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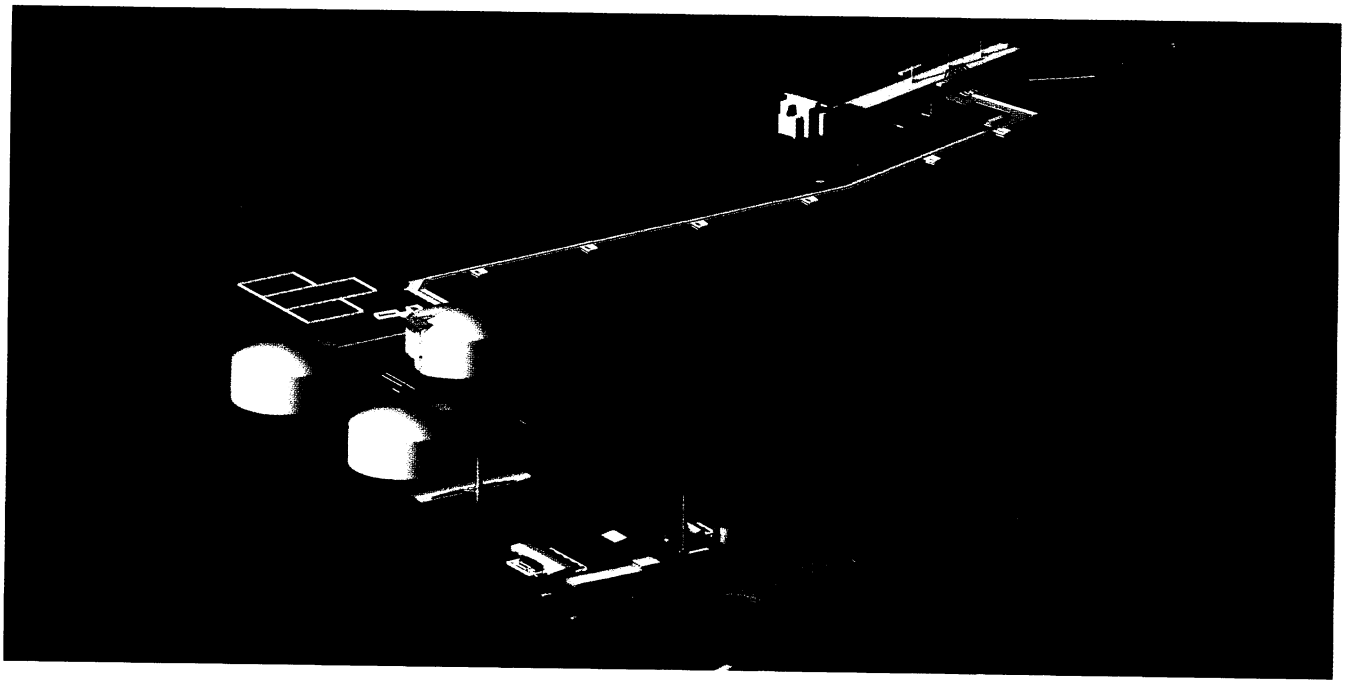
PUBLIC

Draft Environmental Impact Statement

Crown Landing LNG and Logan Lateral Projects

Crown Landing, L.L.C.
Texas Eastern Transmission, L.P.
Docket Nos. CP04-411-000 and CP04-416-000
FERC/EIS – 0179D



Federal Energy Regulatory Commission
Office of Energy Projects
Washington, DC 20426

Cooperating Agencies

US Army Corps of Engineers

FEB 18 2005

February 2005

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FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426
OFFICE OF ENERGY PROJECTS

U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT
PHILADELPHIA, PA 19107

In Reply Refer To:
OEP/DG2E/Gas Branch 1
Crown Landing, L.L.C.
Texas Eastern Transmission, L.P .
FERC Docket Nos.
CP04-411-000
CP04-416-000

(COE Application Nos.
CENAP-OP-R-200500145
CENAP-OP-R-200500146)

TO THE PARTY ADDRESSED:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) in cooperation with the U.S. Army Corps of Engineers (COE), U.S. Coast Guard, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, and the National Oceanic and Atmospheric Administration Fisheries has prepared a draft Environmental Impact Statement (EIS) for a liquefied natural gas (LNG) import terminal (referred to as the Crown Landing LNG Project) proposed by Crown Landing, L.L.C. (Crown Landing), a BP Energy Company (BP) affiliate, and natural gas pipeline facilities (referred to as the Logan Lateral Project) proposed by Texas Eastern Transmission, L.P. (Texas Eastern) in the above-referenced dockets.

This is a joint public notice by the FERC and COE to advertise:

- the availability of the draft EIS;
- the scheduling of joint public meetings/hearings on March 29,30, and 31, 2005; and
- the submission of two Department of the Army permit applications (CENAP-OP-R-200500145 and CENAP-OP-R-200500146) to the COE for the Crown Landing LNG and Logan Lateral Projects in Gloucester County , New Jersey, New Castle County, Delaware and Delaware County, Pennsylvania.

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The draft EIS has been prepared to satisfy the requirements of the National Environmental Policy Act (NEPA). The FERC concludes that if the project is constructed and operated in accordance with Crown Landing's and Texas Eastern's proposed mitigation and our recommended mitigation measures, the proposed facilities would have limited adverse environmental impact. The draft EIS identifies and evaluates the preferred alternative proposal and other alternatives, including system alternatives, alternative sites for the LNG import terminal, and pipeline alternatives, and requests comments on them.

The proposed LNG terminal would be located on the shoreline of the Delaware River in Logan Township, Gloucester County, New Jersey, and would consist of facilities capable of unloading LNG ships, storing up to 450,000 cubic meters (m^3) of LNG (9.2 billion cubic feet of natural gas equivalent), vaporizing the LNG, and sending out natural gas at a baseload rate of 1.2 billion cubic feet per day (Bcfd) and a maximum rate of 1.4 Bcfd (using spare equipment). Crown Landing proposes to interconnect the LNG facilities onsite with three pipelines. One interconnect would be with the new pipeline that Texas Eastern proposes to construct and operate (i.e., Logan Lateral) between its existing Chester Junction facility in Brookhaven Borough, Pennsylvania and the proposed LNG terminal. The other two interconnects would be with existing pipelines that currently cross the LNG terminal site. One of these pipelines is owned and operated by Columbia Gas Transmission Company (Columbia Gas). The other pipeline is owned and operated by Transcontinental Gas Pipe Line Corporation (Transco). To date, neither Columbia Gas nor Transco have filed applications with the FERC to construct and operate the interconnects. The Crown Landing LNG Project would have a maximum delivery capacity of 0.5 Bcfd to the Columbia Gas pipeline system, 0.6 Bcfd to the Transco pipeline system, and 0.9 Bcfd to the Texas Eastern pipeline system.

The proposed preferred project construction site, referenced above, is approximately 175 acres in size (waterward of the low water line on the Delaware River). Within the site there are uplands, wetlands (federally regulated) and intertidal river shoreline (also federally regulated). Construction of the proposed LNG terminal (Crown Landing) would involve the dredging of shallow water riverbottom and the filling of a small area of intertidal river shoreline for the installation of berthing structures in the Delaware River. No permanent filling of federally regulated wetlands is proposed for construction of the terminal facilities. The proposed new pipeline (Texas Eastern) connection would involve the installation of about 11.00 miles of new underground pipeline from the storage and transfer facility in Gloucester County, New Jersey, crossing Birch Creek, Raccoon Creek, the Delaware River, Chester Creek and several smaller waterways on both sides of the Delaware River, to an existing pipeline junction facility in Pennsylvania.

The Birch Creek, Raccoon Creek, Delaware River, and Chester Creek crossings would all be accomplished by Horizontal Directional Drilling (HDD) method. All

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smaller waterway crossings would be accomplished by open-cut trenching. The rigging for the HDD crossing of the Delaware River would be set-up on the Pennsylvania bank of the river in Chester. The pipeline would be "pulled under" the river from the old Ferry Road roadbed on the New Jersey side.

The draft EIS addresses the potential environmental effects of the construction and operation of the following LNG and natural gas pipeline facilities:

- a ship unloading facility capable of receiving LNG ships with capacities up to 200,000 m^3;
- three 150,000 m^3 (net capacity) full-containment LNG storage tanks, comprised of 9 percent nickel steel inner tank, pre-stressed concrete outer tank, and a concrete roof;
- a closed-loop shell and tube heat exchanger vaporization system;
- various ancillary facilities, including administrative offices, warehouse/maintenance building, main control center, guardhouse, and a pier control room;
- three meter and regulation stations located on the proposed LNG terminal site; and
- approximately 11.00 miles of 30-inch-diameter natural gas pipeline (4.92 miles in Pennsylvania and 6.08 miles in New Jersey), a pig launcher and receiver facility at the beginning and end of the pipeline, a mainline valve, and a meter and regulation station at the end of the pipeline.

Crown Landing and Texas Eastern have applied, concurrently, to the COE for two Department of the Army Individual permits pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) for the proposed structures in and under navigable waters and the discharge of dredged, excavated, and/or fill material into waters of the United States, including wetlands to construct the preferred alternative identified in the draft EIS. The decision whether to issue the permits will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed projects on the public interest. The decision will reflect the national concern for the protection and utilization of important resources. The benefits, which would be reasonably expected to accrue from the proposed projects, must be balanced against its reasonably foreseeable detriments. All factors, which may be relevant to the proposed work, will be considered, including the cumulative effect thereof; among those are conservation, economics, aesthetics, general

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environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply, and consideration of property ownership, and in general, the needs and welfare of the people. Department of the Army permit(s) will be granted by the COE unless it is determined that the proposed work would be contrary to the public interest.

Joint FERC Public Meetings/COE Public Hearings will be held to provide interested individuals with the opportunity to testify about the effects of the projects, including their social, economic and environmental effects. These meetings/hearings provide the opportunity to present views, opinions, and information that will be considered by the FERC and COE in evaluating the proposed projects.

Comment Procedures and Public Meetings

Any person wishing to comment on the draft EIS may do so. To ensure consideration prior to a Commission decision on the proposal, it is important that we receive your comments before the date specified below. **Please carefully follow these instructions to ensure that your comments are received in time and properly recorded**:

- Send an original and two copies of your comments to:

  Magalie R. Salas, Secretary
  Federal Energy Regulatory Commission
  888 First St. NE, Room 1A
  Washington, DC 20426;

- Reference Docket No. CP04-411-000, et al.;

- Label one copy of your comments for the attention of Gas Branch 1, PJ-11.1; and

- **Mail your comments so that they will be received in Washington, DC on or before April 18, 2005.**

Please note that the Commission strongly encourages electronic filing of any comments or interventions to this proceeding. See, 18 CFR 385.2001(a)(1)(iii) and the instructions on the Commission's web site at http://www.ferc.gov under the "e-Filing" link and the link to the User's Guide. Prepare your submission in the same manner as you would if filing on paper and save it to a file on your hard drive. Before you can file comments you will need to create a free account, which can be created by clicking on "Login to File" and then "New User Account."

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In addition to or in lieu of sending written comments, we invite you to attend the public comment meetings we will conduct three meetings in the project area. The locations and times of these meetings are listed below.

March 29, 2005
7:00 PM
Holiday Inn
One Pureland Drive
Swedesboro, NJ 08085
(856) 467-3322

March 30, 2005
7:00 PM
Crozer Community Hospital
2600 West 9th St.
Chester, PA 19013
(610)-494-0700

March 31, 2005
7:00 PM
Holiday Inn
630 Naamans Road
Claymont, DE 19703
(302) 791-4603

Information regarding these meetings is also posted on the Commission's calendar located at http://www.ferc.gov/EventCalendar/EventsList.aspx along with other related information. Interested groups and individuals are encouraged to attend and present oral comments on the draft EIS. Transcripts of the meetings will be prepared.

After these comments are reviewed, any significant new issues are investigated, and modifications are made to the draft EIS, a final EIS will be published and distributed by the staff. The final EIS will contain the staff's responses to timely comments received on the draft EIS.

Comments will be considered by the Commission but will not serve to make the commentor a party to the proceeding. Any person seeking to become a party to the proceeding must file a motion to intervene pursuant to Rule 214 of the Commission's Rules of Practice and Procedures (18 CFR 385.214).

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Anyone may intervene in this proceeding based on this draft EIS. You must file your request to intervene as specified above.[1] **You do not need intervenor status to have your comments considered.**

The draft EIS has been placed in the public files of the FERC and is available for distribution and public inspection at:

Federal Energy Regulatory Commission
Public Reference Room
888 First Street NE, Room 2A
Washington, DC 20426
(202) 502-8371

A limited number of copies are available from the FERC Public Reference Room identified above. In addition, copies of the draft EIS have been mailed to federal, state, and local agencies; public interest groups; individuals and affected landowners who requested a copy of the draft EIS; libraries; newspapers; and parties to this proceeding.

The draft EIS is also available for review and inspection (not for distribution) at the locations listed below:

Gloucester County Library
415 Swedesboro Road
Gibbstown, NJ 08027

Gloucester County Library
101 Beckett Road
Logan Township, NJ 08085

J. Lewis Crozier Library
620 Engle Street
Chester, PA 19013

Aston Public Library
3720 Concord Road
Aston, PA 19014

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1 Interventions may also be filed electronically via the Internet in lieu of paper. See the previous discussion on filing comments electronically.

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Brandywine Hundred Branch of
the New Castle County Library
1300 Foulk Road
Wilmington, DE 19803

U.S. Army Corps of Engineers
Regulatory Branch
John Wanamaker Building
100 Penn Square East
Philadelphia, PA 19107
215-656-5940

Additional information about the project is available from the Commission's Office of External Affairs, at **1-866-208-FERC** or on the FERC Internet website (www.ferc.gov) using the eLibrary link. The draft EIS can be accessed on this website. Click on the eLibrary link, click on "General Search" and enter the docket number excluding the last three digits in the Docket Number field. Be sure you have selected an appropriate date range. For assistance, please contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll free at 1-866-208-3676, or for TTY, contact (202) 502-8659. The eLibrary link on the FERC Internet website also provides access to the texts of formal documents issued by the FERC, such as orders, notices, and rulemakings.

In addition, the FERC now offers a free service called eSubscription which allows you to keep track of all formal issuances and submittals in specific dockets. This can reduce the amount of time you spend researching proceedings by automatically providing you with notification of these filings, document summaries and direct links to the documents. Go to the eSubscription link on the FERC Internet website.

Magalie R. Salas,
Secretary

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Draft Environmental Impact Statement

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ACRONYMS AND ABBREVIATIONS

AADT	average annual daily traffic
ABSG	ABSG Consulting Inc.
ACHP	Advisory Council on Historic Preservation
APE	area of potential effects
AQCRs	Air Quality Control Regions
ASSRT	Atlantic Sturgeon Status Review Team
AST	aboveground storage tank
BA	biological assessment
BACT	Best Available Control Technology
Bcfd	billion cubic feet per day
BG LNG	BG LNG Services, L.L.C.
BP	BP Energy Company
Btu	British thermal unit
Btu/ft^2-hr	British thermal units per square foot per hour
C	carbon
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAFRA	Coastal Area Facility Review Act
CEII	Critical Energy Infrastructure Information
CEQ	Council on Environmental Quality
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
ChevronTexaco	ChevronTexaco Corporation
Class I	Mandatory Federal Class I
CMP	Coastal Management Program
CO	carbon monoxide
CO_2	carbon dioxide
Coast Guard	U.S. Coast Guard
COC	Certificate of Compliance
COE	U.S. Army Corps of Engineers
COI	Coast Guard Certificate of Inspection
Columbia Gas	Columbia Gas Transmission Company
Commission	Federal Energy Regulatory Commission
CPT	cone penetration tests
CRA	Charles River Associates
Crown Landing	Crown Landing, L.L.C.
CWA	Clean Water Act
CZMA	Coastal Zone Management Act of 1972
CZMP	Coastal Zone Management Program
dBA	decibels of the A-weighted scale
DCMP	Delaware Coastal Management Program
DDT	dichlorodiphenyltrichloroethane
DMT	dilatometer
DNREC	Delaware Department of Natural Resources and Environmental Control
DOE	U.S. Department of Energy
Dominion	Dominion Cove Point LNG, LP

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DOT	U.S. Department of Transportation
DRBC	Delaware River Basin Commission
DRCS	Delaware River Creek Survey
DSCZA	Delaware State Coastal Zone Act of 1971
EA	Environmental Assessment
EFH	Essential Fish Habitat
EI	environmental inspector
EIA	Energy Information Administration
EIS	Environmental Impact Statement
El Paso	El Paso Global LNG
EN 1473	European Standard for LNG facilities
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973
ESS	emergency shutdown system
Excelerate	Excelerate Energy, L.L.C.
F	Fahrenheit
FERC	Federal Energy Regulatory Commission
FERC Plan	FERC's Upland Erosion Control, Revegetation and Maintenance Plan
FERC Procedures	FERC's Wetland and Waterbody Construction and Mitigation Procedures
FPC	Federal Power Commission
FSO	Facility Security Officer
FSRU	Floating, storage, and regasification unit
ft^3	cubic feet
FWS	U.S. Fish and Wildlife Service
g	gravity
Gas Tanker Code	*International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk*
GBS	gravity-based structure
gpm	gallons per minute
GTB	geotechnical boring
HAP	hazardous air pollutant
HCAs	high consequence areas
HDD	horizontal direction drill
IMO	International Maritime Organization
kPa	kilopascals
LAER	lowest achievable emission rate
lb/s	pounds per second
L_{day}	daytime sound level
L_{dn}	day-night sound level
$L_{eq(24)}$	24-hour equivalent sound level
LFL	lower flammability limit
LNG	liquefied natural gas
L_{night}	nighttime sound level
LPG	Liquefied Petroleum Gas
LUST	leaking underground storage tank
m^2	square meters
m^3	cubic meters
m^3/hr	cubic meters per hour
MACT	Maximum Achievable Control Technology

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ACRONYMS AND ABBREVIATIONS (cont'd)

MARSEC	Maritime Security
MCE	Maximum Considered Earthquake
MCS	Management Classification System
Memorandum	Memorandum of Understanding on Natural Gas Transportation Facilities
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MLLW	mean lower low water
mm	millimeters
MMBtu/hr	million British thermal units per hour
MMcfd	million cubic feet per day
MMI	Modified Mercalli Intensity
MNI	Moffatt & Nichol International
MOA	Memorandum of Agreement
MP	milepost
mph	miles per hour
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAAQS	National Ambient Air Quality Standards
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NFPA 59A	NFPA Standards for the Production, Storage, and Handling of LNG
NGA	Natural Gas Act
NHPA	National Historic Preservation Act
NJAAQS	New Jersey Ambient Air Quality Standards
NJAC	New Jersey Administrative Code
NJCMP	New Jersey Coastal Management Program
NJDEP	New Jersey Department of Environmental Protection
NJDFW	New Jersey Division of Fish and Wildlife
NJDOT	New Jersey Department of Transportation
NJSCC	New Jersey Soil Cleanup Criteria
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_2	nitrogen dioxide
NOI	*Notice of Intent to Prepare an Environmental Impact Statement for the Proposed Crown Landing LNG Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meeting*
NO_x	low nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSAs	noise sensitive areas
NSPS	New Source Performance Standards
NSR	New Source Review
NYISO	New York Independent System Operator
O_3	ozone
OBE	Operating Basis Earthquake
OCPPC	Office of Coastal Planning and Program Coordination
OEP	Office of Energy Projects

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OPS	Office of Pipeline Safety
OCRM	Office of Coast and Ocean Resource Management
OWM	Office of Water Management
PADCNR	Pennsylvania Department of Conservation and Natural Resources
PADEP	Pennsylvania Department of Environmental Protection
PADOT	Pennsylvania Department of Transportation
PAFBC	Pennsylvania Fish and Boat Commission
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCB	polychlorinated biphenyl
PCZMP	Pennsylvania Coastal Zone Management Plan
PEL	Probable Effects Level
PGA	peak ground acceleration
PGS	Pennsylvania Geological Survey
PM_{10}	particulate matter less than 10 microns in diameter
ppmvd	parts per million by volume on a dry basis
ppt	parts per thousand
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
PTE	potential to emit
Quest	Quest Consultants, Inc.
RM	river mile
RNA	Regulated Navigation Area
RPT	rapid phase transition
RSPA	Research and Special Programs Administration
SAP	Sampling and Analysis Plan
SB	soil boring
SESC	Soil Erosion and Sedimentation Control
SHPO	State Historic Preservation Officer
SIP	state implementation plan
SO_2	sulfur dioxide
SOLAS	*International Convention for the Safety of Life at Sea*
SONAT	Southern Natural Gas Company
SOTA	state-of-the-art
Southern LNG	Southern LNG, Inc.
SPCC	Spill Prevention, Containment and Countermeasure Plan
SPT	standard penetration tests
SSE	Safe Shutdown Earthquake
Strategy	Strategy to Reduce Ship Strikes of Right Whales
SVOCs	semi volatile organics
TEL	Threshold Effects Level
Texas Eastern	Texas Eastern Transmission, L.P.
TNT	trinitrotoluene
TPH	total petroleum hydrocarbons
tpy	tons per year
Tractabel	Tractabel LNG North America, L.L.C.
Transco	Transcontinental Gas Pipe Line Corporation
Trunkline Gas	CMS Trunkline Gas Company, L.L.C.
Trunkline LNG	CMS Trunkline LNG Company, L.L.C.

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ACRONYMS AND ABBREVIATIONS (cont'd)

TSP	total suspended particulate
TSS	total suspended solids
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UV/IR	ultraviolet/infrared
VOCs	volatile organics

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EXECUTIVE SUMMARY

This draft environmental impact statement (EIS) for the Crown Landing LNG and Logan Lateral Projects has been prepared by the staff of the Federal Energy Regulatory Commission (FERC or Commission) to fulfill the requirements of the National Environmental Policy Act (NEPA) and the Commission's implementing regulations under Title 18, Code of Federal Regulations, Part 380. The purpose of this document is to inform the public and the permitting agencies about the potential adverse and beneficial environmental impacts of the proposed project and its alternatives; and to recommend mitigation measures that would avoid or reduce any significant adverse impact to the maximum extent possible.

Crown Landing, L.L.C. proposes to construct and operate a liquefied natural gas (LNG) terminal in New Jersey and Delaware, and Texas Eastern Transmission, L.P. proposes to construct and operate a new natural gas pipeline and ancillary facilities in New Jersey and Pennsylvania. Crown Landing's proposed facilities would transport a baseload rate of 1.2 billion cubic feet per day (Bcfd) and a maximum rate of 1.4 Bcfd (using spare equipment) of imported LNG to the United States market. Crown Landing proposes to interconnect the LNG facilities onsite with three pipelines. One interconnect would be with the new pipeline that Texas Eastern proposes to construct and operate (i.e., Logan Lateral) between its existing Chester Junction facility in Brookhaven Borough, Pennsylvania to the proposed LNG terminal. The other two interconnects would be with existing pipelines that currently cross the site, one pipeline owned and operated by Columbia Gas Transmission Company (Columbia Gas) and the other pipeline owned and operated by Transcontinental Gas Pipe Line Corporation (Transco).

The LNG terminal and pipeline facilities would include:

- a ship unloading facility with a single berth capable of receiving LNG ships with cargo capacities of up to 200,000 cubic meters (m^3);
- three 150,000 m^3 (net capacity) full containment LNG storage tanks;
- a closed-loop shell and tube heat exchanger vaporization system, sized for a normal sendout of 1.2 Bcfd;
- various ancillary facilities, including administrative offices, warehouse/maintenance building, main control center, guardhouse, and a pier control room;
- three meter and regulation stations located on the proposed LNG terminal site; and
- approximately 11 miles of 30-inch-diameter natural gas pipeline, a pig launcher and receiver facility at the beginning and end of the pipeline, a mainline valve, and a meter and regulation station at the end of the pipeline.

PROJECT IMPACTS

The environmental issues associated with construction and operation of the Crown Landing LNG and Logan Lateral Projects are analyzed in this draft EIS using information provided by Crown Landing and Texas Eastern and further developed from data requests; field investigations by the Commission staff; literature research; alternative analyses; comments from federal, state, and local agencies; and input from public organizations and individual citizens.

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The LNG terminal would be developed on a privately owned 175-acre parcel. Of the 175-acre site, about 39 acres would be permanently developed for the LNG terminal facility and access road. The proposed LNG terminal would also require dredging of up to about 800,000 cubic yards of sediment from the Delaware River. This dredging would disturb about 27.4 acres of the bed of the river. Construction of the Logan Lateral Project would temporarily affect another 177.3 acres of land. Of this land affected by construction of the pipeline facilities, about 54.1 acres would be retained as permanent right-of-way for the pipeline and 1.8 acres for the aboveground facilities.

Construction and operation of the project would have minimal impact on geologic resources in the project area, and the potential for geologic hazards or other natural events to significantly impact the project is low. The LNG storage tanks and other critical structures at the terminal site would be designed to address predicted ground shaking associated with a seismic event. The proposed LNG terminal site would be protected against storm surge associated with tropical storms of the magnitude that are likely to affect the project area.

Soils at the proposed LNG terminal site consist largely of dredged material that was placed onsite during past dredging of the Delaware River. Crown Landing identified some areas of soil contamination on the site that would require further evaluation. Construction of the LNG facilities would increase the potential for soil erosion on the site and sedimentation in adjacent waterbodies and wetlands. Soils along the pipeline route would also be subject to various impacts, including compaction and erosion. Crown Landing and Texas Eastern would minimize impacts on soils through their implementation of the erosion and sedimentation control measures contained in our *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures), as well as site-specific Soil Erosion and Sedimentation Control (SESC) Plans.

Construction of the LNG terminal would require dredging about 800,000 cubic yards of sediment to create the berth area for the ship unloading facility. The dredged material would be disposed in an existing upland confined disposal facility. Chemical analyses of the proposed dredged sediments determined that eight metal contaminants were identified at elevated concentrations. The concentrations of most metals in all samples were below the Threshold Effects Levels (TEL) criteria, indicating that the sediments would not be expected to pose a threat to the aquatic environment. Only the concentrations of arsenic, cadmium, and nickel exceeded the TEL screening criteria. However, these three metals are all well below their Probable Effects Level (PEL) criteria, suggesting limited potential for adverse impacts.

One sole-source aquifer, the Potomac-Rariton-Magothy aquifer, is located near the LNG terminal location but would not be affected by the proposed project. Further, we do not expect the physical effects of constructing the LNG facility on the proposed terminal site would have a significant impact on the groundwater flow regime.

There is one private water supply well located within the proposed pipeline right-of-way and six supply wells within 150 feet of the right-of-way. Texas Eastern would provide pre- and post-construction monitoring of well yield and water quality date at the landowner's request, and would return any wells to their preconstruction condition if damaged by construction activities. Construction of the proposed pipeline could temporarily affect groundwater along the pipeline route but these effects would be mitigated by Texas Eastern's plan to backfill the trench with native material and restore natural contours and drainage patterns in accordance with our Procedures. The proposed pipeline would cross three hazardous waste sites and would be located adjacent to three others. Contaminated soils associated with these or other undocumented hazardous waste sites could be encountered during construction of the proposed pipeline facilities. To reduce any potential impacts, we have recommended that Texas Eastern prepare a Plan for the Discovery and Management of Contaminated Soils and Groundwater. There is also a potential for a spill of hazardous material during construction that could impact groundwater. Texas

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Eastern and Crown Landing would minimize the potential impact of a spills on groundwater by implementing Spill Prevention, Containment, and Countermeasure (SPCC) Plans.

The proposed dredging activities would impact the Delaware River by resuspending sediment into the water column. Sediment modeling indicates that suspended sediment impacts would be temporary and primarily localized to the dredge area. Contaminants in the dredged sediments are not anticipated to adversely affect water quality. The proposed pipeline would cross the Delaware River and three other waterbodies using the horizontal directional drill construction technique. Other waterbodies would be crossed using the open-cut construction technique. Texas Eastern would minimize impacts on these waterbodies by implementing its SESC and SPCC Plans and by adhering to the protective measures in our Procedures.

Crown Landing designed the proposed LNG terminal facilities to avoid wetlands on the site. Thus no wetlands would be permanently filled or drained as a result of construction of the LNG terminal. However, construction of the LNG terminal site would impact approximately 5.5 acres of state-designated wetland transition area. Crown Landing is currently evaluating options for mitigating the impacts on transition areas. Construction of the Logan Lateral Project would temporarily disturb about 22.4 acres of wetlands, of which about 2.4 acres would be permanently converted to other wetland types. Texas Eastern would minimize impacts on wetlands by implementing our Procedures and proposes to compensate for permanent wetland impacts that cannot be avoided by developing and implementing a wetland mitigation plan.

The proposed LNG terminal site is located on an undeveloped parcel consisting of agricultural land, emergent wetlands, and scattered areas of open, forest, and shrub lands. The LNG terminal would be primarily constructed within cropland; however, about 1.5 acres of shrub land and 1.7 acres of open land would be permanently converted to industrial uses. Following construction, portions of the site that are not developed with buildings, roads, gravel, or other hard surfaces would be restored and revegetated.

Construction of the proposed pipeline would disturb about 125.7 acres of vegetation consisting of 50.8 acres of agricultural lands, 35.0 acres of open lands, 23.4 acres of forests, and 16.5 acres of non-forested wetlands. Impacts on most of these vegetation communities would be temporary and short term. About 8.5 acres of forest land on the permanent right-of-way would be permanently cleared and maintained in an herbaceous state. All disturbed areas would be restored and revegetated in accordance with our Plan and Procedures and Texas Eastern's SESC Plan.

Construction of the proposed facilities and associated vegetation clearing would affect wildlife by removing habitat and temporarily displacing wildlife from the construction work areas into surrounding areas. The removal of forest land would result in a long-term loss of habitat. Texas Eastern would minimize permanent impacts by constructing the pipeline within or adjacent to other existing rights-of-way where possible and by implementing its SESC Plan and our Plan and Procedures.

The proposed dredging activities associated with construction and future maintenance of the ship berth would have both direct and indirect impacts on aquatic resources. Potential adverse effects on aquatic resources include impairment of water quality, destruction of benthic habitat and communities, and direct and indirect impacts to fish and their prey species. Dredging also has the potential to introduce deleterious compounds currently in the bottom sediments into the water column. Use of a hydraulic dredge would reduce turbidity, sedimentation, and the release of deleterious compounds associated with dredging. However, hydraulic dredging could entrain or impinge fish larvae and eggs during certain times of the year. To minimize this impact, Crown Landing revised its dredging schedule to avoid anadromous fish migrations and spawning periods. Crown Landing is also consulting with applicable

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resource agencies to develop a mitigation plan for potential impacts on shallow water habitat as the result of dredging the deeper ship berth.

During operation of the LNG terminal, prop wash from LNG ships and tugs could temporarily increase suspended sediments and turbidity within the ship channel and ship berth. Ballast water intakes could also entrain and/or impinge fish larvae and eggs. To avoid or minimize impacts associated with ballast water intake, we recommend that Crown Landing coordinate with appropriate resource agencies to determine the need for additional conservation measures.

The National Oceanic and Atmospheric Administration (NOAA) Fisheries reported that the mixing zone within the Delaware River, of which the proposed LNG terminal occurs at the upriver edge, has been designated as Essential Fish Habitat (EFH) for nine federally managed fish species. NOAA Fisheries also expressed concern about impacts on prey for managed species likely occurring in the project area. This draft EIS includes an EFH Assessment as necessary for compliance with the Magnuson-Stevens Fishery Conservation and Management Act. We have determined that the proposed project could affect open water, shallow water habitat, and benthic habitat, and anadromous fish and shellfish, two of the primary prey groups for the managed fish species. Dredging of the ship berth would result in permanent conversion of existing shallow water habitat to deeper water habitat within the dredging footprint. However, implementation of the conservation measures discussed in this EIS, including Crown Landing's continued coordination with the applicable resource agencies to develop appropriate mitigation for project impacts, would likely avoid or minimize adverse impacts on managed fish species and EFH

The U.S. Fish and Wildlife (FWS) reported that two federally listed species under its jurisdiction, the bald eagle and bog turtle, could potentially occur near the proposed project. NOAA Fisheries identified three additional federally listed endangered or threatened sea turtle species (Kemp's ridley, green, and loggerhead sea turtles), a whale (North Atlantic right whale), and one fish (shortnose sturgeon) that could potentially occur in the general vicinity of the proposed project or along the proposed shipping route. We have determined that the project would have no effect on the bald eagle and is not likely to adversely affect the three turtle species, bald eagle, and North Atlantic right whale. However, we believe that in-water construction activities associated with the project are likely to adversely affect the shortnose sturgeon. This draft EIS serves as a Biological Assessment which is necessary for compliance with section 7 of the Endangered Species Act.

There are about 20 residences or residential structures located within 1 mile of the proposed entrance to the LNG terminal. There are another 147 residences along the pipeline route that would be within 50 feet of construction work areas. Impacts on residences near the LNG terminal could include increased visibility of aboveground structures associated with the facility, increased traffic, changes in air quality, and safety hazards. Residences near the pipeline could experience similar effects during construction. The LNG storage tanks would be the most prominent visual feature at the proposed terminal site. To minimize construction-related impacts on residences along the pipeline route, Texas Eastern would prepare site-specific residential mitigation plans.

Construction of the projects would result in a temporary increase in population, traffic, and the demand for temporary housing and public services. These effects would be temporary and limited to the period of construction. Construction and operation of the projects would have a beneficial impact on local tax revenues and economies.

We have determined that the potential impacts of the projects would not have a disproportionately high or adverse effect on environmental justice areas along the proposed pipeline route.

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Crown Landing conducted an aboveground cultural resources survey, a terrestrial archaeological survey, and an underwater archaeological survey for the proposed LNG terminal. These surveys documented two aboveground resources and one terrestrial archaeological site that either are listed in or recommended eligible for the National Register of Historic Places (NRHP). None of these resources would be affected by the project. The New Jersey SHPO concurred with the results and recommendations of the surveys, and we also concur.

Texas Eastern conducted an aboveground cultural resources survey and an archaeological reconnaissance survey for the pipeline facilities. In Pennsylvania, the surveys documented two archaeological sites recommended potentially eligible for listing in the NRHP. Neither site would be affected by construction of the pipeline facilities. The Pennsylvania SHPO concurred with the results and recommendations of the surveys, and we also concur. No resources were documented by the field surveys in New Jersey, but fieldwork by Crown Landing for the LNG terminal identified an NRHP-eligible archaeological site adjacent to the pipeline facilities. This site would not be affected by the project. The New Jersey SHPO has not yet commented on the results and recommendations of these surveys. In addition, about 1.2 miles of the pipeline facilities and a pullback area in New Jersey have not yet been surveyed for cultural resources. As a result, we have recommended that Texas Eastern defer construction of the pipeline facilities until the field surveys are completed and the survey reports, any required treatment plans, and the SHPO's comments on all reports and plans are filed with the Commission for review and approval by the Director of the Office of Energy Projects.

Construction and operation of the proposed LNG terminal and pipeline would result in air emissions. The fugitive dust and tailpipe emissions associated with construction activities would be temporary and intermittent, and would not result in a long-term impact on air quality. Dust emissions would be minimized by the application of water during the construction of the LNG terminal and pipeline. In addition, the construction emissions from the project may require offsetting in accordance with the general conformity regulations. The primary pollutants emitted during operation of the LNG terminal would be nitrogen oxides (NO_x) and carbon monoxide. The operational air emissions from the LNG terminal would be minimized by using ultra dry low NO_x burner systems on the water/glycol heaters and would meet the lowest achievable emission rate (LAER) requirement under the new source review (NSR) regulations. A final LAER determination would be required from the New Jersey Department of Environmental Protection (NJDEP) during the preconstruction permitting process. The NO_x emissions generated by the LNG terminal would also be required to obtain emission offsets from other sources within the air basin as part of the NSR permitting process; thereby minimizing any air quality impacts from these stationary sources.

Noise receptors in the immediate vicinity of construction activities would experience an increase in noise levels. In most areas the increase in noise would be localized, temporary, and limited primarily to daylight hours. Noise associated with construction activities would be the most noticeable with a potential noise impact of 89 decibels of the A-weighted scale (dBA) under peak conditions for short periods of time (when construction equipment is close to the residence). This noise would be limited to daylight hours. The operational noise from the LNG terminal stationary sources would be about 50.9 dBA L_{dn} at the nearest residence, which equates to a noise increase of 0.4 dBA. This noise impact is less than the FERC's 55 dBA day-night sound level (L_{dn}) and the NJDEP nighttime noise criterion of 50 dBA equivalent sound level (L_{eq}). In addition, the noise increase from the sources at the LNG terminal would not be perceptible at nearby residences.

We evaluated the safety of both the proposed facilities and the related LNG vessel transit through the Delaware Bay and River. As part of our evaluation, we performed a cryogenic design and technical review of the proposed terminal design and safety systems. Several areas of concern were noted with

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respect to the proposed facility upgrade, and specific recommendations to be addressed prior to construction have been identified.

Thermal radiation and flammable vapor hazard distances were calculated for an accident or an attack on an LNG vessel. For 1, 2.5, 3.0, and 3.9-meter-diameter holes in an LNG cargo tank, we estimated distances to range from 2,267 to 5,691 feet for a thermal radiation level of 1,600 British thermal units per hour per foot squared, the level which is hazardous to unprotected persons located outdoors. However, the evaluation of safety is more than an exercise in calculating the consequences of worst case scenarios. Rather, it is a determination of the acceptability of risk which considers: the probability of events, the effect of mitigation, and the consequences of events. Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the U.S. Coast Guard (Coast Guard) and the local pilots, the likelihood of a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely. For similar reasons, an accident involving the onshore LNG import terminal is unlikely to affect the public. As a result, the risk to the public from accidental causes should be considered negligible.

As part of our marine safety analysis, we considered how vessel security requirements for LNG ships calling on the proposed LNG terminal might affect other ship and boat traffic in Delaware Bay and River. Based on the Coast Guard's longstanding experience in controlling the movements of dangerous cargo vessels in the Delaware Bay and River and LNG vessels in other ports, potential impacts can be evaluated for several general security requirements: 1) moving safety and security zones for inbound and outbound LNG vessels; 2) one-way vessel traffic during LNG vessel transit; 3) safety and security zones around a moored LNG vessel; and 4) other measures as deemed appropriate. The moving safety and security zone, the safety and security zone at the terminal, and one-way traffic would affect other commercial, ferry, and recreational traffic using the bay and river. Based on a navigation simulation study conducted by Moffatt & Nichol, International on behalf of Crown Landing, the addition of 150 LNG ships per year would have minor effect on barge traffic associated with the Logan Generating Station operations. The impact on ferry traffic would generally be small because most of the ferry routes only cross the LNG ship route and conflicts could be managed by schedule coordination.

The extent of the impact on recreational boaters would depend on the number of boats in the project area during the two to three LNG vessel transits per week when LNG ships would call on the LNG terminal, and on several other variables such as the size of the Coast Guard-imposed safety and security zone and the width of the channel at the point where a boat encounters the LNG ship. Using certain assumptions, we estimate that a recreational craft attempting to travel in the opposite direction of an LNG ship at one of the narrower locations within the navigation channel might need to wait up to 16 minutes for the LNG ship to pass. To minimize potential impacts on other marine traffic, the Coast Guard is expected to use a program of announcements to give advance notice of each safety and security zone schedule and could schedule the transit of LNG ships for times of day less likely to affect recreational boaters.

Unlike accidental causes, historical experience provides little guidance in estimating the probability of a terrorist attack on an LNG vessel or onshore storage facility. For an LNG import terminal proposal that would involve having a large volume of energy transported and stored near populated areas, the perceived threat of a terrorist attack is a primary concern of the local population and requires that resources be directed to mitigate possible attack paths. While the risks associated with the transportation of any hazardous cargo can never be entirely eliminated, they can be managed.

An issue that has developed for several LNG terminal projects is a concern that local communities would have to bear some of the costs of ensuring the security/emergency management of the

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LNG facility and the LNG vessel while in transit and unloading at the dock. The potential costs will not be determined until the specific security needs have been identified, and the responsibilities of federal, state, and local agencies have been established in the Coast Guard's Incident Action Plan. Crown Landing and the Coast Guard have formally initiated the process for development of the safety and security plans for the LNG facility. This process will involve three sub-processes: 1) the Port and Waterway Safety Assessment Workshop, which will develop the Vessel Transit Safety Plan; 2) the Security Workshop, which will develop the Facility Safety Plan; and 3) the Consequence Management Plan Workshop, which will facilitate the development of the Consequence Management Plan for the facility and communities located along the vessel transit route.

Once these plans are finalized and the resources required to implement them have been identified, Crown Landing will be able to more specifically discuss the funding of such resources. In order to better define how the potential burden on local communities would be addressed, we have recommended that Crown Landing provide a plan that identifies the mechanisms for funding project-specific security/emergency management costs that would be imposed on state agencies and local communities.

ALTERNATIVES CONSIDERED

We evaluated the alternatives of no action or postponed action, system alternatives, alternative LNG terminal sites, pier alternatives, and pipeline route alternatives. While the no action or postponed action alternative would eliminate the environmental impacts identified in this EIS, the project objectives of providing a new source of natural gas to the Mid-Atlantic market would not be met. This in turn could lead to higher natural gas prices, conservation, use of alternative sources of energy, or alternative proposals to develop natural gas delivery and storage infrastructure. Conservation and the development of other sources of energy are anticipated to play a part in meeting the future energy needs of the country but are not expected to significantly reduce the long-term requirement for additional natural gas supply.

Our analysis included an evaluation of existing LNG facilities and pipelines as alternative systems that could be used to meet the objectives of the Crown Landing LNG Project. We considered most of these facilities to be either too far from the project area to effectively serve the Mid-Atlantic market, or would require expansions or modifications that would likely result in as much if not more environmental impacts than the proposed project. We also examined the potential for recently approved, proposed, or planned projects to meet the objectives of the proposed projects. Similar to the existing terminal facilities, we considered the majority of the recently approved, proposed, or planned projects too far away to effectively serve the Mid-Atlantic market. Additionally, most of these projects would require substantial expansion or modification, which could result in significant environmental impacts. We examined the four proposed or planned projects that are closest to the Mid-Atlantic area and are substantially developed enough to conduct an analysis but determined that none of these projects would provide the storage and sendout capacity proposed by Crown Landing. We also concluded that although a combination of these projects could provide a sendout and storage capacity at least equal to the proposed project, it seems likely that much of the capacity of these projects would likely be used to satisfy the growing demand for natural gas in the New England and New York area and would be unavailable for the Mid-Atlantic region.

We considered alternative locations for an LNG import terminal in the Mid-Atlantic region. Although there are some safety and environmental advantages to locating an LNG terminal offshore, there are environmental, economic, and technical factors that make an offshore LNG terminal impractical as an alternative to the facilities proposed for the Crown Landing LNG Project. Similarly, there are no alternative LNG terminal sites at onshore locations that are reasonable and/or would be environmentally preferable to the proposed project. Difficulties associated with identifying suitable locations in the Mid-

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Atlantic region include finding property available for industrial development in an area accessible to LNG ships where there would be fewer environmental impacts.

We considered three alternative pier and berth configurations to the proposed pier design recognizing that a pier further from shore would reduce the amount of dredging required and minimize shallow water habitat impacts but would also increase potential ship hazards. We concluded that the proposed pier configuration, which was developed after consultations with several agencies, offers the best balance of increased safety and reduced environmental impact.

Our alternatives analysis included the evaluation of major pipeline route alternatives and minor pipeline route variations. We could not find any major pipeline route alternative that would reduce environmental impacts to such an extent that it would be environmentally preferable to the proposed route. However, we approved one minor route variation that was adopted by Texas Eastern to avoid an area of contaminated soil. We also recommended another minor route variation to reduce impacts on a municipal park in the City of Chester.

PUBLIC INVOVLEMENT AND AREAS OF CONCERN

On April 19, 2004, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Proposed Crown Landing LNG/Logan Lateral Projects, Request for Comments on Environmental Issues, and Notice of Joint Public Scoping Meeting* (NOI). The NOI announced that FERC staff was initiating its NEPA pre-filing review of the Crown Landing LNG and Logan Lateral Projects under Docket Nos. PF04-2-000 and PF04-5-000, respectively.[1] The NOI was sent to 632 interested parties, including federal, state, and local officials; agency representatives; conservation organizations; Native American tribes; local libraries and newspapers; residents within a 0.5 mile of the proposed LNG terminal; and property owners along the proposed pipeline route. On September 29, 2004, the FERC issued a *Notice of Applications*, which announced the filing of applications by Crown Landing and Texas Eastern and a final opportunity to submit comments. The FERC's comment period closed on October 20, 2004. In total, 22 comment letters were received by the FERC in response to these notices.

On May 5 and 6, 2004, FERC staff conducted public scoping meetings in Chester Township, Pennsylvania and Swedesboro, New Jersey, respectively, to provide opportunities for the general public to learn more about the proposed project and to participate in our analysis by commenting on issues to be included in the EIS. In response to agency requests, FERC staff also conducted a scoping meeting on June 9, 2004 in Claymont, Delaware, which is located across the Delaware River and downstream of the proposed LNG terminal site. Seven people commented at the meeting in Pennsylvania, 20 commented in New Jersey, and 11 in Delaware. Transcripts of these comments are part of the public record for the Crown Landing LNG and Logan Lateral Projects.

On January 11, 2005, FERC staff conducted an inspection of the proposed terminal site that was open to the public. The next day, FERC staff conducted a cryogenic design and technical conference with Crown Landing personnel in Swedesboro, New Jersey to discuss design and engineering aspects of the Crown Landing LNG Project. The meeting was limited to existing parties to the proceeding (i.e., anyone who specifically requested to intervene as a party). Attendees included agency representatives (DOT Office of Pipeline Safety and Coast Guard), industry representatives, and other interested parties.

In addition to the public notice and scoping process discussed above, the FERC conducted numerous interagency meetings with representatives of federal and state resource agencies to identify issues that should be addressed in this EIS. These agencies included the U.S. Army Corps of Engineers,

[1] The purpose of the pre filing process is to involve interested stakeholders early in project planning and to identify and resolve issues before an application is filed with the Commission

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Coast Guard, FWS, U.S. Environmental Protection Agency (EPA), NOAA Fisheries, NJDEP, Pennsylvania Department of Environmental Protection (PADEP), and Delaware Department of Natural Resources and Environmental Control (DNREC).

During the agency and public involvement period we received comments regarding alternatives to the proposed project; the impact of dredging on the Delaware River and its aquatic resources; the impingement and entrainment of ichthyoplankton as the result of water withdrawals; the impact of LNG terminal and pipeline construction on wetlands and wetland transition areas; the economic impacts on Logan Township and surrounding communities; the impact of LNG ships on other commercial and recreational vessels using the Delaware River; environmental justice associated with constructing the pipeline in minority and low-income communities; the effect of the proposed facilities on surrounding property values and insurance rates; the impacts on public safety; and other environmental- and safety-related comments.

This draft EIS was filed with the EPA and mailed to 824 federal, state, and local agencies, elected officials, Native American tribes, newspapers, public libraries, intervenors to the FERC proceeding, and other interested parties (i.e., landowners, other individuals, and environmental groups who provided scoping comments).[7] A formal notice that the draft EIS is available for review and comment has been published in the Federal Register. The public has 45 days to review and comment on the draft EIS both in the form of written comments and at public meetings planned in the project vicinity. All comments received on the draft EIS during the 45-day comment period will be addressed in the final EIS.

MAJOR CONCLUSIONS

As part of our review, we developed measures we believe would appropriately and reasonably avoid, minimize, or mitigate for environmental impacts resulting from the construction and operation of the proposed project. We are recommending that these mitigation measures be attached as conditions to any authorization issued by the Commission. We conclude that if the project is found to be in the public interest and is constructed and operated in accordance with Crown Landing and Texas Eastern's proposed mitigation and our recommended mitigation measures, the proposed facilities would have limited adverse impacts.

The primary reasons for our decision are:

- the project would make use of a previously disturbed site adjacent to an existing industrial site;
- in-water, silt-disturbing activities would occur outside of major anadromous fish migration periods;
- Crown Landing and Texas Eastern would implement the FERC staff's Plan and Procedures to mitigate impacts on soils, wetlands, and waterbodies;
- Crown Landing would develop and implement mitigation plans for permanent shallow water habitat impacts and wetland transition area impacts and Texas Eastern would mitigate for permanent wetland impacts;

[7] Intervenors are officials to the proceeding and have the right to receive copies of case-related Commission documents and filings by other intervenors. Likewise, each intervenor must provide 14 copies of its filings to the Secretary of the Commission and must send a copy of its filings to all other intervenors. Only intervenors have the right to seek rehearing of the Commission's decision.

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- all applicable federal, state, and local permits and authorizations would be obtained by Crown Landing and Texas Eastern prior to initiating activities requiring such permits and authorizations;
- the safety features that would be incorporated into the design and operation of the LNG import terminal and the LNG vessels;
- the operational controls to be imposed by the local pilots and Coast Guard to direct the movement of LNG vessels, and the security provisions to deter attacks by potential terrorists; and
- the environmental inspection and mitigation monitoring program that would ensure compliance with all mitigation measures that become conditions of any FERC authorization.

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1.0 INTRODUCTION

On September 16, 2004, Crown Landing, L.L.C. (Crown Landing), a BP Energy Company (BP) affiliate, filed an application with the Federal Energy Regulatory Commission (FERC or Commission) under section 3(a) of the Natural Gas Act (NGA) for a proposed liquefied natural gas (LNG) import terminal (referred to as the Crown Landing LNG Project). Texas Eastern Transmission, L.P. (Texas Eastern) also filed an application on September 17, 2004 with the FERC under section 7(c) of the NGA for an associated natural gas pipeline (referred to as the Logan Lateral Project). The applications were noticed in the Federal Register on October 6, 2004. In Docket No. CP04-411-000, Crown Landing seeks authorization to site, construct, and operate an LNG import terminal in Logan Township, New Jersey. In Docket No. CP04-416-000, Texas Eastern seeks a Certificate of Public Convenience and Necessity (Certificate) to site, construct, and operate a new natural gas pipeline and ancillary facilities to connect the proposed LNG terminal to Texas Eastern's interstate gas transmission facilities.

Crown Landing proposes to construct and operate an LNG import terminal on the shoreline of the Delaware River in Logan Township, Gloucester County, New Jersey. The LNG terminal would consist of facilities capable of unloading LNG ships, storing up to 450,000 cubic meters (m^3) of LNG (9.2 billion cubic feet of natural gas equivalent), vaporizing the LNG, and sending out natural gas at a baseload rate of 1.2 billion cubic feet per day (Bcfd) and a maximum rate of 1.4 Bcfd (using spare equipment). Crown Landing proposes to interconnect the LNG facilities onsite with three pipelines. One interconnect would be with the new pipeline that Texas Eastern proposes to construct and operate (i.e., Logan Lateral) between its existing Chester Junction facility in Brookhaven Borough, Pennsylvania to the proposed LNG terminal. The other two interconnects would be with existing pipelines that currently cross the site, one pipeline owned and operated by Columbia Gas Transmission Company (Columbia Gas) and the other pipeline owned and operated by Transcontinental Gas Pipe Line Corporation (Transco). To date, these latter two companies have not filed applications with the FERC to construct and operate the interconnects. The Crown Landing LNG Project would have a maximum delivery capacity of 0.5 Bcfd to the Columbia Gas pipeline system, 0.6 Bcfd to the Transco pipeline system, and 0.9 Bcfd to the Texas Eastern pipeline system.

The LNG terminal and pipeline facilities would consist of:

- a ship unloading facility capable of receiving LNG ships with capacities up to 200,000 m^3;
- three 150,000 m^3 (net capacity) full-containment LNG storage tanks, comprised of 9 percent nickel steel inner tank, pre-stressed concrete outer tank, and a concrete roof;
- a closed-loop shell and tube heat exchanger vaporization system;
- various ancillary facilities, including administrative offices, warehouse/maintenance building, main control center, guardhouse, and a pier control room;
- three meter and regulation stations located on the proposed LNG terminal site; and
- approximately 11.00 miles of 30-inch-diameter natural gas pipeline (4.92 miles in Pennsylvania and 6.08 miles in New Jersey), a pig launcher and receiver facility at the beginning and end of the pipeline, a mainline valve, and a meter and regulation station at the end of the pipeline.

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1.1 PURPOSE AND SCOPE OF THIS STATEMENT

The FERC is the federal agency responsible for authorizing applications to construct and operate onshore LNG import and interstate natural gas transmission facilities. As such, the FERC is the lead federal agency for the preparation of this Environmental Impact Statement (EIS) in compliance with the requirements of the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40, Code of Federal Regulations (CFR) 1500-1508), and the FERC's regulations implementing NEPA (18 CFR 380). This document is a draft EIS that has been prepared for public review and comment. A final EIS will be prepared subsequently to respond to comments received on this draft EIS. The distribution list for the draft EIS is provided in Appendix A.

Our[1] principal purposes in preparing this EIS are to:

- identify and assess potential impacts on the natural and human environment that would result from the implementation of the proposed actions;
- describe and evaluate reasonable alternatives to the proposed actions that would avoid or minimize adverse effects on the human environment;
- identify and recommend specific mitigation measures, as necessary, to minimize the environmental impacts; and
- facilitate public involvement in identifying the significant environmental impacts.

After a final EIS is prepared, the FERC will determine whether the project should be approved. A final approval will only be granted if after consideration of both environmental and non-environmental issues, the FERC finds that the proposed project is in the public interest. The environmental impact assessment and mitigation development discussed herein will be important factors in this final determination. Final action on any FERC authorization would not occur until after the environmental review is completed, all environmental issues have been appropriately addressed, and a final Order is issued by the Commission.

Our analysis in this EIS focuses on the facilities that are under the FERC's jurisdiction (i.e., the LNG import terminal proposed to be constructed by Crown Landing and the natural gas sendout pipeline proposed to be constructed by Texas Eastern) as well as a non-jurisdictional electric transmission line that would be constructed to the LNG terminal site to supply power to the facilities.

The topics addressed in this EIS include geology; soils and sediments; water use and quality; wetlands; vegetation; wildlife; fish and invertebrates; threatened, endangered, and special-status species; land use, recreation, and visual resources; cultural resources; socioeconomics and traffic; air quality and noise; reliability and safety; cumulative effects; and alternatives. The EIS describes the affected environment as it currently exists, discusses the environmental consequences of the proposed project, and compares the project's potential impact to that of alternatives. The EIS also presents our conclusions and recommended mitigation measures.

1.2 PROJECT PURPOSE AND NEED

Crown Landing proposes to provide additional natural gas supplies primarily to the Mid-Atlantic region (i.e., New York, New Jersey, Pennsylvania, and Maryland) to meet the increasing energy demands

[1] The pronouns "we," "us," and "our" refer to the environmental staff of the FERC's Office of Energy Projects (OEP).

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in this region of the United States. With interconnections to three interstate pipeline systems, the project would also be capable of supplying natural gas to other portions of the East Coast.

Natural gas is used in the Mid-Atlantic region for home heating and cooking, commercial heating, a variety of industrial applications, including electrical power generation. Based on studies conducted by the U.S. Department of Energy (DOE), Energy Information Administration (EIA), the projected use of natural gas in the Mid-Atlantic region (which it defines as New Jersey, New York, and Pennsylvania) is expected to increase from 2.4 trillion cubic feet/year in 2001 to 3.3 trillion cubic feet/year in 2025 (DOE, 2004), an increase of about 1.2 percent annually.

It is anticipated that most of the future increase in demand for natural gas will be the result of the increased use of gas for electrical power generation. Many electric utility companies are switching to natural gas as an environmentally preferred fuel source to reduce air emissions and to meet the U.S. Environmental Protection Agency's (EPA) air quality standards for ozone. The demand for natural gas for use in electrical generation is expected to increase about 0.5 trillion cubic feet/year or 2.6 percent annually from 2001 to 2025 (DOE, 2004).

According to a New York Independent System Operator (NYISO) report, the increased demand for electricity in New York has exceeded the supply (NYISO, 2001). Furthermore, a study conducted by Charles River Associates (CRA) for the New York State Energy Research and Development Authority concluded that between 2005 and 2010, demand for natural gas for electricity generation will increase 20 percent (CRA, 2002). As a result, the NYISO recommends long-term goals of increasing and upgrading natural gas transmission facilities and facilitating the development of natural gas-fired power plants.

The natural gas currently delivered to this region comes primarily from domestic sources in the Gulf of Mexico. Some gas supplies are imported from Canada and more recently provided by LNG imports, as the result of the reactivation of the Cove Point LNG Terminal in southern Maryland. Because the Mid-Atlantic region is located far away from the domestic and Canadian sources of natural gas and near the end of the North American natural gas pipeline grid, the region experiences increased transportation costs and decreased gas availability, resulting in price volatility.

Neither the domestic production of natural gas nor the importation of Canadian gas is anticipated to keep up with projected increased demand. The increased importation of LNG is viewed as a means of meeting the projected shortfall in domestic supplies, as well as providing back-up supplies of natural gas during periods of peak demand. In addition, LNG marine transportation is recognized as a viable way of accessing "stranded" natural gas reserves in production areas throughout the world that are inaccessible by conventional pipelines, thereby increasing available supplies.

The Crown Landing LNG Project would provide:

- a new LNG import terminal in the Mid-Atlantic region;
- storage facilities for LNG;
- access to natural gas reserves in production areas throughout the world that are inaccessible by conventional pipelines; and
- a new supply of natural gas to the Mid-Atlantic region as well as other portions of the East Coast.

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1.3 PERMITS, APPROVALS, AND REGULATORY REQUIREMENTS

As the lead federal agency for the Crown Landing LNG and Logan Lateral Projects, the FERC is required to comply with section 7 of the Endangered Species Act of 1973 (ESA), the Magnuson-Stevens Fishery Conservation and Management Act (MSA), section 106 of the National Historic Preservation Act (NHPA), and section 307 of the Coastal Zone Management Act of 1972 (CZMA). Each of these statutes has been taken into account in the preparation of this document.

Section 7 of the ESA, as amended, states that any project authorized, funded, or conducted by a federal agency (e.g., the FERC) should not "jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined...to be critical" (16 United States Code (USC) § 1536(a)(2)(1988)). The FERC, or the applicant as a non-federal party, is required to consult with the U.S. Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries to determine whether any federally listed or proposed endangered or threatened species or their designated critical habitat occur in the vicinity of the proposed project. If, upon review of existing data or data provided by the applicant, the FERC determines that these species or habitats may be adversely affected by the proposed project, the FERC is required to prepare a biological assessment (BA) to identify the nature and extent of adverse impact, and to recommend measures that would avoid the habitat and/or species, or would reduce potential impacts to acceptable levels and to initiate formal consultation with FWS or NOAA Fisheries. Because a federally listed species may be adversely affected by the Crown Landing LNG Project, this EIS is intended to serve as the BA and will be used to initiate formal consultation with NOAA Fisheries (see section 4.7.1).

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a federal fisheries management plan. The MSA requires federal agencies to consult with the NOAA Fisheries on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH (MSA §305(b)(2)). Although absolute criteria have not been established for conducting EFH consultations, the NOAA Fisheries recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as NEPA, the Fish and Wildlife Coordination Act, or the ESA (50 CFR 600.920(e)) to reduce duplication and improve efficiency. As part of the consultation process, the FERC has prepared an EFH Assessment which is included in Appendix E of this EIS. NOAA Fisheries is a cooperating agency assisting in the preparation of this EIS.

Section 106 of the NHPA requires the FERC to take into account the effects of its undertakings on properties listed on or eligible for listing on the National Register of Historic Places (NRHP), including prehistoric or historic sites, districts, buildings, structures, objects, or properties of traditional religious or cultural importance, and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the undertaking. The FERC has requested that Crown Landing and Texas Eastern, as non-federal parties, assist in meeting the FERC's obligation under section 106 by preparing the necessary information and analyses as required by the ACHP procedures in 36 CFR 800. Section 4.10 of this EIS provides a discussion of cultural resources in the project area and addresses compliance with the section 106.

The CZMA calls for the "effective management, beneficial use, protection, and development" of the nation's coastal zone and promotes active state involvement in achieving those goals. As a means to reach those goals, the CZMA requires participating states to develop management programs that demonstrate how these states will meet their obligations and responsibilities in managing their coastal areas. The agencies responsible for administering Coastal Zone Management Programs (CZMP) in the

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three states include: the New Jersey Department of Environmental Protection (NJDEP), Office of Coastal Planning and Program Coordination (OCPPC); the Delaware Department of Natural Resources and Environmental Control (DNREC), Coastal Management Program (CMP); and the Pennsylvania Department of Environmental Protection (PADEP), Office of Water Management (OWM). Because section 307 of the CZMA requires federally licensed or permitted activities to be consistent to the maximum extent practicable with the enforceable policies of a management program, the FERC has requested that Crown Landing and Texas Eastern seek determinations of consistency with New Jersey's, Delaware's, and Pennsylvania's CZMPs. Section 4.8.3 of this EIS provides additional discussion of these CZMPs.

At the federal level, required permits and approval authority outside of the FERC's jurisdiction include compliance with the Clean Water Act (CWA) of 1972, the Rivers and Harbors Act of 1899, the Clean Air Act (CAA), and U.S. Coast Guard (Coast Guard) regulations relating to LNG waterfront facilities.

The U.S. Army Corps of Engineers (COE) has the authority to issue permits for work or structures in navigable waters under section 10 of the River and Harbors Act and the discharge of dredged or fill material into waters of the United States under section 404 of the CWA. The COE would regulate the dredging of the ship berth, the construction of the pier, and filling and grading activities in wetlands and waterbodies crossed by the proposed pipeline. The EPA has the authority to review and veto COE decisions on section 404 permits. The Coast Guard has the primary responsibility for reviewing and approving the navigational and security aspects of the project in accordance with 33 CFR 127 and 66. All three of these federal agencies are cooperating agencies assisting in the preparation of the EIS.

Crown Landing and Texas Eastern must also obtain Water Quality Certifications pursuant to section 401 of the CWA. The federal authority to issue Water Quality Certifications in New Jersey, Delaware, and Pennsylvania has been delegated to the NJDEP, DNREC, and PADEP, respectively.

In addition to the federal permits and approvals discussed above, Crown Landing and Texas Eastern would obtain other permits and approvals from state and local agencies. Table 1.3-1 lists the major federal, state, and local permits, approvals, and consultations for the Crown Landing LNG Project and table 1.3-2 lists these permits, approvals, and consultations for the Logan Lateral Project.

The FERC encourages cooperation between applicants and state and local authorities, but this does not mean that state and local agencies, through application of state and local laws, may prohibit or unreasonably delay the construction or operation of facilities approved by the FERC. Any state or local permits issued with respect to jurisdictional facilities must be consistent with the conditions of any Certificate the FERC may issue.[2]

[2] See, e.g., Schneidewind v. ANR Pipeline Co., 485 U.S. 293 (1988), National Fuel Gas Supply v. Public Service Commission, 894 F.2d 571 (2d Cir. 1990), and Iroquois Gas Transmission System, L.P., et al., 52 FERC ¶ 61,091 (1990) and 59 FERC ¶ 61,094 (1992).

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TABLE 1.3-1

Major Permits, Approvals, and Consultations for the Crown Landing LNG Project

Agency	Permit/Approval/Consultations	Actual or Anticipated Application Filing/Consultation Date
FEDERAL		
Federal Energy Regulatory Commission	Authorization to construct and operate an LNG import facility under section 3(a) of the Natural Gas Act (NGA)	September 2004
Advisory Council on Historic Preservation	Comment on the project under section 106 of the National Historic Preservation Act	Consultation, as necessary
U.S Army Corps of Engineers	Authorization required for work (including dredging) or structures in navigable waters under section 10 of the Rivers and Harbors Act of 1899 and the discharge of dredged or fill material (including filling and grading activities) into waters of the United States (including wetlands) under section 404 of the Clean Water Act (CWA) of 1972	January 2005
U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA)		
NOAA Fisheries	Consultation regarding compliance with section 7 of the Endangered Species Act; the Magnuson-Stevens Fishery Conservation and Management Act; and the Marine Mammal Protection Act	Consultation ongoing
U.S. Department of the Interior		
U.S. Fish and Wildlife Service	Consultation regarding compliance with section 7 of the Endangered Species Act, the Migratory Bird Treaty Act, and the Fish and Wildlife Coordination Act	Consultation ongoing
U.S. Department of Homeland Security		
U.S. Coast Guard	Letter of Intent/Letter of Recommendation	July 2004
	Permission for establishment of aids to navigation	March 2006
	Spill prevention and spill response plan approval	March 2006
STATE – NEW JERSEY		
New Jersey Department of Environmental Protection		
Land Use Regulation Program	Wetlands Letter of Interpretation	February 2004
	Freshwater Wetlands Permit	January 2005
	Waterfront Development Permit	January 2005
Bureau of Tidelands Management	Tidelands License	October 2004
Office of Dredging and Sediment Technology	Section 401 Water Quality Certificate	January 2005
Air Quality Bureau of Preconstruction Permitting	Subchapter 8 Air Quality Permits	October 2004
Air Quality Bureau of Operating Permitting	Subchapter 22 Title V Air Quality Permit	One year after operations commence

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TABLE 1.3-1 (cont'd)

Major Permits, Approvals, and Consultations for the Crown Landing LNG Project

Agency	Permit/Approval/Consultations	Actual or Anticipated Application Filing/Consultation Date
Water Quality Bureau of Nonpoint Pollution Control	Industrial Stormwater Permit	February 2005
	Treatment works approval for subsurface disposal system	February 2005
Bureau of Point Source	Surface Water Discharge General Permit	February 2005
Bureau of Release Prevention	Approval of Discharge Prevention, Containment and Countermeasure Plan and Discharge Cleanup and Removal Plan	February 2005
Bureau of Safe Drinking Water	Well Drilling Permit	February 2005
Bureau of Water Allocation	Water Allocation Permit	February 2005
Division of Fish, Game, and Wildlife	Endangered species review	Consultation ongoing
State Historic Preservation Office	Review under section 106 of the National Historic Preservation Act	August 2004 and October 2004 (no effect letters)
Office of Coastal Planning and Program Coordination	Coastal zone consistency determination	January 2005
Division of Watershed Management	Water Quality Management Plan consistency	August 2004 (Informal Determination)
New Jersey Department of Transportation	Road Opening and Access Permit	February 2005
STATE – DELAWARE		
Delaware Department of Natural Resources and Environmental Control		
Office of the Secretary	Coastal Zone Status Decision and Permit	December 2004
Coastal Management Program	Coastal zone consistency determination	February 2005
Division of Water Resources	Subaqueous Lands Permit	February 2005
	Water Allocation Permit	February 2005
	Section 401 Water Quality Certificate	February 2005
Division of Fish and Wildlife	Endangered species review	Consultation ongoing
Delaware State Historic Preservation Office	Review under section 106 of the National Historic Preservation Act	September 2004 (no effect letter)
LOCAL		
Gloucester County Soil Conservation District	Approval of Soil Erosion and Sedimentation Control Plan	February 2005
	Discharge of Stormwater from Construction Site General Permit	February 2005

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TABLE 1.3-1 (cont'd)

Major Permits, Approvals, and Consultations for the Crown Landing LNG Project

Agency	Permit/Approval/Consultations	Actual or Anticipated Application Filing/Consultation Date
Gloucester County Health Department	Septic system approval	February 2005
Logan Township Zoning Commission	Redevelopment plan approval	January 2005
Logan Township Planning Commission	Site plan approval/building permit	February 2005

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TABLE 1.3-2

Major Permits, Approvals, and Consultations for the Logan Lateral Project

Agency	Permit/Approval/Consultations	Anticipated Application Filing/Consultation Date
FEDERAL		
Federal Energy Regulatory Commission	Certificate of Public Convenience and Necessity to construct, install, own, operate, and maintain a pipeline under section 7(c) of the NGA	September 2004
Advisory Council on Historic Preservation	Review under section 106 of the National Historic Preservation Act	Consultation, as necessary
U.S. Army Corps of Engineers	Authorization required for work (including dredging) or structures in navigable waters under section 10 of the Rivers and Harbors Act of 1899 and the discharge of dredged or fill material (including filling and grading activities) into waters of the United States (including wetlands) under section 404 of the CWA of 1972	February 2005
U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA)		
NOAA Fisheries	Consultation regarding compliance with section 7 of the Endangered Species Act; the Magnuson-Stevens Fishery Conservation and Management Act; and the Marine Mammal Protection Act	Consultation ongoing
U.S Department of the Interior		
U.S. Fish and Wildlife Service	Consultation regarding compliance with section 7 of the Endangered Species Act, the Migratory Bird Treaty Act, and the Fish and Wildlife Coordination Act	Consultation ongoing
STATE – NEW JERSEY		
New Jersey Department of Environmental Protection		
Land Use Regulation Program	Freshwater Wetlands Permit Stream Encroachment Permit Waterfront Development Permit	February 2005 February 2005 February 2005
Bureau of Water Allocation	Water Allocation Permit	April 2006
Bureau of Point Source	Surface Water Discharge General Permit	April 2006
Office of Dredging and Sediment Technology	Section 401 Water Quality Certificate	February 2005
Division of Fish, Game, and Wildlife	Endangered species review	Consultation ongoing
State Historic Preservation Office	Review under section 106 of the National Historic Preservation Act	Consultation ongoing
Office of Coastal Planning and Program Coordination	Coastal zone consistency determination	February 2005

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TABLE 1.3-2 (cont'd)

Major Permits, Approvals, and Consultations for the Logan Lateral Project

Agency	Permit/Approval/Consultations	Anticipated Application Filing/Consultation Date
STATE – PENNSYLVANIA		
Pennsylvania Department of Environmental Protection		
Office of Water Management	Coastal zone consistency determination	February 2005
Bureau of Watershed Management	Water Allocation Permit	April 2006
Bureau of Water Supply and Wastewater Management	NPDES General Permit for Hydrostatic Test Water Discharges	April 2006
Pennsylvania Department of Natural Resource Conservation	Endangered species review (plants)	Consultation ongoing
Pennsylvania Game Commission	Endangered species review (mammals)	Consultation ongoing
Pennsylvania Fish and Boat Commission	Endangered species review (fish, reptiles, and amphibians)	Consultation ongoing
Pennsylvania State Historic Preservation Office	Review under section 106 of the National Historic Preservation Act	October 2004 (no effect letter)
LOCAL		
Gloucester County Soil Conservation District	Approval of Soil Erosion and Sedimentation Control Plan	April 2006
	Discharge of Stormwater from Construction Site General Permit	April 2006
Delaware County Conservation District	Approval of Soil Erosion and Sedimentation Control Plan	April 2006
	Discharge of Stormwater from Construction Site General Permit	April 2006
	Chapter 105 Waterways and Wetlands General Permits	February 2005
Delaware County, Brookhaven Borough, City of Chester, Chester Township, Aston Township, Logan Township	Road Crossing Permits	April 2006

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1.4 STAKEHOLDER INVOLVEMENT PROCESS

On December 5, 2003 and January 9, 2004, Crown Landing and Texas Eastern, respectively, filed requests with the FERC to use the NEPA Pre-filing Process. At that time, both companies were in the preliminary design stages of the projects and no formal applications had been filed with the FERC. Crown Landing's and Texas Eastern's requests to use the NEPA Pre-filing Process were approved on January 8, 2004 and January 20, 2004, respectively. Pre-filing docket numbers (PF04-2-000 for the Crown Landing LNG Project and PF04-5-000 for the Logan Lateral Project) were established to place information filed by the companies and related documents issued by the FERC into the public record. The Pre-filing Process provided opportunities for interested stakeholders to become involved early in project planning, facilitated interagency cooperation, and assisted in the identification of issues prior to the companies filing their applications with the FERC.

Since initiating the Pre-filing Process with the FERC, Crown Landing and Texas Eastern have conducted open houses for the general public, attended several meetings with federal, state, and local agencies, and met with various elected officials in New Jersey, Pennsylvania, and Delaware. Crown Landing sponsored three informational open houses: March 9 in Claymont, Delaware; March 10 in Logan Township, New Jersey; and March 11 in Marcus Hook, Pennsylvania. Texas Eastern participated in the March 10 open house in Logan Township and then held additional open houses in Pennsylvania on March 30 in Brookhaven, March 31 in Chester Township, and April 1 in Chester. The primary purpose of these open houses was to provide project information to interested stakeholders and to respond to questions and comments regarding the projects. A FERC representative was in attendance at these open houses to provide information on its regulatory process.

Five interagency meetings were held on March 4, March 9, May 6, May 20, and August 19, 2004 with state and federal agencies to discuss the project and to identify issues that need to be addressed in the EIS. Table 1.4-1 lists the location and attendees at each of the interagency meetings that were conducted during the pre-filing process.

TABLE 1.4-1

List of Interagency Meetings Conducted for the Proposed Projects

Meeting Date	Meeting Location	Meeting Attendees
March 4, 2004	Trenton, New Jersey	FERC, Coast Guard, COE, FWS, NJDEP, NJ State Historic Preservation Office (SHPO), NJ Department of Transportation (DOT), Delaware River Basin Commission, Texas Eastern, and Crown Landing
March 9, 2004	Dover, Delaware	FERC, DNREC, DE SHPO, Delaware Energy Office, and Crown Landing
May 6, 2004	Swedesboro, New Jersey	FERC, COE, FWS, EPA, NOAA Fisheries, U.S. DOT Office of Pipeline Safety, NJDEP, PADEP, Texas Eastern, and Crown Landing
May 20, 2004	Dover, Delaware	FERC, COE, EPA, NOAA Fisheries, DNREC, DE SHPO, and Crown Landing
August 19, 2004	Swedesboro, New Jersey	FERC, COE, FWS, EPA, NOAA Fisheries, NJDEP, DNREC, Delaware River Basin Commission, Crown Landing, and Texas Eastern

Crown Landing and Texas Eastern also established project web sites (www.bpcrownlanding.com and www.degt-loganlateral.com), which are periodically updated with project information.

Within 3 days of filing their applications with the FERC, and in accordance with the Commission's regulations and Orders 609 and 609-A, Crown Landing and Texas Eastern notified

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affected landowners and residents within 0.5 mile of the LNG terminal site and along the pipeline route that they filed their applications. Crown Landing and Texas Eastern also published notices of their applications in newspapers that are in general circulation in the project area and placed copies of their applications at the following libraries:

- Crown Landing LNG Project - Logan Branch of the Gloucester County Library, Logan Township; Brandywine Hundred Branch of the New Castle County Library, Wilmington; and
- Logan Lateral Project – J. Lewis Crozier Library, Chester; Aston Public Library, Aston; Logan Branch of the Gloucester County Library, Logan Township

1.5 PUBLIC REVIEW AND COMMENT

On April 19, 2004, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Proposed Crown Landing LNG and Logan Lateral Projects, Request for Comments on Environmental Issues, and Notice of Public Scoping Meetings* (NOI). The NOI was sent to 793 interested parties, including federal, state, and local officials; agency representatives; conservation organizations; Native American tribes; local libraries and newspapers; residents within a 0.5 mile of the proposed LNG terminal; and property owners along the proposed pipeline route. Issuance of the NOI signified the start of the time period for receiving written comments on the projects. On September 29, 2004, the FERC issued a *Notice of Applications*. This second notice announced the filing of FERC applications by Crown Landing and Texas Eastern and a final opportunity to submit comments.

As noticed in the April 19, 2004 NOI, FERC staff initially conducted two public scoping meetings: one meeting on May 5, 2004 in Chester Township, Pennsylvania; and another meeting on May 6, 2004 in Swedesboro, New Jersey. At the request of Delaware officials, a third public scoping meeting was held on June 9, 2004 in Claymont, Delaware (notice of this meeting was issued by the FERC on May 26, 2004). These meetings provided an opportunity for the general public to learn more about the proposed projects and to participate in our analysis by commenting on issues to be included in the EIS. A total of about 200 people attended these meetings and 38 people provided oral comments (7 commentors at the Pennsylvania meeting, 20 commentors at the New Jersey meeting, and 11 commentors at the Delaware meeting). Transcripts of these meetings are part of the public record for the projects.

On January 11, 2005, the FERC conducted an inspection of the proposed terminal site that was open to the public. The next day, the FERC conducted a cryogenic design and technical conference with Crown Landing personnel in Swedesboro, New Jersey to discuss design and engineering aspects of the Crown Landing LNG Project. The meeting was limited to existing parties to the proceeding (i.e., anyone who specifically requested to intervene as a party). Attendees included Crown Landing representatives, agency representatives (Department of Transportation (DOT) Office of Pipeline Safety and Coast Guard), industry representatives, and other interested parties.

Although the NOI established an initial closing date of June 21, 2004 for scoping comments on the projects, the FERC staff continued to receive, accept, and consider comments through the end of the comment period specified in the second notice (comment period ending October 20, 2004). A total of 36 comment letters were received in response to the notices; 16 of these letters were in support of the project and the other 20 letters identified specific issues and concerns. Table 1.5-1 briefly summarizes the primary issues identified and comments received during the public scoping process.

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TABLE 1.5-1

Primary Issues Identified and Comments Received During the Public Scoping Process for the Crown Landing LNG and Logan Lateral Projects

Issue	Specific Comments	EIS Section Where Comments are Addressed
ALTERNATIVES	alternative LNG terminal sites, pipeline routes, and dredge disposal areas; alternative LNG terminal sites that are less populated and have fewer nearby industrial sites; alternative pipeline routes that avoid residences and residential streets	3.0
DREDGING AND DREDGE DISPOSAL	the quantity and quality of sediments to be dredged from the ship berth area; future maintenance dredging and dredge disposal needs	2.4.1.3 and 4.2.2
WATER RESOURCES	impacts of dredging and terminal construction and operation on water quality of the Delaware River	4.3
WETLANDS	impacts on tidal wetlands along the Delaware River and Oldmans Creek	4.4
FISH AND WILDLIFE	impacts on shallow water habitat in the Delaware River; impacts on spawning and foraging habitat of striped bass, shortnose sturgeon, and other resident and transient aquatic organisms; potential impingement and entrainment impacts on fish and fish eggs as the result of appropriating hydrotest water and ballast water; impacts on a heron rookery on Pea Patch Island; impacts on pied-billed grebe inhabiting wetlands along Birch Creek; impacts on bald eagles	4.6 and 4.7
LAND USE	effects of LNG ships on other ship and boat traffic in the Delaware River; effects of construction-related traffic on existing traffic levels on U.S Route 130; impacts on public access to tidal waters and recreational fishing areas; potential to encounter contaminated sites in the project area; impacts on nearby commercial developments	4.8
SOCIOECONOMICS	economic impacts on Logan Township and surrounding communities; environmental and economic justice associated with constructing the proposed pipeline in minority and low-income neighborhoods; potential for and economic impact of closure of Delaware Memorial Bridge; impacts on property values and insurance rates; the demand of the project on local police and fire services; the potential for the project to provide jobs and support economic development; costs of providing security to LNG terminal and ships	4.9
CULTURAL RESOURCES	impacts on cultural resources including architectural resources and marine archaeological sites	4.10
AIR QUALITY AND NOISE	air and noise impacts including the effects of dust and emissions from construction equipment and facility operations; the potential for odors and noise associated with construction and operation of the proposed facilities	4.11
RELIABILITY AND SAFETY	Impacts on public safety, particularly the safety of people that live or work near proposed LNG terminal; risks associated with storing and transporting LNG; safety and security measures to protect ships and the terminal, the potential for terrorism; emergency preparedness and response planning with local communities; effects of releases of LNG from ships or the terminal; potential impacts on the Salem Nuclear Power Plant, Logan Generating Station, or other industrial facilities as the result of an LNG-related incident; impacts of security zone around LNG ships and terminal	4.12
CUMULATIVE IMPACTS	cumulative impacts on the Delaware River as a result of the project and existing industrial activities	4.13

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1.6 NONJURISDICTIONAL FACILITIES

Electrical power to operate the LNG terminal facilities would be provided by a new 69 kV electric transmission line that would be constructed from an existing Conectiv Power Delivery substation (Conectiv's Nortonville Substation) located on the south side of U.S. Route 130 to the LNG terminal site. The transmission line would cross U.S. Route 130 and follow the proposed access road into the LNG facility (which is the existing access road into the Logan Generating Station). Approximately 3,500 feet of dual feed electric transmission line supported on transmission poles spaced about 225 feet apart would be installed. This transmission line would replace a smaller existing powerline that extends along the site entrance road to the proposed terminal area. The Nortonville Substation and two other substations would need some modifications but none of these modifications would result in expansions of the facilities or land-disturbing activities outside of the existing fence lines. An environmental analysis of these nonjurisdictional facilities is included in this EIS.

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2.0 DESCRIPTION OF PROPOSED ACTION

2.1 EXISTING SITE CONDITIONS

The proposed LNG import terminal would be located on a 175-acre undeveloped parcel located along the Delaware River between Oldmans Creek and the Logan Generating Station, a pulverized coal-fired power plant owned by National Energy Power Company, L.L.C. The site is predominantly agricultural land and wetland. Ten pipelines, including three natural gas pipelines, one nitrogen pipeline, and six Sun Oil Company pipelines traverse the site. Of the six Sun Oil Company pipelines on the site, three of the pipelines transport petroleum products (butane, jet fuel, and gasoline) and the other three pipelines are currently inactive. U.S. Route 130 borders the southern boundary of the site and provides access to the site via the existing road to the Logan Generating Station. The offshore portions of the proposed project would be located in the Delaware River between the Marcus Hook anchorage area and the shoreline. An aerial photograph showing the existing conditions on the LNG terminal site is provided on figure 2.1-1.

2.2 PROPOSED PROJECT

The Crown Landing LNG Project would consist of onshore LNG storage and process facilities located in Logan Township, Gloucester County, New Jersey and an offshore ship unloading facility located in New Castle County, Delaware. The LNG import terminal would have interconnections with three natural gas pipeline systems. One of these interconnections would be the Logan Lateral Project, which would consist of 11.00 miles of 30-inch-diameter natural gas pipeline from Texas Eastern's Chester Junction facility located in Brookhaven Borough, Delaware County, Pennsylvania to the LNG facility. Other towns and townships crossed by the Logan Lateral route include the City of Chester, Aston Township, and Chester Township in Pennsylvania and Logan Township in New Jersey. The other two interconnections (Columbia Gas and Transco pipelines) would be within the proposed LNG facility site. A general project location map for both projects is provided on figure 2.2-1.

2.2.1 LNG Terminal

The LNG terminal facilities would include a ship unloading facility, three LNG storage tanks, vaporization and vapor handling systems, a nitrogen injection system, and administrative and support buildings. A layout of the proposed facilities is provided on figure 2.2.1-1.

2.2.1.1 Ship Unloading Facility

The proposed project would include the construction and operation of a ship unloading facility that would be capable of handling LNG ships with cargo capacities up to 200,000 m^3. At the present time, the largest LNG ships in the world fleet have cargo capacities of 138,000 m^3. The facility would be capable of mooring and offloading one LNG ship at a time. Crown Landing anticipates that a ship about every 2 to 3 days (about 120 to 180 ships per year with an average about 150 ships per year) would offload LNG at the proposed facility.

The ship unloading facility would be located in the Delaware River adjacent to the Marcus Hook anchorage area. It would consist of an angled pier with a 2,000-foot-long by 50-foot-wide trestle, an approximately 6,000 square foot unloading platform, and a single berth with four breasting dolphins and five mooring dolphins. Walkways connecting the dolphins to the platform would provide personnel access and a gangway between the ship and the dolphins would provide crew access. The trestle would provide structural support for cryogenic lines, a spill containment trough, and utility lines connecting the unloading facility with onshore facilities and would accommodate two travel lanes for light vehicles. A

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control room would be located on the pier to facilitate monitoring of ship unloading operations. To accommodate future larger LNG ships (i.e., 200,000 m^3 capacity), the ship unloading facility would be constructed with additional quick release hooks for extra lines, a modified fendering system, some larger structural elements, and modified locations of the mooring dolphins.

An LNG transfer system would be installed on the unloading platform to transfer the LNG from the ship to the storage tanks. This transfer system would consist of three 16-inch-diameter unloading arms for liquid transfer to the storage tanks and a 16-inch-diameter arm for vapor return to the ship. A 44-inch-diameter cryogenic transfer line would connect the liquid unloading arms to the tanks and a 16-inch-diameter vapor return line would connect the tanks to the vapor return arm. The unloading arms would be equipped with powered emergency release couplers that would disconnect the arms from the ship in the event that the ship moves excessively relative to the unloading platform and the safe operating distance of the arms. Onboard ship pumps would be used to pump the LNG through the transfer system and into the storage tanks. An additional 12-inch-diameter cryogenic line would be installed from the tanks to the main header on the unloading platform to recirculate LNG through the system to maintain cold conditions between ship unloadings.

Crown Landing would design the ship unloading facility in accordance with applicable codes and standards, including but not limited to the Oil Companies International Marine Forum, Society of International Gas Tanker and Terminal Operators, American Petroleum Institute, and American Society of Civil Engineers. The facility would be designed to provide a safe berth for the receipt and support of LNG ships and to ensure the safe transfer of LNG cargoes from the ships to the onshore storage tanks.

2.2.1.2 LNG Storage Tanks

LNG unloaded from the ships would be stored in a three 150,000 m^3 net (158,000 m^3 gross) full containment storage tanks. The tanks would have a design pressure of 4.2 pounds per square inch gauge (psig) and a normal operating pressure of 2.7 psig. Figure 2.2.1-2 shows the conceptual design of Crown Landing's proposed storage tanks. The double-walled tanks would have a primary inner container and a secondary outer container and would be designed so that both the self-supporting primary container and secondary container could independently contain the LNG. The inner container would be made of 9 percent nickel steel and the outer container would be pre-stressed reinforced concrete. A concrete-domed roof with a carbon steel liner would be constructed over the outer container. The diameter of the outer containers would be about 250 feet and the height of the storage tanks would be about 175 feet from grade to the top of the dome roof. The storage tank foundations would consist of a concrete pile cap supported by steel pilings. Based on preliminary design, each tank would require 1,176 18-inch-diamater steel pipe piles driven to a depth of about 100 feet below grade.

The insulated tanks would be designed to store LNG at a temperature of -260° Fahrenheit (F) with a maximum boil-off rate of 0.05 percent of the tank contents per day at 96° F ambient temperature (highest 1-day mean temperature). The 4-foot annular space between the sidewalls of the inner and outer containers would be insulated with loose-fill expanded perlite and fiberglass resilient blanket. The suspended deck at the top of each tank would be insulated with 3 feet of perlite deck insulation and the bottom of each tank would be insulated with 16 inches of cellular glass load-bearing blocks.

All piping connections and tank nozzles would enter and exit from the top of the tanks. There would be no penetrations through the inner or outer walls or bottom of the tanks. Three low-pressure sendout pumps would be installed within each tank to pump the LNG to external high-pressure pumps and the vaporizers. The three pumps provided in each tank would be capable of sending out the base-load capacity of the terminal from a single tank.

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Non-Internet Public

Facility Location Maps
Figures 2.1-1, 2.2-1, 2.2.1-1 (Pages 3-5)

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

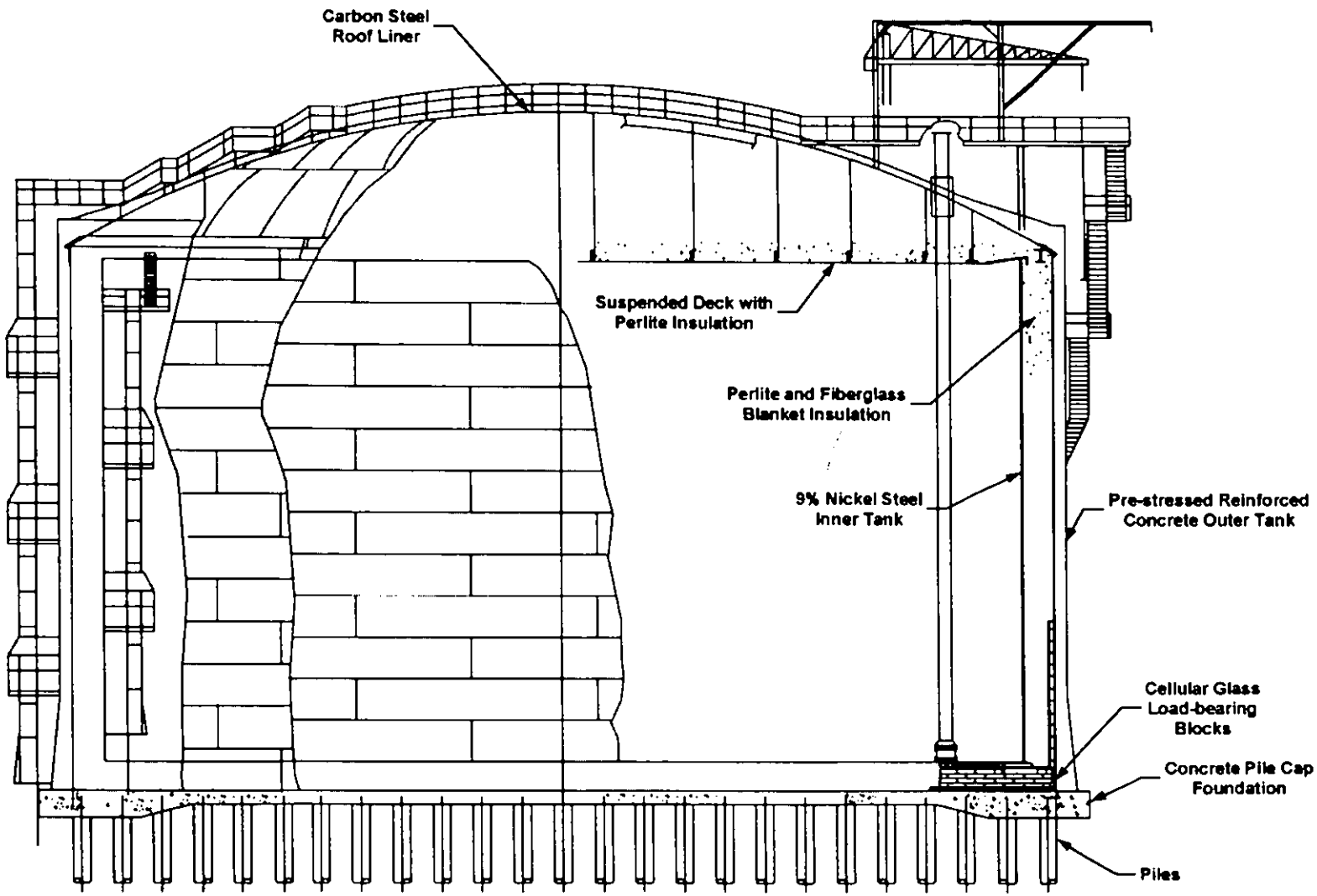

Figure 2.2.1-2
Crown Landing LNG Project
Conceptual Design of LNG Storage Tanks

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2.2.1.5 Nitrogen Injection System

Depending on the source, the imported LNG may have a British thermal unit (Btu) content that is higher than the pipelines can accept. To reduce the heating value of the vaporized LNG to meet specifications of the receiving pipeline systems, Crown Landing would inject nitrogen into the vaporized LNG via the boil-off gas compressor. The nitrogen would be produced in a cryogenic air separation system and would be injected into the LNG stream at the boil-off gas condenser. The air separation system would consist of air filtration and dehydration, air and nitrogen compressors, heat exchangers, a turbo-expander, distillation towers, and a 750,000 gallon liquid nitrogen storage tank. Direct Btu analyzers would be used to monitor and control the heating value of the vaporized LNG.

2.2.2 LNG Ships

LNG could be shipped from a variety of sources around the world, including Algeria, Australia, Brunei, Indonesia, Malaysia, Nigeria, Oman, Qatar, Trinidad, and United Arab Emirates. Crown Landing anticipates that the proposed LNG terminal would receive LNG from Trinidad and West Africa (Nigeria or Algeria). Although LNG ships and their operation are directly related to the use of the proposed import terminal, they are not subject to the section 3 authorization sought in this application.

Ship Selection and Inspections

The LNG ships that would deliver LNG to the terminal would include both predominantly dedicated ships (BP's Trader Class ships) and ships that would deliver LNG that BP has purchased from the worldwide market. The dedicated ships would be owned and operated by BP and flagged under the British flag. Ships not under the control of BP would be vetted by BP to ensure that they meet its requirements regarding safe operating procedures and crew qualifications. The vetting would include a review of a recent inspection conducted by either a BP ship inspector or accredited inspector, an audit of the ship manager's office, and a review of current information on the ship. BP would continually monitor ship operations to ensure that the operations are according to their established procedures and to ensure that the ships are maintained to all standards.

Ships using the terminal would also comply with the Coast Guard regulations for LNG ships. This compliance is demonstrated by the operator of the LNG ship having proper certificates authorizing the transport of LNG as follows:

- United States Flag LNG Ship - The Coast Guard Certificate of Inspection must be valid and endorsed for the ship to transport LNG (46 CFR 154, 1979). A Coast Guard Certificate of Inspection (COI) is issued for a period of 5 years and retention of the COI depends upon the continued maintenance of the vessel in a safe operating condition and satisfactory completion of required annual inspections during the 5-year COI period.

- Foreign Flag LNG Ship - The ship must have a valid Certificate of Compliance issued by the Coast Guard. The certificate is issued after the ship has proven that it complies with the Coast Guard regulations and after it has been satisfactorily inspected by a Coast Guard Marine Safety Office (46 CFR 154, 1979). A Certificate of Compliance (COC) is valid for a 2-year period and remains valid pending satisfactory completion of an annual mid-period examination between COC renewals

Both United States and foreign flagships must be annually inspected by the Coast Guard and the flag state. Coast Guard officers from the Marine Safety Office/Group Philadelphia may board the LNG ships arriving at the mouth of the Delaware Bay to perform a security inspection and to assure compliance with safety standards.

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Ship Design and Construction

The LNG terminal would be designed to accommodate vessels with cargo capacities from 138,000 m^3 to 200,000 m^3. LNG vessels of this size would typically have total lengths of 914 to 1,056 feet, beams (widths) of 138 to 167 feet, and loaded drafts of 38 feet

The ships that transport LNG are specially designed and constructed to carry LNG for long distances. LNG ship construction is highly regulated and consists of a combination of conventional ship design and equipment, with specialized materials and systems designed to safely contain liquids stored at temperatures of -260° F.

Profile

LNG ships have a distinctive appearance compared with other transport ships. An LNG ship has a high freeboard (i.e., that portion of the ship above water) because of the comparatively low density of the cargo. Because of the high freeboard, when compared with vessels such as an oil tanker, wind velocity can affect the maneuverability of the ship, particularly at slow speed, such as during docking.

Hull System

All LNG ships are constructed with double hulls while most other liquid transport ships presently in use have single hull construction. Double hull construction increases the structural integrity of the hull system and provides protection for the cargo tanks in case of an accident. The space between the inner and outer hulls is used for water ballast. The *International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk* (Gas Tanker Code) and Coast Guard regulations require that LNG ships meet a Type IIG standard of subdivision, damage stability, and cargo tank location.

The Type IIG design ensures the LNG ship could withstand flooding of any two adjacent compartments without any adverse effect upon the stability of the ship. Type IIG design also requires that the cargo tanks must be a minimum of 30 inches from the outer hull and a minimum distance above the bottom of the ship equal to the beam of the ship divided by 15, or 7.5 feet, whichever is less. This distance is intended to prevent damage to the cargo tanks in case of low energy type accidents that might occur in harbors and during docking. Most large LNG ships have a distance of 10 to 15 feet between the outer hull and cargo tank.

Containment Systems

An LNG containment system on the ships consists principally of the cargo tank (sometimes called a primary barrier), the secondary barrier, and insulation. The containment system also includes cargo monitoring and control and safety systems.

Three basic tank designs have been developed for LNG cargo containment: prismatic free-standing, spherical, and membrane. The earliest form of LNG containment is the prismatic free-standing tank. It consists of an aluminum alloy or 9 percent nickel steel, self-supporting tank that is supported and restrained by the hull structure. Insulation consists of reinforced polyurethane foam on the bottom and the sides, with fiberglass on the top. The spherical tank design, also known as the Moss design, uses an unstiffened, spherical, aluminum alloy tank that is supported at its equator by a vertical cylindrical skirt, with the bottom of the skirt integrally welded to the ship's structure. This free-standing tank is insulated with multi-layer close-cell polyurethane panels. In the membrane containment system, the ship's hull constitutes the outer tank wall, with an inner tank membrane separated by insulation. Two forms of membrane are commonly used: the Technigaz membrane using stainless steel and the Gas-Transport membrane using Invar.

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LNG ships are of the double-hulled design regardless of the containment system used. A double bottom and double sides are provided for the full length of the cargo area and arranged as ballast tanks, independent of the cargo tanks. The double-hulled design provides greatly increased reliability of cargo containment in the event of grounding and collisions. Further, the segregated ballast tanks prevent ballast water from mixing with any residue in the cargo tanks.

Pressure/Temperature Control

A basic goal of all LNG containment systems is to maintain the LNG cargo at or near atmospheric pressure at the boiling temperature of the LNG (about -260° F). This is accomplished using "auto-refrigeration," a phenomenon that results from the constant heat flow into the tank and the removal of the associated vapor. The vapor removal rates range from 0.25 to 0.15 percent (by volume) per day and is used to supplement the bunker fuel in the ship's boilers. As a result, LNG ships have reduced emissions when compared with conventional oil-fired ships.

Ballast Tanks

Sufficient ballast water capacity must be provided to permit the ship to return to the loading port safely under various sea conditions. LNG cargo tanks are not used as ballast tanks because these tanks must contain a minimal amount of LNG to remain at cryogenic temperatures. Consequently, LNG ships must be designed to provide adequate ballast capacity in other locations.

Ballast water tanks on LNG ships are arranged within the LNG ship's double hull. It is essential that ballast water not leak into the LNG containment system. To reduce the potential for leakage, the ballast tanks, cofferdams, and void spaces are typically coated to reduce corrosion. LNG ships are also periodically inspected to examine the coating and to renew it as necessary.

A ballast control system, which permits simultaneous ballasting during cargo transfer operations, is also incorporated into each LNG ship. This system allows the LNG ship to maintain a constant draft during all phases of its operation to enhance performance. Under normal operating conditions, ballast water would be taken onto the ship during and after LNG offloading to maintain the trim and stability of the ship. A 138,000 m^3 LNG ship would typically take on ballast water at a rate of about 5,200 cubic meters per hour (m^3/hr) (about 1.4 million gallons/hour) and a 200,000 m^3 ship would take on ballast water at a rate of about 7,500 m^3/hr (about 2 million gallons/hour). For both ships, the ballast water would be taken on over a 10-hour period, resulting in a total ballast water intake per ship of about 52,000 m^3 (13.7 million gallons) for a 138,000 m^3 ship and 75,000 m^3 (19.8 million gallons) for a 200,000 m^3 ship. Assuming a 10-hour reballasting period for a 138,000 m^3 ship, the average ballast water intake velocity would be about 1 foot per second. A portion of this ballast water would be taken on while at berth and the remaining amount would be taken on while in transit down the Delaware River. Ballast water would not be discharged to the Delaware Bay and River during unloading operations.

BP's Trader Class ships have three ballast water intakes, each with ballast pumps rated at 3,000 m^3/hr. Typically, two of the pumps operate during ballasting and the third pump is on stand by. The total area of the two lower ballast intake openings is 3.55 square meters. The openings are protected by bar-type grids having 4.5 millimeters (mm) bars spaced 25 mm apart, reducing the clear flow area to 2.36 square meters. The highest and lowest points of the openings are 8.38 and 9.46 meters below the ship's waterline. The upper (third) opening has a total grid clear flow area of 4.16 square meters and has strainers with a 5 mm mesh fitted inboard of suctions valves prior to the ballast pump.

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Crew Qualifications and Training

All officers and crews of the LNG ships using the terminal would comply with the International Convention Standards of Training, Certification and Watch Keeping for Seafarers. Key members of the crew must have specific training in the handling of LNG and the use of the safety equipment. Officers must receive simulator training in the handling of the ship and the cargo systems specific to the conditions at the project site. A licensed Delaware River Pilot would advise the LNG ship Captains on the navigation of the ships on the Delaware Bay and River. In addition, a Docking Pilot would board each ship at the Delaware Memorial Bridge to navigate the ship upriver to the LNG terminal berth as well as navigate the ship back down river upon departure.

2.2.3 Pipeline Facilities

The LNG terminal would be connected to three interstate natural gas pipeline systems, including Columbia Gas, Transco, and Texas Eastern. The interconnections for the Columbia Gas and Transco pipeline systems would be on the LNG facility site. The meter and regulation stations for these two interconnections would be located west of the storage tank area. An approximately 500-foot-long, 20-inch-diameter pipeline would be constructed onsite from Columbia Gas' existing pipeline to the meter station. No additional pipeline would be needed for the Transco interconnection.

To interconnect the LNG terminal with the existing Texas Eastern pipeline system, Texas Eastern proposes to construct 11.00 miles of 30-inch-diameter pipeline between its Chester Junction facility in Pennsylvania and the LNG terminal site. The pipeline in Pennsylvania would cross 1.26 miles of Brookhaven Borough, 1.68 miles of Chester Township, 0.16 miles of Aston Township, and 1.82 miles of the City of Chester. All 6.08 miles of the pipeline in New Jersey would be in Logan Township. Figure 2.2.3-1 shows the location of the Logan Lateral.

Aboveground facilities associated with the proposed Logan Lateral include:

- a pig receiver and launcher facility[1], valves, and piping at the beginning of the pipeline located within the fenceline of the Chester Junction facility;
- a remote-controlled mainline valve with above ground valve operator and associated building and equipment at milepost (MP) 2.11; and
- a meter and regulation station and pig receiver and launcher facility at the end of the pipeline located on the LNG facility site adjacent to the other two stations.

[1] A pig is an internal tool used to clean and dry a pipeline or to inspect a pipeline for damage or repair.

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Non-Internet Public

Facility Location Maps
Figure 2.2.3-1, Sheets 1-3

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2.3 LAND REQUIREMENTS

2.3.1 LNG Terminal

The proposed onshore LNG terminal facilities would be located on a privately owned 175-acre parcel of land situated between the south side of the Delaware River and U.S. Route 130 in Logan Township, Gloucester County, New Jersey. Of the 175-acre site, about 39 acres would be permanently developed for the LNG terminal facilities and access road. The pipeline facilities associated with the Logan Lateral Project would also occupy portions of the 175-acre site (see section 2.3.2). In addition to the 39 acres permanently developed for the LNG terminal facilities, about 4 acres of the site would be used as a temporary staging and expanded work area during construction. The 4-acre area would be located in the southeast corner of the site adjacent to the access road and approximately 300 feet north of U.S. Route 130 and would include construction offices, material storage, and parking. The facility septic system would also be located in this area. The majority of the 4 acres would be graded and returned to open space after construction; however, 0.5 acre would be used for a septic system drain field. Dual feed electric transmission lines would be extended to the LNG terminal site from the existing Conectiv electric substation across U.S. Route 130 from the site entrance and along the site access road to the terminal area. About 3,500 feet of transmission line would be supported by transmission poles spaced an average of 225 feet apart. A layout of the proposed LNG terminal facilities is provided on figure 2.2.1-1. Additional information on the land use and requirements for the LNG terminal site is provided in section 4.8.1.1.

The Crown Landing LNG Project would also require about 29.8 acres of riverbed associated with the Delaware River for a pier (approximately 2.4 acres) and a ship berth (approximately 27.4 acres, including the area to be dredged). The majority of the offshore ship unloading facility would be located in Delaware waters within the boundaries of New Castle County.

2.3.2 Pipeline Facilities

Construction of the pipeline facilities would disturb a total of about 177.3 acres of land, consisting of 101.1 acres for the pipeline construction right-of-way, 65.6 acres for temporary extra workspace and staging areas, 4.4 acres for access roads, and 6.2 acres for aboveground facilities.

Of the 177.3 acres of land affected by construction of the pipeline facilities, about 54.1 acres would be retained as permanent right-of-way for the pipeline and 1.8 acres for the aboveground facilities. The remaining 121.5 acres would be allowed to revert to its former use. Table 2.3.2-1 summarizes the land requirements for the pipeline facilities.

About 6.4 miles (58 percent) of the pipeline would be constructed within or adjacent to various existing rights-of-way (see table 2.3.2-2). Of the 6.4 miles, 3.1 miles would be located within Texas Eastern's existing pipeline easement (1.4 miles) or other existing pipeline easements (1.7 miles), 3.1 miles would be located within existing road rights-of-way, and 0.2 mile would be located within an existing railroad right-of-way. The remaining 4.6 miles (42 percent) would be constructed on newly created right-of-way.

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TABLE 2.3.2-1

Summary of Land Requirements Associated with Construction and Operation of the Pipeline Facilities for the Logan Lateral Project

Facility	Land Affected During Construction (acres)	Land Affected During Operation (acres)
Pipeline		
Pipeline Right-of-Way a/	101.1	54.1
Temporary Extra Workspace and Staging Areas	65.6	0.0
Access Roads	4.4	0.0
Pipeline subtotal	171.1	54.1
Aboveground Facilities		
Chester Junction b/	5.7	1.2
Logan Mainline Valve c/	0.1	0.1
Meter and Regulation Station d/	0.5	0.5
Aboveground Facility Subtotal	6.2	1.8
Project Total	177.3	55.8

a/ Based on a 100-foot-wide construction right-of-way. Some areas would have a reduced construction right-of-way to avoid impacts on residential and wetland areas. Operation acreage is based on a 50-foot-wide permanent right-of-way in all areas except at road crossings where the right-of-way width would be as permitted by the local agencies. Beginning at approximately MP 10, the pipeline right-of-way would be located within the proposed 175-acre LNG terminal site but does not overlap the 39 acres that would be permanently developed for the terminal facilities.

b/ The modifications and upgrades at Chester Junction would be conducted within the existing 1.3-acre fenced facility located on a 5.7-acre site owned by Texas Eastern. The work would be conducted within the limits of the existing site and no new property would need to be acquired by Texas Eastern.

c/ The Logan Mainline Valve would require an additional 0.1 acre outside of Texas Eastern's existing right-of-way.

d/ The Crown Landing meter and regulation station would be located within the developed area (i.e., 39 acres) of the 175-acre LNG terminal site.

Note: The totals shown in this table may not equal the sum of addends due to rounding.

Texas Eastern generally proposes to use a 100-foot-wide right-of-way to construct the pipeline and a 50-foot-wide permanent right-of-way to operate and maintain the pipeline. The typical right-of-way cross sections that Texas Eastern would use for the Logan Lateral Project are provided in Appendix B. Texas Eastern's actual use of workspace and permanent right-of-way width (e.g., spoil storage, equipment travel lane) may vary depending on the space available for construction and its road crossing permits and easements with local agencies.

Temporary extra workspaces and staging areas would be required for construction at waterbody, road, and railroad crossings, as well as at horizontal directional drill (HDD) work sites. The locations and sizes of the identified temporary extra workspaces and staging areas that Texas Eastern proposes to use are listed in table C-1 in Appendix C. It is also anticipated that temporary offsite workspace would be required for pipe and contractor yards, although the size and location of these areas have not yet been identified by Texas Eastern.

Texas Eastern proposes to temporarily use nine roads for access to the right-of-way during construction. These access roads are primarily existing paved, gravel, or dirt roads. Table C-2 in Appendix C lists the proposed access roads that would be used during construction of the Logan Lateral Project. Texas Eastern believes the majority of the roads can be used without improvements but anticipates that it may be necessary to add gravel to the surface of some of the existing gravel roads.

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TABLE 2.3.2-2

Location of Existing Rights-of-Way in Relation to the Proposed Pipeline Route

Begin MP	End MP	Segment Length (miles)	Existing Easement	Relationship to Existing Rights-of-Way	Width of Existing Right-of-Way (feet)	Width Used for Temporary Construction Right-of-Way (feet)	Width Used for Permanent Right-of-Way (feet)
0 00	0.10	0.10	Texas Eastern's 14-inch Sinclair Pipeline	South	25	25	25
0.10	0.21	0.11	Texas Eastern's 14-inch Sinclair Pipeline	North	25	25	25
0 21	0 30	0.09	None, new right-of-way	Not Applicable (NA)	NA	NA	NA
0 30	1 12	0.82	Trimble Boulevard	a/	45	b/	b/
1.12	1.19	0.07	Clearwater Avenue	a/	45	b/	b/
1.19	1.21	0.02	None, new right-of-way	NA	NA	NA	NA
1.21	1 23	0.02	Texas Eastern's 14-inch Sinclair Pipeline	North	25	25	25
1 23	1.65	0 42	Texas Eastern's 14-inch Sinclair Pipeline	South	25	25	25
1.65	2.29	0.64	Texas Eastern's 14-inch Sinclair Pipeline	South	50	50	50
2.29	2.55	0.26	None, new right-of-way	NA	NA	NA	NA
2.55	2.71	0.16	Texas Eastern's 12-inch Pipeline	South	25	25	20
2.71	2.85	0.14	Felton Avenue	a/	45	b/	b/
2 85	2.92	0.07	Bethel Road	a/	45	b/	b/
2.92	2.95	0.03	None, new right-of-way	NA	NA	NA	NA
2.95	3.02	0 07	Interstate 95	c/	Unknown	c/	c/
3.02	3.15	0.13	Palmer Street	a/	45	b/	b/
3.15	3.71	0.56	None, new right-of-way	NA	NA	NA	NA
3.71	4.00	0.29	Palmer Street	a/	45	b/	b/
4 00	4.02	0.02	None, new right-of-way	NA	NA	NA	NA
4.02	4.20	0.18	Norfolk Southern Railroad	South	Unknown	d/	d/
4.20	5.44	1.24	None, new right-of-way	NA	NA	NA	NA
5.44	6.90	1.46	Ferry Road	a/	45	b/	b/
6.90	9.28	2.38	None, new right-of-way	NA	NA	NA	NA
9.28	10.33	1.05	Williams Transco Pipeline	North	50	45	35
10.33	10.89	0.56	Williams Transco Pipeline	North	50	35	25
10.89	11.00	0.11	Sun Oil Company Pipelines	West	60	31	21

a/ The pipeline would be located within the road/railroad right-of-way but the exact location would be based on the location of other existing utilities within the easement (e.g., water, sewer, residential natural gas pipelines).

b/ The right-of-way width would be as permitted by the local agencies.

c/ Texas Eastern would install the pipeline across Interstate 95 by boring underneath the road (bored crossing).

d/ The right-of-way width would be as negotiated with Norfolk Southern.

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Texas Eastern proposes to construct two new aboveground facilities and modify and upgrade one existing aboveground facility. The new Meter and Regulation Station would be located within the proposed 175-acre LNG terminal site. This facility would require a 0.5-acre area within the 175-acre terminal property. Modifications and upgrades would be made to Chester Junction, which is an existing 1.3-acre fenced facility located on a 5.7-acre site owned by Texas Eastern in the Borough of Brookhaven. The work would be conducted within the limits of the existing site and no new property would need to be acquired by Texas Eastern. The Logan mainline valve at MP 2.1 would be a new facility located partially within Texas Eastern's existing right-of-way. Texas Eastern would need to acquire an additional 0.1 acre of land for construction and operation of this facility.

2.4 CONSTRUCTION PROCEDURES

This section describes the general procedures proposed by Crown Landing and Texas Eastern for construction of the LNG terminal and pipeline facilities, respectively. Refer to section 4 for more detailed discussions of proposed construction and restoration procedures as well as additional measures that we are recommending to mitigate environmental impacts.

The proposed LNG terminal and natural gas pipeline would be designed, constructed, operated, and maintained in accordance with federal safety standards that are intended to ensure adequate protection for the public and to prevent LNG and natural gas pipeline accidents or failures.

Under the provisions of the Natural Gas Pipeline Safety Act of 1968, as amended, Crown Landing would design, construct, operate, and maintain the LNG terminal facilities in accordance with the DOT Federal Safety Standards for Liquefied Natural Gas Facilities, 49 CFR 193. The facilities would also meet the National Fire Protection Association (NFPA) Standards for the Production, Storage, and Handling of LNG (NFPA 59A). These standards specify siting, design, construction, equipment, and fire protection requirements for new LNG facilities. The ship unloading facility and any appurtenances located between the LNG ships and the last valve immediately before the LNG storage tanks would comply with applicable sections of the Coast Guard regulations for Waterfront Facilities Handling LNG, 33 CFR 127 and Executive Order 10173.

The proposed pipeline facilities would be designed, constructed, operated, and maintained in accordance with DOT regulations in 49 CFR 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards. Among other design standards, 49 CFR 192 specifies pipeline material selection; minimum design requirements; protection from internal, external, and atmospheric corrosion; and qualification procedures for welders and operations personnel. In addition, Texas Eastern would comply with the siting and maintenance requirements in 18 CFR 380.15 and other applicable federal and state regulations.

Crown Landing would construct the LNG terminal facilities in accordance with our Upland Erosion Control, Revegetation and Maintenance Plan (FERC Plan) and Wetland and Waterbody Construction and Mitigation Procedures (FERC Procedures). It would also be required to construct the facilities in accordance with a site-specific Soil Erosion and Sedimentation Control (SESC) Plan that is approved by the Gloucester County Soil Conservation District. Texas Eastern would construct the pipeline facilities in accordance with its SESC Plan, which is mostly consistent with our Plan and Procedures (see section 4.2.1 for a discussion of differences between the SESC Plan and our Plan and Procedures). Texas Eastern's SESC Plan is provided in Appendix D. Copies of our Plan and Procedures are available on our website at www.ferc.gov.

Crown Landing and Texas Eastern would be required to develop Spill Prevention, Containment and Countermeasure (SPCC) Plans to be implemented during construction of the facilities. The SPCC

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Plans must address potential spills of fuels, lubricants, and other hazardous materials and describe spill prevention practices, spill handling and emergency notification procedures, and training requirements. Crown Landing has indicated that it would be preparing an SPCC Plan for construction activities at the LNG terminal. This plan would include provisions for addressing spills at the onshore and offshore facilities. Texas Eastern's SPCC Plan for the pipeline facilities is included in its SESC Plan, which is provided in Appendix D of this EIS.

2.4.1 LNG Terminal

Construction of the LNG terminal facilities would include construction of the onshore LNG storage, process, and support facilities and construction of the ship unloading facility in the Delaware River, including dredging of an LNG ship berth.

2.4.1.1 LNG Storage and Process Facilities

Site Preparation

The first step in the construction of the LNG storage tanks and process facilities would be site preparation, including clearing and grubbing and placement of fill material. Minimal clearing and grubbing would be needed because the facilities would be mostly constructed in an agricultural field. The trees along the shoreline of the river would not be cleared. Approximately 150,000 cubic yards of fill material would be placed in the process area to raise the grade above the 1,000-year storm range elevation and to construct the 10-foot-high earthen containment dike around the storage tank area. Crown Landing anticipates obtaining fill material for the process area and dike from either a local dredge disposal area or borrow pit.

Foundation Installation

Once the site has been filled and graded to the required level, the next step would be construction of foundations for the storage tanks, buildings, major equipment, and pipe racks. Based on preliminary designs, Crown Landing anticipates that the foundations for the storage tanks would be supported on steel pipe pilings installed to a depth of approximately 100 feet below the ground surface. Concrete foundations for other major structures, including buildings, major equipment, and pipe racks, would be installed on the finished grade. To prevent post-construction settlement, it may be necessary to surcharge the foundations of these other major structures.

Storage Tank Installation

The construction of the three LNG storage tanks would require about 29 months to complete. After the foundations of the tanks are installed with embedded heating system conduits, to prevent sub-base freezing from the stored LNG, tank construction would consist of the following sequential activities:

- construction of the outer tank carbon steel wall liner;
- installation of the outer tank carbon steel bottom liner on the foundation;
- erection of the outer tank carbon steel roof liner on the outer tank bottom using temporary supports;
- erection of the inner tank suspended deck and connection of the inner tank to the steel roof;
- air raising the steel roof and suspended deck to the final position upon completion of the outer tank carbon steel liner, and welding the steel roof to the top compression bar;
- installation of the bottom installation;

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- installation of the secondary and inner tank bottoms;
- erection of the inner shell;
- construction of the concrete walls to full height;
- installation of the roof rebar and placement of the roof concrete;
- installation and tensioning of the concrete wall prestress tendons;
- installation of the roof platforms and stairways;
- hydrotesting of the inner tank; and
- installation of the annulus insulation.

The storage tanks would be hydrostatically tested in accordance with DOT regulations to ensure that the tanks are capable of operating at the design pressure. Approximately 25 million gallons of water obtained from the Delaware River would be used to test each tank. The water to test each tank would be pumped at a low rate (less than 0.5 feet per second) through a screened intake from the river over a 2-week period, retained in the tank for about 1 to 2 days, and then discharged back to the river over a 1 to 2 week period. After testing is completed, about 250,000 gallons of freshwater pumped from onsite wells would be used to rinse each tank of any brackish water residue. Chlorine may need to be added to the test water to prevent microbiologically influenced corrosion in the tanks. The test water would be appropriated from and discharged in accordance with our Procedures and applicable state permits.

Other Facility Construction

During the construction of the storage tanks, other facility structures and buildings would be constructed and major mechanical and electrical equipment, process and utility piping, and instrumentation would be installed. Onsite wells would be installed to provide service water and firewater. An onsite septic system would be installed to treat sanitary wastes. An approximately 3,500-foot-long, 69 kV electrical transmission line would be constructed from an existing substation located across U.S. Route 130 south of the existing Logan Generating Station entrance road to provide electrical power to the LNG terminal. All of these facilities would be completed and pre-commissioned in readiness for completion of the storage tanks.

Final Grading and Site Restoration

After final grading, the areas around the process buildings, equipment, piping, and storage tanks would be covered with crushed rock. Other disturbed areas would be seeded and planted in accordance with a landscaping plan.

2.4.1.2 Ship Unloading Facility

The first step in construction of the ship unloading facility would be the dredging of a slip berth adjacent to the anchorage area in the Delaware River. The berth would be oriented perpendicular to the ship channel and out of the anchorage area to enhance the safety of the LNG ship while berthed. Section 2.4.1.3 provides additional information on these proposed dredging and dredge disposal activities.

The next step would be to construct the pier for the ship unloading facility. The pier would be constructed using a conventional "over the top" method of construction, which involves using land-based equipment to build the pier from the shore out into the river. This method would minimize the dredging that would otherwise be required to provide sufficient water depths for a barge-based construction approach. A large crawler crane would be used to drive the steel piles and to pick up and set the structural elements of the pier. Once the piles are in place, either precast concrete or fabricated steel pile caps and precast/prestressed girders or fabricated steel beams would be installed. A concrete deck with appropriate railing or barriers would be cast in place to contain the piping and form a roadway on the pier.

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The final step would be the construction of the berth structure, including the unloading platform and dolphins. The platform and dolphins would likely consist of cast-in-place or precast concrete decks with steel pipe pile foundations. Once the deck is completed, the unloading arms, fenders, mooring equipment, and walkways would be installed. Due to the sizes of some of the structural elements of the unloading platform and dolphins, a barge-based approach using marine equipment would be used to construct the berth structure.

2.4.1.3 Dredging and Dredge Disposal

About 800,000 cubic yards of sediment would be dredged from the berth area to construct a slip for LNG ships. The berth area would be dredged to a depth of 40 feet below mean lower low water (MLLW), which is the current depth of the adjacent anchorage area and ship channel. To reduce the dredging volume and to minimize impacts on subtidal shallow habitats, sheet piling would be used on three sides of the berth to form perpendicular walls. The sheet piling would extend about 30 feet above the dredged mud line and buoys would mark the locations of the submerged sheet piling. Figure 2.4.1-1 shows the proposed dredging area within the slip berth for LNG ships.

Because a disposal site is within feasible pumping distance and the sediments are relatively soft and unconsolidated, Crown Landing proposes to remove the sediments by hydraulic dredging. This type of dredging uses a dredge with a cutter section head to produce a slurry of sediments and water (approximately 20 percent solids and 80 percent water), which is essentially vacuumed up and pumped to a disposal site via a temporary discharge pipe. If boulders are encountered that would preclude the use of a hydraulic dredge, the dredged material would be removed through the selective use of a clamshell dredge, loaded in scows, and transported to the disposal facility discussed below.

The dredged material would be pumped directly to a confined disposal facility owned and operated by Weeks Marine Inc. The disposal facility is located about 4 miles northeast of the LNG terminal site on the New Jersey shoreline east of the Commodore Barry Bridge. This facility is an existing upland confined disposal facility that has approximately 8 million cubic yards of permitted capacity. The 800,000 cubic yards of dredged material would be pumped into an approximately 5.8 million cubic yard expansion area that is currently under construction. The dredge slurry would be transported by a temporary 28- to 30-inch-diameter steel pipe laid on the river bottom along the edge of the Marcus Hook anchorage area to the southern limits of the disposal cells (i.e., the point furthest from the discharge spillway). The disposal cells would be confined within a large earthen dike around the perimeter that would structurally contain the slurry. As the dredge material is deposited within the cell, the slurry would flow across the disposal cell and deposit suspended materials. The remaining water would flow out of the disposal cell through a weir and be discharged in accordance with existing permit conditions of the facility. The location of the confined disposal facility is shown on figure 2.4.1-2.

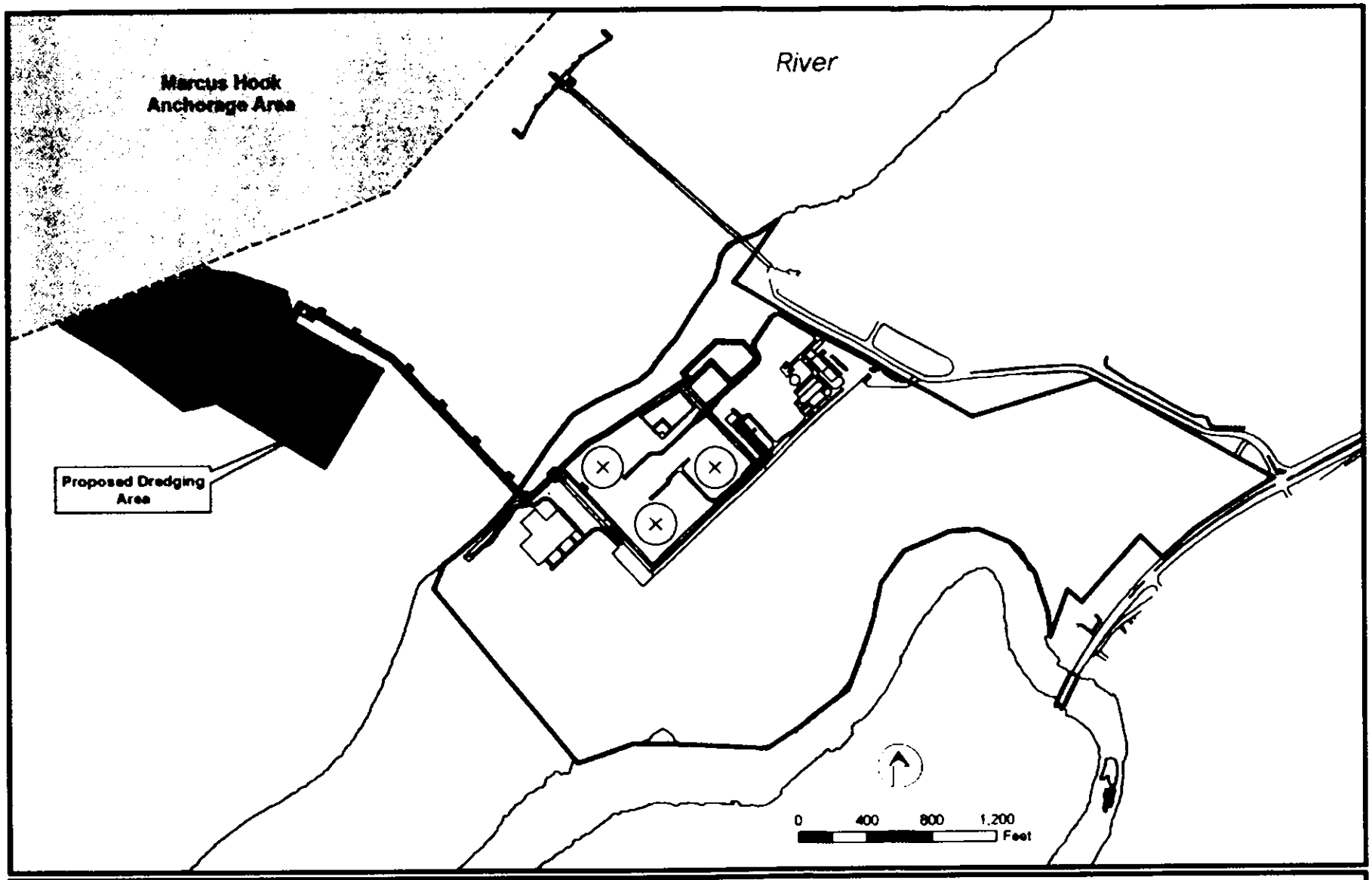

Figure 2.4.1-1
Crown Landing LNG Project
Proposed Dredging Area

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Non-Internet Public

Facility Location Map
Figure 2.4.1-2

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2.4.2 Pipeline Facilities

Construction of the Logan Lateral would primarily involve standard cross-country pipeline construction techniques in New Jersey and more specialized construction techniques in Pennsylvania. Due to constraints which limit the work area and the width of the construction right-of-way (e.g., residences and structures within 50 feet of the proposed construction right-of-way), special construction techniques would be used to install portions of the pipeline in residential and commercial areas. Special construction techniques would also be used when constructing the pipeline across or within waterbodies, wetlands, roads, and railroads. These special construction techniques are described in section 2.4.2.2.

Texas Eastern would construct the Logan Lateral in accordance with its SESC and SPCC Plans. The SESC Plan is consistent with our Plan and Procedures except as noted in section 1.2 of the SESC Plan. Both of these plans are provided in Appendix D.

2.4.2.1 General Construction Techniques

Figure 2.4.2-1 shows the typical steps of cross-country pipeline construction. Standard pipeline construction proceeds in the manner of an outdoor assembly line composed of specific activities that make up the linear construction sequence. These operations collectively include survey and staking of the right-of-way, clearing and grading, trenching, pipe stringing and bending, welding and coating, lowering-in and backfilling, hydrostatic testing, and cleanup.

Survey and Staking

Before construction, Texas Eastern crews would survey and stake the centerline and exterior boundaries of the construction right-of-way. The exterior boundary stakes would mark the limit of approved disturbance areas and would be maintained throughout the construction period. Utility lines would be located and marked to prevent accidental damage during pipeline construction. During this period, equipment involved in pipeline construction would be moved onto the right-of-way using existing roads for access wherever practicable.

Clearing and Grading

Texas Eastern would clear the right-of-way of shrubs and trees. In the absence of other agency regulations or the preferences of private landowners, trees would be stockpiled to the side or removed from the right-of-way before any soil disturbance activities in order to prevent soil mixing with cut timber. In accordance with our Plan, topsoil up to a depth of 12 inches would be stripped from the trench and spoil storage area and placed at the edge of the right-of-way in agricultural lands and residential areas. If there is inadequate space for topsoil segregation in residential areas, our Plan would alternatively allow Texas Eastern to import topsoil.

Trenching

Backhoes or trenching machines would be used to excavate a trench approximately 5 to 6 feet deep. The trench walls would generally be sloped outward. Depending on soil conditions, the top of the trench would typically be 9 to 12 feet wide and the bottom of the trench would typically be between 3 and 4 feet wide. In unstable and saturated soils, the trench could be wider.

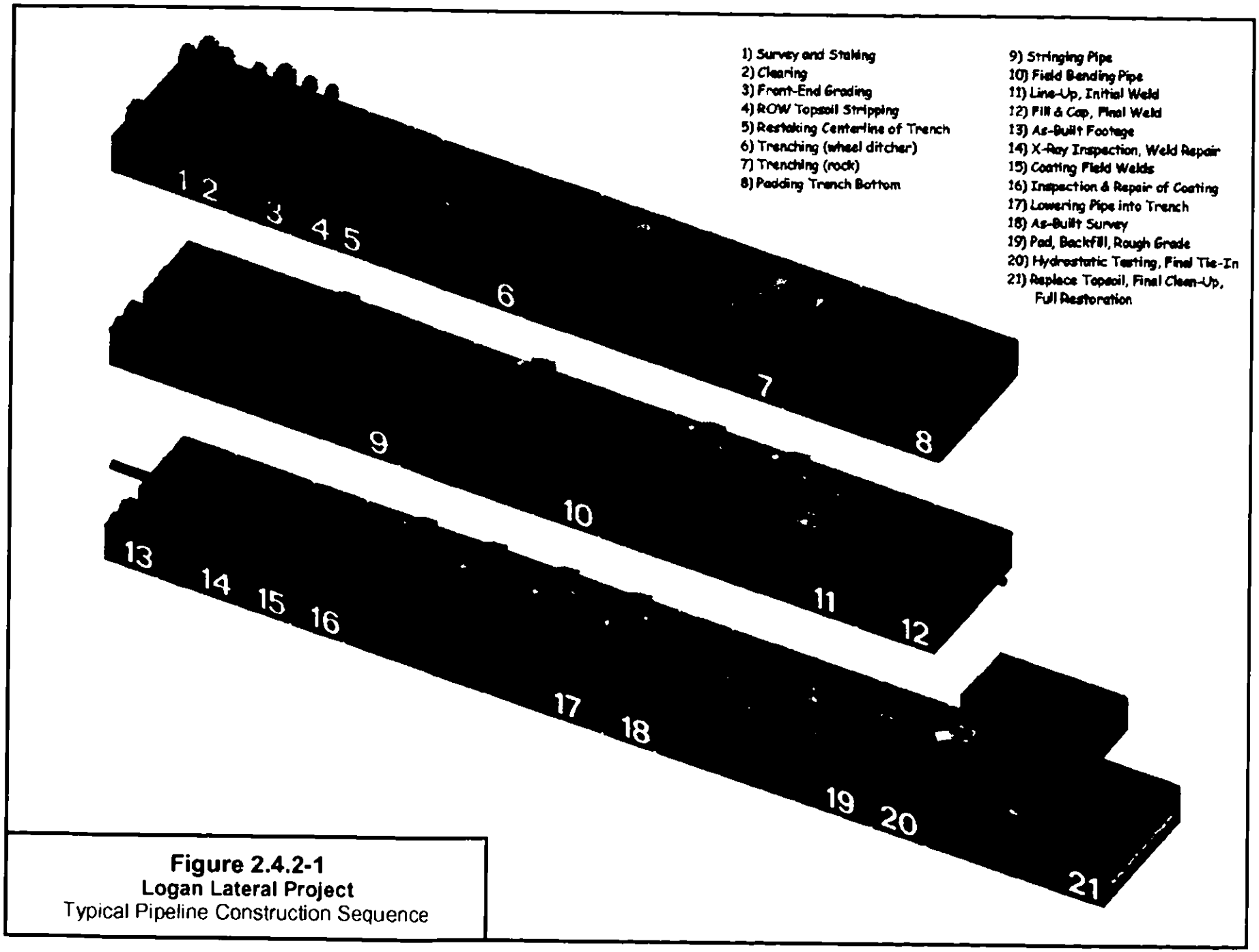

Figure 2.4.2-1
Logan Lateral Project
Typical Pipeline Construction Sequence

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Spoil material excavated during trenching operations would be temporarily piled to one side of the right-of-way adjacent to the trench. In areas where topsoil stripping is required, the topsoil and subsoil would be stored in separate windrows or piles on the construction right-of-way and would not be allowed to mix. Where trench dewatering is needed, water would be discharged directly to the ground if there is adequate vegetation along the right-of-way to filter the water effectively. Where vegetation is sparse or absent, or in environmentally sensitive areas (e.g., adjacent to streams or wetlands), hay bale filters or suitable filtering alternatives would be used to limit siltation.

Stringing and Bending

Either before or after trenching, individual joints of pipe would be strung along the right-of-way adjacent to the excavated trench and arranged to be accessible to construction personnel. This operation typically involves specially designed stringing trucks to deliver pipe from the pipe yard to the right-of-way. Small portable cranes and/or side-boom tractors are used to unload the stringing trucks and place the pipe along the trench line. A mechanical pipe-bending machine would bend individual joints of pipe to the desired angle to accommodate changes in the natural ground contour or pipeline alignment. In certain areas, prefabricated fittings would be used where field bending is not practicable.

Welding and Coating

After stringing and bending are complete, pipe sections would be aligned, welded together, and placed on temporary supports along the edge of the trench. Texas Eastern would inspect all welds, both visually and radiographically (i.e., x-ray), and would make repairs, if necessary. The pipe is typically delivered with a factory coating of fusion-bonded epoxy or similar material. Texas Eastern would apply coating at welded joints and would electronically inspect the entire pipeline coating to locate any flaws. All flaws in the coating would be repaired before the pipe is lowered into the trench.

Lowering-in and Backfilling

After welding and coating are completed, the pipe would be lowered into the trench by side-boom tractors. Bladed equipment or a specially designed backfilling machine would be used to backfill the trench. No construction debris, including wooden supports, welding rods, containers, brush, trees, or refuse of any kind, would be permitted in the backfill. If rocks are present in the backfill, the pipeline would be protected with rock shields or similar protective coating and/or backfilled with clean padding prior to backfilling with the rocky material.

Hydrostatic Testing

After backfilling, Texas Eastern would hydrostatically test the pipeline in accordance with DOT regulations to ensure that the system is capable of operating at the design pressure. The testing process would involve filling a segment of the pipeline with water and maintaining a prescribed pressure for a specified amount of time. If a leak or break in the line were to occur during testing, Texas Eastern would repair and retest that section of pipe until DOT specifications are met.

The length of individual test segments would be determined by topography and water availability. Water withdrawals used to fill and test the pipeline would be consistent with state regulations and our Procedures. Texas Eastern currently plans to obtain hydrostatic test water from a municipal source, Ridley Creek, and/or Delaware River. After testing is completed, the water would be discharged, either to Ridley Creek or the Delaware River, in accordance with our Procedures and permits issued by the state agencies. Texas Eastern has not yet determined the volume of hydrostatic test water needed nor the expected intake/discharge rates.

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Cleanup

After hydrostatic testing is completed, Texas Eastern would regrade and restore work areas as nearly as practicable to the original contour of the land. Topsoil would be respread over areas from which it was originally removed. Permanent soil stabilization efforts would primarily include revegetation of the right-of-way. Fences that are removed to install the pipeline would be reconstructed across the right-of-way.

Disposal of timber, slash, and rock would be in accordance with the desires of the landowner and consistent with local regulations and our Plan. In the absence of other agency regulations or the preferences of private landowners, timber would be stockpiled along the edge of the right-of-way. Slash would be stockpiled on the edge of the right-of-way, chipped and spread across the right-of-way in upland areas, hauled offsite, or burned onsite in accordance with local regulations. Excess rock would be stockpiled onsite if requested by the landowner, or disposed of in an alternative, landowner- and FERC-approved upland area or permitted landfill.

Restoration and Revegetation

Following installation and backfilling of the pipeline, original grade and contours would be restored and permanent erosion controls would be installed. Disturbed soils would be revegetated in accordance with Texas Eastern's SESC Plan, other permit requirements, and site-specific landowner requests. Turf, ornamental shrubs, and other landscaping material would be restored in accordance with landowner agreements.

2.4.2.2 Special Construction Techniques

Residential and Commercial Areas

Texas Eastern has indicated that it would use stovepipe or drag section construction techniques near some residential and commercial areas along the pipeline route to reduce the width of the construction right-of-way and thus minimize the disturbance area. These techniques are as follows:

- Stovepipe construction involves excavating limited segments of open trench and installing the pipeline one or two pipe sections at a time. Depending on the amount of workspace available, the excavated material is either temporarily stored on the reduced construction right-of-way or hauled offsite for temporary storage. Once one or two pipe sections are placed in the open trench, associated pipeline installation activities such as welding, radiography, and pipe coating are conducted in the trench. Following these activities, the trench is immediately backfilled.

- Drag section construction involves welding two or more pipe sections together in an area away from the residences and carrying the pipe into place for installation. This method reduces the construction workspace requirements near residences and also reduces the amount of time the residents are disturbed.

Texas Eastern would notify affected residents in advance of construction activities and coordinate any scheduled disruption of utilities and crossings of private roads or driveways. If construction activities disrupt the ingress/egress to a residence, Texas Eastern would offer to temporarily relocate the landowner to a motel and provide a meal allowance. Other mitigative measures that would be implemented near residences include maintaining a minimum distance of 25 feet between the construction right-of-way and residences; installing safety fencing along open trenches and along the construction right-of-way for a

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distance of 100 feet on either side of residences; and restoring landscaping and private structures as soon as practical. Texas Eastern would also develop site-specific construction plans for residences located within 25 feet of the construction right-of-way. These plans would address concerns such as dust control, noise minimization, access by landowners or occupants, and safety near open trenches. Additional measures that would be implemented to minimize construction-related impacts on residences are provided in the SESC Plan in Appendix D and further discussed in section 4.8.2.2.

Waterbody Crossings

Waterbody crossings would be constructed in accordance with our Procedures, Texas Eastern's SESC Plan, and applicable permits. Texas Eastern proposes to install the pipeline across all waterbodies except the Chester Creek, Delaware River, Raccoon Creek, and Birch Creek using the open-cut construction method. These open-cut crossings would involve excavation of the pipeline trench across the waterbody, installation of the pipeline, and backfilling of the trench with native material with no effort to isolate flow from construction activities. Excavation and backfilling of the trench would be accomplished using backhoes or other excavation equipment operating from one or both banks of the waterbody. Trench spoil would be stored at least 10 feet from the stream banks (topographic conditions permitting). Sediment barriers, such as silt fence and staked straw bales, would be installed to prevent spoil and sediment-laden water from entering the stream.

Texas Eastern proposes to construct the pipeline across Chester Creek, Delaware River, Raccoon Creek, and Birch Creek using the HDD technique, which essentially involves drilling a hole beneath the waterbody and installing the pipe in the drilled hole. The feasibility of this method depends on site-specific conditions such as subsurface lithology, crossing length, burial depth, sediment composition, bank conditions, availability of workspace, and access. The primary advantages of an HDD crossing are that the waterbody is not disturbed and boat traffic is not disrupted.

The HDD method consists of three steps: 1) drilling a pilot hole typically between 30 and 50 feet beneath the waterbody; 2) enlarging the pilot hole with a series of reamers to accommodate the pipeline; and 3) pulling a prefabricated section of pipe back through the hole. Drilling mud, consisting of a bentonite slurry, is used to lubricate the drill bit, maintain the hole, and remove drill cuttings. Bentonite is the commercial name for a mixture of non-toxic clays and rock particles consisting of about 85 percent montmorillonite clay, 10 percent quartz and feldspars, and 5 percent accessory materials, such as calcite and gypsum.

Each HDD crossing would require additional work areas for drilling equipment, pipe assembly, support vehicles, supplies and materials, temporary mud pits and tanks, access to the drilling sites; and areas to turn equipment around. Access to the stream bank would also be needed for placement of temporary surface wires to electronically track the HDD pilot drill across the waterbody. Access to the bank on either side of the stream may also be necessary to withdraw water as needed for hydrostatic testing of the pipe section. Texas Eastern would install erosion control measures in accordance with its SESC Plan to prevent runoff from the temporary work areas.

After the HDD is completed, drilling mud would be disposed of within the construction right-of-way or in an approved off-site landfill. Onsite disposal of drilling mud would be subject to landowner approval and would consist of spreading the mud over the disposal area followed by a tillage operation to work the dried mud into the soil.

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Wetland Crossings

Texas Eastern would construct the pipeline across wetlands in accordance with its SESC Plan, our Procedures, and applicable permits using primarily open-cut crossing methods. Woody vegetation would be cut off at ground level and removed from the wetlands leaving the root systems intact. Temporary erosion control devices would be installed as necessary immediately after initial disturbance of wetlands or adjacent upland areas to prevent sediment flow into wetlands, and would be maintained until revegetation is complete. Timber mats or terra mats would be used where necessary to stabilize the right-of-way for equipment, minimize rutting, and prevent the mixing of topsoil and subsoil. The pulling of stumps would not be permitted except in the area of the pipeline trench and in other areas where their removal is necessary for safety reasons.

In accordance with the SESC Plan and consistent with our Procedures, topsoil would be stripped over the trench line to a maximum depth of 12 inches in unsaturated soils and placed in a separate spoil pile. Following installation of the pipe, the trench would be backfilled and the topsoil replaced. Permanent trench breakers would be installed as necessary to maintain wetland hydrology. Natural contours of the wetland would be restored, any required permanent erosion control measures would be installed, and the area would be temporarily stabilized with appropriate vegetation to protect the wetland soil from erosion. Materials such as timber mats placed in wetlands during construction would be removed during final cleanup.

Roads and Railroads

Texas Eastern would construct road and railroad crossings in compliance with applicable state and local permits and approvals. Crossings at most paved public roads, private roads, and driveways would be open cut. This would involve trenching across the road, installing the pipeline, backfilling the trench, and then repairing and repaving the road. All open-cut road crossings would be completed as quickly possible. At least one lane of traffic would be maintained to the extent practical when constructing in residential streets. Any open trenches across roads would either be fenced or covered with steel plates during non-working hours. Steel plates would also be available onsite to cover open trenches to allow crossing by emergency vehicles.

At Bridgewater Road, Concord Road, Interstate 95, West 9th Street, and two railroad crossings the pipeline would be installed by boring underneath the road or railroad (bored crossing). Boring involves excavating a bore pit and a receiving pit on opposite sides of the road or railroad, placing a boring machine at the bottom of the bore pit, and augering a hole under the road or railroad to the receiving pit. As the bore is progressed, a casing is advanced with the auger and the pipe is pushed through the completed casing. No traffic would be disrupted during boring activities.

Albert Road would be drilled as part of the HDD for the Chester Creek crossing.

Texas Eastern proposes to construct the pipeline immediately adjacent to or within five city streets in Pennsylvania (Trimble Boulevard, Clearwater Avenue, Felton Avenue, Bethel Road, and Palmer Street). We are also recommending that Texas Eastern install the pipeline adjacent to Ward Street to minimize impacts on Veterans Memorial Park (see section 3.5.3). The stovepipe or drag section methods described above would generally be used to install the pipeline adjacent to or within these streets. Pipeline trenches in or adjacent to these streets would be backfilled or covered with steel plates daily. In addition, steel plates would be readily available to cover the trench in the event of an emergency that requires access across the trench. After the pipeline is installed under the road and the trench backfilled, the road would be repaired and repaved.

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2.5 CONSTRUCTION SCHEDULE

Crown Landing anticipates that the entire project would take approximately 3 years to construct. Crown Landing proposes to begin construction of the LNG facilities in late summer 2005 after all permits and approvals have been obtained. After the initial site mobilizations and preparation activities are completed, placement of fill material in the process area and installation of the pilings for the storage tanks would begin. Construction of the LNG storage tanks would begin in late 2005 and would take approximately 29 months to complete. Dredging of the berth slip would also begin in late summer 2005 with the ship unloading facility completed about 19 months later. Construction of the LNG process facilities and support buildings would begin in the early spring 2006. Crown Landings plans to begin operation of the terminal in the summer 2008.

Texas Eastern would begin construction of the Logan Lateral in 2007 and be in-service in 2008 at the completion of the LNG terminal.

2.6 ENVIRONMENTAL COMPLIANCE, INSPECTION, AND MITIGATION MONITORING

In preparing construction drawings and specifications for the project, Crown Landing and Texas Eastern would incorporate mitigation measures identified in their applications as well as requirements of federal, state, and local agencies. Contractors would also be provided copies of applicable environmental permits.

Prior to construction, Crown Landing and Texas Eastern would provide environmental training to all construction personnel regarding environmental conditions and proper implementation of environmental mitigation measures. This environmental training would be ongoing during construction.

Both Crown Landing and Texas Eastern would each be required to have at least one Environmental Inspector during construction of the facilities to ensure quality assurance and compliance with environmental mitigation measures, other applicable regulatory requirements, and company specifications. The Environmental Inspector's duties are described in our Plan and Procedures and would include ensuring compliance with environmental conditions attached to any authorization, other permits or authorizations, and to Crown Landing's or Texas Eastern's environmental designs and specifications.

In addition, FERC staff would conduct inspections to monitor the project for compliance with the Commission's environmental conditions.

2.7 OPERATION AND MAINTENANCE PROCEDURES

2.7.1 LNG Terminal

Imported LNG would be obtained from liquefaction plants throughout the world and delivered via LNG ships to the proposed terminal. At least 96 hours prior to its arrival, each LNG ship would notify the terminal, the Coast Guard, the Immigration and Naturalization Service, pilots, tug operators, and shipping agents. The Coast Guard may inspect the ship prior to entry into U.S. territorial waters and before the inbound transit up the Delaware Bay and River. A licensed Delaware River Pilot would advise the LNG ship Captains on the navigation of the ships on the Delaware River. In addition, a Docking Pilot would board each ship downstream of the Delaware Memorial Bridge to navigate the ship upriver to the LNG terminal berth as well as navigate the ship back down river upon departure. Two tugs would be secured fast to the ship downstream of the Delaware Memorial Bridge and would escort the ship to and from the LNG terminal. The 71-mile transit from the mouth of the Delaware Bay to the LNG terminal would take about 5.5 hours.

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At the terminal, the tugs would assist in maneuvering and docking the ship at the unloading facility and one tug would standby during unloading operations. The berth would be equipped with an electronic docking assistance system that would facilitate docking operations. Once securely docked at the berth of the unloading facility with the bow facing the river channel, the ship would attach to the unloading arms and transfer LNG to the storage tanks using the ship's LNG pumps. The unloading arms would be designed to offload LNG from the ships at a rate up to 14,000 m^3/hr. As the LNG is offloaded, ballast water would be taken on to compensate for the loss of cargo. No ballast water or sanitary waste would be discharged into the river. After the LNG is offloaded, the ship would be detached from the unloading arms and mooring and breasting dolphins, moved from the berth with tug assistance, and then proceed seaward under the supervision of a Delaware River Pilot. The entire offloading process from docking to undocking would take about 24 hours.

LNG would be stored in the storage tanks at a temperature of approximately -260° F. Boil-off gas generated from vaporization of LNG while in the storage tanks, and piping and flash gas from pump circulation would be compressed by boil-off gas compressors and then passed to a condenser system, where it would be condensed into the outgoing LNG.

A series of in-tank and second stage sendout pumps would be used to pressurize the stored LNG to pipeline pressure and to pump the pressurized LNG to the vaporizers. The LNG would be vaporized in a closed-loop shell and tube heat exchanger system. Nitrogen would be injected into the vaporized LNG, as needed, to lower the Btu content to pipeline specifications. The natural gas would be odorized and then discharged into the sendout pipelines for delivery to markets.

Crown Landing would operate and maintain the facilities in compliance with 49 CFR 193, 33 CFR 127, NFPA 59A, and other applicable federal and state regulations. In accordance with 49 CFR 193.2503 and 193.2605 and sections 11.3.1 and 11.5.2 of NFPA 59A, Crown Landing would be required to prepare operation and maintenance manuals that address specific procedures for the safe operation and maintenance of the LNG storage and process facilities. These manuals would address startup, shutdown, cooldown, purging, and other routine operation, maintenance, and monitoring procedures. In accordance with 33 CFR 127.305, Crown Landing would also prepare an operation manual that addresses specific procedures for the safe operation of the ship unloading facility. These manuals would include training requirements and programs for operations and maintenance personnel.

2.7.2 Pipeline Facilities

Texas Eastern would be responsible for operating and maintaining the Logan Lateral facilities in accordance with 49 CFR 192, Minimum Federal Safety Standards for the Transportation of Natural and Other Gas by Pipeline, as required by the DOT. Columbia Gas and Transco would be responsible for operating and maintaining their respective meter and regulation stations on the LNG terminal site. Section 4.12.7 presents a discussion of the DOT's safety regulations and requirements for natural gas pipelines and describes how these requirements would be met by the pipeline operator.

The pipeline would be regularly inspected by aerial patrols or on-the-ground inspections to observe general right-of-way conditions and to identify any natural gas leaks, construction activity on or near the permanent right-of-way by outside parties, evidence of possible pipeline damage, or damage to erosion-control structures. All inspections would be in accordance with DOT standards. Any erosion or unstable conditions observed on the right-of-way would be repaired as necessary. The aboveground facilities would be inspected at intervals that meet or exceed DOT requirements. During these inspections, equipment would be tested, recalibrated, and repaired as needed.

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2.8 SAFETY CONTROLS

2.8.1 LNG Terminal

The LNG terminal would be sited, designed, constructed, operated, and maintained in compliance with federal safety standards. Federal siting and design requirements for LNG facilities are summarized in table 2.8.1-1.

TABLE 2.8.1-1

Federal Siting and Design Requirements for LNG Facilities

Requirement	Description
Thermal Radiation Protection (49 CFR 193.2057 and section 2.2.3.2 of NFPA 59A)	This requirement is designed to ensure that certain public land uses and structures outside the LNG facility boundaries are protected in the event of an LNG fire.
Flammable Vapor-Gas Dispersion Protection (49 CFR 193 2059 and sections 2.2.3.3 and 2.2.3.4 of NFPA 59A)	This requirement is designed to prevent a flammable vapor cloud associated with an LNG spill from reaching a property line that can be built upon.
Wind Forces *(49 CFR 193.2067)*	*This requirement specifies that all facilities be designed to* withstand wind forces of not less than 150 miles per hour without the loss of structural integrity.
Impounded Liquid (section 2.2 3.8 of NFPA 59A)	This requirement specifies that liquids in spill impoundment basins cannot be closer than 50 feet from a property line that can be built upon or a navigable waterway.
Container Spacing (section 2.2 4.1 of NFPA 59A)	This requirement specifies that LNG containers with capacities greater than 70,000 gallons must be located a minimum distance of 0.7 times the container diameter from the property line or buildings
Vaporizer Spacing *(section 2.2.5.2 of NFPA 59A)*	*This requirement specifies that integral heated vaporizers must* be located at least 100 feet from a property line that can be built upon and at least 50 feet from other select structures and equipment.
Process Equipment Spacing (section 2.2.6 1 of NFPA 59A)	This requirement specifies that process equipment containing LNG or flammable gases must be located at least 50 feet from sources of ignition, a property line that can be built upon, control rooms, offices, shops, and other occupied structures.
Marine Transfer Spacing (33 CFR 127.105)	This requirement specifies that each LNG unloading flange must be located at least 985 feet from any bridge crossing a navigable waterway.
Proximity to Airport Runways (49 CFR 193.2155)	This requirement specifies that an LNG storage tank must not be located within a horizontal distance of 1 mile from the ends of or 0.25 mile from the nearest point of an airport runway, whichever is longer.

2.8.1.1 Spill Impoundment System

A spill impoundment system would be constructed at the LNG terminal in accordance with the requirements of 49 CFR Part 193 and NFPA 59A. The system would include concrete pads and curbing under all LNG-containing equipment and piping, concrete trenches to drain spilled LNG away from the equipment and piping, and five concrete and earthen sumps to collect the spilled LNG in safe locations remote from property lines, equipment, and buildings. Impoundment sumps would be constructed for the following five design spills:

- Major Spill: An earthen impoundment sump designed to collect a 10-minute spill from the 44-inch-diameter LNG unloading line would be located in the northeast corner of the earthen dike surrounding the storage tanks. This sump would be 172 feet wide, 240 feet long, and 4 feet deep;

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- LNG Tank Withdrawal Header Design Spill: An earthen impoundment sump designed to collect a 10-minute spill from an 18-inch-diameter storage tank withdrawal line would be located within the major spill sump. This sump would be 83 feet wide, 83 feet long, and 3 feet deep;

- Process Area Design Spill: A concrete impoundment sump designed to collect a 10-minute spill from a 1-inch instrument connection at the discharge header of the high-pressure sendout pumps would be located within the LNG tank withdrawal header spill sump. This sump would be 32 feet wide, 32 feet long, and 4 feet deep;

- Marine Transfer Area Design Spill: A concrete impoundment sump designed to collect a 10-minute spill from a 1-inch instrument connection at the discharge header of the unloading arms would be located on the pier adjacent to the ship unloading platform. This sump would be 6 feet wide, 32 feet long, and 3 feet deep; and

- Shoreline Isolation Valve Area Design Spill: A concrete sump designed to collect a 10-minute spill from a shoreline isolation valve would be located on the pier adjacent to the shoreline isolation valve area. This sump would be 7 feet wide, 7 feet long, and 3 feet deep.

The impoundment sumps for the major spills, LNG tank withdrawal header, and the process area would be integrated to allow the concrete sump to fill first and then overflow into the large earthen sumps. The concrete trenches used to drain LNG spills towards the impoundment sumps would also be an integrated system. The main trench located on the pier and onshore would be a minimum of 18 feet wide and 2 feet deep and would be designed to accommodate a major spill. A smaller trench (3 feet wide and 2 feet deep) would be located within the onshore portions of the main trench and would be designed to accommodate the LNG tank withdrawal header and process area spills.

The impoundment sumps would contain pumps to remove collected stormwater. Any stormwater collected in the spill containment system would be routinely pumped from the impoundment sumps to the onsite stormwater management system. The sumps and trenches would be equipped with automatic level control activators and low-temperature sensors and switches to prevent operation of the pumps in the event of an accidental release of LNG to the sumps.

In addition to the above spill impoundment system, an earthen berm would be constructed around the LNG storage tanks and impoundment sump area to prevent the offsite release of spilled LNG. The berm would be 10 feet high and would be capable of containing over 100 percent of the maximum liquid capacity of one of the tanks.

2.8.1.2 Fire and Hazard Detection System

Fire and hazard detectors would be installed throughout the facility to:

- provide operating personnel early detection of releases of flammable gases and fires;

- show the general location of a release or fire; and

- initiate shutdown of equipment in the affected portion of the facility.

The fire and hazard detection system would include:

- combustible gas and low-temperature detectors to monitor for potentially hazardous conditions;

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- high-temperature, smoke, and ultraviolet/infrared (UV/IR) flame detectors to monitor for fire;
- an integrated system that would be monitored from a main control room; and
- automatic emergency shutdown capabilities in the event of hazard or fire detections.

Locations where smoke, combustible gas, and UV/IR flame detectors would be installed are summarized in table 2.8.1-2.

High-temperature detectors would be installed on the relief valves of the LNG storage tanks to detect a fire in the discharge vents of the tanks. As discussed in the previous section, low-temperature detectors would be installed in the spill impoundment sumps and trenches to prevent the start-up of the stormwater pumps should there be an accidental release of LNG to the sumps or trenches. Low-temperature detectors would also be installed in the discharge vents of the tanks to detect the release of cold vapors.

Crown Landing would also install a closed-circuit television system to monitor key facilities. This system would be used to detect visual evidence of LNG releases, fires, or other emergencies as well as to monitor site security.

TABLE 2.8.1-2

Proposed Locations of Smoke, Combustible Gas, and UV/IR Flame Detectors at the LNG Terminal

Detector Location	Combustible Gas a/	UV/IR Flame a/	Smoke a/
BUILDINGS			
Administration Building	4		4
Maintenance Shop	2		4
MCC Building	2		2
Main Control Room	2		2
Pier Control Building	2		2
Utility Building	2	2	3
Heater Building	8	4	
Boil-off Gas Compressor Building	4	4	
Emergency Generator Enclosure	1		1
PROCESS AREAS			
Nitrogen Plant Area	2	4	
High Pressure Pump Area	4	4	
Vaporizer Area	4	4	
Metering Area	3	2	
Flare Area	1		
Warm Water/Ethylene Glycol Pumps		2	
Water/Ethylene Glycol Expansion Tank	1		
MARINE AREAS			
Ship Unloading Platform	4	2	
Shoreline Isolation Valve Area	2	2	
LNG STORAGE TANKS			
Tank Roof Platforms	12	6	

a/ Numbers represent the number of detectors to be installed at each location.

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2.8.1.3 Fire and Hazard Control System

The fire and hazard control system would be designed in accordance with NFPA 59A requirements and would provide for extinguishing Class A fires; cooling tanks, structures, and equipment exposed to thermal radiation; and dispersing flammable vapors. The main components of the system would include:

- an approximate 300,000 gallon firewater storage tank, which would be filled from onsite wells;
- two firewater pumps (one electric and one diesel engine-driven) and one electric jockey pump that would supply an underground firewater loop; and
- a firewater piping distribution system that would provide water to firewater monitor nozzles, hydrants, and hoses located throughout the onshore and offshore facilities.

Fixed dry chemical extinguishment skids and wheeled dry chemical extinguishment units would be located in the process areas and on the ship unloading platform as listed in table 2.8.1-3. Dry chemical extinguishment units would also be provided on the LNG storage tank relief valves. Portable hand-held dry chemical and carbon dioxide (CO_2) fire extinguishers would be provided in buildings and in the process areas as listed in table 2.8.1-3.

2.8.1.4 Emergency Shutdown System

The proposed LNG terminal would have an emergency shutdown system (ESS) that would isolate and shut off sources of combustible gas and automatically shut down process equipment. ESS pushbuttons would be located at various locations throughout the LNG terminal to manually activate an overall emergency shutdown as well as other zoned emergency shutdowns that control groups of related equipment such as the ship unloading facility or the terminal sendout system. An emergency shutdown could also be activated automatically by the fire and hazard detection system (see section 2.8.1.2) upon detection of a fire or a release of combustible gas. In addition, ESSs on the LNG ships would be interfaced with the terminal ESS during ship unloading operations. When an emergency shutdown is activated, audible alarms would be activated throughout the facility and visual alarms would be activated in the main control room and the pier control room. After an emergency shutdown, normal operations would be stopped until the emergency is resolved and the ESS has been reset in the main control room.

2.8.2 Pipeline Facilities

The pipelines and aboveground facilities associated with the Logan Lateral Project would be designed, constructed, operated, and maintained in accordance with DOT Minimum Federal Safety Standards in 49 CFR 192. These safety standards are discussed in section 4.12.7.

2.8.2.1 Corrosion Protection and Detection Systems

Texas Eastern would add a protective coating of fusion bond epoxy on the exterior of the pipe to prevent or minimize corrosion. A cathodic protection system would also be installed to prevent or minimize corrosion of the pipeline facilities. Direct current in the ground flows from sacrificial anodes in zinc ground bed systems through the earth to the pipeline (cathode). This system reverses the natural current flow from the pipeline to the ground, which could result in corrosion at imperfections in the pipeline coating.

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TABLE 2 8.1-3

Proposed Locations of Fire Protection System Equipment at the LNG Terminal

Location	Firewater		Fire Extinguishers			
	Hydrants	Monitors	Skid Mount Dry Chem	Wheeled Dry Chem	Hand-held Dry Chem	Hand-held CO_2
BUILDINGS						
Administration Building	1				4	
Guardhouse					1	
Maintenance Shop	1				2	
MCC Building	2	2				2
Main Control Room						2
Pier Control Room						2
Utility Building	1	1			2	
Heater Building	2	2			2	
Boil-off Gas Compressor Building	1	1		1	2	
PROCESS AREAS						
Nitrogen Plant Area	3	3		1	4	
High Pressure Pump Area	2	2	1	1	1	
Vaporizer Area	2	2	1	1	1	
Metering Area	2	2		1	1	
Flare Area	1	1			1	
MARINE AREAS						
Ship Unloading Platform	2	2	2	1	2	
Firewater Connection to Ship	2					
LNG STORAGE TANKS						
Tank Roof Platforms					6	
Tank Pressure Relief Valve Stacks			12			

a/ Numbers represent the number of extinguishers to be installed at each location.

2.8.2.2 Emergency Response Procedures

Pipeline system emergencies can include gas leaks, fire or explosion, and/or damage to the pipeline and aboveground facilities. In accordance with DOT regulations, Texas Eastern would develop a new plan or revise its existing plan to address procedures to be followed in the event of an emergency along the pipeline. This plan would include training of employees on emergency procedures; establishing liaisons with appropriate fire, police, and other community officials; and informing the public on how to identify and report an emergency condition on the pipeline route.

2.9 FUTURE PLANS AND ABANDONMENT

Crown Landing and Texas Eastern have no future plans for expansion or abandonment of the proposed LNG terminal or pipeline. Depending on future market demand, additional vaporizers could be added to increase the sendout capacity of the facility.

Future dredging of the ship berth would be needed to maintain the appropriate depth for safely mooring ships at the berth. Based on its sediment transport analysis, Crown Landing estimates that the sedimentation rate in the ship berth would be about 60,000 to 90,000 cubic yards per year. Crown Landing anticipates that maintenance dredging of the berth would be conducted on an annual basis and the dredged material would be disposed of at the Weeks confined disposal facility. Any future dredging would require permits from the appropriate federal and state agencies.

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3.0 ALTERNATIVES

In considering Crown Landing's and Texas Eastern's applications, the FERC will review both the environmental and non-environmental record in deciding whether it is in the public convenience and necessity to issue any authorization for the project. In accordance with NEPA and Commission policy, we have evaluated a number of alternatives to the Crown Landing LNG Project and Logan Lateral Project to determine if any are reasonable and environmentally preferable to the proposed actions. Alternatives described in the following sections include no action or postponed action, system alternatives, LNG terminal site alternatives, LNG pier alternatives, and pipeline alternatives.

The evaluation criteria for selecting potentially reasonable and environmentally preferable alternatives include whether they:

- are technically and economically feasible, reasonable, and practical;
- offer significant environmental advantage over the proposed projects; and
- meet the project objectives of providing additional natural gas supplies to meet the increasing energy demand in the Mid-Atlantic region through its interconnection with the interstate natural gas pipeline grids.

With respect to the first criteria, it is important to recognize that not all conceivable alternatives are technically and economically feasible and practical. Some alternatives may be impracticable because they are unavailable and/or incapable of being implemented after taking into consideration costs, existing technologies, and logistics in light of the overall project purpose. In conducting a reasonable analysis, it is also important to consider the environmental advantages and disadvantages of the proposed action and to focus the analysis on those alternatives that may reduce impacts and/or offer a significant environmental advantage.

Through the application of evaluation criteria and subsequent environmental comparisons, each alternative was considered to a point where it was clear that the alternative was not reasonable or would result in significantly greater environmental impacts that could not be readily mitigated. Those alternatives that appeared to be the most reasonable with less than or similar levels of environmental impact are reviewed in the greatest detail.

3.1 NO ACTION OR POSTPONED ACTION

The Commission has three alternative courses of action in processing an application for a Certificate. It may: 1) deny the Certificate; 2) postpone action pending further filings or study; or 3) grant the Certificate with or without conditions.

If the Commission denies the Certificate or postpones action on the application, the short- and long-term environmental impacts identified in this EIS would not occur. If the Commission selects the no action or postponed action alternative, however, the objectives of the proposed project would not be met and Crown Landing would not be able to provide a new and competitively priced supply of natural gas to the Mid-Atlantic region. It is purely speculative to predict the resulting effects and actions that could be taken by other suppliers or users of natural gas in the region as well as any associated direct and indirect environmental impacts. However, demand for energy in the Mid-Atlantic region is predicted to increase, customers would have fewer and potentially more expensive options for obtaining natural gas supplies in the near future. This might lead to alternative proposals to develop natural gas delivery or storage

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infrastructure, increased conservation or reduced use of natural gas, and/or the use of other sources of energy.

The adoption of the no action alternative would result in the need for other LNG facilities or additional pipeline capacity to meet the increasing demand for natural gas in the Mid-Atlantic region. This might include constructing or expanding regional pipelines as well as LNG import and storage systems. Any construction or expansion work would result in specific environmental impacts that could be less than, similar to, or greater than those associated with the Crown Landing LNG Project. We have conducted and included in this EIS an analysis of what appear to be the most reasonable natural gas and LNG system alternatives that have the potential to meet the project objectives (see section 1.2).

Denying or postponing a decision on Crown Landing's and Texas Eastern's applications could limit access to new supplies of natural gas in the future, which could in turn contribute to higher natural gas prices. Higher prices could potentially result in customers conserving or reducing the use of natural gas. During the energy crisis of the 1970s, numerous aggressive energy conservation programs were developed. Although additional conservation measures may have some affect on the demand for natural gas, conservation efforts are not expected to significantly reduce the long-term requirements for natural gas or effectively exert downward pressures on gas prices (EIA, 2003). On the other hand, it seems more likely that higher natural gas prices would adversely influence the regional economy by reducing realized household incomes and business profits (Greenspan, 2003).

Denying or postponing a decision on Crown Landing's and Texas Eastern's applications could also force potential customers of the natural gas provided by the project to seek regulatory approval to use other forms of energy. Nuclear or renewable energies such as hydroelectric, wind, or solar are not commercially viable substitutes able to replace or significantly offset the demand for natural gas over the next 20 years (EIA, 2003). Furthermore, each of these forms of energy involves significant environmental issues such as the disposal of toxic materials, alterations to hydrological/biological systems, and visual impacts.

Compared to other fossil fuels such as coal or oil, natural gas is a relatively clean and efficient fuel that can reduce the emission of regulated pollutants (e.g., nitrogen oxides, sulfur dioxide, and particulate matter) or unregulated greenhouse gases (e.g., carbon dioxide). Given there are emissions associated with producing, processing, transmitting, and distributing natural gas and other fossil fuels, it is difficult to accurately quantify the impact of an LNG import project on air quality. However, credible estimates of air emissions can be developed based on reasonable assumptions regarding burning natural gas delivered by the project compared to burning fossil fuels that would likely be utilized if the gas from the project was not available. Table 3.1-1 lists the emissions that would result from the Crown Landing LNG Project assuming it provides about 1.2 Bcfd of natural gas to the market and the corresponding emissions that would result if an equivalent amount of energy were generated using coal or fuel oil in lieu of natural gas. It is clear from the table that the use of either fuel oil or coal would increase emissions significantly. Additionally, to comply with current air emission regulations, emission control technologies could be required that could limit the economic viability of any new oil- or coal-fired facility.

In addition to the increased emissions associated with the burning of coal or fuel oil, each of these fuels would also have to be imported into the project area and stored, similar to the proposed LNG. Also, since there is no pipeline infrastructure in place to distribute these fuels to market in the Mid-Atlantic, use of these fuels would require more truck, barge, and train trips than the distribution of an equivalent amount of energy derived from natural gas, which would increase air emissions and traffic congestion.

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TABLE 3.1-1

Comparison of Air Emissions from Burning Fossil Fuels a/

Fossil Fuel	SO_2 (tpy)	NO_x (tpy)	PM_{10} (tpy)	CO_2 (tpy)	C (tpy)
Natural Gas	132	19,866	1,590	21,999,999	6,000,000
Fuel Oil	103,971	39,735	2,253	31,899,999	8,700,000
Coal	278,142	139,071	6,159	41,799,999	11,400,000

a/ The emissions generated by coal, fuel oil, and natural gas were estimated using recent Best Available Control Technology (BACT) analyses identified on the EPA Reasonably Available Control Technology/BACT/Lowest Achievable Emission Rate Clearinghouse for boilers with heat input ratings between 100 and 250 million Btus per hour The emissions from each fuel source are estimated based on a total annual fuel use of 438,000,000 million Btus per year (1.2 billion cubic feet per day, 365 days per year, 1,000 Btus/cubic foot).

SO_2 sulfur dioxide
NO_x nitrogen oxides
PM_{10} particulate matter
CO_2 carbon dioxide
C carbon
tpy tons per year

3.2 SYSTEM ALTERNATIVES

System alternatives are options to the proposed action that would make use of other existing or proposed LNG or natural gas facilities to meet the stated objectives of the proposed project. A system alternative would make it unnecessary to construct all or part of the proposed project even if some modifications or additions to the existing or proposed facilities are necessary. These modifications or additions would result in environmental impacts that could be less, similar to, or greater than those associated with construction of the proposed project. Ultimately, the purpose of identifying and evaluating system alternatives is to determine whether potential environmental impacts associated with the construction and operation of the Crown Landing LNG Project could be avoided or reduced by using another system.

The Mid-Atlantic natural gas market is concentrated in Delaware, Maryland, New Jersey, New York, and Pennsylvania. Currently, this market area is supplied with natural gas and vaporized LNG through interstate pipeline systems and an existing LNG import terminal in Cove Point, Maryland. As described in section 1.2, the objectives of the Crown Landing LNG Project are to provide a new LNG import terminal and up to 1.2 Bcfd of new natural gas to the Mid-Atlantic region. The analysis below examines other potential existing, modified, or proposed LNG terminals and pipeline systems and considers whether these systems could meet the proposed project objectives.

3.2.1 Existing LNG Facilities

Currently, there are four existing LNG terminals in the United States. These include the Cove Point LNG Terminal in Cove Point, Maryland; the Distrigas LNG Terminal in Everett, Massachusetts; the Trunkline LNG Terminal in Calcasieu Parish, Louisiana; and the Southern LNG Terminal on Elba Island in Chatham County, Georgia. The closest of these terminals is the Cove Point LNG Terminal, which is located about 115 miles from the project area. The other LNG import terminals are located considerably further away. For these existing facilities to meet the proposed project objectives, one or more of the facilities would need to provide similar ship unloading, storage, and sendout capacities as the proposed project in addition to its current or planned expansion capacities.

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Cove Point LNG Terminal

An LNG import terminal owned by Dominion Cove Point LNG, LP (Dominion) is located on the western shore of the Chesapeake Bay in Calvert County, Maryland. Although originally authorized in 1972, the Cove Point LNG Terminal was decommissioned as an LNG import facility in the early 1980s, and in 1995 returned to service as a peakshaving facility, liquefying, storing, and vaporizing LNG as needed to meet demand. In 2001 and 2002, Dominion received authorization from the FERC to reactivate, repair, and replace various offshore and onshore facilities to convert the existing peakshaving plant and recommission the LNG import terminal, and was completed and placed in service in December 2004. This reactivation included the replacement of the vaporizer components and the addition of a new 135,000 m^3 LNG storage tank in addition to the four existing 60,000 m^3 tanks. The LNG terminal now has 375,000 m^3 of LNG storage capacity and is capable of delivering a total of about 1.0 Bcfd of natural gas. The facility also has a maximum ship unloading capacity of 120 ships per year. The LNG terminal is connected to a mainline pipeline system by an 87-mile-long, 36-inch-diameter sendout pipeline. Dominion has long-term binding precedent agreements for 100 percent of the firm LNG unloading, storage, and delivery services.

Dominion recently proposed another expansion, which is currently in the Commission's Pre-filing process (in Docket No. PF04-15-000), to increase the daily sendout capacity from 1.0 Bcfd to 1.8 Bcfd and to increase the storage capacity from 7.8 Bcf to 14.6 Bcf. The planned expansion would include the construction of two additional 160,000 m^3 LNG storage tanks on the existing LNG terminal site and the construction of five new natural gas pipelines totaling about 161 miles in length to deliver additional capacity to pipeline systems in Virginia and Pennsylvania. These pipelines would include about 47 miles of 36-inch-diameter pipeline in Maryland and about 81 miles of 24-inch-diameter pipeline in Pennsylvania. As part of the new pipeline system in Pennsylvania, Dominion plans to construct two new compressor stations. In addition, three pipelines in Pennsylvania would be constructed to support the storage and transport of natural gas at the Leidy Hub, including two 24-inch-diameter pipeline loops totaling 23 miles in length and one 20-inch-diameter pipeline loop totaling 10 miles in length. The expansion would also include pipeline upgrades, modifications at existing aboveground facilities, and other minor facility modifications.

Although the proposed expansion could potentially deliver a substantial amount of the volumes of natural gas proposed by Crown Landing, the additional pipeline facilities for the Cove Point LNG Terminal expansion, totaling about 161 miles of new pipeline, would likely result in as much, if not more, environmental impact than Crown Landing's proposed LNG terminal and Texas Eastern's proposed pipeline. Therefore, this alternative does not provide a clear environmental advantage over the proposed projects. In addition, Crown Landing's proposed LNG terminal would bring in a new supply of LNG that would provide additional flexibility and reliability in the Mid-Atlantic states so customers could have alternate supplies.

Distrigas LNG Terminal

The only existing LNG import terminal in New England is the Distrigas LNG facility owned by Tractabel LNG North America, L.L.C. (Tractabel). The facility occupies a 24-acre site on the Mystic River in Boston Harbor that is surrounded by industrial development on all sides. In service since 1971, the Distrigas facility is the oldest LNG import terminal in the United States. In 2000 and 2001, the FERC authorized installation of a vapor recovery system to recover flash gas during ship unloading (which is complete), replacement of all vaporizers to be compatible with a new thermal transfer system with a new adjacent power plant (which is pending), and the installation of additional vaporizers and pumps to provide natural gas service to an electric power generation plant under construction by Sithe Mystic Development, L.L.C. (which is under construction). The facility has two tanks that can store 155,000 m^3

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of LNG. When ongoing and planned construction is complete, the facility will have an installed vaporization capacity of 1.035 Bcfd, although maximum sendout is limited to 715 million cubic feet per day (MMcfd) due to pipeline capacity. A significant quantity of LNG is loaded onto LNG trucks and delivered to peakshaving facilities throughout New England. The four-bay truck station on the site can fill up to 100 trucks per day. Recently, about 50 LNG ships per year have been unloading at this facility.

The Distrigas facility is dedicated to LNG imported by Tractabel and is not operated as an open-access import terminal that provides terminalling services to other parties. To provide the same service as proposed by Crown Landing, it would be necessary to add another 450,000 m^3 of storage and 1.2 Bcfd of vaporization. There is no space on the existing 24-acre site to construct the additional facilities associated with the proposed Crown Landing LNG Project, nor is there available adjoining property to accommodate these facilities and the associated exclusion zones. As a result, expansion of the existing Distrigas LNG import terminal is not a reasonable system alternative.

Trunkline LNG Terminal

CMS Trunkline LNG Company, L.L.C. (Trunkline LNG) currently owns and operates an LNG import facility in Calcasieu Parish, Louisiana. The existing LNG terminal includes three 95,000 m^3 storage tanks, a ship unloading dock with a full design capacity of 120 ships per year, and vaporization facilities with a maximum sendout capacity of 1 Bcfd. In December 2002, the Commission approved plans to add a second ship unloading dock, a 140,000 m^3 LNG storage tank, three first stage LNG pumps, four second stage LNG pumps, three vaporizers, and two electric generators. With the addition of these facilities, which are currently under construction, the LNG terminal will have a sustainable sendout capacity of about 1.2 Bcfd (1.3 Bcfd maximum) and a ship unloading capacity of about 175 ships per year. In February 2004, Trunkline LNG and a related subsidiary, CMS Trunkline Gas Company, L.L.C. (Trunkline Gas), announced plans to further expand sendout capacity of the terminal by adding pumps, vaporizers, and new unloading facilities to a second dock at the terminal and constructing a new 23-mile-long, 30-inch-diameter pipeline between the LNG terminal and Trunkline Gas' existing mainline pipeline system. If approved, these new facilities would increase the maximum sendout capacity of the terminal to about 2.1 Bcfd. Trunkline LNG currently has signed agreements with BG LNG Services, L.L.C. (BG LNG) for all of the storage and sendout capacity that will be provided by the expanded facilities.

After these expansions are completed, the Trunkline LNG facility is unlikely to have space for more storage tanks within its 125-acre fenced site. Further expansion outside of the existing fenceline is limited by other industrial facilities. Another factor potential limiting additional expansion of the Trunkline LNG facility is its ability to deliver increased volumes of natural gas to an interstate natural gas pipeline system. If the proposed pipeline is constructed, the Trunkline LNG facility would be connected to a mainline pipeline by two (one existing and one proposed) 30-inch-diameter pipelines. To deliver volumes of additional natural gas from Trunkline LNG's terminal similar to those proposed by Crown Landing, would likely require extensive expansion or looping of these sendout pipelines. It is also likely that additional ship unloading facilities would be needed to deliver a volume of natural gas similar to what is proposed by Crown Landing. For these reasons, we do not consider expansion of the Trunkline LNG Terminal a reasonable system alternative.

Southern LNG Terminal

Southern LNG, Inc. (Southern LNG) owns and operates an LNG import terminal located at Elba Island along the Savannah River in Chatham County, Georgia. Currently, the Elba Island site includes a single berthing facility and LNG storage capacity of 190,000 m^3. In 2001, the FERC authorized Southern LNG to replace the existing vaporizers, increase the sendout capacity of the facility, and add Btu stabilization facilities. In 2003, Southern LNG received FERC authorization to install a new 160,000 m^3

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storage tank, a new ship unloading facility with two berths, two additional first stage pumps, three additional second stage pumps, three additional vaporizers, and desuperheaters. With the addition of these facilities, which are currently under construction, the sustainable sendout capacity of the terminal will increase to about 0.8 Bcfd (1.2 Bcfd maximum) and the ship unloading capacity of the terminal will increase to about 118 LNG ships per year. Southern LNG currently has a long-term, firm contract for 100 percent of the existing LNG unloading, storage, and delivery capacity and has a 30-year binding precedent agreement for the capacity that would be provided by the expanded facilities.

Further expansion of the facility is limited by its ability to deliver large volumes of natural gas to an interstate natural gas pipeline system. Currently, the Southern LNG facility is connected to Southern Natural Gas Company's (SONAT) mainline pipeline system by two small-diameter (20-inch and 14- to 16-inch) pipelines that are about 200 miles long. To deliver significant additional volumes of natural gas from Southern LNG's terminal would likely require extensive expansion or looping of its sendout pipeline. Additionally, it may be necessary to expand SONAT's mainline pipeline system to deliver the proposed volumes of natural gas to the broader U.S. market.

Conclusions Regarding Existing LNG Terminals as System Alternatives

Crown Landing is proposing a facility that would have the capabilities of unloading and storing imported LNG and delivering approximately 1.2 Bcfd of natural gas into the Mid-Atlantic region. Because the capacity of each of the existing LNG import terminals is fully committed (including their current expansion proposals), use of an existing LNG terminal to meet the proposed project objectives would not be possible without significant expansions and/or modifications to their unloading, storage, and delivery systems and possibly substantial expansion or looping of the existing sendout pipeline(s). The additional facilities required for required expansion would likely result in as much if not more environmental impact as Crown Landing's proposed LNG terminal.

From a commercial perspective, the best location for an LNG terminal is close to the market it is intended to serve. The great distance of the existing Southern LNG and Trunkline LNG terminals from the project area (a distance of at least 800 miles) effectively limits them from serving the Mid-Atlantic market. The existing Distrigas and Cove Point LNG terminals are closer to the proposed LNG terminal (within 200 miles). The Distrigas LNG facility, however, has physical constraints (e.g., small site size, insufficient space for additional storage tanks, etc.) that make it unsuitable to supply the natural gas volumes proposed by Crown Landing. Dominion has recently proposed an expansion of the Cove Point LNG facility that would significantly increase both the LNG storage and the natural gas sendout capacity of this facility. This expansion would include the construction of about 161 miles of pipeline which would result in as much if not more environmental impacts than the proposed projects.

3.2.2 Recently Approved LNG Projects

In addition to the LNG terminals discussed above, a number of other LNG terminal projects capable of supplying U.S. markets have been recently approved. Table 3.2.2-1 provides information about the location, facilities, and capacity of these projects:

All of the recently approved LNG projects listed in table 3.2.2-1 are too far from the Mid-Atlantic region to efficiently provide the natural gas delivery volumes proposed by Crown Landing. Additionally, the use of the Gulf Coast, Canadian, and Bahamian projects as alternatives would likely require substantial expansion of the existing pipeline systems, which could have significant environmental impacts.

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TABLE 3.2.2-1

Recently Approved LNG Terminals a/

Project Name and Owner/ *Applicant*	Location	Sendout Capacity	Number of Storage Tanks and Capacity	Status
Cameron LNG Project *Sempra Energy, LNG*	Hackberry, Louisiana	1.5 Bcfd	Three 160,000 m^3 tanks	FERC approval issued September 2003; construction pending
Freeport LNG Project *Contango Oil and Gas/ ConocoPhillips/Cheniere Energy, Inc.*	Freeport, Texas	1.5 Bcfd	Two 160,000 m^3 tanks	FERC approval issued June 2004, construction pending
Gulf Gateway Project *Excelerate Energy* (formerly known as Energy Bridge Offshore Deepwater Port Project *El Paso Global LNG)*	Gulf of Mexico, Lease Block West Cameron 603, Offshore Louisiana	0.5 Bcfd	Transport and regasification vessels, no storage	Coast Guard and DOT approvals issued in January 2004; facility currently under construction
Port Pelican Offshore Deepwater Port Project *ChevronTexaco*	Gulf of Mexico, Vermillion Block 140, Offshore Louisiana	1.6 Bcfd	Gravity-based structure; 330,000 m^3 of storage capacity	Coast Guard and DOT approvals issued in November 2003; construction pending
Ocean Express Project *AES*	Bahamas	0.84 Bcfd	--	Bahamian government approval pending
Calypso Project *Tractabel, LNG*	Bahamas	0.83 Bcfd	--	Bahamian government granted preliminary approval
Canaport Project *Irving Oil/Repsol*	Saint John, New Brunswick	1.0 Bcfd	Three 160,000 m^3 tanks	Canadian government approvals issued August 2004
Bear Head LNG Project *Anadarko Petroleum Corp.*	Point Tupper, Nova Scotia	1.0 Bcfd (Phase I) 1.5 Bcfd (Phase II)	Two 180,000 m^3 tanks (Phase I) One 180,000 m^3 tanks (Phase II)	Canadian government approvals issued mid-2004; facility currently under construction
Altamira *Shell/Total*	Altamira, Tamaulipas, Mexico	0.5 Bcfd	Two 150,000 m^3 tanks	Mexican state and federal agencies including Comision Reguladora de Energia approvals issued; facility currently under construction
Energy Costa Azul LNG *Sempra Energy LNG/Shell*	Baja California, Mexico	1.3 Bcfd	Two 160,000 m^3 tanks	Mexican state and federal agencies including Comision Reguladora de Energia approvals issued. Road construction currently under way; terminal construction expected to begin before the end of 2004

a/ Project information obtained from LNG Express (Vol. XIV, No.6, June 2004; Vol. XIV, No. 8, August 2004; and Vol. XIV, No. 9, September, 2004), Natural Gas Intelligence Press, Inc., EPA informal dockets, and project applications and EISs.

3.2.3 Recently Proposed and Planned LNG Projects

Table 3.2.3-1 identifies recently proposed and planned LNG terminal projects capable of supplying U.S. markets.

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TABLE 3.2.3-1

Recently Proposed and Planned LNG Terminals a/

Project Name and Owner / *Applicant*	Location	Sendout Capacity	Number of Storage Tanks and Capacity	Status
Proposed Onshore Terminals b/				
Weaver's Cove LNG Project *Weaver's Cove Energy, LLC (Hess LNG)*	Fall River, Massachusetts	0.8 Bcfd	One 200,000 m^3 tank	Draft EIS issued July 2004. FERC Docket Nos. CP04-36-000 and CP04-41-000
Port Arthur LNG Project *Sempra Energy LNG*	Port Arthur, Texas	1.5 Bcfd (Phase 1) 3.0 Bcfd (Phase 2)	Three 160,000 m^3 tanks	NEPA Pre-filing Process initiated April 9, 2004. Formal application expected September 2004. FERC Docket No. PF04-11-000
Ingleside Energy Center LNG Project, *Occidental Energy Ventures Corp.*	Ingleside, Texas	1.0 Bcfd	Two 160,000 m^3 tanks	NEPA Pre-filing Process approved by FERC in April 2004. FERC Docket No CP05-13-000
Long Beach LNG Import Project, *Sound Energy Solutions (Mitsubishi)/ConocoPhillips*	Long Beach, California	0.7 Bcfd	Two 160,000 m^3 tanks	NEPA Pre-filing Process established July 11, 2003. Formal application filed January 26, 2004. Analysis ongoing. FERC Docket No. CP04-58-000
Vista del Sol LNG Terminal Project, *ExxonMobil Corporation*	Corpus Christi, Texas	1.0 Bcfd	Three 160,000 m^3 tanks	NEPA Pre-filing Process established; Draft EIS in preparation. FERC Docket Nos. CP04-395-000, CP04-405-000, and CP04-374-000
Cheniere Corpus Christi LNG Terminal Project *Corpus Christi LNG LP.*	Corpus Christi, Texas	2.6 Bcfd	Three 160,000 m^3 tanks	FERC Draft EIS under preparation. FERC Docket Nos. CP04-37-000, CP04-44-000, CP04-45-000, and CP04-46-000
Golden Pass LNG Terminal Project *ExxonMobil Corporation*	Sabine Pass, Texas	1.0 Bcfd (Phase 1), 2.0 Bcfd (Phase 2)	Five 160,000 m^3 tanks	NEPA Pre-filing Process established December 5, 2003. FERC Docket Nos. CP04-386-000 and CP04-400-000
Sabine Pass LNG Terminal Project *Cheniere Sabine Pass Pipeline Company*	Sabine Pass Channel, Louisiana	2.6 Bcfd	Three 160,000 m^3 tanks	Order issued September 10, 2003. Draft EIS issued August 2004. FERC Docket Nos CP04-47-000 and CP04-38-000
KeySpan LNG Facility Upgrade Project *KeySpan LNG, LP and Algonquin Gas Transmission, L L.C.*	Providence, Rhode Island	0.5 Bcfd	--	FERC Application filed April, 2004. FERC Docket Nos. CP04-223-000 and CP04-293-000
Highrock LNG Project *El Paso/FPL*	Bahamas	1.0 Bcfd	--	FERC Docket No. PF04-8-000

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TABLE 3.2.3-1 (cont'd)

Recently Proposed and Planned LNG Terminals a/

Project Name and Owner / *Applicant*	Location	Sendout Capacity	Number of Storage Tanks and Capacity	Status
Proposed Offshore Terminals c/				
Main Pass Energy Hub Deepwater Port Project *Freeport-McMoRan Energy LLC*	Main Pass Block 299, Offshore Louisiana	1.0 Bcfd	Two 30,000 m^3 tanks	Application filed February 27, 2004. Coast Guard Docket No. 17696
Gulf Landing Offshore Deepwater Port Project *Shell US Gas and Power, LLC*	West Cameron Block 213, Offshore Louisiana	1.0 Bcfd	Gravity-based structure; 200,000 m^3 of storage capacity	Application filed November 3, 2003. Coast Guard Docket No. 16860
Clearwater Port Offshore Deepwater Port Project *Crystal Energy, LLC*	MMS Lease Block 217,Offshore California	0.5 Bcfd	--	Application pending Coast Guard and California State Lands Commission approval.
Pearl Crossing Project *ExxonMobil Corp*	West Cameron Block 220, Offshore Louisiana	2.0 Bcfd	Gravity-based structure; 250,000 m^3 of storage capacity	Application filed May 2004. Coast Guard Docket No. 18474
Compass Port Terminal Project *Compass Port, LLC (ConocoPhillips)*	11 miles of Daupin Island, Alabama	1.0 Bcfd	Two 150,000 m^3 tanks	Application received March 29, 2004. Coast Guard Docket No. 17659
Cabrillo Port Project *BHP Billiton*	Offshore California	1.5 Bcfd	--	Coast Guard Docket No. 16877. Application pending California State Lands Commission Approval
Planned Terminals and Expansions d/				
Cheniere LNG Partners	Brownsville, Texas	1.5 Bcfd	--	--
Navy Homeport LNG ExxonMobil	Mobile Bay, Alabama	1.0 Bcfd	--	--
Brayton Point LNG Somerset LNG	Somerset, Massachusetts	0.65 Bcfd	--	--
Terminal GNL Mar Adentro Chevron Texaco	Offshore, Baja California	1.4 Bcfd	Storage capacity of 250,000 m^3.	Pending at Mexican regulatory agencies. Received Environmental Approval
Chevron Texaco	Offshore, California	0.75 Bcfd	--	--
Quoddy Bay LNG Quoddy Bay, LLC	Pleasant Point, Maine	0.5 Bcfd	--	Announced June 2004
Rabaska Enbridge/Gaz Metro/Gas de France	St. Lawrence River, Quebec City, Quebec	0.5 Bcfd	Two 160,000 m^3 tanks	--
Lazaro Cardenas Tractebel/Repsol	Lazaro Cardenas, Mexico	0.5 Bcfd	--	Pending at Mexican regulatory agencies

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TABLE 3.2.3-1 (cont'd)

Recently Proposed and Planned LNG Terminals a/

Project Name and Owner / *Applicant*	Location	Sendout Capacity	Number of Storage Tanks and Capacity	Status
Pinto Island Cheniere LNG Partners	Mobile Bay, Alabama	1.0 Bcfd	--	--
Puerto Libertad Sonora Pacific LNG	Puerto Libertad, Mexico	1.3 Bcfd	--	Pending at Mexican regulatory agencies
Northeast Gateway, *Excelerate Energy LLC*	Offshore Gloucester, Massachusetts	0.8 Bcfd	No storage tanks	Announced July 2004--
Kitimat LNG *Galveston LNG*	Kitimat, British Columbia	0.34 Bcfd	--	--
Prince Rupert *WestPac Terminals*	Prince Rupert, British Columbia	0.3 Bcfd	--	--
Cacouna LNG *TransCanada/PetroCanada*	Gros Cacouna Island, Quebec	0.5 Bcfd	Two 160,000 m^3 tanks	Announced September 2004
Keltic LNG *Keltic Petrochemical LNG*	Goldboro, Nova Scotia	0.5 Bcfd (Phase I) 1.9 Bcfd (Phase II)	--	Filed with Canadian regulatory agencies August 2004
Point Tupper *Statia Terminals Canada*	Nova Scotia	0.5 Bcfd	--	--
Pelican Island *BP*	Galveston, Texas	1.5 Bcfd	--	--
Jordan Cove *Energy Projects Development, LLC*	Coos Bay, Oregon	0.2 Bcfd	One 95,000 m^3 tank	--
Port Westward *Port Westward LNG, LLC*	St. Helens, Oregon	1.25 Bcfd	--	--
Broadwater LNG Facility *TransCanada Corporation and Shell US Gas & Power LLC*	Offshore in New York waters of Long Island Sound	1.0 Bcfd	Floating Storage Regasification Unit, 350,000 m^3 of storage capacity	Announced November 2004

a/ Project information obtained from LNG Express (Vol. XIV, No.6, June 2004; Vol. XIV, No. 8, August 2004; and Vol XIV, No. 9, September, 2004), Natural Gas Intelligence Press, INC., EPA informal dockets, and project applications and EIS's.

b/ Proposed onshore terminals with applications submitted to the FERC.

c/ Proposed offshore terminals with applications submitted to the Coast Guard.

d/ Planned terminals with no applications submitted to the FERC or Coast Guard.

-- Blanks indicate that the definitive design information is unavailable or unknown.

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As is the case for the recently approved projects, most of the proposed and planned LNG projects listed in table 3.2.3-1 are located too far from the Mid-Atlantic region to efficiently provide the natural gas delivery volumes proposed by Crown Landing. Additionally, the use of many of these projects as alternatives would likely require substantial expansion of the existing pipeline systems, which could have significant environmental impacts. Others of the proposed projects have not been sufficiently described or developed to conduct a detailed comparison with the proposed project.

The four closest proposed and planned projects to the Mid-Atlantic region for which there is sufficient information to conduct a comparative analysis include: the KeySpan LNG Facility Upgrade Project in Providence, Rhode Island; the Weaver's Cove LNG Project in Fall River, Massachusetts; the Northeast Gateway Project; and the Broadwater LNG Facility Project (see section 3.3.2.1 for more discussion of the Northeast Gateway Project and the Broadwater LNG Facility Project). Each of these projects has site-specific environmental issues and/or safety concerns, and none of these projects would provide the storage or sendout capacity proposed by Crown Landing. Although the Weaver's Cove LNG Project and either of the other three projects combined could provide the sendout capacity proposed by Crown Landing, and the Weaver's Cove LNG Project and Broadwater LNG Facility Project collectively would be able to provide Crown Landing's proposed storage capacity, it seems unlikely that these projects could effectively serve the Mid-Atlantic region. Based on recent projections of natural gas demand in the New England region, by 2009 there will be demand for an additional 500 MMcfd of natural gas above what the current infrastructure is able to provide during peak periods of use (FERC, 2003). Demand in the New York market area is also increasing. Consequently, even if more than one of these projects are authorized and constructed, much of the capacity of these projects would likely be used to satisfy the increasing demand for natural gas in the New England and New York markets and would be unavailable for the Mid-Atlantic region.

3.2.4 Pipeline System Alternatives

As an alternative to developing a new LNG import terminal, we considered the feasibility of utilizing or expanding the existing pipeline systems in the region to provide an equivalent amount of natural gas to the Mid-Atlantic region as that proposed by Crown Landing. Existing pipeline systems in the Mid-Atlantic region include those owned and operated by Texas Eastern, Columbia Gas, and Transco (see figure 3.2.4-1). Texas Eastern's local pipeline system consists of four pipelines: two 20-inch-diameter pipelines that run south from Eagle, Pennsylvania to Chester Junction, Pennsylvania; a 16-inch-diameter pipeline that runs east from Chester Junction to a meter regulator; and a 16-inch-diameter pipeline that narrows down to a 14-inch-diameter pipeline and runs west from Chester Junction to meter regulators. Columbia Gas' pipeline system in the project area consists of a 20-inch-diameter pipeline that runs from Claymont, Delaware across the Delaware River to Gloucester County, New Jersey. Transco's pipeline system in the project area includes two pipelines: a 12-inch-diameter pipeline and a 20-inch-diameter pipeline. Transco's two pipelines cross the Delaware River from Pennsylvania and proceed north across northwest New Jersey. All of these pipeline systems primarily provide natural gas from production areas in Canada and the Gulf Coast. While new supplies of natural gas might be developed outside of the market area, including the construction or expansion of other LNG import terminals along the Gulf and East Coasts, the existing Columbia Gas, Transco, and Texas Eastern systems do not have sufficient capacity to deliver the volumes proposed by Crown Landing without expansion

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Non-Internet Public

Facility Location Map
Figure 3.2.4.-1
(Page 3-12)

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

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Expanding or modifying the existing pipeline systems to be able to deliver natural gas to the Mid-Atlantic region would result in a variety of environmental impacts depending on the project size, length, and design. It is typical for significant pipeline construction projects in the region to result in short- or long-term impacts on water resources, upland vegetation, wetlands, wildlife habitats, traffic patterns, and land use. Substantial expansion or modifications to the existing pipeline systems would be required to deliver the gas volumes to the Mid-Atlantic region as proposed by Crown Landing. In addition to construction-related effects, the operation of pipeline compressor stations also would result in permanent noise and air quality impacts.

We expect that new pipelines or proposals to modify existing pipelines will continue to increase the capacity of existing systems delivering natural gas to the Mid-Atlantic region. Nevertheless, these projects could not meet the project objectives of providing access to new natural gas supplies around the world. Additionally, since the production from conventional natural gas reserves in the United States and Canada has not experienced much growth, it is unlikely that pipeline alternatives connected to these reserves would be able to meet the project objective of providing an additional 1.2 Bcfd of natural gas to the Mid-Atlantic region. Even if a pipeline system alternative was combined with the use of an existing, modified, or proposed LNG facility, the costs and environmental impacts of such an alternative would not provide a clear advantage over the Crown Landing LNG Project.

3.3 LNG TERMINAL ALTERNATIVES

The examination of alternative sites for an LNG import terminal involved a comprehensive process that considered environmental, engineering, economic, safety, and regulatory factors. The first step included determining the most suitable area for an LNG terminal based on the stated purpose of the project of providing an additional supply of natural gas to the Mid-Atlantic region. The second step included identification of a specific port capable of accommodating ships that can transport up to 200,000 m^3 of LNG. The third step included comparatively evaluating specific sites within suitable ports that are capable of supporting the necessary docking, storage, and vaporization facilities.

3.3.1 Regional Review

As discussed in section 1.2, there is a current and growing demand for natural gas in the Mid-Atlantic region. Due to the limitations in the existing pipeline systems serving the region as well as the other disadvantages discussed in section 3.2.3, we believe an LNG import facility should be located somewhere in New York, New Jersey, Pennsylvania, Delaware, or Maryland to efficiently serve the Mid-Atlantic region. As such, we did not consider alternative LNG terminal sites north of Long Island, New York or south of the Virginia and Maryland border.

3.3.2 Port Review

Ships that are presently used to transport LNG typically have capacities of up to 138,000 m^3. These ships are up to 1,000 feet long with typical drafts up to 38 feet. To ensure that the LNG ships do not easily or frequently run aground, an additional 2 feet of water is required under the keel. This means that LNG ships will typically only access areas with depths of 40 feet Although dredging in shallow water areas could provide access for LNG ships, the dredging required in undeveloped ports would generally be cost prohibitive and would most likely result in significant environmental impacts. Consequently, our analysis of alternative LNG terminal sites was limited to offshore or existing deepwater coastal ports that could readily accommodate LNG ships without dredging or without significantly more dredging than would be required for use of the proposed site.

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3.3.2.1 Offshore Ports

To avoid many of the environmental issues and safety concerns associated with locating an LNG facility onshore, many companies have considered locating LNG import terminals in offshore areas. As defined in the Deepwater Port Act of 1974 (as amended by the Maritime Transportation Security Act of 2002 to include natural gas facilities), deepwater ports include fixed or floating structures that are located off of the U.S. coast and that are used as a port or terminal for the transportation, storage, and further handling of oil or natural gas. This legislation further requires the DOT (Maritime Administration) and the Coast Guard to regulate the licensing, siting, construction, and operation of deepwater ports for natural gas.

An LNG import facility located entirely offshore has not yet been built and operated. Nevertheless, the technology for doing so is being developed and guidance documents for building offshore LNG storage and regasification terminals have recently been produced (American Bureau of Shipping, 2002). As shown in table 3.2.2-1, ChevronTexaco Corporation (ChevronTexaco) and El Paso Global LNG (El Paso) were recently authorized to build offshore LNG import terminals in the Gulf of Mexico. El Paso's offshore project was subsequently acquired by Excelerate Energy, L.L.C. (Excelerate). These two projects are currently referred to as the Port Pelican Deepwater Port Project and the Gulf Gateway Project, respectively. There are currently several other proposals to build offshore LNG import terminals in the United States. Additional offshore LNG terminals have been proposed and are under review in Australia, West Africa, Taiwan, Mexico, and Italy (LNG Express, 2002).

Recently, companies have introduced various strategies for operating an LNG import terminal in offshore waters (LNG Express, 2003). The most recent proposals would allow offshore docking and unloading of LNG ships as well as offshore regasification of LNG for delivery as natural gas to onshore markets via undersea pipelines. Although there is a potential that one or more of these proposed projects may eventually be built, no formal applications to build an offshore LNG facility in the Mid-Atlantic region have been filed with the DOT or the Coast Guard.

One significant issue for any offshore facility in the Mid-Atlantic region is how the facility would connect with the existing interstate pipeline systems. As discussed in section 3.3.2.2, the existing interstate pipeline systems in the Mid-Atlantic region are mostly located a fair distance inland between approximately New Brunswick, New Jersey and Norfolk, Virginia. Connecting an offshore facility to the interstate systems in this area would require a fairly long pipeline, which would likely have both offshore and onshore impacts. The one area where the interstate pipeline system is much closer to the coast is in northern New Jersey. Locating an offshore facility near this area would reduce both the costs and onshore impact of the sendout pipeline. This factor suggests that if an offshore facility is proposed to serve the Mid-Atlantic region, it would likely be located offshore of the New Jersey coast south of Long Island. We have included a discussion below of those offshore strategies that are currently being considered in other parts of the country. In particular, we have included a more in-depth analysis of the Northeast Gateway Project, which is an offshore LNG project being planned in the New England region, and the Broadwater LNG Facility Project, which is an offshore LNG project being planned in the New York waters of Long Island Sound.

Fixed or Floating Structures

There are basically two different types of structures that can be used as an offshore LNG import terminal. These include: 1) fixed structures that have ship docking and unloading facilities, regasification units, and other associated equipment on pile-based platforms or concrete structures and foundations located directly on the seafloor; and 2) floating units comprised of storage tanks, offloading, and

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vaporization facilities. Both designs would allow docking and unloading of LNG ships and vaporization of LNG for delivery to onshore markets via undersea pipelines.

One strategy to build a fixed offshore terminal would be to use a gravity-based structure (GBS). A GBS facility would include placing LNG storage tanks and associated facility platforms on foundations directly on the seafloor. LNG could be offloaded from conventional LNG ships, placed in storage tanks, and then vaporized for delivery as natural gas to the onshore market via an undersea pipeline. GBS terminals would only be feasible in areas of relatively shallow water, where the depths range between 45 and 100 feet. Given the costs associated with constructing and operating a GBS, it appears that these facilities are only economically feasible for projects with relatively large LNG storage (e.g., 250,000 to 330,000 m^3) and natural gas sendout volumes (e.g., 800 to 2,000 MMcfd). ChevronTexaco received approval from the Coast Guard to build a facility of this design in the Gulf of Mexico but is still seeking approval from the Coast Guard and Texas regulatory agencies for its GBS construction yard in Corpus Christi, Texas. The construction of this facility is currently on hold until ChevronTexaco receives all necessary permits and secures an LNG supply source.

Another strategy using a fixed offshore terminal involves constructing or converting existing offshore platforms. Because these platforms are or would be anchored using fixed-tower structures, they could be located in a much broader range of water depths than a GBS unit. These platforms could be fitted with docking, unloading, storage, and vaporization equipment. Similar to the GBS design, LNG could be unloaded from a conventional LNG ship, vaporized at the platform, and sent as natural gas to the onshore market via an undersea pipeline. Depending on the specific design, the use of an offshore platform may not include significant offshore storage of LNG. Given the lack of existing offshore platforms in the Mid-Atlantic region, this approach would require construction of a new platform.

Floating, storage, and regasification units (FSRUs) are another approach being considered for importing LNG into the United States. In essence, an FSRU would be an oversized LNG ship that is outfitted with LNG vaporizers and docking/unloading equipment. The FSRU would be about 930 to 1,150 feet long, 195 to 215 feet wide, and be able to store between 250,000 and 290,000 m^3 of LNG - over twice the capacity of a typical LNG ship. These units would be anchored offshore of the proposed market area where conventional LNG ships could dock next to and unload LNG to the FSRU. After the LNG is unloaded, it could be vaporized and the natural gas transported to onshore markets through an undersea pipeline. Depending on the vaporizers and the size of the pipeline, these units could have a natural gas sendout capacity ranging from 700 to 1,500 MMcfd. Based on the designs suggested to date, it appears that FSRUs would be limited to depths greater than 90 feet to accommodate a flexible pipeline connection between the unit and the sendout pipeline. The proposed Broadwater LNG Facility Project would include an FSRU. BHP Billiton also recently proposed to use this design to import natural gas to markets in California.

We have examined offshore LNG terminals, with either a fixed or floating design, to determine if they could provide an import service similar to the Crown Landing LNG Project and if suitable sites could be located and developed in the waters off of the East Coast. By constructing an LNG terminal offshore, some of the more significant environmental impacts associated with the proposed Crown Landing LNG Project could be avoided (e.g., dredging the ship berth). Although a fixed or floating LNG import terminal located offshore would generally increase the distance of the facility from populated areas, there are operational and environmental tradeoffs associated with offshore LNG technology. Additionally, a recent congressional report suggested that offshore LNG facilities may be more vulnerable to terrorist attack compared to an onshore facility (Parfomak, 2003).

Estimates released to the public indicate that the capital costs for constructing an offshore terminal that includes significant LNG storage would be at least twice as expensive as a similar sized

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onshore facility. Operating costs would also be higher. For example, costs associated with the need for a larger staff and personnel to operate an offshore terminal would be greater than for the proposed LNG terminal.

Another issue is that the use of an offshore facility does not avoid the need for some onshore facilities. Temporary onshore facilities would be needed to construct the fixed or floating structures, which would then be transferred to the offshore terminal site. While not specifically addressed in existing environmental documents and analyses, the construction of a GBS requires fabrication of the GBS in what is called a graving dock. The graving dock must be of sufficient size to fabricate the GBS, of sufficient depth, and constructed in an area adjacent to sufficient water depth to float the GBS. One side of the graving dock must be directly adjacent to the waterbody and that side must be removable to flood the dock and float the GBS, allowing it to be towed from the dock to its final destination. Graving for the size of the proposed LNG terminal can be on the order of 50 to 100 acres. Permanent onshore facilities would also be required for terminal support activities.

An LNG import terminal that is located in an offshore setting would be highly exposed to the effects of meteorological and oceanographic forces such as high winds, waves, and currents. These concerns are particularly pronounced in the Mid-Atlantic region during the winter, a period when the region experiences its most severe weather and its peak demand for natural gas supplies. The potential for severe weather equates with a need for increased storage volume at offshore terminals to maintain a predictable, constant flow of natural gas to shore. A key technical issue for the successful operation of an LNG terminal in this environment includes designing the LNG transfer system (i.e., unloading arms) to compensate for the relative motion between the terminal and LNG ship during unloading operations. Although storage and unloading technologies similar to those that would be used with an offshore LNG terminal have been applied for many years at onshore LNG terminals and at offshore petroleum product facilities (LNG Express, 2002), the technologies needed to transfer a cryogenic liquid under the harsher conditions in an offshore setting have not been demonstrated. This may be particularly problematic for offloading to a FSRU where the stresses on a transfer system could be even greater than what would be experienced at a fixed structure.

Construction and operation of an offshore LNG terminal could result in environmental impacts related to aesthetics, water quality, biological communities, socioeconomics, and air quality. Aesthetic impacts could include impacts on the offshore viewshed. Because there is not any existing and available offshore infrastructure that could be utilized for an offshore LNG terminal in the Mid-Atlantic region (e.g., existing platforms), constructing an offshore facility would affect a number of marine and nearshore resources. In the case of the Broadwater LNG Facility Project, the FSRU would be constructed at a shipyard and towed to the project location for permanent mooring. Thus the impact of the facility on Long Island Sound would be limited primarily to the mooring system and the security zone around the mooring system, which would permanently restrict commercial and recreational boating and fishing activities within about 0.5 mile of the FSRU, and the impacts associated with LNG shipping, offloading, and ballasting.

An offshore LNG facility would also require the construction and hydrostatic testing of a sendout pipeline from the offshore site to an interconnection with an existing pipeline system. Offshore pipeline construction typically involves laying the pipeline directly on the seafloor at depths greater than 200 feet, and excavating a shallow trench in areas with depths less than 200 feet. The level of impact of the offshore pipeline would depend on the resources in the vicinity of the pipeline route, the length of the pipeline, the seafloor substrate, and the type of equipment that is used for construction. The Broadwater LNG Facility Project, for example, would require a new 25-mile-long pipeline to connect the FSRU to the existing Iroquois pipeline system. This pipeline would be located in waters less than 200 feet deep and would likely need to be buried beneath the seafloor.

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Construction methods for offshore pipelines include jetting, subsea plowing, and dredging. Excavating a shallow trench to bury the pipeline using any of these methods would have both direct and indirect impacts. Direct impacts would include the disturbance of bottom substrates and habitats located in the area of the trench. Other impacts could include the disturbance of substrates adjacent to the trench as a result of sidecasting the trench spoil, and impacts associated with anchor strikes and cable sweep resulting from the need to stabilize and position pipe-lay barges and other equipment and indirect impacts associated with the suspension and transport of disturbed sediments in the water column and the resettlement of suspended sediments on the seabed. Laying the pipeline directly on the seafloor could also displace and/or replace existing substrates and, in some cases, create a potential barrier to invertebrate movements (Glaholt et al., 2000).

Based on our analysis of the HubLine and Islander East pipeline projects (FERC, 2001; FERC, 2002), which are illustrative of the various environmental issues associated with offshore pipeline construction along the East Coast, we estimate that the sendout pipeline for the Broadwater LNG Facility Project would result in the disturbance of more than 3,000 acres of seabed. Impacts on water quality and aquatic resources could also result if seawater is utilized to help vaporize LNG at the terminal, which may be possible during the warmest months of the year. Water discharged from the vaporizer units would decrease the water temperature, increase the turbidity, and increase dissolved oxygen content in marine waters near the terminal. During water intake, fish eggs or larvae could be impinged or entrained from nearby waters. During colder months of the year, the LNG vaporizers would burn natural gas which would result in air emissions similar to the proposed project.

Technical issues associated with the feasibility of constructing and operating an offshore LNG facility have not yet been demonstrated in practice and can not be fully evaluated within the timeframe of the Crown Landing LNG Project. The evaluation of an offshore facility as an alternative to this project cannot merely transpose the onshore facility to an offshore location. Rather, it represents a complete redesign of the entire facility such that the feasibility of meeting the operational and economic objectives of the proposal is highly questionable. Although offshore storage and vaporization structure may eventually find a role for importing LNG into the United States, the current level of information and limited operational experience is not sufficient to justify consideration of this emerging application of offshore technology as a reasonable alternative to the Crown Landing LNG Project.

Transport and Regasification Vessels

Several companies are investigating or proposing to install vaporization equipment on conventional LNG ships. These ships would be able to dock at a mooring system made up of a submerged turret buoy and flexible riser connected to a natural gas pipeline on the seafloor. After docking is complete, LNG could be vaporized onboard the LNG ship and injected as natural gas directly into the offshore pipeline for delivery to onshore markets. When not in use, the buoy and flexible riser system would be lowered to a depth of about 100 feet below the surface and held in position until retrieved by the next LNG ship. Based on the designs suggested to date, it appears that the submerged turret buoy and flexible riser system would be limited to areas where the water is between 130 and 490 feet deep. This design does not provide for LNG storage so it must be limited to an LNG fleet with regasification equipment on all of the vessels. Depending on the vaporizers and the size of the sendout pipeline, an LNG carrier and regasification ship could deliver between 400 to 900 MMcfd of natural gas to market.

As discussed above, Excelerate acquired the Energy Bridge Project from El Paso and renamed the project the Gulf Gateway Project. Excelerate began construction of this project in 2004 and expects to be in operation by late 2004 or early 2005. The Gulf Gateway Project is located in the Gulf of Mexico and uses the regasification vessel strategy. Excelerate is currently exploring the use of the same technology to

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develop the Northeast Gateway Project offshore of Massachusetts. This project would be the closest offshore LNG project to the Mid-Atlantic region.

As of the publication of this draft EIS, Excelerate has not submitted an application to the DOT and Coast Guard for authorization to construct and operate the Northeast Gateway Project. Because an application has not been filed by Excelerate, details on the facilities and proposed construction methods are not known at this time. However, Excelerate's project literature (Bryngelson, 2004) and a review of the final Environmental Assessment (EA) prepared for the Gulf Gateway Project (Coast Guard, 2003) provide some indication of the potential project components and the impacts that could result from construction of this type of project. The following discussion assumes that impacts similar to those described in the EA for the Gulf Gateway Project could also result from construction of the Northeast Gateway Project.

The Northeast Gateway Project would be located in federal waters about 12 miles east of Marblehead and 10 miles southeast of Gloucester, Massachusetts. The proposed project would include two turret buoys (docking stations), a meter and regulation facility, and about 11.8 miles of offshore pipeline that would interconnect with the existing HubLine pipeline system (operated by Duke Energy). The project would have a baseload capacity of 400 MMcfd and a peak capacity of 800 MMcfd.

Additional physical structures that would likely be needed for the project include an offshore platform to support the meter and regulation equipment, a pipeline end manifold to connect the turret buoys with the sendout pipelines, and anchor arrays to support the docking stations and ships during unloading. In addition, the Coast Guard would probably require a minimum 500-meter (1,640-foot) safety zone around each docking station and possibly an additional 500-meter precautionary zone.

Due to the length of time required to unload and the open-sea location of the docking facilities, there would be an increased potential for delays associated with inclement weather and rough seas, which could make this design less reliable than an onshore facility. For the Gulf Gateway Project, Excelerate established the following docking and cargo transfer design criteria: a 5-meter (16-foot) sea condition maximum for connecting at the docking station and a 12-meter (39-foot) sea condition maximum for cargo unloading. Similar docking systems are currently in use for crude oil transfers in the North Sea, where docking maneuvers have occurred in seas up to 5.5 meters (18 feet) and loading/unloading operations have occurred in seas of 13 meters (43 feet) (Coast Guard, 2003). Based on weather and wave data from the Gulf of Mexico and Excelerate's design criteria, the EA for the Gulf Gateway Project estimated that the LNG import facility would be operable 98 percent of the year.

To evaluate sea conditions offshore from the Mid-Atlantic region, we examined wave height data from the National Data Buoy Center for Station Number 44025. This buoy is located about 33 nautical miles south of Islip, New York at 40° 15' 01'' North and 73° 10' 00'' West, and has a relatively continuous record of meteorological data extending back to 1992 (NOAA, 2004a). We evaluated wave height data from even-numbered years from 1992 through 2002 as well as 2003. Seasonal average wave heights ranged from 5.1 feet (winter) to 3.2 feet (summer), suggesting that the 16-foot sea condition for connecting to the buoy is achievable throughout much of the year. Because peak demand for natural gas is likely to coincide with periods of the worst weather conditions, we also looked at maximum wave heights for the months of November through March. Maximum wave heights ranged from 23.7 feet in January 1996 to 7.9 feet in March 2002. Maximum wave heights during the winter and early spring months suggest that the 39-foot sea condition established for unloading conditions may also be achievable in most years.

Although the Coast Guard has approved the Gulf Gateway Project for offshore Louisiana and LNG regasification vessels for the project are currently under construction, the reliability of this system to

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provide continuous service during the most severe offshore conditions has not been demonstrated in practice. Furthermore, the LNG regasification vessels are unique to this application. Docking and cargo transfers at the proposed Northeast Gateway site cannot presently be performed by conventional LNG vessels. Excelerate has two regasification vessels under construction and has ordered a third. If the project were constructed, its ability to reliably meet the projected gas volumes with only two operable LNG carriers would be questionable.

One advantage of the Northeast Gateway Project is that it would situate the LNG facility in a remote area far from population centers, which would minimize risk to the public. Although a recent congressional report suggests that offshore LNG facilities may be more vulnerable to terrorist attack compared to onshore facilities (Parfomak, 2003), the consequences of such an attack to the general public would be lower due to the remote locations of offshore facilities.

Our analysis also indicates that both the construction and operation of an offshore facility like the Northeast Gateway Project could potentially result in substantial environmental impacts. Construction-related impacts would result from the installation of the physical structures necessary for the system to function. In the case of the Northeast Gateway Project, which would connect to an existing offshore pipeline, these impacts would likely include disturbance of more than 900 acres of seafloor. For a project off the Mid-Atlantic coast, where there are no existing offshore interstate pipeline systems, there would likely be additional impacts associated with the onshore pipeline needed to interconnect the facility to an onshore interstate pipeline system. Operational impacts would also result from docking procedures and the vaporization of LNG prior to sending out the natural gas into the pipeline(s). These would include long-term impacts associated with a permanent anchor array for the buoy system, air emissions associated with vaporization equipment, and potential entrainment and impingement of aquatic organisms and water temperature impacts if an open-loop vaporization system is used (i.e., seawater is used to vaporize the LNG).

In summary, although we recognize the potential for offshore docking and LNG regasification vessels to have a future role in the gas supply mix, no such facilities have yet been proposed in the offshore areas of the Mid-Atlantic region. Additionally, these facilities do not provide the LNG storage that would be supplied by the proposed project and, depending on the design and location of an offshore facility, could potentially result in substantial environmental impacts. Thus LNG regasification vessels do not currently appear to be a viable alternative to the proposed Crown Landing LNG Project.

Offshore Docking/Onshore Storage

Where deepwater access to a coastal port or harbor is unavailable, LNG can be transported to onshore storage tanks from ships using specially designed cryogenic pipelines. Such facilities enable LNG ships to berth and transfer their LNG cargo to the cryogenic pipeline at docking facilities in offshore areas where natural water depths exceed 40 feet. Although feasible, a number of technical factors related to transporting LNG in a pipeline limit the practical maximum length of such a pipeline to about 3 miles. This approach has been used at the existing Cove Point LNG Terminal, where the ship docking/unloading platform is located in the Chesapeake Bay about 1 mile from the shoreline. While it would be possible to transfer LNG to shore through a cryogenic pipeline from an offshore docking structure, such a design would still require locating LNG storage tanks and process facilities at an onshore location, which would involve most of the same disadvantages of an onshore terminal (in addition to the disadvantages associated with an offshore docking structure and pipeline). Furthermore, industrial ports in the Mid-Atlantic region are largely situated along narrow waterfronts that are accessible only from narrow navigational channels. Therefore, an offshore docking structure and a cryogenic pipeline would have to be located relatively close to a navigation channel which could interfere with other port operators or

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marine traffic. Although considered, we did not identify a site where the use of this approach appeared practical.

3.3.2.2 Coastal Ports

Our regional review of coastal areas that might be suitable for an onshore LNG terminal encompassed the Chesapeake Bay, Atlantic coasts of Maryland and Delaware, the Delaware Bay and River, the north and south Atlantic coasts of New Jersey, New York Harbor, and the north and south shores of Long Island. Our review focused on the following five major screening criteria:

- The first criterion was a minimum channel depth of 40 feet. The rational for this depth requirement is that LNG ships generally have drafts of 38 feet and water depths of at least 40 feet are typically required to navigate and prevent grounding. We recognize that the required depth might be achieved by dredging shallow waters, but in light of the relatively minor amount of dredging required for the proposed project, we considered the cost and environmental impacts of significant dredging to be substantial and likely outweigh any other advantages.

- The second criterion was a minimum channel width of 800 feet and a maneuvering area of 2,000 feet to provide sufficient space for the LNG ships to safely transit and berth at the terminal.

- The third criterion was a minimum air draft (vertical clearance) of 140 feet to allow the LNG ships to safely transit under any structures (e.g., bridges) spanning the navigation channel.

- The fourth criterion was a distance to natural gas pipeline systems of less than 50 miles. Because of the impacts associated with constructing a large diameter interstate natural gas pipeline, we considered 50 miles the maximum reasonable distance between the port and existing interstate pipeline systems.

- The fifth criterion was the compatibility of existing land uses in the area with the proposed development of an LNG terminal. Although not an absolute requirement, we considered industrial areas in sparsely populated areas preferable to siting either in densely populated residential and commercial areas, or undeveloped areas such as recreational areas or protected shorelines.

Using these five criteria, we reviewed the Chesapeake Bay area and determined that Baltimore is one area within the Chesapeake Bay region that is close to Crown Landing's intended market and has sufficient water depth to accommodate LNG ships. There is also considerable industrial land in the Baltimore area that is located in relatively low-density population areas. A primary disadvantage of an LNG terminal in the Baltimore area, however, would be its distance from existing natural gas pipeline systems. To develop an LNG terminal in Baltimore, a sendout pipeline about 30 miles long would need to be constructed to connect an LNG terminal to the existing Transco and Columbia Gas pipeline systems. This pipeline would result in more land disturbance and likely impact more streams and wetlands than the proposed sendout pipeline. This pipeline would also need to cross densely developed and urbanized areas in and around the city and, therefore, would probably have a similar if not greater impact on residences, streets, and businesses as the proposed Logan Lateral. For these reasons, we felt that the Baltimore area did not warrant further investigation.

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We determined that the Atlantic coasts of Maryland, southern New Jersey, and Delaware would also be unsuitable for the development of an LNG terminal because they lack the deepwater ports required for LNG ship navigation and are far from both the intended market and existing interstate natural gas pipeline systems. Additionally, the Atlantic coasts of these states tend to be more densely populated with little available industrial property. The Delaware Coastal Zone Act and Coastal Zone Management Plan also include provisions that would make siting of an LNG terminal difficult. Delawares' Coastal Zone Act prohibits new heavy industrial uses[1] of any kind in the coastal zone and Delaware's Coastal Zone Management Plan includes a policy that states "there is no site in Delaware suitable for the location of any LNG import-export facility." Thus any LNG facility in Delaware, including the proposed project (the proposed ship unloading facility would be located in Delaware state waters) would require an exemption from these Act and Plan.

We identified a number of ports in northern New Jersey, including Perth Amboy, Woodbridge, Carteret, Linden, Port Elizabeth, Port Newark, Jersey City, and Bayonne that are close to the intended market as well as existing natural gas pipeline systems. We determined that there also appears to be ample industrial property available in the northern New Jersey area. The primary drawback of this area is that the northern New Jersey ports are designed for and typically serve only smaller vessels such as ocean-going barges, cruise ships, dry cargo bulk vessels, and container ships. As a consequence, the channel widths and turning basins associated with these ports are small and would require substantial improvement to accommodate LNG ships. Another issue is that LNG ships would not be able to access some of the northern New Jersey ports because there is insufficient vertical clearance for LNG ships at the bridges across the Kill Van Kull. For these reasons, we did not investigate the northern New Jersey area further.

We determined that New York Harbor has adequate channel depths, industrially zoned land, and is close to both the intended market and existing natural gas interstate pipeline systems. However, there is currently a high level of ship traffic within the New York Harbor and ports, which could increase the risk of LNG shipping. Additionally, it would be difficult and expensive to operate LNG ships within the harbor while still accommodating the use of the ports by these smaller vessels. There are also several bridges within the harbor that have insufficient vertical clearance for LNG ships, which would preclude them from being used as LNG terminal sites. Another drawback is that potentially suitable sites within the harbor are generally close to residential and commercial areas. For these reasons, we did not further investigate alternative LNG terminal sites in New York Harbor.

The north shore of Long Island is close to the intended market but there is only limited access to interstate natural gas pipelines. Currently, the Iroquois Pipeline is the only major natural gas pipeline serving eastern Long Island and it is fully subscribed. The FERC recently authorized a second pipeline across Long Island Sound, the Islander East Pipeline Project, which would provide additional transportation capacity, but the State of Connecticut has denied the section 401 Water Quality Certification for the Islander East Pipeline Project. Additionally, the State of Connecticut recently renewed a moratorium on construction of new pipelines and transmission lines across the Long Island Sound. Both of these factors make the timing of the Islander East Pipeline Project uncertain. Another issue is that the Long Island Sound generally lacks turning basins and ship channels sufficient for LNG ships, thus development of an LNG terminal would require substantial dredging. Finally, much of the coastline is commercially or residentially developed. For these reasons, we did not further investigate alternative LNG terminal sites along the north shore of Long Island.

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[1] Heavy Industrial Use is defined in the Coastal Zone Act as "a use characteristically involving more than 20 acres, and characteristically employing some but not necessarily all of such equipment such as, but not limited to, smokestacks, tanks, distillation or reaction columns, chemical processing equipment, scrubbing towers, pickling equipment and waste treatment lagoons; which industry, although conceivably operable without polluting the environment, has the potential to pollute when equipment malfunctions or human error occur."

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We determined that the south shore of Long Island is both close to the intended market and existing natural gas pipeline systems. The primary problem with the south shore of Long Island is that it lacks industrial ports and adequate channel depths and turning basins for LNG ships. Additionally, a large portion of the south shore of Long Island comprises federally and state protected lands, including the Fire Island National Seashore, Jones Beach State Park, Gateway National Recreation Area, Tobay Beach Park, Gilgo State Park, Robert Moses State Park, and local area beaches and parks. Since development of an LNG terminal on the south shore of Long Island would require extensive dredging and would likely have direct and indirect impacts on recreational areas and parks, we did not consider this area further in our alternatives analysis.

We determined that the Delaware River and Bay at least as far north as the Philadelphia Naval Yard has deep water and a sufficiently wide channel that would meet the navigational requirements of LNG ships. We also found that portions of the Delaware River and Bay, excluding the Delaware shoreline, are close to the intended market and the existing Columbia Gas, Transco, and Texas Eastern natural gas pipeline systems. Additionally, at least in New Jersey, we found that there is ample rural and industrial land relatively far from residential and commercial areas that might be suitable for an LNG terminal. For these reasons, we further investigated specific potential site alternatives in Delaware River and Bay area.

3.3.3 Site Specific Review of the Delaware Bay and River

To narrow the range and fully evaluate site alternatives, we refined the five major screening criteria discussed above and developed additional criteria to assist in identifying and comparing specific sites for consideration as LNG terminal alternatives. The review process included the examination of additional required and favorable review criteria.

Required criteria included regulatory specifications regarding LNG facility layout and safety siting factors that are required to be met for the project to be feasible. Required criteria included:

- **Thermal Exclusion/Vapor Dispersion Zone** (49 CFR 193.2057 and 193.2059) - Thermal exclusion and vapor dispersion zones must be established in accordance with NFPA 59A. Based on the proposed project design, we have applied a thermal exclusion zone with a radius of 1,000 feet from the center of the LNG storage tanks.

- **Airports** (49 CFR 193.2155(b)) - LNG storage tanks must not be located within a horizontal distance of 1 mile from the ends of the runway, or 0.25 mile from the nearest point of a runway, whichever is longer. The height of LNG structures in the vicinity of an airport must also comply with Federal Aviation Administration requirements.

- **LNG Waterfront Handling Requirements** (33 CFR 127.105) - Waterfront facilities where LNG is handled must comply with Coast Guard regulations pertaining to layout and spacing of the marine transfer area. These regulations require that each LNG loading flange be located at least 985 feet from general public or railway bridges crossing navigable waterways or entrances to any tunnel under navigable waterways.

Our responsibility under NEPA as the lead federal agency is to determine if environmentally preferable alternatives to the proposed action exist. All alternative sites were, therefore, compared to the proposed LNG terminal site. Favorable review criteria, although not absolute alternative requirements, were applied to identify those sites that would be reasonable and most likely to provide some environmental advantage over the proposed project. Favorable criteria were not intended to strictly eliminate the evaluation of certain sites. Given the limited availability of suitable sized parcels in areas

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with deepwater access, it was not possible to locate an alternative that met all of the favorable review criteria. However, some sites were selected for further analysis because they satisfied a majority, but not all of the favorable criteria. Favorable criteria included:

- **Population Centers/Residences** - We made an effort to identify alternative LNG terminal sites in areas that are not in close proximity to population centers and/or residences. Similarly, alternative LNG terminal sites were considered preferable if the location did not require LNG ships to transit near residentially and commercially developed shorelines. In addition to avoiding potential conflicts with existing land uses, application of this favorable criterion would ideally avoid conflicts regarding perceived safety issues related to transport and storage of LNG.

- **LNG Terminal Footprint** - Based on the proposed design and the need to contain the thermal exclusion zone, a waterfront site of about 135 acres would be preferable to accommodate the proposed configuration of the LNG unloading, storage, and sendout facilities. Assuming the LNG storage tanks are located near the waterfront, this site would have to be about 2,000 feet by 3,000 feet to contain the thermal exclusion zones that are centered on the LNG storage area. An ideal waterfront site available for development would include an area in excess of the exclusion zone which would provide an additional buffer from development. However, to expand the range of potential candidate sites, we have relaxed the preferred acreage limit, recognizing that the facilities would need to be compressed and that exclusion zones may extend offshore or onto adjacent properties.

- **Dredging Required** - Given the environmental impacts associated with significant dredging projects, we considered the amount of dredging necessary to provide access to LNG ship access one of the alternative site review criteria. Areas requiring either no or minimal dredging to develop and maintain a ship berth and a ship channel of sufficient depth for the LNG ships were considered more favorable than those areas requiring more substantial dredging. In addition to avoiding impacts on water quality and aquatic resources, minimal dredging requirements provide the added benefit of reducing costs associated with disposal of dredged material.

- **Parcel Availability** - One of the greatest challenges of siting an LNG facility in the Mid-Atlantic region is finding suitable property that is available for industrial development. Availability is critical since section 3 of the NGA does not provide the project proponent the authority of eminent domain in acquiring property for the LNG terminal project. In some cases, a site may possess the size required for an LNG terminal but the owner is unwilling to sell or has placed unacceptable conditions on the acquisition of the site.

- **Existing Land Use** – We considered areas previously disturbed or cleared for industrial or commercial activities (brownfield sites) preferable to undisturbed areas (greenfield sites) when identifying alternative LNG terminal sites. Additionally, we preferred sites where existing land use zoning, coastal zone management guidelines, or development plans were consistent with an LNG import terminal. Sites that could be developed consistent with existing land uses were considered the most practical alternatives to the proposed site.

- **Sendout Pipeline Length** - We considered sites proximate to existing interstate pipeline systems which could accommodate the proposed volume throughput more favorable than sites further from existing pipelines. For purposes of this analysis, we assumed a pipeline

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should be at least 30-inches in diameter to accommodate the normal project volumes. On top of the additional costs and environmental impacts, longer pipelines would likely directly and indirectly affect more landowners/residences.

- **Road Access**- Because there would be considerable traffic into and out of the site during construction and access to the site would be required during facility operations, we considered the available access to the site from public roads. In general, we considered access from highways and other primary roadways preferable to access from undeveloped or secondary roads.

- **Navigational Suitability and Berth Orientation** - Sites that offer minimal disturbances to existing ship traffic and allow for good access by LNG ships were considered a favorable selection criterion. We considered a slip berth oriented perpendicular to the ship channel preferable to a berth oriented parallel to the ship channel. Because LNG ships require a vertical clearance of at least 135 feet and horizontal clearance of not less than 165 feet, we also considered bridge passage along the navigation channel in our site analysis.

- **Environmental Justice** - As part of our NEPA analysis, we are responsible for addressing the potential for a federal action to result in disproportionately high and adverse health or environmental effects on minority or low-income populations. We considered per capita income, the percentage of minorities within the population, and the percentage of the population below the poverty level as general measures of the potential for a site to have an environmental justice issue. Those sites in communities with the lowest per capita income, the highest percentage of minorities, or the highest percentage of the population below the poverty level were considered to have the highest potential to raise environmental justice issues.

- **Special Interest Areas** - We considered favorably sites that avoided conflicts with special interest areas such as state or national parks and marine sanctuaries. When applying this criterion, we considered potential conflicts with special interest areas from either an LNG terminal or its associated sendout pipeline.

- **Various Environmental Factors** - Environmental factors that were considered in our site selection included: minimizing wetland disturbance and preferring sites in uplands; identifying soil conditions with suitable foundation materials for the LNG storage tank development; avoiding areas that would conflict with recreational activities; and selecting sites where the LNG storage tanks would minimally impact the viewshed from roadways and surrounding communities. Due to the potential concerns regarding the consistency of the proposed site with Delaware Coastal Zone Act and Coastal Zone Management Plan, we also reviewed sites for any obvious inconsistency with existing regulatory policies concerning coastal zone management.

Through the application of these more detailed siting criteria we identified seven alternative sites to the proposed LNG terminal site (Church Landing, Carneys Point, Ferro, Shuran, Repaupo, Paulsboro, and Mantua Creek). The general locations of these seven sites relative to the proposed site are shown on figure 3.3.3-1. A comparison of these sites to the proposed site is presented in table 3.3.3-1. The specific issues associated with each of these sites are discussed below.

TABLE 3.3.3-1

Environmental Comparison of the LNG Terminal Site Alternatives to the Crown Landing LNG Terminal Site

	Proposed Site	Church Landing Site	Carneys Point Site	Ferro Site	Shuran Site	Repaupo Site	Paulsboro Site	Mantua Creek Site
	Delaware River Mile 78 Logan Township, NJ	Delaware River Mile 68 Pennsville Township, NJ	Delaware River Mile 69 Pennsville and Carneys Point Township, NJ	Delaware River Mile 79 Logan Township, NJ	Delaware River Mile 80 Logan Township, NJ	Delaware River Mile 86 Greenwich Township, NJ	Delaware River Mile 88 Paulsboro Borough, NJ	Delaware River Mile 90 West Deptford, NJ
Required Criteria a/								
Site Encompasses the Thermal Exclusion/Vapor Dispersion Zone	Yes	Yes	No	No	No	No	No	Yes
Site Meets Airport Setback Requirements b/	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Site Satisfies Waterfront Handling Requirements	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Favorable Criteria								
Estimated Population Within 1 mile/2 mile Radius	82/383	1,577/5,362	482/4,407	60/178	57/589	1,943/3,783	3,578/10,354	389/8,091
Site Size (acres)	175	170	30	80	210	86	90	277
Dredging Requirement (cubic yards)	0.8 million	0.6 million	0.2 million	1.5 million	2.0 million	0.75 million	0.1 million	1.5 million
Parcel Availability c/	High	Medium (not available until 2007)	Low	Low	Medium	Medium	Medium	Unknown
Existing Site Activities	Limited Agricultural Use	Connectiv's Deepwater Generating Station	DuPont Plant	Chemical Factory	DuPont Plant	Adjacent to DuPont Plant	BP/Mobil Corporate Industrial Park	PG&E Facility
Existing Land Use	Agricultural	Industrial	Industrial	Industrial	Forested Wetland/Open	Forested/Wetland	Industrial	Open
Existing Zoning	Industrial	Industrial	Industrial	Industrial	Industrial	Industrial	Industrial	Industrial

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TABLE 3.3 3-1 (cont'd)

Environmental Comparison of the LNG Terminal Site Alternatives to the Crown Landing LNG Terminal Site

	Proposed Site	Church Landing Site	Carneys Point Site	Ferro Site	Shuran Site	Repaupo Site	Paulsboro Site	Mantua Creek Site
	Delaware River Mile 78 Logan Township, NJ	Delaware River Mile 68 Pennsville Township, NJ	Delaware River Mile 69 Pennsville and Carneys Point Township, NJ	Delaware River Mile 79 Logan Township, NJ	Delaware River Mile 80 Logan Township, NJ	Delaware River Mile 86 Greenwich Township, NJ	Delaware River Mile 88 Paulsboro Borough, NJ	Delaware River Mile 90 West Deptford, NJ
Approximate Total Sendout Pipeline Length (miles) d/	11	22	20	9	8	10	12	14
Road Access	U.S. Route 130	State Route 49	U S Route 130	U.S. Route 130	U.S. Route 130	Township Road	Borough Road	Township Road
Ship Channel Width and Maneuvering Area	adequate	adequate	adequate	adequate	adequate	adequate	adequate	adequate
Ship Channel Transit Distance (nautical miles) e/	61.5	52.5	53.5	63.0	64.0	68.5	70 5	71.5
Berth Orientation	perpendicular	perpendicular	perpendicular	perpendicular	perpendicular	parallel	parallel	parallel
Distance of Shore from Ship Channel (feet)	4,000	2,500	1,700	4,200	4,500	900	200	2,800
Potential Shipping Conflicts	none	yes	yes	none	none	yes	Yes	yes
Potential Bridge Conflicts	none	yes	yes	none	none	none	None	none
Per Capita Income	$22,708	$22,717	$22,717	$22,708	$22,708	$24,791	$16,368	$24,219
Percent Minority	13	3 5	3.5	13	13	5.5	36 4	7.7
Percent of Population Below Poverty Level (all ages) f/	6.2	4.9	4.9	6 2	6.2	3.6	17.7	5.3
Conflict with DE CZA and CZMP	Yes	Yes	Yes	No	No	No	No	No
Special Interest Areas	None	None	None	None	None	None	None	None
Non-tidal Wetland Impacts (acres)	<1.0	<1.0	<1.0	>10 0	>1.0	>1.0	<1/0	<1.0

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TABLE 3.3.3-1 (cont'd)

Environmental Comparison of the LNG Terminal Site Alternatives to the Crown Landing LNG Terminal Site

	Proposed Site	Church Landing Site	Cameys Point Site	Ferro Site	Shuran Site	Repaupo Site	Paulsboro Site	Mantua Creek Site
	Delaware River Mile 78 Logan Township, NJ	Delaware River Mile 68 Pennsville Township, NJ	Delaware River Mile 69 Pennsville and Cameys Point Township, NJ	Delaware River Mile 79 Logan Township, NJ	Delaware River Mile 80 Logan Township, NJ	Delaware River Mile 86 Greenwich Township, NJ	Delaware River Mile 88 Paulsboro Borough, NJ	Delaware River Mile 90 West Deptford, NJ
Other Miscellaneous Environmental Factors	--	Site is adjacent to recreation areas and historical site.	--	Site is within bald eagle nest buffer. Site development would require large amount of wetland impacts.	Site is within bald eagle nest buffer.	Site development would require large amount of wetland impacts.	Site is within bald eagle nest buffer.	Site is within bald eagle nest buffer.

a/ Required criteria include regulatory specifications regarding LNG facility layout and safety siting.

b/ See text below for potential site conflicts in reference to the 2020 Philadelphia International Airport (PHL) Master Plan.

c/ High availability - the site is available for industrial use and a negotiated settlement to use the property has been reached with the current landowner.
Medium availability - the site is available for industrial use but no negotiations have taken place with the current landowner.
Low availability - the site is not available based on discussions between Crown Landing with the current landowner.

d/ Distance listed includes minimum distance needed to tie into existing pipeline

e/ Transit distance = start of navigation channel to terminal site

f/ Based on 2000 U.S. Census Bureau poverty thresholds.

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Facility Location Map
Figure 3.3.3.-1
(Page 3-28)

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Church Landing Site

The Church Landing Site is located in Pennsville Township, New Jersey at River Mile (RM) 68 (see figure 3.3.3-2). The site encompasses Conectiv's Deepwater Generating Station and consists of approximately 170 acres with about 1,000 feet of shoreline along the Delaware River. The site is similar to the proposed site with respect to zoning, size, berth orientation, non-tidal wetland impacts, channel width and maneuverability, airport conflicts, availability of power, and adequacy of road access. Development of the Church Landing Site, like the proposed site, may also be inconsistent with Delaware's Coastal Zone Act and Coastal Zone Management Plan regarding LNG facilities.

The primary differences between the Church Landing Site and the proposed site are the amount of dredging and the length of sendout pipeline that would be required, the number of people living near the site, and the proximity of the site to bridges. The Church Landing Site would require dredging about 200,000 cubic yards less dredged material than the proposed site. However, because it is further from existing natural gas pipeline systems, the Church Landing Site would require construction of about 11 miles of additional sendout pipeline to connect with the existing Transco, Columbia Gas, and Texas Eastern pipeline systems. The additional length of pipeline would double the amount of land disturbance and the costs of the sendout pipeline.

The Church Landing Site is also closer to more populated areas than the proposed site. Based on an analysis of 2000 census data (U.S. Census Bureau, Landview 5), we estimate that there are about fourteen times the number of people living within 2 miles and more than nineteen times the number of people living within 1 mile of the Church Landing Site than the proposed site. There is also a recreational area (including athletic fields) and a historic site (Church Landing Farmhouse) located approximately 1,000 from the site. Additionally, unlike the proposed site, the Church Landing Site is located adjacent to the Delaware Memorial Bridge. Although there appears to be adequate space to locate the pier more than 985 feet from the bridge to comply with Coast Guard requirements, Crown Landing expressed concerns regarding the safety of mooring an LNG ship so close to a bridge.

Because the Church Landing Site does not appear to offer any significant environmental advantages over the proposed site except a little less dredging, we have determined that the Church Landing Site is not preferable to the proposed site.

Carneys Point Site

The Carneys Point Site is located in Pennsville and Carneys Point Townships in New Jersey at RM 69 (see figure 3.3.3-3). The site is currently part of the Dupont Carneys Point Plant property but about 30 acres of the property are potentially available for redevelopment. This site is similar to the proposed site with respect to zoning, berth orientation, non-tidal wetland impacts, channel width and maneuverability, airport conflicts, availability of power, and adequacy of road access. Development of the Carney's Point Site, like the proposed site, may also be inconsistent with Delaware's Coastal Zone Act and Coastal Zone Management Plan regarding LNG facilities.

The primary differences between the Carneys Point Site and the proposed site are the size of the site, amount of dredging that would be required to develop the site, the number of people living near the site, and proximity to bridges. The Carneys Point Site would require dredging about 600,000 cubic yards less dredged material than the proposed site. However, because it is further from existing natural gas pipeline systems, the Carneys Point Site would require construction of about 9 miles of additional sendout pipeline to connect with the existing Transco, Columbia Gas, and Texas Eastern pipeline systems. The additional length of pipeline would increase the amount of land disturbance and the costs of the sendout pipeline and would probably increase stream and wetland impacts.

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Facility Location Maps
Figures 3.3.3.-2, 3.3.3-3
(Pages 30, 31)

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The Carneys Point Site is considerably smaller and located in a more densely populated area than the proposed site. Because of the small size of the site (which is about one fifth the size of the proposed site), the thermal radiation and vapor dispersion exclusions zones would extend beyond the terminal property. Additionally, based on an analysis of 2000 census data (U.S. Census Bureau, Landview 5), we estimate that there are more than eleven times the number of people living within 2 miles and more than five times the number of people living within 1 mile of the Carneys Point Site as the proposed site.

Another issue is that the Carneys Point Site is located close to the Delaware Memorial Bridge. Although there appears to be adequate space to locate the pier more than 985 feet from the bridge to comply with Coast Guard requirements, Crown Landing has expressed concerns regarding the safety of mooring an LNG ship so close to a bridge. Another disadvantage of the site is its proximity to the ship channel. We estimate that the safety exclusion zone around the LNG ship while at berth would extend into the ship channel, which may increase the need for the Coast Guard's services to maintain the safety zone while the LNG ship is berthed at the site.

In summary, the Carneys Point Site's only advantage over the proposed site is that it would require less dredging. This advantage, however, is outweighed by the numerous relative disadvantages of the site. For this reason, we do not consider the Carneys Point Site preferable to the proposed site.

Ferro Site

The Ferro Site is located in Logan Township, New Jersey at RM 79 (see figure 3.3.3-4). The site is currently part of a polymer additive chemical factory property but about 71 acres are potentially available for redevelopment. This site is similar to the proposed site with respect to zoning, berth orientation, channel width and maneuverability, airport conflicts, bridge conflicts, availability of power, and the adequacy of road access. No portion of the Ferro Site is located within Delaware so there would be no conflicts with Delaware's Coastal Zone Act and Coastal Zone Management Plan regarding LNG facilities.

The primary differences between the Ferro Site and the proposed sites are the size of the site, length of sendout pipeline needed, amount of dredging that would be required to develop the site, amount of wetland impact that would result from site development, number of people living near the site, and the proximity of the site to endangered species habitat. The Ferro Site would require 2 miles less sendout pipeline than the proposed site. This reduction in length of sendout pipeline would reduce the amount of land disturbed and the cost of the pipeline. It may also reduce stream, wetland, residential, and roadway impacts associated with the proposed pipeline. Additionally, based on an analysis of 2000 census data (U.S. Census Bureau, Landview 5), we estimate that there are even fewer people living within 2 miles and 1 mile of the Ferro Site than the proposed site.

The Ferro Site is less than half the size of the proposed site and the thermal radiation and vapor dispersion exclusions zones would extend beyond the site boundaries. Another disadvantage of the Ferro Site is the amount of dredging and non-tidal wetland impacts that would result from site development. Crown Landing conducted a reconnaissance of the site and determined that between 10 and 30 acres of wetlands would be affected to construct an LNG facility on the site. Additionally, development of the ship berth would nearly double the amount of dredging required. The site is also within a designated bald eagle nest buffer zone

In summary, the Ferro Site's primary advantage over the proposed site is that it would avoid conflicts with Delaware's Coastal Zone Act and Coastal Zone Management Plan. This advantage, however, is outweighed by the numerous relative disadvantages of the site. For this reason, we do not consider the Ferro Site preferable to the proposed site.

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Figure 3.3.3.-4
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Shuran Site

The Shuran Site is located in Logan Township, New Jersey adjacent to the Ferro Site at RM 80 (see figure 3.3.3-5). The site is encompasses 210 acres and includes about 4,000 feet of shoreline along the Delaware River. The Shuran Site is similar to the proposed site with respect to zoning, berth orientation, channel width and maneuverability, size, airport conflicts, bridge conflicts, availability of power, length of sendout pipeline required, and adequacy of road access. No portion of the Shuran Site is located within Delaware so there would be no conflicts with Delaware's Coastal Zone Act and Coastal Zone Management Plan regarding LNG facilities.

The primary differences between the Shuran Site and the proposed site are the length of sendout pipeline required, amount of dredging that would be required, amount of wetland impact that would result from site development, number of people living near the site, and proximity of the site to endangered species habitat. The Shuran Site would require 3 miles less sendout pipeline than the proposed site. This reduction in sendout pipeline would reduce the amount of land disturbed and the cost of the pipeline. It may also reduce stream, wetland, residential, and roadway impacts associated with the proposed pipeline. These advantages, however, would be offset by several disadvantages. Despite its relatively large size, the thermal radiation and vapor dispersion exclusions zones would extend beyond the site boundaries due to the shape of the property. Additionally, based on an analysis of 2000 census data (U.S. Census Bureau, Landview 5), we estimate that there approximately 200 more people living within 2 miles (but slightly fewer people living within 1 mile) of the Shuran Site than the proposed site.

Another disadvantage of the Shuran Site is the amount of dredging required and the amount of non-tidal wetlands that would be affected by site development. Construction of the ship berth would more than double the amount of dredging required compared to the proposed site. Additionally, much of the Shuran Site is covered with wetlands and development of the property would increase wetland impacts relative to the proposed site. Also, to minimize wetland impacts, the LNG tanks would need to be located further from the shoreline, which would increase the length and cost of the cryogenic liquid unloading line. The site is also within a designated bald eagle nest buffer zone.

In summary, the Shuran Site's primary advantage over the proposed site is that it would avoid conflicts with Delaware's Coastal Zone Act and Coastal Zone Management Plan. This advantage, however, is outweighed by the numerous relative disadvantages of the site. For this reason, we do not consider the Shuran Site preferable to the proposed site.

Repaupo Site

The Repaupo Site is located in Greenwich Township, New Jersey at RM 86 (see figure 3.3.3-6). The site encompasses 86 acres adjacent to the Dupont Repaupo Plant. This site is similar to the proposed site with respect to zoning, channel width and maneuverability, amount of dredging required, airport conflicts, bridge conflicts, and availability of power. No portion of the Repaupo Site is located within Delaware so there would be no conflicts with Delaware's Coastal Zone Act and Coastal Zone Management Plan regarding LNG facilities.

The primary difference between the Repaupo Site and the proposed site are the size of the site, road access, amount of wetland impact that would result from site development, length of the sendout pipeline needed, number of people living near the site, and the orientation of the ship berth and potential shipping conflicts. The only environmental advantage of the Repaupo Site is that it would require about 1 mile less sendout pipeline than the proposed route. The reduction in pipeline length would decrease the amount of land disturbed and the cost of the pipeline. It could also reduce stream and wetland impacts.

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Figures 3.3.3.-5, 3.3.3-6
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The Repaupo Site is less than half the size of the proposed site. Due to the relatively small size of the site, the thermal radiation and vapor dispersion exclusions zones may extend beyond the site boundaries. Additionally, based on an analysis of 2000 census data (U.S. Census Bureau, Landview 5), we estimate that due to its proximity to Gibbstown, there are twenty-four times more people living within 1 mile and about ten times more people living within 2 miles of the Repaupo Site than the proposed site.

Two other disadvantages of the Repaupo Site are the orientation of the ship berth, which would need to be parallel versus perpendicular to the ship channel, and the proximity of the ship berth to the ship channel. We estimate that the safety exclusion zone around the LNG ship while at berth would extend into the ship channel, which may increase the need for the Coast Guard's services to maintain the safety zone while an LNG ship is berthed at the site. Additionally, much of the Repaupo Site is covered by forest or wetlands, which would be affected by site development.

In summary, the Repaupo Site's primary advantage over the proposed site is that it would avoid conflicts with Delaware's Coastal Zone Act and Coastal Zone Management Plan and require a shorter sendout pipeline. These advantages, however, are outweighed by the numerous relative disadvantages of the site. For this reason, we do not consider the Repaupo Site preferable to the proposed site.

Paulsboro Site

The Paulsboro Site is located in Paulsboro Borough, New Jersey at RM 88 (see figure 3.3.3-7). The 90-acre site is part of the BP/Mobile Oil Corporate Industrial Park and is surrounded by oil refineries on two sides. This site is similar to the proposed site with respect to zoning, channel width and maneuverability, non-tidal wetland impacts that would result from site development, bridge conflicts, and availability of power. No portion of the Paulsboro Site is located within Delaware so there would be no conflicts with Delaware's Coastal Zone Act and Coastal Zone Management Plan regarding LNG facilities.

The primary differences between the Paulsboro Site and the proposed site are the size of the site, road access, amount of dredging required for site development, length of the sendout pipeline needed, number of people living near the site, orientation of the ship berth, and potential shipping and airport conflicts. The Paulsboro Site would require dredging about 700,000 cubic yards less dredged material than the proposed site. Less dredging would reduce the water quality and aquatic resource impacts of the project. The Paulsboro Site would require construction of about 1 mile more sendout pipeline than the proposed site. The additional length of pipeline would increase the amount of land disturbed and the cost of the pipeline and could also increase stream and wetland impacts. Additionally, due to the relatively small size of the site, the thermal radiation and vapor dispersion exclusions zones could possibly extend beyond the site boundaries. Also, based on an analysis of 2000 census data (U.S. Census Bureau, Landview 5), we estimate that there are more than forty-three times more people living within 1 mile and more than twenty-seven times more people living within 2 miles of the Paulsboro site than the proposed site.

Two other disadvantages of the Paulsboro Site are the orientation of the ship berth, which would need to be parallel versus perpendicular to the ship channel, and the proximity of the ship berth to the ship channel. We estimate that the safety exclusion zone around the LNG ship while at berth would extend into the ship channel, which may increase the need for the Coast Guard's services to maintain the safety zone while the LNG ship is berthed at the site. The site is also within a designated bald eagle nest buffer zone.

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Figure 3.3.3.-7
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Another potential issue with the Paulsboro Site is its proximity to the Philadelphia International Airport. The Paulsboro Site is currently about 1.3 miles across the Delaware River from Runway 9Left/27Right. A Master Plan for the airport is being developed to address the needs of the airport over the next 20 years. The Master Plan examines two expansion alternatives, which would involve expansion and/or construction of new runways. One of these alternatives, the parallel alternative, would involve construction of a new 10,000-foot-long runway south of Runway 9Left/27Right. If approved and constructed, the LNG ship berth and a portion of the terminal site would be within 1 mile of the end of proposed runway. Although there appears to be sufficient space to site LNG storage tanks more than a mile from the end of the runways and thus avoid conflicts with 49 CFR 193.2155(b), the proposed runway changes could limit the locations on the site that would be suitable for tanks.

In summary, the Paulsboro Site's primary advantages over the proposed site are that it would avoid conflicts with Delaware's Coastal Zone Act and Coastal Zone Management Plan and would require less dredging. These advantages, however, are outweighed by the numerous relative disadvantages of the site. For this reason, we do not consider the Paulsboro Site preferable to the proposed site.

Mantua Creek Site

The Mantua Creek Site is located in West Deptford, New Jersey at RM 90 and encompasses 277 acres of land owned by PG&E (see figure 3.3.3-8). The Mantua Creek Site is similar to the proposed site with respect to zoning, channel width and maneuverability, non-tidal wetland impacts, bridge conflicts, and availability of power. No portion of the Mantua Creek Site is located within Delaware so there would be no conflicts with Delaware's Coastal Zone Act and Coastal Zone Management Plan regarding LNG facilities.

The primary differences between the Mantua Creek Site and the proposed site are the size of the site, road access, amount of dredging needed, length of the sendout pipeline needed, number of people living near the site, orientation of the ship berth, and potential for shipping and airport conflicts. The Mantua Creek Site is 102 acres larger than the proposed site and would provide a larger buffer zone around the LNG facility.

The Mantua Creek Site would require construction of about 3 miles more sendout pipeline than the proposed site. The additional length of pipeline would increase the amount of land disturbed and the cost of the pipeline and could increase stream and wetland impacts. The Mantua Creek Site would also require almost double the amount of dredging as the proposed site. Additionally, based on an analysis of 2000 census data (U.S. Census Bureau, Landview 5), we estimate that there are more than four times as many people living within 1 mile and twenty-one times as many people living within 2 miles of the Mantua Creek Site as the proposed site.

Two other disadvantages of the Mantua Creek Site are the orientation of the ship berth, which would need to be parallel rather than perpendicular to the ship channel, and the proximity of the ship berth to the ship channel. We estimate that the safety exclusion zone around the LNG ship while at berth would extend into the ship channel, which may increase the need for the Coast Guard's services to maintain the safety zone while the LNG ship is berthed at the site. The site is also within a designated bald eagle nest buffer zone.

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Figure 3.3.3.-8
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Another potential issue with the Mantua Creek Site is its proximity to the Philadelphia International Airport. The Mantua Creek Site is currently about 1.3 miles across the Delaware River from Runways 17-35 and 9Right/27Left. As mentioned previously, the Master Plan for the airport examines two expansion alternatives, which would involve expansion and/or construction of new runways. Both alternatives would decrease the distance between the airport runways and the Mantua Creek Site. If either of the proposed runway alternatives are approved and constructed, the LNG ship berth and a portion of the terminal site shoreline would be within 1 mile of the end of proposed runways. Although there appears to be sufficient space to site LNG tanks more than 1 mile from the end of the runways and thus avoid conflicts with 49 CFR 193.2155(b), the proposed runway changes could limit the locations on the site that would be suitable for storage tanks.

In summary, the Mantua Creek Site's primary advantage over the proposed site is that it would avoid conflicts with Delaware's Coastal Zone Act and Coastal Zone Management Policy. This advantage, however, is outweighed by the numerous relative disadvantages of the site. For this reason, we do not consider the Mantua Creek Site preferable to the proposed site.

3.4 PIER ALTERNATIVES

As described in section 2.4.1.3, development of the proposed ship berth would require excavation and disposal of about 800,000 cubic yards of sediments using hydraulic dredging equipment, which would affect water quality and aquatic organisms (see sections 4.3.2 and 4.6.2). During scoping of this EIS, agencies expressed concern about impacts associated with the dredging required to develop the proposed pier perpendicular to the ship channel and suggested that these impacts could be eliminated or reduced by moving the pier closer to the ship channel.

Potential pier alternatives were evaluated in three steps. The first step was to determine whether it would be reasonable and practicable to use the existing pier for the Logan Generating Station in lieu of constructing a new pier. If the existing pier is not selected, then the next step was to determine a suitable location of the pier offshore of the LNG terminal site. The final step involved a more detailed assessment of potential pier and berth configurations and orientations in the same general area as the selected pier location.

One alternative that we considered was to collocate the proposed LNG ship unloading facility with the existing coal barge unloading pier for the Logan Generating Station. We determined that the use of the existing pier is not preferable to the proposed pier design for several reasons. First, the existing pier would need to be modified to accommodate the unique requirements for offloading LNG. Since Crown Landing does not own the pier, it would be required to seek an agreement with National Energy Power Company, L.L.C. for the proposed modifications. Section 3 of the NGA, under which Crown Landing is seeking the FERC's authorization, does not include the authority to acquire land by eminent domain. Consequently, if National Energy Power Company, L.L.C. is unwilling to agree to such an arrangement, there is no means for Crown Landing to compel them to share the pier. Another issue is the orientation of the existing pier, which is parallel and near the edge of the Marcus Hook anchorage area. This orientation would put moored LNG ships close to other ships in the anchorage area, and thus increase the potential for allisions with errant ships. Finally, we believe the logistics of sharing the pier would be impracticable. Currently, the Logan Generating Station receives two coal barges per week, which require about 24 hours to berth, unload, and disembark. Crown Landing would receive an LNG ship every 2 to 3 days, which would take about 24 hours to berth, unload, and disembark. The use of a single pier by all these ships would be complicated and bad weather and tides would likely result in conflicts between scheduled deliveries.

The options for relocating the pier are limited by the presence of the several existing pipelines, which cross the river from Marcus Hook, Pennsylvania to the New Jersey shoreline at the southwestern

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corner of the proposed LNG terminal site. To avoid these pipelines, the pier could potentially be located upstream of the existing Transco pipeline (i.e., between the Transco pipeline and Logan Generating Station pier), or between the existing Transco, Columbia Gas, and Colonial Pipelines. We believe that the space between the Transco pipeline and the Logan Generating Station pier is insufficient for safe ship operations. Therefore, we focused our review of alternative pier locations on the area between the Transco, Columbia Gas, and Colonial pipelines

Crown Landing's proposed pier design is perpendicular to the ship channel and located adjacent to the Marcus Hook anchorage area (see figure 2.2.1-1). Conceptually, we evaluated how far the pier should be located from the shoreline. It was apparent that a pier further from shore would reduce the amount of dredging and minimize shallow water habitat impacts. However, locating the pier further out into the river would place it closer to and possibly in the ship channel or anchorage area, which would increase potential ship hazards. Locating the pier farther from shore would also lengthen the trestle and, therefore, increase the costs of the pier. Conversely, locating the pier closer to shore would provide additional safety to LNG ships and reduce trestle length and costs. A nearshore pier would also increase the amount of dredging and would affect more shallow water habitat. To balance these benefits and impacts, we determined that the preferable location for the pier would be between about 1,000 and 2,000 feet from the shore. We evaluated three alternative pier designs (Pier Options A, B, and C) that would be located within this preferred distance from shore. The proposed pier and Pier Option A are oriented perpendicular to the ship channel, Pier Option B is parallel to the ship channel, and Pier Option C is at an angle to the ship channel. Table 3.4-1 provides a comparison of the three alternative pier options to the proposed pier design. The alternative pier options are shown on figures 3.4-1 through 3.4-3.

TABLE 3.4-1

Comparison of Alternative Pier Options With the Proposed Pier Design

Environmental/Engineering Factor	Proposed Pier	Pier Option A	Pier Option B	Pier Option C
Shallow Water Habitat Impacts (acres)	7.4	12.7	16.1	0.5
Volume of Dredging (million cubic yards)	0.8	0.8	1.8	0.3
Riverbed Affected (acres)	27.4	27.7	52.4	19.4
Trestle Length (feet)	2,000	2,000	4,600	3,000

Pier Option C would result in the least disturbance of shallow water habitat and riverbed. Also, due to its location near the edge of the Marcus Hook anchorage area, it would also require the least amount of dredging. Pier Option B, conversely, would result in the most disturbance of shallow water habitat and riverbed and would require the most amount of dredging. These additional impacts and dredging requirements are the result of the berth for Pier Option B being mostly located closer to shore in shallow water. Pier Option A and the proposed pier would have similar trestle lengths and dredging requirements and would affect a similar amount of riverbed. However, the proposed pier would affect about 40 percent less shallow water habitat than Pier Option A.

To assess ship traffic and safety issues associated with the various pier and slip options, Crown Landing conducted ship simulation studies at Marine Safety International in June 2004. Through these studies it was determined that Pier Option C would provide the least protection from errant ships because there would be essentially no shallow water area between the LNG ship berth and the anchorage area to slow or stop an errant ship from alliding with a berthed LNG ship. This pier option could also hinder the access of coal barges to the Logan Generating Station pier. All of the other pier configurations would avoid conflicts with the existing coal unloading pier and provide a protective shallow water barrier between berthed LNG ships and the anchorage area. For the proposed pier and Pier Option B, the pier itself, which would be located between the berth and the anchorage area, would provide additional protection to berthed LNG ships.

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Figures 3.4-1, 3.4-2, 3.4-3
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Based on our evaluation of pier alternatives, we believe that Pier Options A and B would have greater environmental impacts than the proposed pier. Although it appears Pier Option C would provide some environmental advantages, it would expose berthed LNG ships to increased safety risks. For these reasons, we believe that the proposed pier configuration offers the best balance of increased safety and reduced environmental impacts.

3.5 PIPELINE ALTERNATIVES

3.5.1 Pipeline System Alternatives

Crown Landing proposes to deliver up to 1.2 Bcfd of natural gas to the Mid-Atlantic region. The majority of this natural gas (a maximum of about 0.9 Bcfd) would be delivered to the Texas Eastern pipeline system via the proposed 11-mile Logan Lateral. The remainder would be delivered to the Columbia Gas and Transco pipeline systems (a maximum of about 0.5 Bcfd and 0.6 Bcfd, respectively) through interconnects on the proposed LNG terminal site. FERC staff conducted an engineering analysis to determine if either the existing Columbia Gas or Transco pipeline systems could transport the natural gas volumes proposed for the Texas Eastern system and thus avoid the impacts associated with construction and operation of the Logan Lateral. The FERC concluded from this evaluation that neither Columbia Gas' nor Transco's existing systems separately or combined has sufficient capacity to transport the volumes of natural gas proposed for the Texas Eastern pipeline system. These pipeline systems would need to be expanded to accommodate larger gas volumes.

Columbia Gas' existing local pipeline system consists of a 20-inch-diameter pipeline in Claymont, Delaware that becomes a 16-inch-diameter pipeline which crosses the Delaware River and connects with another 20-inch-diameter pipeline that is located north of the LNG terminal site. To transport the natural gas volumes proposed for the Texas Eastern pipeline system, Columbia Gas would need to construct the following pipeline and aboveground facilities:

- 37 miles of new 36-inch-diameter pipeline from the proposed LNG terminal site, across the Delaware River to Columbia Gas' existing Eagle Compressor Station located in Chester County, Pennsylvania.;
- 20,000 hp of additional compression at Columbia Gas' existing Downingtown Compressor Station located in a residential area of Chester County, Pennsylvania; and
- A new meter and regulation station at the proposed LNG terminal site.

Since the Columbia Gas pipeline expansion would be much longer and would require additional compression, there would be greater environmental impacts, including additional noise impacts at the Downingtown Compressor Station (which currently has noise compliance issues), than the proposed Logan Lateral Project. Therefore, we did not further investigate the Columbia Gas pipeline system alternative.

Transco's existing local pipeline system consists of three pipelines. Two of these pipelines, a 12-inch-diameter pipeline and 20-inch-diameter pipeline, cross from Marcus Hook, Pennsylvania under the Delaware River to the New Jersey shoreline at the southwestern corner of the proposed LNG terminal site. A third 20-inch-diameter pipeline crosses from Marcus Hook, Pennsylvania under the Delaware River to the New Jersey at a landfall location just north of the proposed LNG terminal site. After crossing the river, these pipelines proceed northeast and form part of Transco's Trenton-Woodbury Line. To transport the volumes proposed for the Texas Eastern pipeline system, Transco would need to construct the following pipeline and aboveground facilities:

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- 12 miles of 24-inch-diameter pipeline from the proposed LNG terminal site across the Delaware River to Transco's existing Compressor Station 200 located near Frazer, Pennsylvania; and
- A new meter and regulation station at the proposed LNG terminal site.

Transco would need to construction about 1 mile more pipeline than the proposed Logan Lateral. Since the Transco pipeline would cross similar areas and resources, we anticipate that it would have similar impacts as the Logan Lateral Project. Because it would not offer any significant environmental benefits over the proposed facilities, we do not believe expansion of the Transco pipeline system would be environmentally preferable to the proposed Logan Lateral Project.

3.5.2 Major Route Alternatives

In evaluating alternatives to the Logan Lateral Project, we also assessed whether it might be possible to reduce the environmental impacts associated with the proposed pipeline[2] by developing alternative pipeline routes. We assessed both environmental factors such as wetlands, waterbodies, land uses, public lands, forest land, cultural resources, residences, and engineering factors such as terrain, potential construction techniques, and the number of roads and railroads crossed. Through this process, we identified six pipeline route alternatives or variations. Four of these are major route alternatives, which begin and end at the same location as the proposed pipeline route, but share the same alignment as the proposed route in some areas. The relative locations of these four major route alternatives are shown on figure 3.5.2-1. A comparison of these four routes to the proposed route is provided in table 3.5.2-1.

TABLE 3.5.2-1

Environmental Comparison of Alternative Routes to the Proposed Route

Environmental Factor	Proposed Route	Railroad Alternative	Hayes Street Alternative	Sunoco Alternative	Upland Road Alternative
Length (miles)	11.00	10.90	12.92	8.86	10.29
Collocated with Existing Right-of-Way (miles)	4.95	5.00	7.49	5.13	4.93
Collocated with existing Pipeline Right-of-Way (miles)	3.12	1.95	4.60	1.50	1.95
Construction Right-of-Way (acres)	101.1	101.7	125.1	81.5	95.9
Permanent Right-of-Way (acres)	54.0	52.3	72.9	45.2	52.8
State Lands Crossed (miles)	0.24	0.15	0.43	0.12	0.00
Wetlands Crossed (miles)	0.91	0.91	0.95	0.42	0.91
Parkland Crossed (miles)	0.23	0.60	0.44	0.43	0.00
Forest Land Traversed (miles)	1.71	1.41	2.30	0.85	0.91
Open Land Traversed (miles)	4.01	4.40	4.76	2.32	4.06
Agricultural Land Crossed (miles)	1.53	1.53	1.53	0.31	1.53
Industrial/Commercial Land Crossed (miles)	0.62	0.52	1.03	2.25	0.54
Waterbodies Crossed (numbers)	11	9	14	6	9
Residences within 50 feet of Construction Right-of-Way (numbers)	144	125	142	114	116
Other Buildings within 50 feet of Construction Right-of-Way (numbers)	11	21	27	20	25
Major Paved Roads Crossed (numbers)	36	12	20	15	17
Railroads Crossed (numbers)	4	3	5	5	3
Cultural Resources (potential sensitivity)	low	high	low	low	high

[2] We did not consider alternatives to the Columbia Gas and Transco interconnects warranted because these interconnects would be accomplished on the LNG terminal site with minimal environmental impact.

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Figure 3.5.2-1
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3.5.2.1 Railroad Alternative

The Railroad Alternative begins at Texas Eastern's Chester Junction and follows the same alignment as the proposed route to MP 1.2. The alternative route then turns and proceeds southeast along Bridgewater Road for about a 0.1 mile where it enters Upland Park. Within Upland Park, the alternative route proceeds south across the park. At the southern end of the park property, the alternative route crosses the Caleb Pusey Historic District and proceeds across Chester Creek to an abandoned railroad grade. The alternative route then turns and follows the abandoned railroad grade east and then southeast for about 1.4 miles, crossing the CSX railroad, Interstate 95, an active Amtrak railroad, and several streets, until it reaches the active Norfolk Southern railroad. The alternative route then proceeds southwest adjacent to the Norfolk Southern railroad for about 0.9 mile. At this point, the alternative route rejoins the proposed route. The Railroad Alternative then follows the same alignment as the proposed route across the Delaware River into New Jersey and on to the proposed LNG terminal site.

As shown in table 3.5.2-1, the Railroad Alternative is about the same length and would disturb similar types of land as the proposed route. An advantage of this alternative is that it would cross about 0.3 mile less forest land and two less waterbodies than the proposed route. The Railroad Alternative would also cross 24 fewer roads and one less railroad. Another advantage of this alternative is that it would pass within 50 feet of 19 fewer residences than the proposed route.

The major disadvantage of the Railroad Alternative is that it has a high potential to impact archaeological resources. The Railroad Alternative would cross a historic district associated with the Caleb Pusey House and Landingford Plantation that is listed on the NRHP. The historic district consists of several standing structures that are historic remnants from some of the earliest mills in Pennsylvania. Although none of the standing structures would lie within the construction right-of-way of the alternative route, a cursory review of the area has identified at least one historic mill race that would be crossed by the Railroad Alternative. It is expected that archaeological remains from other mills may still exist and that these remains would provide a source of information to verify historical accounts and provide additional historical information on daily activities associated with the mills. As such, it is expected that any archaeological remains associated with this site have a high potential to be considered eligible for listing on the NHRP.

Other disadvantages of the Railroad Alternative include the crossing of additional parkland and more difficult and possibly more costly construction requirements. The Railroad Alternative would cross almost three times as much parkland as the proposed route. In addition to crossing about 792 feet of Caleb Pusey Historic District, this alternative route crosses about 2,376 feet of Upland Park. The proposed route in comparison would cross only 1,214 feet of Veterans Memorial Park. The Railroad Alternative would be more difficult to construct than the proposed route in several locations. The alternative crossing of Interstate 95 would be more difficult because there is less space available on both sides of the highway. Additionally, there is more residential housing on the southeastern side of Interstate 95 along the alternative route, which could be affected if HDD techniques are used. Another complicated construction area along the alternative route would be where the former railroad grade crosses 7th Street in Chester. An elevated trestle at this location would require that the pipeline be installed using either conventional bore or HDD techniques, which would be difficult due to the location of the road and an electrical substation.

For the reasons discussed above, we do not believe the Railroad Alternative would be preferable to the proposed route.

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3.5.2.2 Hayes Street Alternative

The Hayes Street Alternative begins at Texas Eastern's Chester Junction and follows the same alignment as the proposed route to MP 2.3. The alternative route then deviates to the west and continues to follow an existing Texas Eastern pipeline parallel to an active railroad for about 1.6 miles. In this segment, the alternative route crosses a railroad and Interstate 95. South of Interstate 95, the alternative route crosses Laughhead Avenue, Johnson Park, and Marcus Hook Creek twice. The alternative route then proceeds northeast adjacent to the railroad for about 1 mile until it reaches Hayes Street. The alternative route then follows Hayes Street for about 0.5 mile to MP 4.3 where it rejoins the proposed route. The Hayes Street Alternative then follows the same alignment as the proposed route across the Delaware River into New Jersey and on to the LNG terminal site.

As shown in table 3.5.2-1, the Hayes Street Alternative route and the proposed route would cross a similar amount of wetlands and would be constructed adjacent to a similar number of residences within 50 feet of the construction right-of-way. Two advantages of the Hayes Street Alternative are that it would be collocated with existing rights-of-way for a greater percentage of its length and would cross 16 fewer roads than the proposed route. However, these advantages are offset by several disadvantages. This alternative route would be longer and would result in more land disturbance, including more forest clearing, than the proposed route. The alternative route would also cross both Jack's Park and Johnson's Park, which would almost double the amount of parkland crossed compared to the proposed route. Additionally, the alternative route would cross three more waterbodies and one more railroad, and would be constructed within 50 feet of 16 more non-residential buildings than the proposed route.

Another disadvantage of the Hayes Street Alternative is that it has a higher risk than the proposed route to encounter hazardous wastes. This alternative route would cross a property that contains petroleum storage tanks and a property with large industrial waste ponds. Both of these properties have the potential to be contaminated by hazardous wastes. The presence of contaminated soils and/or groundwater in the pipeline construction right-of-way could require special construction techniques and remediation measures. These techniques and measures could be costly and could expose workers to increased health and safety risks.

For the reasons discussed above, we do not believe the Hayes Street Alternative would be preferable to the proposed route.

3.5.2.3 Sunoco Alternative

The Sunoco Alternative begins at Texas Eastern's Chester Junction and follows the same alignment as the Hayes Street Alternative, mostly adjacent to an existing Texas Eastern pipeline, for about 3.9 miles to a location north of Interstate 95. The Sunoco Alternative then deviates from the Hayes Street Alternative and continues to follow the existing Texas Eastern pipeline south and west across Interstate 95, State Route 452, and several other roads. After crossing Blue Ball Avenue, the alternative route stops following the existing pipeline and proceeds west along U.S. Route 13 to the Sunoco Marcus Hook refinery property. The Hayes Street Alternative then crosses the refinery property and the Delaware River to the proposed LNG terminal site.

As shown in table 3.5.2-1, the Sunoco Alternative would be more than 2 miles shorter than the proposed route and thus would result in less land disturbance and require less permanent right-of-way. The Sunoco Alternative would also be collocated with other rights-of-way for a greater percentage of its length than the proposed route. Additionally, this alternative route would cross about 0.8 mile less forest land, about 0.5 mile less wetland, and about 1.2 miles less agricultural land than the proposed route. The

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alternative route would also cross five less waterbodies and 21 less roads, and would be constructed within 50 feet of 30 fewer residences than the proposed route.

A disadvantage of the Sunoco Alternative is that it would be constructed within 50 feet of nine more non-residential buildings It would also require construction activities within the vicinity of the industrial storage tank farm located north of Interstate 95, as well as within the limits of the Sunoco Marcus Hook refinery located adjacent to the Delaware River. The refinery has been in operation since 1902 and produces fuels and other petrochemical products. As a result of the long history of operation and nature of work done at this refinery, it is highly likely that contaminated soils and/or groundwater would be encountered during installation of a pipeline through this property. The presence of contaminated soils and/or groundwater in the pipeline construction right-of-way could require special construction techniques and remediation measures. These techniques and measures could be costly and could expose workers to increased health and safety risks.

The Sunoco Alternative would cross both Jack's Park and Lower Chichester Municipal Park, which would almost double the amount of parkland crossed compared to the proposed route. The alternative route would also require a 7,000-foot crossing of the Delaware River. Texas Eastern has indicated that a river crossing of this length has never been accomplished for a large diameter pipeline using HDD techniques. If HDD techniques would be infeasible for installing the pipeline along the alternative route across the Delaware River, the pipeline would need to be installed across the river using open-cut techniques. This type of construction technique would result in substantial more impacts on the river and could be difficult to get approved by the applicable regulatory agencies.

For the reasons discussed above, we do not believe the Sunoco Alternative would be preferable to the proposed route.

3.5.2.4 Upland Road Alternative

The Upland Road Alternative begins at Texas Eastern's Chester Junction and follows the same alignment as the proposed route for about 0.2 mile. It then deviates from the proposed route and proceeds southeast along Edgmont Avenue for about 800 feet. The alternative route then proceeds south along Upland Road for about 1.2 miles. At this point, the alternative route leaves the road and proceeds south and southeast across Chester Creek and Interstate 95. South of Interstate 95, the alternative route follows the same alignment as the Railroad Alternative for about 1.8 miles until it rejoins the proposed route at MP 4.3. From MP 4.3, the Upland Road Alternative follows the same alignment as the Railroad Alternative and the proposed route across the Delaware River to New Jersey and on to the LNG terminal site.

As shown in table 3.5.2-1, the Upland Road Alternative would be shorter than the proposed route and thus would result in less land disturbance and require less permanent right-of-way than the proposed route. This alternative route would cross two less waterways and 19 less roads than the proposed route. This alternative route would also reduce the crossing of forest land by about 0.8 mile. Additionally, the Upland Road Alternative would not cross any parkland and would be constructed within 50 feet of 28 fewer residences than the proposed route.

A disadvantage of this alternative route is that Upland Road is a heavily traveled, tree-lined thoroughfare that would be adversely affected by pipeline construction. Construction of a pipeline along this alternative route would likely require closing the street to traffic and establishing local detours, particularly near 10th Street where the road is narrow. This road closure would hinder or restrict access to three churches, a school, and two businesses located along Upland Road and slow the flow of traffic,

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resulting in increased traffic congestion. The Upland Road Alternative would also pass within 50 feet of 14 more non-residential buildings than the proposed route.

Another complicated construction area along the alternative would be near Chester Creek and Interstate 95. There is limited space available on either side of the creek and highway at the alternative crossing location to set up equipment for a bore or HDD.

The Upland Road Alternative would also pass close to the National Historic District associated with the Caleb Pusey House and Landingford Plantation, which would increase the potential to encounter significant cultural resources.

For the reasons discussed above, we do not believe the Upland Road Alternative would be preferable to the proposed route.

3.5.3 Minor Route Variations

During the NEPA Pre-filing Process, Texas Eastern identified three minor route variations to avoid or minimize impact on specific resources along the pipeline route. Some of these minor variations were adopted as part of Texas Eastern's proposed route prior to filing its application. The other variations were either rejected by Texas Eastern or are still being evaluated.

Palmer Street Variation

The Palmer Street Variation was identified by Texas Eastern as an alternative to the proposed route between MPs 3.13 and 3.31, which is located within an existing wooded ravine behind several residential homes in the City of Chester. This variation deviates from the proposed route about 750 feet south of Interstate 95 and continues south within Palmer Street for about 1,000 feet until it dead ends near the end of Columbia Street. The street would need to be open cut to install the pipeline beneath the road pavement. At the end of Palmer Street, the variation proceeds west down a steep 15-foot embankment into a forested area. The variation then continues south across about 0.11 mile of forest land before crossing 9th Street (U.S. Route 13), and rejoining the proposed route in Veterans Memorial Park. The location of the Palmer Street Variation is shown on figure 3.5.3-1.

The primary advantage of the variation is that it avoids crossing about 640 feet of forest land, a small man made ditch or drain at MP 3.19, and two forested wetlands located at MPs 3.22 and 3.34, respectively, within the narrow wooded corridor west of Palmer Street. The disadvantages of the variation are that it would be located within about 1,250 feet more of residential street and would require construction near seven more residences than the proposed route. Construction within the street would also increase construction costs, increase traffic impacts on Palmer Street, and possibly hinder access of residents to their homes.

Texas Eastern rejected the Palmer Street Variation after holding public open houses, discussing the issue with the local community, and receiving requests from residents that the pipeline should be located along the proposed route within the wooded corridor west of Palmer Street. We concur that although the proposed route would affect wetlands and forest land, it would result in less residential impact than the variation and, therefore, is preferable to the variation.

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Non-Internet Public

Figure 3.5.3-1
(Page 3-53)

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Ward Street Variations

Texas Eastern met with officials of the City of Chester in August 2004 to discuss the crossing of Veterans Memorial Park. At the request of city officials, Ward Street Variations A and B were developed to avoid or minimize impacts on the park. Both variations would deviate to the west of the proposed route at MP 3.33 about 400 feet north of 9th Street (U.S. Route 13). From there, Variation A would proceed west until it reaches the western boundary of Veterans Memorial Park adjacent to Ward Street. Variation A would then proceed south following the edge of the park for 1,000 feet. At this point, Variation A would turn and proceed east across the southwest corner of the park for about 250 feet where it would rejoin the proposed route just north of the railroad at MP 3.67. Variation B would essentially follow the same alignment as Variation A except the pipeline would be located within Ward Street rather than along the edge of the park. The locations of Ward Street Variations A and B are shown on figure 3.5.3-2.

The Ward Street Variations would slightly increase the length of the pipeline. The primary advantage of these variations is that they would avoid or minimize impacts on the park, including disruption of recreational activities during pipeline construction. In addition, the variations would also avoid or minimize encumbrance of the pipeline on any future park developments such as swimming pools, club houses, memorials, or other amenities. The primary disadvantage is that the variations would result in the placement of the pipeline and associated construction activities closer to several residences located along Ward Street and 6th Street. Another disadvantage specific to Variation B is that it would require in-street construction, which would increase construction costs, increase traffic impacts on Ward Street, and possibly hinder access of residents to their homes. In a November 19, 2004 letter to Texas Eastern (Cartisano, 2004), the City Solicitor of Chester indicated a preference for Variation A because it would not encumber any future expansion of the park.

Because Ward Street Variation A would either avoid or substantially minimize impacts on Veterans Memorial Park and the street, **we recommend that:**

- **Texas Eastern incorporate Ward Street Variation A into the proposed route.**

Soil Safe Variation

The Soil Safe Variation in New Jersey was developed as an alternative to the last 3 miles of the original pipeline route, which followed an existing dirt road roughly parallel to and about 1,000 feet south of the Delaware River shoreline. The original route crossed the Soil Safe facility property and proceeded west behind the Ferro Polymer facility and in front of the Logan Generating Station. Based on consultations with representatives of the Soil Safe facility and the Ferro Polymer facility, a contaminated soil cleanup operation and areas of potentially contaminated soils were identified along the original route. The Soil Safe Variation avoids these contaminated soil areas by proceeding southwest adjacent to U.S. Route 130 about 2,000 feet south of the original route. Texas Eastern adopted the Soil Safe Variation as part of the proposed route prior to filing its application with the FERC. We concur that the Soil Safe Variation is preferable to the original pipeline route.

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Facility Location Map
Figure 3.5.3-2

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4.0 ENVIRONMENTAL ANALYSIS

The environmental consequence of constructing and operating the proposed Crown Landing LNG and Logan Lateral Projects would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impact generally occurs during construction with the resource returning to preconstruction condition almost immediately afterward. Short term impact could continue for up to 3 years following construction. Impact was considered long term if the resource would require more than 3 years to recover. A permanent impact could occur as a result of any activity that modifies a resource to the extent that it would not return to preconstruction conditions during the life of the project, such as the construction of an LNG terminal. We considered an impact to be significant if it would result in a substantial adverse change in the physical environment.

In this section, we discuss the affected environment, general construction and operational impact, and proposed mitigation for each resource. Crown Landing and Texas Eastern, as part of their proposals, agreed to implement certain measures to reduce impact. We evaluated Crown Landing's and Texas Eastern's proposed mitigation to determine whether additional measures are necessary to reduce impact. These additional measures appear as bulleted, boldfaced paragraphs in the text. We will recommend that these measures be included as specific conditions to the authorization and Certificate that may be issued to Crown Landing and Texas Eastern for their projects.

Conclusions in this EIS are based on our analysis of the environmental impact and the following assumptions:

- Crown Landing and Texas Eastern would comply with all applicable laws and regulations;
- the proposed facilities would be constructed as described in section 2.0 of this document; and
- Crown Landing and Texas Eastern would implement the mitigation measures included in their applications and supplemental filings to the FERC.

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4.1 GEOLOGIC RESOURCES

4.1.1 Physiographic and Geologic Setting

The proposed project is located within two major physiographic provinces: the Atlantic Coastal Plain Province and the Piedmont Province. The demarcation between these provinces in the project area, referred to as the Fall Line, has been interpreted somewhat differently in the literature, but generally corresponds to the uplands that rise along the northwestern shore of the Delaware River (Fenneman and Johnson, 1946; WPC, 2003a). Therefore, the proposed LNG terminal site and the portion of the Logan Lateral route from approximate MP 4.0 to MP 11.0 are situated in the Atlantic Coastal Plain Physiographic Province, and the remainder of the Logan Lateral route, from MP 0 to MP 4.0, crosses the Piedmont Physiographic Province.

The Atlantic Coastal Plain forms a flat to gently rolling plain, with surface elevations at the LNG terminal site ranging between 5 and 10 feet North American Vertical Datum (NAVD) and along portions of the proposed pipeline ranging between sea level and 20 feet NAVD. Regionally, the Atlantic Coastal Plain is underlain by Cretaceous to Early Tertiary sediments that range from minimal thickness landward to more than 40,000 feet thick at the continental shelf break beneath the Atlantic Ocean. The sediments consist of sand, silt, and clay deposited alternately in deltaic and marine environments as sea level fluctuated during Cretaceous and Tertiary times. Bedrock beneath the Atlantic Coastal Plain consists of crystalline rocks of Precambrian, Early Paleozoic, and Triassic ages. The bedrock surface beneath the Atlantic Coastal Plain is highly irregular due to structural warping associated with past tectonism.

As shown on figure 4.1.1-1, site-specific soil boring data from the LNG terminal site indicate that the site is underlain by the following deposits and geologic units:

- Layer 1, Dredged Fill – The surficial layer is dredged material placed onsite between the 1930s and 1960s during dredging of the Delaware River. The unit extends from the surface to an average depth of 4 feet and is composed of silts and sands in varying proportions.

- Layer 2, Sand/Gravelly Sand – This unit is referred to as the Cape May Formation and is of Pleistocene alluvial origin. The unit is approximately 5 to 20 feet thick at the site.

- Layer 3, Clayey Silt – Layer 3 forms a confining unit between the overlying Cape May Formation and the underlying Potomac-Magothy-Raritan Formation (undifferentiated) of Layer 4. The unit is Upper Cretaceous or Tertiary in age and was deposited in marine or lacustrine environments. Layer 3 is 85 to 95 feet thick and consists primarily of clayey silt with interbedded sand seams. Due to its significant thickness and compressibility, Layer 3 poses geotechnical issues to the proposed LNG terminal, as discussed in section 4.1.4.2.

- Layer 4, Sand and Gravel – This unit forms the Potomac-Magothy-Raritan Formation and is believed to be of Cretaceous alluvial origin. The unit is 10 to 20 feet thick beneath the site. Piles proposed for the foundations of the LNG storage tanks and other critical structures would be driven to Layer 4.

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regulations governing the use of explosives, including PA Code Chapters 210 and 211 and New Jersey Administrative Code (NJAC) 12:190. The general provisions of the blasting plan include:

- Installation of blast mats in congested areas, in shallow waterbodies where necessary, and near structures to prevent damage by fly-rock;
- Posting of warning signals, signs, flags, and barricades in the area;
- Following procedures for the safe storage, handling, loading, firing and disposal of explosives;
- Manning adjacent pipelines at valves for emergency response; and
- Controlling excessive vibrations by limiting the size of the charge and staggering charges in a series of explosions.

4.1.3 Mineral Resources

Sand, gravel, and clay have been mined in the project area for construction and industrial purposes (U.S. Geological Survey (USGS), 1908; 2002a; 2002b). Two active sand and gravel pits and one active dimension-stone quarry were identified in Delaware County, Pennsylvania; however, none of these active operations are located within 1 mile of the project (Pennsylvania Geological Survey (PGS), 1997; USGS, 2004a). Aerial photograph review and site reconnaissance did not identify any abandoned or active mining operations within 0.25 mile of the project, and soil borings did not identify any commercially exploitable mineral deposits at the proposed LNG terminal site. Coal, petroleum, and other commercially exploitable mineral resources are not known to exist in the project area (PGS, 1993; 2002).

Construction and operation of the proposed projects would not impact any current mineral resource recovery operations. Based on the lack of significant and unique mineral resources and the high degree of development that exists in the area, the projects would not significantly reduce the future ability to recover sand, gravel, clay, or other mineral resources.

4.1.4 Geologic Hazards

Geologic or other hazards in the project area consist of seismic-related hazards; load-bearing capacity of soils at the LNG terminal site; slope instability, subsidence, and flooding. Conditions necessary for the development of other geologic hazards including karst terrain, avalanches, and volcanism are not present in the project area.

In general, the potential for geologic or other natural hazards to significantly affect the construction or operation of the proposed projects is low. The risk of damage resulting from geologic or other natural hazards would be avoided or reduced by specific engineering design criteria, ground modification, and other construction techniques and operating procedures to be implemented by Crown Landing and Texas Eastern.

4.1.4.1 Seismic-related Hazards

The proposed projects are situated in an area with a relatively low potential for significant seismic activity. Potential seismic-related hazards that exist in the area include earthquakes, surface faulting, soil liquefaction and related soil failures, and tsunamis.

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Crown Landing conducted detailed, site-specific geotechnical and geoseismic studies to evaluate the risk of seismic-induced damage to the proposed LNG terminal. Texas Eastern also conducted a general seismic review of the area for construction of the Logan Lateral. The results of the LNG terminal site studies are presented in reports entitled *Geotechnical Engineering Investigation Report – Liberty [now Crown Landing] LNG Project, Logan Township, Gloucester County, New Jersey* (WPC, 2003a) and *Seismic Hazard Study Report – Liberty [now Crown Landing] LNG Project, Logan Township, Gloucester County, New Jersey* (WPC, 2003b). These reports were reviewed by Dr. Felix Yokel (2004), an expert in geotechnical engineering. Dr. Yokel concluded that the geotechnical investigation was thorough and of a high quality, providing adequate and reliable data for the design of the project. Dr. Yokel also concluded that the seismic risk assessment was a state-of-the-art analysis which complied with seismic hazard provisions of 49 CFR 193 and NFPA 59A (2001 edition) *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)* and which met the guidelines in NBSIR 84-2833, *Data Requirements for the Seismic Review of LNG Facilities.*

Earthquakes

The majority of significant earthquakes around the world are associated with tectonic subduction zones, where one crustal plate is overriding another (e.g., the Japanese islands), or where plates are sliding past each other (e.g., California). Unlike these highly active tectonic regions, the East Coast of the United States is located on the "trailing edge" of the North American continental plate, which is relatively seismically quiet. Earthquakes, however, do occur in the project area, largely due to trailing edge tectonics and residual stress release from past orogenic (mountain building) events.

The project area is located near the border between Seismic Zones 1 and 2A as defined in the Uniform Building Code. The area is characterized by generally low magnitude events that have been recorded for the past 300 years, although stronger earthquakes have occurred in the region. Two notable earthquakes have occurred in relatively close proximity to the projects:

- An 1871 earthquake occurred in northern Delaware, about 12 miles from the LNG terminal site. This earthquake resulted in Modified Mercalli Intensity (MMI) VII damage, including toppled chimneys and broken windows. In an MMI VII event, damage is negligible to buildings of good design and construction (PGS, 2003); and

- A 1944 earthquake occurred approximately 7 miles from the LNG terminal site, resulting in MMI V damage such as broken windows and cracked plaster. The level of shaking associated with an MMI V event is generally below the threshold of damage to well built structures.

Other larger, but more distant, earthquakes have also affected the project area including the 1811 to 1812 earthquake sequence near New Madrid, Missouri and the 1886 earthquake near Charleston, North Carolina. These and other earthquakes were considered in the seismic hazard assessment for the LNG terminal site.

As required by NFPA 59A, a site-specific seismic hazard analysis was conducted to develop seismic design criteria for the proposed LNG terminal. The results of the site-specific seismic hazard analysis were used to predict the level of shaking associated with the Safe Shutdown Earthquake (SSE, defined as the 5,000-year mean return earthquake) and the Operating Basis Earthquake (OBE, scaled as two-thirds of the Maximum Considered Earthquake (MCE), which is the 2,500-year mean return earthquake). The OBE represents the level of shaking through which the facility should be able to operate and continue operating after its occurrence, with perhaps a brief shutdown for a safety inspection to

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confirm that no damage occurred. The larger SSE represents the level of shaking that should not damage the vital, safety-related components of the facility to the extent that they could not function.

Detailed seismic design criteria are presented in the seismic report (WPC, 2003b). In general, the seismic hazard analysis indicates that the LNG terminal site would experience a peak ground acceleration (PGA) of 10.4 percent of the acceleration due to gravity (0.104 g) during the 2,500-year earthquake and a PGA of 0.129 g during the 5,000-year earthquake. The OBE would result in a PGA of 0.069 g.

To provide a higher level of safety, Crown Landing would construct the LNG storage tanks to allow for safe shutdown during an earthquake with a recurrence interval of 10,000 years, rather than 5,000 years as currently required by NFPA 59A. Based on the seismic hazard analysis performed for the site, the LNG terminal would experience a PGA of 0.153 g during the 10,000-year earthquake event.

In conclusion, based on the evaluation conducted for the LNG terminal site, the likelihood of a major earthquake occurring in the project area during the operating life of the LNG facility is low. Crown Landing's commitment to meet or exceed applicable seismic design standards would further reduce the potential effects associated with earthquakes to the LNG terminal. These seismic design elements include:

- installing a pile foundation system beneath the LNG tanks and other critical structures, which would dissipate a substantial portion of earthquake-induced vibrational energy into the supporting soil, thereby dampening the effects of ground motions to the LNG tanks themselves;
- designing the outer and inner LNG tanks to account for the predicted seismic motions in accordance with NFPA 59A and ACI 318 guidelines; and
- accounting for the calculated LNG slosh wave height in the dimensions and design of the LNG tanks resulting from the predicted seismic loads.

Ground shaking would not be expected to materially affect the proposed pipeline, which would be constructed of modern steel that is capable of remaining elastic during the level of shaking that could potentially occur in the area (O'Rourke and Palmer, 1994).

Surface Faulting

There are no mapped surface faults in the project area (USGS, 1908; 2004b) and site-specific geotechnical and seismic studies did not identify any evidence of active surface faults at the proposed LNG terminal site. Furthermore, the low to moderate level of seismic activity that does occur within 125 miles of the project has not been associated with movement on any specific fault (Yokel, 2004).

In conclusion, the potential for surface faulting to occur in the project area is low. The proposed LNG storage tanks and other LNG facility structures and the proposed pipeline would be constructed to meet or exceed all applicable engineering and seismic design standards, further reducing any potential damage that could occur in the highly unlikely event of surface faulting in the project area.

Soil Liquefaction

Secondary seismic effects triggered by strong ground shaking are often more serious than the shaking itself. One such secondary effect, soil liquefaction, is a physical process in which saturated, cohesionless soils temporarily lose their load-bearing strength when subjected to strong and prolonged

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shaking. Soil liquefaction can also lead to other ground failures, including settlement and lateral spreading.

Standard penetration tests (SPT), cone penetration tests (CPT), flat-blade dilatometer (DMT) soundings, geophysical measurements, and laboratory analyses were performed to evaluate the physical and engineering properties of existing soils at the LNG terminal site. A liquefaction analysis was performed based on the CPT data using a commercial computer program (LiquefyPro), which employs the Robertson and Wride (1998) method. CPT gathers data at a much smaller sampling interval than SPT and DMT, which helps detect weak pockets or lenses within the soil column. The analysis indicates that soils at the LNG terminal site would not liquefy if subjected to the level of ground shaking associated with the 10,000-year earthquake predicted for the site (WPC, 2003a). The installation of deep foundation piles beneath the LNG tanks and other critical structures, as proposed, would further reduce any potential for liquefaction to affect those structures.

Because the risk of a strong earthquake in the project area is low, the potential for soil liquefaction to occur along the proposed pipeline is low. Due to their strength and ductility, modern steel pipelines can span considerable distances unsupported without threatening the integrity of the pipeline.

Tsunamis

Tsunamis are long oceanic waves generally caused by seismic activity. While a tsunami could potentially occur along the East Coast of the United States, only two Atlantic Ocean tsunamis have been recorded: a tsunami which struck Lisbon, Portugal in 1755, and one which struck eastern Canada in 1929. The probability of a significant tsunami occurring along the East Coast is very low (NOAA, 2003) and would not pose a significant risk to the projects.

4.1.4.2 Load-Bearing Capacity

The physical and engineering properties of existing geologic materials at the LNG terminal site were determined using SPT, CPT, DMT soundings, geophysical measurements, test pits, and laboratory analyses (WPC, 2003a). These analyses determined that, without foundation improvement, excessive settlement would occur beneath the LNG tanks and process area due to the compressibility of the thick, clayey silt layer at the site (Layer 3).

Preliminary recommendations for the LNG tank foundation system include a reinforced concrete pile cap supported by 18-inch-diameter steel pipe piles driven into the hard sand and gravel layer (Layer 4) at an approximate depth of 100 feet below ground surface. Other preliminary LNG tank foundation design elements include placement of 6 inches of coarse granular fill beneath the center of the concrete pile cap to protect the foundation from frost heave during construction, and installation of heating cables in conduit embedded within the concrete pile cap to prevent frost heave during operation of the terminal. Corrosion protection could also be necessary to further protect the steel piles.

Final settlement criteria have not been developed for the LNG tanks; however, settlement criteria for similar projects included permissible tilting of 7 inches across the tank and 6 inches of differential settlement between the center and edge of the tank. The preliminary foundation design for the proposed LNG tanks would result in an estimated total settlement of 1.5 inches, a majority of which should be uniform and occur during hydrostatic testing of the tanks (WPC, 2003a). Crown Landing will conduct additional CPT tests and field pilot tests to finalize the LNG foundation design.

Excessive settlement is also the primary concern for equipment foundations in the LNG process area. Existing grades in the process area vary from 5 to 10 feet NAVD. Assuming a final grade elevation

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of up to 12 feet NAVD in this area, 2 to 3 feet of fill would be needed in the majority of the process area, with up to 7 feet of fill required in some areas. An estimated total settlement of 10.5 inches would occur from 7 feet of fill and approximately 8.5 inches of settlement would occur due to foundation loads. The total settlement to be experienced by the equipment in the process area would be somewhere between one-half to two-thirds of the total combined settlement due to the fill and foundation loads, or approximately 9.5 to 12.5 inches. Preliminary foundation improvement options considered for the process area include mat foundations in conjunction with surcharging and piles. Crown Landing will conduct additional field tests to finalize the foundation designs for the process area and other terminal structures.

The engineering and construction of the proposed LNG tanks are discussed in more detail in section 4.12. Based on preliminary engineering analysis, it appears that the potential for excessive settlement to occur at the LNG terminal site can be effectively mitigated through foundation design.

4.1.4.3 Slope Instability

An earthen dike with sideslopes would be constructed around the three LNG tanks to prevent LNG from flowing off the terminal site in the unlikely event of a double failure of the steel inner tank and the concrete outer tank. Initial designs indicate that the dike would be approximately 780 feet by 900 feet, with a top elevation of 18 feet NAVD. The engineering and construction of slopes to be created at the proposed LNG terminal site are discussed in more detail in section 4.12. Based on preliminary analysis, it appears that the stability of site slopes can be ensured by implementing sound engineering and construction methods.

The proposed pipeline would traverse areas of low relief in New Jersey and low to moderate relief in Pennsylvania. Elevations along the proposed route vary from sea level near the Delaware River to approximately 100 feet NAVD between MPs 2.0 and 3.0. The project is in an area of moderate landslide susceptibility but low landslide occurrence, (USGS, 1982) as no Holocene debris flows or landslides have been identified in the area (USGS, 1999a). Therefore, the potential for landslides or other slope failures to affect the proposed pipeline is low, and would be further reduced through the use of appropriate erosion control measures during construction and operation.

4.1.4.4 Subsidence

Regional subsidence is most often caused by significant groundwater use or petroleum production. The proposed projects are not located in an area of regional subsidence and they do not cross any known underground mines or karst areas. Therefore, subsidence or localized land surface collapse events would not be expected to affect the projects.

4.1.4.5 Flooding

Flash Flooding

The potential for flash flooding to occur and significantly impact construction or operation of the proposed projects is low. The greatest potential for flash flooding to occur in the project area is associated with tropical storms or severe frontal storms, which are usually accompanied by significant precipitation over a short period of time. The potential effects associated with high rainfall events during construction of the LNG terminal would be mitigated by implementing our Plan and Procedures and Crown Landing's SESC Plan. After construction, the proposed LNG terminal would be stabilized with permanent erosion control measures such as vegetative cover, and a stormwater management system would be constructed to treat and manage stormwater runoff. Texas Eastern's implementation of our Plan

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and Procedures and its SESC Plan would also minimize the effects of rainfall events during construction and operation of the proposed pipeline.

Storm Surge

Storm surge, the abnormal rise in sea level due to the wind and pressure forces associated with hurricanes and other tropical storms, is often the most significant cause of damage to facilities and property in low-lying coastal areas. According to the NOAA (2004b), one Category I hurricane made landfall in New Jersey from 1900 through 1996. Category I storms have sustained winds of 74 to 95 miles per hour and storm surges on the order of 4 to 5 feet. No hurricanes made landfall in Delaware during the same time period.

A storm surge study of the proposed LNG terminal site determined the 1,000 year flood elevation to be 12 feet NAVD. The terminal area to the east of the LNG tanks and the metering area to the west of the tanks would be constructed with a finished grade of at least 12 feet NAVD. The base of the LNG tanks themselves would be approximately 7 feet NAVD, but the top of the earthen dike surrounding the tanks would be 18 feet NAVD. Therefore, the proposed LNG terminal site would be protected against storm surge associated with tropical storms of the magnitude that are likely to affect the project area.

4.1.5 Paleontological Resources

Construction and operation of the LNG terminal would not impact important paleontological resources. The project area is not known to contain sensitive paleontological resources, but is underlain by Cretaceous age sediments which often contain paleontological artifacts (New Jersey Paleontological Society, 2003). Cretaceous age sediments are not found at the surface of the proposed LNG terminal site, but occur at an approximate depth of 10 feet below ground surface. No paleontological resources were discovered during the cultural resource surveys on the LNG terminal site, which included the excavation of several trenches and shovel test pits.

Construction of the proposed pipeline would be unlikely to encounter any significant paleontological resources, and the route does not cross any protected paleontological resources (PGS, 2004; New Jersey Geological Survey, 2004; New Jersey Natural History Museum, 2004).

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4.2 SOILS AND SEDIMENTS

4.2.1 Soil Resources

Soil Characteristics at the LNG Terminal Site

Soils at the proposed LNG terminal site are highly variable with textures ranging from gravelly sandy soils to silts and clays. Table 4.2.1-1 summarizes the characteristics of the soils on the site. Borings indicate that the majority of the proposed construction area is primarily sands and gravels, with some traces of silt and clay. Soil testing and USDA soil mapping indicate that approximately 147 acres or 84 percent of the soils at the site consist of Made-land. This Made-land, which is up to 4 feet in depth, consists of dredged material that was placed onsite during dredging of the Delaware River, primarily between the 1930s and 1960s (USDA, 1962). The Made-land materials consist of two textural types: Made-land/coarse (Mc), which predominates on the northern and central portions of the site; and Made-land/fine (Mf), which is present along the southern and southeastern portions of the site. Based on the distribution of these two Made-land types, it seems likely that dredged materials were placed on the northern end and then the finer textured materials were redeposited to the southern portions of the site during dewatering operations.

The remaining soils on the LNG terminal site include 20 acres of Woodstown/Klej and Downer loamy sands, 4 acres of Fallsington sandy loam, and 4 acres of tidal marsh. None of the soils on the LNG terminal site are classified as prime farmland.

TABLE 4.2.1-1

Acreage of Soils and Soil Characteristics at the Proposed LNG Terminal Site

Soil Series	Area on Site (acres)	Temporary Disturbance Area (acres)	Permanent Disturbance Area (acres)	Soil Characteristics	Prime or Unique Farmland
Made-Land/ Coarse	61.2	37.3	37.3	Moderately well-drained, coarse-textured material, poor structure, variable in texture and depth	Undetermined
Made-Land/ Fine	85.7	< 0.86	< 0.86	Fine-textured material with poor structure, variable texture and depth	Undetermined
Fallsington Sandy Loam	3.5	< 0.3	0	Poorly drained, permeable sandy loam	No
Tidal Marsh	3.5	0	0	Saturated soils	No
Woodstown Loamy Sand	19.2	3.7	0.5	Deep, moderately well-drained loamy sand	No
Downer Loamy Sand	< 1.7	< 0.3	0	Deep well-drained loamy sand	No
Total	174.8	42.5	38.7		

Soil Quality at the LNG Terminal Site

Seventy-one soil samples from the proposed LNG terminal site were analyzed for EPA priority pollutants, semi volatile organics (SVOCs), volatile organics (VOCs), polycyclic aromatic hydrocarbons

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(PAHs), pesticides, polychlorinated biphenyls (PCBs), phenols, cyanide, total petroleum hydrocarbons (TPH), and metals. The soil sampling locations are shown on figure 4.2.1-1. The results were compared with New Jersey Soil Cleanup Criteria (NJSCC). The soil samples that exceeded NJSCC criteria are listed in table 4.2.1-2.

TABLE 4.2.1-2

Analytical Results of Soil Samples Collected within the Proposed LNG Terminal Site

Parameter	Type	NJSCC (residential) a/	NJSCC (non-residential) a/	Sampling Locations b/	Analytical Results
Arsenic	Metal	20 mg/kg	20 mg/kg	AST-3	24.7 mg/kg
				AST-4	23 0 mg/kg
				AST-5	26.8 mg/kg
				AST-6	24 3 mg/kg
				AST-7	23.5 mg/kg
				AST-8	22.9 mg/kg
				SB-32	24.3 mg/kg
Dieldrin	Pesticide	42 µg/kg	180 µg/kg	SB-1	54 µg/kg
				SB-2	84 µg/kg
				SB-21	74 µg/kg
				SB-22	79 µg/kg
				GTB 6	82 µg/kg
				GTB 11-18	50 µg/kg
				GTB 21-29	72 µg/kg
TPH	Petroleum	10,000 mg/kg	No Criteria	AST-1	46,800 mg/kg
				AST-2	53,000 mg/kg
Benzo(a)anthracene	SVOC/PAH/Fuel/ Hydrocarbons	900 µg/kg	4,000 µg/kg	SB-24	1,600 µg/kg
				GTB-Area 31	1,900 µg/kg
Benzo(b)flouranthrene	SVOC/PAH/Fuel/ Hydrocarbons	900 µg/kg	4,000 µg/kg	SB-24	1,500 µg/kg
				GTB-Area 31	1,100 µg/kg
Benzo(k)flouranthrene	SVOC/PAH/Fuel/ Hydrocarbons	900 µg/kg	4,000 µg/kg	SB-24	960 µg/kg
				GTB-Area 31	1,400 µg/kg
Benzo(a)pyrene	SVOC/PAH/Fuel/ Hydrocarbons	660 µg/kg	660 µg/kg	SB-24	830 µg/kg
				GTB-Area 31	1,200 µg/kg

a/ NJDEP Soil Cleanup Criteria, May 1999 New Jersey Administrative Code 7:26D.

b/ See figure 4.2.1-1 for sampling locations AST – aboveground storage tank; SB – soil boring; GTB – geotechnical boring.

mg/kg milligrams per kilogram
µg/kg micrograms per kilogram

The results of the laboratory analyses indicated elevated concentrations of TPH, SVOCs, arsenic, and dieldrin in a few limited areas. The elevated TPH concentrations were only found in the vicinity of two abandoned 275-gallon aboveground storage tanks (AST 1 and 2). The SVOCs were only found in the upper 6 inches of soil in two adjacent borings (SB-24 and GTB-Area 31).

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Non-Internet Public

Figure 4.2.1-1
(Page 4-13)

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Elevated arsenic levels were detected in the vicinity of an abandoned 1,500-gallon storage vessel (AST-3 to AST-8), and one other isolated boring (SB-32). All of the results were slightly above the NJSCC (i.e., 22.9 to 26.8 milligrams per kilogram (mg/kg) relative to the cleanup criterion of 20 mg/kg). The cause of the elevated arsenic level is unknown but could be the result of a spill from a storage vessel, historic use of arsenic-containing pesticides in the project area[1], or high native arsenic levels associated with the dredged materials that were removed from the Delaware River. The NJDEP estimates that background arsenic concentrations in the New Jersey Coastal Plain province are between 1.15 and 6.15 mg/kg in rural areas and between 5.2 and 13.6 mg/kg in urban areas (Sanders, 2003). Thus the arsenic concentrations on the site soils are between five and twenty times higher than background estimates for rural areas of the Coastal Plain.

The analytical results also indicated elevated levels of dieldrin near the soil surface in 7 of the 71 soil borings. Dieldrin, a persistent organic compound that degrades very slowly in the environment, was once commonly used in agriculture as an insecticide. The use of dieldrin has been banned in the United States by the EPA since 1987 (Agency for Toxic Substances and Disease Registry, 2003). All seven of the soil borings containing elevated levels of dieldrin were located in historic dredge disposal areas above the elevation of the underlying natural soil. None of the concentrations in these seven samples were above the NJSCC for non-residential use, but all exceeded NJSCC residential standards. The source of dieldrin is unknown but may be from the dredged material that was deposited on the site or the result of the spraying of insecticides associated with agricultural operations subsequent to the dredged materials being deposited.

Soil Impacts from LNG Terminal Construction and Operation

Crown Landing proposes to use fill material to raise the LNG process area above the 1,000-year design storm surge elevation of 11.4 feet NAVD and to create a containment dike around the LNG storage tanks. Approximately 150,000 cubic yards of fill would be needed. Crown Landing would import soils of suitable structural and chemical quality for use as fill material. Some of this material could consist of reclaimed and dewatered dredged material obtained from offsite sources.

Initial site preparation (grading and other soil disturbing activities), including the removal of existing vegetation, and placement and grading of fill to raise the site grade, could increase the potential for soil compaction, soil erosion, and sedimentation of adjacent waterbodies and wetlands. Of these potential effects, compaction is not anticipated to be a significant issue since the soils on the terminal site are almost entirely moderately-well drained sands and gravels, which are not compaction prone.

Crown Landing would minimize the potential for erosion and sedimentation by implementing the measures specified in our Plan and in a site-specific SESC Plan that would require approval from the Gloucester County Soil Conservation District. These measures would include installation of sediment filters and barriers during construction to prevent the flow of silt-laden water into adjacent wetlands and the Delaware River. Following construction, Crown Landing would permanently stabilize disturbed soils on the site by establishing a vegetative or gravel cover and installing other appropriate landscaping.

Soil contamination from a variety of sources was identified on the LNG terminal site. Most of the contamination occurs in limited areas and at low concentrations. Only TPH and benzo(a)pyrene exceeded the NJSCC for non-residential use. Arsenic and dieldrin were identified at concentrations above the residential NJSCC but below the non-residential NJSCC.

[1] Gloucester County had some of the highest agricultural arsenic usage in New Jersey between 1900 and 1980 (Vowinkel, et al., 2001); therefore, it seems more likely that elevated arsenic concentrations are a result of former agricultural practices.

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Construction workers would have higher risk of exposure to the contaminated soils. To minimize this risk and protect construction workers, Crown Landing proposes to further delineate the extent of TPH- and SVOC-contaminated soils and excavate and dispose of the contaminated soils and the associated aboveground tanks at a permitted disposal facility prior to construction. Crown Landing would also further delineate the areas of elevated arsenic and dieldrin contamination and consult with the NJDEP regarding whether any remedial actions other than the removal of the 1,500-gallon storage vessel and/or institutional controls (e.g., restricting any future residential use of the LNG terminal site) would be necessary to mitigate the arsenic and dieldrin contamination.

All of the samples with elevated contaminant concentrations, except core SB-32, occur in areas that would be located beneath the LNG process area. Thus most of the contaminated soils would be buried by a significant volume of fill material placed to raise the site grade and to create the containment berm for the storage tanks. The fill pad, containment berm, and LNG process facilities would effectively isolate the contaminated soils from future human exposure.

Soils Along the Pipeline Route

According to published soils information (USDA, 1963), the proposed pipeline route from MP 0 to MP 4.9 crosses eight different soil series and one miscellaneous land type in Pennsylvania. The soil series include:

- Manor series - well to somewhat excessively drained soils with loam and channery loam textures and moderate permeability;
- Sassafras series - well drained soils with a sandy loam texture and moderate to moderately slow permeability;
- Glenelg series - well drained soils with a channery silt loam texture and moderate permeability;
- Congaree series - well to moderately well drained soils with a silt loam texture and moderate permeability;
- Beltsville and Butlertown series - moderately well drained soils with a silt loam texture and slow to very slow permeability;
- Chewacla series - somewhat poorly to moderately well drained soils with a silt loam texture and moderate permeability; and
- Othello series - poorly drained soils with a silt loam texture and moderately slow permeability.

The miscellaneous land types that would be crossed by the Pennsylvania portion of the pipeline include two Made-Land map units: map unit Ma, which is dominated by gravelly-textured materials, and map unit Me, which is dominated by materials derived from metamorphic bedrock (schist or gneiss).

In New Jersey, the proposed pipeline route from MP 4.9 to MP 11 crosses four soil series and two miscellaneous land types (USDA, 1962). The soil series include:

- Klej series - moderately well drained soils with a loamy sand texture and rapid to very rapid permeability;

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- Downer series - moderately well drained soils with a loamy sand texture and moderate to moderately rapid permeability;
- Woodstown series - moderately well drained soils with a loamy sand texture and moderate permeability;
- Fallsington series - poorly drained soils with a sandy loam texture and moderate to moderately slow permeability; and
- Pocomoke series - very poorly drained soils with moderate to moderately rapid permeability.

The miscellaneous land types that would be crossed by the New Jersey portion of the pipeline include tidal marsh and two Made-land map units: map unit Mc, which consists of coarse material, and map unit Mf, which consists of fine materials.

Soils along the proposed pipeline route were evaluated for characteristics that would affect construction or increase the potential for construction-related soil impacts. Table 4.2.1-3 provides a summary of significant soils characteristics along each segment. Each soil characteristic is discussed separately below.

TABLE 4.2.1-3

Acreage of Soil Characteristics for the Proposed Pipeline Right-of-Way a/

Route	Total	Prime Farmland b/	Hydric Soils c/	Compaction Prone d/	Highly Erodible e/	Revegetation Concerns f/
Pennsylvania						
MP 0 – MP 4.9	42.1	10.5	2.1	2.1	2.4	16.6
New Jersey						
MP 4.9 – MP 11	59.0	0.0	10.9	2.7	8.1	0.0
Pipeline Total	101.1	10.5	13.0	4.9	10.6	16.6

a/ Acreage is based on a variable-width construction right-of-way, but does not include access roads or temporary extra workspace. Soil characteristics do not add across rows because soils may occur in more than one characteristic class, or may not occur in any class listed.

b/ As designated by the Natural Resources Conservation Service (NRCS) and includes farmland of local or statewide importance.

c/ As designated by the NRCS.

d/ Includes soils in somewhat poor to very poor drainage classes with surface textures of sandy clay loam and finer.

e/ Includes soils with slopes greater than 8 percent and soils designated by NRCS as highly erodible land and potentially highly erodible land.

f/ Includes soils with slopes greater than 8 percent, high content of surface stones, and dense subsoils, including fragipans.

Pipeline construction activities such as clearing, grading, excavation, backfilling, and the movement of construction equipment along the right-of-way could impact soil resources in several ways. Clearing would remove protective cover and expose soil to the effects of wind, sun, and precipitation, which could increase the potential for soil erosion and the movement of sediments into sensitive areas. Grading and equipment traffic could compact soil, reducing porosity and percolation rates resulting in increased runoff potential and decreased soil productivity. Trench excavation and backfilling could lead

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to mixing of topsoil and subsoil which could lower soil productivity. Contamination from spills or leaks of fuels, lubricants, and coolants from construction equipment could also impact soils.

Prime Farmland

About 25 percent (10.5 acres) of the soils that would be affected by the pipeline in Pennsylvania are designated prime farmland. None of the soils that would be affected by the pipeline in New Jersey are designated prime farmland. Most of the prime farmland soil in Pennsylvania is within or directly adjacent to commercial or residential developments and none of it is actively cultivated or available for farming. Pipeline construction would temporarily impact this soil. Since no aboveground facilities would be constructed on prime farmland, no prime farmland would be permanently lost as a result of the construction activities. Texas Eastern would minimize temporary impacts on prime farmland by segregating topsoil from subsoil prior to trenching and returning the segregated topsoil to the trench following backfilling of the trench spoil. Other potential impacts on prime farmland would be reduced and controlled by minimizing erosion, replacing or repairing damaged tile drainage systems (if present), and preventing the introduction of invasive/nuisance plant species.

Hydric Soils

Hydric soils are defined as "soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (Federal Register, July 13, 1994). Soils that are artificially drained or protected from flooding (e.g., by levees) are still considered hydric if the soil in its undisturbed state would meet the definition of a hydric soil. Hydric soils include poorly and very poorly drained soils and some somewhat poorly drained soils.

About 13 percent (13.0 acres) of the soils along the entire pipeline route are hydric soils. Two percent (2.1 acres) of the hydric soils occur in Pennsylvania and 11 percent (10.9 acres) of these soils occur in New Jersey. Hydric soils can be susceptible to compaction (as discussed below). In addition, high groundwater levels associated with hydric soils could create a buoyancy hazard for the pipeline. Special construction techniques such a concrete coating and other weighting methods would be used to overcome buoyancy hazards during operation of the pipeline. Practices such as dry season construction and/or trench dewatering would typically be used to minimize buoyancy problems during construction.

Compaction Potential

Construction equipment traveling over wet soils could disrupt the soil structure, reduce pore space, increase runoff potential, and cause rutting. The degree of compaction is dependent on moisture content and soil texture. Fine-textured soils with poor internal drainage that are moist or saturated during construction are the most susceptible to compaction and rutting.

As noted above, hydric soils can be susceptible to compaction. Of the total acreage of hydric soils along the proposed pipeline route, about 38 percent (4.9 acres) have surface layers with silt loam or finer textures that are somewhat poorly drained or wetter. The Othello series and areas mapped as Tidal Marsh account for most of these soils (4.1 acres). The other 0.7 acre consists of very poorly drained Pocomoke loam soils The remaining hydric soils are not susceptible to compaction but may be susceptible to rutting impacts if construction activities occur when the soils are wet.

Impacts related to soil compaction would be minimal due to the limited acreage of compaction-prone soils. Texas Eastern would minimize compaction and rutting of some soils by using construction mats where wetland soils cannot support equipment. In addition, in agricultural areas Texas Eastern would implement the compaction mitigation measures in its SESC Plan. In residential areas Texas

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Eastern has requested a variance from the FERC's Plan requirement for compaction mitigation. As outlined in section 1.2 of the SESC Plan, Texas Eastern has proposed to not conduct compaction testing and mitigation in residential areas. Instead, the SESC Plan specifies topsoil segregation or replacement in all residential areas. Texas Eastern suggests that subsequent freeze thaw cycles of the upper portion of the subsoil would provide sufficient natural mitigation of any compacted areas of the right-of-way in residential areas within 2 to 3 years.

Soil compaction in residential areas not only affects the rooting depth of grasses and shrubs but also influences water movement through the soil. Excessive application of water to lawns and shrubs in soils with substantial subsurface soil compaction could lead to water-logged conditions and increased incidence of disease and insect damage. However, because Texas Eastern would segregate or replace topsoil in residential areas, and because its SESC Plan requires that they monitor the right-of-way following construction and rectify any landowner complaints regarding revegetation (as discussed in section 8.1 of its SESC Plan), we grant this variance request to omit compaction testing and mitigation in residential areas.

Erosion

Erosion is a continuing natural process that can be accelerated by human disturbance. Factors that influence the degree of erosion include soil texture, soil structure, length and percent of slope, vegetative cover, and rainfall or wind intensity. Soils most susceptible to erosion by water are typified by bare or sparse vegetative cover, noncohesive soil particles with low infiltration rates, and moderate to steep slopes. Wind erosion processes are less affected by slope angles. Clearing, grading, and equipment movement could accelerate the erosion process and, without adequate protection, result in discharge of sediment to waterbodies and wetlands. Soil loss due to erosion could also reduce soil fertility and impair revegetation.

Erosion potential is moderate to slight for the majority of soils that would be affected by the proposed pipeline. Only about 0.4 acre of Manor soils and 2.1 acres of Glenelg soils located in Pennsylvania exhibit severe erosion potential. The New Jersey segment contains no highly erodible soils. However, this segment does contain 6.7 acres of Downer soils and 1.4 acres of Sassafras soils which are considered potentially highly erodible. Texas Eastern's SESC Plan specifies the use of erosion control devices and construction practices that would minimize erosion during construction such as silt fence, hay bales, and soil berms. After construction is complete, Texas Eastern would minimize further erosion by re-grading and reseeding disturbed areas. Following restoration and clean up, Texas Eastern would monitor the disturbed areas to maintain erosion control structures and repair any developing erosion.

Stony/Rocky Soils and Shallow-to-Bedrock Soils

Grading, trenching, and backfilling may bring stones to the surface that could interfere with or damage agricultural equipment, and hamper revegetation efforts by reducing soil moisture holding capacity. Additionally, ripping and blasting of shallow bedrock during construction could incorporate bedrock fragments into the topsoil.

Stony and rocky soils present in the Pennsylvania segment include the Glenelg channery silt loam (GeB2, GeC2) and Manor loam and channery loam (MhE) map units. These soils account for 5.1 acres along the proposed pipeline right-of-way. In addition to having stony/rocky surface layers, the Manor soils in Pennsylvania also contain shallow bedrock. These soils account for less than 1 percent of the total route (about 0.5 acre) but could require blasting to excavate the trench. Stony/rocky soils and shallow bedrock or fragipan are not present along the New Jersey segment of the pipeline route. Impacts on soils due to excess rock in surface horizons would be minimal due to the limited acreage of these soils.

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In addition, Texas Eastern would remove excess rock from the upper 12 inches of the soil in all rotated and permanent cropland, hayfields, pastures, residential areas, and other areas at the landowner's request. Rock would be removed until the size, density and distribution of rock in surface soils are similar on and off the right-of-way.

Revegetation Potential

Successful restoration and revegetation are important to maintain soil productivity and to protect the underlying soil from potential damage such as erosion. About 16 percent (16.6 acres) of the soils that would be affected by pipeline construction activities exhibit poor revegetation potential (table 4.2.1-3). All of these soils are in Pennsylvania. Soils with poor revegetation potential include those that have stony or rocky surface layers, dense subsoils (e.g., fragipans) that could restrict root penetration, and soils with slopes greater than 8 percent that are potentially erosive and would require additional stabilization, such as mulch, to promote germination and seedling establishment. In accordance with its SESC Plan, Texas Eastern would mitigate the effects of poor revegetation potential by applying fertilizer, pH modifiers, and using mulch (where appropriate) in areas with poor revegetation potential in order to create a favorable environment for the re-establishment of vegetation. Texas Eastern would further enhance revegetation potential by using seed mixes approved by local soil conservation authorities to reseed the right-of-way following construction.

The discussion of revegetation success in section 8.3.1 of Texas Eastern's SESC Plan (see Appendix D) does not appear to be consistent with section VII.A.2 of our Plan. Determining if revegetation measures have been successful should be consistent with the guidelines in our Plan.

Soil Contamination

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. The effects of contamination would typically be minor because of the low frequency and volumes of spills and leaks. Texas Eastern has developed an SPCC Plan that specifies cleanup procedures in the event of soil contamination from spills or leaks of fuel, lubricants, coolants, or solvents. This SPCC Plan, which is included in Texas Eastern's SESC Plan (see Appendix D), would minimize the potential to contaminate soils.

Texas Eastern conducted a database search of all areas within 0.25 mile of the proposed pipeline route to determine the location of federal and state hazardous waste sites as identified in various government databases. Twenty-seven hazardous, potentially hazardous, and solid waste sites are located within 0.25 mile of the proposed pipeline route. Of these 27 sites, the proposed pipeline route would cross two hazardous waste sites and would run parallel to a leaking underground storage tank (LUST), a solid waste facility, and an abandoned, uncontrolled, or inactive hazardous waste site. Further details about the database search results are provided in sections 4.3.1 and 4.8.4. Construction of the pipeline in the vicinity of these sites could disturb contaminated soils. Although Texas Eastern has included a Contaminated Contingency Plan in its SPCC Plan, it does not adequately address potential impacts and mitigative measures associated with encountering contaminated soils during construction. To be prepared in the event of encountering contaminated soils and groundwater in the construction right-of-way, **we recommend that:**

- **Texas Eastern prepare a Plan for the Discovery and Management of Contaminated Soils and Groundwater. This Plan should comply with applicable state and federal regulations and should provide for management of contaminants at known sites and include procedures for the identification and management of unknown**

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contaminants in other locations The Plan should be filed with the Secretary for review and approval by the Director of OEP prior to construction.

4.2.2 Sediments

Construction of the LNG terminal would require dredging about 800,000 cubic yards of sediment to create the berth area for the ship unloading facility. To characterize the sediments that would be dredged, Crown Landing collected a series of six vibracores from within or near the proposed dredging footprint (see figure 4.2.2-1). Each core was advanced to about 30 feet below the sediment water interface. Samples were collected from three stratums within each core (one from 18 inches below the surface; one at about 12 feet below the surface; and one at about 30 feet below the surface), resulting in a total of 18 sediment samples from the six cores. None of the cores were composited for analytical purposes. Each of the 18 samples represents a discreet stratum from an individual core.

Physical Analyses

Crown Landing did not conduct an analysis of the physical properties of the sediment samples. However, sediment samples were collected and analyzed by the COE from the Marcus Hook reach of the river as part of the Delaware River Comprehensive Navigation Study (Black and Veatch Waste Science, 1996). Vibracores collected from the berth area of the BP Oil facilities across the river from the LNG terminal site consisted primarily of organic silts overlying layers of well-graded sands. These sediments extended from about 41 feet to 49 feet below MLLW. This is deeper than the proposed depth of dredging for the proposed LNG ship berth, but the upper, silty sediment observed in the berth area cores probably represents recently deposited material and is likely representative of the sediment that would be dredged for the proposed berth area. Crown Landing has indicated that it will conduct analyses of the physical properties of samples collected from the proposed berth area as part of its geotechnical study of the berth. The geotechnical study is expected to be conducted in the Spring of 2005, and the results of the physical analyses will be discussed in the final EIS.

Chemical Analyses

Chemical analyses of the proposed dredged sediments included the EPA list of 126 priority pollutants and an additional 40 non-priority organic compounds. Of the 166 constituents that were analyzed, only the following eight metals were detected in the sediment samples: arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. Average metal concentrations for the surface, middle, and bottom of each sediment core in comparison to NOAA sediment screening criteria are presented in table 4.2.2-1.

The highest concentrations of all metals were detected in the surface sample of Core 104. This sample was also the only sample in which cadmium was detected. Arsenic was detected in all but one sample and ranged from 3.1 to 31 mg/kg. Mercury was detected in only 2 core samples (both from the surface layer) at concentrations less than 0.20 mg/kg. The five remaining metals were detected in all samples. Chromium concentrations ranged from 20.2 to 46.5 mg/kg; copper concentrations ranged from 5.7 to 36.2 mg/kg; lead concentrations ranged from 6.8 to 78.2 mg/kg; nickel concentrations ranged from 13.2 to 26.9 mg/kg; and zinc concentrations ranged from 39.2 to 279 mg/kg. Similar concentrations for all of these metals have been reported at several sites along the Marcus Hook of the Delaware River (Black and Veatch Waste Science, 1996).

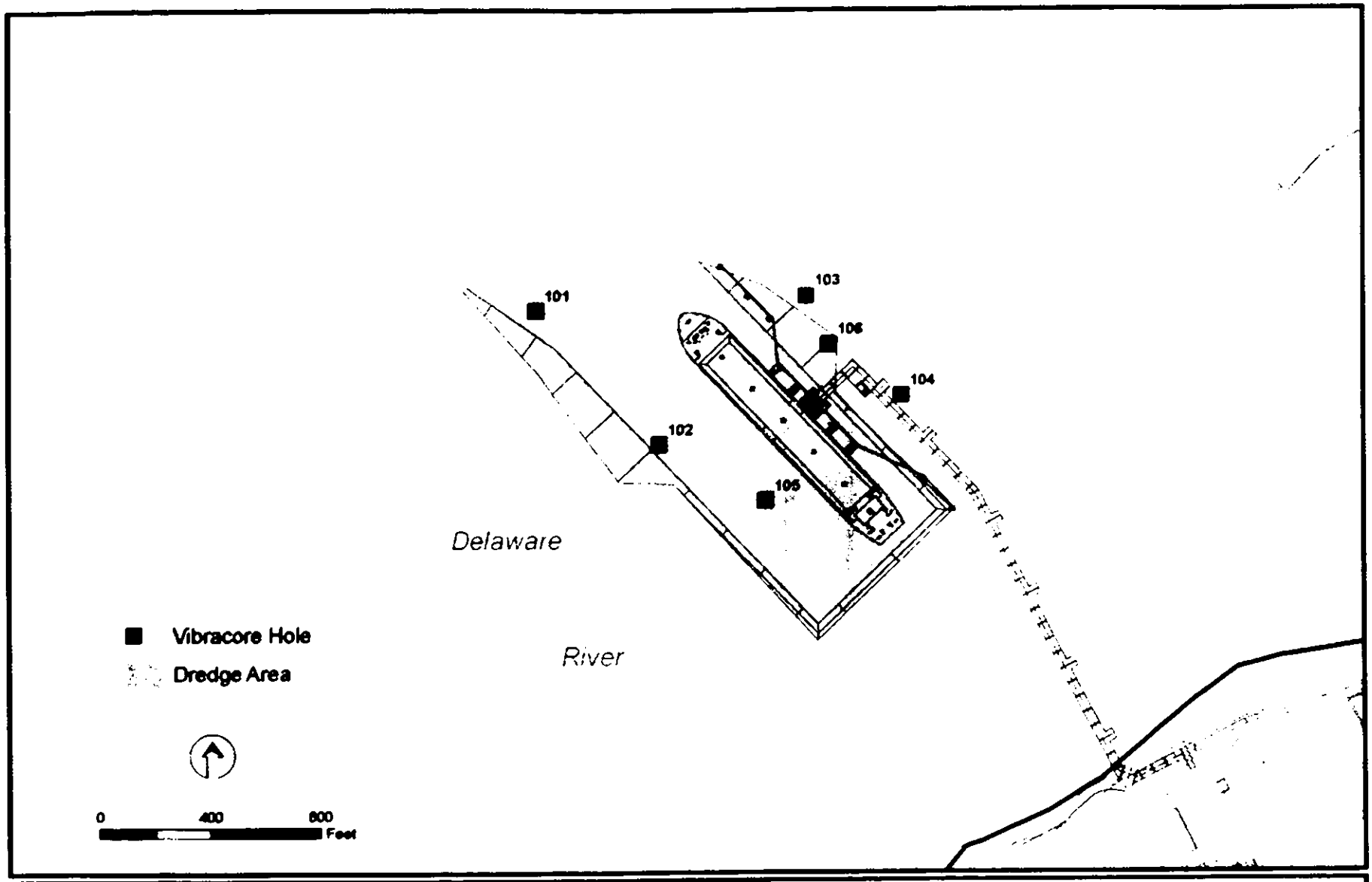

Figure 4.2.2-1
Crown Landing LNG Project
Sediment Core Locations

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TABLE 4.2.2-1

Comparison of Average Metal Concentrations in the Sediment Samples and NOAA Sediment Screening Criteria

	Dredged Sediment Samples			NOAA Sediment Screening Criteria	
Metals (concentrations in mg/kg)	Surface (18 inches)	Middle (12 feet)	Deep (30 feet)	TEL a/	PEL b/
Arsenic	11.4	5.3	6.4	5.9	17.0
Cadmium	1.1 c/	ND d/	ND	0.596	3.53
Chromium	35.1	31.6	35.7	37.3	90.0
Copper	18.1	8.7	8.7	35.7	197.0
Lead	33.1	10.9	9.5	35.0	91.3
Mercury	0.17 e/	ND	ND	0.174	0.486
Nickel	16.3	17.8	20.3	18.0	35.9
Zinc	116.6	53.2	54.6	123.1	315.0

a/ TEL = Threshold Effects Level

b/ PEL = Probable Effects Level

c/ Value represents a single analytical result from Core 104, the remaining surface samples contained non-detectable levels of cadmium.

d/ ND – not detected.

e/ Value represents the mean of two analyses from Cores 104 and 105; the remaining surface samples contained non-detectable levels of mercury.

Table 4.2.2-1 provides a comparison of average sediment concentrations with ecologically risk-based screening criteria to assess the potential hazards posed to the aquatic environment by the dredged sediment. Freshwater sediment values presented in the NOAA Screening Quick Reference Tables (Buchman, 1999) were used in assessing the sediment core results. The following NOAA screening criteria for freshwater sediments were used for comparisons:

- Threshold Effects Level (TEL) represents a conservative screening value at which the sediments are not expected to pose a threat; and
- Probable Effects Level (PEL) represents a concentration screening value above which adverse biological effects are frequently expected.

The concentrations of most metals in all samples were below the TEL values, indicating that the sediments would not be expected to pose a threat to the aquatic environment. Only the concentrations of arsenic, cadmium, and nickel exceeded the TEL screening criteria. The average concentration of arsenic in the surface and bottom core increments varied from 1.1 to 1.9 times the TEL value but was still below the PEL criterion. Similar concentrations of arsenic were reported from vibracore samples collected in the Marcus Hook segment of the Delaware River by the COE (Black and Veatch Waste Science, 1996). Arsenic is widespread in the geologic formations and soils of the Delaware River basin and the concentrations in the sediment cores are similar to those reported as background for soils in urban areas of the Atlantic Coastal Plain Province (Sanders, 2003). Cadmium was only detected in a single sample from the surface of Core 104. The concentration of cadmium in the sample from Core 104 was about twice the TEL but well below the PEL value. Similar cadmium concentrations were reported for other parts of the Marcus Hook segment (Black and Veatch Waste Science, 1996). Elevated nickel concentrations were limited to the bottom segment of the core samples. The average nickel concentration of 20.3 mg/kg is only slightly higher than the TEL value of 18 mg/kg but well below the PEL criterion. Similar nickel

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concentrations were reported in other parts of the Marcus Hook segment of the Delaware River (Black and Veatch Waste Science, 1996).

Crown Landing has indicated that it will conduct additional sampling and analysis of sediment from the proposed ship berth area when it receives approval of its sampling and analysis plan (SAP) from the NJDEP and DNREC. Crown Landing will file the approved SAP with the FERC. The SAP and the results of the updated chemical analyses will be analyzed in the final EIS.

To minimize the resuspension of sediment during dredging, Crown Landing would primarily use hydraulic cutterhead dredging to excavate the berth area. Studies by the COE indicate that cutterhead dredging generally results in lower sediment resuspension than other forms of dredging (e.g., clamshell or hopper barge) (COE, 1986; COE, 1988a). Dredged material would be transported by pipeline directly to an existing, permitted upland confined disposal facility. The disposal facility is located about 4 miles from the berth area (see section 2.4.1.3 for further discussion of dredging and dredge disposal activities).

Dredging operations to excavate the ship berth would suspend sediments and affect water quality. In general, dredging-related water quality impacts would include both the physical effects of suspended sediment and alterations of water chemistry due to the release of various chemical constituents associated with the sediment (see section 4.3.2 for further discussion of water quality impacts).

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4.3 WATER RESOURCES

4.3.1 Groundwater

Regional Groundwater Quality and Quantity

The proposed LNG terminal site and pipeline route in New Jersey are located within the Northern Atlantic Coastal Plain aquifer system, which underlies an area of approximately 50,000 square miles and extends from North Carolina north to Raritan Bay, New Jersey (USGS, 1997). The western limit of the aquifer system is the Fall Line between the Atlantic Coastal Plain and Peidmont Physiographic Provinces; the eastern limit is effectively the Atlantic Ocean.

The Northern Atlantic Coastal Plain aquifer system consists of six regional aquifers. The boundaries of these aquifers are irregular and none extend over the entire area. The majority of groundwater withdrawn in the project area is from the Potomac-Raritan-Magothy aquifer, which is part of the Northern Atlantic Coastal Plain aquifer system. The Potomac-Raritan-Magothy aquifer is composed of alternating layers of clay, silt, sand, and gravel of Cretaceous age. Regionally, this aquifer extends to a depth of between 50 and 1,800 feet, and typically yields 500 to 1,000 gallons per minute (gpm) but can exceed 2,000 gpm (USGS, 2003). Most of the wells completed in this aquifer are 90 to 105 feet deep. Water from the Potomac-Raritan-Magothy aquifer is generally low in dissolved solids, although iron and manganese present localized problems due to the low pH of the groundwater. In southern New Jersey, the Potomac-Raritan-Magothy aquifer contains salty groundwater with chloride concentrations ranging from less than 250 milligrams per liter (mg/L) to as high as 27,000 mg/L. Chloride concentrations in the groundwater increase with depth as well as toward the ocean.

In Pennsylvania, the pipeline route crosses crystalline rock and sand and gravel aquifers. Crystalline rock aquifers have very small fractures so storage capacity and yield are relatively low. The water is generally soft and yields are commonly 5 to 25 gpm (Water Resources Education Network (WREN), 2003). The sand and gravel aquifers contain large quantities of water, which can be easily withdrawn and commonly yield 1,000 gpm. The natural quality of this groundwater is good to excellent (WREN, 2003).

Sole Source Aquifers

The proposed LNG terminal site and the pipeline route in New Jersey are located within the New Jersey Coastal Plain Sole Source Aquifer and the proposed pipeline route in Pennsylvania is located within the stream flow source zone for the New Jersey Coastal Plain Sole Source Aquifer (EPA, 2003). EPA-designated sole source aquifers are those that contribute more than 50 percent of the drinking water to a specific area and for which there are no reasonably available alternative sources of water should the aquifer become contaminated. The proposed projects are not on or do not cross any state-designated sole-source aquifers.

Public and Private Water Supply Wells

Crown Landing consulted with the Gloucester County Department of Health to identify the locations of water wells proximate to the LNG terminal site. Based on this consultation, the nearest water supply well is located approximately 1,600 feet to the northeast at the Logan Generating Station. The LNG terminal site is not located within any designated wellhead protection zones (New Jersey Geographic Information Network, 2004).

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Well location information from Environmental Data Resources, the Delaware River Basin Commission (DRBC), and Gloucester County identified eight water supply wells within 150 feet of the proposed construction right-of-way for the Logan Lateral (see table 4.3.1-1). Civil surveys of the proposed right-of-way indicate that the two wells identified at MP 9.3 in table 4.3.1-1 likely represent the same well, which is owned by Solutia Inc. and Ferro Corp. No public water supply wells were identified within 0.25 mile of the proposed pipeline route in New Jersey or within 3 miles of the pipeline route in Pennsylvania.

TABLE 4.3.1-1

Water Supply Wells Located Within 150 Feet of the Logan Lateral Route

Milepost	Location	Supply Type	Approximate Distance From Construction Right-of-Way (feet)
3.2	Delaware, PA	Domestic Use	150
3.8	Delaware, PA	Groundwater Well	150
3.9	Delaware, PA	Groundwater Well	150
9.3	Gloucester, NJ	Unknown	Located within the construction right-of-way
9.3	Gloucester, NJ	Industrial	Located within the construction right-of-way
9.9	Gloucester, NJ	Industrial	150
10.3	Gloucester, NJ	Industrial	150
10.3	Gloucester, NJ	Industrial	150

The proposed Logan Lateral would cross one designated wellhead protection zone in Gloucester County, from approximate MP 6.0 to MP 7.3.

Groundwater Conditions at the LNG Terminal Site

A detailed description of the geologic units present at the LNG terminal site is provided in section 4.1.1. In general, the water table occurs at a depth of 2 to 6 feet below the surface of the site within the unconsolidated Pleistocene sand and silt deposits of the Cape May Formation. This formation is underlain by an approximately 85- to 95-foot-thick clayey silt confining unit that limits groundwater movement from the Cape May Formation to the underlying Potomac-Raritan-Magothy aquifer.

Crown Landing installed eight monitoring wells to obtain site-specific groundwater data at the LNG terminal site. The monitoring wells were installed in the surficial aquifer of the Cape May Formation to a depth of approximately 20 feet below ground surface. Based on the results of groundwater elevation monitoring in these wells, the surficial aquifer flows towards the Delaware River in the northern and western portions of the site and towards Oldmans Creek in the eastern and southern portions of the site.

The monitoring wells on the site were sampled in accordance with NJDEP requirements. Groundwater samples from the wells were analyzed for petroleum products, VOCs, SVOCS, priority pollutant metals, priority pollutant pesticides, PCBs, cyanide, and phenols. All of these compounds except arsenic were either not detected in the groundwater samples or detected at concentrations below groundwater quality standards. Arsenic was detected at concentrations ranging from 13.9 to 114 micrograms per liter in five of the eight wells, exceeding the New Jersey Class IIA Groundwater Quality Standard of 8 micrograms per liter.

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As discussed in section 4.2.1, the cause of the elevated arsenic level at the site is unknown but could be the result of a spill from an abandoned onsite storage vessel, historic use of arsenic-containing pesticides in the project area, or high native arsenic levels associated with the dredged materials that were historically removed from the Delaware River. Crown Landing will enter into a Memorandum of Agreement (MOA) with NJDEP to perform further site investigations and remediation, if needed. The MOA will allow NJDEP to review, comment, and approve of all documentation submitted in support of site investigation, remediation, and contaminated media management. The MOA process should result in NJDEP issuance of a No Further Action letter, possible establishment of a classification exemption area for impacted groundwater, and possible issuance of a deed restriction for impacted soils. The MOA process would benefit the environment by ensuring that any remediation is conducted according to NJDEP regulations and by reducing the potential for human exposure to existing contamination at the site.

LNG Terminal Groundwater Requirements

Because the LNG terminal site is not located near an existing municipal water supply system, at least one water supply well would be installed at the site to provide freshwater for short-duration construction-related uses and long-term facility operations. The number of wells to be installed would depend on the well yield. Preliminary information indicates that more than one well, but probably not more than two wells, would be needed to meet the construction and operation needs of the facility. The well or wells would likely be completed in the Potomac-Raritan-Magothy aquifer in accordance with a NJDEP Bureau of Safe Drinking water well construction permit. The well or wells would provide a one-time demand of 250,000 gallons of freshwater to rinse each LNG tank after completion of hydrostatic testing and an estimated 500 to 1,500 gallons per day for normal facility operations such as firewater makeup, lawn sprinkling, and sanitary purposes. Potable water would be delivered to the LNG facility.

Groundwater Resources Impacts and Mitigation

LNG Terminal

Construction and operation of the proposed LNG terminal and pipeline facilities would not significantly affect groundwater quality or quantity in the project area. Most groundwater impacts would be avoided or minimized by use of standard construction techniques as set forth in our Plan and Procedures, and by implementing project-specific SESC and SPCC Plans.

Dredging of the berth area for the ship unloading facility could affect groundwater recharge through introduction of salt- or brackish water into the Potomac-Raritan-Magothy aquifer. The COE evaluated the effects of dredging on saltwater intrusion into the Potomac-Raritan-Magothy aquifer as part of the Delaware River Main Channel Deepening Project Final Supplemental Environmental Impact Statement (COE, 1997). The COE concluded that dredging the Delaware River navigation channel to 45 feet deep would have a negligible effect on the recharge characteristics of the aquifer, and not pose undue risk to water quality of the aquifer. Because the Crown Landing LNG Project would require significantly less dredging (0.8 million cubic yards) than the Delaware River Main Channel Deepening Project (33 million cubic yards), dredging associated with construction of the LNG terminal is also anticipated to have negligible effects on the recharge characteristics and groundwater quality of the Potomac-Raritan-Magothy aquifer.

Other construction activities at the LNG terminal, including grading, excavation, and construction of footings and foundations could potentially cause minor fluctuations in the Cape May Formation surficial aquifer and/or increase turbidity within this aquifer. These impacts would be temporary and localized and would not extend off of the LNG terminal site. Due to the presence of the thick confining

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unit below the Cape May Formation, these relatively shallow impacts would not be expected to affect the underlying Potomac-Raritan-Magothy aquifer. Deep pile foundations would be used to support the proposed LNG tanks, pier, and possibly some process equipment. These piles would extend from the ground surface, through the 85- to 95-foot-thick clayey silt confining unit, and into the underlying Potomac-Raritan-Magothy aquifer. These piles would be driven, thus forming a tight seal between the piles and surrounding soil, and likely decreasing the vertical permeability of soils adjacent to the piles. Therefore, the use of deep driven piles should not increase the potential for shallow, arsenic-impacted groundwater in the Cape May Formation to migrate vertically down to the Potomac-Raritan-Magothy aquifer.

Potential impacts on groundwater associated with the use of oils, lubricants, and other hazardous substances during construction and operation of the LNG terminal would be minimized by Crown Landing's compliance with federal regulations related to fuel transport, handling, and spill response procedures and its implementation of a project-specific SPCC Plan.

Pipeline Facilities

As shown in table 4.8.4-1, Texas Eastern reviewed state and federal environmental regulatory databases and identified several known and potential sources of contamination within approximately 0.25 mile of the proposed pipeline route. The pipeline route crosses two of these sites and is adjacent to three other sites. The pipeline route also crosses property associated with the PECO Chester Generating Station located in Chester, Pennsylvania adjacent to the Delaware River. This site is not included in table 4.8.4-1; however, according to the PADEP, this site was contaminated as a result of its historical use as a coal-fired power plant and has undergone remediation. Based on the presence of these known contaminated sites in the vicinity of the proposed pipeline route, contaminated soils and groundwater could be encountered during construction of the pipeline. As detailed in section 4.2.1, we have recommended that Texas Eastern develop a site-specific Plan for the Discovery and Management of Contaminated Soils and Groundwater. Implementation of this Plan would protect the safety of workers and ensure that any contaminated media encountered during construction is properly managed in accordance with applicable regulations.

Limited blasting may be necessary for construction of the Logan Lateral (see section 4.1.2). However, blasting is not anticipated within 1 mile of any of the wells listed on table 4.3.1-1. If blasting is required within 150 feet of any wells, pre- and post-construction monitoring of well yield and water quality would be conducted with the well owner's permission. If it is determined that any private water supply is damaged as a result of the project, Texas Eastern would provide a temporary source of water until the damaged well is restored to its former capacity. Similarly, for wells located within 150 feet of the construction right-of-way but not within any blasting areas, Texas Eastern would also provide pre- and post-construction monitoring of well yield and water quality at the landowner's request.

Other pipeline construction activities could result in minor, temporary impacts to shallow groundwater resources in proximity to the proposed pipelines. These impacts could include increased turbidity, groundwater level fluctuations, short-term disruption of recharge, localized flow along the pipeline trench, contamination from a spill or leak of hazardous substances, and decreased water yield. Most potential impacts would be avoided or minimized by the use of standard construction methods and measures set forth in our Plan and Procedures, and appropriate hazardous materials management and spill response procedures contained in Texas Eastern's SPCC Plan. Therefore, construction and operation of the proposed pipeline would not have a significant impact on overall groundwater quality in the area.

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4.3.2 Surface Water

Watershed Descriptions

The Crown Landing LNG and Logan Lateral Projects would be located within the Delaware River Basin. The mainstem of the Delaware River extends approximately 330 miles from the confluence of its east and west branches near Hancock, New York to the Atlantic Ocean near Cape May, New Jersey. The Delaware River Basin is 13,539 square miles in size and drains portions of Delaware, New Jersey, New York, and Pennsylvania (DRBC, 2004). The tidal influence along the Delaware River extends to Trenton, New Jersey at approximate RM 133 (USGS, 2002c). The tidal range within the project area is between 5.53 and 5.86 feet, with salinity levels ranging between 0.0 and 0.5 parts per thousand, which indicates a predominantly freshwater system. The average annual flow of the river upstream of Trenton is about 11,700 cubic feet per second (USGS, 1999b).

Based on information provided by the PADEP and the NJDEP, the LNG terminal and pipeline facilities would not be located within a surface water protection area (Newbold, 2003; NJDEP, 2003a). In addition, no surface water intakes are currently located along the Delaware River in the vicinity of the LNG terminal site or the proposed pipeline crossing.

Waterbody Classifications

LNG Terminal

The proposed LNG terminal would be constructed adjacent to and within the Delaware River and near Oldmans Creek. The DRBC classifies and regulates uses of water within the Delaware River. The DRBC establishes the water quality standards for the Delaware River in cooperation with the States of Delaware, Pennsylvania, New Jersey, and New York. The LNG terminal site is located in Zone 5 at approximate RM 78.4. The designated uses in Zone 5 include:

- industrial water supplies after reasonable treatment;
- maintenance of resident fish and other aquatic life;
- propagation of resident fish from RM 48.2 to 70.0;
- passage of anadromous fish;
- wildlife;
- recreation; and
- navigation.

The State of Delaware also regulates water use for the portion of the Delaware River that lies within the Delaware state boundaries. The DNREC designates the following uses between RMs 48.2 and 78.8:

- industrial water supply;
- primary contact recreation;

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- secondary contact recreation; and
- fish, aquatic life, and wildlife.

The water quality classification for Oldmans Creek is FW2-NT/SE1. The designated uses in FW2 waters include:

- maintenance, migration, and propagation of the natural and established biota;
- industrial and agricultural water supply;
- public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation, and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and
- any other reasonable use.

The NT designation for Oldmans Creek indicates non-trout waters. These waters are generally not suitable for trout because of their physical, chemical, or biological characteristics, but are suitable for a variety of other fish species.

The designated uses in SE1 waters include:

- shellfish harvesting in accordance with NJAC 7:12;
- maintenance, migration, and propagation of the natural and established biota;
- primary and secondary contact recreation; and
- any other reasonable uses.

Pipeline Facilities

Construction of the Logan Lateral Project would require crossing eight perennial waterbodies, including the Delaware River, and four intermittent streams. Waterbodies crossed by the proposed pipeline are listed in table 4.3.2-1. Descriptions of the fishery resources in these waterbodies are provided in section 4.6.2.

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TABLE 4 3 2-1

Waterbodies Crossed by the Logan Lateral Project

State/ Milepost	Waterbody Name	Flow Regime a/	Crossing Width (feet)	State Water Quality Classification b/	Fishery Classification	Proposed Crossing Method c/
Pennsylvania						
1.5	Chester Creek	P	104	TSF	Warmwater	HDD
1.7	Baldwin Run	P	20	WWF	Warmwater	Open-cut
1.8	Unnamed Tributary of Chester Creek	I	2	TSF, MF	Warmwater	Open-cut
3.2	Unnamed Ditch	I	10	Not Classified	Warmwater	Open-cut
Pennsylvania and New Jersey						
4.9	Delaware River	P	4,576	WWF, MF (PA) Zone 4 (DRBC) FW2-NT/SE2 (NJ)	Warmwater	HDD
New Jersey						
7.3	Raccoon Creek	P	606	FW2-NT/SE2	Warmwater	HDD
8.0	Unnamed Ditch	I	15	Not Classified	Warmwater	Open-cut
8.3	Unnamed Ditch	I	10	Not Classified	Warmwater	Open-cut
9.2	Birch Creek	P	50	FW2-NT/SE2	Warmwater	HDD
10.3	Tributary of Oldmans Creek	P	30	FW2-NT/SE2	Warmwater	Open-cut
10.3	Tributary of Oldmans Creek	P	20	FW2-NT/SE2	Warmwater	Open-cut
10.9	Tributary of Oldmans Creek	P	40	FW2-NT/SE2	Warmwater	Open-cut

a/ P =Perennial, I=Intermittent

b/ Pennsylvania

TSF – Trout Stocking Fishery

WWF – Warmwater Fishery

MF – Marine Fishery

Delaware River Basin Commission

Zone 4– Designated uses include:

- industrial water supplies after reasonable treatment;
- maintenance of resident fish and other aquatic life;
- passage of anadromous fish;
- wildlife;
- recreation below RM 81.8, and
- navigation.

New Jersey

FW2 – General surface water classification applied to freshwaters that are not designated as FW1 or Pineland Waters.

NT – Non-trout waters

SE – Saline Estuaries

c/ HDD – horizontal directional drill

Sensitive Waterbodies

None of the waterbodies identified in table 4.3.2-1 are designated as a National Wild and Scenic River in the vicinity of the LNG terminal site or pipeline facilities (National Park Service, 2004). The Delaware River is listed on the EPA's National Estuary Program. The National Estuary Program was established in 1987 to improve the quality of estuaries of national importance. Section 320 of the Clean Water Act directs the EPA to develop plans for attaining or maintaining water quality in these estuaries.

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None of the other waterbodies crossed by the Logan Lateral Project are characterized as sensitive by any state or federal agency (Newbold, 2003; Springer, 2003).

Contaminated Sediments

Based on review of Integrated Monitoring and Assessment Reports prepared by the PADEP and NJDEP, none of the waterbodies in the project area, except the Delaware River, are suspected of containing contaminated sediments (PADEP, 2004; NJDEP, 2004a). Crown Landing collected and analyzed sediment samples from the proposed dredge area within the Delaware River. The sediments were found to have detectable levels of eight metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc). A detailed discussion of the sediment sampling and analysis program is provided in section 4.2.2.

Surface Water Resources Impacts and Mitigation

LNG Terminal Construction Impacts

Construction of the Crown Landing LNG Project could adversely affect surface water quality in the Delaware River during dredging operations, construction of the ship unloading facility, and the appropriation and discharge of hydrostatic test water. In addition, surface water runoff during clearing, grading, and the placement of fill material at the LNG terminal site could impact water quality in the Delaware River and the wetlands located adjacent to the LNG terminal site. Because Crown Landing would maintain a buffer zone of wetlands between Oldmans Creek and the LNG storage and process facilities, construction and operation of the LNG terminal is not anticipated to have any effects on the creek.

The primary impact on water quality associated with dredging would be the resuspension of sediment into the water column. The suspended sediment could: reduce light penetration and lower the rate of photosynthesis and aquatic productivity in the area; introduce organic material and/or nutrients which could lead to an increase in biological oxygen demand and reduce dissolved oxygen; and release chemical constituents, such as metals, contained in the sediment. In addition, an accidental release of fuel or other hazardous materials during construction could degrade water quality.

Crown Landing is proposing to primarily use hydraulic dredging to remove approximately 800,000 cubic yards of sediment from the Delaware River. The hydraulic dredge operates by displacing bottom sediments with a cutterhead and then capturing the sediment slurry using pumps that transport the slurry via a pipe to an existing confined disposal facility. In addition to the hydraulic dredge, Crown Landing indicated that it may be necessary to mechanically dredge in select areas if boulders or other obstructions are encountered during dredging operations that would preclude the use of the hydraulic dredge. The mechanical dredge would differ from the hydraulic dredge in the method of sediment removal and transportation to the disposal site. The mechanical dredge would operate using a crane to lower a clamshell bucket to the river bottom to excavate a load of sediment. After picking up a load of sediment, the clamshell bucket would be raised through the water column and emptied into a scow for transportation to the disposal site.

As part of the environmental analysis for the Delaware River Main Channel Deepening Project, the COE conducted computer modeling of dredging-induced sediment impacts on water quality in the Marcus Hook segment of the river, which is located adjacent to the LNG terminal. The purpose of this modeling was to determine whether potential sediment contaminants that may be released during dredging operations could exceed Delaware River water quality criteria. The DREDGE model (Hayes and Je, 2000) was used to estimate the suspended sediment concentrations, the size and extent of the

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suspended sediment plume, and the particulate and dissolved contaminant concentrations in the water column from hydraulic and mechanical dredging operations within a 200-foot mixing zone (Versar, 2001).

Bulk sediment data collected from the Marcus Hook channel and Marcus Hook ship berths were used by the COE to model impacts from hydraulic dredging and mechanical dredging, respectively. Table 4.3.2-2 provides a comparison of the metal concentrations in the sediments located at the proposed LNG terminal site, Marcus Hook channel, and Sun Marcus Hook berth.

TABLE 4.3.2-2

A Summary of Metal Concentrations in Sediments from the Proposed LNG Terminal Site and the Marcus Hook Channel and Berth

	Proposed LNG Terminal Site		Marcus Hook Channel a/		Sun Marcus Hook Berth a/	
Metal (mg/kg)	Mean b/	Maximum	Mean c/	Maximum	Mean d/	Maximum
Arsenic	7.84	31.0	7.25	18.4	3 78	6.4
Cadmium	0.06 e/	1.1	1.15	4.0	0.17	0.39
Chromium	34.12	46.5	28.54	63.7	22.25	37.8
Copper	11 81	36.2	13.54	38 4	15.73	24.70
Lead	17.87	78.2	22.41	78.9	10.2	22.8
Mercury	0 019 f/	0.183	0.180	0.484	0.13	0.16
Nickel	18.13	26 9	19.27	31 6	14 43	21.8
Zinc	74.78	279	74.84	240	46 68	98.6

a/ Data obtained from a report titled *Near-Field Water Quality Modeling of Dredging Operations in the Delaware River* (Versar, 2001)

b/ Number of samples = 18

c/ Number of samples = 23

d/ Number of samples = 4

e/ Mean is based on only a single detectable concentration

f/ Mean is based on only two detectable concentrations

Hydraulic Dredging

The model results indicated that the concentration of suspended sediments resulting from hydraulic dredging (based on total suspended solids (TSS)) would be highest close to the channel bottom and would decrease rapidly downstream and higher in the water column (i.e., further from the channel bottom). Modeled total suspended sediment levels more than 0.5 meter (1.6 feet) above the river bottom were predicted to be no higher than background levels. Actual field results from a monitored dredging project in the same area were consistent with the total suspended sediments predicted by the DREDGE model, although measured and predicted sediment concentrations varied (Farrar et al., 2001 as cited in Versar, 2001). Elevated total suspended sediment levels measured near the river bottom extended downstream from the dredge site for a distance of up to 300 feet. Field measurements of suspended solids at the water surface and middle of the water column downstream of the dredging operation were not measurably different than background levels (Farrar et al., 2001 as cited in Versar, 2001).

Crown Landing used the DREDGE model to predict total suspended sediment concentrations that could be expected from dredging the ship berth. Based on a conservative TSS background concentration

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of 5 mg/L,[2] the modeling results indicate that TSS concentrations would be less than background concentrations at points within the water column located 2 meters or more above the river bottom. The model predicted that background TSS concentrations would be exceeded at a point 1 meter above the river bottom beginning approximately 820 feet downstream of the dredge for a distance of approximately 1,150 feet.

As described previously and shown in table 4.3.2-2, the concentrations of metals in the proposed dredged sediments at the LNG terminal site are similar to those in the sediments modeled by the COE in the Marcus Hook Range of the river. Based on these similarities, it is possible to estimate the potential for water quality impacts associated with alterations of water chemistry due to the release of various chemical constituents from the sediments at the LNG terminal site.

The COE estimated dissolved concentrations of various metal constituents in the water column near the cutterhead of the hydraulic dredge using the equilibrium partitioning method in the DREDGE model. Based on the maximum metal concentrations for the Marcus Hook segment listed in table 4.3.2-2, only mercury and chromium concentrations were predicted to exceed the water quality criteria. Predicted mercury concentrations exceeded the chronic exposure water quality standard near the river bottom and up to 0.5 meter (1.6 feet) above the bottom. River bottom mercury concentrations exceeded chronic exposure levels for a distance of as much as 350 meters (1,148 feet) downstream of the point of dredging. At 0.5 meter above the bottom, mercury concentrations exceeding chronic exposure levels extended about 180 meters (590 feet) downstream. Generally, chronic exposure criteria apply to continuous releases of contaminants, rather than short duration releases from activities such as dredging. Predicted mercury concentrations 0.5 meter and higher above the bottom were within acceptable water quality criteria. Because the valence state of chromium was not indicated for the COE data, we conservatively assumed that all chromium was hexavalent (a more toxic form of the metal with the most stringent water quality criteria). Under this assumption, predicted chromium concentrations at the river bottom exceeded both acute and chronic exposure criteria up to 80 meters (262 feet) downstream of the point of dredging. Predicted chromium concentrations at 0.5 meter and higher in the water column were within acceptable water quality criteria. The predicted concentrations of the remaining six metals did not exceed acute or chronic water quality standards at any depth in the water column.

The COE also conducted additional modeling using a much more conservative approach to estimate dissolved metals. This approach assumed that 80 percent of the sorbed metals could be dissolved in solution. Using this highly conservative model, chromium, copper, and zinc exceeded acute water quality criteria at the edge of a 60 meter (about 200 feet) mixing zone, but only near the river bottom. Cadmium, chromium, copper, lead, and mercury exceeded chronic exposure criteria near the bottom out to 60 meters. Most metals were below chronic exposure water quality criteria at 0.5 meter or higher in the water column. Only chromium, lead, and mercury exceeded chronic exposure criteria at 0.5 meter above the river bottom at the edge of the 60-meter mixing zone.

Mechanical Dredging

The COE model results indicated that the concentration of total suspended solids for mechanical dredging would be approximately 162 mg/L at the point of dredging and decrease to approximately 50 mg/L within 100 meters (328 feet) downstream of the dredging operation. Unlike the modeling completed for the hydraulic dredge, which calculates the suspended sediment concentration at any

[2] Based on TSS monitoring completed by Crown Landing between March and June 2003, TSS concentrations ranged from 13.9 to 24.9 mg/L. Other TSS data obtained from the Delaware River Basin Commission indicates that, for this reach of the Delaware River, TSS concentrations may range from 3 to 60 mg/L.

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position in the water column, the modeling for the mechanical dredge calculates the depth-averaged concentration throughout the water column.

The COE estimated dissolved concentrations of metals in the water column near the mechanical dredge. Based on the maximum metal concentrations for the Sun Marcus Hook Berth identified in table 4.3.2-2, none of the dissolved metal concentrations exceeded the water quality criteria at the edge of a 60-meter mixing zone.

Similar to the modeling completed for the hydraulic dredging, the COE completed a more conservative model, which assumed that 80 percent of the metals sorbed to the sediment could be dissolved into the water column upon suspension. Using the maximum metal concentrations for the sediments in Sun Marcus Hook Berth, the COE determined that, with the exception of chromium and mercury, none of the other metals exceeded water quality criteria at any point within the 60-meter mixing zone. Chromium exceeded water quality criteria out to a distance of 40 meters (131 feet) from the point of dredging and mercury exceeded water quality criteria out to a distance of 100 meters (328 feet). However, mercury concentrations were below method detection limits and the value used in the model was one-half the detection limit, which could be substantially higher than actual values. Therefore, even using a conservative approach, no metals with measurable sediment concentrations exceeded water quality criteria outside of a 60-meter mixing zone during the modeling of the mechanical dredge.

The modeling results described above indicate that using even the most conservative assumptions, metal concentrations in the water column from hydraulic dredging activities associated with the proposed ship berth would only be likely to exceed water quality criteria for a short distance from the dredging operations, and generally within about 0.5 meter of the river bottom. For mechanical dredging, metal concentrations would not be expected to exceed water quality criteria beyond a 60-meter mixing zone.

Ship Unloading and Land-Based Facilities

As described in section 2.4.1.2, construction of the LNG ship unloading facility would be completed using land-based equipment to build the pier from the shore out into the Delaware River. This construction technique would avoid dredging in the near-shore waters that would otherwise be required to provide sufficient water depths to install the pier using barge-based construction methods. While installation of the piles would disturb the river bottom, the impacts would be localized and temporary.

Construction of the proposed LNG terminal would require importing approximately 150,000 cubic yards of fill material to raise the LNG terminal above the 1,000 year storm range elevation and to construct the LNG storage tanks containment dike. Stormwater runoff from the disturbed soils on the construction site could affect water quality by increasing suspended sediment and turbidity levels in the river near the construction activities. Erosion and sedimentation at the site would be controlled and mitigated through implementation of the measures specified in our Plan and in a site-specific SESC Plan. Crown Landing would also develop and implement a stormwater management plan to control and treat stormwater runoff

LNG Terminal Operation Impacts

In addition to the construction-related impacts discussed above, the Delaware River could be affected during operations of the proposed facilities. During operation of the LNG terminal, maintenance dredging and prop wash from LNG ships and tugs would temporarily increase suspended sediments and turbidity within the ship channel and berth area. Crown Landing estimated that as much as 60,000 to 90,000 cubic yards of sediment may be deposited in the LNG ship berth each year and indicated that

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annual maintenance dredging would likely be required to remove these sediments. Impacts associated with prop wash would occur more frequently than dredging since as many as 120 to 180 LNG ships may travel to and from the terminal annually.

The LNG ships would also need to take on ballast water to stablilize the ship during transit. Crown Landing indicates that a 138,000 m^3 LNG ship would withdraw approximately 13.7 million gallons of water and a 200,000 m^3 LNG ship would withdraw about 19.8 million gallons from the Delaware River. Crown Landing estimates that the water would be taken in over about a 10-hour period at intake rates of about 1.4 million gallons/hour (23,000 gpm) for a 138,000 m^3 LNG ship and about 2 million gallons/hour (34,000 gpm) for a 200,000 m^3 LNG ship. The intake rates of 23,000 gpm to 34,000 gpm for ballasting represents less than 0.1 percent of the average flow of the Delaware River. Assuming 120 to 180 LNG ships (138,000 m^3 capacity) offload at the terminal each year, a total of between 1.6 and 2.5 billion gallons of water could be removed from the Delaware River by LNG ships annually. Because fewer 200,000 m^3 LNG ships would be needed, the total ballast withdrawal volumes on an annual basis would be similar for these ships. No ballast water would be discharged to the Delaware River.

An LNG spill on the water of the river is another potential impact that could occur during operations of the terminal. Although we consider the potential for a spill of LNG on the Delaware River unlikely, if a spill were to occur on the river, the cryogenic liquid would vaporize rapidly upon contact with the warm air and water. Being less dense than water, the LNG would float on the surface before vaporizing. Because LNG is not soluble in water and the LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water. Therefore, water quality would not be affected by an LNG spill.

To manage stormwater runoff from the developed LNG terminal site during operations of the facility, Crown Landing would provide stormwater management facilities that would be designed in accordance with NJDEP guidelines. The stormwater management system would include a treatment pond located outside of the LNG storage area containment dike. Stormwater runoff in the storage area would be collected in a sump and pumped to the treatment pond. Runoff from other portions of the facility would flow to the pond through a gravity system. After treatment in the pond, the stormwater would be discharged to the Delaware River.

Pipeline Construction and Operation Impacts

Texas Eastern has proposed to install the Logan Lateral across Chester Creek, Delaware River, Raccoon Creek, and Birch Creek using the HDD construction technique. The HDD technique is a trenchless crossing method that involves drilling a hole beneath the waterbody and installing a pre-fabricated section of pipe through the hole to complete installation. This technique would avoid disturbing the bed or banks of the waterbodies and minimize environmental impacts. Texas Eastern is currently completing geotechnical investigations at the four waterbodies to characterize subsurface conditions along the drill path and to determine the feasibility of using the HDD construction technique for crossing each waterbody. If Texas Eastern determines that installing the pipeline using the HDD technique is not feasible at any of these waterbodies, an alternative crossing technique would need to be developed; therefore, **we recommend that:**

- **Texas Eastern prepare a site-specific crossing plan identifying all areas that would be disturbed by construction if alternate crossing methods are proposed at Chester Creek, Delaware River, Raccoon Creek, or Birch Creek. Texas Eastern should file this plan with the Secretary concurrent with its application to other federal and state agencies for a permit to construct using the alternate method. The Director of OEP must review and approve this plan in writing prior to construction.**

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Texas Eastern would install the pipeline across the other waterbodies listed in table 4.3.2-1 using the open-cut construction technique. Pipeline construction across perennial streams using the open-cut construction technique could adversely affect surface waters. Potential impacts from clearing and grading, in-stream trenching, trench dewatering, and backfilling could modify aquatic habitat, increase sedimentation rates and turbidity levels, decrease dissolved oxygen concentrations, increase water temperature, and introduce fuels and oils from accidental spills.

The impacts of the open-cut construction method on perennial streams located along the proposed pipeline would generally be localized and short term. Clearing, grading, and trenching within and adjacent to these streams would have the greatest affect on water quality. Sediments would be resuspended by in-stream construction activities or by erosion of cleared stream banks and riparian areas. Turbidity resulting from the resuspended sediments could reduce light penetration and the corresponding photosynthetic oxygen production. Resuspension of deposited organic material and inorganic sediments could cause an increase in consumption of biological and chemical oxygen, decreasing available dissolved oxygen. Texas Eastern would be required by our Procedures to complete most in-stream work within 24 hours for minor waterbody crossings (i.e., those less than 10 feet wide) and within 48 hours for intermediate waterbody crossings (i.e. those greater than 10 feet wide, but less than 100 feet wide). In addition, Texas Eastern would be required to stabilize and restore the stream banks after construction is completed.

Construction impacts would be temporary and suspended sediment and turbidity levels would be expected to return to preconstruction levels soon after the stream crossing is completed. By implementing the construction and restoration methods identified in our Procedures and in Texas Eastern's SESC Plan, we believe that the impacts would be minimized and no long-term impacts on surface water quality would occur. Other federal, state, or local agencies may require Texas Eastern to implement additional protective measures as part of their permit requirements.

Hydrostatic Testing

Hydrostatic water for testing of the LNG storage tanks would be obtained from the Delaware River. Crown Landing estimates that a total of about 75 million gallons of water would be required to test the three tanks. Water would be appropriated from the Delaware River over a 2-week period at an intake rate of approximately 2,000 to 4,000 gpm. To minimize entrainment and impingement of aquatic organisms, Crown Landing would screen the intake with a 2 mm wedgewire screen and limit the velocity at the intake to 0.5 feet per second (see section 4.6.2). Crown Landing indicated that the hydrostatic test water may need to be chlorinated to prevent microbiologically influenced corrosion, a condition that could lead to corrosion of the tanks and piping from the presence and interaction of bacteria, fungi, and/or algae, if not treated. Chlorine would be added to the test water at levels significantly less than EPA water quality standards. Following the testing, Crown Landing would discharge the test water back to the Delaware River over a 1 to 2 week period in accordance with National Pollutant Discharge Elimination System (NPDES) permitting requirements. To minimize erosion and scour that could occur if the water were discharged in the nearshore portion of the Delaware River, Crown Landing indicated that it would discharge test water in deeper waters in the vicinity of the Marcus Hook anchorage area. Crown Landing would then flush each tank with approximately 250,000 gallons of freshwater obtained from onsite wells to remove the remaining brackish river water from the tanks. The rinse water would also be discharged into the Delaware River.

Based on preliminary plans, Texas Eastern proposes to appropriate water from Ridley Creek (located adjacent to Chester Junction at MP 0.0), Delaware River (MP 4.9), and/or municipal sources located within the project area to hydrotest the pipeline. Texas Eastern indicated that no chemical additives would be required to complete hydrostatic testing and that intakes would be screened with wire

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mesh to prevent the entrainment or impingement of aquatic species. After the testing is completed, Texas Eastern proposes to discharge the water back to Ridley Creek and/or the Delaware River in accordance with NPDES permitting requirements.

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4.4 WETLANDS

Regulatory Permits

Wetlands affected by the proposed projects would be regulated by federal, state, and local agencies. At the federal level, the COE has authority under section 404 of the CWA and section 10 of the Rivers and Harbors Act to review and issue permits for activities that would result in the discharge of dredged or fill material into waters of the United States. In 1994, the NJDEP assumed responsibility for administering section 404 of the CWA for the majority of the wetlands and waterbodies located in the state under the New Jersey Freshwater Wetlands Protection Act rules as specified in the New Jersey Administrative Code (NJAC 7:7A). In addition to section 404 responsibilities, the NJDEP uses the standards and procedures identified in NJAC 7:7, 7:7A, and 7:7E to determine whether the activity complies with the state's water quality standards, a prerequisite to issuing a section 401 water quality certificate. While New Jersey's Freshwater Wetlands Protection Act Rules operates in lieu of the section 404 program in certain waters, the COE has retained jurisdiction over interstate and navigable waters, such as the Delaware River and its adjacent wetlands.

In Pennsylvania, construction activities within wetlands and waterbodies would be regulated by the PADEP under the Chapter 105 Water Obstruction and Encroachment Permit Program. The Chapter 105 Program regulates obstructions and encroachments located in, along or across, or projecting into a watercourse, floodway or body of water, whether temporary or permanent, and is the nexus for determining whether the activity complies with the state's water quality standards as required by section 401 of the CWA. The two types of Chapter 105 authorizations include General Permits and Individual Permits. General Permits are used to streamline the permitting of activities that are sufficiently similar in design or construction to warrant general requirements or conditions, such as utility line stream crossings. The PADEP has delegated the processing of General Permits to local agencies, including the Delaware County Conservation District.

Construction within wetlands would require compliance, at a minimum, with the requirements of sections 401 and 404 of the CWA, section 10 of the Rivers and Harbors Act, and the respective state permitting programs. As part of complying with federal, state, and/or local regulatory requirements, Crown Landing and Texas Eastern must demonstrate that impacts on wetlands have been avoided to the extent practicable. Where unavoidable wetland impacts would occur, the agencies would require measures to mitigate the effects of construction. We believe this is consistent with the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the NEPA (40 CFR 1508.20), which defines mitigation to include the following criteria:

- avoiding the impact altogether by not taking a certain action or parts of an action;
- minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and
- compensating for the impact by replacing or providing substitute resources or environments.

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Wetlands on the LNG Terminal Site

Crown Landing conducted wetland delineations at the proposed LNG terminal site using the methods specified in the *1987 COE Wetlands Delineation Manual* (COE, 1987). As shown on figure 4.4-1, six wetlands were identified and delineated within the 175-acre LNG terminal site. The wetland boundaries were reviewed and approved by the COE and the NJDEP. The wetlands occupy about 109 acres of the site and consist of emergent, scrub-shrub, and forested types. Table 4.4-1 provides a summary of wetlands located on the proposed site. A description of vegetation in these wetlands is provided in section 4.5.

TABLE 4.4-1

Wetlands and Wetland Transition Areas Located on the Proposed LNG Terminal Site Property

Wetland Identification	Wetland Classification a/	Total Wetland Area (acres)	Temporary Impact Area (acres)	Transition Area Width (feet)/ Acres of Impact b/
Wetland I	PEM	7.4	0.0	50 / 0.0
Wetland D	PFO	7.8	0.0	150 / 4.1
Wetland E	PEM/PFO	63.2	0.3	50 / 0.3
Wetland H	PSS	1.8	0.0	50/ 0.9
Wetland J	PFO	8.5	0.0	50 / 0.0
Wetland K	PEM/PFO	20.5	0.0	50 / 0.2
Project Total		109.2	0.3	NA / 5.5

a/ Cowardin Classification System:
PEM Palustrine Emergent
PSS Palustrine Scrub Shrub
PFO Palustrine Forested

b/ Wetland transition areas regulated by the NJDEP under the New Jersey Freshwater Wetlands Protection Act (N.J.S.A. 13:9B)

Crown Landing designed the proposed LNG terminal facilities to avoid wetlands on the site. Thus no wetlands would be permanently filled or drained as a result of construction of the LNG terminal. Construction of the Columbia Gas pipeline interconnect would temporarily impact about 0.3 acre of Wetland E, a palustrine emergent wetland. Following installation of this interconnect, the disturbed wetland area within the construction right-of-way would be restored to original contours and allowed to naturally revegetate.

In addition to wetlands, the NJDEP regulates transition areas of varying widths along the borders of wetlands in the State of New Jersey. Transition areas provide an ecological transition zone from uplands to freshwater wetlands and provide temporary refuge for wildlife during high water episodes, critical habitat for animals dependent upon but not resident in freshwater wetlands, and slight variations of freshwater wetland boundaries over time due to hydrologic or climatologic effects. In addition, transition areas provide sediment and stormwater control zones to reduce the impacts of development on freshwater wetlands and associated plants and animals. The transition areas are based on the resource value of the wetland and can be 50- or 150-feet wide. Wetlands of ordinary resource value do not have a regulated transition area. Wetlands of intermediate and exceptional resource value have regulated transition area widths of 50 and 150 feet, respectively. With the exception of the forested wetland located adjacent to the Delaware River (Wetland D), all of the wetlands located on the LNG terminal site are classified by the NJDEP as having intermediate resource value. Due to the potential presence of foraging bald eagles, Wetland D is classified as having exceptional resource value.

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Non-Internet Public

Figure 4.4-1
(Page 4-40)

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

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As shown in table 4.4-1, construction of the LNG terminal would permanently impact about 5.5 acres of transition area. During construction, ground-disturbing activities in the wetland transition areas could increase erosion and sedimentation and alter wetland hydrology and drainage patterns. To minimize these impacts, Crown Landing would implement the measures contained in our Plan and Procedures and its SESC Plan, including, but not limited to, installing and maintaining sediment barriers and restoring disturbed areas following construction. While these measures would minimize impacts during construction, the resource values provided by the transition area (e.g., habitat, flood control) would be modified during operation of the facility and would require a transition area permit from the NJDEP. The NJDEP indicated that impacts on transition areas, especially the area adjacent to Wetland D which provides wintering and foraging habitat for bald eagles, would require some type of mitigation. Crown Landing discussed mitigation options with the NJDEP and the FWS on September 13, 2004 (Clark, Mars, Wilkinson, 2004). Based on these discussions, the following three options were identified as potential mitigative measures to compensate for transition area impacts:

Option 1. Planting native tree species along Oldmans Creek to provide a buffer and habitat for bald eagles and enrolling undeveloped portions of the LNG terminal site into a conservation easement program.

Option 2. Restoring onsite habitat, such as planting trees along Oldmans Ditch, controlling the spread of *Phragmites australis*, and/or creating inlets to improve tidal flow and fish and wildlife habitat within adjacent wetlands.

Option 3. Purchasing land in the vicinity of the LNG terminal site and enrolling it into a conservation easement program.

Crown Landing indicated that it would continue to coordinate with the NJDEP and the FWS on the development of an appropriate mitigation plan. Because Crown Landing has not selected a transition area mitigation site or developed a transition area mitigation plan, **we recommend that:**

- **Crown Landing continue to consult with the NJDEP, FWS, and other appropriate agencies, and prepare a wetland transition area mitigation plan. This plan should include details regarding the amount, location, and forms of mitigation proposed; a monitoring plan with clearly defined criteria for determining if and when the mitigation is successful; and remedial measures, as necessary, to ensure that compensatory mitigation is successful. Crown Landing should file the wetland transition area mitigation plan with the Secretary prior to construction.**

Wetlands Located Along the Proposed Pipeline Route

Texas Eastern completed a wetland survey in June 2004 using the current federal and state delineation methodologies to identify and delineate wetlands along the Logan Lateral route. Based on the results of this survey, the Logan Lateral would cross about 2.5 miles of wetlands (approximately 22 percent of the total pipeline length). Table 4.4-2 identifies the state, milepost location, wetland classification, wetland identification number, crossing length, acreage affected during construction, and acreage affected during operation for wetlands located along the proposed pipeline route.

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TABLE 4.4-2

Wetlands Located Along the Logan Lateral Route

State/ Milepost Location	Wetland Classification a/	Wetland I.D.	Crossing Length (feet) b/	Acreage Affected by Construction c/	Acreage Affected by Operation d/
Pennsylvania					
1.80	PEM	W-DE-100	48	0.04	0.0
2.11	PEM/PFO	W-DE-101	100	0.08	0.06
2.21	PEM/PSS/PFO	W-DE-102	1,680	1.09	0.34
2.34	PFO	W-DE-103	197	0.22	0.07
2.44	PFO	W-DE-104	480	0.7	0.11
3.22	PFO	W-DE-105	215	0.29	0.13
3.34	PFO	W-DE-106	70	0.03	0.0
Subtotal			**2,790**	**2.45**	**0.71**
New Jersey					
5.38	PFO/PEM	W-GL-100	300	0.64	0.25
5.45	PEM/PSS	W-GL-102	3,550	3.44	0.8
7.33	PEM/OW	e/	290	1.44	0.0
7.49	PEM/OW	e/	250	0.6	0.0
7.64	PEM/OW	e/	160	0.36	0.0
8.03	PEM	W-GL-109	61	0.14	0.0
8.29	PEM/PFO	W-GL-112	0	0.03	0.0
8.33	PEM/PFO	W-GL-111	50	0.1	0.03
8.72	PEM	W-GL-114	800	1.66	0.0
8.92	PEM/PFO	W-GL-115	757	1.29	0.23
9.08	PEM/PFO	W-GL-116	2,038	2.01	0.01
9.89	PEM/PFO	W-GL-113	270	1.02	0.0
10.88	PEM/PSS/PFO	Crown Landing Wetland #3	2,516	7.18	0.33
Subtotal			**11,042**	**19.91**	**1.65**
Project Total			**13,832**	**22.36**	**2.36**

a/ Cowardin Classification System:

PEM Palustrine Emergent

PSS Palustrine Scrub Shrub

PFO Palustrine Forested

OW Open Water

b/ A crossing length of zero (0) indicates that the pipeline would not cross the wetland, but that temporary workspace would be located within the wetland.

c/ Acreage affected by construction includes the temporary construction right-of-way and temporary workspaces.

d/ Acreage reflects a maintained permanent right-of-way width of 30 feet centered over the pipeline in forested wetlands and 10 feet centered over the pipeline in scrub-shrub wetlands. Emergent wetlands would not be affected during operation of the pipeline.

e/ Due to lack of survey access, these wetlands have not been field delineated and are based on NWI data. In accordance with the FERC staff's Procedures, Texas Eastern would be required to complete field delineations and submit a wetland delineation report to the FERC prior to construction.

No wetlands would be permanently filled or drained as a result of construction. In addition, none of the access roads identified by Texas Eastern would affect wetlands. In addition to siting the facilities

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outside of wetlands to the extent practicable, Texas Eastern would utilize specialized construction techniques to avoid trenching across wetlands. For example, Texas Eastern proposes to cross Birch Creek utilizing the HDD construction method, which would avoid trenching across about 1,500 feet of wetlands at MP 2.21.

The primary impact of pipeline construction and right-of-way maintenance activities on wetlands would be the temporary alteration of wetland vegetation and the permanent conversion of forested wetland to scrub-shrub or emergent wetlands. Construction of the Logan Lateral would temporarily disturb approximately 22.36 acres of wetlands and, through right-of-way maintenance activities, approximately 2.36 acres of scrub-shrub or forested wetlands would be permanently maintained in an herbaceous state. Impacts on emergent wetlands would be considered temporary because herbaceous vegetation would likely regenerate within a few growing seasons following restoration of the right-of-way. In a letter dated September 14, 2004, the FWS recommended that Texas Eastern compensate for permanent wetland impacts (FWS, 2004a). The FWS indicated that mitigation should be in the form of in-kind compensation at a 2:1 ratio (i.e., 2 acres created for every 1 acre of wetland impacted). Texas Eastern indicated that it would coordinate with the COE, NJDEP, and PADEP during the permitting process to identify appropriate mitigation measures. Because Crown Landing has not prepared a wetland mitigation plan, **we recommend that:**

- **Texas Eastern consult with the COE, FWS, NJDEP, and PADEP and other appropriate agencies on wetland mitigation requirements. If the agencies determine that compensatory wetland mitigation is required, Texas Eastern should prepare a wetland mitigation plan describing the type of mitigation proposed, the location and size of the mitigation site, and any monitoring requirements that would be required to ensure the successful implementation of the compensatory mitigation. Texas Eastern should file its wetland mitigation plan with the Secretary <u>prior to construction.</u>**

Clearing, trenching, and other ground disturbing activities in wetlands could affect wetland hydrology and water quality. Operating heavy equipment could compact wetland soils, create ruts, and result in increased sedimentation and turbidity. In addition, the pipeline trench could act as a conduit for subsurface water flow which could impact wetland hydrology. These effects would be greatest during and immediately following construction.

To minimize potential impacts on wetlands during construction of the pipeline, Texas Eastern would implement the protective measures specified in our Procedures and its SESC Plan, including the following:

- limiting the construction equipment operating in the wetland to that necessary to complete construction;
- facilitating revegetation by leaving existing root systems in place except over the trench and where safety considerations requires their removal;
- segregating topsoil from the trench in unsaturated wetland soils;
- installing and maintaining sediment barriers across the entire construction right-of-way and along the edges of the right-of-way as necessary to prevent sediment from entering wetlands; and
- installing trench breakers as necessary to prevent the draining of wetlands.

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We believe that these measures would minimize impacts on wetlands and promote revegetation following pipeline installation.

Operational impacts are primarily limited to periodic vegetation clearing over the pipeline centerline and Texas Eastern would minimize impacts on wetlands by adhering to the wetland vegetation maintenance requirements specified in our Procedures. Specifically, Texas Eastern would limit vegetation maintenance in wetlands to annual mowing of a 10-foot-wide strip centered over the pipeline and the periodic cutting of trees greater than 15 feet in height that are located within 15 feet of the pipeline centerline.

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4.5 VEGETATION

LNG Terminal

The proposed LNG terminal site is an undeveloped parcel located adjacent to the Delaware River. The vegetation communities on the site consist primarily of agricultural land and emergent wetland, with scattered areas of open, forest, and shrub lands. These vegetative communities are described below. The offshore portion of the proposed LNG terminal (i.e., ship unloading facility) would be partially located in a shallow, intertidal area of the river that is almost devoid of vegetation.

Agricultural crops are the most predominant upland cover type on the LNG terminal site. Typical crops grown on the site include soybeans and wheat. The onshore LNG facilities would be located within an agricultural field that has recently been planted in soybeans.

Emergent wetlands on the site are dominated by common reed grass. Other species within these wetlands include soft rush, cattails, reed canary grass, straw colored sedge, lady's thumb, jewelweed, blue flag iris, arrow arum, and sensitive fern. Scrub-shrub wetlands primarily bordering onsite drainage ditches are dominated by black willow, silky dogwood, false indigo, blue flag iris, common reed grass, and square stem monkey flower.

Open land on the site consists of existing farm roads and dikes. Common species in these areas include late-flowering thoroughwort, yellow foxtail, pineapple-weed, jimsonweed, lady's thumb, bull thistle, Canada thistle, Asiatic tearthumb, Pennsylvania smartweed, ground cherry, switchgrass, and crabgrass.

Upland shrub land, including young forest, occurs as narrow strips located adjacent to field roads. These areas are dominated by common elder and white mulberry interspersed with common reed, Asiatic tearthumb, pokeweed, and Japanese honeysuckle in the understory.

Forest land on the site includes a narrow strip of forested wetland along the river and some remnant areas of forested wetland scattered throughout the site. The forested wetland along the river is dominated by black willow and has an understory consisting predominantly of false indigo, soft rush, and silverweed. The other forested wetlands are dominated by black willow, green ash, common reed grass, stilt grass, Asiatic tearthumb, and Japanese honeysuckle. Some upland areas adjacent to the forested wetlands are being invaded by the tree-of-heaven.

Crown Landing designed the LNG terminal facilities to avoid the natural vegetation communities on the site to the extent practicable. Most of the facilities would be constructed within cropland. Of the 38.6 acres of vegetative communities that would be permanently developed into LNG facilities, 35.4 acres (91 percent) would be in agricultural fields that have most recently been planted in soybeans and at present are fallow. Table 4.5-1 summarizes the vegetative communities that would be affected by construction and operation of the LNG terminal. A more detailed discussion of the wetland impacts is provided in section 4.4.

To minimize disturbance to vegetative communities, Crown Landing would restrict construction activities to the area disturbed within the permanent facility footprint to the extent practicable. A 3.8-acre temporary staging area would be needed during construction and would be located in an agricultural field adjacent to U.S. Route 130. About 0.3 acre of emergent wetland on the site would also be temporarily affected during construction of the Columbia Gas pipeline interconnection. Both of these temporary construction areas as well as other disturbed areas that are not required for buildings, roads, gravel, or

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other hard surfaces would be restored in accordance with our Plan and Procedures and Crown Landing's SESC Plan after construction of the LNG terminal.

TABLE 4.5-1

Acreage of Vegetative Communities Affected by Construction and Operation of the Proposed LNG Terminal a/

	Cropland	Open Land b/	Shrub Land	Wetland	Total
Area Affected by Construction (acres)	39.2	1.7	1.5	0.3	42.7
Area Affected by Operation (acres)	35.4	1.7	1.5	0.0	38.6

a/ Portions of the Logan Lateral would be located within the boundaries of the proposed LNG terminal. These impacts are discussed under the Pipeline Facilities section.

b/ Includes existing farm roads and dikes

Pipeline Facilities

Vegetative communities crossed by the Logan Lateral route include forest land, open land, shrub land, and cropland interspersed among developed commercial and residential areas. Most of the pipeline route in Pennsylvania crosses urban areas with limited vegetative communities. The pipeline route in New Jersey crosses mostly undeveloped areas that are predominantly open land and cropland (soybean fields).

Upland forest located along the proposed pipeline route includes mixed-forest communities of maple-ash and beech-oak. The maple-ash communities are dominated by red maple, green ash, box elder, and tulip tree with an understory dominated by honeysuckle. The beech-oak communities are dominated by American beech and white oak with an understory consisting mostly of black cherry, white mulberry, bittersweet, and honeysuckle. Forested wetlands crossed by the pipeline route are primarily located in bottomlands and floodplains adjacent to waterbodies and are dominated by black willow, red maple, sweet gum, black gum, pin oak, and ash.

Open areas located along the proposed pipeline route include undeveloped areas and existing utility and road rights-of-ways. Plant species such as stinging nettle, bristle foxtail, curly dock, pink knotweed, goldenrod, and blackberry are common. Shrub lands are also considered open areas and along the pipeline route are dominated by red maple, sweet gum, and willow.

The proposed pipeline would cross numerous emergent and scrub-shrub wetlands. The emergent wetlands are dominated by common reed grass, foxtail, deer tongue, switchgrass, rushes, and cattails. The scrub-shrub wetlands are dominated by willows, red maple, sweet gum, arrow wood, alder, foxtail, bushy bluestem, and locust.

Table 4.5-2 summarizes the impacts of pipeline construction and operation on each vegetative community. The Pennsylvania portion of the pipeline route is primarily composed of open and forest lands accounting for 9.4 acres and 17.8 acres, respectively, of the construction right-of-way and extra workspace. The New Jersey portion of the pipeline route is mostly composed of croplands and open lands accounting for 50.8 acres and 25.6 acres, respectively, of the construction right-of-way and extra workspace.

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TABLE 4.5-2

Acreage of Vegetative Communities Affected by Construction and Operation of the Logan Lateral Project a/

Facility	Forest Lands b/		Wetlands c/		Open Lands		Cropland d/		Totals	
	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.
Pennsylvania										
Pipeline Right-of-way	12.4	4.8	0.6	0.3	5.6	5.0	0.0	0.0	18.6	10.1
Temporary Extra Workspaces	5.4	0.0	<0.1	0.0	3.8	0.0	0.0	0.0	9.2	0.0
Aboveground Facilities	0.0	0.0	0.0	0.0	<0.1	<0.1	0.0	0.0	<0.1	<0.1
Pennsylvania Subtotal	17.8	4.8	0.7	0.3	9.4	5.1	0.0	0.0	27.9	10.1
New Jersey										
Pipeline Right-of-way	3.7	3.8	13.9	4.7	18.1	14.0	18.7	9.3	54.4	31.8
Temporary Extra Workspaces	1.9	0.0	1.9	0.0	7.5	0.0	31.7	0.0	42.9	0.0
Aboveground Facilities	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5
New Jersey Subtotal	5.6	3.8	15.8	4.7	25.6	14.0	50.8	9.7	97.8	32.3
Pipeline Facilities Subtotal										
Pipeline Right-of-way	16.1	8.5	14.6	5.0	23.7	19.1	18.7	9.3	73.0	41.9
Temporary Extra Workspaces	7.3	0	1.9	0.0	11.3	0.0	31.7	0.0	52.2	0.0
Aboveground Facilities	0.0	0.0	0.0	0.0	<0.1	<0.1	0.5	0.5	0.5	0.5
Pipeline Facilities Total	23.4	8.5	16.5	5.0	35.0	19.1	50.8	9.7	125.7	42.4

a/ Based on a 100-foot-wide construction right-of-way. Some areas would have a reduced construction right-of-way to avoid impacts on residential and wetland areas. Operation acreage is based on a 50-foot-wide permanent right-of-way in all areas except at road crossings and within roadways where the right-of-way width would be as permitted by the local agencies. Beginning at approximately MP 10, the pipeline right-of-way would be located within the proposed 175-acre LNG terminal site but does not overlap the 39 acres that would be permanently developed for the terminal facilities.

b/ Forest lands include both upland and wetland forest. In forested areas where portions of the existing right-of-way are used for both permanent and temporary right-of-way, the acreages for both open land (existing right-of-way) and forested (new right-of-way) have been determined and separated accordingly. Operation impacts on forest lands include those areas that will be maintained free of trees. Forested areas avoided by HDD are not included.

c/ Impacts on wetlands include those areas affected by construction and retention of a permanent right-of-way. These impacts do not include forested wetlands and farmed wetlands.

d/ Cropland impacts include farmed wetlands.

Const. Construction Impacts

Oper. Operation Impacts

Note: The totals shown in this table may not equal the sum of addends due to rounding.

During construction, existing vegetation would be temporarily removed from within the construction right-of-way and other necessary workspaces to facilitate the installation of the pipeline. The impact of clearing and the amount of time required for complete recovery of vegetation to pre-disturbance levels would depend on the size and age of the pre-existing vegetation. In general, impacts would be greatest in forest lands because they are more structurally complex than other vegetation types and take longer (perhaps 30 to 40 years) than other vegetation types to become reestablished to preconstruction conditions. In addition, as discussed below, trees would be prevented from growing on the permanent right-of-way by routine pipeline maintenance activities. Texas Eastern would avoid most impacts to forest land adjacent to Chester Creek and Raccoon Creek by using the HDD technique to install the pipeline at these stream crossings; impacts on vegetation would be limited to a 3-foot-wide corridor cleared over the pipeline for a line-of-sight down the corridor.

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The loss of vegetation could also have secondary impacts, including forest fragmentation and the loss of wildlife habitat. Other secondary impacts could include increased erosion, from the conversion of deep rooted vegetation to shallow rooted vegetation on the right-of-way and increased solar radiation, which could dry the soil and stimulate the growth of early successional species within and immediately adjacent to cleared areas. The removal of trees on the right-of-way could also expose trees growing adjacent to the newly cleared areas to higher levels of wind, which may increase the risk of blow downs. The majority of these effects would be minor and temporary and would diminish upon restoration and revegetation of the right-of-way.

Operation and maintenance of the proposed pipeline facilities would have additional effects on vegetation after site clearing and right-of-way restoration are completed. The pipeline right-of-way would be maintained in accordance with our Plan and Procedures and Texas Eastern's SESC Plan. Implementation of the measures provided in these Plans and Procedures would minimize potential long-term impacts by allowing annual maintenance of only a 10-foot-wide strip centered over the pipeline. Additionally, routine vegetation maintenance across the entire permanent right-of-way could occur only once every 3 years in uplands and would be restricted in wetlands to the periodic clearing of trees greater than 15 feet in height that are within 15 feet of the pipeline centerlines.

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4.6 WILDLIFE AND AQUATIC RESOURCES

4.6.1 Wildlife Resources

The proposed LNG terminal site consists primarily of agricultural lands with small areas of open land, forest, shrub land, and wetland. The two active agricultural fields, which encompass most of the proposed area to be developed, provide foraging and cover habitat for mammals and birds; however, these fields provide limited breeding habitat since spring tilling and planting occur during the breeding season for most of the mammal and bird species that may use the site. Wildlife species that utilize active croplands in the project area include locally common species typical of agricultural lands in New Jersey such as the white-footed mouse, meadow vole, eastern cottontail rabbit, white-tailed deer, mourning dove, northern bobwhite, and ring-necked pheasant. Canada geese and white-tailed deer were observed foraging in these fields.

The open land at the LNG terminal site was previously used for farming but is now covered by old field vegetation. Typical wildlife that utilize open land habitat in the project area include cottontail rabbit, coyote, red fox, raccoon, opossum, common crow, rock dove, European starling, common grackle, field sparrow, Carolina wren, brown-headed cowbird, red-tailed hawks, and many species of rodents.

The three narrow bands of forest land on the site may provide more vegetatively and structurally diverse wildlife habitat than the agricultural fields and open areas. However, their small size reduces their suitability for many wildlife species. The microhabitat components (e.g., snags, cavities, downed wood, open water) of the forested areas provide breeding habitat for amphibians and birds. Birds likely to nest in these areas include riparian forest species such as downy and hairy woodpecker, American crow, red-eyed vireo, and great-crested flycatcher. Three amphibian species, spring peeper, gray tree frog, and bull frog, may breed in the open waters within the forested areas. The narrow forested and scrub-shrub wetlands along the drainage ditches and along the shoreline of the Delaware River also provide cover and foraging habitat for riparian wetland species such as the green heron, snowy egret, belted kingfisher, water shrew, white-footed mouse, and raccoon.

The LNG terminal site also includes intertidal and open water habitats associated with the Delaware River and Oldmans Creek. Aquatic species known to inhabit these waterbodies are described in section 4.6.2. No marine mammals (e.g., whales, dolphins, or seals) are known to travel this far up the Delaware River. Common mammals using the open water or coastal habitats of the river and creek include muskrat, mink, and raccoon. The shoreline habitats associated with the waterbodies also support a diverse assemblage of avian species, including shorebirds, wading birds, and waterfowl. Some of these bird species are year-round residents but most are migratory and spend only a portion of the year in the area.

Habitat types crossed by the proposed Logan Lateral route include remnant open land, wetland, open water, forest, shrub land, and agricultural land interspersed among developed commercial and residential areas.

The open land habitat consists primarily of existing utility rights-of-way and undeveloped land adjacent to residential and commercial/industrial areas. Wildlife associated with these areas is similar to those discussed for open land areas at the proposed LNG terminal site.

The wetlands that would be crossed by the proposed pipeline consist primarily of monotypic stands of common reed grass. These wetlands are often of little value to most wildlife due to the density of the vegetation and because they lack other native plants. Bird species that are known to nest in common reed grass include red-winged blackbird, common yellowthroat, swamp sparrow, marsh wren,

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and black-crowned night-heron. Several waterfowl species are also known to use common reed grass for nesting sites and as nest material, including American black duck, Canada goose, ruddy duck, pied-billed grebe, American coot, and green-winged teal (Kane, 2001). Common reed grass also provides protective cover for turtles, snakes, and small mammals throughout the year; ducks during their flightless molting period in late summer; and resident wildlife species such as deer, foxes, coyotes, and raccoons in the winter.

The forested areas along the pipeline route consist of isolated second growth stands dispersed within developed areas and a larger forested area adjacent to Chester Creek. Common mammalian species that may utilize these forests for feeding, breeding, and cover include white-tailed deer, red fox, Virginia opossum, gray squirrel, flying squirrel, and striped skunk. Common bird species in these forests may include rufous-sided towhee, downy woodpecker, red-tailed hawk, screech owl, and tufted titmouse (Goodrich et al., 2003).

Aquatic habitats along the pipeline route include intertidal and open water habitats within the Delaware River and some of its tributaries such as Birch Creek, Chester Creek, and Raccoon Creek. Aquatic species known to inhabit these areas are described in section 4.6.2. Mammals associated with these open water areas are similar to those described for the open water areas at the LNG terminal site.

Sensitive or Significant Wildlife Areas

DNREC (2004a) expressed concern regarding a colony (referred to as a heronry) of nesting herons and other wading birds on Pea Patch Island. Pea Patch Island is located in the Delaware River about 15 miles downstream of the proposed LNG terminal site. Several thousand pairs of 10 species of heron, egret, and ibis nest on the island each year. In the late 1980s, this heronry supported over 12,000 nesting pairs. However, in recent years, only about 3,000 nesting pairs have been documented at the site. In an effort to identify causes of the decline and protect the heronry and the resource on which it depends, the DNREC, Coastal Program has developed a Special Area Management Plan (DNREC, 1998) for the region surrounding the heronry.

The original Special Area Management Plan identified a 15-kilometer-radius area around the heronry as the primary area used for foraging by individuals nesting on the island. This original area extended to within about 6 miles of the LNG terminal site. A progress report issued in 2001 (DNREC, 2001) included an expanded heronry region that included about 1,500 square miles. The northern edge of the expanded region follows the boundary between New Castle County, Delaware and Delaware County, Pennsylvania, across the Delaware River to the Salem County – Gloucester County boundary in New Jersey. The LNG terminal site is located in the section of Gloucester County that is included in the expanded region.

Although the proposed project area occurs within the expanded heronry region, the original 15 kilometer radius likely captures the majority of critical foraging areas used by species nesting at the site. The proposed conversion of agricultural land to industrial land is not likely to affect the ability of foraging individuals to locate adequate food. The addition of LNG ships in transit to the LNG terminal would slightly increase the overall amount of ship traffic that passes the heronry, but the effect would be similar to the effects of other large ships that currently pass the island, and thus would not be expected to deter individuals from nesting at the heronry or result in long-term impacts on Pea Patch Island. The slight increase in ship traffic on the Delaware River also would not likely increase shoreline erosion on the island. Potential risks associated with an accidental release of LNG from a transiting ship are discussed in section 4.12.5. Due to the low probability of an accidental LNG release from a ship during transit, the heronry on Pea Patch Island would be at low risk to be affected by an LNG ship accident.

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Wildlife Resources Impacts and Mitigation

Construction and operation of the Crown Landing LNG and Logan Lateral Projects would result in both short term and permanent alteration of wildlife habitat, directly impacting wildlife through disturbance, displacement, injury, and/or mortality.

Vegetation clearing necessary to construct the LNG terminal would reduce cover, nesting, and foraging habitat for some wildlife. Of the wildlife species present in the project area, the larger more mobile species would be temporarily displaced from the construction areas to similar adjacent habitats, where available. Because most of the project area is developed and fragmented, the area is not likely to support abundant wildlife populations. However, the developed nature of the project area also limits the amount of habitat that would be available to wildlife displaced by construction. It is expected that wildlife displaced by construction would return to the temporary construction areas and adjacent undeveloped habitats soon after completion of construction and the restoration and revegetation of disturbed areas. However, some individuals of less mobile species, such as small mammals, reptiles, and amphibians, as well as nesting birds located in the construction areas, could be injured or killed by construction activities.

Development of the terminal would convert approximately 35.4 acres of cropland to developed land. Additionally, the improvement and widening of the existing dirt road to provide access to the proposed LNG terminal would convert a small area of ruderal vegetation and roughly 1.7 acres of open land to impervious surface. While these areas provide only marginal habitat and, therefore, are unlikely to support much wildlife, any wildlife using the areas would be displaced to other habitats on the site or in the immediate vicinity. The construction of the containment dike around the LNG tanks could also alter or interfere with the movement patterns of some mammals, amphibians, and reptiles at the site, particularly between the southern portion of the site and Oldmans Creek and the Delaware River.

Construction of the liquid unloading pipeline between the pier and the LNG storage tanks and construction of the foundation for the flare would result in the loss of 1.5 acres of shrub and young deciduous forest along the existing berm that runs between the shoreline and the active cropland. The affected habitat provides limited wildlife value because it occurs in a narrow band (less than 20 feet wide) between the shoreline and the dirt access road, contains no mature trees, and supports abundant Japanese knotweed, an invasive species.

Construction of the Columbia Gas pipeline interconnection at the LNG terminal would result in the temporary disturbance of about 0.3 acre of wetland habitat on the western portion of the site. Wildlife species that inhabit the affected area would be temporarily displaced and required to compete with other species in adjacent areas for habitat requirements.

Operation of the low- and high-pressure flares at the terminal could pose a threat to raptors that like to use tall objects such as trees and power poles as perches. The flares would be incorporated into a 120-foot-high self-supporting stack and located within 150 feet of the Delaware River shoreline, which is a high use area for foraging raptors. In general, the risk of the flares to raptors would be minimal since use of the flare would be limited to emergency situations. To further reduce the risks to raptors and other birds, Crown Landing proposes to install perch guards on the flares to discourage or eliminate perching.

Wildlife would also be affected by construction of the Logan Lateral, which would require the clearing of about 23.4 acres of forested vegetation and result in the permanent conversion of 8.5 acres of forest land to commercial/industrial, herbaceous, and shrub cover types. The forest land adjacent to Chester Creek likely contains the most diverse and abundant terrestrial wildlife populations. Impacts on this area would be minimized by using the HDD method to cross the creek and by constructing the

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pipeline adjacent to an existing pipeline right-of-way. Forest habitat on the temporary construction right-of-way for the pipeline would be allowed to re-establish to preconstruction conditions following construction. However, it could take several years for tree saplings to become established and many decades before there are mature trees on the restored right-of-way

Generally, forest clearing can contribute to fragmentation, which has been shown to have an adverse impact on forest interior species. The project would not contribute significantly to forest fragmentation since most of the proposed facilities would be located in open non-forested areas and the majority of the pipeline would be adjacent to existing utility or road corridors. Additionally, Texas Eastern proposes to cross the large forested areas along Chester Creek and Raccoon Creek using the HDD method, which would avoid impacts on these areas.

The non-forested habitats that would be affected by construction and operation of the pipeline include wetlands, open land, agricultural land, residential areas, and open water. The impact of the proposed project on most of these habitats and associated wildlife species would generally be minor and short term. Following construction, these areas would be restored and, except for open water areas, revegetated.

To minimize the clearing of vegetated areas for construction activities, Texas Eastern proposes to install 16 percent of the pipeline within existing streets, use the HDD method to cross several waterbodies, and co-locate 58 percent of the pipeline with existing utility corridors. Furthermore, in areas designed for HDD, clearing of vegetation would be limited to that necessary to comply with operation and inspection under the FERC and DOT requirements.

The impact of the pipeline on birds and mammals using the shoreline and surface water habitats of the Delaware River and its tributaries is expected to be minor and temporary. Some birds may move away from the construction area but would return after site restoration. Impacts on Chester Creek, the Delaware River, Raccoon Creek, and Birch Creek are not anticipated because these areas would be crossed using HDD techniques. Potential impacts on pied-billed grebe habitat along Birch Creek are discussed in section 4.7.

Long-term impacts on wildlife resources along the pipeline route would be minimized by Texas Eastern's adherence to its SESC Plan and our Plan and Procedures. As discussed in section 4.5, these plans only allow annual maintenance of a 10-foot-wide strip centered over the pipeline. Routine vegetation maintenance across the entire permanent right-of-way could occur only once every 3 years in uplands and would be restricted in wetlands to the periodic clearing of trees greater than 15 feet in height that are within 15 feet of the pipeline centerline. To further protect nesting birds and in accordance with our Plan and Procedures, Texas Eastern would conduct routine vegetation maintenance only between August 1 and April 15, which is outside of the typical nesting season for most bird species.

4.6.2 Aquatic Resources

The proposed LNG terminal site is located on the Delaware River which is listed on the EPA's National Estuary Program (EPA, 2004). The salinity distribution in the Delaware River is primarily the result of saltwater inflow from the Atlantic Ocean and freshwater inflow from the Delaware River Basin. The mixing of salt and fresh water forms a salinity gradient that ranges from less than 0.5 parts per thousand (ppt) in the freshwater tidal portion of the Delaware River to about 32 ppt at the mouth of the Delaware Bay. This salinity gradient is not static, but is subject to change based on freshwater inflow, weather conditions, and other factors. Fish, benthic invertebrates, aquatic vegetation, and, to a lesser extent, wildlife distribute themselves within the Delaware River in accordance with their salinity tolerances (COE, 1997).

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The riverine area near the project site (located at about RM 78) supports a warmwater fish assemblage that includes anadromous, resident, and catadromous species. The LNG terminal site is located in the oligohaline to freshwater transition zone. Salinity at the site typically ranges up to about 1 ppt.

New Jersey legally defines fisheries downstream of the Commodore Barry Bridge as marine fisheries (NJDEP, 2003b). However, NOAA Fisheries considers Oldmans Creek to be the upstream limit of saltwater intrusion (National Marine Fisheries Service (NMFS), 2003) and fisheries biologists with the NJDEP (2003c) indicated that the project area supports a tidal freshwater fishery. Therefore, for the purposes of regulating fishery resources at the state level, the fishery offshore of the LNG terminal site is considered marine, even though most of the species found there are more characteristic of freshwater environments.

Table 4.6.2-1 lists fish species that based on correspondence with resource agencies and/or field assessments are known to occur in or near the project area.

TABLE 4.6.2-1

Representative Game and Commercial Fish Species Known to Occur in the Project Area

Common Name	Commercial Fishery	Recreational Fishery	Nursery and/or Spawning Habitat	Fishery Management Plans	Threatened or Endangered
Alewife			X	X	
American eel	X	X		X	
American shad			X	X	
Atlantic croaker				X	
Atlantic menhaden			X	X	
Atlantic sturgeon			X	X	State-listed endangered (Delaware and Pennsylvania)
Banded killfish	X				
Black crappie		X			
Blueback herring			X	X	
Brown bullhead		X			
Chain pickerel		X			
Channel catfish		X			
Golden shiner	X				
Hickory shad				X	
Norfolk spot				X	
Largemouth bass		X			
Redear sunfish		X			
Redfin pickerel		X			
Shortnose sturgeon			X		Federally endangered, state-listed endangered (New Jersey and Pennsylvania) and threatened (Delaware)
Smallmouth bass		X			
Striped bass	X	X	X	X	
Striped killfish	X				
White catfish		X			
White perch		X			
White sucker		X			
Yellow perch		X			

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Three general types of aquatic habitat exist within the Delaware River at the LNG terminal site:

- open waters of the Delaware River ship channel, Marcus Hook anchorage, and the area between the anchorage and the subtidal shallows;
- intertidal and subtidal shallows; and
- benthic habitat.

The open water habitat includes all of the waters channelward of the subtidal shallows. This habitat ranges from 4 feet deep to more than 40 feet deep at MLLW and is characterized by turbid, low-salinity (brackish) water over a substrate of fine sand and silt. Atlantic croaker, white perch, bay anchovy, hogchoker, channel catfish, and striped bass are the most abundant species using this habitat in the project area (O'Herron et al., 1994). The project area also provides habitat for Atlantic sturgeon, brown bullhead, white catfish, yellow perch, Norfolk spot, naked goby, and golden shiner. Most of these fish are polyhaline species, which can tolerate a wide range of salinities, and all are physiologically adapted to the natural variations in water quality and the general environmental conditions characteristic of the estuarine environments. Most of these species are also habitat generalists. Some of the smaller species, including hogchoker, naked goby, and bay anchovy, use both the deep open water and shallow water areas of the Delaware River.

The areas between the spring high water line to a depth of 4 feet below MLLW include both shallow water habitat (subtidal shallows) and areas exposed during low tide (intertidal shallows). Within the project area, the slope and width of the subtidal and intertidal zones is relatively uniform along the river and the substrate is a mix of sand, gravel, sparse cobble, and silt. The subtidal shallows extend an average of 550 feet channelward from the mean low water line and are characterized by moderate wave action, generally turbid conditions, and silt substrate. Based on several observations made during June, July, and August 2003, there is almost no aquatic vegetation within the offshore areas of the site area. Several smaller species of fish, such as eastern silvery minnow, banded killifish, tessellated darter, and mummichog are residents of the subtidal and intertidal shallows almost year round. Some of these species, particularly mummichog, are common in the tidal ditches. These species may exhibit a slight shift to deeper environments during winter, however, they rarely move significant distances during seasonal migration. Juvenile Atlantic sturgeon, striped bass, white catfish, channel catfish, yellow perch, white perch, Atlantic croaker, and Norfolk spot also utilize the subtidal zone, particularly in the summer months. Managed species that use shallow water habitat are discussed below in the Special Concern Aquatic Resources section.

The NJDEP (2003c) reported that there are no commercial shellfisheries in the project area. However, adult male blue crabs have been collected on industrial intake screens at RM 81.2, approximately 3 miles upstream of the project site. This data suggests that the project area may provide suitable habitat seasonally (during the summer) for blue crabs.

A study conducted by Crown Landing in 2003 revealed the presence of five major macroinvertabrate taxa in the Delaware River at the site: Bivalvia, Isopoda, Amphipoda, Oligochaeta, and Chironomidae. Asiatic clam (*Corbicula fluminea*) was determined to be the dominant species in the subtidal shallows. Data from the study revealed that the abundance of benthic macroinvertebrates is closely related to substrate condition, water quality, and macrohabitat features. The study also revealed that the species composition of the benthic community in the project area differs from benthic communities elsewhere in the Delaware River estuary in the following ways:

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- the overall density of benthic macroinvertebrates at the project site is low when compared to densities elsewhere in the estuary, and is also low compared to the mean total density of organisms documented for Zone 5 (approximately 1,300 per square meter), which was the lowest for all five zones evaluated during the COE study in 1993[3]; and

- excluding the Asiatic clam, the overall biomass of the benthos at the project site is low when compared to biomass of benthos across all five zones documented by the COE (1993).

Oldmans Creek constitutes the only tidal creek habitat near the project site. The creek is generally turbid, has a silt or sand bottom, extensive vegetated shallows, and lacks significant bathymetric complexity. Numerous small tidal streams and ditches on the LNG terminal site flow into Oldmans Creek. These streams and ditches have mud or sand bottoms and generally lack significant aquatic vegetation. The proposed project would not directly impact any of these waterbodies.

The proposed pipeline route runs perpendicular to the Delaware River in Pennsylvania and parallel to the Delaware River in New Jersey. The pipeline route crosses eight perennial waterbodies. The largest of these is the Delaware River, which would be crossed using HDD techniques. Chester Creek (about 105 feet wide), Raccoon Creek (about 300 feet wide), and Birch Creek (about 50 feet wide) would also be crossed using HDD techniques to avoid impacts on the waterbodies and adjacent wetlands. The four other streams that would be crossed by the pipeline are Baldwin Run, which is a tributary to the Delaware River, and three unnamed tributaries to Oldmans Creek. Texas Eastern currently proposes to cross all four of these waterbodies using open-cut construction methods. Because these latter waterbodies have limited fisheries and the in-stream pipeline construction activities would be temporary, the aquatic resources in these streams would not be adversely affected by the proposed project.

Special Concern Aquatic Resources

There are no exceptional or rare recreational fisheries in the project area, but there are two protected fish species that may occur in the waterbodies that would be affected by the project (see section 4.7). Aquatic areas near the project have been identified as spawning and/or nursery habitat and commercial and recreational fisheries for several finfish species (see table 4.6.2-1).

The Upper Delaware River provides key spawning and nursery habitat for the American shad along its entire length and the LNG terminal site is located within a section of the Delaware River considered as a critical nursery area for striped bass. Tyrawski (1979) also found that the Marcus Hook area on the opposite side of the river as the project site has high densities of anadromous fish larvae from April through June. The value of subtidal shallows as nursery habitat for young finfish generally relates to the abundance of food in these areas and availability of refuge habitat. The abundance of macroinvertebrates is a direct indication of the availability of food for the juvenile fish. Studies conducted for the project indicate that macroinvertebrates are not abundant in the shallow areas surrounding the LNG terminal site. The subtidal shallows in the project area may provide limited refuge from large predatory fish due to the extremely shallow depths and the nearly complete lack of submerged aquatic vegetation, woody debris, and other large habitat features. However, shallow water and the lack of structure in the area also increase the vulnerability of juvenile fish to avian predators. Therefore, the limited availability of food and lack of refuge habitat likely limits the value of subtidal shallows in the

[3] The COE conducted a study in 1993 of the benthic habitats in the Delaware River estuary between the C&D Canal (near RM 59) and Trenton, New Jersey (near RM 133). This study stratified the river into five zones, each with three physical habitat types (intertidal zone, shallow intermediate habitat, and navigation channel), and evaluated the biomass, species composition, and relative density of benthic macroinvertebrates within each zone and physical habitat type. The proposed LNG terminal site occurs near the upriver boundary of Zone 5 of the COE's study (COE, 1993).

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area as nursery habitat. Juveniles of several of these predatory species are also commonly found in near-shore open water and, to a lesser extent, deepwater, especially in the upper reaches of the Delaware River estuary.

The American eel is the only true catadromous fish (a species that spawns in the ocean but completes most of its life cycle in fresh water) that may occur in the project area. Several age classes of eels could be present at any given time. Like many of the fish discussed above, the American eel is a habitat generalist and, thus may occur in both deep and shallow water.

Aquatic Resources Impacts and Mitigation

LNG Terminal Construction

Dredging

The proposed LNG terminal would require dredging of about 800,000 cubic yards (approximately 27.4 acres) of material from the Delaware River to create a berth for the LNG ships. The project would also require construction of an approximate 2,000-foot-long pier that would be supported by approximately 80 steel pilings, each 3 feet in diameter. Dredging in the vicinity of the pier would result in the conversion of existing subtidal shallow water habitat to deeper, channel-like habitat. This dredging would directly impact up to 27.4 acres of benthic habitat and result in a net loss of approximately 7.4 acres of subtidal shallow habitat and a net gain of 7.4 acres of deep channel habitat. During the NEPA Pre-filing Process, Crown Landing redesigned the pier configuration to reduce impacts on subtidal shallow habitat by about 40 percent.

The conversion of 7.4 acres of subtidal shallow habitat to deepwater habitat could affect most of the resident species within the project area to some degree. NOAA Fisheries, NJDEP, and DNREC expressed specific concerns about the potential impacts of this habitat loss on spawning adults (primarily striped bass) and migrating anadromous fish within the Delaware River. These agencies have indicated that mitigation would be necessary to offset the loss of shallow water habitat and its permanent conversion to deepwater habitat. NOAA Fisheries recommended that mitigation should involve creation of shallow water habitat in an area near the proposed project. Crown Landing is currently working with the applicable resource agencies to develop a mitigation plan for potential impacts on shallow water habitat. The plan may include creation of shallow water habitat near the proposed project and conducting or funding studies that would further promote the understanding of sensitive aquatic resources in the Delaware River. Because mitigation plans have not been finalized, and thus not provided to the FERC for review, **we recommend that:**

- **Crown Landing continue coordinating with NOAA Fisheries and other applicable agencies in developing plans to mitigate for impacts on shallow water habitats. The plan, along with agency concurrence, should be filed with the Director of OEP for review and approval prior to initiating dredging activities in the Delaware River.**

The dredging of the ship berth may adversely affect fish and fish habitat. Potential adverse effects on fish and fish habitat include impairment of water quality, destruction of benthic habitat, and direct and indirect effects on fish and their prey species. The extent of these effects depends on project timing and duration, sediment texture and composition, and fish life stage and behavior.

The water quality of the Delaware River is currently degraded by upstream discharges and runoff. The proposed dredging could contribute to further degradation of water quality through increases in turbidity, releases of chemical and nutrient pollutants from sediments, and introduction of chemical

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contaminants. Turbidity resulting from the suspension of sediments would reduce light penetration and the corresponding primary production of aquatic plants, algae, and phytoplankton. Additionally, the suspension of organic materials and sediments could cause an increase in biological and chemical use of oxygen, resulting in a decrease of dissolved oxygen concentrations in the affected area. Lower dissolved oxygen concentrations could cause a temporary displacement of motile organisms and may stress or kill sessile benthic organisms within the affected area.

Dredging activities would result in the disturbance of about 27.4 acres of benthic substrate in the Delaware River. As previously indicated, there is no commercial shellfishery or abundance of commercially important shellfish species in the project area. Project dredging would primarily affect the Asiatic clam, as well as various oligochaetes, amphipods, and isopods. These benthic invertebrates are a food source for demersal species of finfish during part or all of their life cycles. The benthic macroinvertebrate data collected at the project site for the channel and shallow water areas suggest that the species composition of the benthic communities in both areas is impoverished and similar. Additionally, the relative importance of the major taxa in terms of biomass in the shallow water area and the channel is nearly identical.

The direct alteration of the benthic substrate via dredging would remove the existing benthic community and may adversely affect finfish through loss of or changes in prey species abundance or availability. However, pioneering benthic invertebrates would likely colonize the dredged area soon after completion of dredging. Also, conversion of shallow benthic habitat to deeper, channel-like benthic habitat would not likely alter the benthic community in the project vicinity.

Dredging also has the potential to introduce deleterious compounds currently in the bottom sediments (e.g., metals) into the water column. In addition to potentially causing behavioral responses in fish, certain chemical contaminants could have acute and/or chronic growth and physiological effects in fish. To evaluate these risks, Crown Landing performed a sediment characterization study that analyzed a number of organic and inorganic chemicals in the sediments. We compared the average concentrations of these chemicals to ecologically risk-based screening criteria to assess the potential hazard of the sediments on the aquatic environment. The results of this analysis showed eight metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc) with detectable concentrations in the sediment samples collected from the proposed dredging area. All of these metals were detected at concentrations below the PEL (i.e., below the value at which adverse biological effects are frequently expected), suggesting that no adverse effects on aquatic resources are likely from the resuspension of the sediments. A detailed discussion of the study and its results are provided in section 4.2.2.

In addition to potentially releasing deleterious compounds into the water column, suspended sediments could have direct and indirect physical effects on pelagic and benthic communities in the Delaware River. Direct impacts could result from the exposure to sediment particles and indirect impacts could result from habitat alteration caused by sediment deposition. Crown Landing's proposal to primarily use a hydraulic dredge would only minimally increase suspended sediments, thus impacts from sediment suspension and/or subsequent sediment deposition are not expected to result in long-term or substantial effects on aquatic resources near the project area.

Dredging could affect all life stages of the smaller, common resident species (e.g., eastern silvery minnow, banded killifish, tessellated darter, and mummichog), juveniles of the large resident species, and juveniles of anadromous species. However, the larger polyhaline species, such as brown bullhead, white catfish, channel catfish, yellow perch, white perch, Norfolk spot, and Atlantic croaker, are more commonly found in deep, open-water habitats. Thus dredging associated with the project would likely have only a limited effect on the adults of these species as they would be able to use the deep habitat created by the dredged berth.

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Use of a hydraulic dredge would reduce turbidity and sedimentation associated with dredging and limit the extent of impacts on aquatic resources. However, dredging could entrain or impinge juvenile fish, fish larvae, and eggs during certain times of the year. To address this potential impact, resource agencies have recommended that Crown Landing adhere to specific dredging windows. In response to these recommendations and to protect anadromous fish during fish migration and spawning, Crown Landing revised its dredging schedule to avoid dredging and other in-stream construction activities from March 15 to August 1.

Pier Construction

The pier for the ship unloading facility would be supported on approximately 80 steel pilings, each 3 feet in diameter and 100 to 120 feet long. The pier and unloading platform would be constructed over about 2.4 acres of riverbed. Construction of the pier and breasting dolphins would result in a direct loss of approximately 1,900 square feet (0.04 acre) of benthic substrate within the footprints of the individual pilings, of which 1,800 square feet would occur in the intertidal or subtidal shallows.

The pier would be constructed using driven steel piles, which would produce sound waves that could injure fish. The degree to which an individual fish exposed to sound waves would be affected is dependent upon variables such as the peak sound pressure level and frequency as well as the species, size, and condition of a fish (e.g., small fish are more prone to injury by intense sound waves than are larger fish of the same species). In some cases, sound pressure levels greater than 155 decibels can illicit avoidance behaviors or stun small fish (NOAA Fisheries, 2003). Sound levels greater than 190 decibels are thought to physically injure some fish (Hastings, 2002). The presence of predators can also influence how a fish might be affected by pile driving (e.g., fish stunned by pile-driving activities may be more susceptible to predators). The intensity of the sound pressure levels produced during pile driving depends on a variety of factors including, but not limited to, the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water, and the type and size of the pile-driving hammer.

It is anticipated that the majority of the piles would be installed with a Delmag D46-32 diesel impact hammer. Each pile would take approximately 5 hours to install. However, the actual driving time per pile would only be about 30 to 45 minutes depending on the load criteria and the soils encountered. Additional time would be required for barge positioning, pile handling, and bracing for the batter piles. The entire pile driving operation would take about 6 to 8 months to complete.

Driving tubular steel piles with an impact hammer in similar settings has been shown to generate sound levels from 192 to 194 decibels[4], which are above the level that is thought to injure some fish. Depending on the specific conditions at the site, these sounds can have a transmission loss rate of 0.021 to 0.046 decibels per foot (Nedwell and Edwards, 2002; Nedwell et al., 2003). Based on these values, the use of an impact hammer during construction of the proposed ship unloading facility could generate underwater sound levels of 190 decibels as far as 190 feet from a steel pile and sound levels of 155 decibels as far as 1,860 feet from a steel pile. Although the sound waves of the greatest intensity would be limited to the immediate vicinity of the piles, sound levels of 155 decibels could extend out into the Delaware River while piles for some of the mooring dolphins are being driven.

Driving hollow steel piles with impact hammers produce intense, sharp spikes of sound that can injure fish. In some cases, fish may be startled by the first few strikes of an impact hammer. However, this response can wane and the fish may remain in the area (NOAA Fisheries, 2001). As such, the potential effect on fish from impact hammers could be magnified because fish would not only be exposed

[4] All sound levels are expressed as decibels at a reference pressure of 1 micropascal.

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to intense sound waves but may not avoid pile-driving activities, which would prolong their exposure to the potentially harmful sounds and increase their risk of injury or death.

Although some fish may become acclimated to certain sounds, acoustic disturbance could cause other fish to avoid the construction area. If pile installation occurred during anadromous fish migrations, the avoidance of the nearshore areas could restrict migrating fish to deepwater areas that are less suitable for some species, which could in turn increase the susceptibility of some smaller species to predation. Although given the small area that would be affected by acoustical disturbance, it seems unlikely that these effects would substantially alter migration patterns, the relationship of predator or prey species, or their abilities to find shelter or forage. Additionally, Crown Landing has committed to avoiding construction activities in the Delaware River between March 15 and August 1 to avoid impacts on migrating and spawning fish species. Nonetheless, because the area is considered a critical nursery area for anadromous fish species and both federally and state-listed fish species are known to occur in the area (see section 4.7), **we recommend that:**

- **Crown Landing consult with federal and state agencies to determine the need for additional measures to further avoid or minimize impacts on aquatic resources as the result of pile-driving activities. Copies of consultations with these agencies should be filed with the Secretary <u>prior to construction</u>.**

The bottom of the pier deck and unloading platform would be approximately 12 feet above the surface of the water, depending on tidal fluctuations, and would shade a total of approximately 2.4 acres of intertidal, subtidal, and open-water habitat. Predatory species, especially those that forage primarily by sight, are often sensitive to intense sunlight and seek shade or deeper water during periods of intense sunlight. The aquatic habitat in the Delaware River is almost completely devoid of aquatic vegetation in the offshore area of the site and lacks shaded areas where fish can avoid direct sunlight during the day. Shading of the area underneath the pier could enhance the habitat for predatory species, such as striped bass and other species that avoid intense direct sunlight during the day.

Construction of the pier and the marine dolphins could increase the complexity of the aquatic habitat, provide an additional hard substrate for colonization by sessile aquatic organisms, and provide eddy habitat downstream of the pilings that could be used by resident and migrating fish species during high flow periods. Blueback herring and American shad could utilize the shallows for nursery habitat because they do not specifically require vegetation for shelter.

<u>Other Potential Impacts</u>

Construction of the onshore portions of the LNG terminal would temporarily increase erosion, stormwater runoff, and the potential for sediments to reach the Delaware River. If uncontrolled, this sediment could degrade water quality, increase turbidity, affect fish usage of the affected area, and smother aquatic life, especially benthic invertebrates. To minimize the effects of erosion and sedimentation on the river, Crown Landing would construct the facility in accordance with our Plan and its SESC Plan.

Stormwater runoff during operation of the LNG terminal also has the potential to adversely affect water quality and thereby indirectly affect aquatic life. To minimize this potential impact, Crown Landing proposes to construct a permanent stormwater management system at the LNG terminal site in accordance with the New Jersey Stormwater Management Manual (NJDEP, 2004b).

Direct spills of petroleum products into the Delaware River from construction equipment could be toxic to fish. To reduce the potential for direct surface water contamination during construction and

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dredging, Crown Landing would implement a SPCC Plan. This plan would include provisions that prohibit the storage of fuel and other potentially toxic materials within specified distances of waterbodies and procedures to minimize potential spills during the refueling of equipment. This plan would also outline procedures for containing, cleaning up, and reporting spills.

LNG Terminal Operation

Natural river sedimentation would occur within the LNG ship berth. It is estimated that 60,000 to 90,000 cubic yards would be deposited annually. Crown Landing anticipates annual maintenance dredging would be required to remove the sediment from the ship berth. The dredged material would be disposed of at the Weeks Marine disposal facility, which is also proposed for initial dredged material disposal. This facility reportedly has ample capacity to handle maintenance dredged material. Impacts associated with annual maintenance dredging would be similar to those described above for initial dredging activities, but would occur on a shorter and smaller scale compared to initial dredging operations.

During operation of the LNG terminal, prop wash from LNG ships and tugs could temporarily increase suspended sediments and turbidity within the ship channel and ship berth. As a vessel navigates through a waterway, it generates hydraulic disturbances in the form of waves and currents, mainly drawdown, return current, slope supply currents, wash waves, and jet wash (Wolter and Arlinghaus, 2003). These activities have the potential to suspend and redeposit sediments similar to but not necessarily on the same scale as dredging.

Modeling was conducted for the Boston Harbor Navigation Improvement Project to assess the effect of ship passage on the resuspension of surface sediments in a federal ship channel (COE, 1995). The modeling was developed based on the post-dredging dimensions of the channel and information collected during interviews with pilots regarding the operation of various types of vessels. The analysis modeled the effects of an LNG ship, a container ship, a 41,000 ton displacement weight tanker, an ocean tug, and a harbor tug. The modeling assumed a channel depth of 45 feet and varying vessel drafts from 12 to 42 feet. The study concluded that silt, the predominant grain size of the surface sediments assessed in the model, can be resuspended by currents as slow as 0.65 feet per second. The study also found that bottom velocities generated by cargo vessels passing at slow speeds through the harbor can exceed this value up to 1,312 feet astern of the vessel and that tugs can generate bottom velocities above this value up to 656 feet astern of the vessel. Ship turning areas were found to be particularly susceptible to this influence. The COE modeling results indicated that the surface sediments in the federal channels and berth areas are subject to resuspension during essentially every ship passage. Thus impacts associated with prop wash would occur more frequently than dredging since 120 to 180 ships may berth at the proposed Crown Landing terminal annually. However, the results of the modeling also indicated that ship-induced bottom velocities dissipate rapidly following the passage of the ship and that sediments resuspended by these currents settle back to the substrate after being transported relatively short distances, suggesting that the substrate and water column would return to ambient conditions during periods between ship passages.

Prop wash could also affect the substrate within and adjacent to the navigation channel and could limit the recolonization of benthic species in those areas. Vessel propellers also have the potential to directly strike fish species that use the navigation channel and proposed ship berth. Adult Atlantic sturgeon have been found along the shoreline of the river that have been killed by vessel propellers (DNREC, 2004a). Potential indirect effects of vessel movement through the waterway could include disturbances preventing fish from nest-guarding (Mueller, 1980; cited in Wolter and Arlinghaus, 2003) or feeding (Barrett et al., 1992; cited in Wolter and Arlinghaus, 2003), and dislodgement of eggs and redistribution of eggs and larvae in less suitable habitats (Hofbauer, 1965, Jude et al., 1998; cited in

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Wolter and Arlinghaus, 2003). Obstructing nest-guarding behavior and dislodgement and redistribution of eggs into less suitable habitats could lower the reproductive success of affected fish species.

LNG ships calling from international ports could potentially introduce aquatic invasive species into U.S. waters. Alternatively, visiting LNG ships could transport native species to other parts of the world. Although the potential for this to occur cannot be entirely eliminated, several factors, both general and specific to the project, tend to mitigate this potential impact. First, LNG ships would not discharge ballast water into the Delaware River, which would significantly reduce the potential to spread invasive aquatic species. Second, the LNG ships that would visit the proposed terminal would arrive from ports located primarily throughout the Atlantic region, which is also where the project is located. Third, Delaware River is not a new port and ships of all types originating from different ports have and will continue to visit the Delaware River. Fourth, legislation is currently being considered by the U.S. Senate that would require all ships entering U.S. ports to have on board an aquatic species management plan outlining actions to minimize the transfer and introduction of invasive species. Finally, in February 2004, a new international convention to prevent the potentially devastating effects of the spread of harmful aquatic organisms carried by ships' ballast water was adopted by the International Maritime Organization (IMO), the United Nations agency responsible for the safety and security of shipping and the prevention of marine pollution from ships. The Convention will require all ships to implement a Ballast Water and Sediments Management Plan. All ships will have to carry a Ballast Water Record Book and will be required to carry out ballast water management procedures to a given standard. Existing ships will be required to do the same, but after a phase-in period. With the adoption of this Convention, the IMO has made global provisions to control and manage ships' ballast water and thus prevent, minimize, and eliminate the transfer of harmful aquatic organisms and pathogens.

LNG ships are equipped with a ballast water system that pumps water into ballast tanks as cargo is unloaded. The maximum ballast demand for a 138,000 m^3 and 200,000 m^3 LNG ship is about 13.7 million gallons and 19.8 million gallons, respectively. Typical LNG ships have three ballast water intakes, each with ballast pumps rated at 3,000 m^3/hr. Two of the pumps are generally operated during ballasting with the third as a back-up in case of failure of one of the primary pumps. The average intake rates are about 5,200 m^3/hr for a 138,000 m^3 ship and about 7,500 m^3 for a 200,000 m^3 ship. Thus the likely intake rates for the 138,000 m^3 and 200,000 m^3 ships are estimated to be about 23,000 gpm and 34,000 gpm, respectively. The total area of the two lower intake openings is 3.55 square meters. Openings are protected by bar-type grids having 4.5 mm bars spaced 25 mm apart, reducing the clear flow area to 2.36 square meters. The highest and lowest points of the openings are about 8.4 and 9.5 meters below the ship's waterline, respectively.

Because LNG ships would unload LNG at the proposed terminal on average about 150 times annually and during all seasons, each time requiring up to about 13.7 million gallons of ballast water (for a 138,000 m^3 ship), it is likely that ballast water intakes would result in the entrainment, impingement, or loss of aquatic resources, especially larvae and eggs. The New Jersey Division of Fish and Wildlife (NJDFW) and NOAA Fisheries have expressed concern about the proposed ship berth functioning as a collection basin for eggs and larvae transported by tidal movements from adjacent shallow water habitats and the potential for higher rates of entrainment, impingement, or loss of these organisms during ballast water intake from within the proposed ship berth. Crown Landing has indicated that it would minimize the amount of ballast water withdrawal (approximately 8 million gallons) needed for ship stability while moored at the ship berth.

To assess the potential impacts of ballast water withdrawals on fish populations within the Delaware River, we reviewed data included in a Delaware River case study (EPA, 2002) and used in the EPA's analysis of potential impacts from cooling water intake structures within the Delaware River system. In the case study, actual impingement and entrainment data were available only for the Salem

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Nuclear Generating Station. The EPA extrapolated potential impingement and entrainment losses at other facilities withdrawing water from the Delaware River system using the actual data from the Salem facility. One of the facilities the EPA estimated potential impacts for was the Logan Generating Station, which is located immediately adjacent to the proposed LNG terminal site. The Logan Generating Station withdraws about 730 million gallons annually from the Delaware River. Using a simple extrapolation formula based on volume of water withdrawn and assuming 150 138,000 m^3 ships would unload cargo at the LNG terminal annually, each requiring 13.7 million gallons of ballast water, for a total annual water withdrawal volume of about 2.1 billion gallons, we estimated annual fish losses from ballast water intakes associated with operation of the proposed LNG terminal (see table 4.6.2-2). Although the potential exists for Crown Landing to utilize 200,000 m^3 LNG carriers, which would withdraw more water per ship, ships of that size would unload at the terminal less frequently than 138,000 m^3 ships. Thus total annual withdrawals for ballast water for 200,000 m^3 carriers would be similar to ballast water volumes withdrawn for 138,000 m^3 carriers.

TABLE 4.6 2-2

Estimate of Potential Impacts on Selected Fish Species in the Delaware Rive as the Result of Ballast Water Withdrawal by LNG Ships Unloading Cargo at the Proposed LNG Terminal a/

Fish Species	Age-1 Equivalents (individuals) b/	Yield Lost (pounds) c/	Production Foregone (pounds) d/
Alewife	42	0	39
American Shad	3	0	28
Atlantic Croaker	54,043	11,004	30,722
Atlantic Menhaden	7,630	3,830	666
Bay Anchovy	956,693	0	22,912
Blue Crab	5,561	176	1,036
Blueback Herring	185	0	101
Silverside	350	0	0
Spot	78,322	8,772	21,140
Striped Bass	1,456	2,022	10,489
Weakfish	4,287	3,368	12,292
White Perch	4,287	6	1,137
Non-RIS Fishery Species e/	45,800	4,091	52,746
Non-RIS Forage Species e/	27,202	0	978
Estimated Total Entrained by LNG Ships	1,185,861	33,269	154,286
Estimated Total Entrained by Delaware River Facilities (EPA, 2002) f/	630,733,201	16,679,018	61,215,570

a/ Assumes on average 150 LNG ships would unload cargo at the proposed LNG terminal annually and that each ship would intake about 13.7 million gallons of ballast water .

b/ "Age-1 Equivalents" are the number of impinged and entrained individuals that would otherwise have survived to be age-1 plus the number of impinged individuals which are assumed to be impinged at age 1

c/ "Yield Lost" is a measure of the amount of fish or shellfish that is not harvested because the fish are lost to impingement and entrainment.

d/ "Production Foregone" is the expected total amount of future growth of individuals that would be impinged or entrained had they not been impinged or entrained. Foregone production for forage species is used to estimate the subsequent reduction in harvested species yield that results from a decrease in the food supply.

e/ RIS are "recreationally important species" as defined by EPA (2002). See EPA (2002) for a list of species in these categories.

f/ This estimation includes 12 other currently operating facilities along the Delaware River. See EPA (2002) for additional details on these facilities.

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appears to be the only practicable source capable of providing the necessary volume of water for testing the LNG tanks. Therefore, in accordance with our Procedures, Crown Landing would be required to consult with appropriate permitting and resource agencies to obtain authorization to use the Delaware River as a hydrostatic test water source and disposal location.

Water would be appropriated from the Delaware River over a 2-week period at an intake rate of approximately 2,000 to 4,000 gpm. Similar to ballast water withdrawals by LNG carriers during operation of the proposed LNG terminal, withdrawal of hydrostatic test water from the Delaware River during construction would result in entrainment and impingement of ichthyoplankton. Using the same analysis technique as discussed previously for ballast water, we estimated entrainment and impingement losses from hydrostatic test water withdrawals (see table 4.6.2-3). Unlike ballast water withdrawals that would occur throughout the year during the operations of the facility, water withdrawals for hydrostatic testing of the LNG tanks would only require a one-time withdrawal of 25 million gallons for each tank. However, since the estimates presented in table 4.6.2-3 are based on a proportion of the losses at the Logan Generating Station which occur throughout the year, the actual number of individuals that are lost due to hydrostatic test water withdrawals could increase or decrease depending on whether test water withdrawals were conducted during periods of high or low ichthyoplankton densities, respectively.

TABLE 4.6.2-3

Estimate of Potential Impacts of Hydrostatic Test Water Withdrawal during Construction of the Proposed LNG Terminal on Selected Fish Species in the Delaware River a/

Fish Species	Age-1 Equivalents (individuals) b/	Yield Lost (pounds) c/	Production Foregone (pounds) d/
Alewife	2	0	1
American Shad	0	0	1
Atlantic Croaker	1,930	393	1,097
Atlantic Menhaden	273	137	24
Bay Anchovy	34,168	0	818
Blue Crab	199	6	37
Blueback Herring	7	0	4
Silverside	13	0	0
Spot	2,797	313	755
Striped Bass	52	72	375
Weakfish	153	120	439
White Perch	268	0	41
Non-RIS Fishery Species e/	1,636	146	1,884
Non-RIS Forage Species e/	972	0	49
Total	42,470	1,187	5,525

a/ Assumes three LNG storage tanks would be hydrostatically tested and that each tank would require the withdrawal of about 25 million gallons of water from the Delaware River.

b/ "Age-1 Equivalents" are the number of impinged and entrained individuals that would otherwise have survived to be age-1 plus the number of impinged individuals which are assumed to be impinged at age 1.

c/ "Yield Lost" is a measure of the amount of fish or shellfish that is not harvested because the fish are lost to impingement and entrainment.

d/ "Production Foregone" is the expected total amount of future growth of individuals that would be impinged or entrained had they not been impinged or entrained. Foregone production for forage species is used to estimate the subsequent reduction in harvested species yield that results from a decrease in the food supply.

e/ RIS are "recreationally important species" as defined by EPA (2002). See EPA (2002) for a list of species in these categories.

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To minimize entrainment and impingement of aquatic organisms, particularly eggs and larvae, Crown Landing would screen the intake with a 2 mm wedgewire screen and limit the velocity at the intake to 0.5 feet per second pursuant to the recommendations of NOAA Fisheries. Additionally, Crown Landing proposes to withdraw the water from the dredged berth area at a depth of 6 to 8 feet below the water surface.

The discharge of hydrostatic test water could create minor, localized, and temporary increases in turbidity in the project area. To avoid impacts on the subtidal shallows and minimize erosion and scouring of the river bed, Crown Landing proposes to discharge the hydrostatic test water and flushing water in the dredged berth area over a multi-week period in accordance with NPDES permitting requirements. Fish and other aquatic species that occur in the vicinity of the project are adapted to the turbid conditions that are common to the Delaware River; therefore, a temporary, localized increase in turbidity in this location would not likely cause significant stress to these organisms. The hydrostatic testing process would not involve significant changes in the temperature of the test water and would not result in any thermal impacts as a result of its discharge to the Delaware River. Crown Landing indicated that chlorine may need to be added to the test water at concentrations significantly below EPA water quality standards.

Texas Eastern would also conduct hydrostatic tests to ensure the integrity of the proposed pipeline before placing it in service. The test water would be obtained from municipal sources, the Delaware River, and/or Ridley Creek. Texas Eastern would be required to consult with appropriate permitting and resource agencies to obtain authorization to use the Delaware River or Ridley Creek as a hydrostatic test water source and disposal location. The impacts on these waterbodies would be similar to those impacts described above for hydrotest water for the LNG storage tanks.

4.6.3 Essential Fish Habitat

The MSA (Public Law 94-265 as amended through October 11, 1996) was established, along with other goals, to promote the protection of EFH in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. EFH is defined in the Act as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Federal agencies which authorize, fund, or undertake activities that may adversely impact EFH must consult with NOAA Fisheries. Although absolute criteria have not been established for conducting EFH consultations, NOAA Fisheries recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as the NEPA, Fish and Wildlife Coordination Act, ESA, or the Federal Power Act (50 CFR 600.920(e)) in order to reduce duplication and improve efficiency. Generally, the EFH consultation process includes the following steps:

1) **Notification** - The action agency should clearly state the process being used for EFH consultations (e.g., incorporating EFH consultation into EIS, section 10 permit, etc.).

2) **EFH Assessment** - The action agency should prepare an EFH Assessment that includes both identification of affected EFH and an assessment of impacts. Specifically, the EFH should include: 1) a description of the proposed action; 2) an analysis of the effects (including cumulative effects) of the proposed action on EFH, the managed fish species and major prey species; 3) the federal agency's views regarding the effects of the action on EFH; and 4) proposed mitigation, if applicable.

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3) **EFH Conservation Recommendations** - After reviewing the EFH Assessment, NOAA Fisheries would provide recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH.

4) **Agency Response** - Within 30 days of receiving the NOAA Fisheries recommendations, the action agency must respond to NOAA Fisheries. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. For any conservation recommendation that is not adopted, the action agency must explain its reason to NOAA Fisheries for not following the recommendation.

FERC staff proposes to consolidate EFH consultations for the Crown Landing LNG Project and the Logan Lateral Project with the interagency coordination procedures required under NEPA. For purposes of reviewing this project under NEPA, the FERC is the lead federal agency and the COE, EPA, FWS, NOAA Fisheries, and Coast Guard are cooperating federal agencies (see section 1.4). As such, the FERC requests that NOAA Fisheries consider this draft EIS notification of initiation of EFH consultation. The EFH Assessment includes the analysis in section 4.6 as well as the document in Appendix E of this draft EIS. We will address the NOAA Fisheries comments and/or conservation recommendations to the draft EIS and the EFH Assessment in the final EIS.

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4.7 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

Federal agencies are required by section 7 of the Endangered Species Act (Title 19 United States Code Part 1536(c)), as amended (1978, 1979, and 1982), to ensure that any actions authorized, funded, or carried out by the agency do not jeopardize the continued existence of a federally listed endangered or threatened species, or result in the destruction or adverse modification of the designated critical habitat of a federally listed species. The action agency (i.e., the FERC) is required to consult with the FWS and/or NOAA Fisheries to determine whether federally listed endangered or threatened species or designated critical habitat are found in the vicinity of the proposed project, and to determine the proposed action's potential effects on those species or critical habitats. For actions involving major construction activities with the potential to affect listed species or designated critical habitat, the federal agency must prepare a BA. The action agency must submit its BA to the FWS and/or NOAA Fisheries and, if it is determined that the action may adversely affect a listed species, the federal agency must submit a request for formal consultation to comply with section 7 of the ESA. In response, the FWS or NOAA Fisheries would issue a Biological Opinion as to whether or not the federal action would likely jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of designated critical habitat. In compliance with section 7, the FERC requests that the FWS and NOAA Fisheries consider this draft EIS as the BA for the Crown Landing LNG and Logan Lateral Projects.

For purposes of this environmental analysis, special status species of plants and animals include:

- species that are listed by the federal government as endangered, threatened, or candidate species; and
- species that are listed by Pennsylvania, New Jersey, or Delaware as endangered, threatened, or species of concern.

Preliminary informal consultations with the FWS, NOAA Fisheries, and the Natural Heritage and Nongame and Endangered Species Programs of the PADEP, NJDEP, and DNREC were initiated in April 2003 to assess impacts on special status species. These agency consultations resulted in the identification of nine federal and/or state special status species (one of which is also a Species of Concern undergoing status review) that might occur in the project area. During subsequent review of the project, NOAA Fisheries indicated that the environmental analysis of the project should also include indirect effects of increased vessel traffic on federally endangered marine mammals with the potential to occur in the project area, specifically the right whale. NOAA Fisheries also reported that the loggerhead sea turtle should be addressed in addition to the green and Kemp's ridley sea turtles. With the addition of these two species, 11 special status species were considered during the analysis of the project. These 11 species are listed in table 4.7-1 and are discussed below. Crown Landing would not be authorized to begin project work until we have completed consultation with the FWS and NOAA Fisheries regarding these federally listed species.

4.7.1 Federally Listed Threatened and Endangered Species

North Atlantic Right Whale

The North Atlantic right whale is a federally listed endangered species and a state-listed endangered species in New Jersey. The North Atlantic right whale population was historically depleted by commercial whaling and has not recovered despite protection from commercial harvest (NOAA, 2004c). The current population is thought to number about 300 individuals and, thus is considered one of the most critically endangered large whales in the world (NOAA, 2004c). The Mid-Atlantic region of the United States is a principal migratory corridor for right whales that travel between the calving and nursery

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areas in the southeastern United States to the feeding grounds in the northeastern United States and Canada.

TABLE 4.7-1

Special Status Species Potentially Occurring in the Project Area

Species	Federal Status a/	State Status a/	Comments
Mammals			
North Atlantic Right Whale *Eubalaena glacialis*	E	NJ-E	Not likely to occur in the project area, but could be affected by increased ship traffic and LNG carriers entering Delaware Bay while in transit to the proposed LNG terminal.
Birds			
Bald Eagle *Haliaeetus leucocephalus*	T	PA-E; NJ-E	Active nests are located within 3 and 12 miles of LNG terminal; the closest nest is 2 miles from the proposed pipeline route. Foraging habitat is located within the project area at the proposed LNG terminal site and along the pipeline route.
Pied Billed Grebe *Podilymbus podiceps*	None	NJ-E	This species has the potential to occur on the site and along the proposed pipeline route Breeding habitat does not exist on the site.
Peregrine Falcon *Falco peregrinus*	None	NJ-E	Known to nest near the project on the Commodore Barry Bridge.
Fish			
Shortnose Sturgeon *Acipenser brevirostrum*	E	PA-E; NJ-E; DE-T	Known to occur within the project area, but abundance is unknown.
Atlantic Sturgeon *Acipenser oxyrhynchus*	SC	PA-E; DE-E	Likely to occur within the project area throughout the year, but age distribution in project area is unknown.
Reptiles			
Bog Turtle *Clemmys muhlenbergii*	T	PA-E; NJ-E	Surveys determined that suitable habitat for this species was not present within the project area.
Kemp's Ridley Sea Turtle *Lepidochelys kempi*	E	PA-E; NJ-E	Not likely to occur within the project area.
Green Sea Turtle *Chelonia mydas*	E	DE-E; NJ-E	Not likely to occur within the project area.
Loggerhead Sea Turtle *Caretta caretta*	T	DE-E; NJ-E	Not likely to occur within the project area.
Red-bellied Turtle *Pseudemys rubriventris*	None	PA-T	Suitable habitat present at Delaware River and Chester Creek.

a/ Status definitions:
E = endangered
T = threatened
C = candidate for listing
None = no designation under the Endangered Species Act
PA = Pennsylvania
DE = Delaware
NJ = New Jersey

The two most significant human-caused threats to right whales are entanglement in fishing gear and collisions with ships. Because right whales are known to occur in or adjacent to many major shipping corridors along the eastern United States and collisions are known to account for over 50 percent of human-induced mortality in right whales, NOAA Fisheries established a right whale ship strike reduction program. Despite the measures implemented as part of that program (e.g., aerial surveys to notify mariners of whale locations, supporting shipping industry liaisons, mandatory reporting programs, etc.), right whales continue to be killed by vessel strikes. In response to this continuing problem, NOAA Fisheries developed a Strategy to Reduce Ship Strikes of Right Whales (Strategy), which is intended to minimize the overlap between ships and whales and reduce the likelihood of ship strikes to the extent practicable (NOAA, 2004c).

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Although NOAA's Strategy is not yet finalized, the primary regulatory measure proposed to reduce ship strikes in the Mid-Atlantic region is the establishment of uniform speed restrictions within 20 to 30 miles of the approaches of specific ports and areas, including Delaware Bay (NOAA, 2004c). NOAA (2004c) indicated that proposed speed restrictions may be in the range of 10 to 14 knots. For Delaware Bay, these speed restrictions would be enforced from February through April and from October through December.

Assuming that up to 180 LNG carriers could unload cargo at the proposed terminal each year, about 90 of those ships would be expected to unload at the terminal during the total 6 months from February to April and from October to December. These 90 vessels approaching and entering Delaware Bay would be in addition to the existing ship traffic entering the bay and visiting various ports along the Delaware River. The additional ship traffic likely increases the potential risk of a right whale ship strike. However, adherence of LNG ships to NOAA Fisheries' proposed speed restrictions during the applicable time periods, in addition to other currently required measures, would be expected to effectively minimize the potential for strikes, consistent with NOAA Fisheries' goals of the Strategy. Crown Landing has not yet committed to enforcing the applicable speed restrictions for incoming and outgoing LNG ships. However, to provide right whales the maximum protection possible, **we recommend that:**

- **Crown Landing should coordinate with NOAA Fisheries to determine the appropriate speed for LNG ships and file copies of related correspondence with the Secretary <u>prior to commencing operations.</u>**

Although LNG ships servicing the proposed terminal have the potential to strike right whales in the vicinity of Delaware Bay, adherence to speed restrictions proposed by NOAA Fisheries would minimize the potential for strikes such that the proposed project *is not likely to adversely affect* North Atlantic right whales.

Bald Eagle

The bald eagle is a federally listed threatened species and a state-listed endangered species in New Jersey and Delaware. A proposal to remove the bald eagle from the federal list of threatened species was submitted in 2000 and is currently under review by the FWS. In the Delaware Bay region, bald eagles inhabit freshwater and estuarine shoreline habitats and their associated tributaries throughout the year and require large blocks of mature forest in proximity to aquatic foraging areas for nesting (FWS, 1996). Nests are typically located within 1 mile of shallow surface water feeding areas. Preferred nest sites typically occur in areas with minimal human disturbance; however, bald eagles successfully nest in close proximity to human activity and development throughout their range (Livingston et al., 1990).

The NJDEP Landscape Project has identified and mapped most of the LNG terminal site as potential bald eagle foraging habitat (NJDEP, 2004c) and bald eagles are known to forage near the site, particularly during the breeding and chick-rearing season from January through August. Designated bald eagle foraging habitat has also been identified along Raccoon Creek (NJDEP, 2004c). Because the Landscape Project designates foraging habitat primarily through spatial analysis rather than biological evaluation or ground-truthing of specific areas, not all mapped areas have been confirmed as preferred foraging sites.

Crown Landing designed the terminal such that the forested areas along the river, the only areas of the terminal site considered preferred foraging habitat, would be avoided. As such, construction of the LNG terminal would not directly affect preferred bald eagle foraging habitat. Additionally, the pipeline across Raccoon Creek would be crossed by the HDD method, which would avoid permanently disturbing foraging habitat and potential perch trees adjacent to the creek. Nonetheless, the LNG facilities would be

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constructed within mapped foraging habitat. The NJDEP (2004c) stated that the loss of these foraging habitat areas as mapped by the Landscape Project should be mitigated for. Crown Landing has coordinated with the NJDEP and the FWS to develop a mitigation plan and is currently considering four potential mitigation options: 1) plant a forested buffer along Oldmans Creek using native tree species; 2) provide habitat enhancements in the southern portion of the terminal site, such as tree plantings, *Phragmites* control, and creation of water inlets; 3) purchase the parcel west of the terminal site and protect it from development; and/or 4) purchase the known bald eagle winter roost site along Oldmans Creek. Because mitigation plans have not yet been finalized and thus we have not had the opportunity to review them, **we recommend that:**

- **Crown Landing should continue coordinating with the FWS and NJDEP to develop appropriate plans to mitigate for potential impacts on bald eagle foraging habitat. Crown Landing should file final mitigation plans, including copies of correspondence with applicable agencies, with the Director of the OEP for review and approval <u>prior to construction</u>.**

Bald eagles could be temporarily displaced from the foraging areas during construction activities, but would be expected to return to utilize the areas once construction activities are completed. Bald eagles are not particularly sensitive to disturbance when foraging (FWS, 1996) and thus would likely only be displaced during the major construction activities. This displacement would not adversely affect bald eagles because foraging habitat is not limited in the immediate vicinity of the terminal site and pipeline route and there is sufficient foraging habitat nearby. Bald eagles do not exhibit high site fidelity to foraging areas and typically move among different foraging sites, so any displacement caused by the project should not cause a major disruption in foraging activity.

The shoreline of the Delaware River in the vicinity of the proposed LNG terminal, especially that portion that contains tall, mature trees, is suitable for perching by foraging bald eagles. The proposed project would not affect the forested wetland on the LNG terminal site and would not remove potential bald eagle perch trees. However, construction of the proposed 120-foot-high emergency flare at the LNG terminal would provide a potential eagle perch site. Any bald eagle using this perch when the flare is activated could be injured or killed. Crown Landing proposes to eliminate the potential risk of the flare on bald eagles by installing perch guards on top of the flare to restrict or eliminate perching.

The FWS reported that two bald eagle nests occur in the project area (FWS, 2003). These nests, referred to as the Raccoon Creek and Mantua Creek nests, occur about 3 and 12 miles north of the LNG terminal site, respectively. The Raccoon Creek nest has been active since 1996 and is located in a forested area adjacent to an industrial facility. In the past 5 years, the eagle pair using the Raccoon Creek nest have been unsuccessful in producing their own young (hatch failure), possibly due to organochlorine contaminants (Smith, 2003). However, every year from 1999 to 2002, the nesting pair has successfully raised a foster chick to a fledging (Smith, 2003). The Mantua Creek nest has been active since 2001 and is also located in a forested area adjacent to another industrial facility. The bald eagles nesting at Mantua Creek nest were unsuccessful in producing young in 2001 and 2002, probably due to disturbances associated with the proximity of the nest to a road. The pair produced two eaglets in 2003 after moving their nest site further from the road and closer to the Delaware River (but still adjacent to the industrial facility) (NJDEP, 2001, 2002a; Smith, 2003).

Although most eagles in this region are relatively habituated to human activity and disturbance, they are sensitive to disturbance during the early nesting cycle, which typically occurs in New Jersey between January and April. Eagles are least sensitive to disturbance after the young are fledged (late July and August) and before nest selection begins (September to January).

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The Raccoon Creek nest site is located approximately 2 miles from the nearest point of the proposed pipeline route and the Mantua Creek nest is approximately 12 miles away. Thus potential impacts on nesting bald eagles are not likely and the FWS has indicated that project restrictions due to nesting eagles are not warranted. Furthermore, equipment used during construction of the pipeline would be lower than tree height. Therefore, imposition of restrictions due to foraging eagles is similarly not anticipated (FWS, 2004b). However, the FWS has indicated that they will continue to monitor the project area for bald eagle activities. Should conditions change (i.e., new eagles nesting in the area), the FWS would reevaluate potential effects of the project on eagles and, if impacts are anticipated, mitigation measures may be required.

Construction and operation of the proposed LNG terminal and pipeline facilities would not destroy or remove any known bald eagle nests or roost trees but may disrupt foraging activities of individual bald eagles and eagles may temporarily avoid some foraging habitats. Crown Landing has committed to providing mitigation for the permanent loss of foraging habitat. This mitigation would alleviate potential long-term impacts on bald eagle foraging and the impacts associated with construction would be short term and minor. Thus construction and operation of the proposed LNG terminal *may affect* but *are not likely to adversely affect* the bald eagle. Additionally, given the distance of the proposed pipeline route from known nest locations and the avoidance of potential foraging areas by completing HDD crossings of suitable foraging habitat, neither nesting nor foraging eagles are expected to be affected by the construction of the proposed pipeline.

Shortnose Sturgeon

The shortnose sturgeon is a federally listed endangered species and a state-listed endangered species in New Jersey and Delaware. Shortnose sturgeon occur along the Atlantic Ocean seaboard near river mouths, estuaries, and major rivers from the St. John's River in Florida to the St. John River in New Brunswick, Canada. The shortnose sturgeon is not known to undertake large-scale oceanic migrations, and typically spends its entire life cycle within its native estuary or river system. The Delaware River population of shortnose sturgeon is thought to be one of 19 separate, reproductively isolated populations on the Atlantic Coast.

In the Delaware River and Bay, shortnose sturgeon occur from the lower bay upstream to Lambertville, New Jersey at approximate RM 148. Based on tagging studies (O'Herron, 1993), most sturgeon activity occurs between RM 118 and RM 137 and they tend to congregate in upper tidal reaches of the river primarily between RM 118 and RM 130.5 from November through March. Recent surveys have identified shortnose sturgeon along the west side of the ship channel on the northern and southern ends of the Cherry Flats (approximate RM 71; Shirey et al., 1999). NOAA Fisheries (unpubl. data, 2004) documented shortnose sturgeon downstream of Philadelphia in 2003 and 2004.

Shortnose sturgeon typically spawn in areas with clean gravel or cobble bottom in swift water (Jenkins and Burkhead, 1994), although some evidence exists that the firmness of the substrate may be a more important indicator of habitat suitability than particle size. Shortnose sturgeon spawning typically occurs in late March through April, mostly north of Trenton, New Jersey. Male sturgeon typically stay on the spawning grounds longer than females. After spawning, the adults rapidly migrate downstream to summer foraging areas (COE, 1997) and then return upriver during the summer (NOAA Fisheries, 1996).

Shortnose sturgeon are moderately tolerant of a range of salinities. Although sturgeon have occasionally been found in salinities a high as 30 ppt, they prefer minimally saline conditions (0 to 5 ppt) and are primarily residents of estuaries and large, brackish coastal rivers. The proposed LNG terminal site is located at the oligohaline-freshwater interface, and thus is in an area where sturgeon are likely to congregate, especially juveniles during winter. Although not expected near the project area in summer

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months, a juvenile shortnose sturgeon was captured near the mouth of Oldmans Creek, just downstream of the proposed terminal location, during August 2004 (Shirey, 2004). Juvenile sturgeon are not normally caught in this portion of the river, but this capture indicates that juvenile shortnose sturgeon may occur in the vicinity of the project area, especially when salinities are low as they were in the summer of 2004. With the exception of the spawning season, adult and juvenile shortnose sturgeon prefer areas with little or no current (FWS, 1989). Shortnose sturgeon tend to occupy deepwater habitats during the day where sufficient oxygen is available but move into shallow areas at night to feed. Adults show a general tendency to use deeper areas (approximately 30 to 100 feet deep) more often in winter than in summer when they are usually found in water from approximately 4 to 30 feet deep. Although not strictly nocturnal, shortnose sturgeon tend to be most active at night.

Shortnose sturgeon are benthic feeders. Adults primarily feed on mollusks, insects, crustaceans, and small fish while juveniles eat crustaceans and insects. O'Herron and Hastings (1985) reported that the primary food source for shortnose sturgeon in the Delaware River was the Asiatic clam. This mollusk, although generally more numerous in shallow water areas, is known to be widely distributed at all depths in the upper tidal areas of the Delaware River (NOAA Fisheries, 1996) and was the predominant benthic invertebrate identified in samples collected from the proposed dredging area at the LNG terminal site.

NOAA Fisheries (1996) reported that due to the limited information available for shortnose sturgeon, it has not been able to accurately identify the ecological patterns of all age classes and sexes of the sturgeon in the Delaware River. However, dredging in areas of suitable habitat for any life stage, if individuals are present, could affect sturgeon by disrupting migratory movements, destroying habitat/prey resources, and/or entraining fish in hydraulic dredges (NOAA Fisheries, 1996).

The migration of sturgeon moving upstream from their overwintering grounds to spawn during March could be affected if individuals encounter dredging activities. Although turbidity does not seem to negatively affect sturgeon and individuals encountering suspended sediment plumes could pass through the plumes, some individuals may avoid the dredging activities and not return to spawn. Fish movements or feeding patterns may also be slightly altered due to turbid conditions. For example, the higher turbidity levels resulting from dredging may cause some sturgeon to be more active during the day than normal, particularly in shallow waters. Crown Landing proposes to avoid dredging between March 15 and August 1, which would mostly avoid impacts on migrating adults returning to spawning grounds.

As discussed in section 4.6.2, fish are likely to be affected by noise resulting from pile-driving activities during pier construction. Since sturgeon could occur in the area during pile driving, they would be susceptible to the same potential impacts as other fish (e.g., avoidance of construction areas, especially during migrations, injury, or death). Our recommendation in section 4.6.2, which requires Crown Landing to discuss with applicable agencies the need for additional conservation measures to avoid or minimize potential effects of pile driving on fish, could possibly alleviate potential impacts on sturgeon.

Dredging could also remove and reduce the availability of benthic food sources. As mentioned above, the Asiatic clam was the predominant invertebrate identified in benthic samples collected in the proposed dredging area and is the primary food source of shortnose sturgeon in the Delaware River. Removal of Asiatic clams during dredging activities could reduce the amount of forage available for sturgeon. Based on previous studies, it is expected that Asiatic clams would recolonize disturbed areas quickly following construction, although the individuals in the recolonized areas could be smaller and thus provide less biomass (O'Herron and Hastings, 1985). Additionally, maintenance dredging and prop wash from LNG ships could result in the periodic removal of invertebrates from the proposed ship berth and result in a long-term reduction in forage available in the project area. However, this impact would not likely affect sturgeon populations since Asiatic clams are known to inhabit all depths of the Delaware

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River and are common upstream of the proposed LNG terminal site, where sturgeon occur in greater abundance.

The NJDFW (NJDEP, 2004c) expressed concern about the potential for entrainment of sturgeon during initial dredging activities. Crown Landing proposes to primarily use a hydraulic dredge to excavate the ship berth. Because sturgeon are typically on or close to the bottom substrate, hydraulic dredges have the potential to entrain sturgeon, particularly juveniles, in the suction area immediately surrounding the aperture of the cutterhead. The NJDEP (2004c) has recommended that the outlet at the dredge disposal site be monitored to determine whether sturgeon are being entrained. If monitoring indicates that entrainment of protected species is occurring, the NJDEP (2004c) suggested that dredging be suspended until further studies are completed and the entrainment of sturgeon is addressed. Crown Landing has proposed to monitor the dredge outlet but has not committed to suspending dredging operations if sturgeon are detected in the dredge disposal outlet. To minimize the repeated taking of sturgeon during the dredging operations, **we recommend that:**

- **Crown Landing monitor the outlet at the dredge disposal site to determine whether sturgeon are being entrained. If monitoring indicates that sturgeon are being entrained, suspend dredging operations until NOAA Fisheries and the FERC are contacted and provide guidance on how to proceed.**

Crown Landing estimates that sedimentation is expected to occur in the ship berth at a rate of 60,000 to 90,000 cubic yards per year and proposes to conduct maintenance dredging on an annual basis. Impacts on shortnose sturgeon described for the initial dredging effort could also occur during annual maintenance dredging.

Water withdrawals from the Delaware River for hydrostatic testing of the LNG storage tanks and by LNG ships during intake of ballast water could also entrain shortnose sturgeon. For hydrostatic test water, Crown Landing proposes to withdraw the water from the river over a 2-week period. As discussed in section 4.6.2, Crown Landing would screen the intake with a 2 mm wedgewire screen and limit the velocity at the intake to 0.5 feet per second to minimize entrainment and impingement of aquatic organisms, particularly eggs and larvae. Crown Landing proposes to withdraw the water from the dredged berth area at a depth of 6 to 8 feet below the water surface. In addition, Crown Landing proposes to avoid hydrostatic test water withdrawals during the month of May, which is typically a period of high ichthyoplankton densities.

Because LNG ships would unload LNG at the proposed terminal between 120 and 180 times annually and during all seasons, each time requiring about 13.7 million gallons of ballast water at the marine terminal, it is likely that ballast water intake would result in the entrainment, impingement, or loss of aquatic resources. Also, NOAA Fisheries and the NJDFW expressed concern about the proposed ship berth functioning as a collection basin for eggs and larvae transported by tidal movements from adjacent shallow water habitats and the potential for higher rates of entrainment or impingement of these organisms during ballast water intake. To account for these potential impacts, we have recommended that Crown Landing coordinate with resource agencies to determine the need for mitigative measures to avoid or minimize these impacts on aquatic resources in the project area (see section 4.6.2 for additional discussion on potential effects of ballast water intake).

Although water withdrawals have the potential to impact aquatic resources, these activities are not likely to affect shortnose sturgeon eggs or larvae. The primary spawning area for shortnose sturgeon is about 70 miles upstream of the proposed LNG terminal site. Given that sturgeon eggs are adhesive and attach to available substrate or structure within minutes of being spawned, eggs are not likely to occur in the project area. Larval shortnose sturgeon exhibit demersal behavior shortly after hatching and are

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exclusively demersal by the time the post-yolk sac stage is reached (within 10 days of hatching). Although it is possible that demersal larvae could travel the 70 miles from the spawning grounds to the proposed terminal site while still of a size susceptible to water intakes, the hydrostatic test water intake structure would be located in the mid to upper levels of the water column and would not likely affect demersal organisms. Depending on final configurations of the ballast water intakes and intake rates, juvenile fish occurring in the area have the potential to be entrained during ballast water intake if they have not reached a size in which they are able to swim faster than the intake velocity.

In summary, although Crown Landing would avoid dredging during the period when sturgeon are migrating to spawning grounds, dredging associated with the proposed project could still reduce the amount of forage available and could entrain juvenile and adult individuals if present near the cutterhead. Additionally, ballast water intakes have the potential to entrain juveniles if present in the water column and not of sufficient size to swim faster than the intake velocity. Therefore, the Crown Landing LNG Project *is likely to adversely affect* shortnose sturgeon. **We recommend that:**

- **Crown Landing should not begin construction activities <u>until</u>:**

  a. **FERC staff receives comments from NOAA Fisheries, Protected Resources Division regarding the proposed action;**

  b. **FERC staff completes formal consultation with NOAA Fisheries, Protected Resources Division; and**

  c. **Crown Landing receives written notification from the Director of the OEP that construction may begin.**

With the issuance of this draft EIS, we are asking NOAA Fisheries to open formal consultation and issue a Biological Opinion specific to the shortnose sturgeon.

Because Texas Eastern proposes to use HDD techniques to install the pipeline across the Delaware River, impacts on the river and associated biological communities would be avoided. Therefore, the Logan Lateral Project would have *no effect* on the shortnose sturgeon.

Bog Turtle

The bog turtle is a federally listed threatened species known to occur in wetlands within Chester and Delaware Counties in Pennsylvania (Pennsylvania Fish and Boat Commission (PAFBC), 2003a). Bog turtles are a semi-aquatic, omnivorous species that prefer relatively open sphagnum bogs and marshy wetlands. Bog turtles have specific habitat requirements that include specific vegetative communities, mucky soils for burrowing, and open wetlands associated with slow moving springs and/or groundwater (Pennsylvania Department of Conservation and Natural Resources (PADCNR), 2003). Bog turtles are threatened as a result of a loss of habitat, degradation of the remaining suitable habitat, and poaching. Due to the lack of suitable habitat, bog turtles in some cases have become accustomed to disturbed, low quality wetlands that often have a semi-enclosed canopy (PAFBC, 2003a). Bogs turtles are also known to use forested wetlands with small streams or springs as dispersal corridors to other more open marshes.

The PAFBC (2003a) indicated that a Phase 1 habitat suitability assessment for bog turtles would be required if any direct or indirect impacts to wetlands are expected. Texas Eastern conducted a Phase 1 study of the proposed pipeline corridor during early summer 2004. The assessment determined that none of the wetlands traversed by the proposed project provide suitable bog turtle habitat. The PAFBC (2004) reviewed the assessment and concurred that the project is not likely to cause adverse impacts on bog

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turtles. Since suitable habitat for this species is not present along the proposed pipeline route, the Logan Lateral Project would have *no effect* on the bog turtle.

Sea Turtles

Three sea turtle species were identified by NOAA Fisheries as having the potential to occur near the project area: the Kemp's ridley, green, and loggerhead sea turtles. The Kemp's ridley and green sea turtles are federally listed (and state-listed) as endangered. The loggerhead sea turtle is federally listed as threatened and is a state-listed endangered species in Delaware and New Jersey. None of these species are known to nest in the project area.

Green turtles occupy three habitat types: high energy oceanic beaches (nesting), convergence zones in pelagic habitat (juvenile foraging), and benthic feeding grounds in relatively shallow, protected waters (adult foraging). The primary green turtle nesting area within the United States is limited to a six-county area in east central and southeast Florida. Common adult foraging habitats are pastures of seagrasses and/or algae but small green turtles can also be found over coral reefs, worm reefs, and rocky bottoms (NMFS and FWS, 1991a). Coastal development threatens nesting habitat and populations while commercial fisheries and pollution pose significant threats to the marine environment.

The major nesting beach where Kemp's ridley turtles emerge in any concentration to lay eggs is on the northeastern coast of Mexico, although additional nesting has been reported from Texas, Florida, and South Carolina. Juveniles frequent bays, coastal lagoons, and river mouths. Although adults are sometimes found on the eastern seaboard of the northwestern Atlantic Ocean, they are typically confined to the Gulf of Mexico. Members of this genus are usually found in water with low salinity, high turbidity, high organic content, and where shrimp are abundant. Major threats to this species include incidental mortality in commercial shrimping, marine pollution, and dredging activities.

Loggerhead turtle nesting in the United States occurs primarily on the beaches of Florida but has also been reported from North Carolina, South Carolina, and Georgia (NMFS and FWS, 1991b). Post-hatchling and juvenile habitat use is associated with sargassum and/or debris in pelagic drift lines. Subadult habitat usage is associated with nearshore and estuarine waters along continental margins, which are used as developmental habitat. Adult habitat selection is not well understood but it seems clear that adults can use a variety of habitats. Coastal development threatens nesting habitat and populations, while commercial fisheries and pollution pose significant threats to their marine environment.

The greatest potential threat to sea turtles, if present in the project area, would be impingement or entrainment into the hydraulic dredge cutterhead. However, NOAA Fisheries has previously determined that pipeline dredges are unlikely to adversely affect sea turtles (NOAA Fisheries, 1996). In addition, it is likely that turtles would be able to avoid hydraulic dredges. Also, dredging is not currently scheduled to occur during the summer months when sea turtles have the greatest potential to occur in the project area. Therefore, construction of the proposed LNG terminal *is not likely to adversely affect* sea turtles.

Because Texas Eastern proposes to use HDD techniques to install the pipeline across the Delaware River, impacts to the river and associated biological communities would be avoided. Therefore, the Logan Lateral Project would have *no effect* on the sea turtles.

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4.7.2 State-listed Species

Atlantic Sturgeon

The Atlantic sturgeon is a state-listed endangered species in Pennsylvania and New Jersey and a candidate species for federal listing. Although petitioned for federal listing in 1998, it was determined that listing the Atlantic sturgeon as a federally endangered or threatened species was not warranted. However, NOAA Fisheries has retained Atlantic sturgeon on its list of candidate species to monitor. The Atlantic sturgeon is protected by several federal, state, and international programs and the Atlantic States Marine Fisheries Commission has prepared a Fisheries Management Plan to regulate the harvest and coordinate the management of stocks from Maine to Florida (NOAA Fisheries and FWS, 1998).

The Atlantic sturgeon is an anadromous species that inhabits large estuaries and Atlantic coastal waters. Atlantic sturgeons are occasionally found within different salinity regions in the Delaware River. Juveniles also spend time in the Delaware River before going to the ocean (PAFBC, 2001). Atlantic sturgeons generally remain in the Delaware Bay area throughout much of the year but may migrate up the river in June when the water warms. The abundance of sturgeon in the upper reaches of the river tends to decline in September, which likely reflects an outward migration of adults to the Atlantic Ocean in early fall. Juveniles live in freshwater for about 4 years before moving to ocean waters to mature (PADCNR, 2003; NJDFW, 2003) and thus could be present in the river near the proposed LNG terminal site throughout the year.

Preferred Atlantic sturgeon spawning areas consist of clay, rubble, gravel, or shell with fast-flowing water at depths less than 30 feet (Vladykov and Greeley, 1963). Spawning runs generally begin in April and peak in May. Records indicate that most spawning occurs downstream of the LNG terminal site. However, a study conducted by the Atlantic Sturgeon Status Review Team (ASSRT) in 1998 indicated that the primary spawning and nursery habitat for the Atlantic sturgeon in the Delaware River is located upstream of the proposed LNG terminal site between the Delaware-Pennsylvania border and Trenton (ASSRT, 1998). A similar study also determined that Marcus Hook area appears to be primary habitat for immature Atlantic sturgeon during the summer months (O'Herron, 1993). Thus the project could impact spawning migrations, egg development, and individuals that may occupy the site during the summer months. However, because the shallow water areas in the proposed dredging area for the proposed ship unloading facility contains a substrate of fine sand and silt, which is unsuitable as spawning habitat, the project is not expected to impact spawning habitat.

Crown Landing proposes to adhere to agency recommended timing restrictions for dredging activities and would not conduct dredging operations between March 15 and August 1. Avoiding dredging during this period would likely avoid potential impacts on Atlantic sturgeon migrating upstream in the spring to spawn and sturgeon migrating upstream in summer to locate warmer water. However, sturgeon migrating downstream to the Atlantic Ocean in late summer or early fall could pass by active dredging operations. Potential impacts on sturgeon during out-migration would be similar to those discussed previously for shortnose sturgeon. Specifically, dredging could disrupt migratory movements, destroy habitat/prey resources, and/or entrain fish in hydraulic dredges. Although adults and larger juveniles would be expected to avoid dredging operations, smaller sturgeon, which remain in the Delaware River for several years, could be present and potentially affected in the project area during dredging operations. The NJDEP (2004c) has recommended that the discharge outlet should be monitored at the dredge disposal site to determine whether sturgeon are being entrained. As stated in section 4.7.1 regarding the shortnose sturgeon, we recommend that Crown Landing monitor the outlet at the disposal site. If monitoring indicates that sturgeon are being entrained, we recommend that dredging operations be suspended until NOAA Fisheries and the FERC are contacted and provide guidance on how to proceed.

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Similar to the shortnose sturgeon, water withdrawals from the Delaware River for hydrostatic testing of the LNG storage tanks and by LNG ships during intake of ballast water could also entrain Atlantic sturgeon. To account for these potential impacts, we have recommended that Crown Landing coordinate with resource agencies to determine the need for mitigative measures to avoid or minimize these impacts on aquatic resources in the project area (see section 4.6.2). Although spawning by Atlantic sturgeon is not expected to occur within the proposed dredging area, spawning in adjacent suitable habitats could occur and eggs and developing larvae have the potential to be transported via currents or active migration into the proposed project area. Thus, eggs and larvae could be entrained during water intakes. However, similar to shortnose sturgeon, Atlantic sturgeon eggs are adhesive and are expected to adhere to the substrate or other suitable structure soon after being spawned. Additionally, Atlantic sturgeon larvae become primarily demersal within 10 days of hatching; therefore, the likelihood of Atlantic sturgeon eggs or larvae being withdrawn into water intakes located in the mid to upper level of the water column is low.

Similar to shortnose sturgeon, since Atlantic sturgeon could occur in the area during pile driving, they would be susceptible to the same potential impacts as other fish (e.g., avoidance of construction areas, especially during migrations, injury, or death). Our recommendation in section 4.6.2, which requires Crown Landing to discuss with applicable agencies the need for additional conservation measures to avoid or minimize potential effects of pile driving on fish, could possibly alleviate potential impacts on sturgeon.

In summary, because juvenile Atlantic sturgeon have the potential to occupy shallow water areas of the project site throughout the year, there is a potential for the project to affect the species, directly thorough entrainment and indirectly through habitat and prey loss. It is likely that measures implemented to avoid and/or minimize impacts on shortnose sturgeon would also provide conservation benefits to the Atlantic sturgeon. However, also similar to the shortnose sturgeon, there is a potential for individuals to be adversely affected by the proposed project.

Because Texas Eastern proposes to use HDD techniques to install the pipeline across the Delaware River, impacts to the river and associated biological communities would be avoided. Therefore, the Logan Lateral Project would have no effect on the Atlantic sturgeon.

Red-bellied Turtle

The red-bellied turtle is listed as threatened in Pennsylvania due to limited habitat, draining and filling of wetlands, water pollution, and competition from the non-native red-eared slider. Red-bellied turtles can be found in relatively large, deep creeks, rivers, ponds, lakes, and marshes (PADCNR, 2003). The streams, lakes, and marshes inhabited by the red-bellied turtle must have permanent water and plenty of basking sites. The red-bellied turtle is known to inhabit the Delaware River and may be found in other waterbodies that would be crossed by the Logan Lateral. At the recommendation of the PAFBC (2003a), Texas Eastern conducted a habitat assessment of the proposed pipeline route in early summer 2004. The habitat assessment determined that although some of the streams that would be crossed by the pipeline could provide basking habitat for red-bellied turtles, none provide the required habitat for nesting or foraging.

The PAFBC (2004) reviewed Texas Eastern's assessment and determined that only Chester Creek and the Delaware River provide suitable habitat for the red-bellied turtle. The PAFBC concluded that use of the HDD method would avoid impacts on any turtles inhabiting these waterbodies. Since Texas Eastern proposes to use the HDD method to cross these two waterbodies, the proposed project is not likely to have adverse impacts on red-bellied turtles.

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Pied-billed grebe

The pied-billed grebe is a state-listed endangered species in New Jersey. Pied-billed grebes are not known to use the proposed LNG terminal site but have been documented in the vicinity of the site (NJDEP, 2003d). The pied-billed grebe is a small duck-like diving bird of freshwater marshes, lakes, ponds, bogs, reservoirs, and slow moving rivers. Historically, pied-billed grebes were a common nesting species in suitable habitat in New Jersey. By 1940, however, human activities (primarily hunting for both food and feathers) had reduced the numbers of nesting pairs in the state to 12. From the 1940s through the 1960s, pied-billed grebe populations increased as large amounts of land were protected and managed for waterfowl. Since then, the number of nesting grebe populations has declined.

Pied-billed grebes spend nearly all of their time in water. They are particularly well adapted to swimming underwater where they forage for mollusks and crustaceans. Pied-billed grebes nest in freshwater marshes associated with slow moving rivers, ponds, bogs, lakes, and reservoirs. Breeding sites are typically associated with areas of fairly deepwater interspersed with submerged or floating aquatic vegetation and dense emergent vegetation such as cattails, common reed, and bulrushes (NJDFW 2003). During the non-breeding season, pied-billed grebes can be found in a variety of aquatic habitats, including brackish and tidal areas when freshwater freezes (Andrle and Carroll, 1988).

Wetland surveys identified emergent wetlands at the LNG terminal site that could be used by grebes during the non-breeding season, when individuals have less rigid habitat requirements, are highly mobile, and move according to weather patterns and food availability. The emergent wetlands on the proposed site, however, do not contain open-water areas that would make them suitable breeding habitat for pied-billed grebes. The only open-water areas on the site are drainage ditches, which have strong, tidally influenced currents that make them unsuitable for nesting grebes. Additionally, no grebes were seen or heard during wetland surveys in April, May, and August 2003 (Environmental Resource Management, 2003). Pied-billed grebes are extremely secretive during the breeding season, but when disturbed, they make a distinctive alarm call that would likely have been heard during wetland surveys if individuals were on the site.

The agencies did not request that Texas Eastern conduct surveys for pied-billed grebe along the pipeline route. However, records indicate that pied-billed grebes nest in the wetlands adjacent to Birch Creek near MP 9.2 and may also use suitable habitat along Raccoon Creek (Enviroweb, 2003). A habitat assessment conducted by Texas Eastern determined that suitable habitat for the pied-billed grebe does not exist at these wetland areas due to the lack of open-water wetland habitat. Results of this assessment were submitted to the NJDFW on August 30, 2004. Comments provided by the NJDFW will be reviewed and included in project plans, as applicable.

Texas Eastern proposes to use the HDD crossing method to cross Birch and Raccoon Creeks, thus minimizing potential impacts on pied-billed grebes that may utilize these waterbodies as foraging habitat. However, the current proposed alignment of the HDD for Birch Creek does not avoid all of the emergent wetland area adjacent to the waterbody. Following installation of the pipeline, emergent wetlands would be restored and would likely return to near preconstruction condition within a year after construction.

Since Texas Eastern proposes to use the HDD method to cross Birch and Raccoon Creeks and suitable habitat has not been identified within the construction workspace, the proposed project is not likely to have adverse impacts on the pied-billed grebe.

Peregrine Falcon

The peregrine falcon was federally listed as endangered in 1970 and state-listed as endangered by New Jersey in 1974 and by Pennsylvania in 1984. The breeding population of peregrine falcons in

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eastern North America was extirpated by the mid-1960s primarily due to the use of the pesticide dichlorodiphenyltrichloroethane (DDT) (PADCNR, 2003, NJDFW, 2003). The use of DDT was banned in the United States in 1972 and a Peregrine Falcon Recovery Plan was initiated in 1975. Since that time, a reintroduction program as well as the installation of artificial nest sites have resulted in stable breeding populations in most of the eastern United States. Because of these programs the national recovery goals were met and the peregrine falcon was removed from the federal endangered species list in 1999 (NJDFW, 2003). However, the peregrine falcon remains a state-listed species in New Jersey and Pennsylvania. Peregrine falcons historically nested along the cliffs and rocky outcrops of the Delaware River. As humans moved into their habitats, peregrine falcons incorporated the use of man-made structures such as bridges and tall buildings into its breeding and foraging habitats.

Peregrine falcons are found near the project and have been known to nest on the Commodore Barry Bridge (COE, 1997). Given the distance of the bridge from the LNG terminal site (upstream about 3 miles) and the regular disturbance associated with traffic on the bridge and boat traffic on the Delaware River, it is unlikely that the falcons would be affected by the project even if a pair of peregrine falcons is nesting on the bridge during construction.

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4.8 LAND USE, RECREATION, AND VISUAL RESOURCES

4.8.1 Land Use

4.8.1.1 LNG Terminal

The proposed LNG terminal would be located on a privately owned site on the south side of the Delaware River in Logan Township, Gloucester County, New Jersey. The site consists of approximately 175 acres of land between U.S. Route 130 and the Delaware River. The site is currently undeveloped and contains mostly wetlands and active and inactive farm fields. The active farm fields have most recently been planted in soybeans. Historically (primarily between the 1930s and 1960s) the site was used for dredged material disposal. The site is currently zoned as 'light industrial' by Logan Township. Permitted uses within light industrial areas include freight terminals, light manufacturing, and warehousing. Ten pipelines (two natural gas pipelines, one nitrogen pipeline, three inactive pipelines, and four product pipelines) traverse the site.

Of the 175-acre site, about 39 acres would be permanently developed for the LNG terminal facilities. Table 4.8.1-1 summarizes the acres of each land use that would be affected by the proposed LNG terminal. In addition to the 39 acres permanently developed for the LNG terminal facilities, about 4 acres would be used as a temporary staging and expanded work area during construction. The 4-acre area would be located in the southeast corner of the site adjacent to the access road and approximately 300 feet north of U.S. Route 130 and would include construction offices, material storage, and parking. The facility septic system would also be located in this area. The majority of the 4 acres would be graded and returned to open space after construction; however, 0.5 acre would be used for a septic system drain field. Dual feed electric transmission lines would be extended to the LNG terminal site from the existing Conectiv electric substation across U.S. Route 130 from the site entrance and along the site access road to the terminal area. About 3,500 feet of transmission line would be supported by transmission poles spaced an average of 225 feet apart.

TABLE 4.8.1-1

Land Area Affected by the Proposed LNG Terminal

Description	Wetlands (acres)	Cropland (acres)	Upland Shrub (acres)	Industrial/Developed (acres)	Total (acres)
Existing Site Conditions	109.2	60.8	3.1	1.7 a/	174.8
Proposed Site Conditions	109.2	25.4	1.6	38.6 b/	174.8
Land Use Change	0.0	(35.4)	(1.5)	36.9	0.0

a/ Includes existing farm roads.

b/ Includes the 1.7 acres of existing farm roads plus an additional 2.4 acres for roads, 1.3 acres for administrative areas, 18.1 acres for LNG storage, 13.9 acres for LNG process areas, and 1.2 acres for tie-in to the existing natural gas pipeline systems on site.

The Crown Landing LNG Project would also require about 29.8 acres of riverbed associated with the Delaware River for a pier (approximately 2.4 acres) and berthing facilities (approximately 27.4 acres, including the area to be dredged). The majority of the offshore ship unloading facility would be located in Delaware waters within the boundaries of New Castle County.

Existing land uses surrounding the proposed LNG terminal site include a mixture of industrial, agricultural, open space, and scattered residential uses. Land use on the New Jersey side of the Delaware River is dominated by agricultural and open space uses with scattered residential and industrial uses. Northeast of the proposed LNG terminal site are two industrial facilities, the Logan Generating Station

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and Ferro Industries plant. The Delaware and Pennsylvania side of the Delaware River, which is about 1.1 miles wide at the proposed LNG terminal site, is more heavily developed than the New Jersey side. The river frontage on the Delaware and Pennsylvania side is dominated by heavy industrial uses such as oil refineries and petrochemical industries.

4.8.1.2 Pipeline Facilities

The Logan Lateral Project would involve construction of a 30-inch-diameter pipeline that would connect the LNG terminal with the existing Texas Eastern natural gas pipeline system in Brookhaven Borough, Delaware County, Pennsylvania[5]. The pipeline would consist of about 11 miles of 30-inch-diameter pipeline in Delaware County, Pennsylvania (4.9 miles) and Gloucester County, New Jersey (6.1 miles). Table 4.8.1-2 summarizes the land uses crossed by the proposed pipeline route.

TABLE 4.8 1-2

Land Uses Crossed by the Pipeline Route for the Logan Lateral Project

State	Open Land a/ (miles)	Roadway/ Railroads b/ (miles)	Forest Land c/ (miles)	Agricultural Land d/ (miles)	Open Water e/ (miles)	Commercial/ Industrial Land f/ (miles)	Other Land g/ (miles)	Residential Land h/ (miles)	Total (miles)
Pennsylvania	0.9	1.6	0.9	0.0	0.5	0 6	0.3	0 1	4.9
New Jersey	3 1	0.2	0.8	1.5	0.5	0.0	0.0	0.0	6 1
Project Total	4 0	1 8	1 7	1.5	1 0	0.6	0.3	0.1	11.0
	(36%)	(16%)	(15%)	(14%)	(9%)	(6%)	(3%)	(1%)	(100%)

a/ Open land consists of vacant parcels or open space not specifically designated for outdoor recreation. Includes mowed areas (not residential lawns) and undeveloped areas of property owned by commercial/industrial operations or private residents. Also includes open field regrowth and upland scrub Emergent and scrub-shrub wetlands and open maintained existing pipeline right-of-way are also included in this land use category.
b/ Roadway and railroads include both state and federal road and road right-of-way crossings and all active railroad crossings.
c/ Forest land consists of upland and wetland forest areas not being used for agricultural or forestry specific purposes.
d/ Agricultural land consists of areas primarily used for active cropland, orchards, vineyards, or hay fields
e/ Open water includes stream crossings greater than 10 feet in width (e.g., the Delaware River crossing)
f/ Commercial/industrial land includes electric power plants or gas utility stations, manufacturing or industrial plants, and commercial or retail facilities.
g/ Other land includes special use areas including schools, parks, and churches.
h/ Residential land consists of areas used primarily for private dwellings. Residential yards, subdivisions, and planned new residential developments are also included in this land use category.

Of the 11 miles of the proposed pipeline, about 6.4 miles (58 percent) would be constructed within or adjacent to various existing rights-of-way. Of the 6.4 miles, 3.1 miles would be located within Texas Eastern's existing pipeline easement (1.4 miles) or other existing pipeline easements (1.7 miles), 3.1 miles would be located within existing roadways, and 0.2 mile would be located within an existing railroad right-of-way. The remaining 4.6 miles (42 percent) would be constructed on newly created right-of-way. The predominant land use that would be crossed is open land comprising about 4.0 miles (36 percent) of the pipeline route. The remaining land uses crossed include roadway/railroads (1.8 miles or 16 percent), forest land (1.7 miles or 15 percent), agricultural land (1.5 miles or 14 percent), open water (1.0 mile or 9 percent), commercial/industrial land (0.6 mile or 6 percent), other land (0.3 mile or 3 percent), and residential land (0.1 mile or 1 percent). The construction right-of-way associated with the pipeline would also be located within 50 feet of several residences (see section 4.8.3.2).

[5] The tie in with the Columbia Gas and Transco natural gas pipeline systems would occur within the proposed LNG terminal site

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Land use impacts associated with the pipeline would include the disturbance of existing land uses within the right-of-way during construction and retention of a new permanent right-of-way for operation of the pipeline. Texas Eastern proposes to use a maximum 100-foot-wide construction right-of-way. The construction right-of-way would be reduced as necessary in residential and wetland areas. A 50-foot-wide right-of-way would be permanently retained in all areas except at road crossings and within roadways where the right-of-way width would be as permitted by the local agencies. The typical right-of-way cross sections that Texas Eastern would use for the proposed pipeline are provided in Appendix B. In addition to the construction right-of-way, Texas Eastern would use various temporary extra workspaces, staging areas, and access roads to facilitate construction activities. No pipe yards have been identified by Texas Eastern at this time. The locations and sizes of the identified temporary extra workspaces and staging areas are listed in table C-1 in Appendix C. Table C-2 in Appendix C lists the proposed access roads that would be used during construction of the Logan Lateral Project.

Texas Eastern proposes to modify and upgrade one existing aboveground facility and would construct two new aboveground facilities. Modifications and upgrades would be made to Chester Junction, which is an existing 1.3-acre fenced facility located on a 5.7-acre site owned by Texas Eastern within a residential neighborhood in the Borough of Brookhaven. The work would be conducted within the limits of the existing site and no new property would need to be acquired by Texas Eastern. The Logan mainline valve at MP 2.1 would be a new facility located partially within Texas Eastern's existing right-of-way in an open area behind buildings associated with the I-95 Industrial Park. Texas Eastern would need to acquire an additional 0.1 acre of land for construction and operation of this facility. The new Crown Landing meter and regulation station would be located within the proposed developed area of the 175-acre LNG terminal site. The facility would require a 0.5-acre area within the site.

Construction of the pipeline facilities would disturb a total of about 177.3 acres of land, including the pipeline construction right-of-way, temporary extra workspace and staging areas, access roads, and aboveground facilities. Of this total, 101.1 acres would be disturbed by the pipeline construction right-of-way, 65.6 acres would be disturbed by temporary extra workspace and staging areas, 4.4 acres would be disturbed by access roads, and 6.2 acres would be disturbed by aboveground facilities. Table 4.8.1-3 summarizes the acres of each land use that would be affected by construction and operation of the proposed pipeline facilities.

Open land would be the primary land use affected by construction of the pipeline facilities totaling about 51.5 acres (29 percent). The remaining land uses that would be disturbed consist of 50.8 acres (29 percent) of agricultural land, 23.4 acres (13 percent) of forest land, 17.7 acres (10 percent) of roadway/railroad, 16.8 acres (9 percent) of commercial/industrial land, 15.4 acres (9 percent) of other land, 1.4 acres (1 percent) of residential land, and 0.3 acre (<1 percent) of open water.

Of the 177.3 acres of land affected by construction of the pipeline facilities, about 54.1 acres would be retained as permanent right-of-way for the pipeline and 1.8 acres for the aboveground facilities. The land that is retained as permanent right-of-way for the pipeline would be allowed to revert to former use with certain restrictions. Activities such as the construction of aboveground structures, including houses, house additions, garages, patios, pools, or any other object not easily removable, or the planting and cultivating of trees or orchards, would be prohibited within the permanent right-of-way. The remaining 121.5 acres that are used for construction would be allowed to revert to prior uses following construction with no restrictions.

TABLE 4 8 1-3

Acres of Land Affected by Construction and Operation of the Pipeline Facilities for the Logan Lateral Project

State/Facility	Open Land (acres)		Agricultural Land (acres)		Forest Land (acres)		Roadway/Railroad (acres)		Commercial/Industrial Land (acres)		Other Land (acres)		Residential Land (acres)		Open Water (acres)		Total (acres)	
	Const.	Oper.	Const.	Oper.	Const	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper	Const.	Oper.	Const.	Oper.
Pennsylvania																		
Pipeline Right-of-Way a/	6.2	5.3	0 0	0.0	12.4	4 8	8.8	0.0	9 4	3.8	3.8	2.0	1.4	0.3	0.1	2.8	42.1	18.9
Temporary Extra Workspace and Staging Areas	3.8	0.0	0.0	0.0	5.4	0.0	0.1	0.0	1.6	0.0	11.5	0.0	0.0	0.0	0.0	0.0	22.5	0.0
Access Roads	0.0	0.0	0.0	0.0	0.0	0.0	1 0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0
Aboveground Facilities b/	0.1	0.1	0 0	0.0	0.0	0.0	0.0	0.0	5.7	1.3	0.0	0.0	0.0	0.0	0.0	0.0	5.8	1.3
Pennsylvania Subtotal	10.1	5.4	0.0	0.0	17.8	4.8	9.8	0.0	16.8	5 1	15.4	2.0	1.4	0.3	0.1	2.8	71.4	20.2
New Jersey																		
Pipeline Right-of-Way a/	32.0	18 8	18.7	9.3	3 7	3.8	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	3.3	59.0	35.1
Temporary Extra Workspace and Staging Areas	9.4	0.0	31.7	0.0	1.9	0.0	0.2	0.0	0 0	0.0	0.0	0 0	0.0	0.0	0.0	0.0	43.2	0.0
Access Roads	0.0	0.0	0.0	0 0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0 0
Aboveground Facilities c/	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 0	0.0	0.0	0.0	0.5	0.5
New Jersey Subtotal	41.4	18.8	50.8	9.7	5.6	3 8	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	3.3	106.0	35.6
Pipeline Facilities Subtotal																		
Pipeline Right-of-Way	38.2	24.1	18.7	9.3	16 1	8.5	13.1	0.0	9.4	3 8	3.8	2.0	1.4	0.3	0.3	6.1	101.1	54.1

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TABLE 4.8.1-3 (cont'd)

Acres of Land Affected by Construction and Operation of the Pipeline Facilities for the Logan Lateral Project

State/Facility	Open Land (acres)		Agricultural Land (acres)		Forest Land (acres)		Roadway/Railroad (acres)		Commercial/Industrial Land (acres)		Other Land (acres)		Residential Land (acres)		Open Water (acres)		Total (acres)	
	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper	Const.	Oper.
Temporary Extra Workspace and Staging Areas	13.2	0.0	31.7	0.0	7.3	0.0	0.3	0.0	1.6	0.0	11.5	0.0	0.0	0.0	0.0	0.0	65.6	0.0
Access Roads	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0 0	0.0	4.4	0.0
Aboveground Facilities	0.1	0.1	0.5	0.5	0.0	0.0	0.0	0.0	5.7	1.3	0.0	0.0	0.0	0.0	0.0	0.0	6.2	1.8
Pipeline Facilities Total	51.5	24.1	50.8	9.7	23.4	8.5	17.7	0.0	16.8	5.1	15.4	2.0	1.4	0.3	0 3	6.1	177.3	55.8

a/ Based on a 100-foot-wide construction right-of-way. Some areas would have a reduced construction right-of-way to avoid impacts on residential and wetland areas. Operation acreage is based on a 50-foot-wide permanent right-of-way in all areas except at road crossings and within roadways where the right-of-way width would be as permitted by the local agencies. Beginning at approximately MP 10, the pipeline right-of-way would be located within the proposed 175-acre LNG terminal site but does not overlap the 39 acres that would be permanently developed for the terminal facilities.

b/ The modifications and upgrades at Chester Junction would be conducted within the existing 1.3-acre fenced facility located on a 5.7-acre site owned by Texas Eastern. The work would be conducted within the limits of the existing site and no new property would need to be acquired by Texas Eastern. The Logan mainline valve would require an additional 0.1 acre outside of Texas Eastern's existing right-of-way.

c/ The Crown Landing meter and regulation station would be located within the developed area (i.e., 39 acres) of the 175-acre LNG terminal site.

Const. Construction Impacts

Oper. Operation Impacts

Note: The totals shown in this table may not equal the sum of addends due to rounding.

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The majority of the pipeline would be located on privately owned lands. Public lands that would be crossed include roads, waterbodies, one small tract of forested property associated with a sewage treatment plant south of Chester Creek owned by Aston Township, two small tracts of forested property owned by Chester Township, and one municipal park owned by the City of Chester (see section 4.8.5.1). Texas Eastern would need to acquire easements or property to construct and operate the proposed facilities. The easement would convey both temporary (for construction) and permanent rights-of-way to Texas Eastern and would give Texas Eastern the right to construct, operate, and maintain the pipeline facilities. Texas Eastern would negotiate a one-time payment for each easement. An easement agreement between a company and a landowner typically specifies compensation for losses resulting from construction, including losses of non-renewable and other resources, damages to property during construction, and restrictions on existing uses that would not be permitted on the permanent right-of-way after construction.

If an easement cannot be negotiated with a landowner and the project has been certificated by the FERC, the company may use the right of eminent domain granted to it under section 7(h) of the NGA and the procedures set forth under the Federal Rules of Civic Procedure (Rule 71A) to obtain the right-of-way and extra workspace areas. The company would still be required to compensate the landowner for the right-of-way and damages incurred during construction. However, the level of compensation would be determined by a court according to state or federal law. In either case, Texas Eastern would compensate landowners for use of the land.

4.8.2 Existing Residences and Planned Developments

4.8.2.1 LNG Terminal

Existing Residences

Based on a review of aerial photographs and supported by a field survey, about 20 residences are located within 1 mile of the entrance to the proposed LNG terminal site. The closest residence is approximately 2,300 feet from the proposed LNG terminal. All but three of the houses are located across U.S. Route 130 from the proposed LNG terminal site. Of the 20 houses, nearly all are located in clusters south and southeast of the site along U.S. Route 130 and Center Square Road. The other houses are scattered along the south side of U.S. Route 130 and in Oldmans Township. As of 2000, the population living in a 1 mile radius of the proposed LNG terminal site was approximately 28. The population living in a 2 mile radius of the site, which includes portions of Delaware and Pennsylvania on the other side of the river, was approximately 3,538 (U.S. Bureau of the Census, 2001).

During construction of the LNG terminal, short-term impacts on nearby residences could include increased construction-related traffic on local roads, dust generated during site construction, and noise from construction equipment. In general, as the distance to the construction site increases, the impacts on these areas decrease. Additional information on measures Crown Landing would implement to reduce impacts associated with increased traffic, dust, and noise is presented in sections 4.9.4, 4.11.1, and 4.11.2, respectively.

Potential impacts on nearby residences during operation of the LNG terminal include increased visibility of aboveground structures associated with the facility, increased traffic, changes in air quality, and safety hazards. These impacts and applicable mitigation measures are discussed in sections 4.8.6.1, 4.9.4, 4.11.1, and 4.12 respectively.

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Planned Developments

There are no planned residential, commercial, or industrial developments within 2 miles of the proposed LNG terminal site. The closest planned development to the LNG terminal site is a proposal for residential development approximately 2 miles northeast of the site on land adjacent to the eastern side of the Ferro Industries plant and southwest of Raccoon Creek. Logan Township has also expressed possible interest in developing a riverfront park on land near the Commodore Barry Bridge. The Wharf on the Boardwalk is a planned commercial development on the site of a former power plant in Chester, Pennsylvania about 3.2 miles northwest of the LNG terminal site. Construction has begun on this development and is scheduled to be completed in the fall of 2004. Because of the distance between these planned developments and the proposed LNG terminal site, the facility is not expected to conflict with the development plans. However, the pipeline associated with the Logan Lateral Project would cross a portion of the Wharf on the Boardwalk development (see section 4.8.2.2).

4.8.2.2 Pipeline Facilities

Existing Residences

Texas Eastern's proposed construction work area for the pipeline facilities (i.e., construction right-of-way and temporary extra workspaces) would be located within 50 feet of 147 residences or residential structures (e.g., garages, sheds). Of these 147 residential structures, 29 would be located within 25 feet of the construction work area, including 18 within 10 feet. Table F-1 in Appendix F lists these residences by milepost and indicates the distance of each from the proposed construction work area. There are also nine commercial/industrial buildings located within 50 feet of the construction work area. There are no additional residences or commercial/industrial buildings located within 50 feet of the proposed aboveground facilities.

In residential areas, typically the two most significant impacts associated with construction and operation of a pipeline are disturbance during construction and encumbrance of property for future uses (e.g., the limitation on future permanent structures within the permanent right-of-way). Residences within 50 feet of the construction work area would be most likely to experience the effects of construction and operation of the project. In general, as the distance to the construction work area increases, the impacts on residences decrease.

Temporary construction impacts on residential areas could include inconvenience caused by noise and dust generated by construction equipment, personnel, and trenching of roads or driveways; ground disturbance of lawns; removal of trees, landscaped shrubs, or other vegetative screening between residences and/or adjacent rights-of-way; potential damage to existing septic systems or wells; and removal of aboveground structures, such as sheds or trailers, from within the right-of-way.

Texas Eastern would implement the following general measures to minimize construction-related impacts on residences and other structures located within 50 feet of the construction right-of-way:

- notify landowners in advance of construction activities and any scheduled disruption of household utilities;
- adhere to the residential mitigation measures contained in the SESC Plan;
- fence the construction work area for a length of 100 feet on either side of a residence to ensure that construction equipment and materials stay within the confines of the approved construction right-of-way;

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- maintain a minimum of 25 feet between the residence and the construction work area for a distance of 100 feet on either side of the residence;
- secure all open ditches with orange safety fencing;
- minimize the duration of an open trench to the contractor's working hours for a distance of 100 feet on either side of a nearby residence;
- use the stovepipe or drag section construction method;
- offer to temporarily relocate the landowner to a motel and provide a meal allowance if construction activities in a residential area disrupts landowner ingress/egress to the affected residence;
- attempt to leave mature trees and landscaping intact within the construction right-of-way unless the trees and landscaping interfere with the pipe installation techniques or present unsafe working conditions;
- restore all lawn areas immediately after backfilling the trench;
- restore fences, mailboxes, and other structures that were removed during construction;
- restore sidewalks, driveways, and roads as soon as practical after construction; and
- contact landowners after construction to ensure that conditions of all agreements have been meet.

In addition, Texas Eastern would prepare site-specific residential construction mitigation plans to minimize disruption and maintain access to the residences located within 50 feet of the construction work area.

Residential properties encumbered by pipeline easements would sustain long-term impacts associated with the permanent right-of-way. The easements would prohibit certain types of use, such as the construction of aboveground structures, including house additions, garages, patios, pools, or any other object not easily removable, or the planting and cultivating of trees or orchards. However, because the pipeline would be installed within roadways for much of the route through residential areas, many of the residences within 50 feet of the construction work area would not be affected by the permanent right-of-way.

Texas Eastern would also apply the mitigation measures identified above to the nine commercial/industrial structures located within 50 feet of the construction work area.

Planned Developments

Seven planned developments have been identified as being crossed or located within 0.25 mile of the proposed pipeline route. The locations of these planned development and the distance to the proposed pipeline route are presented in table 4.8.2-1.

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TABLE 4.8.2-1

Planned Developments within 0.25 Mile of the Proposed Pipeline Route

State	Approx. Milepost	Planned Development	Approx. Distance from Pipeline Route	Project Start and End Dates
Pennsylvania				
	0.0	Proposed Senior Home /Active Adult Community Development	1,000 feet	None Given
	0.08-0.15	10,000 SF Office Space	NA – Crossed	None Given
	1.66	Rails-to-Trails Project	NA – Crossed	None Given
	1.88	Nine Building Business Park	NA – Adjacent	None Given/Currently Under Construction
	2.59	Chester Charter School/Franklin Elementary	500 feet (Would be used for a staging area)	None Given
	4.47	Renovated Office Space – Parking Lot/Wharf on the Boardwalk	NA – Crossed	None Given/Currently Under Construction
New Jersey				
	7.57	County Equestrian Park	NA – Crossed	None Given

Within the Borough of Brookhaven an active adult community development is proposed south of Ridley Creek between Brookhaven Road and Radio Park Lane about 1,000 feet northwest of the beginning of the pipeline route at Chester Junction. According to both the Borough Zoning Officer and the County Planning Board, this development is currently under preliminary review and no construction schedule has been provided. The installation of the proposed pipeline would not interfere with the future construction of this development (Hampton, 2003).

According to the Delaware County Planning Board, Faith Baptist Church owns a portion of the area located between Williamson Avenue and Edgemont Avenue. In July 2002 the church was given approval to subdivide their property and construct a 10,000 square foot office building; however, this development has not been built and no construction schedule has been filed with the county. Because the proposed pipeline would be constructed adjacent to Texas Eastern's existing pipeline in this area, no impacts on this planned development are anticipated.

The proposed pipeline would cross an abandoned railroad line within the limits of a sewage treatment facility at about MP 1.66. A community group called the Friends of Chester Creek is in the process of trying to turn the inactive rail line into a trail. According to the Friends of Chester Creek, the proposed rails-to-trails project is in the final planning stages and they are trying to secure right-of-way (Fusco, 2003); however, no permits have been obtained and no plans have been submitted to the township. Construction of the pipeline could temporarily affect this planned development if it were to occur after the trail is in operation or if the construction schedules of both projects overlap. Because of its location below ground, operation of the Logan Lateral Project would not affect use of the proposed trail.

A large development is currently under review for Chester Township by the Delaware County Planning Department immediately north of Concord Road. The 68-acre area is the proposed site for a business park that would contain nine buildings. The site is currently being cleared but a construction start date has not been provided to the county. Texas Eastern's existing pipeline right-of-way runs along the eastern edge of the property and the proposed pipeline would be adjacent to this existing pipeline. As a result, no impacts on this planned development are anticipated.

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Within Chester Township plans have also been filed with the county for the expansion of the Chester Charter School located on Green Avenue. The school is currently vacant and partially burned-out but the plans indicate an expansion of this facility although construction plans are currently on hold. The proposed pipeline route would be about 500 feet south of the building but Texas Eastern is planning to utilize the property surrounding the school for a staging area. The staging area would be used temporarily during construction and should not interfere with future development plans.

The existing PECO Chester Generating Station located adjacent to the Delaware River is currently being renovated for "Class A" office space by Rivertown Developers LP. A parking lot associated with the building is currently under construction. The proposed pipeline would cross the Delaware River adjacent to the office building and would cross the associated parking lot, which would be completed before pipeline construction. As a result, the installation of the pipeline would impact the newly constructed parking lot. To minimize parking-related impacts, Rivertown Developers LP has indicated that they could provide a vacant lot that Texas Eastern could asphalt in order to provide alternate parking for tenants during construction. Texas Eastern would repair any construction-related damage to the permanent parking lot after completion of construction. The portion of the development referred to as the Wharf on the Boardwalk would not be directly affected by pipeline construction or operation. Prior to construction, Texas Eastern would work with Rivertown Developers LP to minimize noise and traffic-related impacts on the development. We also evaluated alternative Delaware River crossing locations that would avoid this new development. However, these alternatives were not considered to be environmentally preferable to the proposed pipeline route (see section 3.5.2).

Within Logan Township, Gloucester County, New Jersey, a project proposal championed by the County Improvement Authority is in the preliminary planning stages and would include conversion of a dredge spoil area to a proposed equestrian park south of Raccoon Creek and west of U.S. Route 130. The proposed pipeline would cross the property under consideration for the equestrian park; however, no site plans for the proposed park have been submitted for approval at either the local or county level.

In addition to these planned developments, two dredge disposal sites proposed by the COE for its Delaware River Main Channel Deepening Project could be affected by the proposed Logan Lateral Project. One of the dredge disposal sites is located on Raccoon Island. The portion of the proposed pipeline route along Ferry Road on the island crosses this proposed disposal site. The other dredge disposal site is located west of Raccoon Creek adjacent to U.S. Route 130 (Site 15D). Texas Eastern met with the COE to discuss the proposed dredging of the Delaware River and the use of the proposed Raccoon Island Site and Site 15D for the disposal of dredged material. Texas Eastern is currently evaluating several options discussed with the COE to accommodate both the proposed dredging project and the Logan Lateral Project.

4.8.3 Coastal Zone Management

In 1972, Congress passed the CZMA to "preserve, protect, develop, and where possible, to restore or enhance, the resources of the nation's coastal zone for this and succeeding generations" and to "encourage and assist the states to exercise effectively their responsibilities in the coastal zone through the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone" (16 USC 1452, section 303 (1) and (2)).

Section 307 (c)(3)(A) of the CZMA states that "any applicant for a required federal license or permit to conduct an activity, in or outside the coastal zone, affecting any land or water use or natural resource of the coastal zone of that state shall provide a certification that the proposed activity complies with the enforceable policies of the state's approved program and that such activity will be conducted in a manner consistent with the program." In order to participate in the coastal zone management program, a

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state is required to prepare a program management plan for approval by the NOAA, Office of Coast and Ocean Resource Management (OCRM). Once the OCRM has approved a plan and its enforceable program policies, a state program gains "federal consistency" jurisdiction. This means that any federal action (e.g., a project requiring federally issued licenses or permits) that takes place within a state's coastal zone must be found to be consistent with state coastal policies before federal action can take place.

The Crown Landing LNG and Logan Lateral Projects are subject to a federal Coastal Zone Consistency Review because they would 1) involve activities within the coastal zones of New Jersey, Delaware, and Pennsylvania as described in sections 4.8.3.1, 4.8.3.2, and 4.8.3.3, respectively; and 2) require several federal permits and approvals (see tables 1.3-1 and 1.3-2). New Jersey, Delaware, and Pennsylvania all have approved coastal zone management programs administered by the NJDEP, the DNREC, and the PADEP, respectively. A description of each state's program, the applicable project activities, and information provided by Crown Landing in its FERC section 3(a) application and Texas Eastern in its FERC section 7(c) application regarding consistency of the projects with state policies is provided below.

4.8.3.1 New Jersey

The New Jersey Coastal Management Program (NJCMP) was approved by the OCRM in 1980 and updated in 2000. Federal consistency reviews are conducted by the NJDEP using the Coastal Zone Management rules, which contain several state laws that are the primary implementing authorities for the NJCMP. These laws included the Coastal Area Facility Review Act (CAFRA), the Waterfront Development Law, and the Wetlands Act of 1970, Tidelands Statues, and the Hackensack Meadowlands Reclamation and Development Act (NJDEP, 2002b). In addition to its coastline along the Atlantic Ocean, New Jersey's coastal zone includes, among other areas, the Delaware River and Bay and other tidal streams of the Atlantic Coastal Plain. New Jersey defines its coastal management area as including all lands up to 500 feet from mean high water.

The activities associated with the Crown Landing LNG and Logan Lateral Projects within the coastal zone of New Jersey and subject to the policies of the NJCMP include:

- the portion of the pier associated with the LNG terminal in waters under the jurisdiction of the State of New Jersey;
- the LNG terminal and associated transmission line facilities; and
- approximately 0.9 mile of the pipeline adjacent to and within the Delaware River, Raccoon Creek, Birch Creek, and two unnamed tidal waterways.

The Crown Landing LNG Project is not subject to the CAFRA or the Hackensack Meadowlands Reclamation and Development Act because the project facilities are not located within the areas subject to these laws[6]; however, it is subject to the other laws associated with the NJCMP. Crown Landing and Texas Eastern state that the projects would be consistent with the applicable rules; however, they have not yet filed draft federal consistency certifications with the NJDEP and have not received concurrence from the NJDEP regarding the project's consistency with the NJCMP. If the Crown Landing LNG and Logan Lateral Projects are approved by the Commission, concurrence from the NJDEP that the projects are

[6] The CAFRA area begins where the Cheesequake Creek enters Raritan Bay in Old Bridge in Middlesex County and extends south along the coast around Cape May and north along Delaware Bay to the Kilcohook National Wildlife Refuge in Salem County, about 15 miles downstream of the proposed LNG terminal site. The Hackensack Meadowlands District is a 19,730-acre area of water, wetlands, and associated uplands in Hudson and Bergen Counties.

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consistent with the NJCMP must be received prior to any issuance of a Notice to Proceed with construction from the Secretary of the FERC. Therefore, **we recommend that:**

- **Crown Landing and Texas Eastern file documentation of concurrence from the NJDEP that the projects are consistent with the NJCMP with the Secretary prior to construction.**

4.8.3.2 Delaware

The agency responsible for implementing Delaware's coastal zone management program is the DNREC. The Delaware Coastal Management Program (DCMP) was approved by the OCRM in 1979 and updated in 1993 and 1998. Delaware differentiates between the 'coastal zone' and the 'coastal strip' of the state. The coastal zone includes the entire state, which is managed by the DCMP through several state laws and authorities, including the federal CZMA. The coastal strip was defined by the Delaware State Coastal Zone Act of 1971 (DSCZA) as a band of land approximately 4 miles wide that parallels the entire Delaware coastline. The DSCZA is the primary authority for regulating heavy industry, manufacturing, and bulk transfer facilities in the coastal strip (DNREC, 2004b).

The offshore facilities of the Crown Landing LNG Project would be located within the coastal zone of Delaware, which extends to the New Jersey shoreline, and, therefore, would be subject to the policies of the DCMP. Crown Landing has not yet filed a draft federal consistency certification with the DNREC and has not received concurrence from the DNREC regarding the project's consistency with the DCMP. If the Crown Landing LNG Project is approved by the Commission, concurrence from the DNREC that the project is consistent with the DCMP must be received prior to any issuance of a Notice to Proceed with construction from the Secretary of the FERC. Therefore, **we recommend that:**

- **Crown Landing file documentation of concurrence from the DNREC that the project is consistent with the DCMP with the Secretary prior to construction.**

The offshore facilities would also be located within the coastal strip as defined by the DSCZA. According to the DSCZA, "heavy industry uses of any kind not in operation on June 28, 1971, are prohibited in the coastal zone and no permits may be issued therefore. In addition, offshore gas, liquid or solid bulk product transfer facilities which are not in operation on June 28, 1971, are prohibited in the coastal zone, and no permit may be issued therefore" (7 Del. C. 1953, § 7003; 58 Del. Laws, c. 175; 64 Del. Laws, C. 240, § 6; 66 Del. Laws, c. 256, § 1; 71 Del. Laws, c. 348, § 2). Bulk product transfer facilities are defined as "any port or dock facility, whether an artificial island or attached to shore by any means, for the transfer of bulk quantities of any substance from vessel to onshore facility or vice versa. Not included in this definition is a docking facility or pier for a single industrial or manufacturing facility for which a permit is granted or which is a nonconforming use. Likewise, docking facilities for the Port of Wilmington are not included in this definition" (7 Del. C. 1953, § 7002; 58 Del. Laws, c. 175; 61 Del. Laws, c. 116, § 88(a); 62 Del. Laws, c. 119, § 1,2; 63 Del. Laws, c. 191, § 1(a); 71 Del. Laws, c. 348, §).

Because the Crown Landing LNG Project would involve construction of a new pier and other facilities within Delaware's coastal zone to convey LNG from ships to the terminal, a determination on whether the facilities would be a permissible use under the DSCZA is required. On December 7, 2004, Crown Landing submitted an application to the DNREC for a status determination on the new pier within Delaware's coastal zone. The application is the first step in determining whether the pier would be permitted under the DSCZA. In its application, Crown Landing claims that the construction of the proposed pier is a permissible use under the DSCZA pursuant to the provisions of § 7002(f) of title 7 because it would exclusively support a single facility that meets the definition of "manufacturing" pursuant to § 7002(d).

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In a letter dated February 3, 2005 from DNREC to Crown Landing, the DNREC issued a Coastal Zone Act Status Decision, which determined that the proposed LNG off-loading pier in the Delaware River is prohibited by the State's Coastal Zone Act. The DNREC Decision has a 14-day appeal period, which was ongoing at the time of printing of this draft EIS. As a result, Crown Landing may seek to appeal the decision or present an alternative. Regardless, Crown landing would still be required to file documentation that the project is consistent with each affected states' coastal zone management program before any construction of the project could begin.

4.8.3.3 Pennsylvania

Pennsylvania's coastal zone management program is administered by the PADEP and its Coastal Zone Management Plan (PCZMP) was approved by the OCRM in 1980. The PCZMP is based on a network of regulatory and non-regulatory policies that require specific coastal activities to comply with performance standards defined in the plan and in the regulations of other state authorities (PADEP, 2002). Pennsylvania's coastline along the Delaware River is 57 miles long and includes land in Bucks, Philadelphia, and Delaware Counties. The coastal zone along this area varies from about 0.1 mile wide in urban areas to over 3.5 miles in rural areas and extends to the boundary with New Jersey in the middle of the Delaware River. In the proposed project area, the coastal zone parallels the active Amtrak/SEPTA rail line running north to south. About 0.8 mile of the pipeline associated with the Logan Lateral Project would be located within the coastal zone of Pennsylvania and subject to the policies and performance standards of the PCZMP.

Texas Eastern has not yet filed a draft federal consistency certification with the PADEP and has not received concurrence from the PADEP regarding the project's consistency with the PCZMP. If the Logan Lateral Project is approved by the Commission, concurrence from the PADEP that the project is consistent with the PCZMP must be received prior to any issuance of a Notice to Proceed with construction from the Secretary of the FERC. Therefore, **we recommend that:**

- **Texas Eastern file documentation of concurrence from the PADEP that the project is consistent with the PCZMP with the Secretary <u>prior to construction</u>.**

4.8.4 Hazardous Waste Sites

No hazardous waste sites have been identified within the proposed LNG terminal site; however, eight potential areas of concern were identified through site reconnaissance and a prior Phase I Environmental Site Assessment. Soils around two of the sites contained elevated concentrations of total petroleum hydrocarbons and one site contained elevated concentrations of arsenic. No contamination was found at the remaining five sites. Additional information on potential contamination of soils and groundwater within the LNG terminal site are provided in sections 4.2.1 and 4.3.1, respectively, and potential contamination of sediments within the Delaware River is provided in section 4.2.2.

A search of several databases was conducted to identify hazardous waste sites within 0.25 mile of the proposed pipeline facilities. The databases identified a total of 30 hazardous, potentially hazardous, and solid waste sites crossed by or located within 0.25 mile of the proposed pipeline facilities (see table 4.8.4-1).

The proposed pipeline would cross three hazardous waste sites and would be located adjacent to three others. Two of the sites crossed by the pipeline are located in Logan Township in New Jersey and include the former Monsanto Chemical Company facility (currently Ferro Solutions) and the Logan Generating facility. Both sites have a history of spills and releases involving chemical substances such as nitrogen oxide, diesel fuel, chlorine gas, hydrochloric acid gas, and other chemicals. The Monsanto

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Company is a Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) site that has received no further remedial action and is listed for spill and releases in addition to other corrective actions. The Logan Generating facility is also listed for spills and releases. The third site is the PECO Chester Generating Station located adjacent to the Delaware River. The site is listed as a small-quantity generator and according to the PADEP has undergone past remediation associated with its historical use as a coal-fired generating plant. The site was reportedly remediated under the PADEP Act 2 program.

The three sites located adjacent to the proposed pipeline route include a LUST site, a solid waste facility, and a CERCLIS site. The AMF Auto Clinic is located along Edgemont Avenue and had a LUST resulting in petroleum contamination that has since been remediated. The state waste facility located adjacent to the pipeline route is the Haulaway/Bantas Transfer Station located at 2nd Street. This site is registered as a solid waste facility and landfill and is a private facility that processes municipal waste. The last site is Front Street Tanker, which is a CERCLIS site owned by the City of Chester. Two abandoned tankers were discovered onsite in 1988, one of which contained oil contaminated with PCBs.

Contaminated soils associated with these or other, undocumented hazardous waste sites could be encountered during construction of the proposed pipeline facilities. To reduce any potential impacts, we have recommended that Texas Eastern prepare a Plan for the Discovery and Management of Contaminated Soils and Groundwater (see section 4.2.1).

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TABLE 4.8.4-1

Potential Hazardous and Solid Waste Sites within 0.25 Mile of the Proposed Pipeline Facilities

State	Name/Address	Milepost	Distance/Direction from Centerline (feet)	Description
Pennsylvania				
	Neary Property 165 Ridge Blvd, Brookhaven	0.20	1,320/west	Unregulated leaking tanks. Contaminant is BTEX and the status of the case is unknown.
	Atlantic 4236 Edgemont Ave, Brookhaven	0.20	1,320/west	Leaking underground storage tank containing petroleum. Remedial actions have been initiated or completed.
	Brookhaven Boro Bldg Edgemont Ave/Brookhaven Rd	0.20	660/west	Leaking underground storage tank containing petroleum Case is inactive. Also unregulated leaking tanks with fuel oil #2. Case is closed.
	AMF Auto Clinic 3808 Edgemont Ave, Brookhaven	0.20	Adjacent	Leaking underground storage tank containing petroleum. Cleanup has been completed
	Sec Cleaner Service 3401 Edgemont Ave, Brookhaven	0.20	792/east	Leaking underground storage tanks containing fuel oil #2. Status of case is unknown.
	M&M Restaurant Supply One McDonald Drive, Aston	2.00	924/west	Leaking underground storage tank containing petroleum. Cleanup has been completed
	Penske Truck Leasing 10 McDonald Blvd, Aston	2.00	924/west	Two leaking underground storage tanks both containing petroleum. One has had cleanup completed and the status of the second is unknown.
	Jefferson Smurfit 100 McDonald Blvd, Aston	2.00	924/west	Unregulated leaking tanks containing PHC's The status of the case is unknown.
	Action Mailers 90 Commerce Drive, Chester	2.27	528/northwest	Unregulated leaking tanks with BTEX as a contaminant. The status of the case is unknown.
	Ashland Aston Chemical Dis. Fac. 100 N. Commerce Drive, Aston	2.27	670/northwest	Voluntary Cleanup Program and Act 2 Non-residential and site specific cleanup standards.
	Delco Beverage Co. 100 Commerce Drive, Aston	2.27	670/northwest	Leaking underground storage tank containing petroleum. Cleanup completed.
	Alloy Surfaces Co., Inc. 121 N. Commerce Drive, Chester	2.27	1,320/northwest	Site has numerous FINDS violations dating from 2000 to 2003. Site is also a large quantity generator and has three ASTs containing chemicals.
	Benjamin Beeneker Plaza Apts 2101 W. 7th St, Chester	3.55	1,320/east	Contains unregulated tanks with fuel oil #2. Cleanup is required but status of the case has not been reported.
	Teledyne Packaging 2300 W. Fourth St, Chester	3.76	550/east	Leaking underground storage tanks containing petroleum. Also unregulated tanks with BTEX contaminant. Closure not reported.
	B&S Mobile 2200 W. 2nd St, Chester	3.92	770/east	Leaking underground storage tank containing petroleum. Remedial action initiated in 1994 and 2001. No status given.

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TABLE 4.8.4-1 (cont'd)

Potential Hazardous and Solid Waste Sites within 0.25 Mile of the Proposed Pipeline Facilities

State	Name/Address	Milepost	Distance/Direction from Centerline (feet)	Description
	West End Boat Club Jeffery St/Delaware Ave, Chester	3.92	1,210/east	Leaking underground storage tank. Release of petroleum contaminant in 1989. Status inactive.
	Haulaway/Bantas Transfer Station 24-1 W. 2nd St, Chester	3.92	Adjacent	State waste facility landfill. Private operation that does municipal processing
	Shahadis Landfill 2614 W. 3rd St, Chester	3.83	650/northeast	Historic inactive landfill.
	PECO Gould Chemclear Jeffery St/Delaware Ave, Chester	4.00	880/southeast	Site has designation of FINDS, RAATS, CORRACTs, and small quantity generator.
	Front Street Tanker Front/Ward Streets, Chester	4.10	Adjacent	CERCLIS site owned by the municipality. Two abandoned tankers onsite, one containing oil contaminated with PCBs.
	Chestrees Coalition 235 Hayes Street, Chester	4.24	660/northwest	Unregulated leaking tanks containing fuel oil #2. Status of case is unknown.
	Westinghouse Electric Corp. Front/Thurlow Streets, Chester	4.24	800/west	State waste facility and landfill. Facility type is residential incinerator and has a private operating status Also acts as a municipal transfer station.
	Delaware WTE Chester City	4.36	600/southwest	State waste facility and landfill. Municipal facility type.
	PECO Chester Generating Station Chester	4.47	Traverse	Small quantity generator. Site has undergone past remediation associated with is historical use as a coal-fired generating plant.
New Jersey				
	Bridgeport Boat Yard 116 Buttonwood Lane, Bridgeport	6.26	1,320/south	Leaking underground storage tank. Site has been issued letter of no further action. Site has one area of concern with one media of concern.
	Bridgeport Maintenance Facility Rt 130, Logan Twp	7.19	402/east	State hazardous waste site. Active site with on-site sources of contamination.
	Monsanto Chemical Co (aka Solutia, Ferro) Route 130, Bridgeport	9.65	Traverse	Numerous spills and releases of chlorine gas, hydrochloric acid gas, butyl benzyl phthalate.
	Bridgeport Airport Route 322, Logan Twp.	8.52	1,320/southeast	State hazardous waste site. Site with on-site sources of contamination. Case status pending.
	Logan Twp Municipal Utility Authority Jefferson Lane & Route 130, Bridgeport	9.00	660/southeast	Numerous spills of raw sewage exist and releases to the Delaware River
	Logan Generating Station (aka Keystone Co-Gen Plant) Route 130, Logan Twp.	10.00	Traverse	Numerous historical spills and releases of nitrogen oxide, diesel fuel, and sulfur dioxide.

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4.8.5 Recreation and Public Interest Areas

The Crown Landing LNG and the Logan Lateral Projects would not affect any state forest land, national or state parks, Indian reservations, wild and scenic rivers, designated natural or scenic areas, game management areas, or registered natural landmarks. There are no developed recreation sites located on or adjacent to the LNG terminal site. There are, however, several other designated recreation and public interest areas located near the proposed facilities or crossed by the proposed pipeline. Areas for general recreational activities, including boating and fishing, are also located in the project area.

4.8.5.1 Designated Recreation and Public Interest Areas

New Jersey

The closest recreational areas to the LNG terminal in New Jersey are located approximately 4 miles from the site. About 13 acres of public recreation land is located on Beckett Road approximately 4 miles south of the terminal site and a 0.5-acre playground is located approximately 4 miles east of the terminal site in Bridgeport. Because of the distance from the proposed LNG terminal site, the Crown Landing LNG Project would not affect recreational uses in these areas.

The portion of the proposed pipeline in New Jersey would not cross any designated recreation or public interest areas.

Delaware

The closest recreational site in Delaware to the proposed LNG terminal is Fox Point State Park, which is located approximately 3.3 miles southwest of the site along the Delaware River. The park is about 171 acres in size and includes picnic pavilions, bike and pedestrian trails, playgrounds, and volleyball courts. In the summer, the park averages about 300 visitors per day. Because of the distance from the proposed LNG terminal site, the Crown Landing LNG Project would not affect recreational activities at Fox Point State Park. Crown Landing did, however, conduct a visual analysis from Fox Point State Park to determine if the proposed LNG terminal would be visible from the park and to determine the potential impacts on visual resources (see section 4.8.6.1).

The pipeline would not affect any recreational areas in Delaware.

Pennsylvania

The closest recreational sites in Pennsylvania to the LNG terminal site include the Marcus Hook Public Park and the Wharf on the Boardwalk, both of which are located along the Delaware River. Marcus Hook Public Park is located about 1.1 miles northwest of the LNG terminal site. The park includes a picnic pavilion and playground equipment. The Wharf on the Boardwalk is a planned commercial development, which will be located immediately downriver from the Commodore Barry Bridge and approximately 3.2 miles from the LNG terminal site. Because of the distances from the proposed LNG terminal site, the Crown Landing LNG Project would not affect recreational activities or other uses at either of these facilities. Crown Landing did, however, conduct a visual analysis from both Marcus Hook Public Park and the Wharf on the Boardwalk development to determine if the proposed LNG terminal would be visible from these locations and to determine the potential impacts on visual resources (see section 4.8.6.1).

The Pennsylvania portion of the proposed pipeline would cross Veteran's Memorial Park in the City of Chester for about 1,200 feet at MP 3.59. This municipal park consists mainly of maintained grass

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and baseball and football playing fields. The peak period for park usage is during the summer months but the park does not have any seasonal restrictions. Disruption and noise during construction could preclude the use of the park and temporarily restrict park activities. The degree of these impacts would depend on the timing of construction. Construction of the pipeline during the summer months when park activities are at their peak would cause more of a disruption than construction during the off-peak, winter months. Some of the construction-related impacts would be unavoidable but the duration of the impacts would be short-term, lasting several days to several weeks until the right-of-way and affected park areas are restored in accordance with the requirements specified in the easement agreement between the City of Chester and Texas Eastern. Texas Eastern would also implement measures to minimize disruption to the park, including scheduling work during non-peak hours of the day. Operation of the pipeline would not affect long-term park activities because the construction and permanent right-of-way would be allowed to revert to former use; however, certain activities such as the construction of aboveground structures or the planting of trees would be prohibited within the permanent right-of-way.

The pipeline would also cross land associated with the First Baptist Church (between MPs 0.08 and 0.15) and Toby Farms School (MP 1.32). Disruption and noise during construction would temporarily restrict activities in these areas. Some of the construction-related impacts would be unavoidable but the duration of the impacts would be short-term, lasting several days to several weeks until the right-of-way and affected areas are restored in accordance with the requirements specified in the easement agreement between the owners of these facilities and Texas Eastern. Operation of the pipeline would not affect long-term activities in these areas because the construction and permanent right-of-way would be allowed to revert to former use; however, certain activities such as the construction of aboveground structures or the planting of trees would be prohibited within the permanent right-of-way. A proposal by Faith Baptist Church to subdivide its property and construct a 10,000 square foot office building and the potential impacts associated with pipeline construction and operation is discussed in section 4.8.5.1.

4.8.5.2 General Recreation

The Delaware River provides ample opportunities for recreational boating and fishing. There are six public boating access points to the Delaware River and its tributaries in the vicinity of the proposed projects. The closest of these boating access points to the LNG terminal site is the Borough of Marcus Hook Boat Ramp approximately 1.3 miles to the north. The others include the Richards Buttonwood Marina (2.5 miles east), Bridgeport Boat Yard (2.7 miles northeast), Raccoon Creek Boat Club (2.8 miles northeast), City of Chester Boat Ramp (3.5 miles northeast), and 7th Street Park Boat Ramp (7.7 miles southwest).

The Richards Buttonwood Marina, Bridgeport Boat Yard, and Raccoon Creek Boat Club are all located on Raccoon Creek within Logan Township in New Jersey and have 12, 20, and 30 boat slips, respectively. There is an operating drawbridge where U.S. Route 130 crosses Raccoon Creek, allowing larger boats access to the upstream segment of Raccoon Creek. The bridge is opened an average of 300 times per year, primarily during the summer months, and is operated by the New Jersey Department of Transportation (NJDOT). Approximately half of the annual openings are for boats and the other half are for testing and training (NJDOT, 2003).

There are no marinas on Oldmans Creek but there is a single, private residential dock in use on the west side of Oldmans Creek downstream of the U.S. Route 130 bridge near the LNG terminal site. This bridge is still used as part of U.S. Route 130 but the drawbridge is no longer functional. Bridge clearance over Oldmans Creek is approximately 5 feet, allowing only limited passage to low boats.

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Delaware River boat access from the Pennsylvania side of the river in the project area is provided by the Borough of Marcus Hook Boat Ramp or the City of Chester boat ramp at the base of the Commodore Barry Bridge (PAFBC, 2003b). River access from Delaware is provided by the Christina River at the 7th Street Park Boat Ramp in Wilmington (DNREC, 2003).

Boating on the Delaware River in the project area is primarily limited to power boating for recreation and fishing. Water-skiing is rare. Sailboats are occasionally observed on the river but the trips originate from outside the project area. There is some evidence that the proposed LNG terminal site has been used informally for recreational fishing and hunting. These activities have not been permitted by the property owners and the site is posted with "No Trespassing" signs.

The Delaware River Creek Survey (DRCS) prepared for the Delaware River Basin Commission provides the most recent fishing data for the Delaware River. The objectives of the DRCS were to determine the amount of recreational angler fishing that took place on the Delaware River from mid-March through October 2002. The survey area included the tidal and non-tidal portions of the river, from the Delaware Memorial Bridge to Downsville, New York.

For the purposes of water-based recreation, the project area was defined as a 7-mile-long portion of the Delaware River from RM 75, located 6 miles upstream of the Delaware Memorial Bridge, to RM 82 at the Commodore Barry Bridge. Uniform distribution of fishing activity throughout the tidal portion of the Delaware River was assumed, which means that the project area for water-based recreation represents approximately 10 percent of the total tidal fishing activity in the DRCS. Highlights of the DRCS as applied to the project area using the assumptions mentioned above are as follows:

- total fishing effort for the project area is estimated to be about 4,019 trips encompassing 13,962 hours of fishing;
- the average length of a fishing trip for boat anglers was 4.3 hours. Shore angler trips averaged 2.1 hours;
- approximately 66 percent of the total fishing effort occurred from March through June, coinciding with major fish spawning runs;
- daytime fishing (7 AM to 9 PM) accounted for 92 percent of the total fishing effort;
- aerial surveys showed that 90 percent of the fishing was from boats. Many anglers were observed fishing from large (greater than 20 feet in length) recreational fishing boats, especially on weekends;
- approximately 85 percent of the fishing was catch and release; and
- channel catfish was the most common species caught.

Overall the popularity of recreational fishing in the immediate project area is limited due to fish consumption advisories for the lower Delaware River associated with the risks of PCB or dioxin contamination (NJDEP, 2003e). There is a small commercial bait fishery in the project area but there is no commercial fishery for human consumption. In addition to the Delaware River, the mouth of Oldmans Creek is a popular fishing area and is located approximately 3,500 feet downriver of the LNG terminal site.

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Construction-related activities associated with the LNG terminal could impact recreational boating and fishing within the Delaware River and its tributaries. These include the dredging of the ship berth at the LNG terminal site and construction activities associated with the pier. Construction of the pipeline across the river would not have an affect on recreational boating and fishing because it would be installed using the HDD construction method (see section 2.4.2.2). In accordance with federal and state restrictions to protect anadromous fish during migration and spawning, dredging would only be conducted between August 2 and March 14. According to the DRCS, less than one third of the annual recreational fishing effort occurs during this period because most fishing activities coincide with the major fish spawning runs from March through June. As a result, the proposed dredging should not have a significant impact on recreational fishing in the area. Safety zones would not be required around the pier during construction but noise from pile driving associated with the pier could discourage recreational fishing in the immediate vicinity. However, pile driving for the pier would also be limited to between August 2 and March 14 and would not coincide with the prime fishing season.

Operation of the project facilities would only impact recreational boating and fishing during the arrival, unloading, and departure of the LNG ships. Crown Landing estimates that about two to three ships per week would transit the Delaware River to deliver its cargo to the LNG terminal. Docks in the area currently accommodate both industrial and commercial ships, including liquefied petroleum gas (LPG) ships. As a result, marine traffic associated with the project would not introduce any significant new type of impacts on recreational boating or fishing. However, as part of its Letter of Recommendation, the Coast Guard would impose safety exclusion zones around LNG ships during transit up the Delaware River and while berthed at the LNG terminal. The Coast Guard has not yet determined the extent of a safety exclusion zone that would be enforced around LNG ships on the Delaware River and Bay. The Coast Guard currently enforces a Regulated Navigation Area (RNA) under 33 CFR 165.510 for vessels carrying "dangerous cargoes" within the Delaware River and Bay. This RNA places additional requirements on vessels carrying dangerous cargoes as well as vessels operating in the vicinity of those carrying dangerous cargoes.

The safety exclusion zones enforced around each LNG ship and around the ship unloading facility while a ship is docked would be restricted to boaters. This could cause impacts on recreational boating and fishing but the impacts would be temporary while the boat is in transit or moored at the ship unloading facility. Because of the relatively low volume of recreational boating in the immediate project area, any impacts are expected to be minor. The popular fishing area at the mouth of Oldmans Creek could be temporarily affected during LNG ship transit past the area but any impacts would be minor and short term (i.e., lasting only several minutes). If the Coast Guard requires a 1,500-foot safety exclusion zone for the LNG ships, the area would not be affected when an LNG ship is berthed at the terminal because the safety exclusion zone would not extend to the mouth of the creek, which is 3,500 feet from the proposed pier. Additional information on marine traffic and the safety exclusion zones is presented in sections 4.9.4.2 and 4.12.5.

Shoreline fishing from the LNG terminal site would be prohibited. As previously discussed, the site is posted with "No Trespassing" signs so only those currently using the site without the owner's permission would be affected. In addition, according to the DRCS, shoreline fishing accounts for only approximately 10 percent of the total fishing effort on the Delaware River.

4.8.6 Visual Resources

4.8.6.1 LNG Terminal

The degree of visual impact that may result from a proposed project is typically determined by considering the general character of the existing landscape and the visually prominent features of the

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proposed facility. The proposed LNG terminal would be constructed at a currently undeveloped site, primarily consisting of wetlands and agricultural fields. The site is surrounded by a mixture of industrial, agricultural, open space, and scattered residential uses. The site is bordered on the north and west by the Delaware River; the east by industrial uses and U.S. Route 130; and the south by Oldmans Creek and open areas. The terrain in the area of the site is relatively level and low-lying with elevations ranging from sea level to approximately 10 feet above mean sea level.

The dominant visual feature in the area of the LNG terminal site is the Logan Generating Station. The station itself is 180 feet high and the combustion stack is 430 feet high, which is visible from public roads, bridges, and the Delaware River. A coal pier serving the Logan Generating Station extends approximately 1,500 feet into the Delaware River and the coal storage facility is located along the shoreline. Northeast of the Logan Generating Station is the Ferro Industries facility. The Ferro plant includes industrial buildings, aboveground pipes, and tanks that are clearly visible from U.S. Route 130. The primary visual character along other areas on U.S. Route 130 is rural with views of open land, farm fields, small clusters of one and two story residential structures, and scattered businesses. The right-of-way along U.S. Route 130 is heavily vegetated and provides limited views into the proposed LNG terminal site. The shoreline along the Delaware River at the LNG terminal site is mostly wooded and currently has a relatively natural appearance from the water with the exception of two large warning signs on the site indicating the presence of underwater pipeline crossings. Powerlines and cell phone towers in the project area also interrupt views of an otherwise rural landscape.

The western shore of the Delaware River in Pennsylvania and Delaware (e.g., Marcus Hook) is a heavily industrialized area. The oil refineries and other heavy industry located in this area are visually prominent with large storage tanks, emission stacks, and burning flares from almost all vantage points.

The COE uses a Management Classification System (MCS) to provide general guidelines on the degree of and nature of visual change acceptable in a landscape (COE, 1988b). The five management classes include: preservation, retention, partial retention, modification, and rehabilitation, with preservation area having the most distinct visual quality and rehabilitation having the least distinct visual quality. The characteristics and visual management objectives for these areas include:

- *Preservation:* areas considered to be unique and having the most distinct visual quality in the region. They are highly valued and are often protected by federal and state policies and laws. While limited project activity is not precluded, it should not be readily evident.

- *Retention:* areas are regionally recognized as having distinct visual quality but may not be institutionally protected. Project activity may be evident but should not attract attention.

- *Partial Retention:* areas are locally valued for above average visual quality but are rarely protected by institutional polices. Project activity may attract attention and dominate the existing visual resource.

- *Modification:* areas are not noted for their distinct qualities and are often considered to be of average visual quality. Project activity may attract attention and dominate the existing visual resource.

- *Rehabilitation:* areas are noted for their minimal visual quality and are often considered blighted areas. Project activity should alter the existing undesirable visual resources.

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Based on the characteristics of these management classes, the proposed LNG terminal site would be included in the 'modification' class.

The most prominent visual feature of the proposed LNG terminal would be the LNG storage tanks. The tanks would be about 250 feet in diameter and about 175 feet high. Other prominent visual features include:

- an approximately 2,000-foot-long pier that would extend approximately 1,650 feet into the Delaware River and be located approximately 15 feet above mean sea level;
- a 140-foot-high nitrogen distillation tower;
- a 120-foot-high emergency flare tower; and
- a berth for a single LNG ship. The LNG ships would be up to about 1,000 feet long and would be berthed at the LNG terminal approximately 30 to 40 percent of the year.

The facility would also include one story buildings to the east of the LNG storage tanks, including administrative shelters and offices, and meter and regulation stations to the west of the LNG storage tanks. Approximately 3,500 feet of dual feed electric transmission line supported on transmission poles spaced about 225 feet apart would also be installed as part of the project. The poles would be approximately 47.5 feet high. This transmission line would replace a smaller existing powerline that extends along the site entrance road to the proposed terminal area.

The terminal and pier would be lit at night for safety and security reasons. Lighting at the terminal would be based on nationally recommended practices and in accordance with recommended illumination levels. Outdoor area lighting would be provided for all process areas and certain roadways. Security lighting would be provided on the perimeter fence around the terminal, on the pier roadway, and beneath the pier structure. The LNG storage tanks and other elevated structures would be equipped with warning lights to comply with air safety regulations. Navigational lighting would be installed on the marine structures in accordance with applicable code requirements.

A visual analysis was completed from eight vantage points to determine the potential visual impacts associated with the LNG terminal. A summary of the visual analysis is presented in table 4.8.6-1.

As previously discussed, the project area is in the modification management class landscape where projects may display aesthetic characteristics of form, line, color, texture, scale, and composition that differ from those of the existing visual resources and where project should exhibit good design and visual compatibility with its surroundings (COE, 1988b).

From most vantage points, views of the LNG terminal would be far ground or distant views. Near ground or close views would be limited to views from the Delaware River from commercial ships and the few recreational boats that use the area around the LNG terminal site. Moderate to distant views would occur from Marcus Hook Public Park. Views form the Commodore Barry Bridge would be brief and intermittent. Similar views would occur from the Wharf on the Boardwalk development except that these views may be long or short in duration. The views from both the Commodore Barry Bridge and the Wharf on the Boardwalk would be distant and partially obscured.

The terminal facilities would be partially visible from U.S. Route 130 and areas in Logan or Oldmans Township but would be somewhat screened by vegetation. By using the existing site entrance,

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Crown Landing would preserve and possibly enhance the vegetative screening between the terminal facilities located along the shoreline and U.S. Route 130.

While the LNG terminal would be visible and permanently impact visual resources in the area, the overall aesthetic effect would be minor. The visual character in the project area is defined by heavy industrial uses, dredged material disposal sites with clearly engineered slopes, the Commodore Barry Bridge, Interstate 495, and the large commercial ships that transit through this segment of the Delaware River. Many of these existing uses have already introduced large vertical and horizontal elements into the landscape along the Delaware River. The facilities associated with the Crown Landing LNG Project would be visually compatible with their surroundings and consistent with the management objectives of the modification class.

4.8.6.2 Pipeline Facilities

The pipeline facilities would be located on private or local lands that are not subject to federal or state visual management standards. Visual resources along the pipeline route are a function of geology, climate, and historical processes and include topographic relief, vegetation, water, wildlife, land use, and human uses and development. The vegetation along the pipeline route consists largely of grasses, shrubs, and small- to medium-diameter trees on mostly flat to rolling terrain. In Pennsylvania, the proposed pipeline route crosses predominantly mixed commercial and residential areas with maintained lawns.

Texas Eastern proposes to use a maximum of a 100-foot-wide construction right-of-way. Some areas along the route would be widened for temporary extra workspaces. Visual impacts associated with the construction right-of-way and temporary extra workspaces would include the removal of existing vegetation and the exposure of bare soils, as well as earthwork and grading scars associated with heavy equipment tracks, trenching, and machinery and tool storage. Other visual effects could result from the removal of large individual trees that have intrinsic aesthetic value; the removal or alteration of vegetation that may currently provide a visual barrier from undesirable views; or landform changes that introduce contrasts in visual scale, spatial characteristics, form, line, color, or texture.

Visual impacts would be greatest where the pipeline route parallels or crosses roads and the pipeline right-of-way may be seen by passing motorists, on residents where landscaping and vegetation would be removed, and in forested areas. The duration of visual impacts would depend on the type of vegetation that is cleared or altered. The impact of vegetation clearing would be shortest in open lands consisting of scrub-shrub vegetation, where the reestablishment of vegetation following construction would be relatively fast (generally less than 5 years). The impact would be greater in forest land, which would take many years to regenerate mature trees. The greatest potential visual impact would result from the removal of large specimen trees, which would take longer than other vegetation types to regenerate and would be prevented from reestablishing on the permanent right-of-way.

Construction and operation of the modified and new aboveground facilities associated with the pipeline would have a permanent impact on visual resources. However, the modifications at Chester Junction would occur within the limits of the existing facility so no significant impacts on visual resources are anticipated. The site for the new Crown Landing meter and regulation station is currently undeveloped but would be part of the proposed 175-acre LNG terminal site. The meter station would be located adjacent to the buildings and facilities associated with the LNG terminal so they would not have a significant impact on visual resources. As previously discussed, the LNG terminal would be visually compatible with its surroundings and consistent with the management objectives of the modification class (see section 4.8.6.1).

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TABLE 4.8.6-1

Summary of Visual Analysis Conducted for the Crown Landing LNG Project

Vantage Point (State)	Depth of View	View Type and Duration	Number of Daily Viewers	Spatial Dominance a/	Scale Contrast b/	Compatibility c/	Overall Visual Effect d/
Delaware River (Delaware)	Near, middle, and distant views depending on boat location	Unobstructed view. Short or long duration.	An average of 22 recreational boats and 8 commercial vessels per day.	Co-dominant to subordinate, depending on view	Moderate	Somewhat compatible	Slight to high, depending on boat location
Marcus Hook Public Park	Distant View (1.1 miles)	Unobstructed view. Short or long duration.	Unknown	Co-dominant to subordinate, depending on view	Moderate	Somewhat compatible	Slight to moderate depending on location and interest
Fox Point State Park (Delaware)	Distant View (3.3 miles)	Unobstructed. Short or long duration.	An average of 300 visitors per day (summer average).	Subordinate	Moderate	Somewhat compatible	Slight
Interstate 495, MP 8 (Delaware)	Distant View (1.2 miles)	Intermittent sightlines. Short duration.	An average of 81,200 vehicles per day.	Subordinate	Moderate	Somewhat compatible	Slight
Commodore Barry Bridge, east & west bound travel (New Jersey/Pennsylvania)	Elevated but distant view (3.1 miles)	Obscured by bridge and barriers. Short duration.	An average of 16,500 vehicles per day.	Co-dominate	Moderate to minimal	Compatible	Slight
The Wharf on the Boardwalk	Distant View (3. 2 miles)	Unobstructed. Shore or long duration.	Unknown, still under construction	Subordinate	Moderate to minimal	Compatible	Slight
U.S. Route 130, including the bridge over Oldmans Creek (New Jersey)	Mid-ground view (0.5 mile)	Partially obscured by vegetation Short duration.	An average of 4,700 vehicles per day.	Co-dominant to subordinate depending on the view.	Moderate	Somewhat compatible	Slight to moderate
Delaware Memorial Bridge, east & west bound travel (Delaware)	Distant view (10 miles)	Obscured by bridge. Short duration.	An average of 80,000 vehicles per day.	Subordinate	Moderate to minimal	Compatible	Negligible

a/ Spatial dominance is the prevalent occupation of a space in a landscape by an object(s) or landscape element. Spatial dominance can be described in terms of being dominant, co-dominant, or subordinate.
Dominant – the modification is the major object or area in a confined setting and occupies a large part of the setting.
Co-dominant – the modification is one of the major objects or areas in the confined setting and its features are of equal visual importance.
Subordinate – the modification is insignificant and occupies a minor part of the setting.

b/ Scale contrast is the difference in absolute or relative scale in relation to other distinct objects or areas in the landscape. Scale contrast can be described in terms of being severe, moderate, or minimal.
Severe – the modification is much larger than the surrounding objects.
Moderate – the modification is slightly larger than the surrounding objects.
Minimal – the modification is much smaller than the surrounding objects.

c/ Compatibility is the degree to which landscape elements and characteristics are still unified within their setting. Compatibility can be described in terms of being compatible, somewhat compatible, or not compatible.
Compatible – the modification is harmonious within the setting.
Somewhat Compatible – the modification is more or less harmonious within the setting.
Not Compatible – the modification is not harmonious within the setting.

d/ High – clear, unobstructed views of the project.
Moderate – project will be visible, but views will be of short or medium duration and wholly or partially obscured.
Slight – project will be visible, but views will be of short duration and/or blend into the background and will be dominated by existing features in the landscape
Negligible – site will be scarcely visible.

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4.9 SOCIOECONOMICS

The potential socioeconomic effects from construction, operation, and maintenance of the Crown Landing LNG and Logan Lateral Projects are related to the number of construction workers that would work on the project and their impact on population, public services, nearby homes and businesses, and temporary housing during construction. Other potential impacts are related to construction and operation of the LNG terminal, such as increased ship traffic or disruption of normal vehicular traffic patterns in the vicinity of the terminal site.

The potential impacts of the project on land use and residences in the project area are discussed in section 4.8. A discussion of the project's effects on population and employment, housing, public services, transportation and traffic, property values, tax revenue, and environmental justice is provided below.

4.9.1 Population, Economy, and Employment

Table 4.9.1-1 provides a summary of selected demographic and socioeconomic statistics for the state, county, and communities where project facilities are proposed. The population of Gloucester County, New Jersey was 254,673 in 2000, which was a 10.7 percent increase over the 1990 population. The population of Delaware County, Pennsylvania was 550,864 in 2000, which was a 0.6 percent increase over the 1990 population. New Castle County, Delaware, located across the Delaware River from the proposed LNG terminal site, had a population of 500,265 in 2000, which was a 13.2 percent increase over the 1990 population.

Logan Township, where the proposed LNG terminal would be located, has a population density lower than the rest of Gloucester County and the State of New Jersey. Of the communities crossed by the proposed pipeline, the City of Chester and Brookhaven Borough have the highest populations and population densities in the project area. These communities have higher population densities than that of Delaware County and the State of Pennsylvania.

The main industries in the counties and communities that would be affected by the projects are trade, transportation, and utilities, and educational, health, and social services. The unemployment rate for Logan Township is well below the unemployment rate for Gloucester County and the State of New Jersey (5.8 percent). In Pennsylvania, the unemployment rates in the communities crossed by the Logan Lateral are higher than the state rate of 3.5 percent. Specifically, the City of Chester has the highest unemployment rate (9.9 percent), which is more than triple the unemployment rate for Delaware County (3.1 percent). The City of Claymont has a lower unemployment rate (3.0 percent) than both New Castle County and the State of Delaware.

Crown Landing estimates that an average of 360 workers would be employed during the 36-month-long construction period for the LNG terminal, with a peak workforce of approximately 650 personnel during construction months 15 through 22. Texas Eastern estimates that 275 workers would be required to construct the natural gas pipeline facilities. Crown Landing and Texas Eastern estimate that the vast majority of the workers would be hired locally (i.e., within 50 miles of the project facilities), with a total of approximately 90 non-local workers temporarily relocating from outside the project area. The non-local hires would include personnel highly qualified in mechanical, electrical, and instrumentation work and control tradesmen.

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TABLE 4.9.1-1

Existing Socioeconomic Conditions for the Crown Landing LNG and Logan Lateral Projects

State/County/ Community	Population 1990	Population 2000	Population Density a/ 1990	Population Density a/ 2000	Per Capita Income (2000)	Civilian Labor Force (2000)	Unemployment Rate (percent) 2000	Major Industry b/
NEW JERSEY	7,730,188	8,414,350	1,042	1,134	27,006	4,194,931	5.8	Trade, transportation, and utilities
Gloucester County	230,082	254,673	709	784	22,708	132,737	6.0	Trade, transportation, and utilities
Logan Township	5,147	6,032	228	267	26,853	3,138	1.9	Trade, transportation, and utilities
DELAWARE	666,168	783,600	341	401	23,305	401,152	3.4	Educational, health, and social services
New Castle County	441,946	500,265	1,037	1,174	25,413	263,440	3.5	Educational, health, and social services
City of Claymont	9,800	9,220	4,645	4,371	20,211	4,799	3.0	Educational, health, and social services
PENNSYLVANIA	11,877,228	12,281,054	265	274	20,880	6,000,512	3.5	Educational, health, and social services
Delaware County	547,579	550,864	2,976	2,990	25,040	272,268	3.1	Educational, health, and social services
City of Chester	41,856	36,854	8,636	7,604	13,052	15,898	9.9	Educational, health, and social services
Chester Township	5,399	4,604	3,856	3,302	16,072	2,015	5.4	Educational, health, and social services
Brookhaven Borough	8,567	7,985	5,048	4,705	23,706	4,392	3.2	Educational, health, and social services

a/ Persons per square mile.

b/ Based on North American Industry Classification System and U.S. Census classifications

Source: U.S. Census Bureau, Census of Population and Housing: 2000 and 1990

Population impacts within the project area are expected to be temporary and relatively minor. Most impacts would come from the temporary influx of construction personnel. The total population change would equal the total number of non-local construction workers, plus any family members accompanying them. Assuming all 90 non-local construction workers relocate to the project area with family members, this would equate to 233 people using a typical household size of 2.59 persons (U.S. Census, 2003). This temporary increase in population corresponds to less than 1 percent of the existing population and would not have a permanent impact on population. A brief decrease in the unemployment rate could occur as a result of construction due to the hiring of local workers for construction and the increased demands on the local economy. However, given the relatively short construction period, the impacts on the economy and employment as a whole would be temporary and minimal.

About 60 permanent employees would be required for operation of the LNG terminal. Crown Landing has indicated it would hire and train local workers to the extent possible. Operation of the pipeline would be undertaken by existing employees from Texas Eastern's Eagle Station facility in Delaware County. Given the small number of permanent workers that would be added, the projects would not have a significant impact on the permanent population, economy, or employment in the area.

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4.9.2 Housing

Housing is relatively abundant in the vicinity of the Crown Landing LNG and Logan Lateral Projects. In the three counties within the project area, there over 500,000 housing units with approximately 25,000 of these classified as vacant (see table 4.9.2-1). Logan Township, New Jersey had 76 vacant housing units in 2000, while the community across the Delaware River, the City of Claymont, Delaware, had 401 vacancies in 2000. The communities crossed by the pipeline route had a combined total of 2,470 vacant housing units in 2000. The highest housing vacancy rates are in the City of Chester (14.4 percent) and the City of Claymont (9.6 percent).

TABLE 4.9.2-1

2000 Housing Characteristics for the Project Area

State/County/Community	Total Housing Units	Total Vacant Housing Units	Vacancy Rate (percent)
NEW JERSEY	3,310,275	245,630	7.4
Gloucester County	95,054	4,337	4.6
Logan Township	2,077	76	3.7
DELAWARE	343,072	44,336	12.9
New Castle County	199,521	10,586	5.3
City of Claymont	4,193	401	9.6
PENNSYLVANIA	5,249,750	472,747	9.0
Delaware County	216,978	10,658	4.9
City of Chester	14,976	2,162	14.4
Chester Township	1,754	113	6.4
Brookhaven Borough	3,595	119	3.3

Source: U.S. Census Bureau, American FactFinder.

Table 4.9.2-2 provides the number of temporary housing units for the counties and communities in the vicinity of the proposed projects. The largest number of total vacant temporary housing units (707) is in New Castle County, Delaware. The rental vacancy rate is highest in the City of Claymont, Delaware (14.2 percent). The rental vacancy rates in the communities crossed by the pipeline route range from <1.0 percent in Logan Township to 7.4 percent in the City of Chester.

Construction of the LNG terminal and associated pipeline could affect the availability of housing. Assuming that local construction workers do not require housing, and given the number of available vacant units and existing temporary housing available, the current housing conditions should be sufficient to meet the demand for short-term housing required by the non-local construction workforce. Additionally, abundant temporary housing is available in the form of motels, hotels, inns, or campsites within the project area.

The additional 60 employees anticipated for operation of the LNG terminal would not significantly affect local housing availability.

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TABLE 4.9.2-2

Temporary Accommodations Available in the Project Area

State/County/Community	Rental Vacancy Rate (percent)	Vacant Housing Units Available for Seasonal, Recreational, or Occasional Use (2000)
NEW JERSEY		
Gloucester County	5.7	274
Logan Township	<1.0	6
DELAWARE		
New Castle County	7.4	707
City of Claymont	14.2	7
PENNSYLVANIA		
Delaware County	6.0	423
City of Chester	7.4	24
Chester Township	4.9	0
Brookhaven Borough	6.7	6

Sources: U.S. Census Bureau, DP-1. Profile of General Demographic Characteristics: 2000

4.9.3 Public Services

Two hospitals are located in Gloucester County, New Jersey, with a combined total of 917 beds. The closest hospital to Logan Township, New Jersey is 16 miles from the project site. There are two hospitals in Delaware County, Pennsylvania within 2 miles of the project area. These hospitals have a combined total of over 700 beds. The closest hospital to the pipeline route is the Community Hospital of Chester, which is located adjacent to proposed pipeline corridor at approximate MP 3.4. Given the projects' proximity to medical services, and the extent of these services, no impacts on these services are anticipated during construction or operation of the proposed facilities.

The Logan Township Police Department had a law enforcement workforce of 17 police officers in 2003. The Logan Township Fire Department has two engine companies with a total of 64 volunteer personnel. This fire department also provides emergency medical services. Brookhaven Borough has a fire department that also provides emergency medical services. Several other fire departments and companies are located within 5 miles of the proposed pipeline route. Brookhaven Borough, City of Chester, and Chester Township each have police departments that provide local law enforcement services. Sufficient law enforcement and fire response services are located within the project area to the extent that temporary impacts on these services are anticipated to be minimal.

The limited number of permanent employees associated with the proposed project would not result in long-term impacts on public services. However, fire and other emergencies at the proposed LNG terminal could require the services of local fire departments and emergency response units. Crown Landing has committed to coordinating with the local emergency service providers to ensure sufficient and efficient response to potential emergencies. Section 4.12.X provides more detailed information regarding emergency response and evacuation planning.

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4.9.4 Transportation and Traffic

4.9.4.1 Vehicle Traffic

LNG Terminal

The LNG terminal site is located directly adjacent to U.S. Route 130 and will share an access road with the Logan Generating Station. U.S. Route 130 is a major, four-lane, north-south transportation corridor that generally follows the Delaware River. To the east of the project area, U.S. Route 130 intersects with Interstate 295 in Bridgeport, New Jersey, near the Commodore Barry Bridge. To the west of the LNG terminal site, U.S. Route 130 intersects with Interstate 295 near the Delaware Memorial Bridge.

Traffic levels near the LNG terminal site are generally low. The average annual daily traffic (AADT) on U.S. Route 130 east of the Commodore Barry Bridge was 20,176 in 2000. The AADT west of the Commodore Barry Bridge was 4,700 in 2001. Specifically, traffic levels during peak hours in the morning and evening on U.S. Route 130 are between 400 and 500 vehicles. Based on a traffic study of U.S. Route 130 conducted by Crown Landing using the Highway Capacity Manual (Transportation Research Board, 2000), the two intersections nearest the site (the intersection with the proposed entrance road and the intersection with Center Square Road) both currently operate at acceptable Levels of Service (Levels A or B) during the morning and evening peak hours. Level of Service is a qualitative measure of the effect of traffic flow factors, such as speed, travel time, interruption, freedom to maneuver, driver comfort, convenience, and indirectly, safety and operating costs. It is expressed as levels of service "A" through "F." Level "A" is a condition of free traffic flow where there is little or no restriction in speed or maneuverability caused by presence of other vehicles. Level "F" is forced-flow operation at low speed with many stoppages.

Construction activities at the LNG terminal site are estimated to generate about 650 vehicle trips per day based on the peak workforce of up to 650 workers traveling to and from the site during LNG terminal construction and dredging activities. Additionally, 20 vehicle trips per day related to construction equipment and materials delivery (including concrete) are anticipated during a normal day, with a peak of 100 trips a day during construction months 2 through 6 for the delivery of fill material. Construction workers and material delivery trucks would access the site via U.S. Route 130 and Center Square Road within the Pureland Industrial Complex. It is expected that some construction workers would park in a temporary parking lot located along Center Square Road, and be shuttled to the main construction area. Crown Landing has indicated that it is evaluating two other mitigative measures to minimize traffic impacts during construction: 1) increase the length of the left turn lane on U.S. Route 130 into the entrance road to accommodate larger trucks and/or multiple cars; and 2) install a temporary traffic signal at the intersection of U.S. Route 130 and the entrance road to be used during peak construction periods. The increased traffic levels would be temporary and limited to the period of construction (about 3 years) and would be minimized by implementation of the mitigative measures discussed above.

The traffic during operation of the LNG terminal would be primarily limited to the employees traveling to and from the terminal and an occasional delivery of supplies and materials. About 60 employee vehicle trips are estimated per day during average operating conditions, with about 25 of these trips occurring during the morning and evening peak hours. These new vehicular trips would result in only a minimal increase in the existing road traffic. As discussed above, the left turn lane on U.S. Route 130 may be extended to accommodate additional and/or larger vehicles turning into the entrance road to the LNG terminal.

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Pipeline Facilities

Construction of the pipeline would involve 275 workers consisting of one pipeline spread (200 workers) and one aboveground facility spread (75 workers), generating up to 275 vehicle trips per day from these spreads. Additional vehicular traffic would result from equipment or material deliveries into and out of the pipe/storage yards each day. Many of the roads adjacent to the pipeline right-of-way are narrow and may not be able to easily accommodate high volumes of construction workers' vehicles. The parking of vehicles along these roads could increase traffic congestion. Typically, construction workers use contractor yards as the primary parking area for employee's personal vehicles and then are transported from the contractor yards to the construction site in buses.

Traffic may also be slowed where construction of the pipeline crosses roads or where construction occurs within existing roads. The pipeline would cross 34 paved roadways and 2 unpaved roads. In addition to road crossings, the majority of the pipeline route is either parallel to or within existing road rights-of-way. In Pennsylvania, the pipeline route is located within dense residential and industrial areas. In these areas, the pipeline would be constructed within five city streets, including Trimble Boulevard, Clearwater Avenue, Felton Avenue, Bethel Road, and Palmer Street. In New Jersey, the pipeline route follows the old Ferry Road (formerly U.S. Route 324) after crossing the Delaware River. This road was previously used to access a ferry service that operated on the river. It is now mostly abandoned except for the eastern portion which is used to access a few residences and businesses. The remainder of the route to the LNG terminal site is mostly adjacent to U.S. Route 130.

The pipeline would be installed by boring beneath many of the paved roads, which would minimize impacts on traffic. Where roads must be open cut, Texas Eastern would attempt to keep at least one lane of traffic open. During the brief period when a trench is completely excavated across the road, steel plates would be available onsite to cover the open area to permit travel by emergency vehicles. Traffic lanes and home access would be maintained except for the temporary periods essential for laying the pipeline. Texas Eastern would also implement appropriate control measures such as detouring traffic where possible, signage, and flashing lights.

Where the pipeline would be installed within or adjacent to city streets, Texas Eastern would generally use the stovepipe or drag section construction methods to minimize traffic-related impacts. Pipeline trenches in or adjacent to these streets would be backfilled or covered with steel plates daily. In addition, steel plates would be readily available to cover the trench in the event of an emergency that requires access across the trench. All roadway surfaces would be restored to the specifications of the local or state authorities. Impacts on local traffic would be temporary and limited to the period of construction.

No impacts on traffic would occur along the pipeline route as the result of pipeline operation.

4.9.4.2 Ship Traffic

Approximately 3,200 to 3,300 vessels traverse the Delaware River each year. These vessels use approximately 60 different ports between the Delaware Bay and the Port of Philadelphia, a distance of approximately 86 miles. Vessels that currently use the Delaware River on a daily basis include LPG ships, crude oil tankers, barges, and other commercial vessels.

The Coast Guard regulates ship traffic on the river. Coast Guard regulations and several other factors influence transit times and shipping schedules within Delaware Bay and River. The Coast Guard requires all vessels participating in foreign trade or weighing over 100 tons to have a pilot on board. Historically, approximately 2,000 of the total vessels per year fall into one of these two categories. These

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include all of the LPG vessels and crude oil barges and about one quarter of the other vessels. In addition, vessels with a draft equaling or exceeding 37 feet must enter Delaware Bay within 1 hour of flood tide. About half of the crude oil vessels and about one quarter of the other vessel types are subject to the flood tide restriction.

Current transit conditions on the Delaware River do not require interruption of vehicular traffic across the one major bridge that spans the river downstream of the proposed LNG terminal (the Delaware Memorial Bridge). The Coast Guard does not currently require the closure of the bridge during transits of vessels carrying dangerous cargoes. However, Coast Guard restrictions on vessels carrying dangerous cargo (e.g., LPG) do include safety/security zones. These safety/security zones consist of 500 yards on either side of the vessel, and 1,000 yards ahead and astern (on either end) of the vessel.

The proposed LNG terminal is located at approximate RM 78 of the Delaware River, adjacent to the Marcus Hook anchorage area, which experiences heavy commercial tanker traffic. LNG ships are expected to arrive at the terminal every 2 to 3 days (approximately 120 to 180 ships per year). The average transit time for commercial vessels from Delaware Bay to the Marcus Hook area is about 5.5 hours. Based on the dimensions, type of cargo, and the current regulations controlling ship traffic, it is assumed that the LNG ships entering Delaware Bay and River would be required to have a pilot on board and would be restricted to entering the channel within 1 hour of flood tide. In addition, based on Crown Landing's consultation with the Coast Guard, it is assumed that at a minimum, the current regulations applicable to vessels carrying dangerous cargoes (such as LPG), contained in the RNA in 33 CFR165.510, would also apply to the proposed LNG ships. Additional restrictions may be necessary based on results of a risk assessment currently being conducted by the Coast Guard. Given these restrictions, duration of passage, location of Marcus Hook, and the relatively low number of proposed LNG vessels compared to the current volume of commercial traffic on the river, delays experienced by other vessels are expected to be minor. Based on a ship traffic study conducted by Crown Landing (Moffatt and Nichol, 2003), the total annual delays are anticipated to be less than 5 hours for most vessels and up to 22 hours per year for barges, which are more abundant and slower.

During operation of the LNG terminal, although there would be safety exclusion zones around transiting LNG ships, the addition of 120 to 180 LNG ships per year would not have a long-term impact on commercial ship traffic in the area. The safety exclusion zones enforced around each LNG ship and around the ship unloading facility while a ship is docked would be restricted to other commercial traffic. Although the Coast Guard's current RNA is subject to change based on the results of their risk assessment, the Delaware River is wide enough in this area to avoid significant impacts to other commercial ship traffic. The exclusion zones could cause impacts on recreational boating and fishing, but the impacts would be temporary while the ship is in transit or while moored at the ship unloading facility. Because of the relatively low volume of recreational boating in the immediate area, any impacts are expected to be minor (see section 4.8.5.2). See section 4.12.5 for additional discussion of shipping safety during operation of the proposed project.

We received a scoping comment regarding potential impacts on the Big Stone Beach anchorage area, Cape May-Lewis Ferry service, and the cruise industry in the Port of Philadelphia as a result of LNG ship traffic. Both the anchorage area and the ferry service are located in Delaware Bay at the mouth of the Delaware River, which is more than 60 miles downstream of the LNG terminal site. Because Delaware Bay is the widest portion of the waterbody, any impacts associated with moving exclusion zones around the transiting LNG ships are expected to be minimal. The number of cruise liners calling or departing from the Port of Philadelphia is negligible compared to the number of commercial ships navigating the Delaware River. They are also only present in the Port of Philadelphia during the summer months. Given these conditions and the distance from the LNG terminal site, impacts on cruise ships in the Port of Philadelphia are expected to be minimal.

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4.9.5 Property Values

Comments were received during the scoping process regarding property devaluation and impacts on homeowner's insurance rates caused by the presence of an LNG terminal. The LNG terminal would be constructed on upland fields previously used for dredge disposal and is currently traversed by several pipeline rights-of-way. The site is currently zoned for industrial uses. The Logan Generating Station is located immediately adjacent to the proposed site and has been in operation since 1992.

The nearest residential property to the LNG terminal site is located across U.S. Route 130 and is approximately 2,300 feet from the proposed construction area. Given the presence of the power plant, the location across a four-lane highway, and the overall distance from the LNG terminal, no negative effects on property values are anticipated. The values of properties proximate to the site may already reflect their location near an industrial area.

A real estate study performed by the Real Estate Counseling Group of Connecticut, Inc. for a planned Granite State Gas facility in Wells, Maine indicates that property values or price increases are not diminished because of an LNG facility (Real Estate Counseling Group of Connecticut, 1995). In this study, local assessors were contacted and asked: 1) whether they had received property owner requests for lower valuations due to the presence of an LNG facility; and 2) whether the presence of a storage tank was a factor they considered in doing their valuations. Assessors were contacted in a number of towns including Haverhill, South Yarmouth, and Ludlow, Massachusetts. The study concluded that in no case did the planned LNG facilities play a role in either the assessment or homeowner complaints.

Homeowner insurance rates are generally set on a county-wide basis, with individual rate adjustments made to reflect the age and value of the property and the claims record of the owner; insurance rates are not based on the surrounding landscape or structures at the local level. Properties in the vicinity of an industrial facility may be older and not as well maintained, which can affect the availability of insurance coverage or the insurance rates. It is not anticipated that the presence of an LNG terminal would affect the insurance rates of nearby residences.

Comments were also received during the scoping process regarding property devaluation caused by the construction and operation of the Logan Lateral Project. Appraisal methods used to value land are based on objective characteristics of the property and any improvements. The impact a pipeline may have on the value of a tract of land depends on many factors, including the size of the tract, the values of adjacent properties, the presence of other utilities, the current value of the land, and the current land use. Subjective valuation is generally not considered in appraisals. This is not to say that the pipeline would not affect resale values. A potential purchaser of property may make a decision to purchase based on his or her planned use, such as agricultural, future subdivision, or second home on the property in question. If the presence of a pipeline renders the planned use infeasible, it is possible that a potential purchaser would decide not to purchase the property. However, each potential purchaser has different criteria and differing capabilities to purchase land.

The effect that an easement may have on property values is a damage-related issue and should be negotiated between the parties during the easement acquisition process or would be determined during condemnation proceedings. This negotiation is beyond the scope of this EIS.

Property taxes for a piece of property are generally based on the actual use of the land. Construction of the pipeline would not change the general use of the land, but it would preclude construction of aboveground structures on the permanent right-of-way. If a landowner feels that the presence of a pipeline easement reduces the value of his or her land, resulting in an overpayment of

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property taxes, he/she may appeal the issue of the assessment and subsequent property taxation to the local property tax agency. This is the proper forum for this issue to be addressed.

4.9.6 Tax Revenues

Construction and operation of the Crown Landing LNG Project would have beneficial impacts on local sales tax revenue. The total revenue of Logan Township in 2003 was $6,796,000 and $117,792,000 for Gloucester County, New Jersey. Property taxes in Logan Township account for approximately 22 percent of that amount, and 77 percent for Gloucester County.

The construction of the Crown Landing LNG Project is anticipated to generate at least $600,000 annually in direct revenues for state and local governments. This estimate does not include additional revenues generated from secondary sources. Operation of the proposed LNG terminal is anticipated to generate approximately $6 million is annual revenues for state and local governments. Although only a portion of this tax money would be received by Logan Township, it would be a significant portion of the local government's annual revenues.

The construction of the Logan Lateral is expected to generate revenues to state and local governments within Pennsylvania and New Jersey. These revenues would be generated from the $77.3 million cost to construct the pipeline. The majority of these revenues would be collected from payroll taxes and sales taxes on materials purchased during construction. The operation of the pipeline is expected to generate approximately $1.1 million in property tax revenue annually to the states of Pennsylvania and New Jersey. The estimated $3,900 in yearly payroll taxes would be negligible.

4.9.7 Environmental Justice

Executive Order 12898 on Environmental Justice requires that each federal agency address disproportionately high and adverse health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. Each federal agency must also ensure that public documents, notices, and hearings are readily available to the public. As part of the preparation of this EIS, the NEPA review process must provide opportunities for effective community participation and involve consultation with affected communities. If the proposed action will result in significant adverse effects to minority or low-income populations or Native American tribes, the NEPA analysis should address those impacts as part of the alternatives analysis and identify appropriate mitigation measures to address the effects.

The mailing list for the Crown Landing LNG and Logan Lateral Projects was initiated when the FERC's NOI was issued and has been continually updated throughout the EIS process. All property owners affected by the two projects received notices about the projects without any distinction based upon minority or income status. The distribution list for this draft EIS included federal, state, and local agencies; elected officials; environmental and public interest groups; Native American tribes; affected landowners; intervenors to the FERC's proceeding; and local libraries and newspapers (see Appendix A). Sections 1.4 and 1.5 of this EIS further describe the stakeholder involvement process and the public notification and review process, respectively. Section 4.10.2 describes contacts with Native American tribes that traditionally occupied the area.

Crown Landing sponsored three informational open houses: March 9 in Claymont, Delaware; March 10 in Logan Township, New Jersey; and March 11 in Marcus Hook, Pennsylvania. Texas Eastern participated in the March 10 open house in Logan Township and then held additional open houses in Pennsylvania on March 30 in Brookhaven, March 31 in Chester Township, and April 1 in Chester. The primary purpose of these open houses was to provide project information to interested stakeholders and to

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respond to questions and comments regarding the projects. A FERC representative was in attendance at these open houses to provide information on its regulatory process. The FERC held public scoping meetings and site visits on May 5, May 6, and June 9, 2004 to provide the general public and governmental agencies with the opportunity to comment on both the proposed LNG terminal and pipeline. The locations and dates of these meetings were published in the NOI.

Environmental Justice Areas and Potential Impacts

We received comments regarding the environmental justice of siting the proposed pipeline facilities in Delaware County, Pennsylvania. To address these concerns, we identified environmental justice areas in the vicinity of the proposed project and conducted an analysis of potential impacts that could disproportionately affect these areas. We also evaluated both system and route alternatives to determine if there were other options for transporting the natural gas from the proposed LNG terminal (see section 3.0).

To identify potential environmental justice areas, we reviewed available state, county, and municipal statistics regarding median income and poverty levels. Table 4.9.7-1 provides the general ethnic mix of the counties and communities that would be affected by the proposed pipeline. As shown on this table, the percentages of minority populations within Gloucester County and Logan Township are lower than the state averages. However, in Pennsylvania the African American and Native American minority populations in the City of Chester and Chester Township are considerably higher than the state or county average.

TABLE 4.9.7-1

Racial/Ethnic Statistics for the Project Area

State/County/Community	Racial/Ethnic Group, 2000 (percent)							Persons of Hispanic or Latino Origin (percent) a/
	White	Black	Native American and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Persons Reporting Some Other Race	Persons Reporting Two or More Races	
NEW JERSEY	72.6	13.6	0.2	5.7	0.0	5.4	2.5	13.3
Gloucester County	87.1	9.1	0.2	1.5	0.0	0.9	1.3	2.6
Logan Township	82.0	13.5	0.1	1.8	0.0	1.2	1.4	2.7
PENNSYLVANIA	85.4	10.0	0.1	1.8	0.0	1.5	1.2	3.2
Delaware County	80.3	14.5	0.1	3.3	0.0	0.6	1.2	1.5
City of Chester	18.9	75.7	0.2	0.6	0.0	3.0	1.5	5.4
Chester Township	22.7	73.3	0.3	0.6	0.0	1.0	2.1	2.1
Brookhaven Borough	95.6	2.0	0.1	1.2	0.0	0.4	0.6	1.1

a/ People who identify themselves as Hispanic or Latino may be of any race. Thus the percent Hispanic should not be added to the percentage for racial categories.

Source: U.S. Department of Commerce, U.S. Census Bureau, State and County QuickFacts.

Table 4.9.7-2 provides the general economic status of the counties and communities where the proposed projects would be located. In Logan Township, the median household income ($67,148) is greater than the Gloucester County average of $54,273 and the State of New Jersey average of $55,146. In addition, the percentages of individuals below the poverty level and households receiving public assistance are lower than the county and state averages. In Pennsylvania, the communities of the City of Chester and Chester Township have median household incomes that are much lower than the Delaware

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County and State of Pennsylvania averages. The same trend can be seen in the percentage of persons below the poverty line and the percentage of households receiving public assistance. However, Brookhaven Borough has a median household income ($48,289) more indicative of the county average of $50,092. The percentages of persons below the poverty level and households receiving public assistance also follow the same trend in this community.

TABLE 4.9.7-2

Economic Statistics for the Project Area

State/County/Locality	Median Household Income (2000)	Persons Below the Poverty Level (1999) (percent)	Households Receiving Public Assistance (percent)
NEW JERSEY	$55,146	8.5	2.8
Gloucester County	$54,273	6.2	1.5
Logan Township	$67,148	4.3	0.8
PENNSYLVANIA	$40,106	11.0	3.1
Delaware County	$50,092	8.0	2.6
Chester City	$25,703	22.8	9.6
Chester Township	$32,576	17.1	5.9
Brookhaven Borough	$48,289	3.6	1.7

Source: U.S. Department of Commerce, U.S. Census Bureau

The site for the LNG terminal is located in Logan Township. In economic terms, the population of Logan Township is better off than the average Gloucester County resident or New Jersey resident. At the proposed site specifically, the percentages of minority residents and persons living below the poverty level are less than 10 percent. Based on the economic status of residents in Logan Township, the siting of the proposed LNG terminal would not disproportionately affect minorities or persons living below the poverty level.

An environmental justice area is defined as an area where the community's minority population is equal to or greater than 50 percent of the community population and/or a community in which the percentage of persons living below the poverty level is higher than the county average. Figure 4.9.7-1 shows environmental justice areas crossed by the proposed pipeline. The pipeline facilities associated with the Logan Lateral Project would traverse areas within the City of Chester and Chester Township where more than 70 percent of the population is a minority and the percentage of persons living below the poverty level is higher than the Delaware County average (see tables 4.9.7-1 and 4.9.7-2).

Although the proposed pipeline route crosses environmental justice communities, it would not disproportionately affect these communities for the following reasons. First, the purpose and need of a pipeline from the LNG terminal would necessarily route the pipeline though this area. The route must cross these areas because the pipeline must provide service from the proposed LNG terminal to Texas Eastern's Chester Junction Facility. Without this service, a portion of the purpose and need of the project would not be met. Second, Texas Eastern has routed the pipeline to follow, as much as possible, existing Texas Eastern pipeline rights-of-way and other existing rights-of-way. Finally, although the pipeline route does traverse areas of high minority population and areas with a greater number of persons living below the poverty level, the route also crosses areas of higher-income communities and areas with a minority population more indicative of the two counties where these communities are located. More specifically, of the approximately 10 miles of the proposed route on land, less than 3 miles traverse through environmental justice areas. The remaining portion of the on-land route crosses areas that are not classified as environmental justice areas, and are more indicative of the project area in general. In addition, 155 structures are located within 50 feet of the proposed construction right-of-way. Of this

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total, only 48, or about one-third, of these structures occur within the environmental justice areas and the other two-thirds of the structures are located outside of environmental justice areas.

In addition to the siting of the project, potential impacts during construction and operation of the project could also include visual impacts from the presence of the LNG storage tanks, traffic impacts associated with the construction and operation of the project, and air quality and noise impacts. A summary and analysis of these impacts as they may pertain to environmental justice is presented below. More detailed assessments of visual resources, traffic, air quality, and noise are included in sections 4.8.6, 4.9.4, 4.11.1 and 4.11.2 of this draft EIS, respectively.

As discussed in section 4.8.6, the primary visual impact of the project on the surrounding area would be the LNG storage tanks. The LNG storage tanks would be equally visible from the Pennsylvania side of the Delaware River, the location of the low income and high minority areas, as the New Jersey side of the Delaware River. Furthermore, the Logan Generating Station, located adjacent to the proposed LNG terminal site, stands 180 feet and the associated combustion stack stands 430 feet. Therefore, visual impacts would not be disproportionate given that the LNG storage tanks would not be dissimilar from the current landscape and would be equally visible from both sides of the Delaware River.

The increased amount of vehicular traffic during the construction of the Logan Lateral would impact the environmental justice areas crossed by the proposed pipeline. As described in section 4.9.4, these impacts would be minor and limited to the construction period. Increased traffic levels on U.S. Route 130 during the construction of the LNG terminal would be minimized through the implementation of the proposed mitigation measures described in section 4.9.4. Because similar impacts would occur in both environmental justice and non-environmental justice areas, disproportionate impacts would not occur from increased vehicular traffic.

As discussed in section 4.11.1, operation of the proposed project would result in air emissions from two sources: LNG ships and tugs and stationary equipment (heaters and emergency engines) associated with the LNG facility. These air emissions would not cause or significantly contribute to a violation of an ambient air quality standard. Therefore, the environmental justice areas would not be disproportionately affected by the project.

Impacts from noise during the construction and operation of the LNG terminal are discussed in section 4.11.2. The increased amount of noise during construction of the Logan Lateral would impact the environmental justice areas crossed by the proposed pipeline. These noise impacts would be temporary and limited to the construction area. Also, these temporary noise impacts would occur along the entire length of the pipeline and would not disproportionately affect the environmental justice areas in Pennsylvania. The construction and operation of the LNG terminal would not result in disproportionate impacts on environmental justice areas given the location of the proposed facility across the Delaware River from the environmental justice areas.

In summary, we do not believe construction and operation of the proposed project would result in disproportionate adverse impacts on environmental justice communities. The project is expected to generate a number of temporary and permanent employment opportunities, taxes and other revenue streams within the project area, and, with the use of appropriate mitigation measures, would not result in significant adverse impacts on the local environment and natural resources. Although some of the neighborhoods crossed by the proposed pipeline route have lower incomes than average, the potential impacts described above would affect all of the communities crossed by the pipeline, and would not disproportionately impact only the environmental justice areas.

Pipeline Route
LNG Terminal Site
Environmental Justice Communities
0 1 2 Miles

Figure 4.9.7-1
Crown Landing LNG and Logan Lateral Projects
Environmental Justice Communities

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4.10 CULTURAL RESOURCES

Section 106 of the NHPA (16 USC 470) requires the FERC to take into account the effects of its undertakings (including the issuance of a Certificate) on properties listed, or eligible for listing, on the NRHP and to provide the ACHP an opportunity to comment on its undertakings. Crown Landing and Texas Eastern, as non-federal parties, are assisting the FERC in meeting its obligations under section 106 and the implementing regulations in 36 CFR 800.

4.10.1 Results of the Cultural Resources Surveys

LNG Terminal

Aboveground Cultural Resources

Crown Landing conducted background research and a field survey to identify aboveground historic properties that could be affected by construction of the proposed LNG terminal (Cleven and Williams, 2004). Crown Landing defined the area of potential effects (APE) for this investigation as the proposed terminal site plus a 1.5-mile-radius viewshed.

Background research identified only one previously recorded historic property within the APE: the U.S. Route 130 Bridge across Oldmans Creek (Structure 1710152). The bridge is located outside the LNG terminal site but within the viewshed of the proposed facility. It consists of a two-lane, Waddell-type, vertical lift truss bridge built in 1936 and an adjoining operator's house. The structure was listed on the NRHP in 1992 for its engineering and design.

The field survey revisited Structure 1710152 and identified 31 additional built resources greater than 50 years in age within the APE. All 31 of the newly documented structures are located outside the LNG terminal site but within the viewshed of the facility. Of these, 28 structures are dwellings, one is a farmstead, one is a gas and service station, and one is a commercial building. The dwellings generally consist of simple, wood-frame, gabled houses dating from the late nineteenth to the mid twentieth centuries, with examples of Colonial Revival, Cape Cod, and Four Square style homes also present. The farmstead contains a ca. 1900, two-story, wood-frame house and five associated wood-frame outbuildings. The gas and service station is a ca. 1930 wood-frame, gable-front building. The commercial building consists of a ca. 1955, two-story masonry building. Crown Landing recommended all of the newly documented structures except the farmstead as ineligible for listing on the NRHP. Crown Landing indicated that the ca. 1900 farmstead may be significant for its association with the history of agriculture in Gloucester County and for the design and construction of its constituent buildings; and recommended it as potentially eligible for inclusion on the NRHP.

Crown Landing subsequently assessed the potential affects of its project on the U.S. Route 130 bridge and the ca. 1900 farmstead. Although both properties are located outside the LNG terminal site, the LNG tanks would be partially visible from both resources, and thus could potentially have a visual affect on the bridge and farmstead. Crown Landing concluded, however, that because the viewshed is not a character-defining feature of the bridge or the farmstead, the project would not affect either property.

Crown Landing submitted a report on the results of its architectural survey to the New Jersey SHPO (Cleven and Williams, 2004) and the FERC. In a letter dated August 31, 2004 (New Jersey SHPO, 2004), the New Jersey SHPO indicated that "the project will have no adverse effect on the Route 130 Bridge over Oldmans Creek". We agree.

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Terrestrial Archaeological Resources

Crown Landing conducted background research and a field survey to identify any terrestrial archaeological sites that could be affected by construction of the proposed LNG terminal (Child et al., 2004). The APE for this investigation was defined as the terminal site and an associated construction staging area.

Background research identified four previously documented sites (28GL241, 28GL242, 28GL243, and 28GL244) located immediately adjacent to, but outside of, the LNG terminal site and construction staging area. Sites 28GL242, 28GL243, and 28GL244 each were characterized as small concentrations of historic materials dating from the late nineteenth and twentieth centuries. Site 28GL241 consisted of a prehistoric lithic artifact scatter dating from the Late Archaic through Late Woodland periods. All four sites previously were recommended eligible for listing on the NRHP.

The field investigation combined pedestrian reconnaissance, shovel and auger testing, and backhoe trenching. One archaeological site was identified in the vicinity of the construction staging area. It consisted of a moderately dense scatter of prehistoric lithic materials, and appeared to represent an extension of previously documented Site 28GL241. Evidence of potentially intact cultural deposits was identified at the site, and the newly recorded extension of Site 28GL241 was recommended as eligible for listing on the NRHP. Crown Landing subsequently modified its construction plans to create a no-work buffer zone around the site, which would avoid disturbance or impact on the site and any area within 100 feet of the site.

A diffuse scatter of both prehistoric and historic artifacts also was observed within the construction staging area but outside the extension of Site 28GL241. This material was recovered from disturbed depositional contexts and could not be associated with Sites 28GL241, 28GL242, 28GL243, or 28GL244, described above. Crown Landing concluded that the "prehistoric and historic materials located outside 28GL241 lack sufficient material and integrity to be designated as archaeological sites" (Child et al., 2004:67), and no additional testing of this area was recommended. No other archaeological sites were identified during the survey.

Crown Landing submitted a report (Child et al., 2004) on the results of its terrestrial archaeological survey to the New Jersey and Delaware SHPOs and to the FERC. In its letter of August 31, 2004 (New Jersey SHPO, 2004), the New Jersey SHPO accepted the report and indicated that the project would have "no effect" on Site 28GL241, predicated on installation of the 100-foot protective buffer around the site, maintenance of the buffer throughout the duration of the project, installation and maintenance of heavy duty temporary fencing, and monitoring by an archaeologist to ensure appropriate installation and integrity throughout the project. In a letter dated September 16, 2004, the Delaware SHPO also accepted the report agreeing that no historic properties would be affected by the project. We concur with both SHPOs.

Crown Landing subsequently accepted the avoidance conditions for Site 28GL241 in a written plan submitted to the New Jersey SHPO and the FERC. In a letter dated October 1, 2004, the SHPO agreed with the provisions of the plan. We also concur.

Underwater Archaeological Resources

Crown Landing conducted background research and a field survey to identify any marine archaeological sites that could be affected by construction of the proposed LNG terminal (Child et al., 2004). The APE for this investigation was defined as the proposed pier and berthing area in the Delaware River between the New Jersey shoreline and the Marcus Hook anchorage area. The portion of the project

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located within the anchorage area was excluded from the APE because it was disturbed by previous dredging.

Background research failed to document any previously recorded cultural resources or shipwrecks within the APE. The field investigation consisted of a marine remote-sensing survey utilizing a magnetometer, depth sounder, sub-bottom profiler, and side-scan sonar to examine the bed of the Delaware River. No evidence of shipwrecks or other cultural resources was identified during the survey, and no additional archaeological investigations of the pier and berthing area were recommended.

Crown Landing submitted a report (Child et al., 2004) on the results of its marine archaeological survey to the New Jersey and Delaware SHPOs, and to the FERC. The New Jersey SHPO accepted the report in its letter dated August 31, 2004 (New Jersey SHPO, 2004), as did the Delaware SHPO in a letter dated September 16, 2004 (Delaware SHPO, 2004).

Pipeline Facilities

Aboveground Cultural Resources

Texas Eastern examined its proposed construction corridor to identify built resources that could be affected physically by construction of the proposed pipeline facilities in New Jersey and Pennsylvania (Breetzke, 2004a, 2004b). One aboveground resource, the Chester Creek Railroad Bridge, was identified in Pennsylvania. This bridge consists of a train trestle dating from the mid-nineteenth century. Texas Eastern recommended this resource as ineligible for inclusion on the NRHP. No built resources were identified within the construction corridor in New Jersey.

In its initial review of the project, the Pennsylvania SHPO concluded that although significant built resources may be present in the project area, "there will be no effect on these properties" (Pennsylvania Historical and Museum Commission, 2003). The Pennsylvania SHPO also reviewed the site form for the Chester Creek Railroad Bridge and concurred with Texas Eastern that this resource is ineligible for listing in the NRHP (Pennsylvania Historical and Museum Commission, 2004). We also concur.

Texas Eastern submitted separate reports (Breetzke, 2004a, 2004b) on the results of its survey to the New Jersey and Pennsylvania SHPOs, and to the FERC. In a letter dated October 7, 2004, the Pennsylvania SHPO concurred with the results of the investigation in Pennsylvania. We also concur. The New Jersey SHPO has not commented on the New Jersey report.

Terrestrial Archaeological Resources

Texas Eastern conducted background research and a field survey to identify any terrestrial archaeological sites that could be affected by construction of the proposed pipeline facilities in New Jersey and Pennsylvania (Breetzke, 2004a, 2004b). The APE for this investigation was defined as the proposed construction corridor as well as extra-workspace areas and ancillary facilities.

Background research identified two previously documented sites in Pennsylvania (36DE25 and 36DE26) and one in New Jersey (28GL241) located within or immediately adjacent to the survey corridor. Site 36DE25 was characterized as a historic farmstead. Site 36DE26 was described as a prehistoric artifact scatter with an unidentified cultural/temporal affiliation. Site 28GL241, as discussed previously for the LNG terminal, consisted of a prehistoric lithic artifact scatter dating from the Late Archaic through Late Woodland periods. Site 36DE25 was not previously evaluated for listing in the

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NRHP. Site 36DE26 was previously recommended potentially eligible and Site 28GL241 as eligible for inclusion on the NRHP.

The field investigation for the pipeline facilities combined pedestrian reconnaissance with shovel and auger testing and unit excavation. The survey examined a majority of the proposed pipeline lateral. Survey was not completed, however, from MPs 7.26 to 7.90 and MPs 10.34 to 10.85 in New Jersey. In addition, survey was not completed within a pull-back area for one of the HDD crossings in New Jersey.

The investigation revisited Sites 36DE25 and 36DE26 and identified three previously undocumented resources (Sites 36DE127, 36DE128, and 36DE129). Two of the three previously unidentified sites (Sites 36DE127 and 36DE129) were found during the survey of an alternative pipeline corridor, and are not located along the proposed pipeline route.

Although Sites 36DE25 and 36DE26 were recommended as potentially eligible for listing on the NRHP, Texas Eastern concluded that both sites are located outside of the proposed construction right-of-way and, therefore, would not be affected by the project. No additional testing of these two sites was recommended. However, installation of a barrier fence along the boundaries of the construction right-of-way in the vicinity of Site 36DE26 was recommended.

Sites 36DE128 and 36DE129 both were characterized as historic artifact scatters associated with partially intact building foundations. Site 36DE127 was described as a light scatter of historic materials. Texas Eastern assessed all three sites as ineligible for listing on the NRHP, and no additional testing of these sites was recommended.

Texas Eastern did not attempt to relocate or conduct additional testing at Site 28GL241. The delineation of site boundaries by Crown Landing indicated to Texas Eastern that the site is located outside the proposed construction corridor for the pipeline facilities and, therefore, would not be impacted by the project. Texas Eastern recommended installation of a fence along the boundaries of the construction corridor in the vicinity of the site.

Texas Eastern submitted separate reports (Breetzke, 2004a, 2004b) on the survey results to the New Jersey and Pennsylvania SHPOs, and to the FERC. The Pennsylvania report contained avoidance plans for Sites 36DE25 and 36DE26, and the New Jersey report contained an avoidance plan for Site 28GL241. In its October 7, 2004 letter, the Pennsylvania SHPO concurred with the recommendations of the Pennsylvania report, including the avoidance plans for Sites 36DE25 and 36DE26. We also concur. The New Jersey SHPO has not commented on the New Jersey report.

4.10.2 Native American Consultation

Crown Landing identified and contacted four Indian tribes with historical ties to its project area: the Delaware Tribe of Indians, Delaware Nation of Western Oklahoma, Nanticoke Lenni-Lenape Indians, and the New Jersey Commission of Indian Affairs-Rankokus Indian Reservation. Each tribe expressed an interest in or commented on the project. The Delaware Tribe of Indians requested consulting party status for the project as well as a copy of the archaeological survey report, and they asked to be notified in the event that human remains or artifacts are discovered during construction. The Delaware Nation of Oklahoma and the Nanticoke Lenni-Lenape Indians each requested a copy of the archaeological survey report and asked to be notified in the event that human remains or artifacts are discovered during construction. The New Jersey Commission of Indian Affairs-Rankokus Indian Reservation advised Crown Landing that there are several known archaeological sites located in the project area.

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Crown Landing submitted copies of its archaeological survey report (Child et al., 2004) to the three tribes who requested them. Only the Delaware Tribe of Indians commented on the report. The tribe concurred with the findings of the investigation as well as the plans to avoid Site 28GL241, and deferred comment on the project to the New Jersey SHPO.

Texas Eastern identified and contacted 16 Indian tribes with historical ties to its project area: the Absentee-Shawnee Tribe of Oklahoma, Cayuga Nation, Delaware Nation of Oklahoma, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Oneida Indian Nation, Oneida Tribe of Indians of Wisconsin, Onondaga Indian Nation, Seneca Nation of Indians, Seneca-Cayuga Tribe of Oklahoma, St. Regis Mohawk Tribe, Stockbridge-Munsee Community of Wisconsin, Tonawanda Band of Seneca Indians, Tuscarora Nation, Nanticoke-Lenni Lenape Indian Center, and New Jersey Commission of Indian Affairs-Rankokus Indian Reservation. Eight of these tribes responded to Texas Eastern. The Cayuga Nation stated that it has an interest in the project. The Delaware Nation of Oklahoma and Delaware Tribe of Indians each requested a copy of the archaeological survey reports and asked to be notified in the event of an unanticipated discovery during project construction. The Eastern Shawnee Tribe of Oklahoma, Seneca Nation of Indians, Seneca-Cayuga Tribe of Oklahoma, and the Nanticoke-Lenni Lenape Indian Center each asked to be notified in the event of an unanticipated discovery during project construction. The Oneida Indian Nation stated that the project area is located outside its aboriginal territory and, therefore, the tribe has no comment on the project. None of the other tribes responded to Texas Eastern's project consultation letter.

Texas Eastern subsequently contacted five of the eight remaining tribes in addition to the Oneida Indian Tribe by telephone. The Oneida Indian Tribe, Onondaga Indian Nation, and St. Regis Mohawk Tribe each had no comment on the project but asked to be notified in the event of an unanticipated find during construction. The Absentee-Shawnee Tribe of Oklahoma requested additional information on the project. Neither the New Jersey Commission of Indian Affairs-Rankokus Indian Reservation nor the Tuscarora Nation provided comments on the project. Texas Eastern did not follow-up with the Stockbridge-Munsee Community of Wisconsin, Oneida Tribe of Indians of Wisconsin, or Tonawanda Band of Seneca Indians.

Lastly, Texas Eastern submitted copies of its cultural resources survey reports (Breetzke, 2004a, 2004b) to three tribes: the Absentee-Shawnee Tribe of Oklahoma, Delaware Nation of Oklahoma, and Delaware Tribe of Indians. None of these tribes provided comments on the reports.

4.10.3 Unanticipated Discoveries

Crown Landing developed a plan for responding to the unanticipated discovery of historic properties or human remains during construction of the LNG terminal and submitted it to the New Jersey and Delaware SHPOs, and to the FERC, as an appendix to its archaeological survey report (Child et al., 2004). The New Jersey SHPO accepted this report in its letter dated August 31, 2004 (New Jersey SHPO, 2004), as did the Delaware SHPO in its letter dated September 16, 2004 (Delaware SHPO, 2004).

Texas Eastern also developed a plan for responding to the unanticipated discovery of historic properties or human remains during construction of the pipeline facilities and submitted it to the New Jersey and Pennsylvania SHPOs, and to the FERC. The New Jersey and Pennsylvania SHPOs have not yet commented on the plan.

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4.10.4 Compliance with the NHPA

Texas Eastern has not yet completed its cultural resources surveys in New Jersey. In addition, the New Jersey SHPO has not yet commented on Texas Eastern's survey report for the pipeline facilities. Consequently, we have not completed the process of complying with section 106 of the NHPA.

To ensure that the FERC's responsibilities under the NHPA and its implementing regulations are met, **we recommend that:**

- **Texas Eastern defer construction of the pipeline facilities until:**

  a. **Texas Eastern files the New Jersey SHPO's comments on the New Jersey cultural resources management report;**

  b. **Texas Eastern completes the outstanding cultural resources surveys of the pipeline corridor and ancillary use areas;**

  c. **Texas Eastern files with the Secretary all additional required cultural resources survey reports and any treatment plans, and the New Jersey SHPO's comments on all reports and plans;**

  d. **Texas Eastern adds the St. Regis Mohawk Tribe and Onondaga Indian Nation to the list of tribal contacts in its unanticipated finds plan; and**

  e. **The Director of OEP reviews and approves all cultural resources reports and plans, and notifies Texas Eastern in writing that it may proceed with treatment measures or construction.**

  All material filed with the Secretary containing location, character, and ownership information about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering: "CONTAINS PRIVILEGED INFORMATION - DO NOT RELEASE."

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4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

Climate

The climate in New Jersey is extremely variable. Cold continental air masses from central Canada and the northcentral United States produce cold winter weather often as low as 0° F. In the summer, the major system that influences New Jersey's weather is a high pressure cell (the Bermuda High) generally located over the area extending from the Sargasso Sea region of the North Atlantic to the eastern Gulf of Mexico. The clockwise movement of winds around the Gulf of Mexico brings warm, moist air from the Gulf of Mexico to the eastern United States; resulting in hot and muggy summer days that occasionally reach 100° F. The wind direction in New Jersey varies, although wind observations indicate that the predominant wind direction is north.

National Ambient Air Quality Standards

The EPA has established National Ambient Air Quality Standards (NAAQS) for six pollutants: sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in diameter (PM_{10}), and lead (Pb). The EPA is currently working to implement a NAAQS for $PM_{2.5}$. The NAAQS were set at levels the EPA believed were necessary to protect human health (primary standards) and human welfare (secondary standards). The federal NAAQS for criteria pollutants are the same as the state standards established by the NJDEP with the exception of a few secondary standards and a 1-hour NO_2 "guideline" that the NJDEP uses to assess air quality. This guideline is not an ambient air quality standard under the New Jersey regulations; however, it is used as a guideline by NJDEP to assess the impacts of NO_2 on a short-term basis. The standards established by the NJDEP are referred to as the New Jersey Ambient Air Quality Standards (NJAAQS). The project area is in attainment of the NAAQS for all criteria pollutants except ozone. The entire State of New Jersey is designated "nonattainment" for ozone. The NAAQS/NJAAQS are summarized in table 4.11.1-1.

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TABLE 4.11.1-1

Ambient Air Quality Standards

Air Pollutant	Averaging Period	Primary NAAQS ($\mu g/m^3$)	Secondary NAAQS ($\mu g/m^3$)	Primary NJAAQS ($\mu g/m^3$)	Secondary NJAAQS ($\mu g/m^3$)
Ozone	1-Hour a/	235	235	235	160 c/
	8-Hour b/	157	157	-	-
Carbon Monoxide	1-Hour c/	40,000	-	40,000	40,000
	8-Hour c/	10,000	-	10,000	10,000
Nitrogen Dioxide	1-Hour d/	-	-	470	-
	Annual e/	100	100	100	100
Particulate Matter less than 2.5 microns	24-Hour f/	65	65	-	-
	Annual g/	15	15	-	-
Total Suspended Particulate	24-Hour c/	-	-	260	150
	Annual h/	-	-	75	60
Lead	Quarter e/	1.5	1.5	1.5	1.5
Particulate Matter less than 10 microns	24-Hour c/	150	150	-	-
	Annual e/	50	50	-	-
Sulfur Dioxide	3-Hour c/	-	1,300	-	1,300
	24-Hour c/	365	-	365	260
	Annual e/	80	-	80	60

a/ The expected number of days with maximum hourly average concentrations greater than the standard must be equal to or less than one. This standard will no longer be effective after June 15, 2005.

b/ The 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations at each location within an area over each year must not exceed standard

c/ Not to be exceeded more than once per year (NAAQS)/12-month period (NJAAQS)

d/ Not to be exceeded

e/ Arithmetic mean not to be exceeded

f/ The 3-year average of the 98th percentile of 24-hour concentrations must not exceed standard

g/ The 3-year average of the annual concentrations from a single or multiple local sites must not exceed standard

h/ Geometric mean of 24-hour concentrations during a 12 consecutive month period not to exceed standard

$\mu g/m^3$ micrograms per cubic meter

Existing Air Quality

Air quality data contained in reports from the NJDEP and monitoring data provided by the EPA Airdata network for 2001 were reviewed to characterize ambient air quality related to regulated criteria pollutants. The pollutants include O_3, CO, NO_2, $PM_{2.5}$, total suspended particulate (TSP), Pb, PM_{10}, and SO_2. A summary of these data is presented in table 4.11.1-2.

Air Quality Control Regions

Air Quality Control Regions (AQCRs) were established by the EPA and local agencies, in accordance with section 107 of the CAA, as a means to implement the CAA and comply with the NAAQS through state implementation plans (SIPs). The AQCRs are intra- and interstate regions such as large metropolitan areas where the improvement of the air quality in one portion of the AQCR requires emission reductions throughout the AQCR. The project area is located in the Metropolitan Philadelphia Interstate AQCR, which is designated as a "severe nonattainment area" for the 1-hour ozone standard and a "moderate nonattainment area" for the 8-hour ozone standard.

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TABLE 4.11.1-2

Existing Ambient Air Concentrations for the Project Area

Air Pollutant	Monitoring Station	Averaging Period	Existing Air Quality ($\mu g/m^3$)
Ozone	Clarksboro	1-Hour	244 a/
	Clarksboro	8-Hour	200 b/
Carbon Monoxide	Camden Lab	1-Hour	7,105 c/
	Camden Lab	8-Hour	5,824 c/
Nitrogen Dioxide	Camden Lab	1-Hour	134 c/
	Camden Lab	Annual	38 d/
Particulate Matter less than 2.5 microns	Gibbstown	24-Hour	45 c/
	Gibbstown	Annual	15 d/
Total Suspended Particulate	Pennsauken	24-Hour	156 c/
	Pennsauken	Annual	54 d/
Sulfur Dioxide	Clarksboro	3-Hour	109 c/
	Clarksboro	24-Hour	72 c/
	Clarksboro	Annual	16 d/
Particulate Matter less than 10 microns	Camden Lab	24-Hour	64 c/
	Camden RRF	Annual	26 d/
Lead	Pennsauken	Quarter	0.02 c/

a/ Concentration represents the 4th highest 1-hour average between 1999 and 2001 but number of days with 1-hour average over the standard is zero.

b/ Concentration represents the 4th highest 8-hour average between 1999 and 2001 and the number of days with an 8-hour average over the standard is 17.

c/ Concentration is the maximum concentration measured for 2001.

d/ Concentration is the annual average for 2001.

$\mu g/m^3$ micrograms per cubic meter

Regulatory Requirements for Air Quality

The proposed LNG terminal would generate air emissions through both short-term construction activities and long-term operation of the stationary emission units at the facility. Emissions from all phases of construction and operation of the emission units would be subject to applicable state and federal air regulations.

The new stationary air emission sources associated with operating the proposed LNG terminal are listed in table 4.11.1-3.

Air emission sources in New Jersey are regulated at the federal level under the CAA, as amended, and at the state level by the NJAC. The federal regulations established as a result of the CAA and the NJAC that are potentially applicable to the project include:

- New Source Performance Standards (NSPS);
- Prevention of Significant Deterioration (PSD)/New Source Review (NSR);
- Title V Operating Permits;
- National Emission Standards for Hazardous Air Pollutants (NESHAPs);
- Federal Class I Area Protection;
- General Conformity; and
- State Regulations.

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TABLE 4.11.1-3

Emission Source Information for LNG Terminal Equipment

Air Emission Source (quantity)	Input Rating (MMBtu/hr)	Output Rating	Energy Source
Water/Ethylene-Glycol Heaters (10)	98.4 (each)	NA	Natural Gas
High-Pressure Flare (1)	0.085 (pilot)	NA	Natural Gas
Low-Pressure Flare (1)	0.034 (pilot)	NA	Natural Gas
Emergency Generator (1)	NA	1 MW	Diesel Fuel
Diesel Fire Pump (1)	NA	275 Hp	Diesel Fuel

MMBtu/hr million British thermal units per hour
NA No data available

New Source Performance Standards

NSPS regulations (40 CFR 60) establish pollutant emission limits and monitoring, reporting, and recordkeeping requirements for various emission sources based on source type and size. These regulations apply to new, modified, or reconstructed sources.

Subpart Dc of 40 CFR 60 applies to small industrial, commercial, or institutional steam generating units that are modified, constructed, or reconstructed after June 9, 1989 and have maximum heat input rates of more than 10 million British thermal units (MMBtu/hr) but less than 100 MMBtu/hr. Subpart Dc establishes specific emissions limits for SO_2 (for coal- and oil-fired units) and PM (for coal-fired units). The proposed boilers would not be coal- or oil-fired, so the emission limitations would not be applicable. However, Subpart Dc would be applicable for reporting and recordkeeping requirements.

Subpart Kb of 40 CFR 60 applies to any volatile organic liquid storage unit that is modified, constructed, or reconstructed after July 23, 1984 and has a capacity of 75 m^3 or greater. Even though the LNG would contain only a small quantity of volatile organic compounds it may still be, by definition, a volatile organic liquid because it has the potential to emit VOCs. However, there are several exemptions that may apply to LNG storage tanks at the proposed terminal. Subpart Kb exempts tanks that operate at an absolute pressure of greater than 204.9 kilopascals (kPa) or whose vapor pressure at storage temperature is less than 3.5 kPa. The proposed LNG storage tanks would operate above atmospheric pressure but below 204.9 kPa; however, the LNG tanks would operate at approximately -260° F and the vapor pressure of the VOC (assumed to be propane) at this temperature is 0.007 kPa. This is well below the applicability threshold of 3.5 kPa; therefore, the tank is not subject to NSPS Subpart Kb.

Prevention of Significant Deterioration

Title I of the CAA establishes guidelines for the preconstruction/modification review of large air emission sources. Construction of sources in attainment areas must be reviewed in accordance with the PSD regulations. To be classified as a new major PSD source, the potential to emit (PTE) for the source must be either greater than 100 tons per year (tpy) for any pollutant regulated by the EPA under the CAA for sources that are among the 28 source categories listed in section 169 of the CAA, or greater than 250 tpy for any pollutant regulated by the EPA under the CAA for sources that are not among the 28 source categories listed in section 169 of the CAA. A Best Available Control Technology (BACT) analysis and detailed dispersion modeling are required if a facility is classified as a major PSD source.

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Fossil fuel boilers (or combination thereof) totaling more than 250 MMBtu/hr heat input are identified in the list of 28 source categories in section 169 of the CAA; therefore, the applicability threshold for PSD review for the proposed LNG terminal is 100 tpy.

Nonattainment New Source Review

Construction of sources in nonattainment areas must be reviewed in accordance with the nonattainment NSR regulations. As discussed above, the project area is designated "nonattainment" for ozone (40 CFR 81.331). As such, there are special requirements for sources of VOC and NO_x because these pollutants are precursors to ground-level ozone formation and are regulated by section 182(f) of the CAA for ozone nonattainment areas. The EPA has delegated responsibility of the nonattainment NSR program to the NJDEP. The NJDEP established nonattainment NSR requirements in NJAC 7:27-18 outlining the review requirements for sources with a PTE greater than 25 tpy for NO_x or VOC. The NJDEP has also established several NO_x and VOC regulations for specific source types. These regulations are discussed in the State Regulations section of this draft EIS.

Table 4.11.1-4 presents the annual maximum potential emissions from the proposed LNG terminal and relevant PSD and NSR threshold criteria.

TABLE 4.11.1-4

Operating Air Emissions Summary for the Proposed LNG Terminal a/

	NO_2		CO		VOC		SO_2		$PM_{10}/PM_{2.5}$	
Emission Unit (Quantity)	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Water/Ethylene-Glycol Heaters (10) b/	11.4	45.0	20.8	82.0	5.31	23.24	0.58	2.54	0.98	4.31
High-Pressure Flare (1) c/	0.02	0.11	0.12	0.54	1.8E-03	0.01	2.0E-04	9.0E-04	2.5E-03	1.1E-02
Low-Pressure Flare (1) c/	0.01	0.03	0.03	0.14	4.6E-04	2.0E-03	5.0E-05	2.0E-04	6.3E-04	2.8E-03
Emergency Generator (1) d/	32.30	4.04	1.40	0.18	0.96	0.24	2.43	0.30	1.05	0.13
Fire Pump (1) d/	7.80	0.98	0.60	0.08	0.68	0.09	0.56	0.07	0.61	0.08
Total	-	50.16	-	82.94	-	23.58	-	2.91	-	4.53
PSD Threshold Criteria	NA	NA	NA	100	NA	NA	NA	100	NA	100
NSR Threshold	NA	25	NA	NA	NA	25	NA	NA	NA	NA

a/ Emissions of lead, beryllium, mercury, sulfuric acid mist, asbestos, vinyl chloride, fluorides, hydrogen sulfide, total reduced sulfur, reduced sulfur compounds, CFCs, halons, and ozone depleting substances are negligible.

b/ Annual emissions are based on the lb/hr emission rates and 8,760 hours of operation per year for nine heaters.

c/ Annual emissions are based on the lb/hr emission rates and 8,760 hours of operation per year

d/ Annual emissions are based on the lb/hr emission rates and 250 hours of operation per year.

NO_2 nitrogen dioxide
CO carbon monoxide
VOC volatile organic compound
SO_2 sulfur dioxide
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
lb/hr pounds per hour
tpy tons per year

As shown in table 4.11.1-4, the PTE NO_x is greater than the NSR threshold. Therefore, the proposed LNG terminal would be subject to nonattainment NSR. The nonattainment NSR would require emission offsets and demonstration of compliance with the lowest achievable emission rate (LAER). The LAER is the most stringent emission limitation established in the SIP, or achieved in practice, for a

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similar source of air emissions. Crown Landing has proposed ultralow NO_x burners achieving a NO_x concentration of less than 9 parts per million by volume at 3 percent oxygen in the stack gas. Approval of the LAER determination would be made by the NJDEP during the preconstruction NSR permitting process.

Because the air emission estimates for CO and VOC are based on manufacturer's emission estimates and these emissions guarantees are used to avoid classification as a PSD or NSR major source for these pollutants, **we recommend that:**

- **Crown Landing provide to the Commission a copy of the final manufacturer's guarantees and NJDEP final permit <u>prior to construction</u>. If the estimated PTE for CO or VOC is determined to be greater than the major source threshold, additional information regarding the method of compliance demonstration should also be provided. This may include air dispersion modeling for CO or an LAER determination for VOC.**

<u>Title V Operating Permits</u>

Title V of the CAA requires states to establish an air operating permit program. The requirements of Title V are outlined in 40 CFR 70 and the permits required by these regulations are often referred to as Title V or Part 70 permits. New Jersey has incorporated this program in NJAC 7:27-22.

Under NJAC 7:27-22, major sources (i.e., sources with a PTE greater than a major source threshold level) are required to obtain a Title V operating permit. Title V major source threshold levels in New Jersey are: 100 tpy for CO and PM_{10}, 25 tpy for NO_x or VOC, 10 tpy for an individual hazardous air pollutant (HAP), or 25 tpy for any combination of HAPs. As shown in table 4.11.1-4, the PTE for NO_x is greater than the major source threshold; therefore, the proposed LNG terminal would need to obtain a Title V operating permit from the NJDEP.

<u>National Emission Standards for Hazardous Air Pollutants</u>

The NESHAPs, codified in 40 CFR Parts 61 and 63, regulate HAP emissions. Part 61 was promulgated prior to the 1990 Clean Air Act Amendments (CAAA) and regulates only eight types of hazardous substances (asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride).

The 1990 CAAA established a list of 189 HAPs; resulting in the promulgation of Part 63. Part 63, also known as the Maximum Achievable Control Technology (MACT) standards, regulates HAP emissions from major sources of HAP emissions and specific source categories that emit HAPs. Part 63 defines a major source of HAPs as any source that has the potential to emit 10 tpy of any single HAP or 25 tpy of HAPs in aggregate.

LNG storage and process facilities are not one of the source categories regulated by Part 61; therefore, the requirements of Part 61 are not applicable. Part 63 establishes HAP emission standards for marine vessel loading operations (Subpart Y); oil and gas production facilities (Subpart HH); natural gas transmission and storage facilities (Subpart HHH); industrial, commercial, and institutional boilers and process heaters (proposed as Subpart DDDDD); and reciprocating internal combustion engines (Subpart ZZZZ). These subparts establish requirements for major sources of HAPs only. As indicated above, the potential HAP emissions (in aggregate) from the LNG terminal would be 8.3 tpy. The single largest HAP

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emitted by the terminal would be hexane with a PTE of 7.9 tpy. Therefore, the LNG terminal would not be a major source of HAPs and would not be subject to the NESHAPs.

Federal Class I Area Protection

The U.S. Congress designated certain lands as Mandatory Federal Class I (Class I) areas in 1977. Class I areas were designated because the air quality was considered a special feature of the area (e.g., national parks or wilderness area). These Class I areas, and any other areas that have been redesignated Class I areas since 1977, are given special protection under the PSD program. The PSD program establishes air pollution increment increases that are allowed by new or modified air pollution sources. If the new source is required to comply with PSD program requirements and is near a Class I area, the source is required to determine its impacts at the nearby Class I area(s). The source is also required to notify the appropriate federal land manager(s) for the nearby Class I area(s).

The proposed LNG terminal would not be subject to PSD review for CO and the nearest Federal Class I area is the Brigantine Wilderness Area located approximately 50 miles east of Logan Township. Therefore, the operational impacts of the proposed LNG Terminal on the Brigantine Wilderness Area are not required as part of the preconstruction permitting process.

General Conformity

A conformity determination must be made if a federal action would generate emissions that would exceed the conformity thresholds levels (*de minimis*) of the pollutant(s) for which an air basin is in nonattainment. A conformity determination must show that the emissions would conform to the SIP and would not reduce air quality in the air basin, which can be demonstrated through offsets, SIP provisions, or modeling. Emissions from sources subject to NSR or PSD requirements are exempt and are deemed to have conformed. The requirements for a conformity determination are listed in 40 CFR Parts 6, 51, and 93, and became effective March 15, 1994.

As described above, the project area is designated as a "severe nonattainment area" for the 1-hour ozone standard and a "moderate nonattainment area" for the 8-hour ozone standard. A federal conformity determination is required for any project in a "severe nonattainment" that would result in combined direct and indirect emissions of either NO_x or VOCs equal to or greater than 25 tpy. Since the combined potential direct and indirect emissions of NO_x from the proposed LNG terminal would be greater than 25 tons per year, a general conformity determination is required. A general conformity determination is currently being prepared for the Crown Landing LNG Project. The draft general conformity determination will be issued following the publication of this draft EIS.

State Regulations

Preconstruction Permits

The NJDEP requires a preconstruction permit for all new facilities meeting specific criteria set forth in NJAC 7:27-8. The regulation requires commercial fuel burning equipment with maximum heat input rates of 1 MMBtu/hr or greater to obtain preconstruction permits. In accordance with the regulation, Crown Landing would need to obtain air permits for the water/ethylene-glycol heaters, emergency generator, and fire water pump prior to construction.

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Smoke and Particulate from Combustion Sources

NJDEP regulation NJAC 7:27-3 (Subchapter 3) and 7:27-4 (Subchapter 4) limit visible (smoke) and particulate emissions from combustion equipment. Subchapter 3 establishes a 20 percent opacity limit for internal combustion sources, which includes the emergency generator, diesel water pump, mobile sources, and marine installations. Subchapter 3 also requires no visible emissions from the water/ethylene-glycol heaters except for 3 minutes in any consecutive 30-minute period. Subchapter 4 establishes a particulate emission limit of 0.17 pounds per MMBtu for the water/ethylene-glycol heaters. The heaters would comply with the emission limitation and visible emission requirement by burning natural gas.

Fuel Sulfur Content

Subchapter 9 of NJAC 7:27 limits sulfur content of liquid fuels. Crown Landing proposes to use liquid fuels in the generator and fire pump. Crown Landing would comply with NJAC 7:27 by using low sulfur distillate oil with a sulfur content of less than 0.2 percent by weight to run the proposed liquid fuel equipment.

Control of Volatile Organic Compounds and Oxides of Nitrogen

Subchapter 16 of NJAC 7:27 applies to any stationary source or group of sources that emits or has the potential to emit VOCs. Subchapter 19 applies to any stationary source or group of sources that emits or has the potential to emit 25 tpy of NO_x. Together these subchapters are referred to as the "VOC RACT Rule." The heaters and emergency generator at Crown Landing would be subject to these regulations. Specifically, the heaters must have VOC emissions no higher than 50 parts per million by volume on a dry basis (ppmvd) at 7 percent oxygen, CO emissions no higher than 100 ppmvd at 7 percent oxygen, NO_x emissions no higher than 0.1 pounds per MMBtu, and adjusted combustion processes that comply with NJAC7:27-16.24 annually. The generator must have limited NO_x emissions, CO emissions no higher than 500 ppmvd at 15 percent oxygen, and adjusted combustion processes that comply with NJAC7:27-16.24 annually.

Emission Offset Rule

Subchapter 18 of NJAC 7:27 applies to new air emission sources in or affecting nonattainment areas. As described above, the project area is designated as a "nonattainment area" for ozone. As such, NO_x and VOC are regulated as nonattainment pollutants for the area. Prior to commencing construction, Crown Landing would be required under Subchapter 18 to obtain emission offsets from existing sources that have implemented a permanent, enforceable emission reduction. The emission offsets must be obtained at a ratio of 1.3 to 1 (i.e., Crown Landing must obtain 1.3 tons of offsets for every 1 ton of emissions it would generate). In addition to offsets, Crown Landing would be required to implement LAER for NO_x emissions. The NJDEP would provide a LAER determination as part of the pre-construction permitting process. Crown Landing currently proposes the installation of ultra low NO_x burners on the heaters to reduce NO_x emissions and to comply with LAER.

Operating Permits

The operating permit program in New Jersey is regulated under Subchapter 22 of NJAC 7:27. As discussed in detail above, the LNG terminal would require a Title V operating permit.

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State-of-the-Art Requirements

Under NJAC 7:27-8.12, new equipment and control apparatus are required to incorporate advances-in-the-art of pollution control for emission units that have the potential to emit more than a threshold quantity of an air pollutant. These requirements are typically referred to as the state-of-the-art (SOTA) requirements. The SOTA thresholds, which apply to each individual piece of equipment, are 5 tpy for all criteria pollutants except lead, which has a SOTA threshold of 20 pounds per year. The SOTA thresholds for HAPs and toxic substances vary per compound. The proposed LNG terminal would be subject to the SOTA requirements for the NO_x emissions from the heaters and the emergency generator and for the CO emissions from the heaters. Crown Landing's implementation of LAER for NO_x emissions would satisfy the SOTA requirements. The NJDEP SOTA manual for boilers currently sets the limit for CO emissions at 0.05 pounds per MMBtu. NJDEP recently published proposed revisions to the boiler manual that would lower the CO emissions level to 0.039 pounds per MMBtu. The NJDEP would determine Crown Landing's compliance with SOTA for CO emissions during the preconstruction permitting process.

Air Quality Impacts and Mitigation

Construction of the proposed LNG terminal and pipeline facilities would have temporary adverse impacts on air quality due to fugitive dust emissions. The amount of fugitive dust would depend on several factors including the amount of exposed soil, moisture content of the soil, amount of vehicular traffic, and wind speed. Construction of the LNG terminal and pipeline would also result in tailpipe emissions from a variety of sources, including bulldozers, cranes, trucks, backhoes, side boom tractors, pile drivers, and dredging vessels.

The fugitive dust and tailpipe emissions from construction of the LNG terminal and pipeline are expected to be localized, minor, and temporary. This would be particularly true for pipeline construction, which would be of relatively short duration in any one area. Both Crown Landing and Texas Eastern propose to control fugitive dust resulting from construction activities by applying water as necessary. The construction vehicle emissions would be minimized by complying with the EPA mobile source emission regulations which may include 40 CFR Parts 85, 86, 89, and 90.

Operation of the LNG terminal would result in air emissions from mobile sources (LNG marine vessels, tugs, and commuter and delivery vehicles) and stationary equipment (heaters and emergency equipment) associated with the LNG facility. The estimated emissions from the stationary sources are summarized in table 4.11.1-4 and the mobile source emissions are summarized in table 4.11.1-5.

Marine vessel emissions would be minimized by using diesel electric ships approximately half of the time. These ships are capable of using electricity while at berth to eliminate air emissions. When diesel electric ships are not used, Crown Landing would use ships that burn a combination of fuel oil and LNG. Mobile source emissions are regulated primarily through fuel mandates and engine emission standards that must be met by the engine manufacturers. These fuel mandates and engine standards would likely reduce the mobile source emissions identified above. One of the most significant reductions would be the SO_2 emissions from fuel oil and diesel fuel combustion as fuel mandates significantly reduce the allowable sulfur content in these fuels.

The mobile source emissions from operation of the facility will be assessed in the general conformity determination for compliance with the SIP and demonstrate that the proposed project would not delay attainment of the ozone NAAQS.

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TABLE 4.11.1-5

Estimated Air Emissions from the Crown Landing LNG Mobile Sources a/

	PM_{10}		SO_2 b/		NO_x		CO		VOC	
Source	lb/delivery	tpy	lb/delivery	tpy	lb/delivery	tpy	lb/delivery	tpy	lb/delivery	tpy
Tugs – Transport	25	1.9	195	14.3	664	48.4	84	6.1	30	2.2
LNG Ships – Transport c/	47	1.8	839	31.2	486	30.2	309	16.4	221	8.4
LNG Ships – Berthing c/	47	1.7	839	30.6	342	12.5	141	5.1	9	0.3
Commuter/Delivery Vehicles	---	0.0	---	0.0	---	2.0	---	7.3	---	0.6
Total	---	5.4	---	76.1	---	93.1	---	34.9	---	11.5

a/ The emissions assume 146 deliveries per year.

b/ The SO_2 emissions from the LNG ships are based on an estimated fuel sulfur content of 2.25 weight percent.

c/ The emissions estimates per delivery are based on the worst case scenario. It was assumed that half of the LNG ships would be powered by diesel electric systems and half would be powered by dual fuel steam boilers running fuel oil and LNG.

NO_x oxides of nitrogen
CO carbon monoxide
SO_2 sulfur dioxide
PM_{10} particulate matter less than 10 microns in diameter
VOC volatile organic compounds
lb/delivery pounds per LNG ship delivery
tpy tons per year

No air emissions would be directly generated by the pipeline during normal operation. Rare situations may require blowing down a segment of the pipeline; however, the only regulated emission that would be generated in such event is a small quantity of VOC.

4.11.2 Noise

Noise Environment

Project-related noise would affect the local environment during construction and operation of the proposed LNG terminal and pipeline. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of the day and throughout the week. This variation is caused in part by changing weather conditions and the effects of seasonal vegetative cover. Two measures used by federal agencies to relate the time-varying quality of environmental noise to its known effect on people are the 24-hour equivalent sound level ($L_{eq(24)}$) and the day-night sound level (L_{dn}). The $L_{eq(24)}$ is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The L_{dn} is the average of the daytime sound level (L_{day}) and the nighttime sound level (L_{night}) with 10 decibels of the A-weighted scale (dBA) added to the L_{night}, to account for people's greater sensitivity to sound during nighttime hours. L_{day} is the average sound level from 7 am to 10 pm L_{night} is the sound representative of the location between the hours of 10 pm and 7 am.

In 1974, the EPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. This publication evaluates the effects of environmental noise with respect to health and safety. The document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has determined that to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed an L_{dn} of 55 dBA. The FERC has adopted this criterion for new compression and associated facilities and it is used here to evaluate the potential noise impact from operation of the LNG

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terminal. An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA for facilities that operate at a constant level of noise. The NJDEP regulates noise under NJAC 7:29-1; which prohibits continuous noise levels from industrial, commercial, public service, or community service facilities in excess of 65 dBA during the daytime (7 am to 10 pm) and 50 dBA during the nighttime (10 pm to 7 am) at any affected residential property line. Assuming a continuous noise source, the FERC standard of 55 dBA L_{dn} is more stringent (i.e., compliance with the FERC standard will ensure compliance with the NJDEP noise regulation).

There are several noise sensitive areas (NSAs) within 1 mile of the LNG terminal site. Figure 4.11.2-1 shows the location of NSAs relative to the LNG terminal site.

Table 4.11.2-1 lists the distance and direction of each NSA from the LNG terminal site. The closest NSA (NSA 1) is a residence located about 2,300 feet east of the site.

TABLE 4.11.2-1

Noise Sensitive Areas Near the Proposed LNG Terminal Site

NSA	Distance and Direction a/	Description
NSA 1	2,312 feet Southeast	Residence
NSA 2	2,488 feet Southeast	Residence
NSA 3	3,841 feet Southeast	Residence
NSA 4	4,432 feet Southeast	Residence

a/ Distance and direction of each NSA is relative to the eastern most LNG storage tank.

NSA Noise sensitive area

An ambient sound survey of existing noise levels near the NSAs in the vicinity of the LNG terminal was conducted between August 19 and 21, 2003. The purpose of the sound survey was to document the existing acoustical environment near the NSAs prior to operation of the LNG terminal. Noise measurements were made for a period of about 40 hours at two locations: one adjacent to the boundary of NSA 1 approximately 20 feet from U.S. Route 130 and the other on the LNG terminal site approximately 450 feet from the Delaware shoreline. The data obtained from the sound survey were used to estimate the existing background noise levels at the NSAs for evaluating compliance with our noise requirement of 55 dBA L_{dn} and the New Jersey noise requirement of 65 dBA $L_{eq(24)}$ at any nearby residential property line. The estimated existing noise levels for the NSAs based on the sound survey are listed in table 4.11.2-2.

There are a total of 124 residences and 9 business establishments within 50 feet of proposed pipeline construction work areas. No background data are available for the noise sensitive areas along the pipeline route. Because most of these residences are located along streets in the City of Chester, the expected ambient noise levels at these residences are likely higher than the ambient noise levels measured at the NSAs near the LNG terminal site.