NAGPRA guidelines .Copies of our Pueblo's Culture Affliction Position Paper and Consultation policy are available upon request. **Response:** Thank you for your comment; this is an important component of any of the alternatives and is described under mitigation measures on EIS page 33.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
12	4	Decision Process - General Use of Science	My comments describe several of the numerous instances where scientific knowledge has been limited, confused, or withheld by USFS refusal to approve and insist on the integration of the depth-to water data that was required and provided by the Village of Ruidoso. **Response:** The Forest Service Interdisciplinary Team did review depth-to-water and pumping information provided by this commenter and the Village of Ruidoso. As described in the Supplemental Water Resources Report, event-specific investigations of the Eagle Creek hydrologic system are complicated and obscured by substantial variations in watershed states (precipitation and snowmelt, streamflow, aquifer water levels, recharge, evapotranspiration, pumping, and their seasonal variations) at any particular time and place. [This is also repeatedly supported by the recent USGS publication on the Upper Rio Hondo Basin (USGS Scientific Investigations Report 2014-5153).] The EIS team used a carefully-derived and documented longer-term approach to isolating pumping effects. This is felt to be more supportable for minimizing variables and deriving impartial impact assessments. Other regional data comparisons were also used in the EIS effort. The impartial outcomes of these approaches provide a defensible basis for confirming pumping issues on the North Fork and comparing alternatives. The variation of snowmelt and monsoonal precipitation inputs, and resulting variations in evapotranspiration and recharge, mask the effects of any one pumping/no pumping comparison in short term cases (e.g., days, several weeks, up to a month or so). We do not know how long it takes for precipitation or snowmelt to cycle through the basin and affect the states of watershed variables. There is probably a lag of weeks to years, particularly with the different aquifer zones. Also, evapotranspiration varies over time, and especially between wet and dry cycles. These variables underlie any subsequent comparison of pumping variables. These issues, particularly the “lag”, remain to be further understood through data review, participatory discussions, and management. This is a primary reason behind the monitoring measure for a watershed model/integrative data visualization tool in the document. See also the response to Letter 12, Comment 20.
12	14	Decision Process - General Use of Science	The USGS used the term "may be intermittent" to describe the 2-mile study area in which surface flow is visibly obscured along stretches where flood-carried debris covers the streambed. Historically, in the absence of pumping, surface flow reappeared further downstream where it was no longer obscured by debris. During the period 1969 to 1980, the NFEC was a perennial stream. There is no documentation that any dry (no-flow) days occurred in the NFEC between 1969 and 1980, before pumping. **Response:** A careful review of pre-pumping flow durations along the North Fork was conducted using information from as many sources as possible. Some of this information is anecdotal and conflicting. Based on this review, and documentation of no-flow days at some locations before pumping, it appears that some segments of the North Fork were perennial, and some were intermittent during the pre-pumping period. There already is documentation presented in the SDEIS and its accompanying Supplemental Water Resources Report that zero no-flow days occurred at the Eagle Creek confluence gage in the pre-pumping period. At that time, that location was the only monitoring point on the stream system.

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12	15	Decision Process - General Use of Science	Figure 7. Pg.106 (6) illustrates a partial view of "the cone of depression" underneath the NFEC study area, created and maintained as a result of pumping. Curiously, the USGS chose to locate the north boundary of the area of influence, for no technical reason, at the same point they installed the NF gage. On the other hand, the south boundary of the area of influence did not include the South Fork Eagle Creek (SFEC), a perennial stream before pumping, that has had many documented no- flow days under the influence of pumping. The alternate boundaries provided by Balleau Groundwater, Inc. are far more defensible than the arbitrary boundaries presented by the USGS. **Response:** Figure 7 in the EIS is simply a reiteration of USGS (2011) Figure 16, and is based on that agency's field inspections and well data at the times of their visits. The USFS believes that the USGS's north boundary of the area of influence is based on those observations. The period-of-record at the South Fork gage (USGS 08387575) starts in September 2007, after the start of pumping. While the South Fork certainly could have been perennial beforehand, the USFS is not aware of supporting data. Alternate boundaries provided by Balleau Groundwater were obtained and reviewed, and were used in the pre-fire EIS and water resources report. Assumptions and limitations of that information were presented. After further communication with Balleau Groundwater, the USFS decided to use USGS observations in its projection of drawdown extent for the SDEIS. Other drawdown estimates are available, and that is still mentioned in the SDEIS and water resources report. Proposed monitoring measures would further define this factor.
12	16	Decision Process - General Use of Science	Surface flow across the cone of depression is not possible except during rare storm or flood events that exceed 2.2 cubic feet per second. "Sustained flows greater than 2.2 cubic feet per second are needed to saturate the alluvium and maintain continuous flow in the North Fork." (2) Pg 1. "In the 19-month period of record from September 2007 through March 2009, 2.2 cubic feet per second of discharge was equaled or exceeded at the North Fork gaging station 2 percent of the time." (2) Pg.57 **Response:** Indeed, the USGS report (Matherne and others, 2011) indicates the 2.2 cubic foot per second threshold. However, this is valid only for portions of the North Fork stream channel which are below the North Fork stream gage. Also, since this portion of the North Fork stream channel has lower gradient than the upper portion (Matherne and others, 2011, figure 16), it accumulates more debris from flood flows in the stream channel. Following the floods associated with the Little Bear fire in 2012, it is likely that more than 2.2 cubic feet per second is necessary to maintain flow in the stream channel below the North Fork gage. However, if no pumping were to occur adjacent to that portion of the North Fork, the alluvium would possibly remain saturated.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
12	17	Decision Process - General Use of Science and Analysis	Figure 8. North Fork well field groundwater drawdown, Pg.107 (6) shows the USGS designated area affected by groundwater drawdown, the cone of depression. Curiously, the USGS located the center of their circle about 1/8 mile downstream from NF-4, when NF-3 is the logical center of the well field. **Response:** On the cited figure, the projected drawdown extent depicted is noted in text as being based on USGS observations, which are further described in the preceding figure and text. The drawdown projection is clearly described as an approximation, and other drawdown projections are discussed on SDEIS pages 103 and 104.
12	18	Decision Process - General Use of Science and Analysis	Balleau Groundwater, Inc. is correct in projecting the SFEC as the southern boundary, especially when the depth to water exceeds 400 feet much of the time. A rational, scientific selection of the radius as being 1 mile from NF-3 explains why, under dry conditions and deep pumping, the SFEC is also pumped dry, even though it is classified as a perennial stream. **Response:** Balleau Groundwater (BGW) information was extensively reviewed and included in analysis during technical report and EIS preparation. There are other interpretations of effects and extents, and assumptions and data limitations influence all of the conclusions. The BGW drawdown extent depicted in the DEIS and Figure 33 of earlier draft Water Resources Report indicate approximately 0.1 to 1 foot of pumping drawdown along the South Fork. That is based on a number of assumptions, and the actual drawdown may be more or less. From that, the actual effects on the South Fork are not well understood at this time.
12	20	Decision Process - General Use of Science and Analysis	The difference between a perennial stream, an intermittent stream and a dry arroyo is the depth to water. In spite of numerous assurances from the USFS that depth to water data would be included and evaluated, both the USGS study and the AECOM reviews failed to integrate depth to water data into their reports. Monthly depth to water data reporting was a requirement of the Stipulation and the VoR Operating Plan with which the VoR has often complied. **Response:** We agree that depth to water is important. Monthly depth-to-water reporting was reviewed, but it is sparse data, and does not take into account the states of other watershed variables, notably precipitation and snowmelt, ET, and natural lag in groundwater recharge. Low storage and high transmissivity are understood to be aquifer characteristics in the upper Eagle Creek basin. From a larger perspective, data reviews and multiple outside sources have already documented pumping effects on North Fork streamflows, reducing them due to induced percolation and recharge. That forms a basis for further potential impact comparisons between alternatives.

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12	21	Decision Process - General Use of Science and Analysis	The USGS has described the NF gage as being within the perennial region of the North Fork. The water table that supplies it is uphill from the gage. Once that downward flowing water reaches the cone of depression in the vicinity of the gate to the summer cabins, the surface water is redirected by gravity into media that is porous enough to allow downward flow toward the bottom of the cone. The area of influence of this cone of depression at the surface is about 2 miles across. All of the water inside the cone is below the streambed. Thus, the streambed remains dry from the gate to the summer cabins to the confluence of the NFEC with the SFEC, the dry reach often including the SFEC and the EC gage. **Response:** Comment noted. The EIS analyzes potential impacts from situations such as this, and other circumstances. A range of alternatives that may contribute to this condition, alleviate it, or create a different multiple-use resource setting, has been assessed in the EIS.
12	23	Decision Process - General Use of Science and Analysis	Figure 26, Pg.55 (2) and corresponding depth to water data, confirm the sustainability of surface flow in the NFEC study area, under no-pumping conditions, for over 3 months. Between March 8, 2007, and June 14, 2007, the static water level in NF-1 varied between 9 and 12 feet, the static water level in NF-3 held at 5 feet, and the static water level in NF- 4 held steady at 0 feet, artesian conditions.[...] This visually intermittent stream condition created by a full aquifer is far different than the dry creek bed created by the cone of depression that causes every day to be a no-flow day in the NFEC. **Response:** There is no question that under the conditions of snowmelt, precipitation, recharge, and the lack of pumping during that time period, flow occurred in the North Fork. The EIS team has not contended otherwise. The generalization that every day is a no-flow day in the NFEC due to pumping alone is not supported by available information.
12	17	Decision Process - General Use of Science and Analysis	Figure 8. North Fork well field groundwater drawdown, Pg.107 (6) shows the USGS designated area affected by groundwater drawdown, the cone of depression. Curiously, the USGS located the center of their circle about 1/8 mile downstream from NF-4, when NF-3 is the logical center of the well field. **Response:** On the cited figure, the projected drawdown extent depicted is noted in text as being based on USGS observations, which are further described in the preceding figure and text. The drawdown projection is clearly described as an approximation, and other drawdown projections are discussed on SDEIS pages 103 and 104.

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12	20	Decision Process - General Use of Science and Analysis	The difference between a perennial stream, an intermittent stream and a dry arroyo is the depth to water. In spite of numerous assurances from the USFS that depth to water data would be included and evaluated, both the USGS study and the AECOM reviews failed to integrate depth to water data into their reports. Monthly depth to water data reporting was a requirement of the Stipulation and the VoR Operating Plan with which the VoR has often complied. **Response:** We agree that depth to water is important. Monthly depth-to-water was reporting was reviewed, but it is sparse data, and does not take into account the states of other watershed variables, notably precipitation and snowmelt, ET, and natural lag in groundwater recharge. Low storage and high transmissivity are understood to be aquifer characteristics in the upper Eagle Creek basin. From a larger perspective, data reviews and multiple outside sources have already documented pumping effects on North Fork streamflows, reducing them due to induced percolation and recharge. That forms a basis for further potential impact comparisons between alternatives.
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21	63	Decision Process - General Use of Science and Analysis	The SWRR of the SDEIS is not based on scientific analysis of the post Little Bear Wildfire hydrologic conditions. Data from 2014 were not analyzed as part of the SWRR even though all water level data from the monitoring wells and production wells were provided monthly to the USFS by JSAI. **Response:** This comment has been addressed in responses to similar comments from the same source. See responses to Letter 21, comment 74 and Letter 21, comment 7.
21	64	Decision Process - General Use of Science and Analysis	The results of the SDEIS including the proposed pumping alternatives and associated monitoring measures do not consider the changed hydrologic conditions. It is not understand why the USFS would rush to promulgate the current SDEIS given the changed conditions. It would have been prudent for the USFS to have performed a more detailed analysis of post-fire conditions, and reviewed more references related to fire impacts, vegetation changes, and basin yield changes in order to fairly and scientifically evaluate the changed conditions **Response:** Several changes have been made to the EIS since the fire, as described in chapter 1 of the SDEIS. A considerable number of relevant sources for fire effects in southwestern coniferous forests were reviewed for the SDEIS. Of course there are others, and given unlimited time and resources, endless research could be conducted as suggested by the comment. The ongoing changes in post-fire conditions have been documented, and are expected to keep changing for a period of time. Proposed monitoring would address that.

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21	75	Decision Process - General Use of Science and Analysis	The Supplemental Water Resources Report (SWRR) of the Supplemental Draft Environmental Impact Statement (SDEIS) provides a thorough summary of existing data and reports for the upper Eagle Creek watershed before the Little Bear Wildfire. The objective of the SDEIS was to evaluate changed conditions within the watershed post Little Bear Wildfire. Unfortunately, the report assumes that either now, or within the next few years, the watershed will have the same hydrologic conditions over the entire permit period as those prior to the Little Bear Wildfire. This assumption is unfounded and not based on United States Department of Agriculture, Forest Service (USFS) reports (i.e., General Technical Report RMRS-GTR-42-Volume 4, September 2005) or other published documents. This erroneous assumption results in essentially the same alternatives being presented with respect to pumping or not pumping of the Village wells, as those proposed in the original AECOM (2011). **Response:** This comment has been addressed in responses to similar comments from the same source. See responses to Letter 21, comment 74 and Letter 21, comment 7.
21	84	Decision Process - General Use of Science and Analysis	The Groundwater Recharge section of the SWRR references work by the USGS for estimating recharge using the chloride mass-balance approach. The chloride mass-balance approach used by the USGS to estimate groundwater recharge (Matherne et al., 2010) underestimated groundwater recharge, and therefore, reference to this estimate should not be considered and it should be removed from the final EIS. **Response:** Anthropogenic sources of chloride can be significant, but not in an upland watershed such as the North Fork Eagle Creek basin. If any doubt remains because of concern over chloride contamination from septic effluent from the North Fork cabins, which are only occupied part of the year; then an analysis of the chloride upstream of the cabins should remove all doubt.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	85	Decision Process - General Use of Science and Analysis	The surface-water samples collected by the USGS (Matherne et al., 2010) that were used to estimate groundwater recharge using the chloride mass-balance method were collected above the North Fork Eagle Creek streamflow gage. There were, and still are, septic systems in use immediately adjacent to and above the gage at the time of sample collection. There are about 20 homes above the sample location and each has a septic system or some type of leach field because none of the homes are connected to a regional waste-water collection system. Likewise, samples collected from existing monitoring wells, domestic wells, and Village production wells would also be impacted by return flow from septic systems and attempts to calculate recharge using data from these wells would provide erroneous results. The USGS (Matherne et al., 2010) used other methods to estimate recharge for the area and these methods resulted in recharge estimates as great as 3,330 acre feet per year (ac-ft/yr). **Response:** The septic systems in the North Fork are few and not in continual use. If there is some concern as to their potential for chloride contamination, samples could easily be taken from a point further upstream. The mass-balance recharge estimate had a large range of error due to uncertainty in each of the components of the equation. It is frequently overestimated in arid environments when there is no actual evapotranspiration data. (Gee and Hillel, 1988, Groundwater recharge in arid regions: review and critique of estimation methods, Hydrological Processes, v. 2, p. 255-266.)
21	86	Decision Process - General Use of Science and Analysis	The Groundwater Wells in the Study Area section of SWRR mentions a "fifth" well drilled by the Village in the North Fork of Eagle Creek. It is our understanding that the "fifth" well was turned over to the USFS many years ago. The "fifth" well is not in service and the New Mexico Office of the State Engineer (NMOSE) online database does not contain any information that the USFS submitted meter records for the well or properly plugged and abandoned the well. The Village does not have five production wells in the North Fork of Eagle Creek. **Response:** That is correct, the fifth well is not in service and this clarification has been made to the EIS in response to this comment
21	87	Decision Process - General Use of Science and Analysis	The last column of Table 2 of the SWRR should reflect that the Village's wells are completed as open boreholes from below the bottom of the screen to the total depth of the wells. Therefore, the wells are essentially "screened" from the top of the screen to total well depth. As mentioned above in JSAI' s comments on the Borehole Lithologic and Geophysical Data section of the SWRR, groundwater moves unimpeded from the open borehole into the well. **Response:** Existing footnotes to the table already indicate this adequately for purposes of the EIS.

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21	88	Decision Process - General Use of Science and Analysis	SWRR figure 6 of the Alluvial Aquifer - Village Well Pumping Correlation section presents data from Village North Fork production well pumping, streamflow from the North Fork Eagle Creek gage and water levels in monitoring well MW-5A. This section of the SWRR draws several conclusions from SWRR figure 6 that are incorrect, particularly in the current (post-fire) hydrologic system. The incorrect conclusions include 1) streamflow less than 0.8 cubic feet per second (cfs) does not increase water levels in the alluvial aquifer because pumping from Village production wells creates depressed water levels in the volcanic aquifer, 2) streamflow of 1.2 cfs or greater is required to increase water levels in the alluvial aquifer when Village wells are pumping, and 3) the volcanic aquifer is recharged before the alluvial system is filled. **Response:** **Modifications to the Supplemental Water Resources Report have been made based on this comment**. It should be noted that this was a pre-fire exercise, but the revised discussion still needs to be included as part of the overall documentation.
21	89	Decision Process - General Use of Science and Analysis	In order to properly evaluate the connection between water levels in the volcanic and alluvial aquifers and streamflow, the current hydrologic data must be assessed **Response:** Available hydrologic data has been assessed in the preparation of the EIS; all data considered and any limitations, are described in full in the water resources report and the SDEIS. Since this is likely to be an ongoing process, it is suggested that the limitations of newly-collected data be recognized before the Applicant proceeds. Data limitations exist and are likely to continue. These include cumbersome raw data at randomly-varying time-steps; compromised post-fire surface gages; debatable monitoring well conditions; and a near-term period of record immediately following a disturbance to an already variable hydrologic system. Some of this review was undertaken by the IDT for selected comparisons, and results are included in the Supplemental Water Resources Report.
21	90	Decision Process - General Use of Science and Analysis	The Summary of Groundwater portion of the SWRR correctly points out that the alluvial aquifer system "does not readily transmit water vertically into the underlying volcanic aquifer." Similarly, the volcanic aquifer system cannot readily transmit water to the overlying alluvial aquifer. It should also be understood that recharge to the volcanic aquifer also occurs on outcrops throughout the watershed not just along the creek channel. **Response:** Unfortunately, this statement in the report is vague and without scale for “readily”. The occurrence of induced infiltration and its effects on streamflow are documented in existing information cited in the report (as Finch, et. al. 2004, Balleau and Silver 2010). **In addition, the Supplemental Water Resources Report has been modified in response to this comment.** It now clarifies that aquifer recharge occurs on a watershed basis, and also indicates that additional post-fire water yield may be available (with corresponding implications for potential impacts).

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21	91	Decision Process - General Use of Science and Analysis	As shown on Figures 1 through 3, water levels in the alluvial aquifer at MW-5A are maintained at flows less than 0.5 cfs in the post-fire hydrologic setting. For example, water levels in MW-5A persisted even with flows as low as 0.1 cfs. Furthermore, water levels in MW-5A increase within 1 to 2 days after streamflow increases even when water levels in the volcanic aquifer are below the base of the alluvial aquifer. The post-fire data indicate the volcanic aquifer does not have to be recharged before the alluvial aquifer system is filled (Figs. 4, 5, and 6), and the changed hydrologic conditions after the fire have resulted in water in the shallow alluvial aquifer when surface flows are less than 0.5 cfs as measured at the North Fork Eagle Creek gage (Fig. 3). **Response:** Comment noted. **Changes have been made to the Supplemental Water Resources Report in response to Letter 21, Comment 88 above.** This comment seems to tie in with that. None of the conditions indicated in this comment would activate an adaptive management trigger under Alternative 3 if selected, except perhaps the cumulative withdrawal trigger, which is not based on streamflow or water levels anyway. Under the circumstances indicated, it appears that pumping would continue under Alternatives 1 and 3. If a Alternative 3trigger would otherwise activate, then the Village and the USFS would promptly coordinate on a response. No text changes have resulted from this specific comment.
21	95	Decision Process - General Use of Science and Analysis	Table 3 of the SWRR and any related analysis of data should be removed from the report because the analysis related to the streamflow is incorrect and has no bearing on the subject SDEIS. The Eagle Creek near Alto gage is located outside of the cumulative impacts study area. **Response:** The cumulative impact study area is actually defined by the old Eagle Creek near Alto gage location where some historic data are available. The reasoning behind the cumulative study area boundary is described at the beginning of SDEIS chapter 3.
21	96	Decision Process - General Use of Science and Analysis	Basin yield estimates as presented in the SWRR underestimate yield in the early time periods. The USGS (Darr et al., 2014) estimated pre-wildfire basin yield for the upper Eagle Creek at 3,447 ac-ft/yr and baseflow at 819 ac-ft/yr. **Response:** Existing basin yield estimates in the technical report were done before the USGS finished their 2014 work, and the Supplemental Water Resources Report was being written as the USGS was writing its report. The EIS discloses all data used and its applicability.

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21	97	Decision Process - General Use of Science and Analysis	In addition to the underestimated yield, the watershed is now drastically different than it was pre-fire. The pre-fire estimates may prove valuable to assess basin yield two to three decades from now assuming a properly managed forest. A properly managed forest would, unlike the pre-fire forest, be one that is not allowed to become overgrown resulting in impaired hydrologic function and decreased basin yield. The SDEIS must evaluate baseflow in the changed conditions post-wildfire as they exist today not as they may exist once the forest is allowed to become overgrown again. **Response:** It is true that for the time being, the watershed is different than it was pre-fire. However, we have not seen data or information to support the assertion that two to three decades will be needed to stabilize post-fire hydrologic conditions, or what those conditions might be. Vegetation management is outside the scope of this EIS, but conifer density is discussed in chapter 3 of the EIS. Alternative 3provides flexibility to evaluate baseflows under ongoing changing conditions.
21	99	Decision Process - General Use of Science and Analysis	The SWRR provides some analysis of post-fire surface and groundwater conditions through 2013, but no analysis of 2014 data. Although soils in some areas are initially hydrophobic after a wildfire (USDA, 2003; Moody and Martin, 2001; DeBano et al., 2005; USFS, 2012), this effect decreases over time (DeBano et al., 2005; Ffolliott et al., 2011) and lasts about 1 to 6 years (Ffolliott et al., 2011; DeBano et al., 2005). The decrease in the effect of hydrophobic soils should not be confused with the overall change in the watershed that resulted from the destruction of significant vegetation, woody debris, and forest litter, and the associated relatively long-term change in hydrologic conditions. **Response:** The post-fire assessment is clearly based on a number of watershed and water balance factors described in the Supplemental Water Resources Report text and tables. Hydrophobic soil effects are not at all confused with other fire effects related to vegetation and canopy changes, erosion and sedimentation, increased runoff, and other factors. Proposed adaptive management triggers and monitoring measures have been revised in light of that assessment.
21	100	Decision Process - General Use of Science and Analysis	A summary of basin-yield calculations after the Little Bear Wildfire is provided in Table 3. Calculations were made using the same methods as those provided in the SWRR to calculate basin yield before the fire. The percent canopy after the fire was reduced by the percent of moderate- to high-severity fire within each of the elevation bands. The post Little Bear Wildfire North Fork Eagle Creek basin yield will increase by 425 ac-ft/yr and the South Fork Eagle basin yield will increase by 61.3 ac-ft/yr (Table 3). The baseflow will also increase above those calculated in the SWRR and new calculations should be provided as part of the final EIS, as well as the USFS preferred alternative modified accordingly. **Response:** **Changes have been incorporated into the Supplemental Water Resources Report (and corresponding EIS sections)** with respect to post-fire reduced evapotranspiration and the potential for greater water yield (including groundwater recharge). If implemented, Alternative 3 would provide for further data to be incorporated into management. See also the response to Letter 21, Comment 86 above.

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21	102	Decision Process - General Use of Science and Analysis	the SDEIS does not quantify the increase in streamflow following the changed hydrologic conditions of the watershed after the Little Bear Wildfire. **Response:** Increased streamflow is likely after the fire, as described in SDEIS discussion. However, also as discussed for post-fire conditions, both streamflow gages (USGS 08387550 and 08387600) have been repeatedly compromised by sediment and debris since the fire. That makes the data even more questionable than the pre-fire data at the downstream gage.
21	105	Decision Process - General Use of Science and Analysis	The desired condition of maintaining surface-water flow at the Eagle Creek gage to no flow periods of 20 to 30 days or less per year is not based on scientific data related to the water needs of riparian vegetation, aquatic habitat, or wildlife. This USFS desired condition is essentially unchanged from the first draft EIS. The desired instream flow condition at the Eagle Creek gage appears to be based on the USDA Forest Service (2000) preferred conditions for maintaining instream flows. **Response:** This USFS desired condition is clearly stated to be a compromise between continuous pre-pumping flow at the Eagle Creek gage, and the number of post-pumping no-flow days at the gage. We recognize the Eagle Creek gage has since been described as a compromised monitoring location. That uncertainty is disclosed in the SDEIS and other locations for measurement are identified as part of Alternative 3The relationship of this number of no flow days to riparian and aquatic habitat is also discussed in chapter 2 of the SDEIS.
21	110	Decision Process - General Use of Science and Analysis	The SWRR incorrectly states that the Village's well pumping results in changes to wetlands, springs, and seeps. As previously mentioned, there are no data related to historic flows at springs or seeps, nor has there been a determination as to whether or not the source of the springs or seeps is from perched water movement or from the regional aquifer system. Within the SWRR, the location and extent of wetlands, if they exist, have not been cataloged or documented. This section indicates that "an understanding of the baseline hydrologic and geologic conditions has been ascertained and described." In fact, as documented repeatedly above, the baseline hydrologic conditions have not been ascertained and described in the post-fire setting. The most complete description of the current baseline setting is included in our review of the SWRR. **Response:** **Text modifications were made to correspond to this comment**. There are springs and seeps within the North Fork watershed that may or may not be located within the various projected drawdown extents. In both the EIS and the Supplemental Water Resources Report, it is the EIS team's responsibility to identify that there could be impacts to these features, but also to describe the considerable uncertainty of those impacts and the lack of data for the springs and seeps. With respect to the baseline post-fire hydrologic conditions, the reader is referred to responses to Letter 21, comment 115 and similar comments.

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21	111	Decision Process - General Use of Science and Analysis	As previously mentioned, it is unreasonable to use springs and seeps as a measurement indicator when no data related to them exist, other than approximate location. The lack of historic flow data, whether or not the features are perennial, historic response to drought, and water-quality changes make these features unusable for indicators with respect to Village pumping. This measurement indicator must be removed because it was not "derived on the basis of existing data." **Response:** **Text modifications have been made to correspond to this comment**. There are springs and seeps within the North Fork watershed that may or may not occur within the various projected drawdown extents. In both the EIS and the Supplemental Water Resources Report, it is the EIS team's responsibility to identify that there could be impacts to these features, but also to describe the considerable uncertainty of those impacts and the lack of data for the springs and seeps.
21	112	Decision Process - General Use of Science and Analysis	The Village has water rights for all pumping it performs . Domestic wells do not have water rights, but rather are permitted by the NMOSE to pump water. Any potential impact by Village pumping on domestic wells or any other wells is under the jurisdiction of the NMOSE. The projected drawdown area is not correct and must be reassessed using current hydrologic conditions for the watershed. **Response:** We agree that the VoR has water rights and we acknowledge the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right. We also agree that domestic wells do not have water rights. We are unclear on the assertion that the project drawdown area is not correct.
21	113	Decision Process - General Use of Science and Analysis	As indicated in the SWRR, the stream channel geometry, including depth and width will continue to change for some period of time post-fire. The effects of having a wider and deeper alluvial channel should be assessed as part of the EIS. Thicker and wider alluvial channels will allow more surface water to infiltrate into the alluvial aquifer system, and will result in less surface water. The DEIS should address this change because it has a significant bearing on the Monitoring Measures as proposed in the SWRR. **Response:** The potential fire effect on stream channel geometry, both laterally and vertically, is documented in the EIS and the Supplemental Water Resources Report. A site visit, relevant literature review, and review of the USGS report (Open-File Report 2013-1108) were incorporated into the text. Importantly, additional monitoring flexibility and related measures, at least some of which should be readily attainable, were added due to this consideration.

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21	114	Decision Process - General Use of Science and Analysis	Quantification of surface flow should be based on post-fire conditions. It may take several more years to scientifically develop applicable quantification indicators. **Response:** Agreed, and this is really the overall context of Alternative 3 Current conditions on the North Fork are compromised by the Little Bear Fire. Current adaptive management triggers under Alternative 3 are based on current knowledge, and the intent of Proposed Action would be to create a starting point, and then be adaptive.
21	115	Decision Process - General Use of Science and Analysis	Based on published data related to effects of wildfires, and data for the subject area, it is not reasonable for the SDEIS to assume that "the original assessment approach and its impact indicators are judged to remain appropriate for the longer-term post-fire impact comparisons." This assumption may be true a few decades from now if the forest returns to an overgrown state, but it is certainly not true for the current hydrologic condition due to the extensive damage and changes caused by the Little Bear Wildfire. **Response:** **Text modifications have been made to the post-fire sections of the Supplemental Water Resources Report (and EIS)** in response to this comment. See also responses to similar comments (i.e., comment Letter 21, comment 74)
21	116	Decision Process - General Use of Science and Analysis	The SDEIS presents no data or references from fires of the size and severity of the Little Bear Wild fire that indicate the hydrologic conditions will be similar to what they were within 4 to 8 years as stated. **Response:** The SDEIS review is based on literature and fire experience as available for coniferous forests in the region, and is oriented to processes that are likely to occur in the post-fire watershed. Fire severity and effects (such as water-repellent soils, increased runoff, and debris flows) were reviewed from the fire-specific BAER reports, other USFS data, and the local USGS investigation. All this material is cited.
21	118	Decision Process - General Use of Science and Analysis	Balleau Groundwater, Inc. (BGW) is a hydrogeologic consulting firm providing services to numerous entities in the area that routinely protest all water rights applications by the Village. The use of a model developed by BGW that has not been reviewed and approved by the NMOSE, or Village consultants, is unreasonable and should not be included as part of the SDEIS. In addition, the changed conditions in the watershed post-fire nullify modeling efforts attempted pre-fire or post-fire given the current hydrologic condition of the watershed. **Response:** **The monitoring measure referred to has been revised**. The USFS has not dictated the use of a particular model from any source. However, in its roles of gathering public input, collecting and reviewing available information, and discussing and disclosing that information, the USFS has properly included information from Balleau Groundwater and other sources. Model documentation factors and other considerations mentioned in this comment are why substantial use of the BGW model has not been made for the EIS

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21	128	Decision Process - General Use of Science and Analysis	In the second paragraph under "Well Pumping Volume" at the top of page 32, the 300 acre-feet per year or 900 acre-feet per three year period is based on 500 acre-feet per year recharge as determined by the chloride mass balance method. The chloride mass-balance method has questionable accuracy according to the USGS report and the AECOM report. The basin yield method used by the USGS indicates a midpoint recharge value of 1950 acre-feet per annum which equates to basin yield minus direct run-off. The 490 acre-feet per annum recharge computed by the chloride mass balance method is not compatible in any nature with and does not correlate with basin yield, measured surface water out-flow, direct run-off or base flow of Eagle Creek. The 490 acre-feet per annum is substantially less than the mean annual base flow of 819 acre-feet per annum computed independently by the WHAT analysis of the surface water outflow. This is not possible since recharge is the sum of base flow and groundwater outflow. Obviously the 490 acre-feet recharge value is erroneous. The Little Bear Fire has reduced the forest ET and therefore the groundwater recharge would increase significantly. **Response:** See response to letter 21, comment 120. Darr (2014) points out that the chloride ". . . method is applicable for use in the upland subwatersheds of the upper Rio Hondo Basin because chloride sources are typically not present in volcanic rocks." Also, anthropogenic sources of chlorine in the North Fork watershed are insignificant.
21	130	Decision Process - General Use of Science and Analysis	Under "Well Pumping Volume" last paragraph, page 31,in footnote 2, it is stated that "However, Figure 16 makes note that the alluvial wells were dry in March of 2009, which will also need to be considered in the adaptive management for riparian areas." To monitor the alluvium water levels which are depleted and dry much of the time with or without well pumping makes no scientific sense. **Response:** Additional data from monitoring locations along the North Fork would benefit an adaptive management program by improving the understanding of relationships between pumping, alluvial water levels, riparian condition, and flow in the stream. The existing data and associated uncertainties have been discussed in the EIS and the Supplemental Water Resources Report. Given the high degree of variability in the North Fork hydrologic system, additional data would benefit future management. As for alluvial water levels being depleted with or without well pumping: regarding Figure 16 (from USGS 2011), production well NF-4 had been pumping at approximately 1.6 acre-feet per day in early March 2009, and for approximately two months preceding. However, there are also short periods of data showing reduced streamflows, or no flow, in some parts of the North Fork in the absence of pumping. Additional monitoring would help define conditions and promote improved management. Matherne and others (2011) states on p. 31 that "During the study, the alluvial wells were generally dry, except when there was flow in the North Fork or shortly after heavy rainfall." Flow in the North Fork resulted in the alluvial wells not being dry. That is the general condition; no flow, no alluvial water.

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21	131	Decision Process - General Use of Science and Analysis	Referring to the discussion related to the NPDES permit within the third paragraph of page 45, the North Fork of Eagle Creek is intermittent and described under 20.6.4.98 NMAC as "All non-perennial unclassified waters of the state, except those ephemeral waters included under 20.6.4.97 NMAC". This water-body has not had a use attainability analysis (UAA) performed which triggers full protection of swimmable/fishable. This means that since there has been no UAA, then under EPA review, the strictest standard is applied without any regard for the existing on-site conditions. This strictest standard application does not make sense in this intermittent stream. **Response:** Water quality aspects were introduced to the EIS on the basis of aquatic habitat and related fisheries concerns. The Forest Service does not have authority or responsibility for State and USEPA rules, or how they are administered by those agencies. State and USEPA stream-use designations, related water quality standards, and their application are outside USFS jurisdiction. If implemented, the proposed monitoring measures related to flow and water quality may form a source of information on this topic if it is ever pursued by appropriate agencies. This standard is an EPA standard and is not a Forest Service standard. The EPA administers this standard. Intermittent streams are a natural occurrence in nature and do support appropriate riparian ecosystems and associated flora and fauna. The NFEC is capable of performing as both intermittent and perennial functions depending on water flow conditions throughout the system.
21	135	Decision Process - General Use of Science and Analysis	The entire discussion on pages 47 and 48, under "Add more storage capacity to the system" should be deleted. The information is not correctly done using sound engineering principles and should be completely omitted or treated in the same way as the suggestion for a water purification plant. **Response:** Adding storage was considered but dismissed from detailed analysis, as stated in the SDEIS, chapter 2: “This suggestion is outside the scope of this project . . . this alternative was dismissed from further detailed analysis.”

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21	136	Decision Process - General Use of Science and Analysis	On pages 48 and 49, all of the information related to the 1.2 CFS flow rate being supported by the USGS should be further clarified with additional discussion considering the following information: The USGS report indicates that from 0.6 to 1.2 CFS (depending on permeability) is needed to saturate the alluvium at the widest alluvium section on North Fork in the vicinity of the NF-1well and from 0.7 to 1.0 CFS flow is lost to bedrock above the well field. Referring to Figure 29 of the USGS report, the value of 0.6 to 1.2 CFS flow to saturate the alluvium diminishes drastically down to 0.2 to 0.1 CFS or less needed for continuous surface flow for the majority of the stream reach below the North Fork wells down to the Eagle Creek Below South Fork Gage. The use of 1.2 CFS flow needed to saturate the alluvium is greatly overstated and is an incorrect application of the USGS report information. **Response:** The material on SDEIS pages 48 and 49 is presented under “Alternatives Considered but Eliminated”. Most or all of these were suggested as public input to the USFS from outside parties based on their own ideas. They have not been continued in the NEPA analysis. The 1.2 cfs value has been used as an impact metric for purposes of comparisons. Its derivation and use for that has been further explained in text. However, that value is not included in an adaptive management approach, or in any management objective.
21	137	Decision Process - General Use of Science and Analysis	On page 51 the USGS discussion on the chloride mass balance method for calculating recharge needs to include the following information: The chloride mass-balance method has questionable accuracy according to the USGS report and the AECOM report. The basin yield method used by the USGS indicates a midpoint recharge value of 1950 acre-feet per annum which equates to basin yield minus direct run-off. The 490 acre-feet per annum recharge computed by the chloride mass balance method is not compatible in any nature with and does not correlate with basin yield, measured surface water out-flow, direct run-off or base flow of Eagle Creek. (See Comment No.2 to Chapter 2 of the DEIS above). The derivation of the 300 acre feet per year pumping threshold is not based on correct recharge information and should be reconsidered. **Response:** Matherne and others (2011) discussed the potential errors of the chloride mass-balance recharge determination on page 27 of their report. Basically, they say that the method gives a long-term average determination, with the understanding that annual recharge will vary from year to year depending on climate conditions; higher or lower than the average. Concerning the use of the chloride mass-balance method, Darr and others (2014) state that “. . . the chloride mass-balance approach was used in upland watersheds in order to evaluate the groundwater-recharge components to piedmont areas. The chloride mass-balance approach was not applicable to lower-elevation watersheds where naturally occurring chloride-bearing strata and possible domestic wastewater could influence chloride concentrations.” The North Fork watershed is such an upland watershed.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	141	Decision Process - General Use of Science and Analysis	On page 71 under the "Water Rights" Table and under Alternatives 2 and 3, the Village would not be able to fully apply water to beneficial use and the present inchoate amounts of 625.78 acre-feet per annum within North Fork wells No. 1and No. 3 would be in jeopardy of being lost. Under present policy of the State Engineer, the inchoate water right cannot be moved by application to other wells and locations away from the present authorized wells No.1and No.2. This means that any unproven portion of the water right would be lost by the Village. The present value of the inchoate water rights would be approximately $8,000 per acre-foot, being a total lost water right value of approximately $5,000,000. This loss of water rights would have to be made up by purchases of water rights in the Rio Ruidoso Drainage and moving said water rights to the Village of Ruidoso. This value of water rights is calculated considering the junior water rights value at 50% of senior water rights and the water rights are all consumptive use as adjudicated. **Response:** The village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the VoR's water rights include a permit issued to the Village transferring the 700.83 acft from EC well H-1979 to the surface point of diversion at EC and at Alto Reservoir. The permit severed 700.83 acre feet from EC well H-1979 and transferred the right to the surface point of diversion on EC and at Alto Reservoir.By transferring the 700.83 acre feet from EC H-1979, that allows the remaining inchoate right of 350.42 acre feet/yr to proven up by 12/31/2024. In addition, the 10 permitted supplemental wells off of US Forest lands can divert Eagle Creek water rights, allowing the remaining inchoate rights to be proven at their identified locations. However, depending on the alternative chosen and the Village's diversification in pumping, some inchoate rights could potentially be lost, but actions to secure additional rights and diversion have already been undertaken by the Village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives
7	2	Decision Process – Proposed Action/ Purpose and Need	EPA rates the SDEIS as "LO" i.e., EPA has "not identified any potential environmental impacts requiring substantial changes to the proposal, and the SDEIS adequately sets forth the environmental impacts of the alternatives." The EPA's Rating System Criteria can be found here: http://www. epa.gov /oecaerth/nepa/comment s/rating s.htm l. **Response:** Thank you for your rating and your review
11	1	Decision Process – Proposed Action	As mentioned in our previous comments, the ECCA maintains the position that water extraction at the North Fork Eagle Creek well field will contribute to further degradation of the creek downstream from the wells. **Response:** Thank for your comment and your position. The effects of the alternatives on stream flow and other aspects of the environment are described in detail in EIS chapter 3.

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11	5	Decision Process – Proposed Action/ Purpose and Need	In the past, the ECCA has extensively commented on the original DEIS. Most of these comments were rejected or disregarded by the DEIS team. Although differing in details, Alternative 3of the SDEIS, issuing a permit for the use of the North Fork Eagle Creek (FEC) wells under a managed water withdrawal plan, is not substantially different from of the original DEIS. **Response:** The input of ECCA and other stakeholders in this process have all been valued and carefully considered in developing the EIS and its supporting reports. The original DEIS includes an explanation of all alternatives previously considered but dismissed from detailed analysis as well as a cataloging and response to all comments we received during the original scoping period (DEIS appendix A) **which has also been added to the FEIS**. The SDEIS also includes a summary of the comments we received on the DEIS prior to the Little Bear wildfire and the closure of the comment period (SDEIS appendix C) and a description of how these have been considered in the preparation of the SDEIS. Chapter 1 and the alternative descriptions in chapter 2 of the SDEIS describe the changes made to the alternatives since the DEIS was issued.
11	6	Decision Process – Proposed Action/ Purpose and Need	The Eagle Creek Conservation Association Inc. (ECCA) remains of the opinion that the proposed action is to the detriment of the Eagle Creek. Extracting water near the origin of a stream is just a bad idea. It diminishes the downstream flow and will, like the NFEC, kill the stream and devalue the greater stream area for wildlife and recreation. **Response:** The predicted effects of implementing all three alternatives is included in detail in chapter 3, including each alternative's predicted impact on various aspects of water resources, riparian areas, fisheries, and socioeconomics (including recreation).
11	7	Decision Process – Proposed Action/ Purpose and Need	The ECCA is of the opinion that the implementation of the proposed action will result in not more than little improvement, if any, in the surface flow of the North Fork Eagle Creek (NFEC). This opinion is supported by Dr. Midkiff's paper "North Fork Eagle Creek Degradation/Evaluation of Alternatives".[...]The ECCA recognizes the merits of Dr. Midkiff's paper; attachment of Dr. Midkiff's paper to ECCA's comments does not necessarily constitute full agreement of all ECCA members with its total content **Response:** Comment noted.

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16	2	Decision Process – Proposed Action/ Purpose and Need	As you know, the NEPA process which is the subject of this letter was triggered by a Settlement Agreement between the United States Forest Service and the Eagle Creek Conservation Association ("ECCA"), Gerald Ford, and Bill Midkiff in the above referenced litigation. The underlying litigation was triggered by the plaintiffs' contention that unregulated pumping in the North Fork of Eagle Creek adversely affected environmental and socio-economic values in a way that triggers compliance with NEPA. To settle this litigation, the United States Forest Service ("USFS") agreed to complete an EIS process that would assess the alleged impacts of North Fork pumping. A subsequent supplement to the Settlement Agreement obligates the USFS to assess "all reasonable alternatives," including but not limited to an alternative "that leaves downstream flows in the same state that they would be in absent the pumping of the North Fork wells." **Response:** Thank you for your comment. The EIS does include an alternative (no pumping) that would leave downstream flows in the same state they would be absent pumping.
18	14	Decision Process – Proposed Action/ Purpose and Need	The Forest Service proposed action should be changed to the authorization the existing wells that are in operation (NF well #1 and NF well #4) and require the plugging and abandonment of the two wells that are not presently in use and have not been in use for a significant period of time. The validity of authorizing four municipal water wells when two wells have not been used in many years and the two wells presently in production have the ability to withdraw more ground water than the 300 acre feet per year stated in the Well Pumping Volume section of the proposed action. **Response:** This suggestion is discussed on EIS pages 38 and 39, under alternatives considered but dismissed from detailed analysis

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21	4	Decision Process – Proposed Action/ Purpose and Need	In discussion of Alternatives, including Adaptive Management Strategy and Monitoring it was noted as follows: "Because of the changes anticipated to hydrologic conditions and the other significant issues, as discussed above, we also anticipate that these management triggers may need to be revised." Specifically, "The surface flow volume trigger is directly tied to data that would be collected from the Eagle Creek and North Fork Stream gages. These gages are no longer fully operational and are expected to continue to require frequent maintenance. These gages may no longer be reliable as a basis for this trigger." Continuing, it was noted "The well pumping volume trigger identified may need to be revised based on the fact that the recharge value it was based on (500 acre-feet-per-year) may no longer be valid." "The riparian vegetation trigger may need to be relaxed or made more flexible." Finally, "The monitoring strategy may need to be adjusted; these adjustments are expected to be minor." None of the water levels or streamflow data from 2014 was considered in the SDEIS. Somewhat stunningly, the supplemental DEIS, as issued for comment on November 14, 2014 appears to reflect none of these concerns having been addressed. **Response:** The proposed adaptive management strategy is not intended to be a final, rigid approach to water resource management along the North Fork. By definition, it would be adaptive. Issues with existing data records and monitoring locations have already been presented in the EIS, its supporting documentation, and discussion of the proposed adaptive management strategy. Analysis of intractable short-term data collected close on the heels of the Little Bear Fire, especially when the need for other data sources has been clearly indicated in text, is not likely to modify the outcome of impartial comparisons between EIS alternatives. However, depending on the nature of a Special Use Permit (if one is issued), those data could help inform a continuing water resources management program as proposed by the Forest Service. Keep in mind that the adaptive management triggers, however, have been revised since the DEIS was issued and the fire occurred. These and other changes to the EIS are listed at the beginning of chapter 1 and also in the description of the adaptive management strategy in chapter 2.

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21	7	Decision Process – Proposed Action/ Purpose and Need	The agency, having determined to proceed without consideration of the changed circumstances in issuing the SEIS, simply failed to fulfill its lawfully mandated duty, and did not take the hard look necessary to evaluate the impact of the changed circumstances on the proposed action. **Response:** The USFS considered carefully the changed circumstances in its analysis of post-fire conditions, and also considered ongoing, changing conditions in an impartial analysis. Existing EIS monitoring measures already identify issues with the monitoring stations (including wells) used in the Village's continuing data collection, in addition to substantial stream channel aggradation effects. It is not possible to conduct a quantitative post-fire analysis similar to the pre-fire analysis, which used much longer-term data. The USFS thus performed an extensive, impartial literature review of regional USFS and other research to develop a reasonable qualitative projection of post-fire North Fork watershed conditions and water balance factors. That review, its results, and its sources are presented in the Supplemental Water Resources Report and the EIS. The review is also reflected in revised proposed monitoring, and potential impact comparisons between alternatives. Raw, post-fire data provided by the Village is in a cumbersome, burdensome format (e.g., inconsistent timesteps) that does not correspond to pre-fire USGS data. It would require much additional data processing and analysis to use these data further, when their value for comparisons between EIS alternatives does not correspond to that effort. Where possible, the USFS did do selected additional data analysis to compare selected post-fire data to selected pre-fire data. That exercise and its results are described in the Supplemental Water Resources Report. Under Alternative 3 the adaptive management proposal is, by definition, specifically oriented to adaptability through time as additional information becomes available and is reviewed in an interactive approach. That is the major purpose for proposed continued data collection after recommended modifications to the monitoring system have been made. Current collected data can then be processed and compared to improved monitoring data, and perhaps add value to management.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	8	Decision Process – Proposed Action/ Purpose and Need	As mentioned above, no historic data are available for the springs or seeps. The source of the springs and seeps is unknown, and therefore, potential impacts from pumping are unknown. It is unreasonable and unscientific to assume that springs and seep will be impacted moderately to severely by pumping without documenting the source of the springs and without any historic or actual data that substantiates the assumption. Also, as mentioned above, the post-fire hydrologic conditions have vastly changed from the pre-fire hydrologic conditions and will not be the same in the next 4 to 8 years. All recurring references to this misstatement should be removed. Pre-fire conditions have no relevance to the changed hydrologic conditions of the watershed and should be removed from the SDEIS. **Response:** It is recognized that no historic data or source characterization have been done for springs and seeps. **Revisions have been made to the text to address this comment.** However, as mentioned in responses to other comments, the anticipated post-fire conditions are based on an impartial review of regional and local literature. Some post-fire effects will endure, as described in the EIS and reports. The basis for the conclusions reached regarding potential impacts to springs and seeps are documented in the water resources report and the EIS. While site-specific data are lacking, inferences were made and conclusions reached based on literature review, data and professional judgement.
21	106	Decision Process – Proposed Action/ Purpose and Need	The SDEIS presents no technical data regarding the source of springs and seeps, no discharge measurements, nor any water quality. The desired condition unjustly assumes that Village pumping is the only mechanism that can impact springs and seeps. The desire to maintain a threshold water depth is also arbitrary and capricious. The SWRR attempts to show that when groundwater levels are depressed in the volcanic aquifer, the alluvial aquifer cannot recharge until the volcanic aquifer recharges. As documented above, this is untrue. Therefore, the desired condition of maintaining the as of yet undetermined water-table depths is unjustified. **Response:** As stated above, it is recognized that no historic data or source characterization have been done for springs and seeps and some revisions to this section of the water report and the EIS have been made to address this concern. The threshold water depth measure pertains to the goal of maintaining or improving riparian condition. If, after measures for rehabilitating and re-locating monitoring wells indicate that other water table characteristics are better suited to adaptive management, then current metrics (which simply provide a starting point) can be replaced. The SWRR does not attempt to show that the alluvial aquifer cannot recharge until the volcanic aquifer recharges. It can. The SWRR does attempt to show, using commonly-applied data and other reviews, that pumping from the volcanic aquifer affects the alluvial aquifer and stream baseflows. Pumping drawdown is not the only factor involved in baseflow conditions; **we have made clarifications to the EIS and its SWRR in response to this concern.**

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	108	Decision Process – Proposed Action/ Purpose and Need	The need for action must require the USFS to provide financial assurance that it will properly maintain and manage the forest in order to assure favorable surface and groundwater supplies, riparian habitat, and aquatic ecosystems. **Response:** Please see response to letter 21, comment 70 related to forest management and financial assurances. The Forest Service has worked through a broad spectrum of alternatives, data, and information, and considered extensive public input throughout the EIS process. The agency has not made any decisions. Three alternatives are analyzed in detail in the EIS and were developed to address the purpose and need for action, project objectives, and significant issues. These are described in chapter 1 of the EIS and include protecting natural resources. The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including how well the alternatives address the purpose and need for action, consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions. It will also outline the non-discretionary measures and mitigation necessary for implementation.

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21	119	Decision Process – Proposed Action/ Purpose and Need	In the fourth bulleted paragraph under "Background" on page 2, it should be mentioned that the prior Eagle Creek Below South Fork Gage with surface flow data during years 1969-1980 was located approximately 360 feet downstream from the present location with surface flow data since 1989. The prior downstream location was within a stream reach that, by field inspection of AEAI and according to Figure 29 of the USGS report, was on bedrock with little if any alluvium. It should be noted that there would be basically no alluvium underflow at the prior gage location, whereas the present gage location would have significant alluvium underflow of up to 0.16 CFS referring to Figure 29. The no flow days tabulated for both the pre-pumping period and the post pumping period are not tabulated from the same gage location and are not comparable due to the difference in stream underflow conditions. The no-flow days are greatly exaggerated for the post-pumping period as compared to the pre-pumping period by using the present different location of the gage. **Response:** Please refer to other previous comments and our responses regarding the concern with the location of the Eagle Creek gage. The EIS and supporting water resources report already mention uncertainties about the Eagle Creek gage data. Other outside sources also used historical data from both gage locations in the work that the EIS team reviewed, and developed conclusions consistent with the EIS. **Further text and figures related to this topic have been added to the EIS and the Supplemental Water Resources Report to clarify this situation.** It should be noted that however much “alluvium underflow” actually does occur at the relocated gage site, some of it originates from the South Fork drainage. Given that the North Fork drainage (approximately 3,409 acres) is about twice the size of the South Fork drainage (about 1,778 acres), it seems reasonable to assume that roughly one-third of any alluvial underflow at the gage (and possibly more due to North Fork pumping) could originate from the South Fork, not the North Fork. If, as noted in the comment, up to 0.16 cfs could underflow the Eagle Creek gage (USGS 08387600), then through contributing watershed areas, up to about 0.10 cfs of that may originate from the North Fork. Under similar precipitation conditions, a comparison of long-term mean daily flows (50 percent exceedance values) from the pre-pumping to post-pumping periods indicates that the post-pumping mean daily flow is 1.1 cfs, or 0.5 cfs less than the pre-pumping value (1.6 cfs). If the 0.1 cfs underflow is added back in, then the long-term decline is 0.4 cfs, or 25 percent of the long-term pre-pumping mean daily flow. Similarly, at lower flows (the 80 percent exceedance values), the long-term post-pumping decline is about 31 percent. Obviously, shorter-term specific flow events may vary in either direction from this, due to variable watershed states. Other existing data and comparisons indicate that flow reductions are likely from pumping on the North Fork, and this is described in detail in the EIS and supporting water resources report.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	120	Decision Process – Proposed Action/ Purpose and Need	The fifth bulleted paragraph under "Background" on page 2 indicates that the groundwater recharge was estimated to average 490 acre-feet per year. This value was calculated by the chloride mass-balance method which has questionable accuracy according to the USGS report and the AECOM report. The basin yield method used by the USGS indicates a midpoint recharge value of 1950 acre-feet per annum which equates to basin yield minus direct run-off. The 490 acre-feet per annum is not compatible in any nature with and does not correlate with basin yield, measured surface water out-flow, direct run-off or base flow of Eagle Creek. The 490 acre-feet per annum is substantially less than the mean annual base flow of 819 acre-feet per annum computed independently by the WHAT analysis of the measured surface water outflow. This is not possible since recharge is the sum of base flow and groundwater outflow. Obviously the 490 acre-feet recharge value is erroneous. The Little Bear Fire has reduced the forest ET and therefore the groundwater recharge would increase significantly. **Response:** The range of error for the chloride mass-balance method in Matherne et al (2011) was given as 485 to 502 acre-feet per year for the North Fork Eagle Creek Basin. The basin yield method includes a wider range of error because of uncertainties associated with each component; precipitation, evapotranspiration, and discharge. This results in an uncertainty of ± 1380 acre-feet per year, which is 87% of the midpoint estimate of 1950 acre-feet per year (Matherne et al, 2011). The WHAT analysis resulting in a baseflow estimate of 819 acre-feet per year was based solely on the Eagle Creek gage, and as such is a summation of both North and South forks of the upper Eagle basin. As 65% of the basin is the North Fork sub-basin, its portion of the 819 acre-foot base flow estimate would be on the order of 536 acre-feet per year, closer to the chloride mass-balance estimate. Since the WHAT analysis is a statistical method, it also has a range of error associated with its use, and the selection of coefficients. Its error must also include the gage error and the uncertainty of the relative contributions of the North and South forks of Eagle Creek. The little bear fire would indeed reduce evapotranspiration. However, recharge would not necessarily be increased because of hydrophobic soils and lower resistance to surface flow which would likely result in greater runoff and less infiltration in the short term.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	121	Decision Process – Proposed Action/ Purpose and Need	The sixth bulleted paragraph under "Background" on page 2 states erroneously that sustained flows of 2.2 CFS (consisting of 1.2 CFS to saturate the alluvium and 1.0 CFS bedrock loss) are needed to maintain continuous flow in North Fork. The USGS report indicates that from 0.6 to 1.2 CFS (depending on permeability) is needed to saturate the alluvium at the widest alluvium section on North Fork in the vicinity of the NF-1 well and from 0.7 to 1.0 CFS flow is lost to bedrock above the well field. Referring to Figure 29 of the USGS report, the value of 0.6 to 1.2 CFS flow to saturate the alluvium diminishes drastically down to 0.2 to 0.1 CFS or less needed for continuous surface flow for the majority of the stream reach below the North Fork wells down to the Eagle Creek Below South Fork Gage. The use of 1.2 CFS flow needed to saturate the alluvium is greatly overstated and is an incorrect application of the USGS report information. **Response:** The EIS text is a direct quote from the USGS abstract, page 1, second column (Matherne, et. al. 2011). **Other text changes clarifying the occurrence and use of the 1.2 cfs value have been made in the Supplemental Water Resources Report and the EIS**. See also the response to Letter #21, Comment #136.
21	122	Decision Process – Proposed Action/ Purpose and Need	The Second Bulleted Paragraph on Page 10 under "measurement Indicators" entitled "Streamflow quantity" indicates that 1.2 CFS flow in Eagle Creek Below South Fork Gage should be used as an stream flow impact indicator. This is not a correct Value for Eagle Creek Flow to saturate alluvium for the reasons as discussed in Comment No. 3 above. A much smaller value should be derived and used, possible in the range of 0.25 CFS or less. This smaller number should be related to riparian vegetation water requirements and not derived from saturated alluvium flow requirements. **Response:** Based on impartial consideration of all public comments, a major issue for the EIS is flow in the stream. The EIS team has only used the 1.2 cfs value as an impact benchmark for comparisons between alternatives (i.e. a measurement indicator, see chapter 2 of the EIS for a description of these indicators and how they are used). **This has been clarified in revised text**. It is not, and never was, any sort of management objective, flow restriction, or monitoring tool. The adaptive management triggers, and how they were derived, are discussed in chapter 2 of the EIS and this section describes the relationship between the no-flow -day trigger and the riparian trigger and how it was derived. All of these triggers area adaptive and recognize that as more information is gained during implementation, modifications could be made.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	123	Decision Process – Proposed Action/ Purpose and Need	The fourth bulleted paragraph on page 10 under "Measurement indicators" entitled "Springs and seeps" relies on a Technical Memorandum of May 12, 2004 from Casey W. Cook, Balleau Groundwater, Inc. to identify springs and seeps that may be affected by pumping. Relying on the Technical Memorandum requires a multitude of erroneous assumptions related to aquifer conditions (as described in detail on page 71 of the AECOM Water Resources Report) such that the adverse results are greatly exaggerated to the worst case scenario. To rely on this Balleau Groundwater, Inc. work for any purpose would not be acceptable and would lead to erroneous results. **Response:** **Revisions to the EIS have been made in response to this comment**. See responses pertaining to similar comments (i.e. letter 21, comment 8).
23	20	Decision Process – Proposed Action/ Purpose and Need	Include a provision in the final proposed action to allow for the Village wells to pump sufficient water during high flow periods to prove up their full water right on the North Fork of Eagle Creek which would enable the Village to transfer the current inchoate water rights to non- Forest lands. The transfer of inchoate rights has the potential to save the Village substantial expense associated with finding and obtaining the water rights needed to meet the future needs of the Village. At the very least this opportunity should be explored **Response:** Implementation of Alternative 3 would not preclude the Village to pump at higher levels during high flow periods as long as the triggers were not reached. The success of this approach may depend on the Village's available storage capacity and water conservation programs, which would all be encouraged under implementation of any action alternative. This suggestion is also addressed by alternative 2 – continue pumping at current/historic levels.
18	16	Economic Conditions and Values - Community Economic Effects	The no action alternative of issuing a permit with no changes in the existing operation is not a solution to the problems identified by the available science provided in the reports by USGS, Finch and Balleau. This alternative is not viable to the economy of the area nor the required environmental management of the Eagle Creek drainage as provided in the Forest Service manual. **Response:** The alternatives analyzed in detail in the FEIS do not address the purpose and need for action or the project objectives to the same degree and this is described in the FEIS. The maintenance of current riparian conditions is likely to occur under alternative 1 as a result of the long-term water extraction and a rebalancing of riparian area ecological dynamics of water availability and biotic responses. Each alternative in the EIS is compared and contrasted to each other to provide the public and the Responsible Official with a full understanding of the differences between alternatives, including how well they address the purpose and need for action and move the area toward desired conditions (as documented in chapter 3 and summarized in table 2). The predicted effects of implementing the alternatives to the local economy and to natural resources are described in detail in EIS chapter 3.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
18	17	Economic Conditions and Values - Community Economic Effects	The Village of Ruidoso has proclaimed and promoted the business of tourism in the area but has ignored an integral part of tourism by the environment degradation of the Eagle Creek drainage and its cold water fishery that drew campers, fisherman, and naturalist to a drainage located on the National Forest. VOR has completely eliminated fishing from Alto Lake. This lack of overall tourism management is an economic component that the Village of Ruidoso has chosen to ignore because of poor management and lack of concern for the natural resources that surround the village. **Response:** Consequences to recreation are examined throughout the DSEIS. As stated on page 13 “North Fork Eagle Creek primarily provides opportunities for dispersed recreation; there are no developed recreation sites along the North Fork Eagle Creek between the North Fork gage and Eagle Creek gage; the nearest developed recreation site is Oak Grove Campground, greater than 1 mile from the North Fork Eagle Creek well field. Dispersed recreation, as defined in the forest plan, is recreation use that occurs outside of developed sites and requires few, if any, facilities other than roads and trails. In the project area, dispersed recreation activities primarily including hiking, backpacking, and camping. The only aspects of dispersed recreation with potential to be affected by the alternatives are streamside recreational use and fishing opportunities. Since these recreation aspects are discussed in other sections of chapter 3 (under “Aquatic Habitat and Fish” and “Socioeconomics”), dispersed recreation is not discussed further."

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	77	Economic Conditions and Values - Community Economic Effects	The USFS preferred alternative, Alternative 3, remains little changed from that proposed during the Pre-Draft Environmental Impact Study, or the AECOM (2011), with the exception that extremely onerous monitoring requirements and structures have been added that would be quite expensive to perform and for which there are no baseline data for comparison and justification. **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). **Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FEIS.**

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	78	Economic Conditions and Values - Community Economic Effects	The USFS persists in supporting its originally preferred alternative (Alternative 3) regardless of the changed watershed conditions by not including or evaluating recent data and the changed hydrologic conditions. This is certainly unfortunate for the Village, but more importantly is an unscientific approach to a process that is presumed to be based on scientific methods and analysis. **Response:** Please refer to response to letter 21, comment 7. The USFS considered carefully the changed circumstances in its analysis of post-fire conditions, and also considered ongoing, changing conditions in an impartial analysis. It is not possible to conduct a quantitative post-fire analysis similar to the pre-fire analysis, which used much longer-term data. The USFS thus performed an extensive, impartial literature review of regional USFS and other research to develop a reasonable qualitative projection of post-fire North Fork watershed conditions and water balance factors. That review, its results, and its sources are presented in the Supplemental Water Resources Report and the EIS. The review is also reflected in revised proposed monitoring, and potential impact comparisons between alternatives. Raw, post-fire data provided by the Village is in a cumbersome, burdensome format (e.g., inconsistent timesteps) that does not correspond to pre-fire USGS data. It would require much additional data processing and analysis to use these data further, when their value for comparisons between EIS alternatives does not correspond to that effort. Where possible, the USFS did do selected additional data analysis to compare selected post-fire data to selected pre-fire data. That exercise and its results are described in the Supplemental Water Resources Report. Under Alternative 3, the adaptive management proposal is, by definition, specifically oriented to adaptability through time as additional information becomes available and is reviewed in an interactive approach. That is the primary purpose for proposed continued data collection after recommended modifications to the monitoring system have been made under alternative 3 (and to a lesser extent, alternative 1). Current collected data can then be processed and compared to improved monitoring data, and perhaps add value to management.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	125	Economic Conditions and Values - Community Economic Effects	On page 11 under "Socioeconomics" the mention of availability of water for domestic wells should be omitted due to the following reasons: No data or information has been assembled or correlated to determine any effects to domestic wells on private land off of Forest land and the Village holds all of the existing water rights to divert Eagle Creek surface water with senior priority dates as compared to the domestic permitted wells. The domestic wells upstream from the well field on Forest land are all junior in priority to the Village wells on Forest land and cannot relate the priority of the domestic wells back to the date of the illegal surface water diversions previously used by the cabin owners. The domestic wells could be deepened by the well owners if needed in the future. **Response:** Domestic wells located on National Forest System lands do not have water rights. Domestic wells are authorized as a special use and are for domestic purposes only. The Forest Service has an obligation to assess direct effects to other uses, as a result of actions under the alternatives, Disclosure of those effects does not imply a need to take action on those effects, thus this section will not be omitted. Applicability of Prior Appropriation Doctrine is under the jurisdiction of the Office of the State Engineer.
21	126	Economic Conditions and Values - Community Economic Effects	Under Socioeconomics and near the bottom of page 11under "Streamside Recreational Use" this discussion should be de-emphasized and moved to the non-significant issues and not included in the alternative comparison discussion. The intermittent nature of the pre-pumping stream removes any streamside recreational use since the stream historically has no consistent stream flow. **Response:** Thank you for your opinion on the non-significance of this issue. The DEIS and the SDEIS both described the reasoning behind this and why it was used as a comparison between alternatives.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	143	Economic Conditions and Values - Community Economic Effects	With the Alternative No. 1the well diversion by the VOR on Forest lands would likely average 740 acre-feet per annum. Under Alternative No. 3, the VOR diversion on Forest lands would likely average 300 acre-feet per annum, being the same quantity of water per year as the trigger point in adaptive management, if exceeded. This could result in a loss of 440 acre-feet per year of consumptive use (CU) water diversion for the VOR. This amount of consumptive use diversion of water for municipal use would have to be made up by additional diversion on the Rio Ruidoso. Within the Rio Ruidoso there are very little if any junior water rights that could be moved into the VOR municipal diversions. The water rights available to make up the 440 acre-feet per annum consumptive use are senior irrigation water rights with priorities in the 1800's and with a consumptive irrigation requirement (CIR) of 1.44 acre-feet per acre per annum. Using the court ordered irrigation CIR of 1.44 acre-feet per acre per annum, then an equivalent (440 af/ac/an CU)/(1.44 af/an CIR)=305.56 acres of irrigation water rights. The value of senior priority irrigation water rights within the Rio Ruidoso drainage presently is approximately $23,000 per acre which would equate to a total present cost for 305.56 acres of (305.56 acres)($23,000 per acre)=$7,027,880.The litigation cost to move said water rights to the VOR could be reasonably estimated at $500 per acre being a total of ($500 per acre)(305.56 acres)=$152,780. Apparently the replacement water diversion cost and the litigation cost would total $7,180,660. **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). **Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FEIS.**

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	2	Economic Conditions and Values - Community Economic Effects	The Forest Service proposed action will clearly result in major economic impacts to the Village of Ruidoso and its citizens. Hence, an economic analysis should have been conducted which would have indicated the financial hardships being imposed on the Village. Assuming that there are no major financial impacts (as was done in the DSEIS) does not make them go away. **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). **Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FEIS.**

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	5	Economic Conditions and Values - Community Economic Effects	With Alternative1 continue pumping current amounts, the well diversion by the Village of Ruidoso from wells on Forest lands would average an estimated 740 acre-feet per annum. Under Alternative 3, the Village diversion on Forest lands would average an estimated 300 acre-feet per annum, being the same quantity of water per year as the trigger point in adaptive management plan Alternative 3, if exceeded. This could result in a loss of 440 acre-feet per year of consumptive use (CU) water diversion for the Village. This amount of consumptive use diversion of water for municipal use would have to be made up by purchasing additional diversion on the Rio Ruidoso. Within the Rio Ruidoso there are very few if any junior water rights that could be moved into the Village municipal diversions. The water rights available to make up the 440 acre-feet per annum consumptive use are senior irrigation water rights with priorities in the 1800's and with a consumptive irrigation requirement (CIR) of 1.44 acre-feet per acre per annum. Using the court ordered irrigation CIR of 1.44 acre-feet per acre per annum, then an equivalent 440 acre feet per acre using the court order of 1.44 CIR would amount to 305.56 acres of irrigation water rights needed to be purchased (440 acres divided by 1.44 CIR per acre).2 The value of senior priority irrigation water rights within the Rio Ruidoso drainage presently is approximately $23,000 per acre which would equate to a total present cost for 305.56 acres at $23,000 per acre which totals to $7,027,880.3 **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). **Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FEIS.**

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	7	Economic Conditions and Values - Community Economic Effects	Water Rights Litigation Costs Trying to purchase irrigation water rights on the Rio Ruidoso and getting the rights transferred to the Village is a difficult and time consuming process incurring substantial attorney and water consultants' fees and expenses. Further, the process may take several years to complete. The litigation cost to move said water rights to the Village could be reasonably estimated at $500 per acre-foot for a total of $500 per acre. Thus, the acquisition costs of the needed 305.56 acres of irrigation water rights would amount to a total $152, 780.4 The $500 per acre is a conservative estimate of the cost. If water 2 Email with Jack D. Atkins PE,PS, Akins Engineering Associates to William Gorman, January 15, 2015. 3 Ibid. 4 Ibid. rights had to be purchased from several sellers to acquire the acreage needed the cost could be much greater. **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of National Forest System lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FSEIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	8	Economic Conditions and Values - Community Economic Effects	Problems related to obtaining permits for work associated with new wells could delay the completion of the wells by years, and significantly increase the costs present below. If the water produced during the drilling, completion, develop and test pumping cannot be discharged to the land surface, the cost to complete the wells could increase by 150%. If water cannot be discharged to the ground surface during test pumping, meaningful pumping tests cannot be performed due to the inability to haul significant quantities of water from the sites. Based on our experience with developing groundwater flow models used as part of the EIS process, the costs associated with developing a groundwater flow model by committee as contemplated could easily double the estimated cost. " **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of National Forest System lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FEIS. In addition, the monitoring measure regarding developing a model has been revised.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	9	Economic Conditions and Values - Community Economic Effects	The State Engineer for New Mexico has Jurisdiction over water rights in New Mexico except for reserved federal water rights. One can have adjudicated water rights but these rights must be put to beneficial use to become a property right that allows the owner to transfer the right. Putting the water to beneficial is called "proving-up". The village presently has 625.78 acre feet of annual ground water rights on the North Fork Creek that have not been proven-up (inchoate rights).8 Under the Forest Service 8 Email with Jack D. Atkins PE,PS, Akins Engineering Associates to William Gorman, December 13, 2014. restriction in the Proposed Action, the Village wells No. 1 and No. 3, would not be allowed to pump sufficient water to prove-up these rights which means that these rights would be in jeopardy of being lost by the Village.9 Under the present policy of the State Engineer, the inchoate water rights cannot be moved by application to other well and other locations away from the present authorized wells No.1 and No. 3.10 **Response:** We acknowledge the applicant's state adjudicated water rights. The village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of National Forest System lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. In addition, the 10 permitted supplemental wells off of National Forest System lands can divert Eagle Creek water rights, allowing the remaining inchoate rights to be proven at their identified locations. However, depending on the alternative chosen and the Village's diversification in pumping, some inchoate rights could potentially be lost, but actions to secure additional rights and diversion have already been undertaken by the Village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	11	Economic Conditions and Values - Community Economic Effects	The water rights loss through non-proved up would be junior inchoate water rights. Since the loss is junior rights with a priority date after the year 1947, the rights would be valued at exactly % the value of senior water rights or $11,500 per acre. Each acre would have an adjudicated CIR of 1.44 acre-feet per year. Therefore the junior consumptive use water rights value lost through not being proven up would be equivalent to $11,500 per acre divided by 1.44 acre-feet per acre = $7,986. Rounded to $8000 per acre-foot consumptive use and multiplied by 623.78 acre feet of inchoate rights totals to approximately $5,000,000 (rounded). This deficit would have to be made up by the VOR thorough the purchase of water rights in the Rio Ruidoso Drainage.11 The estimated $5 million needed to compensate for this loss of inchoate water rights does not include the additional $500 dollars per acre in litigation and consultant costs needed to complete the purchase and secure the transfer of the water rights to the Village. **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of National Forest System lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FSEIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	12	Economic Conditions and Values - Community Economic Effects	Costs to the Village to Purchase, Setup and Operate a New Wireless Weather Station Required by the Forest Service in the Proposed Action. Option 3 requires the village to install a weather station in the project area. The cost of weather stations vary greatly depending on the features required, the location, and the quality. A safe estimate is $20,000 for a high quality Campbell system powered by solar energy with backup battery which will log temperature, rain fall wind and solar and transmit data by cellular service. This figure would include installation setup, solar panel, and software. Annual operating costs are expected to be about $150 per month for wireless service and about $450 per year to inspect and service the station about three times per year. If the setup location was not served by a maintained road, the costs might be higher. **Response:** Actually, the proposed measure is only about the Village partnering with the USGS to operate one of the precipitation gages which that agency has already installed. Since precipitation data are already being recorded and published by the USGS from several gages in suitable locations, it was our assumption that this measure would not be too difficult or expensive for the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation “For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision” (40 CFR 1502.23). Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FSEIS.
23	13	Economic Conditions and Values - Community Economic Effects	In addition ignoring the economic impact costs to the Village, Eichman and Loughery13 made several other comments regarding recreation activities and social justice. Many of their comments overstate the potential biological impacts and understated the impacts on social justice. Their comments should be regarded as their opinions as their views are not supported by appropriate data. **Response:** We disagree that the analysis presented in these sections of the EIS are based on personal opinions. The basis for the analysis and conclusions reached by these technical area specialists is described in EIS chapter 3 as well as the more detailed socioeconomic report in the project record.

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23	14	Economic Conditions and Values - Community Economic Effects	Over generalization on reductions of recreation benefits for the proposed action. Their claims, either direct or indirect, that recreation benefits will increase significantly by selecting the proposed action Alternative3 over the current pumping authorization (Alternative 1). The proposed action only impacts a short section of the North Fork Creek projected to have reduced flows and more no-flow days. The potential impacts might impact the relative small project area but not the entire length of the creek and not areas used by hikers and campers some distance from the creek. Recreationists have access to many alternatives other than the project area of North Fork Creek area. There are many equally attractive substitutes such as; the upper part of the Creek, South Fork, Rio Ruidoso and other streams and a large area of the forest not in close proximity to the North Fork Creek to visit. Eichman and Loughery failed to discuss the other available choices for recreational activities leaving the reader with the impression that a recreation disaster would occur because of reduced flows in the relatively small project area. It is equally plausible that most visitors might not perceive any decline in their experience, nor is there evidence that there might be a reduction in overall visitor days. The lack of trees along the stream providing shade due to the Little Bear Fire is a more probably cause for a decrease in visitor days than any reduced stream flows in the near term. **Response:** Consequences to recreation are examined throughout the SEIS. As stated on page 13 “North Fork Eagle Creek primarily provides opportunities for dispersed recreation; there are no developed recreation sites along the North Fork Eagle Creek between the North Fork gage and Eagle Creek gage; the nearest developed recreation site is Oak Grove Campground, greater than 1 mile from the North Fork Eagle Creek well field. Dispersed recreation, as defined in the forest plan, is recreation use that occurs outside of developed sites and requires few, if any, facilities other than roads and trails. In the project area, dispersed recreation activities primarily including hiking, backpacking, and camping. The only aspects of dispersed recreation with potential to be affected by the alternatives are streamside recreational use and fishing opportunities. Since these recreation aspects are discussed in other sections of chapter 3 (under “Aquatic Habitat and Fish” and “Socioeconomics”), dispersed recreation is not discussed further."

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	15	Economic Conditions and Values - Community Economic Effects	The importance of fishing in the project area below the wells is not supported with sufficient evidence. The Bright report (Table 9) list the number of angler days and fish caught in Eagle Creek based on mail survey data from anglers beginning in the 1975-76year through 2007-2008. 14 He compares the average angler days and fish caught from 1975-76 through 1988-89, a period before pumping began, with the period beginning 1990-91 through 2007-08 after pumping began. The average number of angler days dropped from 717 to 320 and fish caught from 3,220 to 890. This is a substantial drop. Bright acknowledge that it is not a scientific study and the data were based on the entire length of the Eagle Creek including the South Fork as well as areas below the confluence of the North and South Forks rather than limited to the study area. The study area comprises only a small part of Eagle Creek but including a discussion on fishing for the entire Eagle Creek is not germane to the evaluation of the impacts of pumping by the Village wells in the small project area. However, including these conclusions in the SDEIS report tends to be misleading and clouds the issue leaving the reader to conclude that fishing impacts are important to the EIS analysis **Response:** Please see also responses to previous comments in this table regarding the fisheries analysis. Changes have been made to this section to address this comments. Consequences to recreation are examined throughout the SDEIS. As stated on page 13 “North Fork Eagle Creek primarily provides opportunities for dispersed recreation; there are no developed recreation sites along the North Fork Eagle Creek between the North Fork gage and Eagle Creek gage; the nearest developed recreation site is Oak Grove Campground, greater than 1 mile from the North Fork Eagle Creek well field. Dispersed recreation, as defined in the forest plan, is recreation use that occurs outside of developed sites and requires few, if any, facilities other than roads and trails. In the project area, dispersed recreation activities primarily including hiking, backpacking, and camping. The only aspects of dispersed recreation with potential to be affected by the alternatives are streamside recreational use and fishing opportunities. Since these recreation aspects are discussed in other sections of chapter 3 (under “Aquatic Habitat and Fish” and “Socioeconomics”), dispersed recreation is not discussed further."

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	18	Economic conditions and Values - Community Economic Effects	Summary of Costs Likely to Impact the Village of Ruidoso with Implementing Alternative 3 Description of Activity Current Dollars Purchase Replacement water rights $7, 180,660 Litigation fees $152,780 Monitoring & Measurement Costs $1,010,760 Loss of Value for inchoate water rights $5,000,000 Weather Station Exclusive of Annual Operating Expenses $20,000 Total $13,346,200 The total cost of nearly of $13.4 million to the Village of Ruidoso for accepting the proposed action plan for a special use water authorization can hardly be considered trivial and judged not worthy of inclusion in the Draft Environmental Impact Statement in the discussion under the socioeconomics impacts section. This incursion of these costs will likely require the Village to sell municipal bonds and to either increase property taxes or increase water utility rates (or both) as a source of funds to retire the bonds. This increased debt load will curtail the capacity of the Village to provide other needed services to its residents. Given that 12 percent of the people living within the Village had incomes below the poverty level in 201216 according to US Census Bureau data; the proposed action would create an inequity issue (Environmental Justice). Those living below poverty level would have decreased capacity to pay increases in city taxes and fees (through increased property taxes or rent or water costs) and would likely eliminate purchases other necessary items in their budget to survive whereas the higher income groups would have more discretionary funds available to cover increases in property taxes and increases in utility [auto-markup:Economic]fees **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of National Forest System lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FSEIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
12	8	Permits	The United States Forest Service (USFS) has always had adequate evidence to deny the Special Use Permit for the Village of Ruidoso (VoR) to operate the North Fork (NF) wells, located in and along the North Fork Eagle Creek (NFEC). While the degradation of the North Fork was never the intent of the USFS, it is indisputably the consequence of allowing continued pumping of the NF wells since 1986. **Response:** The Record of Decision will document whether or not to issue a new permit (EIS page 9). It will document the Responsible Official's selection of an alternative for implementation and its rationale, based on a thorough review of the EIS, the project record and public comments.
18	2	Permits	The issuance of a permit by the Forest Service without firm restrictions on the VOR will result in the same effects as no authorization since 1995. DO NOT continue to violate FS policy and the public trust. **Response:** Record of Decision will document whether or not to issue a new permit (EIS page 9). It will document the Responsible Official's selection of an alternative for implementation and its rationale, based on a thorough review of the EIS, the project record and public comments.
7	4	Permits – Clarification/ Edits	Please clarify what "checking the permit terms and conditions" means. Describe what actions could result from checking the terms and conditions. Describe any consequences that could result from checking the terms and conditions of the permits yearly versus every I 0 years. **Response:** **This has been clarified in the EIS**.
7	5	Permits – Clarification/ Edits	Include specific information regarding groundwater pumping rates if a 3-year declining trend equal to, or below, thresholds is realized. **Response:** The adaptive management strategy proposed as part of Alternative 3 and associated measures are written to allow flexible management of complex water resources uses. There are already sufficient metrics and flexibility for adaptive management in the proposed program.
7	6	Permits – Clarification/ Edits	Also, clarify the amount of time the Village of Ruidoso would have to bring water table depths above the thresholds. **Response:** The amount of time required for water level recovery would depend on other watershed factors, especially rainfall or snowmelt. Those factors are not within Village or USFS control. Adaptive management interactions would address conditions and needs at the time.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
6	2	Position Statement– No Rationale	I AM AGAINST USING NATIONAL LAND FOR DRILLING WELLS. **Response:** Thank you for your comment
10	1	Position Statement– No Rationale	In my capacity as secretary of the ECCA, Inc. I inform you that only correspondence coming from my office under my signature reflects the formal ECCA position on issues of the SDEIS and the North Fork Eagle Creek wells. **Response:** Thank you for your comment; it has been noted
11	3	Position Statement– No Rationale	Attached to the ECCA comments is Dr. Midkiff's draft paper "North Fork Eagle Creek Degradation/Evaluation of Alternatives". Although the ECCA is not completely in agreement with some of the statements in this paper, we believe this paper a valuable contribution to the discussion and we hope that it will be given ample consideration for the final issue of the SDEIS. **Response:** We received and have considered this paper.
13	1	Position Statement– No Rationale	Aquatic Consultants, Inc. (ACI) is pleased to provide comments on behalf of the Village of Ruidoso in reference to the changes that have occurred as a result of the Little Bear Wildfire in the North Fork of Eagle Creek (NFEC) watershed. These comments cover the North Fork Eagle Creek Special Use Authorization Project (NFECWSUAP) Fish & Wildlife Resource Report and Biological Evaluation, the Supplemental Information Report for the NFECWSUAP dated January 2014, and the Supplemental Draft Environmental Impact Statement for the NFECWSUA. **Response:** Thank you for your comments
15	1	Position Statement– No Rationale	The U.S. Department of the Interior has reviewed the Supplemental Draft Environmental Impact Statement for the North Fork Eagle Creek Wells Special Use Authorization Project, Lincoln National Forest, Lincoln County, New Mexico. In this regard, we have no comment. **Response:** Thank you for your review

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
16	1	Position Statement– No Rationale	The comments in this letter are supplementary to and in addition to any comments that you might receive from the ECCA and/or its members, Dr. Midkiff, and Mr. Ford or other individuals representing Mr. Ford. Furthermore, the comments that I make in this letter are supplementary to the other comments that I have made on the proposed action during the on-going decision-making process. These other comments include, but are not limited to, my letter of September 7, 2012 to ex-Supervisor Trujillo and my October 2, 2014 letter to Ms. Deborah[...] McGlothlin **Response:** Thank you for this clarification; it has been noted
19	1	Position Statement– No Rationale	The sad thing is without the wells the village still gets the water from Eagle Creek without all that expense from the diversion dams and the two wells down the creek plus the flow that goes into the Alto Reservoir. So when the village says they will lose 25% of their water resoures - that's plain bull sh_. **Response:** The socioeconomic section of the EIS in chapter 3 includes consideration of the contribution of these wells to municipal water supply, considering the best available information
6	1	Public Involvement	MAY I ALSO COMPLAIN THAT SUCH A LETTER AS THIS ONE IS SO NON INFORMATIVE THAT IT CONSTITUTES AS BEING ALMOST NON EXISTENT IN COMMUNCATING WITH THE PUBLIC - IT IS A NON LETTER WITH LITTLE TO NO INFORMATION IN IT. **Response:** Thank you for your comment; we apologize that the intent of the correspondence was unclear. The email you received was a follow-up to an earlier email with information on the availability of SDEIS for comment and how to do so, with contact information.
5	1	Public Involvement Collaboration / Meetings	I also request that the US Forest Service conduct a public comment session in the area after January 1, 2015. **Response:** This request for a public meeting has been shared with the District Ranger and Forest Supervisor for consideration

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	14	Recreation	Over generalization on reductions of recreation benefits for the proposed action. Their claims, either direct or indirect, that recreation benefits will increase significantly by selecting the proposed action Alternative3 over the current pumping authorization (Alternative 1). The proposed action only impacts a short section of the North Fork Creek projected to have reduced flows and more no-flow days. The potential impacts might impact the relative small project area but not the entire length of the creek and not areas used by hikers and campers some distance from the creek. Recreationists have access to many alternatives other than the project area of North Fork Creek area. There are many equally attractive substitutes such as; the upper part of the Creek, South Fork, Rio Ruidoso and other streams and a large area of the forest not in close proximity to the North Fork Creek to visit. Eichman and Loughery failed to discuss the other available choices for recreational activities leaving the reader with the impression that a recreation disaster would occur because of reduced flows in the relatively small project area. It is equally plausible that most visitors might not perceive any decline in their experience, nor is there evidence that there might be a reduction in overall visitor days. The lack of trees along the stream providing shade due to the Little Bear Fire is a more probably cause for a decrease in visitor days than any reduced stream flows in the near term. **Response:** Consequences to recreation are examined throughout the DSEIS. As stated on page 13 “North Fork Eagle Creek primarily provides opportunities for dispersed recreation; there are no developed recreation sites along the North Fork Eagle Creek between the North Fork gage and Eagle Creek gage; the nearest developed recreation site is Oak Grove Campground, greater than 1 mile from the North Fork Eagle Creek well field. Dispersed recreation, as defined in the forest plan, is recreation use that occurs outside of developed sites and requires few, if any, facilities other than roads and trails. In the project area, dispersed recreation activities primarily including hiking, backpacking, and camping. The only aspects of dispersed recreation with potential to be affected by the alternatives are streamside recreational use and fishing opportunities. Since these recreation aspects are discussed in other sections of chapter 3 (under “Aquatic Habitat and Fish” and “Socioeconomics”), dispersed recreation is not discussed further."
18	2	Roles and Authority	I also object as stated in the federal register of the manage objective that states "Providing water management flexibility and water conservation to the Village of Ruidoso in a way does not foreclose opportunities to transfer a portion of their water rights of these wells to location off of national forest system lands." The Forest Service has no jurisdiction over water rights! The state engineer has this jurisdiction over water rights so I question why this is a management objective of the Forest Service **Response:** We acknowledge the applicant’s state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant’s state adjudicated water right. Please refer to previous comments related to water rights and our response.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
22	4	Roles and Authority	The Forest Service does not have the authority to alter the elements of the Village's water right or to administer groundwater in New Mexico. The Forest Service does not have the **Response:** We acknowledge the applicant's state adjudicated water rights and the authority of the NMOSE to regulate water rights under Prior Appropriations Doctrine. As the surface land management agency, however, we have the authority and affirmative responsibility to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right. Please refer to previous comments related to water rights and our response.
22	6	Roles and Authority	The ownership of land does not confer any rights in flowing surface water or groundwater underneath the land of the Forest Service. Only to the extent that such water rights are acquired via state or federal law, can the Forest Service assert any legal interest in the public waters of New Mexico. Nor does the ownership of water rights, be it under state or federal law, confer upon the Forest Service the right to manage and regulate the water rights of others. Nevertheless, the Forest Service, through its SDEIS, proposes to assert such authority over water rights properly acquired, developed, and owned by the Village. **Response:** We acknowledge the applicant's state adjudicated water rights and the authority of the NMOSE to regulate water rights under Prior Appropriations Doctrine. As the land management agency, however, we have the authority and affirmative responsibility to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right. Please refer to previous comments related to water rights and our response.
22	7	Roles and Authority	New Mexico has a comprehensive and exclusive statutory scheme for managing and regulating its water that must be respected. The law of federal deference to state authority over water is well-established and should be similarly respected. While the Forest Service may manage its own water rights obtained under state or federal law, it has absolutely no authority to prevent other water rights owners with legal access to Forest Service land to divert water under an existing water right. **Response:** Thank you. We acknowledge the applicant's state adjudicated water rights and the authority of the NMOSE to regulate water rights under Prior Appropriations Doctrine. As the surface land management agency, however, we have the authority and affirmative responsibility to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right. Please refer to previous comments related to water rights and our response..

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
18	7	Trust and Credibility	I support the mandatory base line of three hundred acre feet of pumped ground water threshold, but, it is evident that in the past the Lincoln National Forest has violated the public trust by the following: 1) allowing the Village of Ruidoso to dry up what was once a beautiful cold water fishery stream; and 2) by allowing the Village of Ruidoso to continue unrestricted pumping without a permit since 1995. How long is the Forest Service going to allow this atrocity to continue? Who is going to be responsible to the public to make sure the environment is restored? **Response:** The Lincoln National Forest Supervisor will decide whether to issue a new permit or not, and if so, under what terms and conditions (see EIS, page 9). The Record of Decision will document the alternative selected for implementation and the rationale for this decision, considering the EIS, the project record, and public comments.
21	98	Trust and Credibility	Based on the fact that the forest was so overgrown and that the forest was categorized as impaired before the fire, it is not reasonable to assume that the USFS will follow its own plans related to maintaining the forest in good condition without financial assurances from the USFS. Management plans that are unfunded are little better than having no plan at all. **Response:** Please see also response to letter 21, comment 70 related to forest management and financial assurances. Vegetation management is outside the scope of this EIS, but conifer density is discussed in chapter 3 of the EIS. The Lincoln National Forest Supervisor will decide whether to issue a new permit or not, and if so, under what terms and conditions (see EIS, page 9). The Record of Decision will document the alternative selected for implementation and the rationale for this decision, considering the EIS, the project record, and public comments. The ROD will also include necessary adaptive management requirements, mitigations or monitoring measures applicable to the decision. These become non-discretionary once a decision is made.
21	107	Trust and Credibility	The SDEIS presents no technical data regarding the source of springs and seeps, no discharge measurements, nor any water quality. The desired condition unjustly assumes that Village pumping is the only mechanism that can impact springs and seeps. The desire to maintain a threshold water depth is also arbitrary and capricious. The SWRR attempts to show that when groundwater levels are depressed in the volcanic aquifer, the alluvial aquifer cannot recharge until the volcanic aquifer recharges. As documented above, this is untrue. Therefore, the desired condition of maintaining the as of yet undetermined water-table depths is unjustified. **Response:** See the response to Letter 21, comment 8, pertaining to modifications to the EIS regarding springs and seeps.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
1	8	Water Resources Clarification Edits	I have had a quick look at the SDEIS and Water Resources report you kindly provided. There is one problem in the report preparation that needs corrective attention. The draft is correct in the beginning of Chapter 2 to say that alternative 2, no action (no pumping), "sets the baseline against which the effects of pumping are compared", citing the CFR. However, Table 3 and the SDEIS text and the specialist report do not follow that guidance, but instead compare the proposed action to continued pumping at historical levels. The table and texts repeatedly say the proposed action "improves" streamflow and "reduces" drawdown. That is incorrect and misleading in regard to the baseline against which the effects must be compared. The point is important because of the misunderstanding about the nature of effects that might be created in the public readership. **Response:** **Revisions have been made to the EIS to address this comment**
1	9	Water Resources /Clarification Edits	Also, the Forest Supervisor should not be told that the proposal improves streams and reduces drawdown compared to no action, when the opposite is true. **Response:** **Changes have been made in response to this comment**
1	10	Water Resources /Clarification Edits	The p. 128 discussion of cumulative effects is a good illustration of the editorial problem in report preparation where alternative 1 is wrongly labeled "(no action)" when it is elsewhere the "(no change)" alternative. Alternative 1 grants a permit for continued pumping. Continued pumping is said to cause "additional adverse flow and water quality reductions" and "adverse impact to…other beneficial uses" long-term and regional, with "moderate to severe" drawdown impacts. These impacts of continued pumping are compared to the proper baseline. The entire discussion of the proposed (Alternative 3) action is not. Obviously, causing half as much impact as the "severe" impacts does not improve the streamflow and drawdown in comparison to no impacts per the CFR baseline. **Response:** See responses to Letter 1, comments 9, 11, etc.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
11	10	Water Resources /Clarification Edits	The NFEC flow-days recorded in the SDEIS may be valid upstream from the well field but cannot be considered representative for the flow downstream from the well field. In the last years, the NFEC downstream from the well field has been dry for months in succession and Alto Lake has been dry for an entire season. Measuring NFEC stream flow should be measured downstream from the well field independently from the South Fork Eagle Creek. Pump operation criteria should be established on the basis of creek flow downstream from the well field. Only that would allow improved flow in the NFEC. **Response:** Monitoring well data collections are proposed as a means of ascertaining hydrologic conditions along the North Fork. The stream gages remain in the program because they may be repaired and reasonably reliable at some point in the future, and also because they are the links to past data. An alternative gaging location nearer the well field upstream of the existing Eagle Creek gage was discussed within the EIS team, but was considered less reliable and much more expensive to construct and maintain considering unstable post-fire channel conditions. This is discussed in more detail in chapter 2 of the FEIS.
21	60	Water Resources /Clarification Edits	12.1 GENERAL COMMENTS FOR SWRR NOMENCLATURE AND EDITING Below are some suggested changes or corrections related to the SWRR: • Figures 1 and 4 have incorrect locations for MW-lA, North Fork Well 4 (NF-4), and DW-2. • Although referenced within the text, no faults are shown on Figure 2. • San Andres is repeatedly misspelled throughout the document as "San Andreas." • Grayburg is repeatedly misspelled throughout the document as "Greyberg." • The valleys wherein the South Fork and North Forks of Eagle Creek flow should be referred to as drainages or creek channels not river valleys. **Response:** **In response to this comment, changes have been made to the Supplemental Water Resources Report**
11	9	Water Resources Monitoring	The ECCA is of the opinion that the water management plan should include environmental monitoring immediately upon implementation of the plan, rather than waiting for five years as stipulated by the SDEIS. Early monitoring may result in action that will prevent or diminish further degeneration of the NFEC **Response:** The intent of the adaptive management strategy that is proposed as part of Alternative 3 is to initiate monitoring network activities and adaptive management much sooner than five years. Five years would be an interval for a subsequent, collective, overall review.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
13	4	Water Resources Monitoring	On page 4, the document states "The surface flow trigger is directly tied to data that would be collected from the Eagle Creek and North Fork stream gages. These gages are no longer fully operational and are expected to continue to require frequent maintenance. These gages may no longer be reliable as a basis for this trigger". If this is the case, then how come monitoring of the Eagle Creek, North Fork, and South Fork gages are still being required. Additionally, a trigger is still instituted if there is >30 days of no flow at the Eagle Creek gage. **Response:** Monitoring well data collections are proposed as a means of ascertaining hydrologic conditions along the North Fork. The stream gages remain in the program because they may be repaired and reasonably reliable at some point in the future, and also because they are the links to past data.
18	11	Water Resources Monitoring	Manual 2541 limits the actions available to the US Forest Service when there is evidence of degrading the natural resources of the stream. The allowance in the monitor indication section in the proposed action to allow no flow days should not be considered. No flow days during the period of 1988 to 2009 has affected the North Fork tributary and its associated riparian area and its ability of a cold water fishery since the North Fork well were put in operation. The degradation of riparian condition is evidenced by the comparison of the riparian vegetation up stream of the North Fork Eagle Creek wells. I feel that the threshold of 20 days per years of no surface flow or more that 30 no flow days within a single water year will be adverse to the established and improvements of the riparian vegetation between the North Fork wells and the Eagle Creek stream gauge. **Response:** Comment noted. This concern is addressed by the consideration of the no pumping alternative and the comparison of its effects to the other alternatives. Alternative 3 is oriented to multiple uses of water resources. The threshold values proposed under Alternative 3 were determined with that objective in mind. Thresholds identified under alternative 3 would likely result in the maintenance of current riparian vegetation as indicated by the Standards and guidelines in the Forest Plan.
18	14	Water Resources Monitoring	The monitoring of the thresholds should not be left up to the Village of Ruidoso. This avenue is like letting the "fox guard the hen house". Threshold monitoring should be electronic where possible and available for all to see via web sites to facilitate the proposed adapted management strategy. **Response:** This comment raises a reasonable concern, in that the Village of Ruidoso cannot be the only party involved in tracking hydrologic conditions along the North Fork. Agencies routinely monitor water resources on public lands elsewhere in the west, with or without water use conflicts or management programs. Electronic data collection platforms are already in place along the North Fork, and are proposed (with reporting) in monitoring measures for EIS alternatives. The actual data reviews and implementation of adaptive management would be determined through ongoing interactions with the USFS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	11	Water Resources Monitoring	The SWRR monitoring measures as proposed are extremely onerous and costly. The monitoring measures are unreasonable and would likely have the effect of forcing the Village out of the North Fork of Eagle Creek due to costs associated with implementation, and ongoing maintenance and monitoring. The proposed measures seem to be an all-encompassing wish list of monitoring for the watershed. Monitoring post-fire effects on water quality and changes in the alluvial stream channel should be performed by the USFS. **Response:** See the response to letter 18, comment 14. Proposed monitoring measures, and the measurement facilities involved, are recommended from a hydrologic standpoint, in light of existing data gaps and uncertainties. Addressing those issues as proposed would greatly improve a future multiple-use water resources management program. With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FSEIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	12	Water Resources Monitoring	The current monitoring wells provide ample data with which to monitor the shallow alluvial aquifer system, and the intermediate and deep volcanic aquifer. Monitoring wells MW- lB and MW-1C are completed within intervals that are screened, or open boreholes, of the Village production wells. It is perplexing that the USFS would require the completion of numerous additional monitoring wells and test pumping even after the USGS, the federal agency that performs hydrologic and geologic investigations and studies, completed a hydrologic study of the watershed for the EIS. The distance from the upper-most Village North Fork production well to the lowest is about 1,400 ft. The existing groundwater monitoring systems consists of two wells completed in the volcanic aquifer, and four wells completed in the shallow alluvial aquifer including one well above and one below the production well. Water levels in the Village production wells are also monitored. **Response:** See response to Letter 21, comment 190 and letter 21, comment 83
21	13	Water Resources Monitoring	The requirement that each monitoring well be completed within "only one individual water-bearing zone of interest" implies that the current monitoring wells are completed in more[...] than one water bearing zone, which is not true. The rationale for completing additional monitoring wells in the volcanic aquifer above and below the Village's well field with screen lengths that are the same as those of the pumping wells is unjustified. **Response:** See response to Letter 21, comment 190 and letter 21, comment 83
21	14	Water Resources Monitoring	The completion of a monitoring well in the alluvial aquifer near the North Fork gage would be difficult and require specialized track mounted equipment because the terrain is steep. The alluvial aquifer is quite thin in this area; the benefits of monitoring water levels in an area where the creek flows nearly continuously is unreasonable and unsupported by any need for the data within the SDEIS. **Response:** New proposed well locations are proposed as part of Alternative 3 in response to effects of the Little Bear Fire on the stream channel and associated surface flow gages. According to the USGS, the existing North Fork gage is buried under approximately six feet of sediment and debris. It is likely that such deposits will come and go for quite some time at both the North Fork gage and the Eagle Creek confluence gage. That would create unreliable surface flow records and the need for constant inspection and maintenance. The recommended alluvial monitoring wells would be a monitoring approach that could result in more meaningful data at less expense over the long term.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	15	Water Resources Monitoring	The completion of a monitoring well downstream of the South Fork gage is also unreasonable and unsupported by any need for the data within the SDEIS. **Response:** Past comments from several parties have questioned the pre-fire validity of flow measurements at the Eagle Creek confluence gage below the South Fork (USGS 08387600). The post-fire gaging conditions are more suspect. The proposed monitoring well at or near that location would help rectify earlier gaging concerns, and resulting data could be less affected by post-fire debris. An alternative stream gaging location to the existing Eagle Creek gage was discussed within the EIS team, but was considered less reliable and much more expensive considering unstable post-fire channel conditions. This consideration is described in more detail in chapter 2 of the FEIS.
21	16	Water Resources Monitoring	Shallow alluvial monitoring wells are currently being monitored above, within, and below the Village production wells and the proposed wells would be redundant. **Response:** Issues with the existing shallow alluvial monitoring wells have clearly been presented in EIS documents. See the responses to other comments (Letter #21, Comments #15 and #16).
21	17	Water Resources Monitoring	The USFS claims to have attempted debris removal from monitoring wells MW-4B and MW-4C. Unfortunately no data were provided related to work performed on the wells. The USFS claims the wells were damaged by acts of vandalism. It is unlikely that the wells could be made functional again, and they would need to be drilled out, then plugged and abandoned in accordance with NMOSE regulations. The need for replacing the wells has not been demonstrated in the SDEIS. Current monitoring wells MW- IB and MW- IC provide ample data for monitoring the volcanic aquifer. **Response:** Our information regarding this debris filled well is that attempts at debris removal were unsuccessful and that rehabilitation may be difficult.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	18	Water Resources Monitoring	Obtaining Federal permits to discharge water produced during drilling and pumping tests will be difficult and time consuming. This is because the water will ultimately flow into the creek channel, and regardless of whether or not the creek is running, a permit will be required. When the USGS completed the existing monitoring wells, water had to be hauled off in significant quantities during drilling to stay in compliance with turbidity standards associated with the permit. The quantity of water that will have to be hauled off is unknown. It may not be possible to obtain a permit to discharge water to the surface. Permits would also need to be obtained from the USPS to complete any new monitoring wells. Presumably the USFS would issue a categorical exclusion and not require any environmental studies to be performed as part of the permitting process. However, given that the proposed work would require pumping tests, it is unknown if the USFS will need to perform an additional EIS for the work. Permits would need to be obtained from the NMOSE to complete the wells. **Response:** Comment noted. Pumping tests are not simple and do involve certain logistical challenges. However, their employment is still relatively commonplace. If the USFS does require pumping test(s) or more, then the permitting would most likely be expedited. **Additional information has been added to the EIS to describe in more detail these connected actions.**
21	19	Water Resources Monitoring	As indicated in the SWRR, quite a number of pumping tests have been performed in the North Fork of Eagle Creek. Performing slug tests in monitoring wells is essentially an inadequate exercise because only the hydraulic properties of the aquifer very close to the borehole, or at worst only the well annulus, are actually tested. Pumping tests in monitoring wells would provide data that are of little value given that such a small area of the aquifer can be tested and the high likelihood that pumping impacts will not be measureable in nearby wells. Piping water from the tests to distances below the well field to not create recharge conditions on other wells being monitored will be expensive. Federal permits will be required to discharge water to the ground surface because pumped water will ultimately enter the creek channel. It may not be possible to obtain permits to perform the test pumping in which case all produced water would have to be hauled from the site and disposed of elsewhere. Permits would need to be obtained from the NMOSE to perform pumping tests. **Response:** Slug tests are a cost-effective method of gaining aquifer information when other methods are too expensive and when water disposal is problematic. Permitting, if any, is much simpler than for pumping tests. If several slug tests have similar values, then the average and standard deviation can give a better picture of the aquifer characteristics than no data; or even a single pumping test with inadequate monitoring wells or relatively short or uneven pumping intervals. Indeed, pumping tests would require possibly difficult and time consuming permitting; however, that is true of most pumping tests. Aquifer tests generally do require permitting. However, they are routinely performed. Considering that the aquifer is a fractured volcanic aquifer, standard tests may not be applicable. We remain confident that, if permits are required for aquifer testing, then they can be obtained.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	20	Water Resources Monitoring	11.3 Monitoring Measure 3 There appears to be no rationale for monthly monitoring of surface water quality at the gages, unless it is to assess the impacts of the forest fire or inflow from septic systems above the Village's wells. Therefore, the USFS should be responsible for monitoring. Collecting surface water quality data where none have historically existed, particularly in the post-fire hydrologic setting, has little value in terms of the subject permit application. Pumping by the Village cannot affect turbidity. Problems with turbidity are obviously those created by the fire. Other water quality issues that would be affected by the fire include increases in water temperature, calcium, nitrate, magnesium, phosphorous, potassium, sodium, sulfur, total organic carbon, total dissolved solids, and zinc (DeBano et al., 1998; Knoepp et al., 2005). Therefore, the USFS should perform all monitoring to assess fire related impacts on aquatic ecosystems and riparian vegetation. Background water quality at the subject monitoring points was not established pre-fire. **Response:** Even after a special outside agency data collection program, there are essentially no surface water quality data along the North Fork. It should be noted that the currently-proposed (SDEIS) water quality monitoring could readily be accomplished using field instruments. It may provide needed information for examining flow management options, at some unknown future time, which are not being planned or even predicted at this point in time. As the comment implies, any agency or organization could readily complete this effort to at least a reconnaissance level.
21	21	Water Resources Monitoring	11.4 Monitoring Measure 4 Water levels in the alluvial and volcanic aquifers cannot currently be used to determine streamflow. It may be possible 5 to 10 years from now to use water levels as a proxy for streamflow. References to using this approach should be removed from the EIS. The Village has offered to share data from all monitoring wells and pumping wells in the North Fork with the USGS. The USGS (Mike Darr, personnel communication) indicated that the USGS was not interested in using "data obtained by others" because of USGS data collection protocols. The submission of quarterly and annual data summaries with conclusions related to the data collected is not reasonable because the USFS to date has rarely accepted the opinions and conclusions of Village consultant's on hydrologic matters related to the subject application. Rather, the USFS appears to rely heavily on the opinions and comments from various parties protesting the Village's application. **Response:** See the pertinent portion of the response to Letter 21, Comment 20.
21	22	Water Resources Monitoring	11.5 Monitoring Measure 5 There is no rationale for monthly monitoring of the subject springs and seeps. As mentioned, no baseline data either pre- or post-fire exist for the springs and seeps. In addition, it is highly likely that claims could be made that any change from the initial 12-month data set is the result of Village pumping, rather than changes related to the fire, forest density, precipitation, and the like. The USFS should be responsible for managing and monitoring springs and seeps within the forest. These were not defined or monitored pre-fire. **Response:** See the pertinent portion of the response to Letter 21, Comment 20.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	23	Water Resources Monitoring	11.6 Monitoring Measure 6 The SWRR indicates that the alluvial thickness and extent of the creek has and will continue to change because of the fire. This is a monitoring measure that should rightly be performed by the USFS. The changing conditions of the creek channel and extent of alluvial material as a result of the Little Bear fire is not the responsibility of the Village. **Response:** See the pertinent portion of the response to Letter 21, Comment 20.
21	24	Water Resources Monitoring	11.7 Monitoring Measure 7 The Village could work with the NRCS or other appropriate entity for the collection of snowpack and precipitation data. However, these data are generally available online and the USFS should perform data downloads and data review rather than having the Village perform the task. The addition of another precipitation gage to collect data in cooperation with the USGS seems to indicate that the data may really be required to support another study, but the costs and responsibility would be placed on the back of the Village. The need for this additional gage is not supported by the SWRR **Response:** See the pertinent portion of the response to Letter 21, Comment 20.
21	25	Water Resources Monitoring	11.8 Monitoring Measure 8 The development of a water model for the area at this time would not be practical or reasonable. The watershed is still in a state of flux post-fire and attempts to build a reliable predictive model of the system for the next 5 to 10 years is illogical. Changing conditions related to increases in vegetation over the next few decades will affect the ability of any model to correctly predict the hydrologic system, unless USFS financial assurances are made as to density and type of vegetation that will be maintained as part of keeping the watershed healthy to maintain favorable water supplies. This monitoring measure suggests that a model could be developed by the applicant in cooperation with the USPS and other qualified parties and stakeholders. Building a model by committee and consensus will take a significant amount of time and resources. Presumably the Village would hire a consultant to help build the model, and the USPS would hire a consultant, and costs for other qualified parties and stakeholders would be borne by others. **Response:** Please see also response to letter 21, comment 70 regarding forest management and financial assurances. Vegetation management is outside the scope of this EIS, but conifer density is discussed in chapter 3 of the EIS. Regarding modeling, these difficulties, and the complex involvement in developing a model that performs adequately to inform future decision-making, are acknowledged. It is not the intent of the measure to create an unrealistic goal. Under Alternative 3, the objective was simply to create future “big-picture” understandings of water balance factors proceeding through time, so that managers could have better insight to their behavior under different conditions. **Revisions to the EIS have been made to clarify this**

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21	26	Water Resources Monitoring	11.9 Monitoring Measure 9 Under the no pumping alternative, the Village would have no obligation nor desire to perform any monitoring. Under this alternative, the USFS would need to pay the Village for the streamflow gages, monitoring wells, transducers and data loggers, production wells, water rights, and associated infrastructure. **Response:** It is the obligation of the permittee to remove all associated infrastructure. Some limited monitoring is identified for implementation of alternative 2 (no pumping) but is not the responsibility of the Village, as stated in the description of this alternative in EIS chapter 2.
21	59	Water Resources Monitoring	Recommended Preferred Alternative - The Village would be allowed to pump up to 80 percent of the average annual quantity of groundwater recharge that will occur post-wildfire based current canopy density, vegetation type and distribution, and soil moisture requirements. Recharge estimates after 10 years can be recalculated and should be based on actual USPS forest management performed and USPS financial assurances related to maintaining a healthy watershed. The calculation of groundwater recharge must not be performed using the chloride mass-balance method for reasons previously described. Village monitoring would include those provided below:);;>. Monitor groundwater levels in North Fork monitoring wells: MW- lA, MW- lB, MW-lC, MW-3A, and MW-5A. • monitoring frequency: hourly • reporting frequency: monthly);;>. Monitor groundwater levels in North Fork production wells H-1979 (North Fork 1), H-1981 (North Fork 3), and H-1982 (North Fork 4). • monitoring frequency: hourly • reporting frequency: monthly);;>. Monitor diversions from North Fork production wells H-1979 (North Fork 1), H-1981 (North Fork 3), and H-1982 (North Fork 4). • monitoring frequency: monthly • reporting frequency: monthly);;>. Streamflow at North Fork Eagle Creek gage (08387550), South Fork Eagle Creek gage (08387575), and Eagle Creek below South Fork gage (08387600). • monitoring frequency: real time data as currently performed by USGS • reporting frequency: as currently provided on USGS website **Response:** Thank you for this suggested new alternative. We carefully considered , but ultimately dismissed from detailed analysis, this proposal. **Our rationale for this is included in chapter 2 of the FEIS.**

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21	61	Water Resources Monitoring	The monitoring measures are so onerous and all-encompassing that it appears the USFS is trying to develop the most detailed interactive watershed model in the southwest at the expense of the Village, or quite simply the USFS is trying to make the cost of monitoring so expense the Village will not be able to perform the work will have to abandon its wells. **Response:** We recognize that there are several monitoring measures that would apply to the action alternatives and that they would require an investment in time and funding for the Village. These measures were developed to provide continued data-gathering in the future to inform the implementation of the adaptive management strategy. While NEPA does not require a monetary benefit-cost analysis (as stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23), we agree that a comparison of cost estimates for implementation of the alternatives would be a valuable contribution to the EIS. **A discussion of costs of monitoring and benefits from instream flow changes has been added to the FEIS. We have also reviewed each of the monitoring measures in response to this comment and have made some adjustments.** The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision, as well as the details of any selected monitoring. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions.
21	62	Water Resources Monitoring	The concept of developing an interactive management model may be considered a grand and noble idea by some, but it is beyond what is considered usual and customary for permit administration and monitoring. **Response:** Computer models are commonly used in water resources management; at least one is currently available, and perhaps others, with comparatively little modification. This monitoring measure was developed to provide a useful tool to inform future management. This measure, however, has been reviewed and some adjustments made in response to this and similar comments regarding modeling.

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21	82	Water Resources Monitoring	The Borehole Lithologic and Geophysical Data section of the SWRR incorrectly states: "The monitor wells MW- I C and MW-4C are screened below the water-bearing zane tapped by -the Village wells." In fact, all of the Village production wells are completed with upper screened intervals and have open boreholes immediately below the screened intervals. The total depth of each of the production wells exceeds that of the monitoring wells. Groundwater can move unimpeded through the aquifer into the open borehole portion of well. The resultant conclusion reached in the last sentence of the SWRR section Borehole Lithologic and Geophysical Data states: "The deep placement of the well screens in monitor wells MW-1 C and MW-4C makes them less useful in monitoring pumping in the Village wells and for use as monitor wells for pumping tests in the Village wells." This statement is incorrect and likely resulted in the requirement of additional monitoring wells to be installed as specified in the Monitoring Measures section of the SDEIS. **Response:** We have concluded that the multiple-zone construction of the existing monitoring wells is a source of uncertainty in monitoring individual characteristics of water-bearing zones as well as their interactions. The proposed measures would remedy that situation. Further, the Supplemental Water Resources Report only treats a cumulative study area in a qualitative manner, due to the immense complexity of infrastructure and geologic factors. The discussion of the volcanic aquifer extent in the cumulative impact study area has been revised in the SWRR based on this comment and a geologic map review.
21	83	Water Resources Monitoring	The additional monitoring wells as proposed in the SDEIS Monitoring Measures section are unnecessary because the existing monitoring wells completed by the USGS continue to provide detailed data for monitoring the shallow alluvial system, and volcanic aquifer. The SWRR erroneously indicates that the Sierra Blanca volcanic aquifer pinches out 0.25 mile above Alto Reservoir. Drill cuttings from well H-1979-S, located a few tens of feet south of Alto Reservoir, indicate that the volcanic aquifer extends to a depth of at least 1,390 ft at this location. **Response:** See response to the comment above (letter 21, comment 82).
12	1	Water Resources – Watershed Condition	My discussion entitled "North Fork Eagle Creek Degradation / Evaluation of Alternatives" documents that the USFS is fully aware of the cone of depression that is created and maintained by pumping of the North Fork wells. The SDEIS says so. This cone of depression prevents surface flow in the North Fork, most of the time. This was the reason for the lawsuit by the ECCA. This is the environmental degradation problem the USFS has yet to address. **Response:** Thank you for your comment. The EIS discloses the predicted effects of each alternative to natural resources. The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions.

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12	6	Water Resources – Watershed Condition	The USFS has implied that the North Fork seldom flowed before pumping by designating and repeatedly referring to the North Fork as "intermittent". The question is whether the USFS is willing to sacrifice North Fork surface water so the Village can divert it with the ease of flipping an on/off switch. The North Fork of Eagle Creek was a dependable and productive water source prior to pumping. **Response:** This interpretation does not accurately reflect the conclusions we have reached and have documented in the water resources report and the EIS. The interdisciplinary team collected information and reviewed additional data and information to assess the historic pre-pumping range of flow conditions at different places and times along the North Fork. Those conditions were determined to vary, and to include both perennial and intermittent open-channel flow durations. The EIS presents a detailed analysis of three alternatives, including a no pumping alternative and the predicted effects of implementing these in both the short- and long-term. The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions.
13	3	Water Resources – Watershed Condition	In general, discussions concerning what constitutes a fishery are never had on intermittent streams. This document points out clearly that the stretch of the NFEC from the summer homes to the Eagle Creek gage has been intermittent since before 1960. **Response:** As shown and discussed in the aquatic habitat section of the EIS (table 11 and the narratives from Pages 140-143), there were fish populations in the stream prior to well pumping. As described in detail in the water resources report and the water resources section of EIS chapter 3, the interdisciplinary team collected information and reviewed additional data and information to assess the historic pre-pumping range of flow conditions at different places and times along the North Fork. Those conditions were determined to vary, and to include both perennial and intermittent open-channel flow durations. Fish survive intermittent streams by migrating to cooler headwaters where there is adequate water during the periods of intermittent flows. Fish utilize intermittent stream reaches on a seasonal basis based on water conditions.
13	5	Water Resources Watershed Condition	On page 4, the document states "The riparian vegetation trigger may need to be relaxed or made more flexible". It does not appear that this was accomplished. This trigger should be relaxed as alluvium filling and channel instability will drive riparian vegetation recovery for years to come. **Response:** This riparian trigger does acknowledge the changes in the alluvium depth and describes its relationship to trigger #1and provides flexibility in implementation based on on-the-ground information (EIS pages 30-31).

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13	6	Water Resources Watershed Condition	On page 18, the document states, "Quantity, quality, and water flow availability that mirrors natural flow patterns (pre-pumping period or current "no pumping" conditions?), are important for aquatic habitat and fish. The natural flow pattern for this section of the NFEC is intermittent. The document also points out that the number of no flow days at the Eagle Creek gage has increased since 1988 when the Village of Ruidoso started pumping. Keep in mind when it relates to aquatic life and fisheries intermittent is intermittent. **Response:** See earlier responses to comments regarding the fisheries analysis (i.e. letter 13, comment 3).
13	7	Water Resources Watershed Condition	Also on page 18, the document states "Suitable water quality and temperatures, which are partially based on water depth and channel conditions, are necessary to support fish populations". Post fire sediment deposition has added four to six feet of alluvium in some portions of the NFEC substantially decreasing water depth and increasing channel width. The consequences of this in the near future will be increased water temperatures. Additionally, this increased alluvium depth will likely result in the creek being more intermittent. **Response:** This relates to a direct effect of the fire and does not preclude fish population becoming reestablished in future years as the system recovers, as described in the aquatic habitat analysis in EIS chapter 3. As discussed on page 164, Dunham et al. (in University of Idaho 2007) showed that physical stream habitats can remained altered (e.g., stream temperatures) for many years following wildfire, but that native aquatic vertebrates can remain resilient. In a management context, this suggests that wildfire may be less of a threat to native species than human influences that alter the capacity of stream-living vertebrates to persist in the face of natural disturbance. The EIS recognizes the short-term impact the fire is likely to have on water quality and turbidity and water quality was removed as an indicator (see EIS page 4). The water resources section of chapter 3 discusses in detail the predicted short- and long-term influence the fire may have no stream flow (summarized in table 9).

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13	8	Water Resources Watershed Condition	On page 1 the document states "Without pumping, North Fork Eagle Creek would still be intermittent below the wells". And on page 7, it states "Standards and guidelines in the forest plan include that riparian areas and fish habitat are to be maintained and enhanced". It is our opinion that the limiting factor for increased riparian areas in NFEC below the summer homes is water depth. The plants cannot root deep enough, or fast enough, to tap the permanent underground water source. This scenario is much worst following the fire as the alluvium depth has increased substantially. **Response:** The plots closest to the confluence of North Fork and South Fork of eagle Creek have experienced a greater amount of alluvium deposition than plots further upstream. Rooting depths were used in the identification of the adaptive management triggers and the alluvium depth is noted in this discussion (specifically page 29 and pages 30-31). Through adaptive management, the Forest Service could relax the adaptive management trigger for these plots (based on monitoring results (see description of alternative 3 in EIS chapter 2), but Forest Plan standards and guidelines and project objectives still require maintenance or enhancement of riparian habitat.
13	9	Water Resources Watershed Condition	On page 143, the document states "Based on the compilation and evaluation of the best available data (summarized above), there is sufficient information to substantiate reduced flows, less fish presence, and decreased fishing recreation in the North Fork since the wells were authorized and began pumping in 1988. It appears that higher quality aquatic habitat and fishing opportunities existed in the North Fork before the North Fork Eagle Creek wells began pumping when compared to current conditions and fish populations (primarily brook trout) are substantially less now than they were before 1988". Then on page 142, the document states "The New Mexico Department of Game and Fish likely stopped investing in stocking it in the 1970s and 1980s due to fluctuating water levels and the quality of the habitat (Hansen, personal communication 2011. So in reality, in the 1970's and 1980's the New Mexico Department of Game and Fish (NMDGF) stopped stocking due to the intermittent water flow and poor quality of fish habitat. So there has never been any quality aquatic habitat or good fishing opportunity in the section of the NFEC downstream of the summer homes and it has nothing to do with the pumping of wells. **Response:** Please see responses to previous comments related to fish and aquatic habitat (e.g. letter 13, comment 3; letter 21, comment 124; letter 23, comment 15. The discussion of angler days has been removed from the EIS in response to this and similar comments, but we disagree with the conclusion that pumping has had no effect on the quality of aquatic habitat or fishing opportunity. We do recognize that other factors, such as reduced stocking, have an influence on fish presence.

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13	10	Water Resources – Watershed Condition	On page 154, the document states "Medlock (2011) provides a compelling case for the lower half of the North Fork being intermittent prior to pumping. Included in his report is an historical photo of the area showing vegetation similar to current vegetation in the area above the well field in 1947. Of particular note in this photo is the lack of obligate wetland species one would associate with a riparian community along a perennial stream (e.g. willow and cottonwood in the overstory)". This statement summarizes again the fact that the lower section of the NFEC has never been a real riparian area because of its lack of riparian vegetation. Aquatic plants can only grow in water or soil that is permanently saturated and this section of the NFEC has never been permanently saturated, pumping or no pumping. If it was, a permanent riparian community would have been established long before pumping started. **Response:** Please see responses to similar concerns regarding riparian vegetation (letter 21, comment 10 and letter 21, comment 68). Facultative wetland species, are present in the project area as discussed in the Riparian Vegetation report and chapter 3 of the EIS. Forest Plan standards and guidelines and project objectives require maintenance or enhancement of riparian habitat. The EIS recognizes that the riparian habitat along this stretch of NFEC is limited and that this is likely due to a variety of factors.
13	11	Water Resources – Watershed Condition	Also on page 154, "Though we do not know the pre-pumping condition of North Fork riparian vegetation, we do know there has been reduced water availability along the North Fork since the North Fork Eagle Creek wells began pumping, as described in more detail in the "Water Resources" section of this chapter. Reduced water availability can affect riparian vegetation. Reduced water availability for plants can also be influenced by flood deposited alluvium in the valley bottom of the North Fork which raises the flood plain and channel, and causes the stream to flow below the alluvium. Either of these factors could explain the existing conditions and composition of the riparian vegetation along the North Fork. **Response:** Please see responses to similar concerns regarding riparian vegetation (letter 21, comment 10 and letter 21, comment 68). As disclosed in the riparian vegetation report and in the riparian section of chapter 3 analysis using aerial photography of the project area revealed that periodic flooding has resulted in changes to the width of the riparian corridor based on alluvium deposition and then subsequent narrowing in the interim between flooding. While this is a factor in the current condition, it is likely not the only one.

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13	12	Water Resources – Watershed Condition	While we determined that, based on the current level of information, South Fork Rio Bonito may not provide a suitable reference reach from which to establish a baseline survey and quantitatively compare to survey results from the North Fork Eagle Creek, it provided a useful tool for visual comparison and inferences about riparian potential along the North Fork if there were more sustained elevated water tables". This paragraph seems to reference that if there were more sustained water levels (through decreased pumping) that it would increase the "riparian potential" in the lower section of the NFEC. If this was the case, there would have been riparian vegetation already established prior to pumping. The reality is that there has never been enough permanent water in this lower section to establish a riparian community, pumping or no pumping. **Response:** Please see responses to similar concerns regarding riparian vegetation (letter 21, comment 10 and letter 21, comment 68). We recognize the limited information available on riparian conditions pre-pumping from which to draw strong conclusions. All available information was used to prepare the riparian vegetation report and the riparian section of chapter 3 and to reach the conclusions shown. While there is some uncertainty concerning the impacts of pumping on vegetation because vegetation monitoring plots were not established prior to pumping, there is certainty through well monitoring that water levels have dropped and no-flow days have increased since pumping began. There is currently riparian vegetation present in the project area as disclosed by the Riparian Vegetation report and DEIS and SDEIS.
18	1	Water Resources – Watershed Condition	I know from personal observation that the unrestricted pumping of ground water from the North Fork wells by the Village of Ruidoso (VOR) has resulted in the environmental degradation of the Eagle Creek area that once was a perennial flowing stream and a viable cold water fishery. **Response:** Table 11 and the narratives from Pages 140-143 adequately document fish populations in the stream prior to well pumping. Prior to pumping, it is likely that portions of the North Fork Eagle Creek were perennial, whereas others were intermittent. Nonetheless, fish survive intermittent streams by migrating to cooler headwaters where there is adequate water during the periods of intermittent flows. Fish utilize intermittent stream reaches on a seasonal basis based on water conditions, and this could support a fishery in the NFEC. There are other factors affecting water quantity in the NFEC in addition to well water removal, such as yearly and multi-year moisture conditions, changes in evapotranspiration, and channel/alluvium/bedrock relationships from place to place along the stream.

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18	8	Water Resources – Watershed Condition	The USGS study and others have provided the science to provide some common sense management to a area of known environment degradation. The natural stream flow that existed in the past can again be there if the Forest Service will do what's right. **Response:** The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions.
18	9	Water Resources – Watershed Condition	I agree with the USGS final report that indicates that when ground water is pumped unrestricted, from the NF wells, it causes a temporary decline in ground water which lowers the water table and creates a expanding cone of depression around the wells. Go to the area today and you can see the effects are far reaching, both upstream and downstream. The volume of the ground water pumping should be restricted so that the surface flow in the North Fork Eagle Creek can be maintained. **Response:** The Responsible Official will select an alternative for implementation based on the analysis presented in the EIS and the public comments received on the SDEIS. The decision and its rationale, including consistency with laws, regulations, and agency policy will be included in the Record of Decision. The ultimate decision stemming from the EIS will depend on consideration of all public input, management of conflicting water uses, and agency jurisdictions.
18	10	Water Resources – Watershed Condition	The Village of Ruidoso can pump on limited bases the North Fork Eagle Creek wells and maintain and surface flow in the North Fork. The Village of Ruidoso can there after remove addition water through the surface water just east of the Forest Service boundary for additional municipal supply.[...]The Village of Ruidoso has always had this option but has elected to ignore the local water shed management required for a stream with limited and fluctuating precipitation. The Village has environmentally degraded this area of public lands. **Response:** The various components of the municipal water supply system and how the Village manages this water are discussed in the socioeconomics, water resources, and water rights sections of chapter 3

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21	65	Water Resources – Watershed Condition	The development of a predictive model such as that contemplated will take years and be very expensive. In the event that an accurate predictive model can be developed it will likely need to be updated and analyzed weekly by a competent professional. A key aspect of developing a predictive model will be financial assurance from the USFS that it will maintain the watershed in a healthy condition for favorable water supplies **Response:** Please see responses to previous comments regarding the use of a model (letter 21, comment 118; letter 23-comment 8; letter 21, comment 25; letter 21, comment 61). Please also see previous comments regarding USFS financial assurances regarding maintaining the watershed (letter 21, comment 70; among others). Additional text regarding watershed models has been added in response to this comment. A predictive model of the system, as proposed, would provide a valuable management tool. It would assist all parties, including the Village, in addressing enduring local water issues.
21	66	Water Resources – Watershed Condition	USFS guidelines, policies, and management plans to maintain the watershed in a healthy condition in the absence of financial assurances are virtually inadequate. **Response:** Please also see previous comments regarding USFS financial assurances regarding maintaining the watershed (letter 21, comment 70; among others).
21	67	Water Resources – Watershed Condition	The USFS should be responsible for documenting post-fire changes in the watershed that impacted all aspects of the watershed. USFS monitoring should include stream channel assessments, surface water quality monitoring, monitoring of springs and seeps in addition to documenting the source of the springs and seeps, and cataloging and monitoring vegetation type and density. **Response:** Once a decision is made on this project, the Record of Decision will document the alternative selected and the necessary monitoring and who will be responsible. Special use permit applicants have a responsibility for the financial costs of implementing their permits, if approved. As stated on page 8 of the EIS, Alternative 3 would require the Village of Ruidoso to be responsible for the cost and implementation of any identified monitoring and adaptive management of groundwater and surface water resources, once finalized in a Record of Decision and included in the operating plan, which is part of the special use permit. The USDA Forest Service, with assistance from the U.S. Geological Survey, if possible, may also assist with certain aspects as mutually agreed upon by all parties.

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21	79	Water Resources - Watershed Condition	The wildfire impacted 98.7 percent of the North Fork Eagle Creek watershed and 35.4 percent of the South Fork Eagle Creek watershed. Therefore, the assumption in the SWRR that the watershed will have the same hydrologic conditions within the next few years, as it did before the fire, is incorrect. A thorough study of the post-fire effects should be made and all references to pre-fire effects should be removed from the SDEIS **Response:** We believe that we have gathered and evaluated sufficient information to support conclusions regarding the potential impacts of the Little Bear wildfire over the short- and long-term. At this point, the assumption in the EIS documentation that water balance factors will largely return to pre-fire conditions within the term of the requested special-use permit is supported by the impartial review of available regional literature. Uncertainties regarding this, the description of the literature review and its outcome, and the additional flexibility and monitoring that were then incorporated into Alternative 3are all documented in the EIS.
21	80	Water Resources - Watershed Condition	In an attempt to justify using pre-wildfire conditions for evaluation of future pumping impacts from the Village's North Fork Well Field, the Introduction of the SWRR states: "Investigators inpicate that relatively few years (e.g., three to seven) are generall y needed for post-fire hills/ope conditions to approximate pre-fire conditions (DeBano, 1981; Snyder et al., 2012). ,, The above citation is misleading and directs the reader toward the incorrect conclusion that the watershed condition with respect to hydrologic conditions will be the same within 3 to 6 years as it was pre-wildfire. The DeBano (1981) technical report deals specifically with water repellant soils, and not changes in the hydrology of watersheds with respect to watershed yield (recharge plus surface-water runoff). Page 5 of the DeBano (1981) technical report states: "By the six year after the fire, the wettability of both lightly and intensely burned soils was approaching that of the unburned soil." **Response:** Clearly the literature review focused on water balance factors, of which soil water repellency and infiltration effects are known to play a major role in runoff & recharge. The conclusions from the literature review were not intended to find a particular outcome; in fact, it was hoped that relevant research would support a more abundant post-fire hydrologic system. A broad review was conducted, centering on water balance factors, their interplay, and the duration of fire effects on them. All reviewed references are cited and will be available as part of the Administrative Record.

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21	81	Water Resources - Watershed Condition	Furthermore, the hydrology report by Snyder (Snyder et al., 2012) does not indicate that the watershed will return to pre-fire conditions within a few years. The focus of the hydrology report was to estimate post-fire surface-water runoff compared to pre-fire runoff using a numerical model to assess risks immediately after the fire and the work was included in the BAER (Burned Area Emergency Response) Team report (USFS, 2012). The model was not calibrated to pre-fire or post-fire conditions. **Response:** The BAER report (Snyder et. al.) presents little discussion about recovery since that is not its purpose. However, with respect to fire effects in the Rio Bonito watershed, it does state that “Recovery typically takes up to five years and in high severe burn areas such as South Fork could take up to seven years or longer.”The overall purpose of the Snyder et. al. report was simply to identify potential hazards from fire effects, particularly with respect to flooding. Since the water balance depends on the ultimate distribution of finite precipitation inputs, increased runoff would affect other water destinations within the water balance. Other modeling efforts, as proposed, could further define that for water management.
21	92	Water Resources - Watershed Condition	Increased vegetation throughout the North and South Fork Eagle Creek watersheds from 1969 (the time surface-water data collection began at the Eagle Creek below South Fork near Alto gage) until the Little Bear wildfire of 2012 was also responsible for decreased flows at the gage. This is because the watershed was impaired with respect to being overgrown and having multiple vegetation canopies, which resulted in increased evapotranspiration and precipitation interception by vegetative canopies and forest litter. These facts were not considered, or simply dismissed, in the SWRR but must be considered when assessing pre-fire and post-fire changes in streamflow. **Response:** The influence of upland vegetation in the watershed to water yield was considered and is discussed on pages 199, and pages 201-204 of the EIS.

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21	93	Water Resources - Watershed Condition	There is not a direct correlation between surface-water flow at the Eagle Creek below South Fork near Alto gage (08387600) and the Eagle Creek near Alto gage (08387800) as indicated in the SWRR. Therefore, pumping from the Village's North Fork Well Field can't have a discemable impact on flows at the Eagle Creek near Alto gage; a gage that is no longer in use. The Eagle Creek near Alto gage is located in an area where surface water infiltrates readily from the creek to the underlying rocks. This fact was documented during a seepage study conducted in 2010 by the Village, NMOSE, and USGS. The USGS (Darr et al., 2014) attribute the loss of streamflow along this reach to a paleosinkhole as mapped by Rawling (2009). The seepage loss took place above the Eagle Creek near Alto gage. Seepage loss in Eagle Creek below Alto Reservoir and above the Eagle Creek near Alto gage from March 2 to April 28 calculated from data collected by the USGS and NMOSE to be about 500 ac-ft. **Response:** This comment doesn't appear to disagree with any statements made (or not made) in the EIS or the Supplemental Water Resources Report. There is no claim of a direct correlation between the Eagle Creek below South Fork gage, and the old, recognized-as-discontinued Eagle Creek near Alto gage. Due to a number of factors described in the EIS, the cumulative impact analysis for water resources was primarily qualitative, and the uncertainties and complicating water infrastructure factors below the project study area are disclosed.
21	94	Water Resources - Watershed Condition	Streamflow data and historical references (New Mexico Territorial Engineer, 1909; Mourant, 1963) indicate that Eagle Creek has not been a perennial stream below Alto Reservoir. The New Mexico Territorial Engineer (1909) noted that there is very little water in Eagle Creek except at times of floods. The primary reasons surface flow between the two gages cannot be correlated are as follows: 1) The presence of the sinkhole and high seepage loss through this reach, 2) pumping from Alto Lakes Water Cooperative and domestic wells, 3) unmeasured surface-water inflows between the Eagle Creek below South Fork near Alto gage and the Eagle Creek near Alto gage, and 4) the fact that the groundwater surface is lower than the base of the creek (losing stream section). **Response:** Thank you for providing this information. The 1909 document says merely that "There is practically no irrigation on any of these tributaries excepting a little on the Eagle which is very small as there is very little water in said creek excepting at times of floods." It also states on page 68 that "Parties interested in the water records given herewith should take into consideration the extremely low average precipitation for New Mexico during the period in which these records were collected The run off of all the streams was therefore below normal . . ." Given this period of record with low precipitation and the qualitative nature of the "little water in Eagle Creek" determination, the 1909 document is of limited value compared with current conditions. The Mourant (1963) document is also of limited value, especially given that the Alto reservoir dam was not constructed until 1964 (PECOS VALLEY WATER USERS ORGANIZATION, 2001), and the document says almost nothing quantitative about flow in Eagle Creek.

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21	101	Water Resources - Watershed Condition	Increased snow ablation in the upper Eagle Creek watershed would not offset the overall water surplus gained from the significant loss of vegetation, thinning of the soils by erosion, and reduction in soil moisture requirements for vegetation. **Response:** That assertion is not supported by data or applicable regional research. An EIS team literature review conducted after the Little Bear Fire indicated that, unfortunately, snow losses in new, large, canopy openings can be significant, and can offset additional accumulation (EIS pages 113 and 114).
21	103	Water Resources - Watershed Condition	On October 14, 2014, monitoring well MW- lB, completed to an intermediate depth in the volcanic aquifer, had a water level that was 0.14 ft below ground surface, and from October 12 to November 20 monitoring well MW-1C, completed deeper in the volcanic rock aquifer, had a water level that was about 25 ft below ground surface. Therefore, the aquifer must also be recharged on outcrops at higher elevations, not just along the stream channel. **Response:** The EIS and supporting documentation does not assume that the aquifer is only recharged along the stream channel. Available information does indicate that the alluvial aquifer is more rapidly drained by pumping drawdown in the volcanics.
17	5	Water Resources – Water Supply	Everyone, including the Village of Ruidoso has to live with the available resources. The water supply is limited, therefore, the demand must also be limited. **Response:** Limiting demand is outside the scope this EIS.
17	4	Water Resources Water Rights	The water rights of VOR should be transferred to the surface diversion and return the North Fork of Eagle Creek to as near a natural cold water fishery as possible. **Response:** The Forest Service cannot interfere with the applicant's water rights and/or associated transferability off National Forest System lands. In addition recent changes in the VoR's water rights include a permit issued to the Village transferring the 700.83 acft from EC well H-1979 to the surface point of diversion at EC and at Alto Reservoir. The permit severed 700.83 acre feet from EC well H-1979 and transferred the right to the surface point of diversion on EC and at Alto Reservoir.
18	19	Water Resources Water Rights	I take exception to the fact that the Forest Service indicates that the Village of Ruidoso has 5648 acre feet per years (AFY) of water rights attached to the NEC wells. This amount of water has never been proven up on nor is that volume available as per USGS study. **Response:** Please refer to the "Water Rights" section of our "Purpose and Need" document where we address the 5,648 afy amount and discuss the current consent order between the village and the Office of the State Engineer.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	104	Water Resources Water Rights	This USFS preferred condition is an attempt to develop and instream flow right without having any water rights. The NMOSE has jurisdiction over water rights within the State of New Mexico. **Response:** We acknowledge the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right.
21	109	Water Resources Water Rights	The Village has a water conservation plan. Water conservation measures and plans are properly within the jurisdiction of the NMOSE. Likewise, instream surface-water flows are under the jurisdiction of the NMOSE. The USFS does not have surface-water rights within the Eagle Creek system, and the USFS taking of Village surface and groundwater rights to maintain instream flows should be fairly compensated. **Response:** We acknowledge the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right. Because water rights are transferable and points of diversion can be moved off NFS lands, there are no grounds for compensation if access is restricted.
21	117	Water Resources Water Rights	The diversion of surface and groundwater by the Village in the Eagle Creek or Rio Ruidoso watershed is based on the Village's water rights and conditions of approval as set forth by the NMOSE. As is understood and should be noted, obtaining new water rights is an expensive and time-consuming process that can take years to transfer even as little as 1 ac-ft of water. There is a finite quantity of water rights available within the subject area and many of the existing rights cannot be transferred upstream to the Village for a number of reasons, or rights that may be located in favorable areas may not be for sale. Therefore, although groundwater production rates can be relatively high in parts of the Rio Ruidoso watershed, it would be complicated and may not be possible for the Village to purchase more rights and transfer them for Village use. The NMOSE has conditioned the vast majority of the Village's water rights on the Rio Ruidoso based on streamflow conditions at the Hollywood gage and as a result the Village is quite often unable to divert surface or groundwater rights associated with its Rio Ruidoso rights. Water rights cannot be transferred from the Eagle Creek watershed to the Rio Ruidoso watershed. **Response:** We acknowledge the applicant's state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant's state adjudicated water right. The parameters of transferability would be determined by the OSE.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	138	Water Resources Water Rights	On page 51, referring to the second paragraph from the bottom, containing the discussion on the 1692 acre-feet per annum being the current water right; this written information is incorrect. The adjudicated water right for the NFEC wells includes 761.12 acre-feet per annum supplemental groundwater rights and 2539.34 acre-feet per annum groundwater rights. By Memorandum of Agreement between the Village of Ruidoso and Rio Hondo Land and Cattle Company, the groundwater diversion would be limited to 1624.51 acre-feet per annum. The supplemental groundwater right remained unaffected by the agreement, resulting in a total diversion right of 2385.63 acre-feet per annum for the NFEC wells. **Response:** To our knowledge as of August 2014, this agreement between the two parties has not been acknowledged by the OSE. If an updated consent order from the Office of the State Engineer including this agreement is issued, the USDA Forest Service will recognize the updated consent order as the most current description of the applicant's water rights. Until that time, the USDA Forest Service will use the 2009 final adjudication and recently approved permits as the Village of Ruidoso's water rights in the North Fork Eagle Creek
21	140	Water Resources Water Rights	On page 193, the water rights listed within H-1497 and H-1497-S are incorrect and should read 137.37 acre-feet per annum. The total Eagle Creek water rights should have been 3437.83 acre-feet per year. **Response:** Thank you for that information. The SDEIS will be updated to reflect this accurate information.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	142	Water Resources Water Rights	On page 71 under the "Water Rights" Table and under Alternatives 2 and 3, the Village would not be able to fully apply water to beneficial use and the present inchoate amounts of 625.78 acre-feet per annum within North Fork wells No. 1and No. 3 would be in jeopardy of being lost. Under present policy of the State Engineer, the inchoate water right cannot be moved by application to other wells and locations away from the present authorized wells No.1and No.2. This means that any unproven portion of the water right would be lost by the Village. The present value of the inchoate water rights would be approximately $8,000 per acre-foot, being a total lost water right value of approximately $5,000,000. This loss of water rights would have to be made up by purchases of water rights in the Rio Ruidoso Drainage and moving said water rights to the Village of Ruidoso. This value of water rights is calculated considering the junior water rights value at 50% of senior water rights and the water rights are all consumptive use as adjudicated. **Response:** The village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the VoR's water rights include a permit issued to the Village transferring the 700.83 acft from EC well H-1979 to the surface point of diversion at EC and at Alto Reservoir. The permit severed 700.83 acre feet from EC well H-1979 and transferred the right to the surface point of diversion on EC and at Alto Reservoir.by transferring the 700.83 acre feet from EC H-1979, that allows the remaining inchoate right of 350.42 acre feet/yr to proven up by 12/31/2024. In addition, the 10 permitted supplemental wells off of US Forest lands can divert Eagle Creek water rights, allowing the remaining inchoate rights to be proven at their identified locations. However, depending on the alternative chosen and the Village's diversification in pumping, some inchoate rights could potentially be lost, but actions to secure additional rights and diversion have already been undertaken by the Village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	143	Water Resources Water Rights	With the Alternative No. 1the well diversion by the VOR on Forest lands would likely average 740 acre-feet per annum. Under Alternative No. 3, the VOR diversion on Forest lands would likely average 300 acre-feet per annum, being the same quantity of water per year as the trigger point in adaptive management, if exceeded. This could result in a loss of 440 acre-feet per year of consumptive use (CU) water diversion for the VOR. This amount of consumptive use diversion of water for municipal use would have to be made up by additional diversion on the Rio Ruidoso. Within the Rio Ruidoso there are very little if any junior water rights that could be moved into the VOR municipal diversions. The water rights available to make up the 440 acre-feet per annum consumptive use are senior irrigation water rights with priorities in the 1800's and with a consumptive irrigation requirement (CIR) of 1.44 acre-feet per acre per annum. Using the court ordered irrigation CIR of 1.44 acre-feet per acre per annum, then an equivalent (440 af/ac/an CU)/(1.44 af/an CIR)=305.56 acres of irrigation water rights. The value of senior priority irrigation water rights within the Rio Ruidoso drainage presently is approximately $23,000 per acre which would equate to a total present cost for 305.56 acres of (305.56 acres)($23,000 per acre)=$7,027,880.The litigation cost to move said water rights to the VOR could be reasonably estimated at $500 per acre being a total of ($500 per acre)(305.56 acres)=$152,780. Apparently the replacement water diversion cost and the litigation cost would total $7,180,660. **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FSEIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
22	1	Water Resources Water Rights	The Village of Ruidoso has been using the North Fork Eagle Creek wells since 1988 and relies on this water source to provide water within its municipal service area. Diversions from the North Fork wells have ranged up to 807 acre-feet/year (afy) and averaged 569 afy. Estimates in the SDEIS of the percentage of the Village's total water supply from the North Fork wells range from 36 to 43% of the current annual diversions (page 1), representing a significant portion of the Village's supply. The percentage is much higher (57 to 87%, page 1) during the summer months. As stated irt the SDEIS (pp. 128, 166, 173, 175, 177, 180 and 185), existing water supplies and water rights are inadequate to meet future demands of the Village. **Response:** We agree. The effects under the alternatives acknowledge the effects to the Village from restrictions on diversion. Further the socioeconomics effects section of the SDEIS acknowledges that existing water supplies and water rights are inadequate to meet future demands of the Village.
22	3	Water Resources Water Rights	The Village's water rights on Eagle Creek were established in a court adjudication proceeding in which the USFS was a party. The adjudication court did not limit the term of the right to 20 years; the adjudicated right has an unlimited term. The Village currently has adjudicated rights in the North Fork wells totaling 1,838.51 afy, not the much lower amount of 300 afy proposed in the SDEIS. The Forest Service did not challenge the adjudication court's determination, and that decision is final. **Response:** We acknowledge the applicant’s state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant’s state adjudicated water right. There is a distinction to be made between the term of the applicant’s special use permit (up to 20 years) with the Forest Service and applicant’s water right granted by the State.
22	10	Water Resources Water Rights	The Village of Ruidoso owns water rights in the Lincoln National Forest. Beneficial use of these water rights cannot be hindered or limited by the Forest Service's adoption of an adaptive management plan requiring reductions in the amount of groundwater diverted by the Village in order to establish a minimum flow in a forest stream. **Response:** We acknowledge the applicant’s state adjudicated water rights. As the land management agency, however, we have the authority to determine what is reasonable access (access to the right in this case is via well, pump, and pipeline) to the applicant’s state adjudicated water right.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	5	Water Resources Water Rights	With Alternative1 continue pumping current amounts, the well diversion by the Village of Ruidoso from wells on Forest lands would average an estimated 740 acre-feet per annum. Under Alternative 3, the Village diversion on Forest lands would average an estimated 300 acre-feet per annum, being the same quantity of water per year as the trigger point in adaptive management plan Alternative 3, if exceeded. This could result in a loss of 440 acre-feet per year of consumptive use (CU) water diversion for the Village. This amount of consumptive use diversion of water for municipal use would have to be made up by purchasing additional diversion on the Rio Ruidoso. Within the Rio Ruidoso there are very few if any junior water rights that could be moved into the Village municipal diversions. The water rights available to make up the 440 acre-feet per annum consumptive use are senior irrigation water rights with priorities in the 1800's and with a consumptive irrigation requirement (CIR) of 1.44 acre-feet per acre per annum. Using the court ordered irrigation CIR of 1.44 acre-feet per acre per annum, then an equivalent 440 acre feet per acre using the court order of 1.44 CIR would amount to 305.56 acres of irrigation water rights needed to be purchased (440 acres divided by 1.44 CIR per acre).2 The value of senior priority irrigation water rights within the Rio Ruidoso drainage presently is approximately $23,000 per acre which would equate to a total present cost for 305.56 acres at $23,000 per acre which totals to $7,027,880.3 **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). Consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FSEIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	7	Water Resources Water Rights	Water Rights Litigation Costs Trying to purchase irrigation water rights on the Rio Ruidoso and getting the rights transferred to the Village is a difficult and time consuming process incurring substantial attorney and water consultants' fees and expenses. Further, the process may take several years to complete. The litigation cost to move said water rights to the Village could be reasonably estimated at $500 per acre-foot for a total of $500 per acre. Thus, the acquisition costs of the needed 305.56 acres of irrigation water rights would amount to a total $152, 780.4 The $500 per acre is a conservative estimate of the cost. If water 2 Email with Jack D. Atkins PE,PS, Akins Engineering Associates to William Gorman, January 15, 2015. 3 Ibid. 4 Ibid. rights had to be purchased from several sellers to acquire the acreage needed the cost could be much greater. **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FSEIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	10	Water Resources Water Rights	The State Engineer for New Mexico has Jurisdiction over water rights in New Mexico except for reserved federal water rights. One can have adjudicated water rights but these rights must be put to beneficial use to become a property right that allows the owner to transfer the right. Putting the water to beneficial is called "proving-up". The village presently has 625.78 acre feet of annual ground water rights on the North Fork Creek that have not been proven-up (inchoate rights).8 Under the Forest Service 8 Email with Jack D. Atkins PE,PS, Akins Engineering Associates to William Gorman, December 13, 2014. restriction in the Proposed Action, the Village wells No. 1 and No. 3, would not be allowed to pump sufficient water to prove-up these rights which means that these rights would be in jeopardy of being lost by the Village.9 Under the present policy of the State Engineer, the inchoate water rights cannot be moved by application to other well and other locations away from the present authorized wells No.1 and No. 3.10 **Response:** The village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the VoR's water rights include a permit issued to the Village transferring the 700.83 acft from EC well H-1979 to the surface point of diversion at EC and at Alto Reservoir. The permit severed 700.83 acre feet from EC well H-1979 and transferred the right to the surface point of diversion on EC and at Alto Reservoir.by transferring the 700.83 acre feet from EC H-1979, that allows the remaining inchoate right of 350.42 acre feet/yr to proven up by 12/31/2024. In addition, the 10 permitted supplemental wells off of US Forest lands can divert Eagle Creek water rights, allowing the remaining inchoate rights to be proven at their identified locations. However, depending on the alternative chosen and the Village's diversification in pumping, some inchoate rights could potentially be lost, but actions to secure additional rights and diversion have already been undertaken by the Village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
23	11	Water Resources Water Rights	The water rights loss through non-proved up would be junior inchoate water rights. Since the loss is junior rights with a priority date after the year 1947, the rights would be valued at exactly % the value of senior water rights or $11,500 per acre. Each acre would have an adjudicated CIR of 1.44 acre-feet per year. Therefore the junior consumptive use water rights value lost through not being proven up would be equivalent to $11,500 per acre divided by 1.44 acre-feet per acre = $7,986. Rounded to $8000 per acre-foot consumptive use and multiplied by 623.78 acre feet of inchoate rights totals to approximately $5,000,000 (rounded). This deficit would have to be made up by the VOR thorough the purchase of water rights in the Rio Ruidoso Drainage.11 The estimated $5 million needed to compensate for this loss of inchoate water rights does not include the additional $500 dollars per acre in litigation and consultant costs needed to complete the purchase and secure the transfer of the water rights to the Village. **Response:** With water supply uncertainty, following the Little Bear fire, the village of Ruidoso has taken steps to lease additional water rights and has increased diversion of surface and groundwater on the Rio Ruidoso (Atkins 2014). For example, the village will soon have 10 permitted wells off of US Forest lands that can divert the Eagle Creek water right (Atkins 2014). Recent changes in the Village of Ruidoso's water rights include a permit issued to the Village transferring the 700.83 acre feet from Eagle Creek well H-1979 to the surface point of diversion at Eagle Creek and at Alto Reservoir. The permit severed 700.83 acre feet from Eagle Creek well H-1979 and transferred the right to the surface point of diversion on Eagle Creek and at Alto Reservoir. However, these changes do not appear to have any direct effect on the alternatives. The only likely indirect effect would be to lower the well diversion average associated with Alternative 1. **These factors are considered in the cumulative effects sections of the DSEIS and these sections have been revised in the FEIS.** These actions to secure additional rights and diversion have already been undertaken by the village of Ruidoso and would accommodate anticipated reductions in diversion under the alternatives. Analysis of the potential costs of transfer or purchase of water rights is outside of Forest Service control and our overall decision space; this is a possible outcome potentially mitigated by steps being taken by the Village. Regardless the analysis of direct effects needs to consider monitoring costs that would be incurred by the village of Ruidoso under the alternatives. NEPA does not require a monetary benefit-cost analysis. As stated in Title 40 of the Code of Federal Regulations applying to EIS preparation "For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision" (40 CFR 1502.23). consequently a discussion on costs of monitoring and benefits from instream flow changes has been added to the FSEIS.

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
18	18	Wildlife - Animal Species: TES, etc.	The North Fork of Eagle Creek is a known habitat for the Mexican Spotted owl. I am not well versed in the habit or range of this species but feel certain that if the riparian area that has had environment degradation caused by the excessive pumping of the North Fork well were to recover, more prey base for the owl would result. **Response:** The MSO prey base is far more widespread than the relatively short distance of riparian vegetation that may have been impacted. MSO prey base has not been identified as a limiting factor in MSO reproduction for any of the PACs in the project area. Cordova (2014) reported an increase in MSO productivity during 2014 which indicates an adequate prey base is available.
2	1	Comment Period Extension	Let me take this opportunity to formally request an extension of the comment period until, at least, the end of January 2015. **Response:** Thank you for your comment; the comment period was extended
3	1	Comment Period Extension	This letter is to request a 120-day extension to the comment period for the Supplemental Draft Environmental Impact Statement for the North Fork Eagle Creek Wells Special Use Authorization Project. **Response:** Thank you for your comment; the comment period was extended
3	2	Comment Period Extension	This supplemental draft environmental impact statement (SDEIS) involves significant issues with respect to the Office of the State Engineer (OSE). This agency intends to provide comments to the Forest Service; however, the current 45-day comment period provides insufficient time to conduct a thorough review of the SDEIS. **Response:** Thank you for your comment; the comment period was extended
3	4	Comment Period Extension	I respectfully request that you extend the comment period by 120 days to April 28, 2015. **Response:** Thank you for your comment; the comment period was extended
3	5	Comment Period Extension	I believe an extension to the comment period would allow better public participation in reviewing the SDEIS. **Response:** Thank you for your comment; the comment period was extended

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
3	6	Comment Period Extension	In addition, an extension of 120 days would not jeopardize any natural or cultural resources or create any endangerment to life or public safety. In summary, there appear to be no issues that require an immediate decisicn by the Forest Service. **Response:** Thank you for your comment; the comment period was extended
5	2	Comment Period Extension	I write today to request an extension of the public comment period for the North Fork Eagle Creek Wells Draft Supplemental Environmental Impact Statement (DSEIS), released November 14, 2014. The original 45 day comment period is due to end on December 29, 2014, and I respectfully request it be extended another 120 days to April 28, 2015 **Response:** Thank you for your comment; the comment period was extended
8	1	Comment Period Extension	The Village must have additional time to prepare and submit its comments to assist you fully in this process. Therefore, the Village is requesting this additional 120 day extension until April 28, 2014. I greatly appreciate your consideration of this request. **Response:** Thank you for your comment; the comment period was extended
8	2	Comment Period Extension	I write with a formal request to extend the public comment period of the Lincoln National Forest North Fork Eagle Creek Wells Draft Supplemental Environmental Impact Statement ("DSEIS") comment period that is presently set to close on December 29, 2014. **Response:** Thank you for your comment; the comment period was extended
8	3	Comment Period Extension	The granting of this request for an extension is within the discretion of the Forest Service, and under these circumstances, we believe it is entirely just and proper. This request for an extension is made on behalf of the Village of Ruidoso ("the Village"), the proponent, as well as on behalf of the Ruidoso Hondo Valley Chamber of Commerce. I understand that other local government entities and NGO's will also be submitting a similar request for an extension of the comment period. **Response:** Thank you for your comment; the comment period was extended
8	5	Comment Period Extension	Consequently, the Village requires additional time for its staff and consultants to prepare meaningful and impactful comments with regard to the DSEIS. **Response:** Thank you for your comment; the comment period was extended

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
1	7	Requests for Information	Please let me know if the preparation team will respond to this problem before the final document is released. I would also like to know the schedule of pending actions, including the due date for comments on the SDEIS, the Final Analysis document availability, and the Record of Decision. **Response:** Thank you for your comment; we provided answers to these questions under a separate email reply.
4	1	Requests for Information	Where will I find the AECOM data quantifying the daily quantity of flow in the North Fork determined by flow measurements at the NF, SF and EC gages, as you promised would be authorized in the USFS meeting with the ECCA in July, almost 1 1/2 years ago? **Response:** See pages 108 through 110 of the SDEIS. This discussion summarizes the Final Draft Supplemental Water Resources Report, October 2014. In the latter, the flow durations at the three gages are quantified over the long-term on pages 46 through 54. Figures 18, 19, and 20 indicate flow durations for the Eagle Creek Confluence gage (USGS08387600), which is the long-term, pre-pumping monitoring location. Additional discussion of conditions (flow, no-flow) at that gage over selected long-term no-pumping and pumping periods are on those pages, page 49, and tabulated in Table 7. North Fork gage and South Fork gage summaries are presented on pages 50 through 54. **An additional figure depicting South Fork gage flows compared to the Eagle Creek gage flows has been added to that general area of the water report**.
6	3	Requests for Information	THIS COMMENT IS FOR THE PUBILC RECORD. PLEASE RECEIPT. **Response:** Your comments were received and considered by the IDT
7	3	Requests for Information	Please send our office one copy of the FEIS when it is electronically filed. **Response:** We will update our mailing to ensure we send you a copy of the FEIS when ready
11	4	Attachment	Attachment: Dr. Midkiff; North Fork Eagle Creek Degradation/Evaluation of Alternatives **Response :** This attachment was reviewed and considered by the IDT
21	27	Attachment	see attachment for illustrations. **Response:** This attachment was reviewed and considered by the IDT

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	71	Attachment	Review of USDA Forest Service North Fork Eagle Creek Supplemental Water Resources Report, Final Draft from Roger Peery, CPG, PG, John Shomaker & Associates, Inc., dated January 2015 **Response:** This attachment was reviewed and considered by the IDT
21	72	Attachment	Additional Comments on Supplemental Draft EIS Chapters 1, 2 and 3 for the North Fork Eagle Creek Wells Special Use Authorization from Jackie D. Atkins, PE, PS, Atkins Engineering Associates, Inc., dated January 27, 2015 **Response:** This attachment was reviewed and considered by the IDT
21	73	Attachment	Comments Regarding the Supplemental Draft Environmental Impact Statement (SDEIS) North Fork of Eagle Creek Wells Special Use Authorization from Alvin F. Jones, Esq., Hennighausen & Olsen, L.L.P., dated January 27, 2015 **Response:** This attachment was reviewed and considered by the IDT
23	1	Attachment	Comments on North Fork Eagle Wells Special Use Authorization Project: Socioeconomic Report for Supplemental Draft Environmental Impact Statement from William D. Gorman, PhD, dated January 2015 **Response:** This attachment was reviewed and considered by the IDT
12	9	References	REFERENCES 1. May 17, 2005, e-mail to Jackie Atkins (VoR consultant) with copies to Buck Sanchez,(Smokey Bear Ranger) and Richard Carlson (Smokey Bear RD staff) from Clark Taylor, IRM Specialist, Smokey Bear RD 2. Hydrology of Eagle Creek Basin and Effects of Groundwater Pumping on Streamflow, 1969-2009, USGS Scientific Investigations Report 2010-5205, Revised November 2010 3. North Fork Eagle Creek, Supplemental Water Resources Report, Final Draft, Prepared by AECOM, October 2014 4. Glossary of Hydrology, William E. Wilson and John E. Moore, Editors, 1998 5. Depth to water data supplied by VoR stipulated monthly reports. 6. Supplemental Draft Environmental Impact Statement, North Fork Eagle Creek Wells Special Use Authorization, MB-R3-08-04A, October 2014 **Response:** These references have been reviewed and considered by the IDT
21	28	References	AECOM, 2011, North Fork Eagle Creek, Water Resources Report, Final Draft: consultant's report prepared for TEAMS Enterprise Unit and Smokey Bear Ranger District, Lincoln Nation Forest, 103 p. **Response:** These references have been reviewed and considered by the IDT

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	29	References	Darr, M.J., Rattray, G.W., McCoy, K.J., and Durall, R.A., 2014, Hydrogeology, Water Resources, and Water Budget of the Upper Rio Hondo Basin, Lincoln County, New Mexico, 2010. **Response:** This reference was reviewed by the IDT. This reference actually supports the use of the chloride mass-balance method for this area. Anthropogenic sources referred to are those from lower altitudes where population density is high. Rocks that skew results are the sedimentary rocks also found at the lower elevations, and not the volcanics in the vicinity of the North Fork
21	30	References	DeBano, L.F, 1981; Water Repellant Soils: a state-of-the-art, United States Department of Agriculture, Forest Service, General Technical Report PSW-46, Pacific Southwest Forest and Range Experiment Station, March 1981 **Response:** These references have been reviewed and considered by the IDT
21	31	References	DeBano, L.F., Neary, D.G., and Ffolliott, P.F., 1998, Fire's effects on ecosystems: John Wiley & Sons, Inc. **Response:** These references have been reviewed and considered by the IDT
21	32	References	DeBano, L.F., Neary, D.G., and Ffolliott, P.F., 2005, Wildland Fire in Ecosystems, Effects of Fire on Soil and Water: USDA Forest Service General Technical Report RMRS_GTR- 42-Volume 4, Chapter 2. **Response:** These references have been reviewed and considered by the IDT
21	33	References	Ebel, B.A., Hinckley, E.S., and Martin, D.A., 2012, Soil-water dynamics and unsaturated storage during snowmelt following wildfire: Hydrol. Earth Syst. Sci Discuss, 16, 1401-1417, May 15, 2012. **Response:** These references have been reviewed and considered by the IDT
21	34	References	Elder, K., Dwire, K., Hubbard, R., Rhoades, C., Ryan, S., Young, M., Porth, L., Dixon, M., and Goodbody, A., 2006, Disturbance and Water Related Research in the Western United States; Rocky Mountain Research Station, USDA Forest Service: Proceedings 2nd Interagency Conference on Research in the Watersheds, May 15-18, 2006; Coweeta Hydrologic Lav, Otto NC, pp. 3-21 **Response:** These references have been reviewed and considered by the IDT

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	35	References	Ffolliott, P.F., Stropki, C.L., Chen, H., and Neary, D.G., June 2011, The 2002 Rodeo-Chediski Wildfire's Impacts on Southwestern Ponderosa Pine Ecosystems, Hydrology, and Fuels: USDA Forest Service Rocky Mountain Research Station Research Paper RMRS-RP-85. **Response:** These references have been reviewed and considered by the IDT
21	36	References	Harpold, A.A., Biederman, J.A., Condon, K., Merino, M., Korgaonkar, Y., Nan, T., Sloat, L.L., Ross, M., and Brooks, P.D., 2013, Changes in Snow Accumulation and Ablation following the Las Conchas Forest Fire, New Mexico, USA: Ecohydrology, 7, pages 440 to 452; published in Wiley Online Library Jan. 27, 2013. **Response:** These references have been reviewed and considered by the IDT
21	37	References	Knoepp, J.D., DeBano, L.F., and Neary, D.G., September 2005, Wildland Fire in Ecosystems, Effects of Fire on Soil and Water: USDA Forest Service General Technical Report RMRS_GTR-42-Volume 4, Chapter 3. **Response:** These references have been reviewed and considered by the IDT
21	38	References	Leaf, C.F., 1975, Watershed Management in the Rocky Mountain Subalpine Zone: The State of our Knowledge. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USDA Forest Service Research Paper RM-137. **Response:** These references have been reviewed and considered by the IDT
21	39	References	Matherne, A.M., Myers, N.C., and McCoy, K.J., 2010, Hydrogeology of Eagle Creek Basin and Effects of Groundwater Pumping on Streamflow, 1969-2009: U.S. Geological Survey Scientific Investigations Report 2010-5205, Revised November 2010. **Response:** These references have been reviewed and considered by the IDT
21	40	References	Moody, J.A., and Martin, D.A., 2001, Post-fire, rainfall intensity-peak discharge relations for three mountainous watersheds in the western USA: Hydrologic Processes, 15, 2981-2993. **Response:** These references have been reviewed and considered by the IDT

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	41	References	Moody, J.A., and Martin, D.A., 2004 , Wildfire Impacts on Reservoir Sedimentation in the Western United States: Proceedings of the Ninth International Symposium on River Sedimentation, October 18 - 21, Yichang, China. **Response:** These references have been reviewed and considered by the IDT
21	42	References	Mourant, W.A., 1963, Water Resources and Geology of the Rio Hondo Drainage Basin, Chaves, Lincoln, and Otero Counties, New Mexico: New Mexico Office of the State Engineer Technical Report No. 28, 85 p. plus maps. **Response:** These references have been reviewed and considered by the IDT
21	43	References	Neary, D.G., and Ffolliott, P.F., September 2005, The Water Resource: Its Importance, Characteristics, and General Responses to Fire, Wildland Fire in Ecosystems, Effects of Fire on Soil and Water: USDA Forest Service General Technical Report RMRS_GTR-42-Volume 4, Part B. **Response:** These references have been reviewed and considered by the IDT
21	44	References	Neary, D.G., Ffolliott, P.F., and Landsberg, J.D., 2005, Fire and Streamflow Regimes, Wildland Fire in Ecosystems, Effects of Fire on Soil and Water: USDA Forest Service General Technical Report RMRS_GTR-42-Volume 4, Chapter 5. **Response:** These references have been reviewed and considered by the IDT
21	45	References	New Mexico Territorial Engineer, 1909, Report of the Hondo Hydrographic Survey by the Territorial Engineer to the court of the sixth Judicial District of the Territory of New Mexico. **Response:** These references have been reviewed and considered by the IDT
21	46	References	Peery, R., and McCoy A., 2012, Review of North Fork Eagle Creek Water Resources Report, Final Draft, Prepared by AECOM: consultant's Technical Memorandum dated February 14, 2012 prepared by John Shomaker & Associates, Inc. **Response:** These references have been reviewed and considered by the IDT

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	47	References	Peery, R., 2012, Supplemental Information Report for Village of Ruidoso North Fork Wells Special-Use Permit: consultant's letter to Robert G. Trujillo, Forest Supervisor, Lincoln National Forest dated September 6, 2012 prepared by John Shomaker & Associates, Inc. **Response:** These references have been reviewed and considered by the IDT
21	48	References	Peery, R., 2012, Review of USDA Forest Service Draft EIS for Village of Ruidoso North Fork Wells: consultant's Technical Memorandum dated January 11, 2012 prepared by John Shomaker & Associates, Inc. **Response:** These references have been reviewed and considered by the IDT
21	49	References	Rawling, G.C., 2009, Geology of the Ruidoso Area, Lincoln and Otero Counties, New Mexico, New Mexico Bureau of Geology and Mineral Resources, Open-File Report OFR-507, scale 1:24,000. **Response:** These references have been reviewed and considered by the IDT
21	50	References	Territorial Engineer for the Territory of New Mexico, 1909, Report on the Hondo Hydrographic survey; prepared for the Court of the Sixth Judicial District of the Territory of New Mexico. **Response:** These references have been reviewed and considered by the IDT
21	51	References	Troendle, C.A., 1983, The Potential for Water Yield Augmentation from Forest Management in the Rocky Mountain Region. Water Resources Bulletin, Vol. 19, No. 3, June 1983. American Water Resources Association, Bethesda, Maryland. **Response:** These references have been reviewed and considered by the IDT
21	52	References	Troendle, C.A., MacDonald, L.H., Luce, C.H., and Larsen, I.J., January 2010, Fuel Management and Water Yield; Cumulative Watershed Effects of Fuel Management in the Western United States, Chapter 7, USDA Forest Service, Rocky Mountain Research Station General Technical Report RMRS-GTR-231. **Response:** These references have been reviewed and considered by the IDT

Letter No.	Comment No.	Subject	Comment Text and Forest Service Response
21	53	References	Troendle, C.A., Nankervis, J.M., and Peavy, A., 2007, The Herger-Feinstein-Quincy Library Group Project - Impact of Vegetation Management on Water Yield, Final Report submitted to Colin Dillingham, HFQLG Monitoring Team Leader, Vegetation Management Solutions, Forest Service Enterprise Team, May 1, 2007. **Response:** These references have been reviewed and considered by the IDT
21	54	References	[USFS] U.S. Department of Agriculture Forest Service, January 2000, Water & the Forest Service: USDA Forest Service Policy Analysis. **Response:** These references have been reviewed and considered by the IDT
21	55	References	[USFS] U.S. Department of Agriculture Forest Service, March 2003, Effects of Fire Exclusion in Rocky Mountain Ecosystems: RMRScience, Rocky Mountain Research Station, Fort Collins Colorado. **Response:** These references have been reviewed and considered by the IDT
21	56	References	[USFS] U.S. Department of Agriculture Forest Service, September 2005, Wildland Fire in Ecosystems, Effects of Fire on Soil and Water: USDA Forest Service General Technical Report RMRS_GTR-42-Volume 4. **Response:** These references have been reviewed and considered by the IDT
21	57	References	[USFS] U.S. Department of Agriculture Forest Service, October 2011, Draft Environmental Impact Statement for the North Fork Eagle Creek Wells Special Use Authorization Project, Lincoln National Forest, Lincoln County, New Mexico. **Response:** These references have been reviewed and considered by the IDT
21	58	References	[USFS] U.S. Forest Service Smokey Bear Ranger District, 2012, Little Bear Fire, Burned Area Emergency Response (BAER) Team, White Paper: U.S. Forest Service Smokey Bear Ranger District, Lincoln National Forest, Ruidoso, New Mexico, June 30, 2012 **Response:** These references have been reviewed and considered by the IDT

Letters from Federal, State, and Local Agencies and Elected Officials

The following are text reproductions of letters received by various Federal, State and local agencies and officials. Copies of original letters are available upon request from the project record.

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

CONCHA ORTIZ Y PINO BUILDING, 130 SOUTH CAPITOL, SANTA FE, NM 87501
TELEPHONE: (505) 827-6091 FAX: (505) 827-3806

TOM BLAINE, P.E.
STATE ENGINEER

Mailing Address:
P.O. Box 25102
Santa Fe, NM 87504-5102

December 19, 2014

Mr. Travis Moseley
Forest Supervisor
Lincoln National Forest
3463 Las Palomas Road
Alamogordo, NM 88310

Dear Mr. Moseley,

This letter is to request a 120-day extension to the comment period for the Supplemental Draft Environmental Impact Statement for the North Fork Eagle Creek Wells Special Use Authorization Project. Currently, the 45-day comment period is set to end on December 29, 2014.

This supplemental draft environmental impact statement (SDEIS) involves significant issues with respect to the Office of the State Engineer (OSE). This agency intends to provide comments to the Forest Service; however, the current 45-day comment period provides insufficient time to conduct a thorough review of the SDEIS. I believe an extension to the comment period would allow better public participation in reviewing the SDEIS. In addition, an extension of 120 days would not jeopardize any natural or cultural resources or create any endangerment to life or public safety. In summary, there appear to be no issues that require an inunediate decision by the Forest Service.

Given the above considerations, I respectfully request that you extend the comment period by 120 days to April 28, 2015.

Sincerely,

/s/ Tom Blaine

Tom Blaine, P.E.
State Engineer

TB/kme

cc: Tom Battin, Mayor, Village of Ruidoso
Greg Ridgley, OSE General Counsel
Mike Johnson, OSE Hydrology Bureau Chief

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

January 6, 2015

Dave Warnack, District Ranger
901 Mechem Drive
Ruidoso, NM 88345

Mr. Warnack,

In accordance with our responsibilities under Section 309 of the Clean Air Act (CAA), the National Environmental Policy Act (NEPA), and the Council on Environmental Quality (CEQ) regulations for implementing NEPA, the U.S. Environmental Protection Agency (EPA) Regiop 6 office in Dallas, Texas, has completed its review of the Supplemental Draft Environmental Impact Statement (SDEIS) for the North Fork Eagle Creek Wells Special Use Authorization Project prepared by the U.S. Forest Service (USFS). The USFS proposes to authorize, under a new special use permit, the operation of four municipal supply water wells located on the Lincoln National Forest system lands in the North Fork Eagle Creek drainage.

EPA rates the SDEIS as **"LO"** i.e., EPA has "not identified any potential environmental impacts requiring substantial changes to the proposal, and the SDEIS adequately sets forth the environmental impacts of the alternatives." The EPA's Rating System Criteria can be found here: http://www.epa.go/oecaerth/nepa/comments/ratings.html. EPA's review did identify areas of the SDEIS needing clarification, and we ask that those issues be addressed in the FEIS. Enclosed are detailed comments which identify our concerns.

EPA appreciates the opportunity to review the SDEIS. Please send our office one copy of the FEIS when it is electronically filed. This letter will be published on the EPA website, www:epa.gov, according to our responsibility under Section 309 of the CAA to inform the public of our views on the proposed Federal action. Ifyou have any questions or concerns, I can be reached at 214-665-7560, or contact Keith Hayden of my staff at hayden.keith@epa.gov or 214-665-2133.

Sincerely,

Marie Stucky
Chief, Office of Planning
and Coordination

Enclosures

DETAILED COMMENTS ON THE
UNITED STATES FOREST SERVICE
SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE NORTH FORK EAGLE CREEK WELLS
SPECIAL USE AUTHORIZATION

Items needing clarification

Proposed action; page 8

Under the proposed action, the new permit would be issued for 20 years. The permit terms and conditions would be reviewed anywhere from yearly to once every 10 years. It is unclear what "reviewing the permit terms and conditions" entails. Does it mean the permit could be modified? Does it mean checking the permit terms and conditions against monitoring thresholds to see if adaptive management measures should be implemented?

Recommendation:

Please clarify what "checking the permit terms and conditions" means. Describe what actions could result from checking the terms and conditions. Describe any consequences that could result from checking the terms and conditions of the permits yearly versus every 10 years.

Adaptive management trigger #2; page 30

The SDEIS states "If groundwater pumping of North Fork wells results in a declining trend in the average water table depths over any 3-year period, the Village of Ruidoso would reduce diversions from the wells until the average water table depth is reestablished and the Forest Service determines that pumping may resume without creating further departures over a 3-year period". There is not any specific information on the amount pumping would be reduced or the timeframe the Village of Ruidoso would have to re-establish the average water table depth threshold. Would the timeframe for compliance be non-negotiable, or would it be based on factors like available streamflow, or precipitation amounts?

Recommendation:

Include specific information regarding groundwater pumping rates if a 3-year declining trend equal to, or below, thresholds is realized. Also, clarify the amount of time the Village of Ruidoso would have to bring water table depths above the thresholds.

Ysleta del Sur Pueblo

Tribal Council – Javier Loera (War Captain/Tribal Historic and Preservation Officer) E-mail jloera@ydsp-nsn.gov

117 South Old Pueblo Road * P.O. Box 17579 * El Paso, Texas 79917 * (915) 859-8053 * Cell (915) 497-3876

January 14, 2015
Mr. Travis G. Moseley
Forest Supervisor
USDA

Forest Service Lincoln National Forest
3463 Las Palomas Rd.
Alamogordo, NM 88310

Dear Mr.Moseley

This letter is in response to the correspondence received in our office in which you provide Ysleta Del Sur pueblo the opportunity to comment on the North Fork Eagle Creek Wells Special Use Authorization Project (SDEIS) EIS No. 20140328)

While we do not have any comments on the ***SDEIS (EIS No. 2014328)*** and believe that this project will not adversely affect traditional ,religious or culturally significant sites of our or artifacts unearthed during this project be determined to fall under NAGPRA guidelines .Copies of our Pueblo's Culture Affliction Position Paper and Consultation policy are available upon request.

Sincerely,

Javier Loera
War Captain/Tribal Historic and Preservation officer
Ysleta Del Sur Pueblo

Tribal Council Assistant:
Adam Nevarez

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance 1001 Indian School Road NW, Suite 348
Albuquerque, New Mexico 87104

ER 14/0725
File 9043.1

January 28, 2015

VIA ELECTRONIC MAIL ONLY

Travis G. Moseley
Lincoln Forest Supervisor

U. S. Forest Service
3463 Las Palomas Rd.
Alamogordo, NM 88310

Dear Mr. Moseley:

The U.S. Department of the Interior has reviewed the Supplemental Draft Environmental Impact Statement for the North Fork Eagle Creek Wells Special Use Authorization Project, Lincoln National Forest, Lincoln County, New Mexico. In this regard, we have no comment.

Thank you for the opportunity to review this document.

Sincerely,

Stephen R. Spencer, Ph.D.
Regional Environmental Officer

STATE OF NEW MEXICO

OFFICE OF THE STATE ENGINEER

Tom Blaine, P.E.
State Engineer

Gregory C. Ridgley
General Counsel

LITIGATION & ADJUDICATION PROGRAM
130 South Capitol
Santa Fe, New Mexico 87501

Mailing Address:
P.O. Box 25102
Santa Fe, NM 87504-5102
Telephone : (505) 827-6150
Fax: (505) 827-3887

January 28, 2015

Dave Warnack, District Ranger
901 Mechem Drive
Ruidoso, NM 88345

Dear Mr. Warnack,

This letter provides comments on the Supplemental Draft Environmental Impact Statement (SDEIS) for the No1ih Fork Eagle Creek Wells Special Use Authorization Project, Lincoln National Forest, Lincoln County, New Mexico published by the U.S. Forest Service ("Forest Service"). These comments primarily address issues of concern to the New Mexico Office of the State Engineer with respect to the State Engineer's authority to administer water rights within the state.

The Village of Ruidoso has been using the North Fork Eagle Creek wells since 1988 and relies on this water source to provide water within its municipal service area. Diversions from the North Fork wells have ranged up to 807 acre-feet/year (afy) and averaged 569 afy. Estimates in the SDEIS of the percentage of the Village's total water supply from the North Fork wells range from 36 to 43% of the current annual diversions (page 1), representing a significant portion of the Village's supply. The percentage is much higher (57 to 87%, page 1) during the summer months. As stated iii the SDEIS (pp. 128, 166, 173, 175, 177, 180 and 185), existing water supplies and water rights are inadequate to meet future demands of the Village.

The action proposed in the SDEIS contains administrative triggers that would alter the amount of water that the Village could divert. If valid, such restrictions would create considerable uncertainty in the Village's future supply. On page 21, the SDEIS states that a special use permit would be issued for 20 years, but "the permit term would be shortened if necessary" (paragraph 4). On page 25, the SDEIS states that allowable water diversions would be limited to 300 afy or less, but "could vary based on monitoring results of the adaptive management triggers" (paragraph 3). The diversion limit of 300 afy is significantly less than the average diversions by the Village of 569 afy and the maximum diversion of 807 afy.

The Village's water rights on Eagle Creek were established in a court adjudication proceeding in which the USFS was a party. The adjudication court did not limit the term of the right to 20 years; the adjudicated right has an unlimited term. The Village currently has adjudicated rights in the North Fork wells totaling 1,838.51 afy, not the much lower amount of 300 afy proposed in the

SDEIS. The Forest Service did not challenge the adjudication court's determination, and that decision is final. The Forest Service does not have the authority to alter the elements of the Village's water right or to administer groundwater in New Mexico. The Forest Service does not have the authority to usurp the State Engineer's authority to administer water rights in New Mexico by imposing Forest Service conditions on the administration of groundwater in New Mexico.

The State of New Mexico, and this Office, also addressed these concerns in its October 3, 2014 comment letter ("Comment Letter") to the Forest Service's Proposed Directive on Groundwater Resource Management ("Proposed Directive") pertaining to groundwater lying underneath Forest Service land. As addressed therein, the Forest Service's actions with regard to the Village, and groundwater in general, fails to acknowledge, and in some ways threatens to contradict, a century of well-established federal statutory and United States Supreme Court case law that requires federal deference to state water law in the West.

The ownership of land does not confer any rights in flowing surface water or groundwater underneath the land of the Forest Service. Only to the extent that such water rights are acquired via state or federal law, can the Forest Service assert any legal interest in the public waters of New Mexico. Nor does the ownership of water rights, be it under state or federal law, confer upon the Forest Service the right to manage and regulate the water rights of others. Nevertheless, the Forest Service, through its SDEIS, proposes to assert such authority over water rights properly acquired, developed, and owned by the Village. New Mexico has a comprehensive and exclusive statutory scheme for managing and regulating its water that must be respected. The law of federal deference to state authority over water is well-established and should be similarly respected. While the Forest Service may manage its own water rights obtained under state or federal law, it has absolutely no authority to prevent other water rights owners with legal access to Forest Service land to divert water under an existing water right.

Under New Mexico law, the State Engineer is charged with the supervision of all waters, including groundwater, within the boundaries of the State and the measurement, appropriation and distribution thereof. For over a century, the State Engineer has developed a comprehensive administrative scheme that includes sophisticated technical hydrological analyses. This administrative process requires the State Engineer to exercise his expertise in hydrology to determine with as much scientific precision as possible how much water is available for appropriation and how use of that water will affect existing valid water rights. Once the administrative process is completed, the State Engineer's determination as to a water right, such as the Village's, is final.

Federal law requires that the Forest Service maintain and protect water right owners, such as the Village, in the exercise of their water rights obtained pursuant to state law, even on Forest Service lands. In *Diamond Bar Ranch v. United States,* 168 F.3d 1209, 1214 (10th Cir. 1999), the Tenth Circuit Court of Appeals held:

> The United States has long recognized the validity of private water rights obtained pursuant to state water law. See Andrus v. Charlestone Stone Products, Co., Inc., 436 U.S. 604, 614, 98 S. Ct. 2002, 56 L.Ed.2d 570 (1978) (noting in 1866, 1870, and 1872, Congress affirmed the "view that private water rights on federal lands were to be governed by state and local law and custom"). This recognition was made explicit in the Mining Law of 1866, which provides in relevant part: "Whenever, by priority of possession, rights to use of water for mining, agricultural, manufacturing or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and declarations of courts, the possessors and owners of such vested rights shall be maintained and protected in

> the same; and the right of way for the construction of ditches and canals for the purposes herein specified is acknowledged and confined."

Additionally, in *United States v. New Mexico,* 438 U.S. 696, 702 (1978), the Supreme Court held that unless Congress has reserved water as essential to the primary purpose of the reservation of federal land, the United States must "acquire water in the same manner as any other public or private appropriator." There the Court unambiguously held that the protection of wildlife was not a primary purpose of the reservation of Forest Service lands, but a secondary purpose, for which water rights must be acquired through state law processes.

The Village of Ruidoso owns water rights in the Lincoln National Forest. Beneficial use of these water rights cannot be hindered or limited by the Forest Service's adoption of an adaptive management plan requiring reductions in the amount of groundwater diverted by the Village in order to establish a minimum flow in a forest stream. In light of well-established federal law that requires deference to and protection of water rights developed under state laws, as well as the express directive by the Supreme Court that water rights for wildlife purposes must be obtained in the same manner as any other appropriator, the Forest Service is prohibited from obtaining water for wildlife purposes by forcing non-federal entities to reduce the exercise of their state law water rights.

Sincerely,

/s/ Chris Lindeen

Chris Lindeen
Deputy General Counsel

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