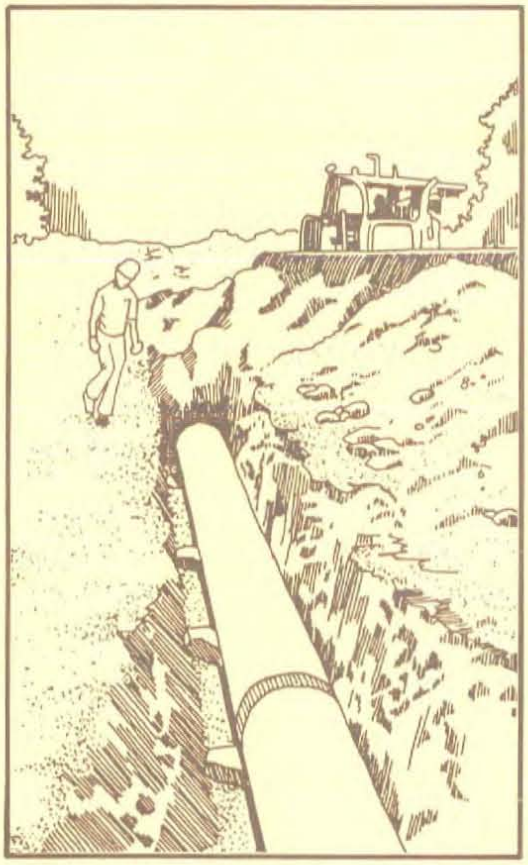
Federal Energy Regulatory Commission

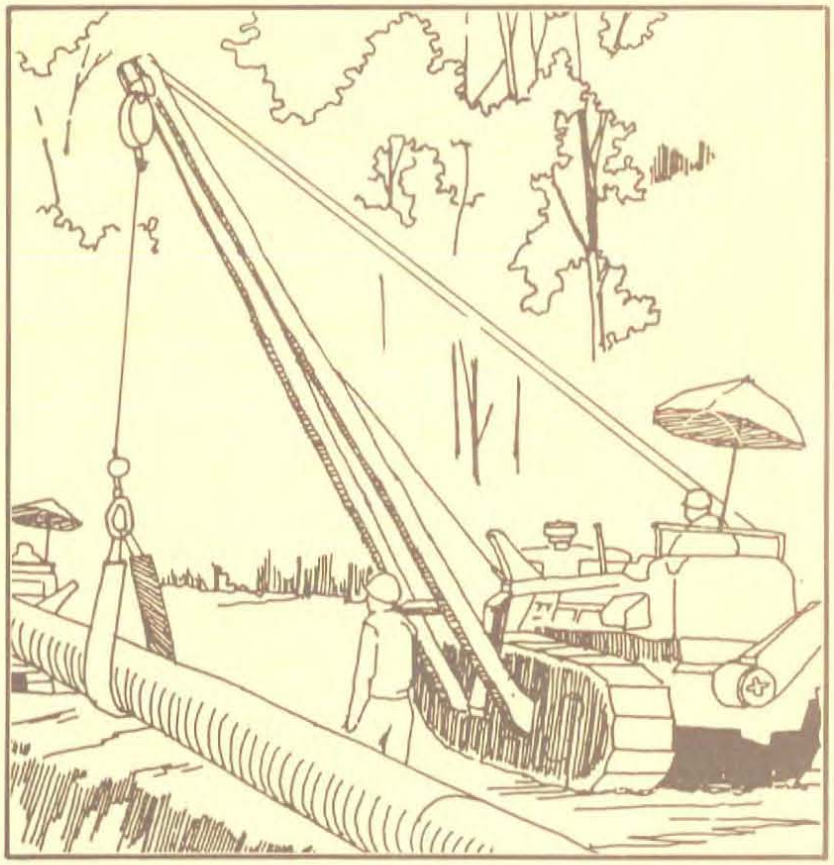
Office of Pipeline and Producer Regulation

June 1990

FERC/EIS 0057

Tennessee Gas Pipeline Company	Docket Nos.	CP88-171-001
Great Lakes Gas Transmission Company		CP89-892-000
Algonquin Gas Transmission Company		CP88-187-002
CNG Transmission Corporation and Texas Eastern Transmission Corporation		CP88-195-002
CNG Transmission Corporation		CP89-712-000
Transcontinental Gas Pipe Line Corporation		CP89-7-001
		CP89-710-000
		CP89-2205-000
Texas Eastern Transmission Corporation		CP89-711-000
National Fuel Gas Supply Corporation and Penn-York Energy Corporation		CP88-194-001





NIAGARA IMPORT POINT PROJECT

Final Environmental Impact Statement

Volume I

WASHINGTON, DC 20426

NIAGARA IMPORT POINT PROJECT

Final Environmental Impact Statement

Volume I

LEAD AGENCY

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF PIPELINE AND PRODUCER REGULATION

COOPERATING AGENCIES

U.S. DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
U.S. DEPARTMENT OF AGRICULTURE
U.S. FOREST SERVICE
U.S. DEPARTMENT OF ENERGY

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UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

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	)	CP89-710-000
	) and	CP89-2205-000
National Fuel Gas Supply Corporation and Penn-York Energy Corporation	)	CP88-194-001

NIAGARA IMPORT POINT PROJECT
NOTICE OF AVAILABILITY OF
FINAL ENVIRONMENTAL IMPACT STATEMENT

(June 15, 1990)

Notice is hereby given that the staff of the Federal Energy Regulatory Commission (FERC) has made available a final environmental impact statement (FEIS) on the natural gas pipeline facilities proposed in the above-referenced dockets and related nonjurisdictional facilities.

The FEIS was prepared to satisfy the requirements of the National Environmental Policy Act. The staff concludes that approval of the proposed project, with appropriate mitigating measures, including receipt of necessary permits and approvals, would have limited adverse environmental impact. The FEIS evaluates alternatives to the proposals.

Great Lakes Gas Transmission Company (Great Lakes) proposed in its application, Docket No. CP89-892-000, to construct seventeen 36-inch-diameter pipeline loops for a total length of

459.6 miles within Minnesota (76.8 miles), Wisconsin (42.6 miles) and Michigan (340.2 miles). The facilities are designed to transport up to 417,500 thousand cubic feet per day (Mcfd) of natural gas for TransCanada PipeLines, Limited (TransCanada) from the United States-Canadian border at Noyes, Minnesota, back to TransCanada at two points along the United States-Canadian border near Sault Ste. Marie and St. Clair, Michigan. TransCanada requires this increase in transportation volumes primarily to satisfy the market requirements of export customers in the Northeastern United States.

Tennessee Gas Pipeline Company (Tennessee) proposed in its application, Docket No. CP89-171-001, to deliver 50,000 Mcfd of Canadian natural gas to a power plant in Rhode Island, 20,000 Mcfd to a cogeneration facility in Syracuse, New York, and 13,900 Mcfd to CNG Transmission Corporation (CNG) at Marilla, New York, for transport on behalf of a cogeneration facility in Brookview, New York. To deliver this gas, Tennessee would construct 41.9 miles of 30-inch-diameter pipeline loops in New York and Massachusetts, 7,000 horsepower (hp) of compression at an existing compressor in Niagara County, New York, one new metering station at an existing compressor station site, and modifications to two existing metering stations.1/

National Fuel/Penn-York proposed in their application, Docket No. CP88-194-001, to construct pipeline facilities to transport and deliver up to 161,500 Mcfd of Canadian natural gas as follows: 125,000 Mcfd to Transcontinental Gas Pipe Line Corporation (Transco) at Leidy, Pennsylvania; 12,000 Mcfd to CNG at Marilla, New York, for transportation on behalf of a cogeneration facility in Oswego, New York; 12,000 Mcfd for delivery by National Fuel to a cogeneration facility in Tonawanda, New York; and 12,500 Mcfd for National Fuel's own system supply. To deliver this gas, National Fuel/Penn-York would construct 2.5 miles of 24-inch-diameter pipeline, 8,640 hp of compression at a new compressor station in Concord, New York, and 2,600 hp of additional compression at the existing Ellisburg Station.

1/ Approximately 17.1 miles of the pipeline loop along Tennessee's Niagara Spur in Erie County, New York, would be jointly owned by Tennessee, National Fuel Gas Supply Corporation and Penn-York Energy Corporation (National Fuel/Penn-York), and CNG/Texas Eastern Transmission Corporation.

CNG and Texas Eastern Transmission Corporation (Texas Eastern) proposed in their application, Docket No. CP88-195-002, to construct pipeline facilities to transport and deliver 101,000 Mcfd of Canadian natural gas to Texas Eastern and Transcontinental Gas Pipe Line Corporation (Transco) in Leidy, Pennsylvania. To deliver this gas, CNG/Texas Eastern would construct 0.4 mile of 20-inch-diameter replacement pipeline, 2,200 hp of additional compression at the State Line Compressor Station, and three new metering facilities at existing compressor and metering stations.

Transco proposed in its applications, Docket Nos. CP89-7-001, CP89-710-000 and CP89-2205-000, to receive 125,000 Mcfd of Canadian natural gas from National Fuel/Penn-York at Leidy, Pennsylvania, and 72,000 Mcfd from CNG/Texas Eastern at Leidy, Pennsylvania. The 125,000 Mcfd would be used to supply expansion of Transco's existing markets (61,900 Mcfd) and two cogeneration facilities in Oyster Bay, New York (15,000 Mcfd), and in Hopewell, Virginia (48,100 Mcfd). Transco would also transport 31,600 Mcfd of domestic natural gas supplies from existing upstream pipelines to the cogeneration facility in Hopewell, Virginia. The 72,000 Mcfd would be for redelivery as follows: 48,817 Mcfd to Algonquin Gas Transmission Company (Algonquin) at Centerville, New Jersey, and 23,183 Mcfd to North Jersey Energy Associates for a cogeneration facility in Sayreville, New Jersey. To deliver this gas, Transco would construct two 36-inch-diameter pipeline loops totaling 8.4 miles, additional 12,600 hp of compression at an existing compressor station in Luzerne, Pennsylvania, 12,000 hp of compression at a proposed compressor station in Mercer County, New Jersey, 7,660 hp of compression at a proposed compressor station in Mecklenburg County, Virginia, a new meter station in Middlesex County, New Jersey, and modification to an existing meter station in Greensville County, Virginia.

CNG proposed in its application, Docket No. CP89-712-000, to receive at Marilla, New York, 13,900 Mcfd of Canadian natural gas from Tennessee for redelivery to a cogeneration facility in Brookview, New York, and 12,000 Mcfd from National Fuel/Penn-York for redelivery to a cogeneration facility in Oswego, New York. To deliver this gas, CNG would construct 2.7 miles of new 30-inch pipeline, 3,600 hp of compression at two existing compressor stations, and a modification to a metering facility.

Algonquin proposed in its application, Docket No. CP88-187-2, to receive 48,817 Mcfd of Canadian natural gas from Transco at Centerville, New Jersey, and 14,000 Mcfd of domestic natural gas supplies from Texas Eastern in Lambertville, New Jersey, for

redelivery to a cogeneration facility in Bellingham, Massachusetts. To deliver this gas, Algonquin would construct 12.8 miles of 12-, 16-, and 36-inch-diameter pipeline loops, 11.4 miles of 10-, 20-, and 24-inch-diameter replacement pipeline and a new metering station.

Texas Eastern proposed in its application, Docket No. CP89-711-000, to receive from CNG/Texas Eastern at Leidy, Pennsylvania 29,000 Mcfd of Canadian natural gas for its own system supply. To deliver this gas, Texas Eastern would construct 5 miles of a 24-inch-diameter pipeline loop.

The FEIS will be used in the regulatory decision-making process at FERC and may be presented as evidentiary material in formal hearings at FERC. While the period for filing interventions in this case has expired, motions to intervene out-of-time can be filed with FERC in accordance with the Commission's Rules of Practice and Procedure, 18 CFR 385.214 (d). Further, anyone desiring to file a protest with FERC should do so in accordance with 18 CFR 385.211.

The FEIS will be placed in the public files of FERC, and is available for public inspection in FERC's Public Reference and File Management Branch, Room 3308, 941 North Capitol Street, N.E., Washington, DC 20426. Copies have been mailed to Federal, state, and local government agencies, interested individuals, public interest groups, newspapers, libraries, and parties to the proceeding.

A limited number of copies of the FEIS is available from the FERC's Public Reference and File Management Branch, telephone (202) 208-1371, or from Mr. Lonnie Lister, Deputy Project Manager, Environmenal Policy and Project Analysis Branch, Office of Pipeline and Producer Regulation, Room 7312, 825 North Capitol Street, N.E., Washington, DC 20426, telephone (202) 208-2191 or FTS 268-2191. When these copies are depleted, the FEIS will be available from the National Technical Information Service (NTIS) Springfield, Virginia. Call the NTIS at (703) 487-4780 to obtain the FEIS identification number and information on how to order additional copies.

Lois D. Cashell
Secretary

MAJOR CONCLUSIONS

The Great Lakes Gas Transmission Company (Great Lakes), Tennessee Gas Pipeline Company (Tennessee), Algonquin Gas Transmission Company (Algonquin), Transcontinental Gas Pipe Line Corporation (Transco), Texas Eastern Transmission Corporation (Texas Eastern), CNG Transmission Company (CNG), and National Fuel Gas Supply Corporation and Penn-York Energy Corporation (National Fuel/Penn-York) propose to construct and operate interstate natural gas pipelines and associated aboveground facilities. These facilities comprise the Niagara Import Point (NIP) Project. The purpose of the project would be to transport natural gas from Canada and domestic sources to the Northeastern United States market for use by a power plant, cogeneration facilities, local distribution companies (LDCs), and the applicants' own system supplies. The applicants have indicated that the proposed facilities are required to service these markets in 1990 and 1991.

The NIP Project Draft Environmental Impact Statement (DEIS) is a document prepared by the staff of the Federal Energy Regulatory Commission (FERC) to fulfill the requirements of the National Environmental Policy Act (NEPA). We (the staff) have concluded that if our recommended mitigative measures to reduce the anticipated environmental impact are adopted, construction and operation of the proposed facilities would have a limited adverse environmental impact and would be an environmentally acceptable action.

We have evaluated energy and route alternatives and in several instances recommended adoption of route variations that we feel would be environmentally preferable to portions of the project as proposed.

PROPOSED ACTION

In the NIP Project, the Great Lakes facilities are designed to transport up to 417,500 thousand cubic feet per day (Mcfd) of Canadian natural gas for TransCanada Pipelines, Limited (TransCanada) between the United States-Canadian border at Noyes, Minnesota, back to TransCanada at two points along the United States-Canada border near Sault Ste. Marie and St. Clair, Michigan. This would require the construction by Great Lakes of approximately 460 miles of pipeline loop in Minnesota, Wisconsin, and Michigan. TransCanada requires this increase in transportation volumes primarily to satisfy the market requirements of the export customers in the Northeastern United States. However, part of the transportation service would be used by TransCanada for sales and transportation services offered to customers in Eastern Canada.

The NIP Project also includes the expansion and modification of other facilities to transport up to 346,400 Mcfd of Canadian natural gas from the Niagara Import Point and 45,600 1/ Mcfd of domestic natural gas to LDCs, cogeneration facilities, a power plant, and applicants' system supplies in the Northeastern United States. Pipeline facilities proposed by the other NIP Project applicants include 68.1 miles of pipeline loops, 11.8 miles of

1/ Bars in the right-hand margins indicate changes from the DEIS.

replacement pipeline, 5.2 miles of new pipeline, 61,800 horsepower (hp) of compression, and additions and modifications to metering facilities.

Tennessee proposes to modify its Niagara Spur Lateral and mainline system to deliver 50,000 Mcfd to a power plant in Rhode Island, 20,000 Mcfd to a cogeneration facility in Syracuse, New York and 13,900 Mcfd to CNG at Marilla, New York, for transport on behalf of a cogeneration facility in Brookview, New York.

National Fuel proposes to transport and deliver up to 161,500 Mcfd of Canadian natural gas as follows: 125,000 Mcfd to Transco at Leidy, Pennsylvania; 12,000 Mcfd for delivery by National Fuel to a cogeneration facility in Tonawanda, New York; 12,000 Mcfd to CNG at Marilla, New York, for transportation on behalf of a cogeneration facility in Oswego, New York; and 12,500 Mcfd for National Fuel's own system supply. The 125,000 Mcfd delivered to Transco would be used to supply the expansion of Transco's existing markets and two cogeneration facilities in Oyster Bay, New York (15,000 Mcfd), and in Hopewell, Virginia (48,100 Mcfd). Transco would also transport 31,600 Mcfd of domestic natural gas from existing upstream pipelines to the cogeneration facility in Hopewell, Virginia.

CNG/Texas Eastern propose to transport and deliver 101,000 Mcfd of Canadian natural gas to Texas Eastern and Transco in Leidy, Pennsylvania. Texas Eastern proposes to use 29,000 Mcfd for its own system supply. Transco proposes to transport and deliver 72,000 Mcfd as follows: 48,817 Mcfd to Algonquin at Centerville, New Jersey, for a cogeneration facility in Massachusetts, and 23,183 Mcfd to North Jersey Energy Associates for a cogeneration facility in Sayreville, New Jersey.

Algonquin proposes to transport 62,817 Mcfd of natural gas for a cogeneration facility in Bellingham, Massachusetts. Approximately 48,817 Mcfd would be Canadian natural gas received from Transco in Centerville, New Jersey, and 14,000 Mcfd would be domestic supplies received from Texas Eastern in Lambertville, New Jersey.

Construction of the NIP Project facilities would have significant effects on forested areas, wetlands, and farmlands that are crossed, and would affect residents near the right-of-way. Most of the adverse effects would occur during the construction process and could be reduced through the mitigative measures we have recommended. Other resources such as air quality, terrestrial, geology and soils, aquatic ecology, and cultural resources would be affected to a lesser extent. To the extent that the natural gas is used to replace or offset use of higher pollutant fuels, there would be beneficial impact on air quality.

Construction of the proposed Great Lakes facilities would result in the clearing of approximately 874 acres of forestland, including forested wetland. Construction of the other applicants' facilities would result in clearing of 166 acres of forestland, including forested wetland. About 509 acres of wetland habitat would be disturbed by the construction of the proposed Great Lakes facilities and approximately 27 acres by the construction of the remaining applicants' facilities.

Approximately 1,314 acres of agricultural land, including croplands, pasture, orchards, and nurseries would be affected by the construction of the NIP Project facilities. Approximately 1,008 acres would be disturbed along Great Lakes loops and 306 acres along the

remaining applicants' facilities. About 9 acres of prime farmland would be permanently disturbed at three new compressor stations. Nine Federally listed or proposed endangered and threatened species may occur within the vicinity of the proposed NIP Project facilities. We have determined that four of these species (the gray wolf, the piping plover, the Kirtland's Warbler, and the shortnose sturgeon) would not be affected. More site-specific data is required to determine whether there would be an effect on the bald eagle, dwarf lake iris, Pitcher's thistles, Houghton's goldenrod, and Michigan monkey-flower. A total of 148 residences would be within 50 feet of the proposed facilities. During construction, residents along the proposed pipeline and adjacent to aboveground facilities would be disturbed by noise, dust, and traffic.

ALTERNATIVES CONSIDERED

The no-action alternative would avoid all the environmental effects of the proposed project but would require potential users to find other energy sources, the most feasible of which are more polluting than natural gas. In assessing system alternatives, we could not find another delivery system in the United States that could be utilized to deliver the volume of gas that would be transported by Great Lakes or that would replace the various pipeline and additional compression facilities proposed by the other applicants to service their geographically diverse customers. No major geographic alternatives were considered feasible to the project as proposed. A total of 18 route variations were considered. Of these, 5 have been recommended for adoption.

AREAS OF CONCERN

On March 16, 1990, FERC published a DEIS on the NIP Project facilities. The DEIS was mailed to public officials; Federal, state and local agencies; township and county supervisors; local libraries and newspapers; and other interested parties. The DEIS had a 45-day comment period during which we received a number of comments, both general and site-specific. During the comment period, we received 44 comment letters from Federal, state and local agencies, the applicants, and the general public. Issues raised included comments on our recommended plans, procedures, and mitigation measures to site-specific impact that had not been addressed. We reviewed each comment and responded to each of these comment letters. Our responses to the DEIS comments are included in Volume II of this Final EIS (FEIS).

Concerns were expressed regarding the effects of construction on federally or state-listed or proposed endangered plant and animal species. Issues raised were the need for surveys to determine the presence of endangered and threatened species along the proposed routes and the type of construction mitigation and timing techniques required to minimize any adverse effects.

Other issues raised concerning the environment included the effects of wetland crossings and the measures planned to avoid/minimize wetland disturbance, effects of construction in peatlands where it is necessary to determine adequate pipeline separation and bedding to protect pipeline stability, and the effects of stream crossings on water quality and sensitive fisheries.

Many comments were raised on our recommended mitigation measures in appendix C, Erosion Control, Revegetation, and Maintenance Plan; appendix D, Stream and Wetland Construction and Mitigation Procedures; and our recommendations in section 7.3. Major issues raised concerned the restrictions on the timing of construction on wetlands, stream crossings, and agricultural crops; soil and erosion control measures; and review and approval of mitigation plans. Many commentors were supportive of our measures and suggested additional mitigative measures to be considered.

Several commentors voiced concern about the impact of pipeline construction and operation on public interest areas such as national forests, wildlife refuges, local conservation lands, and local recreation areas. Issues were raised concerning limiting the width of construction and permanent rights-of-way; aesthetic impact of a pipeline right-of-way, especially at major road crossings; loss of sensitive habitats; and the protection of established recreational facilities. Each of the U.S. Forest Service's districts affected by the project wrote specific recommendations for mitigation measures on forestlands.

Some concerns were raised regarding construction and mitigative procedures by those who live adjacent to the proposed pipeline right-of-way. Concerns included proximity to dwellings, blasting as it may affect the structural integrity of existing buildings and water supply wells, construction safety procedures, removal of residential trees, access to private lands, pipeline safety, and effects on emergency response service.

Many comments were made about our recommended route variations. Comments ranged from support of our recommended variations to suggestions for additional variations to be considered based on more detailed site-specific information.

Other concerns were raised about the need for the natural gas supplies, the use of other energy alternatives and conservation, the analysis of system and routing alternatives, and the analysis of environmental impact from nonjurisdictional facilities.

In our analysis we have recommended a number of mitigative measures that would require implementation by the applicants prior to, during, and after construction.

Another area of concern relates to the cultural resource aspects of the project. Historical properties and archeological sites that are on or eligible for listing in the National Register of Historic Places and previously unidentified cultural resources are being identified and evaluated pursuant to the requirements of Section 106 of the National Historic Preservation Act. The State Historic Preservation Officers' (SHPO) comments regarding the significance of each identified property and/or site, and the project's effect on each, will be obtained. Mitigative measures will be developed in coordination with the SHPOs and the Advisory Council on Historic Preservation for any listed or eligible properties that would be affected by construction and operation of the proposed project. Although the site-evaluation work and mitigative requirements may not be completed for inclusion in the FEIS, we have recommended that completion of this activity prior to construction be a condition to any Certificate of Public Convenience and Necessity that may be issued by the Commission.

NIAGARA IMPORT PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

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ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
AGA	American Gas Association
Algonquin	Algonquin Gas Transmission Company
ANR	ANR Pipeline Company
APEC	Associated PennEast Customer Group
ARS	Archaeological Research Specialists
ATV	all-terrain vehicles
BACT	best available control technology
BCF	billion cubic feet
BIA	Bureau of Indian Affairs
Btus	British thermal units
CDFO	Canadian Department of Fish & Oceans
Certificate	Certificate of Public Convenience and Necessity
CETI	Cogen Energy Technology, Inc.
CFR	Code of Federal Regulations
Champlain	Champlain Pipeline Company
CNG	CNG Transmission Company
COE	U.S. Army Corps of Engineers
Con Edison	Consolidated Edison Company of New York
Columbia	Columbia Gas Transmission Corporation
CTDEP	Connecticut Department of Environmental Protection
CWA	Clean Water Act
dBA	decibel
dbh	diameter at breast height
DEIS	Draft Environmental Impact Statement
DNR	Department of Natural Resources
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
Dthd	dekatherms per day
DWA	deer wintering area
Elizabethtown	Elizabethtown Gas Company
E&SC	Erosion and Sedimentation Control
EA	environmental assessment
EFSC	Massachusetts Energy Facility Siting Council
EIS	Environmental Impact Statement
EME	Energy Marketing Exchange
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FS	U.S. Forest Service
FWS	U.S. Fish and Wildlife Service
GAS	Gas Alternative Systems
GPM	gallons per minute

Great Lakes	Great Lakes Gas Transmission Company
hp	horsepower
Hopewell	Hopewell Cogeneration Limited Partnership
ILHR	(Wisconsin Department of) Industry, Labor, and Human Relations
Indeck/Oswego	Indeck Energy Services of Oswego, Inc.
Indeck/Yerkes	Indeck-Yerkes Services Inc.
Iroquois/Tennessee	Iroquois/Tennessee Pipeline Project
IWPA	interim wellhead protection area
Lakehead	Lakehead Pipeline Company
LAKWMU	Leota Area Kirtland's Warbler Management Units
L90	sound level exceeded 90 percent of the observation period
LDC	local distribution company
Ldn	day-night sound level
Leq(24)	24-hour equivalent sound level
LILCO	Long Island Lighting Company
Long Island Cogen	Long Island Cogeneration Limited Partnership
MADEP	Massachusetts Department of Environmental Protection
MBT	Migratory Bird Treaty
MDEQE	Massachusetts Department of Environmental Quality Engineering
Mcfd	thousand cubic feet per day
MIDNR	Michigan Department of Natural Resources
MLV	mainline valve
MNDNR	Minnesota Department of Natural Resources
MNHESP	Massachusetts Natural Heritage and Endangered Species Program
MP	milepost
MPCA	Minnesota Pollution Control Agency
NAAQS	National Ambient Air Quality Standards
National Fuel/ Penn-York	National Fuel Gas Supply Corporation and Penn-York Energy Corporation
NEA	NorthEast Energy Associates
NEEPC	New England Energy Policy Council
NEP	New England Power Company
NEPA	National Environmental Policy Act
NGA	Natural Gas Act
NHL	National Historic Landmark
NHPA	National Historic Preservation Act of 1966
Niagara Mohawk	Niagara Mohawk Power Company
NIP	Niagara Import Point
NJDEP	New Jersey Department of Environmental Protection
NJEA	North Jersey Energy Associates
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
NSP	Niagara Settlement Project

NWI	U.S. Fish and Wildlife Service National Wetland Inventory
NYDAM	New York Department of Agriculture and Markets
NYDEC	New York Department of Environmental Conservation
NYDER	New York State Department of Environmental Resources
NYDOS	New York Department of State
NYNHP	New York Natural Heritage Program
NYPSC	New York Public Service Commission
OPPR	Office of Pipeline and Producer Regulation
ORV	off-road vehicle
OSHA	(U.S. Dept. of Labor) Occupational Safety and Health Administration
OSP II	Ocean States Power Project
PADER	Pennsylvania Department of Environmental Resources
PAF	Public Archaeological Facility
PAL	Public Archaeological Laboratory
PCBs	polychlorinated biphenyls
PGC	Pennsylvania Game Commission
PM	particulate matter
ppmv	parts per million by volume
PSE&G	Public Service Electric and Gas Company
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RIDEM	Rhode Island Department of Environmental Management
ROW	right-of-way
SCS	U.S. Department of Agriculture Soil Conservation Service
SEQRA	New York State Environmental Quality Review Act
SHPO	State Historic Preservation Officer
SO_2	sulfur dioxide
SR	state route
SS-2	SS-2 Storage Service
SUNY	State University of New York
TEMCO	Transco Energy Marketing Company
Tennessee	Tennessee Gas Pipeline Company
Texas Eastern	Texas Eastern Transmission Corporation
tpy	tons per year
TransCanada	TransCanada Pipelines Limited
Transco	Transcontinental Gas Pipe Line Corporation
TSCA	Toxic Substances Control Act
UMASS	University of Massachusetts Archaeological Services
USBM	U.S. Bureau of Mines
USGS	U.S. Geological Survey
WIDNR	Wisconsin Department of Natural Resources

1.0 PURPOSE

1.1 PURPOSE AND NEED

The Niagara Import Point (NIP) Project is part of the Niagara Settlement Project (NSP) described in section 1.2.1. Tennessee Gas Pipeline Company (Tennessee), Algonquin Gas Transmission Company (Algonquin), Transcontinental Gas Pipe Line Corporation (Transco), Texas Eastern Transmission Corporation (Texas Eastern), CNG Transmission Company (CNG), National Fuel Gas Supply Corporation and Penn-York Energy Corporation (National Fuel/Penn-York) have proposed to construct and operate natural gas pipeline facilities to transport up to 346,400 thousand cubic feet per day (Mcfd) of Canadian natural gas from the Niagara Import Point in Niagara County, New York, and 45,600 Mcfd of domestic natural gas to a power plant, cogeneration facilities, local distribution companies (LDCs), and their own system supply. The applicants have identified the shippers, shown in table 1.1-1, that require these gas quantities to meet their current market needs. The applicants have indicated that these proposed facilities are required for natural gas deliveries in 1990 and 1991. Approximately 52.8 percent of the gas would be delivered in 1990 and the total volume in 1991.

To support the deliveries of Canadian natural gas to the Niagara Import Point, Great Lakes Gas Transmission Company (Great Lakes) has proposed to construct and operate natural gas pipeline facilities to transport up to 417,500 Mcfd of Canadian natural gas for TransCanada Pipelines Limited (TransCanada) from the United States-Canadian border at Noyes, Minnesota, back to TransCanada at two points along the United States-Canadian border near Sault Ste. Marie and St. Clair, Michigan. Upon delivery from Great Lakes, TransCanada would transport the gas to its existing interconnection with Tennessee at the United States-Canadian border in Niagara County, New York. TransCanada would require this transportation service primarily to satisfy the market requirements of export customers in the Northeastern United States. However, part of the transportation service to be provided by Great Lakes would be for sales and transportation services that TransCanada offers to its customers in eastern Canada.

1.2 RELATIONSHIP TO OPEN SEASON SETTLEMENT PROJECTS

Following the Federal Energy Regulatory Commission's (FERC or Commission) "Notice Inviting Applications to Provide New Gas Service to the Northeast U.S.," issued on July 24, 1987, Tennessee, Algonquin, Transco, Texas Eastern, CNG, and National Fuel/Penn-York, along with numerous other parties, submitted applications on January 15, 1988, for Certificates of Public Convenience and Necessity (Certificate). The Commission issued an order on March 17, 1988, consolidating these applications into 31 distinct project proceedings. The Commission identified certain other projects as discrete projects that could be processed outside of a comparative hearing. The Commission then determined on June 29, 1988, that some of the applications initially identified as potentially mutually exclusive in fact constituted additional discrete projects.

To facilitate the processing of the remaining applications, the Commission, on July 27, 1988, consolidated the remaining 13 potentially competitive projects into one proceeding and appointed a settlement judge to conduct settlement negotiations. During the course of the settlement negotiations, new settlements and several projects were severed from the settlement proceeding and designated as discrete projects. The formal conferences ultimately

TABLE 1.1-1

Proposed Shippers and Natural Gas Deliveries

Applicant	Shippers	Delivery Point	Quantity (Mcfd)	Nonjurisdictional Facilities
TENNESSEE	Ocean State Power II	Burrillville, RI	50,000	250 MW Power Plant Addition
	GAS Alternative Systems	Syracuse, NY	20,000	80 MW Cogeneration Plant/Pipeline
CNG/TEXAS EASTERN/ TRANSCO/ALGONQUIN	NorthEast Energy Associates	Bellingham, MA	62,817 a/	300 MW Cogeneration Plant
CNG/TEXAS EASTERN/TRANSCO	North Jersey Energy Associates	Sayreville, NJ	23,183	300 MW Cogeneration Plant/Pipeline
NATIONAL FUEL/PENN-YORK/ TRANSCO	Consolidated Edison Co. of New York, Inc.	Manhattan, NY	30,600	LDC - none
	Elizabethtown Gas Company	Various delivery points in NJ	15,000	LDC - none
	Energy Marketing Exchange, Inc.	New Village, NJ	6,000	none
	Long Island Cogeneration Limited Partnership	Oyster Bay, NY	15,000	80 MW Cogeneration Plant/Pipeline
	UGI Corporation	Hazeltown and Humboldt, PA	10,000	LDC - none
	Hopewell Cogeneration Limited Partnership	Prince George County, VA	80,000 c/	356 MW Cogeneration Plant/Pipeline
CNG/TEXAS EASTERN	Texas Eastern	Leidy, PA	29,000	System Supply - none
NATIONAL FUEL/PENN-YORK/ CNG	Indeck Energy Services of Oswego	Oswego, NY	12,000	49 MW Cogeneration Plant/Pipeline
TENNESSEE/CNG	Cogen Energy Technology, Inc.	Brookview, NY	13,900	60 MW Cogeneration Plant/Pipeline
NATIONAL FUEL/PENN-YORK	National Fuel	East Aurora, NY	10,000	System Supply - none
		Clarence, NY	2,500 b/	System Supply - none
	Indeck-Yerkes Energy Services, Inc.	Tonawanda, NY	12,000	53 MW Cogeneration Plant
TOTAL			392,000	

a/ Includes 14,000 Mcfd of domestic natural gas supplies from Texas Eastern at Lambertville, New Jersey.
b/ Approximately 2,500 Mcfd of the 12,500 Mcfd for National Fuel's system supply was previously certificated by the Commission, on July 24, 1987, in the Boundary Gas Inc., Docket No. CP81-108-005 et al.
c/ Includes 31,600 Mcfd of domestic supplies to be moved through existing upstream pipelines on a self-implemented basis.

resulted in four additional settlement projects: the Niagara, the Iroquois/Tennessee, the Champlain, and the ANR. The last three were identified in a "Final Report of the Chief Judge and Certification of Settlement" issued on November 30, 1988. The NSP was identified in a "Final Report of the Chief Judge and Certification of Settlement" issued on November 18, 1988.

Acting on the November 18, 1988, report, the Commission issued an order on January 12, 1989, severing the NSP from the open season proceeding for processing as a discrete project, and required the filing of amended applications to implement the NSP. As required by the settlement, the sponsors of the settlement project submitted most of their amended applications by January 27, 1989.

On February 24, 1989, Great Lakes filed an application with the Commission for facilities to support TransCanada deliveries to the Niagara Import Point for the NSP.

1.2.1 Niagara Settlement Project

All the facilities proposed by the applicants in the NSP are designed to transport up to 624,480 Mcfd of natural gas received from TransCanada and domestic gas supplies. The gas would be transported from the Niagara Import Point and domestic receipt points and delivered to LDCs, cogeneration plants, storage facilities, and a power plant in the Northeastern United States.

Overall, for NSP, the proposed Great Lakes and NSP facilities consist of approximately 631.0 miles of 12-, 24-, 30-, 36- and 42-inch-diameter pipeline loop 1/; 12.1 miles of 10-, 20-, and 24-inch-diameter replacement pipeline; 46.2 miles of new 20-, 24-, and 30-inch-diameter pipeline; the addition of 48,600 horsepower (hp) of compression at existing compressor stations; and 28,300 hp of new compression at three proposed compressor stations.

In reviewing the facilities proposed in the NSP, the Commission determined, based on the existing capacity of TransCanada and the firm commitments of downstream users, that the facilities may be phased as three independent projects. The three projects are the SS-2 Storage Service (SS-2) Project, the Transco Energy Marketing Company (TEMCO) Project, and the NIP Project.

The SS-2 Project would consist of the construction and operation of facilities to provide up to 11 billion cubic feet (BCF) of natural gas annually at a rate of up to 100,000 dekatherms per day (Dthd) of storage service to eight electric generators or LDCs. Facilities for the SS-2 Project would include 67 miles of 20-, 24-, 30-, 36-, and 42-inch-diameter pipeline facilities, as well as metering facilities at the existing Leidy Compressor Station. An environmental assessment (EA) for these facilities was completed by the Commission staff in July 1989. On July 27, 1989, the Commission issued an Order Issuing Certificates and Approving Abandonment for the SS-2 Project.

1/ A pipeline loop is a segment of pipeline that is usually adjacent to an existing pipeline and connected to it at both ends. The loop allows more gas to flow through the pipeline without additional compression.

The TEMCO Project would consist of approximately 77.3 miles of 16-, 30-, and 36-inch-diameter pipeline loop; 0.28 mile of 24-inch-diameter replacement pipeline; 15,100 hp of additional compression at four existing compressor stations; and the addition and modification of six measurement facilities. The TEMCO Project would provide transportation services for 132,480 Mcfd of Canadian and domestic natural gas for LDCs and cogeneration facilities. An EA for these facilities was completed by the Commission staff in January 1990. On May 2, 1990, the Commission issued an Order Issuing Certificates for the TEMCO project.

The SS-2 and TEMCO Projects do not depend upon construction of the facilities proposed by Great Lakes for the NIP Project.

In the NIP Project, the Great Lakes facilities are designed to transport up to 417,500 Mcfd of Canadian natural gas for TransCanada from the United States-Canadian border at Noyes, Minnesota, back to TransCanada at two points along the United States-Canadian border near Sault Ste. Marie and St. Clair, Michigan. This would require the construction by Great Lakes of approximately 460 miles of pipeline loop in Minnesota, Wisconsin, and Michigan. TransCanada requires this increase in transportation volumes primarily to satisfy the market requirements of the export customers in the Northeastern United States. However, part of the transportation service to be provided by Great Lakes would be for sales and transportation services that TransCanada offers to its customers in eastern Canada.

The NIP Project also includes the expansion and modification of the other applicants' facilities to transport up to 346,400 Mcfd of Canadian natural gas from the Niagara Import Point and 45,600 Mcfd of domestic natural gas to LDCs, cogeneration facilities, a power plant and applicants' system supply in the Northeastern United States. Pipeline facilities proposed by the NIP Project applicants are described in section 2.1.

The Canadian natural gas received at the Niagara Import Point would be transported along the Niagara Spur Loop, which would be jointly owned by Tennessee, National Fuel, and CNG/Texas Eastern. Each owner's daily entitlement to the Canadian natural gas would be as follows: Tennessee - 83,900 Mcfd, National Fuel - 161,500 Mcfd, and CNG/Texas Eastern - 101,000 Mcfd. Tennessee proposes to construct the Niagara Spur Loop as well as other modifications to its mainline system for delivery of 50,000 Mcfd to a power plant in Rhode Island, 20,000 Mcfd to a cogeneration facility in New York, and 13,900 Mcfd for delivery to CNG at Marilla, New York, for transport on behalf of a cogeneration facility in Brookview, New York.

National Fuel proposes to transport up to 161,500 Mcfd of Canadian natural gas for delivery as follows: 125,000 Mcfd for delivery to Transco at Leidy, Pennsylvania; 12,000 Mcfd for delivery by National Fuel to a cogeneration facility in Tonawanda, New York; 12,000 Mcfd for delivery to CNG at Marilla, New York, for transportation on behalf of a cogeneration facility in Oswego, New York; and 12,500 Mcfd for National Fuel's own system supply 2/. The 125,000 Mcfd delivered to Transco would be used to supply expansion of Transco's existing markets and two cogeneration facilities in Oyster Bay, New York (15,000 Mcfd) and in Hopewell, Virginia (48,100 Mcfd). Transco would also transport 31,600 Mcfd

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2/ Approximately 2,500 Mcfd of the 12,500 Mcfd for National Fuel's system supply was previously certificated by the Commission on July 24, 1987, in the Boundary Gas Inc., Docket No. CP81-108-005, et al.

of domestic natural gas supplies from existing upstream pipelines to the cogeneration facility in Hopewell, Virginia.

CNG/Texas Eastern propose to transport 101,000 Mcfd of natural gas for delivery to Texas Eastern and Transco in Leidy, Pennsylvania. Texas Eastern proposes to use 29,000 Mcfd for its own system supply. Transco proposes to transport 72,000 Mcfd as follows: 48,817 Mcfd for delivery to Algonquin at Centerville, New Jersey, for a cogeneration facility in Massachusetts, and 23,183 Mcfd for delivery to North Jersey Energy Associates for a cogeneration facility in Sayreville, New Jersey.

Algonquin proposes to transport 62,817 Mcfd of Canadian natural gas for a cogeneration facility in Bellingham, Massachusetts. Approximately 48,817 Mcfd would be Canadian natural gas received from Transco in Centerville, New Jersey, and 14,000 Mcfd of domestic supplies received from Texas Eastern in Lambertville, New Jersey.

1.2.2 Other Northeast Settlement Projects

The other three Northeast Settlement Projects are the Iroquois/Tennessee Pipeline Project, the Champlain Pipeline Project, and the ANR Pipeline Project. These three projects are discussed briefly below. Each is being studied in a separate environmental document.

1.2.2.1 The Iroquois/Tennessee Pipeline Project

The Iroquois/Tennessee Pipeline Project (Iroquois/Tennessee) is designed to transport up to 575,900 Mcfd of natural gas received from TransCanada to various LDCs, cogeneration, and electric generation customers in the southern New England, New Jersey, and New York regions. The project includes the construction by Iroquois of approximately 369 miles of pipeline from the United States-Canadian border near Iroquois, Ontario, through New York and Connecticut to Long Island, New York.

Iroquois/Tennessee also includes the expansion and modification of Tennessee's facilities to transport Canadian natural gas received from Iroquois for delivery to LDCs and cogeneration customers in Massachusetts, Connecticut, Rhode Island, New York, and New Hampshire; and to transport 70,000 Mcfd of domestic natural gas on Tennessee's system from Louisiana to an interconnection with Algonquin for ultimate delivery to an electric power generation customer in Massachusetts and Rhode Island. Algonquin proposes to receive Canadian natural gas from Iroquois/Tennessee and redeliver it to LDCs in Connecticut and New York. Finally, Texas Eastern would deliver by exchange 55,000 Mcfd of natural gas received from Iroquois at South Commack, New York, to three LDCs in New Jersey.

The facilities proposed in this project are being phased as two independent projects. Phase I contemplates the delivery of 422,900 Mcfd of natural gas from Canada through the proposed Iroquois system and the expanded Tennessee system. The Phase II services contemplate transportation and delivery of 153,900 Mcfd of Canadian natural gas and 70,000 Mcfd of domestic natural gas. An EIS for Phase I was issued by the Commission staff in June 1990. The Phase II facilities will be studied in a separate NEPA document later in 1990.

1.2.2.2 The Champlain Pipeline Project

The Champlain Pipeline Project was originally designed to transport 430,600 Mcfd of natural gas received from TransCanada to various LDCs, cogeneration, and electric power production and pipeline customers in the New England region. The project was to include the construction by Champlain of 4,000 hp of compression and approximately 322.7 miles of pipeline extending from the United States-Canadian border near Philipsburg, Quebec, through Vermont, New Hampshire, and Massachusetts to a point of termination near West Medway, Massachusetts. The proposed pipeline would have had one proposed point of interconnection with Tennessee at Upton, Massachusetts, and one point of interconnection with Algonquin at West Medway, Massachusetts.

On November 7, 1989, ANR, which had become the operator of Champlain, requested that the Commission suspend processing of the Champlain application. In the filing, ANR indicated that the project would be restructured and refiled with FERC sometime in 1990. As a result of this request three original customers of Champlain requested transportation service from the Iroquois/Tennessee Pipeline Project. At this time the Champlain proposal is not being processed.

Algonquin originally proposed to receive up to 307,174 Mcfd of Canadian natural gas from the Champlain Pipeline Project, phased in over 2 years, on behalf of 12 customers of Champlain. Algonquin then proposed to redeliver up to 196,574 Mcfd to 10 LDCs and cogeneration and electric generation customers at various points of delivery along the Algonquin system; redeliver up to 60,000 Mcfd to NEP at its Brayton Point and Manchester Street electric generating stations; and to receive up to 50,600 Mcfd for its own system supply requirements.

The Champlain Pipeline Project is currently postponed and no date has been set for when or if it will become active.

1.2.2.3 The ANR Project

The ANR Project involves the expansion of ANR's, Columbia Gas Transmission Corporation's (Columbia), CNG's, Texas Gas Transmission Corporation's (Texas Gas), and Transco's systems to deliver 503,000 Mcfd of primarily domestic natural gas on a firm basis on behalf of LDCs, cogenerators, and one electric generation customer. These five listed companies propose to construct approximately 489 miles of pipeline, 159,450-hp of compression, and appurtenant facilities. ANR would deliver about 115,000 Mcfd to Columbia near Paulding, Ohio.3/ Columbia would deliver 55,000 Mcfd to a cogenerator in New Jersey and 60,000 Mcfd to Algonquin for redelivery to the NEP Brayton Point and Manchester Street plants.

3/ Columbia presented their deliveries in terms of dekatherms of gas per day (Dthd). We have converted these units to Mcfd for consistency with other units.

ANR would also deliver 138,000 Mcfd to CNG at Lebanon, Ohio, for transportation to end users. CNG intends to deliver 76,900 Mcfd to six cogenerators in New York and 29,600 Mcfd to other cogenerators that are, currently, unidentified. In addition, CNG will redeliver 31,500 Mcfd to Transco at Leidy, Pennsylvania for ultimate delivery to a cogenerator in New York. Texas Gas proposes to redeliver 250,000 Mcfd to CNG at Lebanon, Ohio. CNG, in turn, will redeliver this gas to Transco at Leidy, Pennsylvania for ultimate delivery to 14 shippers from North Carolina to Massachusetts. The ANR Project is currently being processed by the staff.

1.3 PURPOSE AND SCOPE OF THE STATEMENT

FERC evaluates applications filed for authority to construct and operate interstate natural gas pipeline facilities. Certificates are issued pursuant to Section 7(c) of the Natural Gas Act (NGA) when FERC has determined that the project is required by the public convenience and necessity. This Environmental Impact Statement (EIS) was prepared by the FERC staff in compliance with the National Environmental Policy Act (NEPA) and the Commission's implementing regulations under Chapter I, Title 18, Code of Federal Regulations (CFR), Part 380. FERC is the lead agency in preparing this EIS. The U.S. Forest Service (FS), U.S. Fish and Wildlife Service (FWS), and the U.S. Department of Energy (DOE) are cooperating Federal agencies for this project. The principal purposes of this EIS are to:

- Identify and assess potential impact on the human environment that would result from the implementation of the proposed action.
- Assess reasonable alternatives to the proposed action that would avoid or minimize adverse effects on the human environment.
- Identify and recommend alternatives and specific mitigation measures to minimize the environmental impact.
- Facilitate public involvement in identifying significant environmental impact.

This EIS addresses the environmental impact of the proposed pipeline and compressor station additions and modifications proposed by Great Lakes in Docket No. CP89-892-000, Tennessee in Docket No. CP89-171-001, Algonquin in Docket No. CP88-187-002, Transco in Docket Nos. CP89-710-000, CP89-7-001, and CP89-2205-000, Texas Eastern in Docket No. CP89-711-000, CNG in Docket No. CP89-712-000, National Fuel/Penn-Yorkin Docket No. CP88-194-001, and CNG/TexasEastern in Docket CP88-195-002. Environmental analysis in this EIS covers land resources, water resources, air quality, noise, ecology, sociocultural resources, archeological and historic sites, endangered and threatened species, floodplains, and wetlands.

1.4 SCOPE OF NONJURISDICTIONAL FACILITY ANALYSIS

Under Section 7 of the NGA, FERC is required to consider, as part of a decision to certify jurisdictional facilities, all factors bearing on the public convenience and necessity. The NIP Project jurisdictional facilities would include new pipeline, pipeline loops and replacement, new and modified metering facilities, new compressor stations, and addition of horsepower at existing compressor stations. These facilities are discussed in detail in sections 2.1.1 and 2.1.8.

Further, under NEPA, FERC considers the environmental impact of nonjurisdictional facilities when, as a practical matter, operation of the nonjurisdictional facilities is impossible without use of the jurisdictional facilities. Such nonjurisdictional facilities would be considered an "integral part" of the jurisdictional project. Nonjurisdictional facilities required for end use of the gas include major facilities such as electric power plant conversion and cogeneration facilities, as well as less significant facilities such as lateral pipeline connections to LDCs. Our environmental review was limited to these direct tie-ins to the interstate network 4/. These are discussed in detail in section 2.1.9.

FERC is also obligated by statute to consider the potential impact of a proposed pipeline project on federally listed or proposed endangered and threatened species. Under the FWS regulations implementing the Endangered Species Act (ESA) of 1973 as amended (50 CFR Part 402), the Commission is required to ensure that certificated projects are not likely to jeopardize the continued existence of federally listed or proposed endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. This requirement extends to integrally related nonjurisdictional projects.

The Commission is also required to ensure that historic and cultural resources are not adversely affected by issuance of a certificate. Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires the Commission to take into account the effects of the proposed project on properties included in or eligible for listing in the National Register of Historic Places (NRHP) and, before issuing final approval of the project, to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on the project. The regulations implementing the NHPA (36 CFR Part 800) also require the Commission to consider the impact of nonjurisdictional projects that are directly related to the jurisdictional proposal.

The purpose of this environmental analysis is to determine which, if any, of the nonjurisdictional facilities would have the potential for significant environmental impact. This EIS includes descriptions of all integrally related nonjurisdictional facilities. The current status of each of these nonjurisdictional projects is identified and the potential impact on federally listed or proposed endangered and threatened species and cultural resources is discussed. If the project has received all necessary state and/or local approvals and no significant issues have been raised before FERC, we do not consider the environmental impact to be significant. If there are outstanding issues associated with any of the projects, we have recommended that any approval granted by FERC be conditioned upon completion of subsequent environmental reviews prior to operation.

4/ Pronouns "we, us, and our" refer to the staff of the Office of Pipeline and Producer Regulation (OPPR).

2.0 PROPOSED ACTION

2.1 PROPOSED FACILITIES

As shown in tables 2.1-1 and 2.1-2, the NIP Project pipeline and aboveground facilities would consist of approximately 527.7 miles of 12-, 16-, 20-, 24-, 30-, and 36-inch-diameter pipeline loop; 11.8 miles of 10-, 20-, and 24-inch-diameter replacement pipeline loop; 5.2 miles of new 24- and 30-inch-diameter pipeline; 61,800 hp of compression; and metering facilities. The largest portion of the project is the approximately 459.6 miles of 36-inch-diameter pipeline proposed by Great Lakes in Minnesota, Wisconsin, and Michigan. The remaining facilities would be constructed in New York, Pennsylvania, New Jersey, Connecticut, Massachusetts, and Rhode Island.

2.1.1 Great Lakes

Great Lakes proposes to construct seventeen 36-inch-diameter pipeline loops for a total length of 459.6 miles within Minnesota (76.8 miles), Wisconsin (42.6 miles), and Michigan (340.2 miles). The 17 loops would be constructed adjacent to the existing pipeline system. Figure 2.1.1-1 shows the geographic location of the proposed pipeline loops. Table 2.1.1-1 lists the general location, diameter, and length of each proposed loop and the figure number for the detailed route maps in appendix A, figure A-1.

2.1.2 Tennessee

Tennessee proposes to construct and operate 41.9 miles of 30-inch-diameter pipeline loops in New York and Massachusetts. Table 2.1-1 lists the location, diameter, and length of each pipeline loop proposed by Tennessee. Figures 2.1.2-1 and 2.1.2-2 show the geographic locations of the proposed pipeline loops. Detailed Tennessee pipeline route maps are contained in appendix A, figure A-2.

Tennessee also proposes to add compression to its system to facilitate increased flow rates. This would involve the addition of 7,000 hp of compression at its Station 230C in Niagara County, New York. The proposed compressor station facility is listed in table 2.1-2. A map showing the location of Compressor Station 230C is contained in appendix A, figure A-2-7.

2.1.2.1 Segment 1

Segment 1 would consist of 17.1 miles of pipeline loop needed to complete looping of the Niagara Spur Line. It would extend north from milepost (MP) 230B-101 to MP 230B - 103 + 2.0 in Erie County, New York. The Niagara Spur Loop would be constructed by Tennessee and jointly owned by Tennessee, National Fuel, and CNG/Texas Eastern (see figure A-2-1). 1/

1/ Mileposts along the Tennessee segments are measured from the preceding mainline valve (e.g., MP 301 + 3.01 is located 3.01 miles past mainline valve 301). Since the distance between mainline valves varies, mileposts cannot be added to determine total length.

TABLE 2.1-1

Proposed NIP Project Pipeline Facilities

Proposed Facilities	Pipe Diameter (in)	Approximate Length (mi) a/	State	County
GREAT LAKES				
Loop 1	36" Loop	5.6	MN	Marshall
Loop 2	36" Loop	12.2	MN	Marshall
Loop 3	36" Loop	21.3	MN	Clearwater
Loop 4	36" Loop	19.0	MN	Cass, Itasca
Loop 5	36" Loop	3.9	MN	Itasca
Loop 6	36" Loop	14.8	MN	Itasca
Loop 7	36" Loop	27.0	WI	Douglas, Bayfield
Loop 8	36" Loop	36.6	WI/MI	Iron/Gogebic
Loop 9	36" Loop	41.3	MI	Gogebic, Iron
Loop 10	36" Loop	36.0	MI	Dickinson, Marquette, Delta
Loop 11	36" Loop	45.6	MI	Delta, Schoolcraft, Mackinac
Loop 12	36" Loop	30.8	MI	Mackinac
Loop 13	36" Loop	31.9	MI	Emmet
Loop 14	36" Loop	16.2	MI	Otsego, Crawford
Loop 15	36" Loop	39.2	MI	Missaukee, Clare
Loop 16	36" Loop	51.4	MI	Midland, Gratiot, Saginaw
Loop 17	36" Loop	26.8	MI	Lapeer, St. Clair
		459.6		
TENNESSEE				
Segment 1	30" Loop	17.1	NY	Niagara, Erie
Segment 2	30" Loop	0.5	NY	Niagara
Segment 3	30" Loop	3.2	NY	Wyoming
Segment 4	30" Loop	12.5	NY	Livingston, Ontario
Segment 8	30" Loop	5.4	MA	Hampden
Segment 9	30" Loop	3.2	MA	Middlesex
		41.9		
ALGONQUIN				
G-5 Replacement	24" Replacement	5.5	MA	Bristol
G-8 Replacement/Loop	20" Replacement	4.1	MA	Plymouth
	20" Loop	1.4	MA	Plymouth, Barnstable
Medfield Loop	36" Loop	3.3	MA	Norfolk, Middlesex
H-1 Replacement	10" Replacement	1.8	MA	Worcester, Norfolk
E-1 Loop	12" Loop	4.9	CT	New London
Chaplin Loop	36" Loop	1.1	CT	Windham
Tiverton Loop	16" Loop	2.1	RI	Newport
		24.2		
TRANSCO				
6.79-Mile Leidy Loop	36" Loop	6.8	PA/NJ	Northampton, Warren
1.61-Mile Leidy Loop	36" Loop	1.6	PA	Northampton
		8.4		
TEXAS EASTERN				
Line No. 37	24" Loop	5.0	PA	Centre
CNG				
TL-470 Line	30" New	2.7	NY	Albany, Rensselaer
NATIONAL FUEL/PENN-YORK				
Y-M54 Line	24" New	2.5	PA	Potter
CNG/TEXAS EASTERN				
TL-403 Replacement	20" Replacement	0.4	NY	Erie

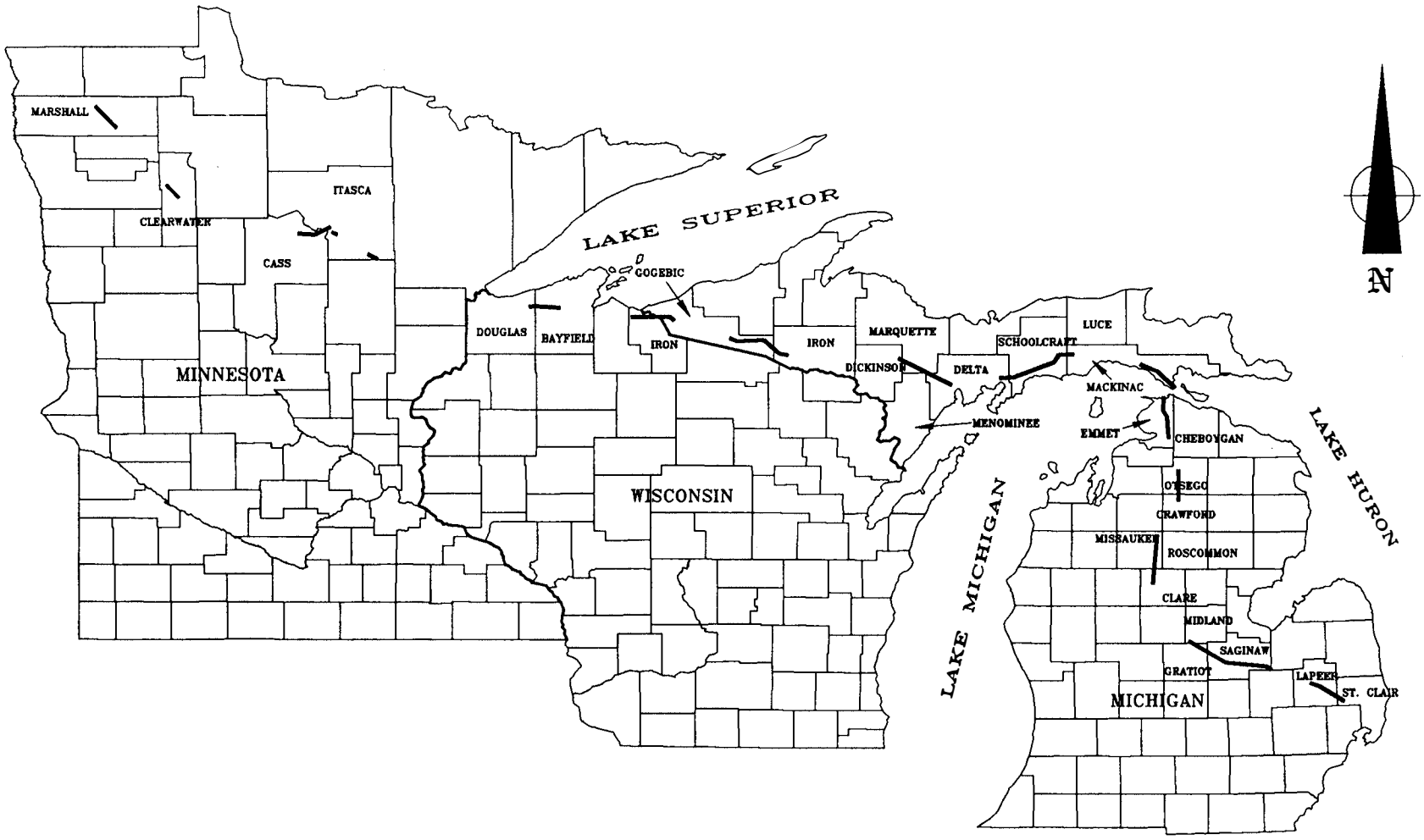
a/ Scaled from U.S. Geological Survey 7.5-minute series topographic maps. Actual length of pipeline to be installed would be slightly greater due to terrain relief.

TABLE 2.1-2

NIP Project Compressor and Meter Stations

Applicant Facility	New or Modified Meter Station	New Horsepower	Added Horsepower	County	State
TENNESSEE					
Compressor Station 230C			7,000	Niagara	NY
Meter Station M-2	New a/			Onondaga	NY
Meter Station M-3	Modification			Erie	NY
Meter Station M-7	Modification			Providence	RI
ALGONQUIN					
Bellingham Meter Station	New a/			Norfork	MA
Burrillville Compressor Station			5,500	Providence	RI
TRANSCO					
Compressor Station 205		12,000		Mercer	NJ
Compressor Station 515			12,600	Luzerne	PA
Compressor Station 167	New	7,660		Mecklenburg	VA
Sayreville Meter Station	New			Middlesex	NJ
Emporia Meter Station	Modification			Greensville	VA
CNG					
State Line Compressor Station			1,350	Potter	PA
Utica Compressor Station			2,250	Herkimer	NY
Brookview Meter Station	Modification			Rensselaer	NY
NATIONAL FUEL/PENN-YORK					
Concord Compressor Station		8,640		Erie	NY
Ellisburg Compresor Station			2,600	Potter	PA
CNG/TEXAS EASTERN					
State Line Compressor Station			2,200	Potter	PA
Marilla Meter Station	New a/			Erie	NY
Ellisburg Meter Station	New a/			Potter	PA
Leidy Meter Station	New a/			Clinton	PA

a/ These new meter stations would be located within the property lines of existing compressor, meter stations, or cogeneration facilities.



KEY

PROPOSED PIPELINE ——

0 70

APPROXIMATE SCALE IN MILES

FIGURE 2.1.1-1

LOCATION OF PROPOSED NIP PROJECT FACILITIES IN MINNESOTA, WISCONSIN AND MICHIGAN

SCALE AS SHOWN

DWG: NOI

TABLE 2.1.1-1

Great Lakes Proposed Pipeline Facilities a/

Loop	Length	Beginning MP	Ending MP	County	State	Figure No.
1	5.6	58.5	64.1	Marshall	MN	A-1-1
2	12.2	51.9	64.1	Marshall	MN	A-1-2
3	21.3	110.1	131.4	Clearwater	MN	A-1-3
4	19.0	182.2	201.2	Cass, Itasca	MN	A-1-4
5	3.9	209.8	213.7	Itasca	MN	A-1-5
6	14.8	226.4	241.2	Itasca	MN	A-1-6
7	27.0	317.4	344.4	Douglas, Bayfield	WI	A-1-7
8	36.6	379.6	416.2	Iron/Gogebic	WI/MI	A-1-8
9	41.3	433.4	474.7	Gogebic, Iron	MI	A-1-9
10	36.0	524.3	560.3	Dickinson, Marquette, Delta	MI	A-1-10
11	45.6	575.2	620.8	Delta, Schoolcraft, Mackinac	MI	A-1-11
12	30.8	649.7	680.5	Mackinac	MI	A-1-12
13	31.9	685.1	717.0	Emmet	MI	A-1-13
14	16.2	736.6	752.8	Otsego, Crawford	MI	A-1-14
15	39.2	776.5	815.7	Missaukee, Clare	MI	A-1-15
16	51.4	850.3	901.7	Midland, Gratiot, Saginaw	MI	A-1-16
17	26.8	925.1	951.9	Lapeer, St. Clair	MI	A-1-17

a/ Great Lakes also proposes to make yard piping modifications at 5 compressor stations and replace 25 aerodynamic assembly units at 11 compressor stations.

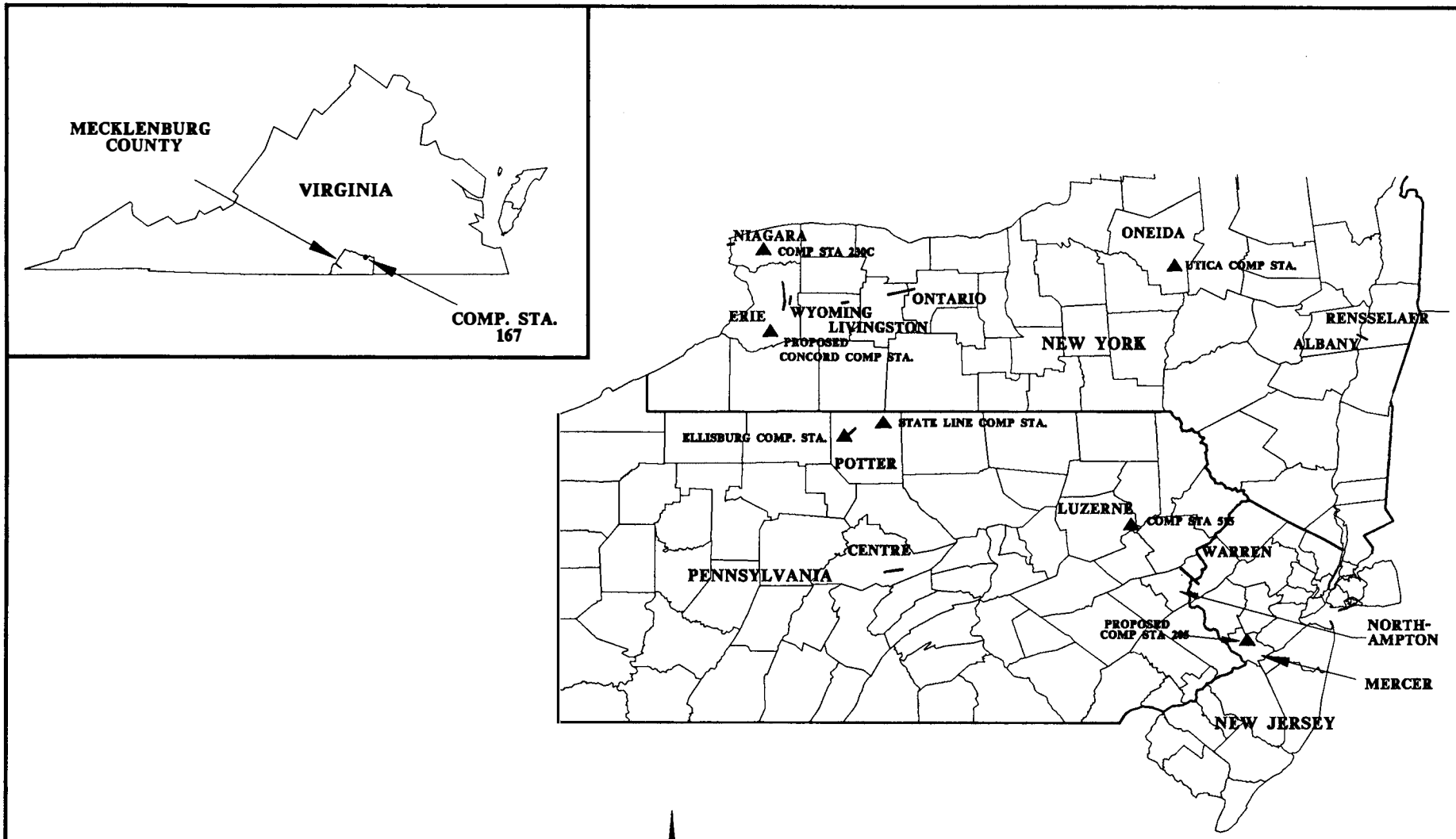


FIGURE 2.1.2.1

LOCATION OF PROPOSED NIP PROJECT FACILITIES IN PENNSYLVANIA, NEW YORK NEW JERSEY AND VIRGINIA

SCALE AS SHOWN

DWG: FERC011

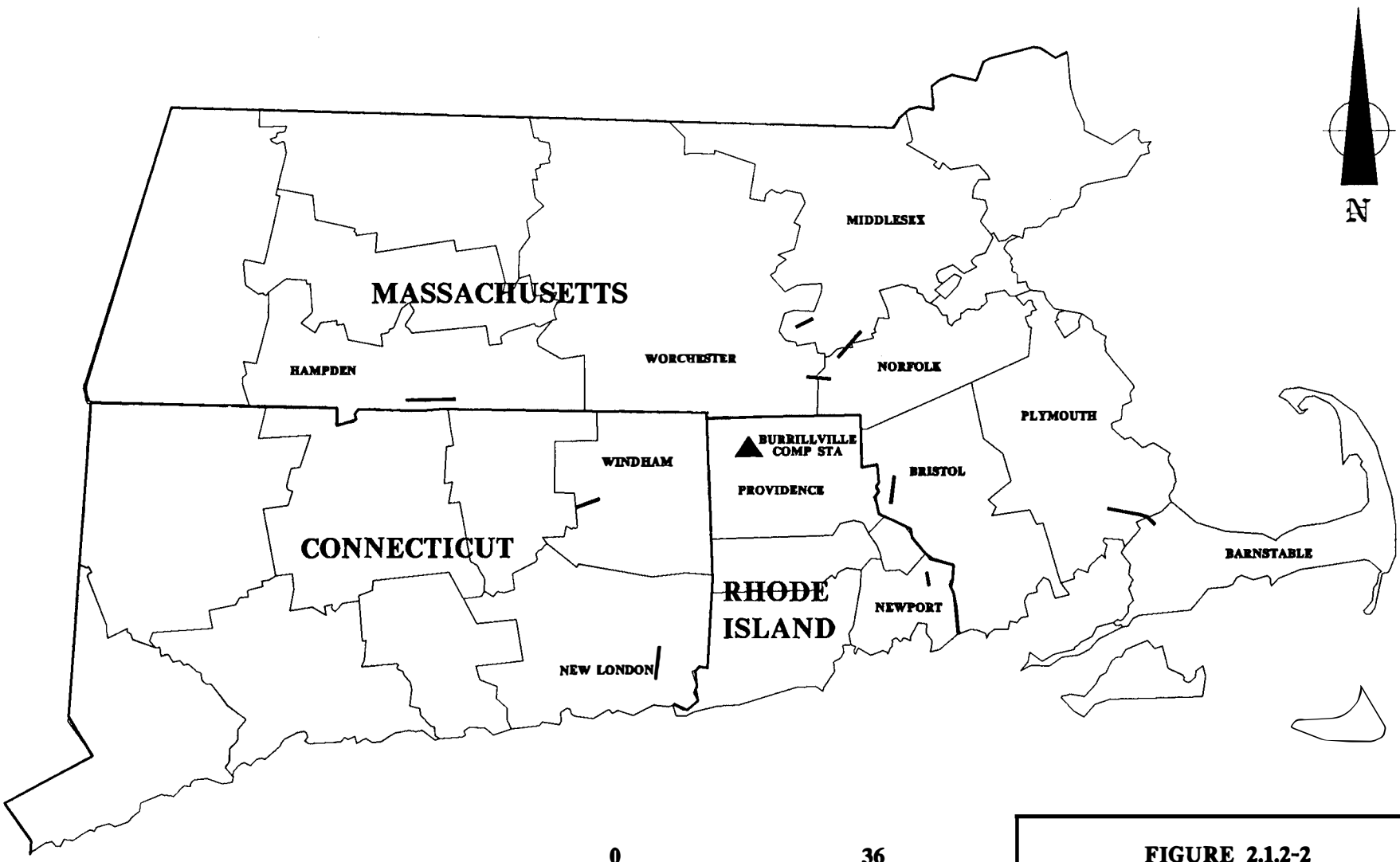


FIGURE 2.1.2-2

LOCATION OF PROPOSED NIP PROJECT FACILITIES IN CONNECTICUT, MASSACHUSETTS AND RHODE ISLAND

SCALE AS SHOWN

DWG: NOI

2.1.2.2 Segment 2

Segment 2 would be a 30-inch-diameter pipeline loop at the Niagara River between Canada and New York. It would extend from MP 230B-108 to mainline valve (MLV) 230B-107 for a total length of 0.5 mile (see figure A-2-2).

2.1.2.3 Segment 3

Segment 3 would be a 30-inch-diameter pipeline loop in Wyoming County, New York. It would extend from MLV 232 to MP 232 + 3.2 for a total length of 3.2 miles (see figure A-2-3).

2.1.2.4 Segment 4

Segment 4 would be a 30-inch-diameter pipeline loop in Livingston and Ontario Counties, New York. It would extend from MLV 234 to MP 235 + 1.0 for a total length of 12.5 miles (see figure A-2-4).

2.1.2.5 Segment 8

Segment 8 would be a 30-inch-diameter pipeline loop in Hampden County, Massachusetts. It would extend from MP 261 + 1.8 to MP 261 + 7.2 for a total length of 5.4 miles (see figure A-2-5).

2.1.2.6 Segment 9

Segment 9 would be a 30-inch-diameter pipeline loop in Middlesex County, Massachusetts. It would extend from MP 266 + 6.2 to MLV 267 for a total length of 3.2 miles (see figure A-2-6).

2.1.2.7 Station 230C Compressor

A 7,000-hp compression addition would be installed at Tennessee's existing Compressor Station 230C in Niagara County, New York. Refer to section 4.1.8 for a detailed description of this station and its environmental setting (see figure A-2-7).

2.1.3 Algonquin

Algonquin proposes to construct a total of 12.8 miles of 12-, 16-, 20-, and 36-inch-diameter pipeline loop and 11.4 miles of 10-, 20-, and 24-inch-diameter replacement pipeline. Table 2.1-1 lists the location, diameter, and length of each pipeline section in Algonquin's proposed system. Figures 2.1.2-1 and 2.1.2-2 show the geographic locations of Algonquin's proposed facilities. Detailed Algonquin pipeline route maps are contained in appendix A, figure A-3.

Algonquin also proposes to add 5,500 hp of compression at its existing Burrillville Compressor Station in Rhode Island and to construct a new meter station at Bellingham, Massachusetts. The location of the compressor and meter stations are shown in appendix A, figures A-3-8 and A-3-9.

2.1.3.1 G-5 Replacement

The G-5 Replacement pipeline would be a 5.5-mile 24-inch-diameter replacement pipeline in Bristol County, Massachusetts. It would extend between the existing G-5 tap, located in Attleboro, Massachusetts, and the existing G-12 tap, located in Seekonk, Massachusetts (see figure A-3-1, sheets 1 to 2).

2.1.3.2 G-8 Replacement/Loop

The G-8 Replacement/Loop pipeline would comprise a 4.1 mile 20-inch-diameter replacement pipeline in Plymouth County, Massachusetts, and a 1.4 mile 20-inch-diameter loop in Plymouth and Barnstable Counties. It would extend 5.5 miles between the existing G-9 system loop in Carver, Massachusetts, to a point just east of the Wareham/Bourne town line in Bourne, Massachusetts (see figure A-3-2, sheets 1 to 3).

2.1.3.3 Medfield Loop

The proposed Medfield Loop would be a 36-inch-diameter pipeline loop in Middlesex and Norfolk Counties, Massachusetts. It would extend for 3.3 miles along a 24-inch-diameter mainline in the towns of Medway and Millis, Massachusetts (see figure A-3-3).

2.1.3.4 H-1 Replacement

The H-1 Replacement would be a 10-inch-diameter replacement pipeline in Worcester and Norfolk Counties, Massachusetts. It would extend for 1.8 miles along Algonquin's existing H-1 system, terminating at the existing Milford Meter Station (see figure A-3-4).

2.1.3.5 E-1 Loop

The E-1 Loop would be a 12-inch-diameter pipeline loop in New London County, Connecticut. It would extend for 4.9 miles from a point of interconnection with the E-3L pipeline to the Salem Pike Metering Station in Norwich, Connecticut (see figure A-3-5).

2.1.3.6 Chaplin Loop

The Chaplin Loop would be a 36-inch-diameter pipeline loop in Windham County, Connecticut. It would begin approximately at the East Branch of Stonehouse Brook and extend 1.1 miles east along an existing 30-inch-diameter mainline loop (see figure A-3-6).

2.1.3.7 Tiverton

The proposed Tiverton Loop would be a 16-inch-diameter pipeline loop in Newport County, Rhode Island. It would follow the G-4 system to Tiverton, Rhode Island, and have a length of 2.1 miles (see figure A-3-7).

2.1.3.8 Burrillville Compressor Station

A 5,500-hp compressor addition would be installed at Algonquin's existing Burrillville Compressor Station in Burrillville, Rhode Island. Refer to section 4.1.8 for a detailed description of this station and its environmental setting (see figure A-3-8).

2.1.4 Transco

Transco proposes to construct two 36-inch-diameter pipeline loops totaling 8.4 miles on its existing Leidy Line in Pennsylvania and New Jersey. Table 2.1-1 lists the location, diameter, and length of Transco's proposed pipeline loops. Figure 2.1.2-1 shows their location. Detailed Transco route maps are contained in appendix A, figure A-4.

Transco also proposes to add 12,600 hp of compression at its existing Compressor Station 515 in Luzerne County, Pennsylvania; 12,000 hp of compression at a proposed Compressor Station 205 in Mercer County, New Jersey; 7,660 hp of compression at a proposed Station 167; to construct a meter station at Sayreville, New Jersey; and to modify its existing Emporia Meter Station in Greensville County, Virginia. The location of the compressor and meter stations is shown in appendix A, figures A-4-3 to A-4-6.

2.1.4.1 6.79-Mile Leidy Loop

The 6.79-Mile Leidy Loop would be a 36-inch-diameter pipeline loop in Northampton County, Pennsylvania, and Warren County, New Jersey. It would extend between MPs 29.51 and 36.30 (see figure A-4-1).

2.1.4.2 1.61-Mile Leidy Loop

The 1.61-Mile Leidy Loop would be a 36-inch-diameter pipeline loop in Northampton, Pennsylvania. It would extend between MPs 36.30 and 37.91 (see figure A-4-2).

2.1.4.3 Compressor Station 205

Transco proposes to install a new electric-powered 12,000-hp compressor station at a 100-acre site near MP 1773.41 on Transco's mainline in Lawrence Township, Mercer County, New Jersey. Refer to section 4.1.8 for a detailed description of this station and its environmental setting (see figure A-4-3).

2.1.4.4 Compressor Station 515

A 12,600-hp compression addition would be installed at Transco's existing Compressor Station 515 in Luzerne County, Pennsylvania. Refer to section 4.1.8 for a detailed description of this station and its environmental setting (see figure A-4-4).

2.1.4.5 Compressor Station 167

Transco proposes to construct a new 7,660-hp Compressor Station 167 on a 21-acre site in Mecklenburg County, Virginia. Refer to section 4.1.8 for a detailed description of this station and its setting (see figure A-4-6).

2.1.5 Texas Eastern

Texas Eastern proposes to construct a 24-inch-diameter pipeline loop off its Leidy Line in Centre County, Pennsylvania (see table 2.1-1). The proposed Line No. 37 Loop would extend 5.0 miles between MPs 40.91 and 35.91. The location of the pipeline loop is shown in figure 2.1.2-1. A detailed Texas Eastern route map is contained in appendix A, figure A-5-1.

2.1.6 CNG

CNG proposes to construct 2.7 miles of new 30-inch-diameter pipeline in Rensselaer and Albany Counties, New York (see table 2.1-1). This TL-470 pipeline would connect an existing 12-inch CNG pipeline in Rensselaer County, New York, with Niagara Mohawk Power Company's (Niagara Mohawk) 16-inch line in Albany County, New York. The location of this proposed pipeline is shown in figure 2.1.2-1. A detailed CNG route map is contained in appendix A, figure A-6-1.

CNG also proposes to install an additional 3,600 hp of compression at two existing compressor stations. A 1,350-hp compression addition would be installed at the existing State Line Compressor Station in Potter County, Pennsylvania, and a 2,250-hp compression addition at the existing Utica Compressor Station in Herkimer County, New York. The location of these compressor stations is shown in figure 2.1.1-1. Refer to section 4.1.8 for a detailed description of these stations and their environmental setting (see figures A-6-2 and A-6-3).

CNG would also modify its existing Brookview Meter Station in Rensselaer County, New York. The proposed meter station is listed in table 2.1-2, and a map showing the location is contained in appendix A, figure A-6-4.

2.1.7 National Fuel/Penn-York

National Fuel/Penn-York propose to construct 2.5 miles of new 24-inch-diameter pipeline in Potter County, Pennsylvania (see table 2.1-1). This Y-M54 Line would connect the existing National Fuel Ellisburg Compressor Station near Andrews Settlement, Pennsylvania, with CNG's existing Ellisburg Compressor Station in Ellisburg, Pennsylvania. The location of this proposed pipeline is shown in figure 2.1.2-1. A detailed National Fuel/Penn-York route map of the pipeline is contained in appendix A, figure A-7-1.

National Fuel/Penn-York also propose to construct a 2,600-hp compressor addition at its existing Ellisburg Compressor Station and a new 8,640-hp Concord Compressor Station in Erie County, New York. The locations of these stations are shown in figure 2.1.2-2. Refer to section 4.1.8 for a detailed description of these stations and their environmental setting (see figures A-7-1 and A-7-2).

2.1.8 CNG/Texas Eastern 2/

CNG/Texas Eastern propose to replace an existing 10-inch-diameter pipeline with a 20-inch-diameter pipeline in Erie County, New York (see table 2.1-1). The TL-403 replacement pipeline would be approximately 0.4 mile long and would extend between the Marilla Meter Station and CNG's Line No. 546. The location of this replacement pipeline is shown in figure 2.1.2-1. A detailed CNG/Texas Eastern route map is provided in appendix A, figure A-8-1.

CNG/Texas Eastern also propose to install a 2,200-hp compression addition (in addition to the 1,350-hp addition described in section 2.1.6) at the existing State Line Compressor Station in Potter County, Pennsylvania; two new metering stations at existing compressor station sites in Erie County, New York, and Potter County, Pennsylvania; and modifications to an existing meter station in Clinton County, Pennsylvania (see table 2.1-2). A detailed plot plan and description of the compressor station addition is provided in section 4.1.8. Maps showing the proposed meter station additions and modifications are contained in appendix A, figures A-8-2, A-8-3, and A-8-4.

2.1.9 Related Nonjurisdictional Facilities

Several of the NIP Project applicants have identified shippers of natural gas for several end uses. These uses include electric power generation, cogeneration, local distribution, and system supply. Table 1.1-1 lists proposed shippers and gas deliveries. The gas deliveries and related nonjurisdictional facilities are described in this section. For each shipper, the location and types of major facilities are described. Where pertinent, maps showing the location of nonjurisdictional facilities are contained in appendix A, figure A-9.

2.1.9.1 Tennessee Delivery

2.1.9.1.1 Ocean State Power II

Tennessee proposes to deliver 50,000 Mcfd of natural gas for the second phase (250-MW) of the gas-fired 500-MW combined-cycle Ocean States Power Project (OSP II) electric generating station now under construction in Burrillville, Rhode Island. When completed, the OSP II will provide electric power for wholesale purchasers to meet energy demand in the New England region. Tennessee is constructing a delivery line from its existing pipeline to serve the OSP II. Both the power plant and pipeline facilities are described in detail in our Ocean State Power Project FEIS (July 1988). No new nonjurisdictional facilities would be required to deliver the additional volume of gas proposed by Tennessee.

2.1.9.1.2 Gas Alternative Systems

Tennessee proposes to deliver 20,000 Mcfd of natural gas to Gas Alternative Systems (GAS) to supply a new 80-MW cogeneration plant in Syracuse, New York (see figure A-9-1). The cogeneration plant would produce steam and electricity for Syracuse University, allowing the existing boilers to be renovated and retained for peaking and backup purposes.

2/ Although CNG and Texas Eastern are coapplicants for Docket No. CP88-195-002, the facilities described in section 2.1.8 would be wholly owned and constructed by CNG.

Natural gas would be transported to the plant by a new 8- and 12-inch-diameter 9.4-mile pipeline from a new interconnection with Tennessee's mainline just east of its Compressor Station 241 in Lafayette, New York. In addition, GAS would construct a storage facility and 4-inch-diameter pipeline for propane to ensure availability of fuel to the plant.

2.1.9.2 CNG/Texas Eastern/Transco/Algonquin Delivery

2.1.9.2.1 NorthEast Energy Associates

Algonquin proposes to transport 62,817 Mcfd of natural gas on behalf of NorthEast Energy Associates (NEA) to a new 300-MW dual fuel, combined-cycle cogeneration plant in Bellingham, Massachusetts (see figure A-9-2). Gas would be supplied to the facility from an existing Algonquin pipeline that passes through the site. A transmission line less than 0.5 mile in length would connect the plant to an existing 345 kV transmission line.

2.1.9.3 CNG/Texas Eastern/Transco Delivery

2.1.9.3.1 North Jersey Energy Associates

North Jersey Energy Associates (NJEA) plans to construct a 300-MW gas-fired cogeneration facility in Sayreville, New Jersey (see figure A-9-3). The facility would sell electricity to Jersey Central Power and Light Company and steam to Hercules, Inc. for an adjacent chemical plant. Public Service Electric and Gas Company (PSE&G) would construct 1,400 feet of 16-inch-diameter pipeline between Transco's proposed Sayreville Meter Station and the cogeneration plant site. Transco proposes to transport 23,183 Mcfd of natural gas on behalf of NJEA and PSE&G to this facility.

2.1.9.4 National Fuel/Penn-York/Transco Delivery

2.1.9.4.1 Consolidated Edison Company of New York, Inc.

Transco proposes to deliver 30,600 Mcfd of natural gas for Consolidated Edison Company of New York (Con Edison) to the existing interconnection point with Con Edison's system in the Manhattan area of New York City. No new nonjurisdictional facilities would be required for this delivery.

2.1.9.4.2 Elizabethtown Gas Company

Transco proposes to deliver 15,000 Mcfd of natural gas for Elizabethtown Gas Company (Elizabethtown) to various existing interconnection points with Elizabethtown's system in New Jersey. No new nonjurisdictional facilities on Elizabethtown's system would be required to receive the gas.

2.1.9.4.3 Energy Marketing Exchange, Inc.

Transco proposes to deliver 6,000 Mcfd of natural gas to Energy Marketing Exchange (EME) at Elizabethtown's existing New Village, New Jersey, delivery point. This volume would be used to provide a firm supply of natural gas to the existing 35-MW Kamine-Milford Plant. No new nonjurisdictional facilities would be required for this delivery.

2.1.9.4.4 Long Island Cogeneration Limited Partnership

Long Island Cogeneration Limited Partnership (Long Island Cogen) plans to construct a 79.3-MW cogeneration facility in Oyster Bay, New York (figure A-9-4). Transco proposes to deliver 15,000 Mcfd of natural gas to an existing connection with Long Island Lighting Company (LILCO) at Oyster Bay. A new pipeline, 8,500 feet in length, would be constructed by Long Island Cogen to the proposed plant.

2.1.9.4.5 UGI Corporation

Transco proposes to deliver 10,000 Mcfd of natural gas to UGI at existing delivery points in Hazelton and Humboldt, Pennsylvania. No new nonjurisdictional facilities would be required for these deliveries.

2.1.9.4.6 Hopewell Cogeneration Limited Partnership

Hopewell Cogeneration Limited Partnership (Hopewell) is constructing a 356-MW cogeneration facility in Hopewell, Virginia (see figure A-9-5). Transco proposes to deliver 80,000 Mcfd of natural gas to an existing interconnection with Commonwealth Gas Pipeline. Commonwealth Gas Pipeline would construct about 52 miles of 16-inch- and 12-inch-diameter nonjurisdictional pipeline to the vicinity of the plant (see figure A-9-6). Commonwealth Gas Services would construct a pipeline 330 feet in length from the termination of the 12-inch-diameter pipeline to the plant (see figure A-9-6, sheet 9).

2.1.9.5 CNG/Texas Eastern

2.1.9.5.1 Texas Eastern

CNG/Texas Eastern propose to transport 29,000 Mcfd of natural gas to a new interconnection at Leidy, Pennsylvania. Texas Eastern would use this gas for system supply and would require no new nonjurisdictional facilities.

2.1.9.6 National Fuel/Penn-York/CNG Delivery

2.1.9.6.1 Indeck Energy Services of Oswego, Inc.

National Fuel proposes to transport 12,000 Mcfd of natural gas to CNG at the proposed meter station at Marilla, New York, for downstream transportation to the Indeck Energy Services of Oswego, Inc. (Indeck/Oswego) plant located at International Paper Company's Hammermill plant in Oswego, New York (see figure A-9-7). The 49-MW Indeck/Oswego plant is under construction for anticipated service in May 1990. Niagara Mohawk proposes to construct a new 12-inch-diameter 13-mile-long pipeline extension to the plant from its existing regulator station 176.

2.1.9.7 Tennessee/CNG Delivery

2.1.9.7.1 Cogen Energy Technology, Inc.

Cogen Energy Technology, Inc. (CETI) proposes to construct a 60-MW gas-fired, combined cycle cogeneration plant at the Fort Orange Paper Company in the village of

Castleton-on-Hudson, New York (see figure A-9-8). CNG would deliver 13,900 Mcfd of natural gas at the expanded Brookview Meter Station. Niagara Mohawk would construct a new new 6-inch-diameter 2.4-mile pipeline between the meter station and the plant.

2.1.9.8 National Fuel/Penn-York Delivery

2.1.9.8.1 National Fuel

National Fuel/Penn-York and CNG propose to transport 12,500 Mcfd of natural gas to existing interconnection points with National Fuel in East Aurora, New York, and Clarence, New York, for National Fuel's system supply. No new nonjurisdictional facilities would be required for these deliveries.

2.1.9.8.2 Indeck-Yerkes Services Inc.

National Fuel proposes to transport 12,000 Mcfd of natural gas to the 53-MW cogeneration plant in Tonawanda, New York (see figure A-9-9) proposed by Indeck-Yerkes Services Inc. (Indeck/Yerkes). The Indeck/Yerkes plant is under construction and scheduled for operation in early 1990. No new pipeline facilities would be required to service the plant.

2.2 LAND REQUIREMENTS

2.2.1 Pipeline Facilities

The NIP Project's proposed 544.7 miles of pipeline installation would be located adjacent to or within existing pipeline rights-of-way with the exception of one 2.7-mile segment that would generally be located within a powerline right-of-way. Since the majority of the proposed pipeline would be located adjacent to existing pipeline rights-of-way, the applicants have existing pipeline easements with most affected landowners. These easements can range from single-line to multiple-line rights on right-of-way ranging from 10 feet in width to no specified width. Typically, construction of the proposed pipeline would use a 75-foot-wide construction right-of-way. Because a relatively level work surface is needed for trench excavation equipment, right-of-way widths can exceed typical conditions in steep areas or areas of side slope. For most of the proposed construction, existing pipeline right-of-way would be used for part of the construction right-of-way and would account for approximately one-third of total construction right-of-way requirements. Operation would generally use between 10 and 40 feet of new permanent pipeline right-of-way adjacent to the existing pipeline rights-of-way.

Construction of the proposed pipeline, assuming typical conditions, would affect a total of approximately 5,161 acres of land comprising 2,739 acres of scrub-shrub and other lands, including existing pipeline rights-of-way (53 percent), 1,314 acres of agricultural land (25 percent), 1,040 acres of forestland (20 percent), 52 acres of residential land, and 16 acres of commercial/industrial land (2 percent). The affected lands would be distributed through the states of Michigan (62 percent), Minnesota (14 percent), Wisconsin (8 percent), New York (7 percent), Massachusetts (4 percent), Pennsylvania (3 percent), Connecticut (1 percent), and New Jersey and Rhode Island (1 percent). Additional acreage would also be

temporarily affected for added work space at major roadway and water body crossings and for pipe storage and material laydown yards.

The proposed NIP Project pipelines would use approximately 1,898 acres of land for permanent operational pipeline right-of-way. Of this total, approximately 334 acres would permanently removed forestland. The remaining 1,564 acres would generally be allowed to return to previous land uses with some restrictions such as the erection of buildings or the planting of large trees.

Great Lakes

Great Lakes proposes to loop 459.6 miles of its existing mainline in the states of Minnesota, Michigan, and Wisconsin. The existing cleared right-of-way is generally between 75 and 125 feet wide except on state and Federal lands where it may be as narrow as 30 to 60 feet.

Great Lakes proposes to place the 36-inch-diameter pipeline loops 25 feet from the existing mainline pipeline. However, to prevent disturbing the mainline while installing the loop line in areas of unstable soils in some wetland areas, Great Lakes proposes up to a 50-foot separation between the loop line and the mainline. Except for Loop 11, which would be located north of the proposed mainline, proposed Loops 1 through 12 would be located south-southwest of the existing mainline. Proposed Loops 13 through 15 would be located east of the mainline; Loops 16 and 17 would be located southwest of the mainline.

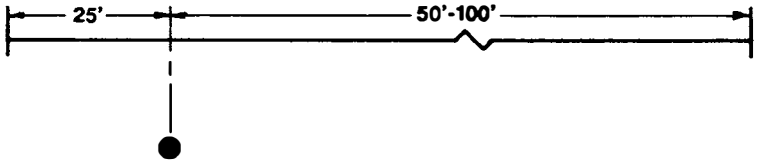
Construction of the proposed Great Lakes loops would typically use a 75-foot-wide construction right-of-way that would include 50 feet of the existing cleared right-of-way and 25 feet of temporary right-of-way (see figure 2.2-1). Approximately 4,404 acres of land would be disturbed during construction; approximately 1,619 acres of land would be converted to permanent operational pipeline right-of-way for the proposed loop lines. Forest, marsh, bog lands, and existing cleared right-of-way would account for 77 percent of the affected land; agricultural land would account for the remaining 23 percent.

In addition to the pipeline construction right-of-way, added temporary work space would be used at the end of each loop line and at most road, railroad, stream, and river crossings. These additional temporary work spaces would range from 0.2 acre for a two-lane road crossing to 2.3 acres for a river crossing over 100 feet wide. Based on information provided by Great Lakes, a total of approximately 333.4 acres would be temporarily affected for these temporary work spaces which would exceed the typical 75-foot-wide construction right-of-way.

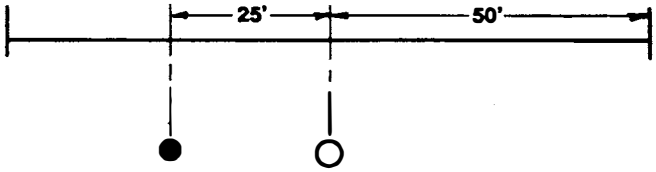
Great Lakes proposes to use 15 to 20 pipe material and storage sites located along the length of the proposed pipelines; seven of these sites are existing pipeyards. The sites would range from 6 to 27 acres in size and would affect approximately 300.5 acres of land. Most of the sites would be located adjacent to major roads or railroads.

Tennessee

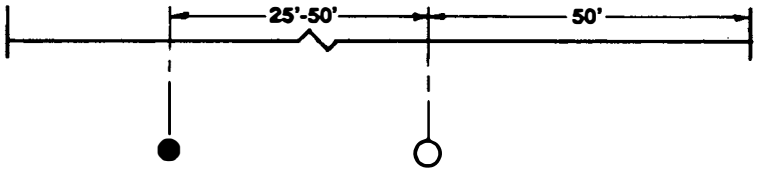
Tennessee proposes to install 41.9 miles of 30-inch-diameter pipeline loops adjacent to existing pipeline in New York and Massachusetts. Generally, the existing cleared right-of-way is 50 feet wide in New York and 30 feet wide in Massachusetts. The proposed loops



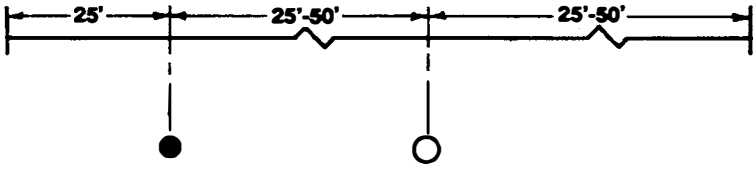
EXISTING R/W - 75'-125'



CONSTRUCTION R/W - 75'
(UPLAND AREAS)



CONSTRUCTION R/W - 75'-100'
(WETLAND AREAS WITH
UNSTABLE SOILS)



OPERATION R/W - 75'-125'

● EXISTING PIPELINE
○ PROPOSED PIPELINE

NOTE: TYPICAL FOR 36-INCH DIAMETER PIPE

FIGURE 2.2-1

GREAT LAKES PIPELINE
TYPICAL RIGHT-OF-WAY SECTIONS

NOT TO SCALE

would typically be located 25 feet from the existing pipeline except where obstacles or special construction techniques require reduced or increased separation. In New York, proposed Segment 1 would be located on both the east and west sides of the existing pipeline, Segments 2 and 3 south of the existing pipeline, and Segment 4 to the north of the existing pipeline for approximately 9 miles and then south for the remaining miles. In Massachusetts, Segment 8 would be located south of the existing pipeline for approximately 2.2 miles and north of the existing pipeline for the remaining 3.2 miles. Segment 9 would be located to the north of the existing pipeline.

In New York, proposed pipeline construction would use 25 feet of existing right-of-way, 25 feet of new pipeline right-of-way, and 25 feet of temporary right-of-way. In Massachusetts, construction would use 15 feet of existing right-of-way, 25 feet of new pipeline right-of-way, and 25 feet of temporary right-of-way. Typical right-of-way sections for these segments are shown in figure 2.2-2.

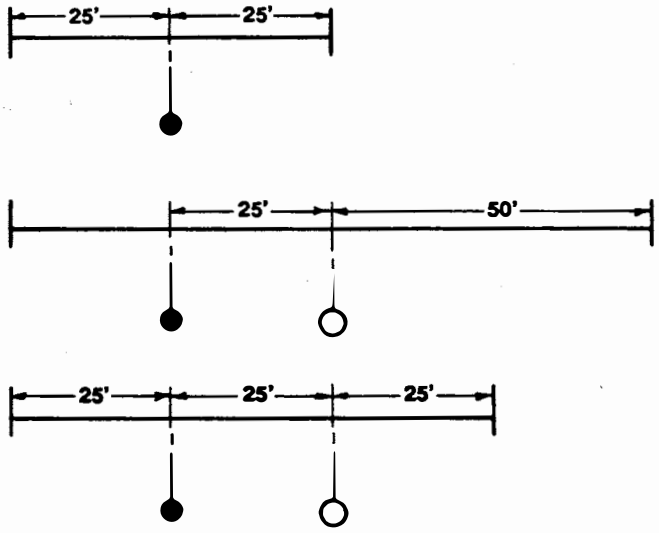
Construction of Tennessee's proposed loops would affect approximately 381 acres of land of which 137 acres would be used for the new permanent pipeline right-of-way. Agricultural land would account for over half of the affected land use with the majority of these lands located along the New York segments. Woodland would be the second largest affected land use category. Although residential land use would only account for some 6 percent of the total acreage affected, it would account for nearly 20 percent of the land use located along the proposed Massachusetts segments.

Temporary work space would also be used at road crossings, typically an additional 0.1 acre, and at stream crossings, typically an added 0.2 acre. Approximately 0.5 acre would be used at the end of each segment to allow for mobilization/demobilization of the contractors' equipment and would affect approximately 6 acres. Several areas of approximately 3 acres each would be required for material storage and contractors' field offices.

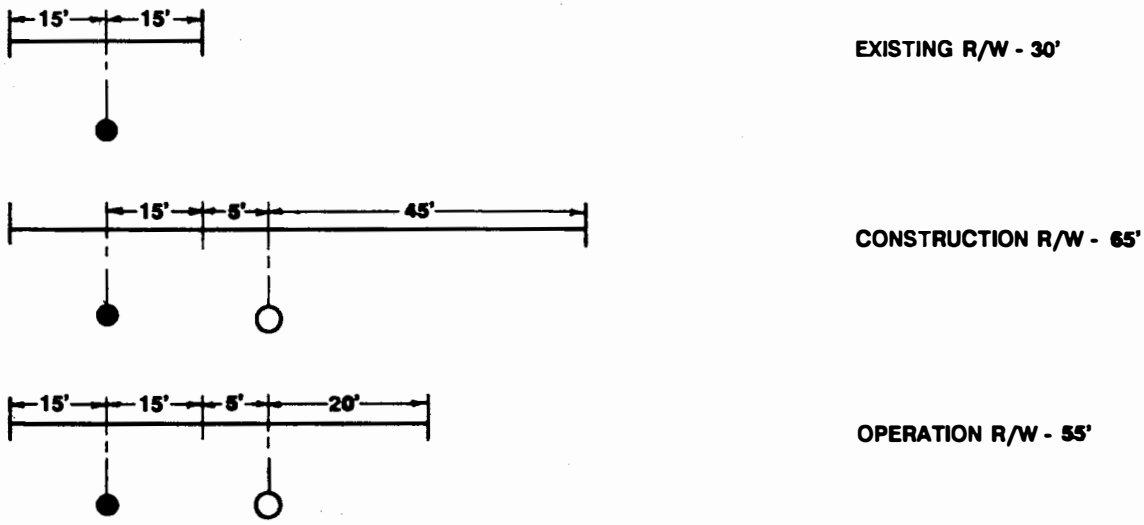
Algonquin

Algonquin proposes to install 11.6 miles of 12-, 16-, and 36-inch-diameter pipeline loops adjacent to existing pipeline in Massachusetts, Connecticut, and Rhode Island, and to replace 12.6 miles of pipeline with 10-, 20-, and 24-inch-diameter pipe in Massachusetts. The 36-inch-diameter Medfield Loop would be located north of the existing pipeline, the 12-inch-diameter E-1 Loop would be located generally west of the existing pipeline, the 36-inch-diameter Chaplin Loop would be located south of the existing pipelines, and the 16-inch-diameter Tiverton Loop would be located northeast of the existing pipeline. As shown in figure 2.2-3, Algonquin's typical proposed construction right-of-way would use an average of approximately 25 to 35 feet of existing pipeline right-of-way, 20 feet of new pipeline right-of-way, and 20 to 30 feet of temporary right-of-way. The 24-inch-diameter G-5, 20-inch-diameter G-8, and 10-inch-diameter H-1 Replacements would use the entire existing right-of-way and an additional 20-35 feet of temporary construction right-of-way. The G-5 Replacement would be placed in the same ditch as the existing G-5 10-inch-diameter pipe, which is generally east of the existing G-5L pipeline. The G-8 Replacement would be placed in the same ditch as the existing G-8 6-inch-diameter pipeline, which is north of the existing G-8 8-inch-diameter pipeline. The H-1 Replacement would be placed in the same ditch as the existing 3-inch-diameter pipeline.

NEW YORK:



MASSACHUSETTS:



● EXISTING PIPELINE
○ PROPOSED PIPELINE

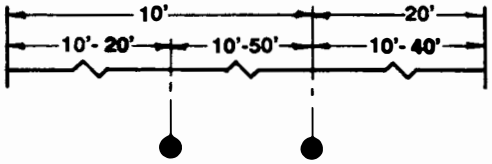
FIGURE 2.2-2

TENNESSEE PIPELINE
TYPICAL RIGHT-OF-WAY SECTIONS

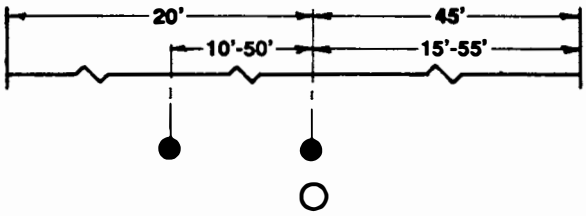
NOT TO SCALE

NOTE: TYPICAL FOR 30-INCH DIAMETER PIPE

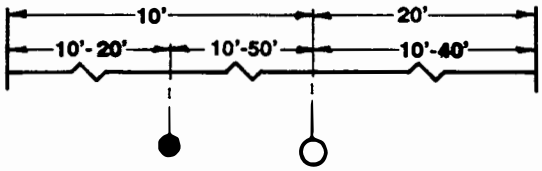
REPLACEMENT:



EXISTING R/W :
ONE PIPELINE - 30'
TWO PIPELINES - 50'-70'

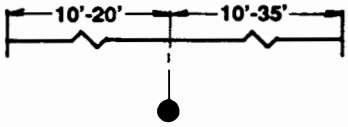


CONSTRUCTION R/W
ONE PIPELINE - 65'
TWO PIPELINES - 75'

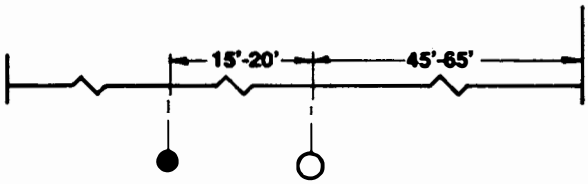


OPERATION R/W:
ONE PIPELINE - 30'
TWO PIPELINES - 50'-75'

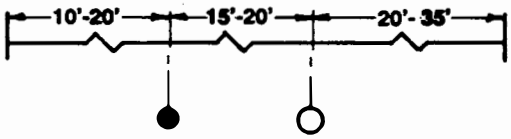
LOOPING:



EXISTING R/W - 30'-55'



CONSTRUCTION R/W - 75'



OPERATION R/W - 50'-75'

NEW: SEE FIGURE 2.2-4

NOTE: REPLACEMENT: TYPICAL FOR 10-, 20-, AND 24-INCH DIAMETER PIPE
LOOPING: TYPICAL FOR 12-, 16-, AND 36-INCH DIAMETER PIPE

● EXISTING PIPELINE
○ PROPOSED PIPELINE

FIGURE 2.2-3

ALGONQUIN PIPELINE
TYPICAL RIGHT-OF-WAY SECTIONS

NOT TO SCALE

Construction would affect approximately 204 acres of land, of which approximately 58 acres would be used for the new permanent pipeline right-of-way. Woodlands and other lands account for 82 percent of the land use that would be affected and residential land use would account for another 14 percent.

Staging areas would generally be located within the proposed construction right-of-way except for the crossing of the Glen Charlie Pond on the proposed G-8 Replacement, and the crossing of the Yantic River and U.S. Route 2 on the proposed E-1 Loop. An additional 0.6 acre may be temporarily affected at these crossings. Algonquin has identified no pipe and material storage sites but estimated that approximately 8.4 acres would be used for these purposes for the proposed loops and replacement pipelines.

Transco

Transco proposes to install 8.4 miles of pipeline 25 feet to the southwest of the existing Leidy Mainline in New Jersey and Pennsylvania. Typically, the construction right-of-way would use 25 feet of existing right-of-way, 25 feet of new pipeline right-of-way, and 25 feet of temporary right-of-way (see figure 2.2-4).

Approximately 76 acres would be affected by construction, of which approximately 25 acres would be used for the new permanent pipeline right-of-way. Agricultural land would account for 73 percent of the affected land use.

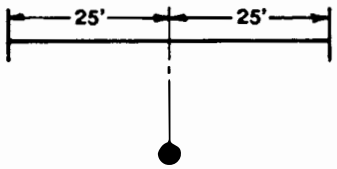
The crossing of the Delaware River would affect two temporary staging areas of approximately 5 acres each on either bank. An additional 0.3 to 0.5 acre would also be affected by major road crossings. No site has been identified for pipe and material storage.

Texas Eastern

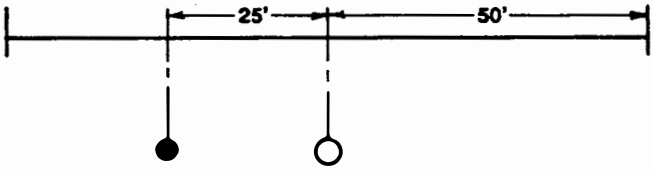
Texas Eastern proposes to install 5 miles of new pipeline 25 feet west of the existing Line No. 24 pipeline in Pennsylvania. As shown in figure 2.2-4, construction would use 25 feet of the existing pipeline right-of-way, 25 feet of new pipeline right-of-way, and 25 feet of temporary right-of-way. Approximately 46 acres (primarily agricultural land) would be affected by construction, of which approximately 15 acres would be used for the new permanent pipeline right-of-way. Additional temporary work area requirements include: four areas totalling approximately 0.4 acre where state roads are crossed and two areas totalling 0.8 acre at the beginning and end of the proposed loop. Pipe material and storage would be located within Texas Eastern's 40-acre Honeybrook material yard.

CNG

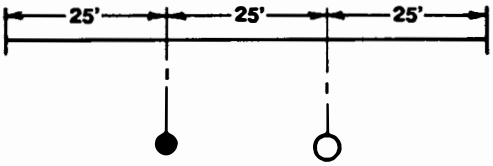
CNG proposes to construct 2.7 miles of new 30-inch-diameter pipeline in New York which would be located almost entirely within the Niagara Mohawk existing powerline easement. Figure 2.2-5 shows the proposed 75-foot-wide construction right-of-way, which CNG proposes to retain for the new permanent pipeline right-of-way. Construction and operation would affect 24 acres of land with woodlands making up over 50 percent of the land use. Agriculture and commercial/industrial land use accounts for most of the remaining land use.



EXISTING R/W - 50'



CONSTRUCTION R/W - 75'



OPERATION R/W - 75'

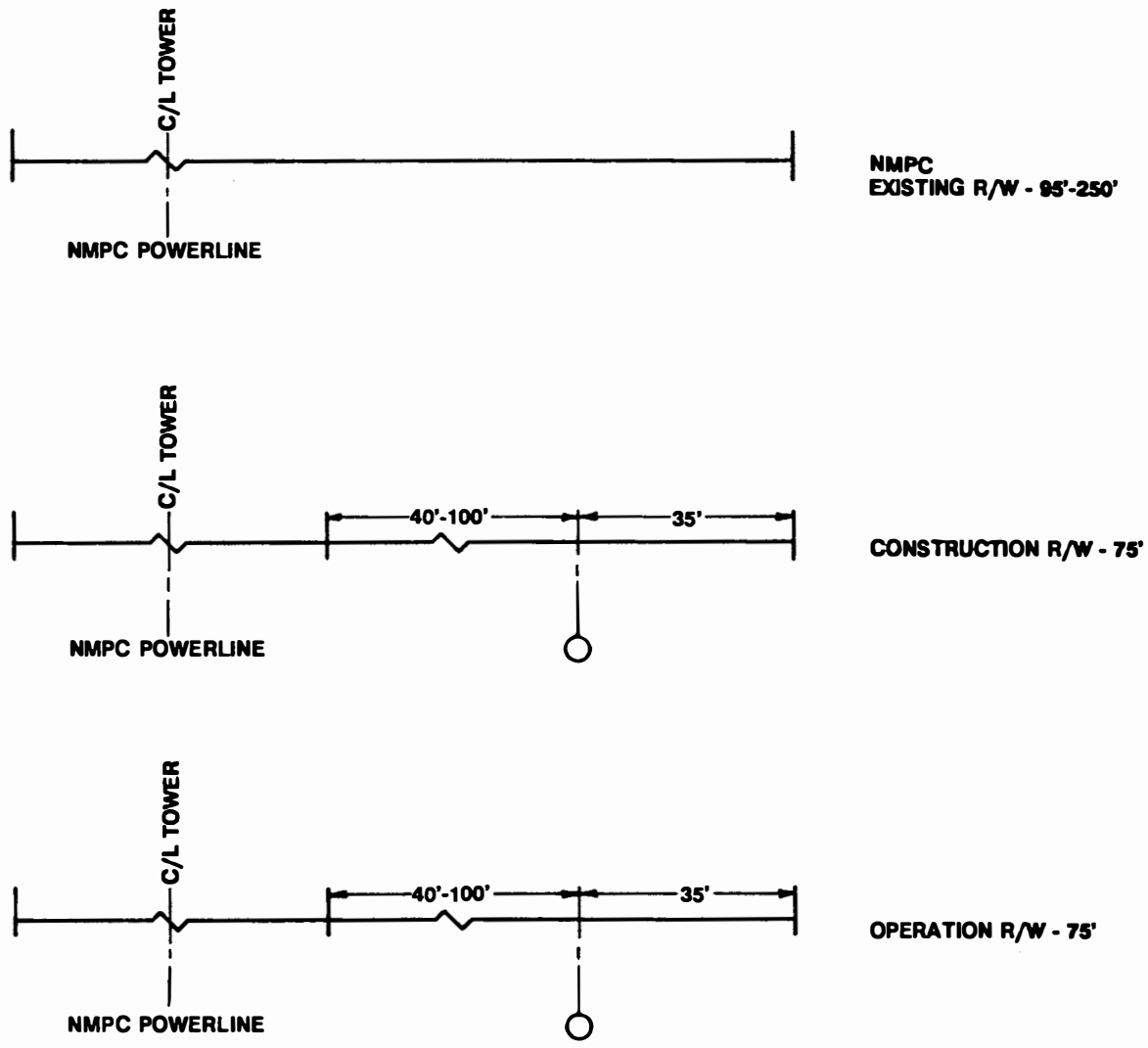
● EXISTING PIPELINE
○ PROPOSED PIPELINE

NOTE:
TRANSCO: TYPICAL FOR 36-INCH DIAMETER PIPE
TEXAS EASTERN: TYPICAL FOR 24-INCH DIAMETER PIPE

FIGURE 2.2-4

TRANSCO OR TEXAS EASTERN PIPELINE TYPICAL RIGHT-OF-WAY SECTIONS

NOT TO SCALE



O PROPOSED PIPELINE

NOTE: TYPICAL FOR 30-INCH DIAMETER PIPE

FIGURE 2.2-5

CNG PIPELINE
TYPICAL RIGHT-OF-WAY SECTIONS
ADJACENT TO POWERLINE

NOT TO SCALE

Approximately 0.8 acre would be temporarily affected for one road crossing and two railroad crossings. An additional 10.7 acres would be temporarily affected for staging areas at the beginning and end of the proposed pipeline and on the east side of the Hudson River crossing. The larger two staging areas (5.1 acres each) would be located on the east and west banks of the Hudson River. No pipe and material storage sites have been identified.

National Fuel/Penn-York

National Fuel proposes to construct 2.5 miles of pipeline adjacent to an existing Tennessee pipeline in Pennsylvania. As shown in figure 2.2-6, construction would use a 66-foot-wide right-of-way that would affect approximately 20 acres of land. Half of the affected land is woodland and the remainder is agricultural or open field. Material and equipment storage and the staging area would be located on a 5-acre site to the west of the Ellisburg Compressor Station and the start of the proposed pipeline.

CNG/Texas Eastern

CNG/Texas Eastern proposes to replace 0.4 mile of pipeline in New York. Construction would occur within a 100-foot-wide right-of-way (as shown in figure 2.2-7) including 55 feet of existing right-of-way and 45 feet of temporary right-of-way. The new pipeline would be installed in the same ditch or directly adjacent to the existing pipeline. Construction would temporarily affect approximately 4.8 acres of agricultural land.

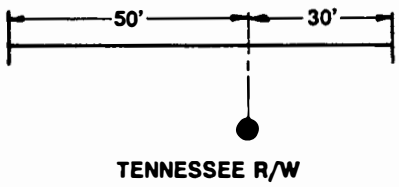
2.2.2 Aboveground Facilities

Land requirements for the proposed NIP Project compressor and meter stations include a 70-acre site to be acquired for the proposed National Fuel Concord Compressor Station in New York, a 1-acre site to be acquired for the proposed Algonquin Bellingham Meter Station in Massachusetts, and a 1.5-acre site to be acquired for the Sayreville Meter Station in New Jersey. The proposed new Concord Compressor Station would be located on approximately 6 acres of the 70-acre tract of land. The proposed Bellingham Meter Station would be located on 0.5 acre of the 1-acre Massachusetts site within the boundaries of the NEA cogeneration plant; the proposed Sayreville Meter Station would be located on 0.7 acre of the 1.5 acre New Jersey site.

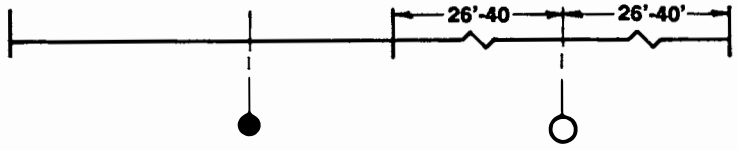
Transco proposes to locate the new Compressor Station 205 on approximately 10 acres of a 99-acre site and the new Compressor Station 167 on approximately 10 acres of a 21-acre site. Both sites are owned by Transco. Proposed new meter installations for Tennessee, Transco, and CNG/Texas Eastern and all proposed compressor station additions and meter modifications would occur within existing facilities and boundaries.

2.3 CONSTRUCTION PROCEDURES

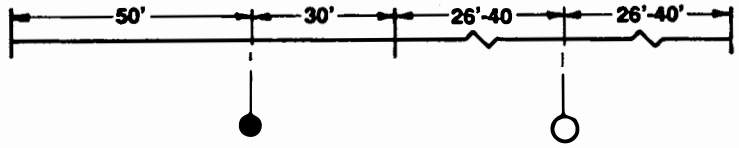
This section describes the general procedures that would be used by the applicants to construct the proposed pipelines and compressor and meter stations. Variations in procedures for each applicant are discussed where appropriate. Figure 2.3-1 depicts the typical installation steps of an overland pipeline construction spread in a rural environment. Sections 5.0 and 7.0 contain further discussion of proposed construction procedures and our recommendations to further mitigate adverse environmental impact.



EXISTING R/W - 0'



CONSTRUCTION R/W - 66'



OPERATION R/W - 66'

● EXISTING PIPELINE
○ PROPOSED PIPELINE

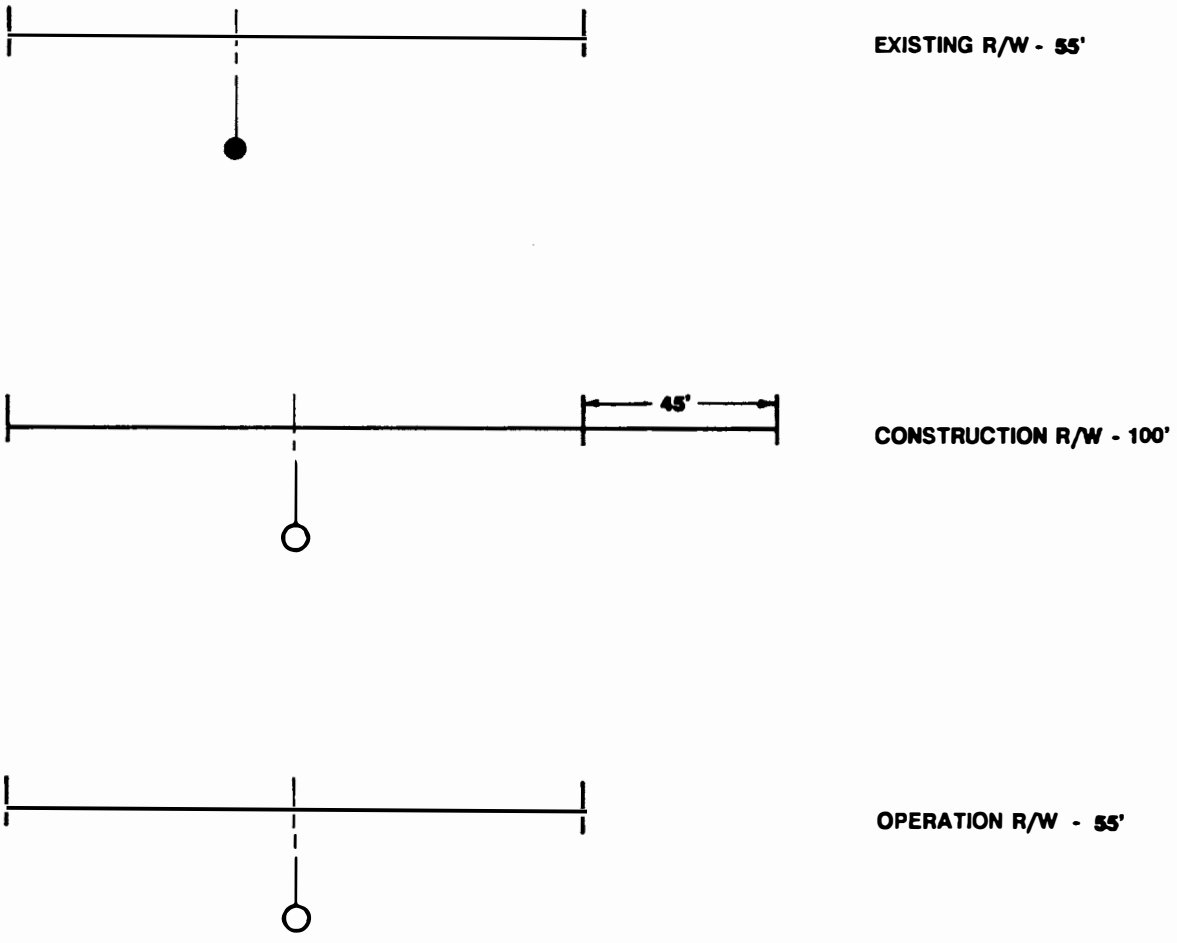
NOTE: TYPICAL FOR 24-INCH DIAMETER PIPE

FIGURE 2.2-6

NATIONAL FUEL/PENN-YORK PIPELINE
TYPICAL RIGHT-OF-WAY SECTIONS

NOT TO SCALE

REPLACEMENT:



● EXISTING PIPELINE
○ PROPOSED PIPELINE

FIGURE 2.2-7

CNG/TEXAS EASTERN PIPELINE TYPICAL RIGHT-OF-WAY SECTIONS

NOT TO SCALE

NOTE: TYPICAL FOR 20-INCH DIAMETER PIPE

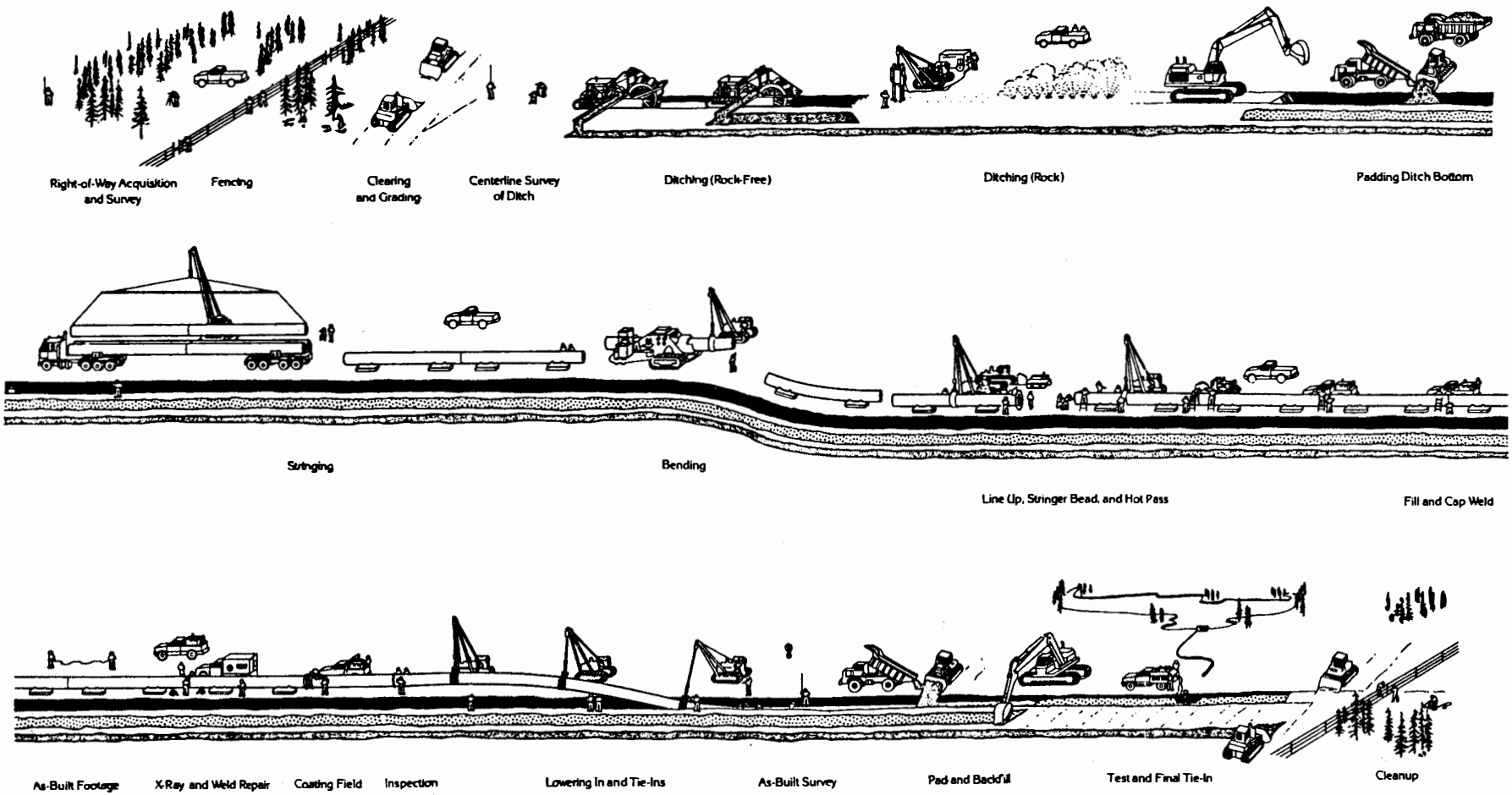


FIGURE 2.3-1

PIPELINE

CONSTRUCTION SEQUENCE

2.3.1 Pipeline Construction Procedures

All proposed pipeline facilities would be designed and constructed in accordance with 49 CFR Part 192, "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards"; 18 CFR Part 2.69, "Guidelines To Be Followed by Natural Gas Pipeline Companies in the Planning, Clearing, and Maintenance of Rights-of-Way and the Construction of Aboveground Facilities"; and other applicable Federal and state regulations.

After the right-of-way has been surveyed and easements secured, the temporary construction right-of-way (and any existing permanent right-of-way if necessary) would be cleared of obstructions. A fence crew would lead the construction spread and install temporary gates at all fences encountered on the right-of-way and a clearing crew would follow and remove large obstacles such as trees, large rocks, and logs. Great Lakes proposes to flag unique specimen trees and protect them from potential construction damage with rubber tire barriers or snow fences. Marketable timber cut from the right-of-way would be purchased at fair market value or cut, limbed, and stacked for use by the landowner. Great Lakes states that its standard method of removing branch and tree limbs and stumps is burning and debris that cannot be burned would be clipped as mulch or hauled from the right-of-way. Tennessee prefers to dispose of unsaleable timber by piling it on the low side of the right-of-way to provide filter strips and wildlife habitat, or by chipping for mulch, burying, or burning. Farmers would be compensated for loss of crops.

The trenching crew would excavate a ditch 12 inches wider and 36 inches deeper than the diameter of the pipe. For example, the trench for a 36-inch-diameter pipeline would be approximately 4 feet wide and 6 feet deep. Generally, the trench would be deeper in agricultural areas to accommodate the use of heavy farm machinery or the existence of drainage systems. A rotary wheel ditching machine or a conventional backhoe would excavate the trench in most locations with unconsolidated rock. In shaly or rocky areas, a tractor-drawn ripper would break or loosen hard substratum material. In areas where bedrock cannot be ripped, drilling and blasting would be required, followed by use of a backhoe to remove rock and soil from the trench. In rock, the minimum depth of cover above the pipe is 24 inches, and for road crossings or agricultural areas, the depth of cover may be greater than 36 inches.

The right-of-way would then be graded to provide a relatively level surface for trench excavating equipment and a work area sufficiently wide for the safe passage of heavy construction equipment. Most of the applicants state that on cultivated lands, they would grade and conserve topsoil separately from the trench material for replacement during final cleanup. Great Lakes, Algonquin, and CNG have stated that they would segregate topsoil in cultivated areas if requested by the landowner. Then a crew would install erosion control facilities, such as temporary interceptor dikes and silt fences.

In the areas of solid bedrock, drilling and controlled blasting would be used to excavate the trench. Explosives would be used in compliance with all applicable permits and authorizations. The use of matting, where appropriate, would minimize vibrations and fly-rock. Safety precautions would also be taken to prevent injury to workmen or livestock and damage to property. Many of the applicants state that blasting, when required, would only take place during the daylight hours to reduce noise impact. Special blasting procedures would be employed when blasting is performed in the vicinity of power lines, telephone lines, existing structures, or buildings to eliminate possibile damage from fly-rock, air blast, or

vibrations. These procedures would include, but not be limited to, the use of fabricated mats, in situ overburden, and sand pad matting, as well as special orientation and sequence timing of the explosive charges.

Excavated soil would normally be stored on the non-working side of the trench in the case of new right-of-way, or over the existing pipeline area in the case of a loop installation. Temporary ditch plugs would be installed to curtail the flow of water along the trench. For construction of loops, a separation of 10 to 25 feet of lateral distance from the existing pipe, depending on right-of-way width constraints, would be maintained to prevent damage of the existing facilities by construction equipment.

Stringing, welding, and lowering-in of the pipeline would normally occur on the working side of the trench. Pipeline single joints (40 feet long) or prewelded double joints (80 feet long) would be hauled by pipe trucks from the storage yards and strung along the right-of-way parallel to the trench, they would be bent to conform to the trench contour, aligned, welded together, and placed on temporary supports on the side of the trench. Welds would be visually and radiographically inspected, and repaired as necessary. Line pipe, normally mill-coated or yard-coated prior to stringing, would also require a field coating at the welded joints prior to final inspection. The entire pipe would be electronically inspected to locate and repair any faults or voids in the pipeline coating. The pipe would then be lowered by side-boom tractors into the trench and placed on padding material in the trench bottom to protect the pipe coating. Padding may consist of sand, selected rock-free materials from the trench excavation, sand bags, or polyethylene foam pillows.

After the pipe has been placed in the trench, a layer of select padding material would be placed around and over the pipe to protect the coating. Where select backfill material is scarce, such as in shallow bedrock, the pipe would be wrapped with a thick "rock shield" material to prevent rock damage during backfilling. Drainage tiles cut or damaged during construction would be repaired or replaced. The trench would then be backfilled with previously excavated materials or imported padding.

Skids, trash, miscellaneous debris, and material unsuitable for backfill would be removed from the right-of-way and deposited in public or private disposal areas. Federal and state hazardous waste regulations prohibit the disposal of chemical, liquid, or solid wastes in the trench. Final erosion and sedimentation control structures (i.e., interceptor dikes, trench plugs, silt fences, and erosion control matting) would be installed during the final grading. All temporary fences and gates would be removed and permanent fences would be restored.

Prior to placing the pipeline in service, all new pipeline loop segments and replacement segments would be hydrostatically tested to ensure their structural integrity. Each pipeline segment would be divided into separate test sections, with test manifolds welded onto each end. Test water secured from streams or rivers would be filtered and pumped into the test section. All applicants have confirmed that no chemical additives would be used for water treatment. Test pressure would be maintained for at least 8 hours, in accordance with 49 CFR Part 192.

Depending on topography and water availability, it may be possible to reuse the test water in succeeding test sections, thereby reducing the amount of water needed for testing. Following the hydrostatic test, the water would be displaced from the test section by pipeline pigs either to the next test section for testing, or discharged onto a metal splashplate or

similar energy dissipation device. Then, to control erosion, it would be filtered through hay bales or natural vegetation. Test water would not be discharged directly into a stream or natural water source. National Fuel proposes to use methanol to dry the interior walls of the pipeline after the hydrostatic test water is removed. The methanol would be collected and hauled to a state-approved incinerator for disposal.

Special pipeline construction procedures would be used for major crossings of roads, streams, wetlands, and in residential areas. Private roads, such as farm lanes and driveways, and some minor public roads would be crossed with an open cut. Pipelaying and backfilling would be conducted as quickly as possible to minimize the duration of an open trench. Railroads, interstate highways, and state highways would be bored to minimize disruption to traffic. Additional temporary rights-of-way, typically 25 feet wide and 150 feet long, would be required on each side of the crossing to accommodate additional excavation for the boring equipment, additional spoil storage, and pipeline fabrication.

Temporary bridges would be installed to cross most of the perennial streams. These temporary structures provide an in-stream work surface and vehicle access throughout the construction period while maintaining stream flow. The trench would be excavated either by a conventional backhoe, or by a crane equipped with a clamshell bucket. All spoil removed from the trench would be stored away from the water's edge or on the streambanks in an area protected by a silt fence.

At small stream crossings, the pipe segment would be assembled at the bankside work area for the full crossing distance, moved into position with side boom tractors, and lowered into the trench. At larger streams, the pipe crossing segment may be prewelded into long pipe strings on one bank and pulled by cable and winch across the streambottom to the opposite bank, or floated across the stream with buoys as the strings are joined by welding, and then submerged into the trench. Negative buoyancy of the pipeline in the trench would be maintained through the use of either concrete bolt-on river weights or concrete-coated pipe. After installation, the trench would be backfilled with the excavated spoil.

Trenching in rivers and large streams that have bedrock bottoms would require drilling and blasting before removal of the excavated material for the pipeline burial. Depending on water depth, two spud barges may be employed, one for the drilling rig and another for excavating broken rock from the trench with a crane and clamshell. Where bedrock is not encountered, a single barge and clamshell would excavate the trench and deposit the spoil downstream of the trench for later backfilling. The width and depth of water, bank configuration, and accessibility of the water crossing would determine the proper crossing method and required equipment. CNG proposes to construct the Hudson River Crossing by trenching. Preassembling the crossing pipe, bending, and weighting would be performed at bankside. The assembly would be buoyed for flotation and pulled across the river by cable, submerged into the trench and backfilled in a procedure similar to the one used for small stream crossings.

When constructing in wetland areas, the working side of the right-of-way would be stabilized with prefabricated mats or timber riprap to provide a firm surface for construction equipment. Great Lakes may elect to construct certain wetland crossings during winter after the ground freezes sufficiently to support construction equipment. Following trench excavation by backhoe or clamshell, the pipeline, having been welded into long strings on dry land and equipped with flotation buoys, would be pushed across the wetland. Then, the

buoys would be released, the pipeline submerged into the trench with concrete saddle weights and/or screw anchors, and the trench would be backfilled. Precautions would be taken (i.e., adding clay trench plugs to keep the backfilled trench from acting as an underground drainage channel). The prefabricated mats and timber riprap would be removed after the trench is backfilled.

Construction procedures would be modified in areas where residences are located in proximity to the temporary construction right-of-way. For installing pipeline loops in construction work areas with limited widths, construction equipment may work over the existing pipelines, by either padding the right-of-way to provide a minimum 4.5-foot cover over the existing pipelines or by using wooden mats. Additionally, "drag section" or "sewer-line" type construction may be used to reduce the area of impact with no more trench opened than can be backfilled in the same working day. In some locations, it may be possible to reduce the normal separation between pipes or use a pipeline crossover to shift the loop to the opposite side. The site-specific application of these methods is evaluated in section 5.1.9, "Land Use, Recreation, and Visual Resources."

Algonquin and CNG/Texas Eastern propose replacement of existing pipe with new 10-, 20-, and 24-inch-diameter pipe and Tennessee proposes to remove some abandoned pipe. Typically, the pipeline would be thoroughly dried by running pipeline pigs to remove remaining free liquids before removal. After the clearing and grading activities on the existing right-of-way are complete, a backhoe would strip the overburden from the existing line. Pipe cradles would be placed under the pipe and sideboom tractors would lift the cradles and walk the pipe out of the ditch. The pipe would then be placed adjacent to the ditch on timber skids, braced, then cut into approximately 40-foot lengths. The pipe would then be loaded on trucks and transported to a secure central location for temporary storage. The trench would then be backfilled and if necessary, the rights-of-way regraded in preparation for the new pipeline trenching, stringing, bending, line-up, welding, and other construction procedures. The new pipe segment would be hydrostatically tested and tied into the existing system and the right-of-way would be cleaned up. Special polychlorinated biphenyls (PCB) decontamination procedures for depressurizing, purging, and tying-in are discussed in section 5.1.13.

2.3.2 Compressor and Meter Station Construction Procedures

Aboveground facilities are constructed with different methods than linear pipeline facilities. The following general construction procedures are typical for new single-site facilities for pipeline systems, such as compressor stations and high volume meter stations.

The building site(s) would first be cleared of trees, brush, and debris, graded and compacted to surveyed elevations, and fenced for construction security and safety. The building foundations and other major equipment foundations would be excavated and the foundations installed with pipe and conduit access ways. Underground piping and conduit trenches would be excavated and prefabricated segments of pipe, valves, fittings, and flanges would be shop- or site-welded and assembled at the site.

The compressor unit(s) and other large equipment would be mounted on their respective foundations and the compressor building and other ancillary buildings would be erected around them. The natural gas piping, both aboveground and belowground, would be installed and pressure-tested using a method similar to that used for the main pipeline,

then tied-in to the main pipeline. The electrical wiring would be "pulled" through pre-installed conduits and the instrument panels and control systems would be installed and circuit-checked.

The initial start-up of the station would be carried out in a carefully planned sequence to verify proper interconnections and equipment operation.

After the start-up and testing is finished, the site would be cleaned and finish-graded, permanent fencing installed or repaired, access roads and parking areas paved, and landscaping completed as necessary for visual and sound buffers.

Meter stations are constructed with methods similar to those used for compressor stations except that the sites are smaller and the aboveground piping would be limited to the multiple meter tubes and sensor instrumentation necessary for accurate flow, pressure, and temperature measurement. The instrument panels and electronic data collection equipment would be located within a small building onsite.

Additions to existing compressor or meter stations would follow similar procedures as those used for new construction, except different components would be added. The principal difference is that construction would be carried out near an operating facility.

2.4 OPERATION AND MAINTENANCE

Proposed pipeline facilities for each applicant would be operated and maintained in accordance with 49 CFR Part 192 and other applicable Federal and state regulations.

Operation and maintenance of expanded pipeline systems would, in most cases, be accomplished by the applicants' existing work forces. In some cases additional employees would be hired. The applicants' staff of full-time employees would comprise a head office, a gas control center, and a field organization. Each head office would have overall responsibility for its respective system. An operations department within each head office would provide technical and environmental services, including the development of operations, maintenance procedures, and emergency response plans.

The gas control center(s) of each applicant would be responsible for operating its expanded pipeline system from a control center. The center would monitor pipeline pressures, alarms, valve configurations, and meter station flows. The operator on duty at the control center would be able to isolate sections of the pipeline system by opening or closing remotely controlled valves.

The field organization of each applicant would have the responsibility for regional day-to-day operation and maintenance of the expanded pipeline system. Each office would be staffed with field employees trained and equipped to perform operations, maintenance, and emergency response activities.

Regularly scheduled gas-leak surveys would be conducted and repairs would be made to correct any potentially hazardous leaks. All pipeline markers such as signs, aerial markers, and decals would be maintained to ensure that the pipeline location is clearly visible from the air and from the ground. All valves would be periodically inspected and greased.

Aerial inspection of the pipeline would be conducted on a regular basis. Factors such as population density and activity along the right-of-way would determine the actual frequency of inspection. Inspection from the air would provide information on possible leaks, construction activities, erosion, exposed pipe, and other potential problems.

Most applicants would maintain their rights-of-way in a generally grassy condition. Procedures consist of periodic manual and mechanical brush clearing and mowing in intervals of between 1 and 3 years depending on applicant and site-specific conditions. Herbicides are not usually used. Tennessee is evaluating the selective use of herbicides and growth inhibitors as part of a vegetation management program in New York.

Repair of terraces and drain tiles and replacement of backfill would be conducted where necessary. Water crossings would be inspected periodically. A supply of emergency replacement pipe, leak repair clamps, sleeves, and related materials would be maintained for repair activities.

Monitoring of the cathodic protection system would be accomplished through regularly scheduled cathodic protection surveys. Problems detected through the monitoring program would be corrected promptly and checked in a follow-up survey no later than 12 months after the initial discovery.

Operating procedures for compressor station personnel would include several routine operations such as recording and transmitting pressure and temperature data, calibrating equipment and instruments, inspecting critical components, maintaining equipment, and cleaning. Safety equipment such as fire protection systems and gas detection systems would be periodically checked. Cathodic protection units within the compressor yard would be regularly monitored.

2.5 SAFETY CONTROLS

Proposed pipeline facilities would be tested, operated, and maintained in accordance with 49 CFR Part 192 and other applicable Federal and state regulations.

The pipeline right-of-way would be clearly marked where it crosses public roads, railroads, rivers and navigable waters, fenced property lines, and other locations as necessary. All pipeline facilities would be marked and identified in accordance with applicable regulations.

The pipeline segments and the compressor and meter station piping systems would be constructed with carbon steel pipe manufactured in accordance with American Petroleum Institute specifications for high-test line pipe. Nominal wall thickness would be based on construction classifications and types in accordance with U.S. Department of Transportation (DOT) safety regulations.

The applicants would continue to implement their established public awareness programs, with new emphasis on the additional pipeline facilities. The programs include maintaining contact with landowners, tenants, utilities, and municipalities that may interact with construction personnel, facilities, and operations. Typical contacts would include

meetings with municipalities, fire departments or volunteer firemen, utilities, and government agencies.

The applicants would continue to participate in the "One Call" system in the states where construction is proposed. Anyone planning excavation activities can call a single phone number to alert all utilities. Representatives of affected utilities can then visit the site and mark their facilities.

Each proposed new or expanded compressor station would be equipped with hazardous gas and fire detection alarm systems, a fire protection system, and an emergency shutdown system that would be checked periodically to ensure optimum performance.

The emergency shutdown system would be designed to shut down and isolate the compressor station if excessive heat were detected, flames were detected by ultraviolet sensors, or an explosive gas mixture were detected by methane-sensitive detectors. It would also shut down equipment if a mechanical failure endangered the integrity of the equipment or presented a hazardous condition. It would automatically route gas around the compressor station during an emergency. The compressor stations would be equipped with relief valves to protect the piping from overpressurization if compressors or unit control systems failed. Fire-fighting equipment would include hand-held and hand-wheeled dry chemical fire extinguishers. In addition, an automatic fire extinguishing system would be used inside the turbine compressor building; it would be activated automatically upon excessive or sudden heat rise.

2.6 FUTURE PLANS AND ABANDONMENT

There are currently no plans by the applicants to further expand the NIP Project facilities described herein after the installation of these facilities.

There are also no plans for abandonment of facilities by any of the applicants within the bounds of the NIP Project in the foreseeable future, as the facilities are intended to be used for an indefinite period. Abandonment would be subject to the approval of the Commission, and would comply with DOT regulations and specific agreements or stipulations made for pipeline rights-of-way. Normally, a buried pipeline that has reached the end of its service life is internally cleaned, purged free of gas, isolated from interconnections with other pipelines and sealed without removing the pipe from the trench. This approach minimizes surface disturbance and other potential environmental impact. Also the aboveground piping at compressor and meter stations would be completely removed with all related aboveground equipment and foundations and the station sites would be restored to as near original condition as possible.

Upon abandonment of the pipeline, in part or in whole, the rights-of-way on private lands would be returned to the owners according to their specific easement agreements, and public lands would be returned to the appropriate leasing agency within the local, state, or Federal government.

2.7 PERMITS AND APPROVALS

In addition to the FERC's requirement of a certificate, other Federal, state, and local government agencies may have permit or approval authority over portions of the proposed project (see table 2.7-1). Some of the state and/or local permits may not be required to construct this proposed project due to the Federal pre-emption status of the FERC certificate of public convenience. At the Federal level, these include compliance with regulations of the Clean Water Act (CWA), the Rivers and Harbors Act, the Clean Air Act, and the Toxic Substances Control Act (TSCA). Each state in which construction would take place may require additional state-level review.

Federal requirements of the CWA include compliance under Sections 401, 402, and 404. Water quality certification (Section 401) has been delegated to the jurisdiction of the individual state agencies or would be reviewed by the U.S. Environmental Protection Agency (EPA). EPA and/or the states would determine if any National Pollution Discharge Elimination System (NPDES) permits (NPDES, Section 402) would be needed for discharge of hydrostatic test waters. Minnesota, Wisconsin, Michigan, New York, New Jersey, Pennsylvania, Massachusetts, and Connecticut each review and sign off on water quality certification relating to dredge and fill activities and NPDES permits. In Massachusetts, all NPDES permit activities are reviewed by the EPA.

The Section 404 permitting process is administered by the U.S. Army Corps of Engineers (COE) for all stream and wetland crossings except in Michigan, where the responsibility has been delegated to the state. Section 10 of the Rivers and Harbors Act is also administered by the COE; individual Section 10 permits would be required for all construction activities that occur in navigable waterways.

Before an individual Section 404/10 permit is issued, the CWA requires that a Section 404(b)(1) guidelines analysis must be completed. The FERC, in the NEPA review required to prepare this EIS, has analyzed all technical aspects required for the Section 404(b)(1) guidelines analysis, including analysis of natural resources and cultural resources affected by the project, as well as analyses of alternatives and route variations that would eliminate or minimize the discharge of fill material in the waters of the United States. The results of these studies are presented in this EIS. In addition, we have proposed a set of best management practices that we would recommend each applicant implement during construction (see appendix D) to minimize adverse impact on the waters of the United States.

Each state reviews pipeline right-of-way regulatory requirements differently. The state environmental regulatory agencies that would review components of the NIP Project are the Minnesota Department of Natural Resources (MNDNR), the Wisconsin Department of Natural Resources (WIDNR), the Michigan Department of Natural Resources (MIDNR), the New York Public Service Commission (NYPSC), the Massachusetts Department of Environmental Protection (MADEP), the New Jersey Department of Environmental Protection (NJDEP), the Rhode Island Department of Environmental Management (RIDEM), the Pennsylvania Department of Environmental Resources (PADER), and the Connecticut Department of Environmental Protection (CTDEP). Individual communities normally also require reviews by their Conservation Commissions or similar organizations. Table 2.7-1 lists state and local permits that may be required.

TABLE 2.7-1

Environmental Permits and Reviews That May Be Required for the Proposed NIP Project

Agency	Permit	Applicant a/
FEDERAL		
U.S. Army Corps of Engineers	Section 404 Permit Section 10 Permit	T, Tr, GL, A, NF/P-Y, CNG
U.S. Environmental Protection Agency	Water Quality Certification (Section 401)	T, Tr, GL, A, NF/P-Y, CNG
	National Pollution Discharge Elimination System Permit (NPDES, Section 402)	All
	Prevention of Significant Deterioration Permit (Compressor Station Modifications)	CNG, NF/P-Y
	Alternative Disposal Permit (TSCA)	T, A, CNG/TE
	Hazardous Waste Disposal (RCRA)	T, A, CNG/TE
U.S. Department of Energy	Natural Gas Act Import License Fuel Use Act Exemption	Tennessee
U.S. Department of Transportation	Federal Highway Crossing Permits	All
U.S. Forest Service	Special Use Permit	Great Lakes
U.S. Department of Interior (Bureau of Indian Affairs)	Indian Reservation Land Crossing Permit	Great Lakes
STATE		
Minnesota Department of Natural Resources	Special Protection Water Crossing Permit State Land Crossing Permit	Great Lakes
Minnesota Department of Transportation	Road Crossing Permits	Great Lakes
Minnesota Pollution Control Agency	National Pollutant Discharge Elimination System Permit (NPDES, Section 402)	Great Lakes
Wisconsin Department of Natural Resources	River and Stream Crossing Permit	Great Lakes
	State Land Crossing Permit	Great Lakes
	National Pollutant Discharge Elimination System Permit (NPDES, Section 402)	Great Lakes
	Coastal Zone Consistency	Great Lakes
Wisconsin Department of Transportation	State Road Crossing Permits	Great Lakes

TABLE 2.7-1 (cont'd)

Agency	Permit	Applicant
STATE (cont'd)		
Michigan Department of Natural Resources Land and Water Management	Coastal Zone Consistency Review	Great Lakes
Michigan Department of Natural Resources	River and Stream Crossing Permits	Great Lakes
	State Land Crossing Permit	Great Lakes
	National Pollutant Discharge Elimination System Permit (NPDES, Section 402)	Great Lakes
Michigan Department of Transportation	State Road Crossing Permits	Great Lakes
New York Department of Environmental Conservation	Freshwater Wetland Permit	T/CNG
	Tidal Wetlands Permit	CNG
	Wild, Scenic, Recreational Rivers Permit	T
	Protection of Waters Permit	T/CNG
	Water Quality Certificates	T/CNG
	Permits To Construct/Certificates To Operate an Air Contamination Source	T/CNG
	State Pollutant Discharge Elimination Permit	T/CNG
	Solid Waste Management Permit	T/CNG
New York Public Service Commission	Article VII Certification	T, CNG
New York SEQRA Division	SEQRA Review	CNG/TE
New York Department of State	Coastal Zone Consistency Review	T, CNG
New Jersey Department of Environmental Protection	Testwater Discharge Permits	Transco
	Stream and Wetlands Crossing Permit	Transco
	Special Use Permit (Parks)	Transco
Connecticut Department of Environmental Protection	National Pollutant Discharge Elimination System (NPDES) and State Discharge Permits	Algonquin
	401 Water Quality Certificate	Algonquin
	Temporary Operating Permit (if rock crusher is used)	Algonquin
Connecticut Siting Council	Certificate of Environmental Compatibility and Public Need	T,A

TABLE 2.7-1 (cont'd)

Agency	Permit	Applicant
STATE (cont'd)		
Pennsylvania Department of Environmental Resources	Permit to cross state rivers	Tr,TE,NF/P-Y
	Testwater Discharge Permit	Tr, TE, NF/P-Y
	Stream and Wetlands Encroachment Permit	Tr, TE, NF/P-Y
	Soil Erosion and Sediment Control Plan Approval and Special Use Permit	Tr, TE, NF/P-Y
	Air Plan Approval to construct or operate	Tr. NF/P-Y, CNG/TE
Pennsylvania Department of Transportation	State Highway Crossing Permits	Tr, TE,NF/P-Y
Massachusetts Department of Environmental Protection	Letter of Authorization for Hydrostatic Test Water Discharge	T,A
	Wetland and Water Quality Certification	T,A
	Waterways Crossing Permit	T,A
Massachusetts Coastal Zone Management Office	Coastal Zone Consistency Review	A
Massachusetts Department of Public Utilities	Road Crossing Permit	T,A
Massachusetts Department of Public Works	Underground Utility Installation	T,A
Massachusetts Department of Environmental Management	State Forest Crossing Permit	Algonquin
Rhode Island Department of Environmental Management	Water Quality Certificate Wetland Permit, Dredge and Fill Permits, Air Quality Permit	T,A
Rhode Island Department of Transportation	Highway Crossing Permit	Algonquin
Rhode Island Historic Preservation Commission	Approval of Proposed Route/Site	T,A
LOCAL		
Towns	Building Permits for compressor station additions	T, Tr, NF/P-Y, CNG, CNG/TE
Counties and Towns	Road Crossing Permits, Soil Erosion and Sediment Plan Approval	All
County Health Departments	Permits to install septic systems at compressor stations	NF/P-Y, Tr
County Drain Commission	Permit to cross county drain (Michigan)	Great Lakes
Zoning Boards	Approvals for aboveground facilities	T, Tr, CNG, NF/P-Y, CNG/TE
Railroad Crossings	S00 Line, Chicago North Western, E and LS, Annarbor Railroad, Chesapeake Ohio, Grand Trunk Western	Great Lakes
	Lehigh Valley, NY NH + H	Tennessee
	Penn Central	GL, T, Tr, TE
	Conrail	CNG, T, Tr
	Central Vermont	Algonquin
Soil Conservation Districts	Soil Permit	All
Conservation Commissions	Wetland Crossing	All (except TE)

a/ T = Tennessee, Tr = Transco, GL = Great Lakes, A = Algonquin, P-Y = Penn-York, NF - National Fuel, TE = Texas Eastern

New York has established coastal zone management policies regarding the use of land and water within designated coastal zones. Federal and state projects within these coastal zones must be deemed consistent with state management objectives. Tennessee's proposed Niagara River crossing and CNG's Hudson River crossing would be within New York's coastal zone management area. Tennessee and CNG must file certifications with the New York Department of State (NYDOS) to demonstrate that their proposals are consistent with the state Coastal Management Program. These applicants must receive concurrence from NYDOS. Algonquin has filed for approval of its consistency determination with the Massachusetts Coastal Zone Management Office. In addition, Great Lakes' proposed facilities in Michigan may require a consistency determination.

3.0 ALTERNATIVES

In accordance with NEPA and with Commission policy, we have evaluated a number of alternatives to the NIP Project to determine whether they are reasonable, environmentally preferable alternatives to the proposed action. This section includes descriptions of the following:

- no action or postponed action
- energy conservation and energy alternatives
- project system alternatives
- route variations
- compressor station alternatives

3.1 NO ACTION

Under the no-action alternative the construction of the proposed pipeline facilities to transport natural gas for use in the Northeast market would not occur. This alternative would prevent all environmental impact associated with the construction and operation of the proposed project.

If the NIP Project is not constructed, potential users will need to seek natural gas from other systems or increase usage of fuel oil, coal, and other alternative fuels. Transportation of 392,000 Mcfd of Canadian natural gas would not be provided by the proposed project. The LDCs, cogeneration, and power-generation customers in New York, Pennsylvania, Massachusetts, Rhode Island, New Jersey, and Virgina would not receive the increased natural gas delivery volumes and would forego the environmental benefits associated with the use of natural gas.

The natural gas supplied by this proposed project would be used in two gas-demand situations: 1) to capture new energy markets, and 2) to replace other fuels currently in use. If this project is not constructed, alternative fuels used to replace natural gas would lead to an increase in the use of alternative fuels. Increased volumes of these dirtier fuels would be used to replace natural gas.

One of the major environmental benefits of using natural gas for residential, commercial, industrial, and utility needs is reduced emissions of nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) relative to fuel oil, coal, and wood. The conversion of electric utilities to gas, the construction of gas-fired cogeneration facilities, and to a lesser degree, new residential, commercial, and industrial facilities utilizing natural gas instead of fuel oil or coal, would lessen future increases in regional emission of air pollutants.

We have conducted an analysis of the environmental consequences if the three Northeast settlement projects 1/, including NIP were not implemented. These three projects (Iroquois/Tennessee, ANR, and NIP) would account for 1,673,000 Mcfd of natural gas (this includes 31,600 Mcfd of natural gas to be transported by Transco to the Hopewell

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1/ In the original discussion, a fourth project (Champlain) was also considered. However, Champlain has been indefinitely deferred.

cogeneration plant). Approximately 23 percent of this gas would be attributable to the NIP Project.

Our analysis consisted of the following tasks:

1. Analyze increased gas demand in the Northeast by 1997 - both with and without the settlement projects.
2. Determine the volumes of alternative fuels that would be used if the settlement projects are not constructed.
3. Calculate the additional air pollutant emissions from increased alternative fuel use.
4. Determine the additional infrastructure required, if any, to deliver the additional volumes of alternative fuels.

To better understand the gas market in the Northeast and how it might grow, task 1 included a review of a range of forecasts for the region published by the Energy Information Agency, Gas Research Institute, and the American Gas Association (AGA). We also reviewed Stanford University's Energy Modeling Forum, Electric Projections by the North American Electric Reliability Council, state energy plans for New York and New Hampshire, and a number of miscellaneous reports pertinent to the energy demand in the Northeast. The forecasts range from no growth to explosive growth, with the projected volumes bracketing those volumes projected by the Northeast settlement projects reviewed herein. It is not the purpose of this document to judge the merits of either the various forecasts or the settlement demand data. Our analysis merely demonstrates that the settlement demand data fall within the range of published demand forecasts. Further, this document does not evaluate the customer's need for additional gas supplies or the need for the related interstate pipeline facilities.

The Commission will address these issues when it considers the entirety of this proposal including customer markets, transportation and sales rates, and gas supply adequacy. These aspects are being considered by FERC on a track parallel to the environmental analysis. That information along with the environmental record will be placed before the Commission for their review and ultimate decision on this project.

Appendix B details the conversion of the peak-day market data filed as a result of the January 12, 1989, settlement to annual alternative fuel consumption by end-use category under task 2. Emission factors specific to each state, alternative fuel, and end-use category were used to calculate emissions of SO_2, NO_2, and particulate matter (PM). This analysis assumes that the majority of alternative fuels would be used in new facilities since new fuel burning equipment must meet more rigorous emission standards than existing equipment. Further, if the facility is classified as a major source of air pollution, it must apply best available control technology (BACT) and comply with appropriate new-source performance standards.

Two fuel substitution scenarios for 1997 were analyzed. Case I is a partial substitution case that assumes additional gas could be delivered off-peak to industrial customers due to the low annual load factor of the systems supplying the Northeast. This analysis adopts the AGA's assumptions that 30 percent of the industrial demand and 75

percent of the electric utility demand could be supplied off-peak with interruptible gas.2/ Under this scenario, only about one-third of the volume of natural gas would be replaced by alternative fuels. Case II is a 100 percent substitution case in which the entire volume of natural gas would be replaced by alternative fuels.

Appendix B-3 presents the emission increases for the total natural gas volumes by end-use category and alternative fuel for both the partial substitution and the 100 percent substitution cases for all Northeast projects and for the NSP which includes the NIP, SS-2, and TEMCO Projects. Although PM emissions are included in the table, increases resulting from the substitution of alternative fuels would be generally minor for all states and are not considered a significant impact for discussion.

Table 3.1-1 presents the relative level of impact for each state by comparing the emission increases for 1997 to EPA's baseline 1985 emissions. The projected increases of SO_2 and NO_2 appear to be significant for Rhode Island, Massachusetts, and Connecticut. Under the 100 percent substitution scenario the following summaries can be made by state for the three Northeast settlement projects identified above.

- Connecticut - an increase of approximately 9,200 tons of SO_2 (10.5 percent) and 3,200 tons of NO_2 (2.5 percent) per year would occur, primarily from increased usage of #2 fuel oil, residual fuel oil, and coal by electric utilities and cogeneration customers.

- Massachusetts - an increase of approximately 28,400 tons of SO_2 (8.6 percent) and 10,600 tons of NO_2 (3.8 percent) per year would occur, primarily from increased usage of coal, #2 fuel oil, and residual fuel oil by electric utilities and cogeneration customers. Approximately one-third of the SO_2 emissions come from current use of residual fuel oil in New England Power's Brayton Point Unit No. 4.

- New Hampshire - minimal increases (less than 1 percent) would occur from proposed low volumes of natural gas received.

- New Jersey - an increase of approximately 9,100 tons of SO_2 (5.0 percent) and 7,200 tons of NO_2 (2.0 percent) per year would occur, primarily from increased usage of #2 fuel oil and coal for electric utilities and cogeneration customers.

- New York - an increase of approximately 17,200 tons of SO_2 (2.6 percent) and 8,200 tons of NO_2 (1.3 percent) per year would occur, primarily from substi-tution of #2 fuel oil in all market sectors and coal usage by cogeneration customers.

- Rhode Island - an increase of approximately 9,400 tons of SO_2 (102 percent) and 5,700 tons of NO_2 (18.7 percent) per year would occur, primarily from alternative fuel usage by Ocean State Power, with #2 fuel oil as backup, and the present operation of the Manchester Street Station using residual fuel oil.

2/ American Gas Association Issue Brief 1988-6, May 16, 1988.

TABLE 3.1-1

Projected Emissions Increase by State for 1997 for the Three Projects

State	Base Emissions (tons/yr) a/			Emission Increase (tons/yr)			Percent Increase		
	NO_X	SO_2	TSP	NO_2	SO_2	TSP	NO_2	SO_2	TSP
CASE I - PARTIAL SUBSTITUTION (1997)									
Connecticut	127,941	87,298	78,661	1,320	4,152	166	1.03	4.76	0.21
Massachusetts	277,018	328,344	136,038	3,046	8,140	332	1.10	2.48	0.24
New Hampshire	54,617	85,283	56,440	24	80	4	0.04	0.09	0.01
New Jersey	369,024	183,448	218,289	2,597	3,288	505	0.70	1.79	0.23
New York	626,284	665,105	492,698	3,780	7,548	801	0.60	1.13	0.16
Pennsylvania	958,041	1,425,005	1,174,176	179	646	42	0.02	0.05	0.00
Rhode Island	30,318	9,227	17,354	1,695	4,315	158	5.59	46.76	0.91
Vermont	25,200	7,338	95,310	0	0	0	0.00	0.00	0.00
TOTAL	2,468,443	2,791,048	2,268,966	12,641	28,169	2,008	0.51	1.01	0.09
CASE II - 100% SUBSTITUTION (1997)									
Connecticut	127,941	87,298	78,661	3,212	9,205	341	2.51	10.54	0.43
Massachusetts	277,018	328,344	136,038	10,620	28,358	1,059	3.83	8.64	0.78
New Hampshire	54,617	85,283	56,440	32	98	5	0.06	0.11	0.01
New Jersey	369,024	183,448	218,289	7,199	9,108	1,068	1.95	4.96	0.49
New York	626,284	665,105	492,698	8,193	17,176	1,352	1.31	2.58	0.27
Pennsylvania	958,041	1,425,005	1,174,176	304	898	57	0.03	0.06	0.00
Rhode Island	30,318	9,227	17,354	5,671	9,383	483	18.71	101.69	2.78
Vermont	25,200	7,338	95,310	0	0	0	0.00	0.00	0.00
TOTAL	2,468,443	2,791,048	2,268,966	35,231	74,226	4,365	1.43	2.66	0.19

a/ Based upon 1987 National Emission Data System output from EPA Regional Offices I, II, and III.

As stated above, the NIP Project represents approximately 23 percent of the study volumes of natural gas to be supplied to New York, Pennsylvania, Massachusetts, New Jersey, Rhode Island, and Virginia (see appendix B, tables 16 and 17 for the increased emissions result from not building the NSP, which includes the NIP Project). It can be assumed that under the 100 percent substitution case, a significant portion of projected SO_2 and NO_2 emissions in 1997 would be attributed to the use of alternative fuels in two of the four states that would be served by the NSP Project.

Although this analysis identifies the potential for significant increase in emissions of air pollutants, it is far more complex to predict the location and significance of ambient pollutant increases. Increased emissions would likely cause higher ambient concentrations of these pollutants in some areas. However, the extent to which higher ambient concentrations have the potential to exceed the corresponding NAAQS can only be predicted by atmospheric dispersion modeling of the affected alternative fuel users. Assembling the detailed source data required for model inputs is beyond the scope of this EIS. However, this type of analysis is normally performed during the permitting process for new major sources, thereby protecting the NAAQS and applicable increments. Nevertheless, the

potential impact of increased alternative fuel use on air quality in the Northeast can be avoided if the settlement projects are authorized.

Acid rain and its relationship to SO_2 and NO_2 emissions are of serious concern in the Northeast. Most Northeast states either have enacted or propose to enact legislation to reduce acidic deposition. Natural gas contains negligible amounts of sulfur and, therefore, its combustion leads to negligible emissions of SO_2. Further, NO_2 emissions from natural gas are generally lower than from other fossil fuels; therefore, use of substitute fuels would not provide cleaner burning fuel supplies for use by the Northeast in combating the acid rain problem.

The potential need for expansion of the infrastructure to deliver the projected additional alternative fuels was evaluated from historic data on alternative fuel deliveries to the Northeast. Deliveries of #2 fuel oil, residual fuel oil, and to a lesser extent coal, have declined significantly over the past two decades. As a result, the unused capacity significantly exceeds the projected increase in alternative fuels. Minor improvements and storage likely would be required in some areas but attempting to determine their location and magnitude was beyond the scope of this study.

3.2 ALTERNATIVE ENERGY SOURCES

In 1986, gas provided approximately 25 percent (approximately 2,023 trillion Btus) of the total energy demand of the eight northeast states; followed by coal, providing 22 percent; residual fuel oil, #2 fuel oil, and nuclear energy, providing approximately 13 percent each; and the remainder provided by hydroelectric, wood, and liquid petroleum gases. Approval of the NIP Project would equate to an additional 143 trillion Btus of energy annually available to the Northeast market or an additional 10 percent of the 1986 natural gas energy demand. The volume of natural gas supplied to each state by the NIP Project would vary, as would the energy replacement, i.e., New York, Connecticut, Massachusetts, Rhode Island, New Jersey, and Pennsylvania would receive approximately 30, 16, 13, 11, and 10 percent of the NIP Project quantities, respectively, with 20 percent available to other regional markets.

The NIP Project would provide natural gas to the residential, commercial, industrial, and electric utility sectors. Table 3.2-1 provides a summary of the primary competitive fuels used by sector. The electric utility sector would be the major user, with the remainder being spread across the remaining three sectors.

3.2.1 Existing Natural Gas Pipeline Network

Presently, natural gas reaches the Northeast market from domestic and Canadian production areas through pipelines. Several major pipelines flow to or near underground natural gas storage fields in western Pennsylvania, western New York, and Maryland. At these locations, a portion of the flow can be diverted into storage during the low-demand summer period for later withdrawal during the peak-demand winter period. The remainder of the natural gas flows through the pipeline system to the marketplace. During spring, summer, and fall months, the systems have excess capacity to move gas east to increase the supply for use during off-peak demand periods and to serve industrial customers and utilities on an interruptible basis. However, there are various pipeline system constraints between the storage reservoirs and proposed delivery points of the NIP Project during periods of peak demand.

TABLE 3.2-1

Natural Gas Fuel Used by Sector and Competitive Alternative Fuels

Sector	Gas Use	Competitive Fuel(s)
Residential	Cooking	Electricity
	Space heating	#2 fuel oil, electricity
	Water heating	#2 fuel oil, electricity
	Drying	Electricity
Commercial	Cooking	Electricity
	Space heating	#2 fuel oil, residual fuel oil, electricity
	Water heating	#2 fuel oil, electricity
	Drying	Electricity
Industrial	Cooking	Electricity
	Space heating	#2 fuel oil, residual fuel oil, coal
Electricity	Boiler fuel	Coal, residual fuel oil, wood
	Engines and turbines	Gasoline, kerosene, #2 fuel oil, wood
	Raw materials	Liquified petroleum gases
Electric Utility	Electric generators	Coal, residual fuel oil, #2 fuel oil
	Turbine-driven during "peaking"	#2 fuel oil or plants primary fuel
	New gas fired, combined cycle plants	#2 fuel oil (dual-fuel)

We looked at the possibility of expanding existing Gulf Coast systems to deliver gas to the Northeast. The cost and facility requirements for such a scenario made that alternative unreasonable.

While construction could eliminate the potential supply constraints to specific locations, many of these constraints would remain and potentially force curtailments, as occurred in the Northeast in the month of December 1989.

3.2.2 Oil

In 1986, the Northeast relied on residual and #2 fuel oil to supply approximately 26 percent of its total energy demand. Much of this oil was purchased abroad, making the Northeast heavily dependent on foreign crude petroleum and petroleum products and increasing its reliance on various unstable oil producing regions. A significant amount of residual and #2 fuel oil would be required yearly in the energy mix for the Northeast to offset the proposed energy supply.

This increased fuel demand would require additional shiploads of oil to the Northeast each year, which would increase the risk of spills and associated environmental impact. Truck and rail deliveries would increase, affecting traffic patterns. Although our analysis indicates that the existing infrastructure is underutilized, minor augmentation of facilities might be required. As discussed in section 3.1, use of fuel oils typically results in increases of SO_2, NO_2, and PM emissions during burning. The existence of SO_2 and NO_2 has been determined to be a major precursor of acid rain.

Much of the natural gas from this project would be used for generating electricity. Oil-fired facilities are a long-lead-time alternative because of the number of issues that

require resolution before approval; therefore, they may not constitute a realistic alternative to gas-fired facilities.

3.2.3 Coal

In 1986, coal accounted for approximately 22 percent of the energy demand for the Northeast. During the 1960s and 1970s, the reliance on coal (primarily for coal-fired electric generating plants) declined due to the relatively low cost of oil and the passage of the Clean Air Act. However, with the drastic increase in oil prices in the mid- and late 1970s, there was a resurgence in the use of coal, primarily for generating electricity. Most residences and businesses are not equipped to burn coal. The increased use of coal as an alternative to the proposed NIP Project would require the expansion of existing facilities or construction of new coal-fired electrical facilities.

Coal is abundant and available domestically in sufficient quantities to supply the projected energy need. However, it must be transported from the coal fields. Transportation could be difficult and costly if a facility is not adjacent to an existing rail corridor. Expansion of existing facilities or construction of a major new coal plant is difficult and would involve even larger concerns than constructing a new oil-fired facility. Coal is inherently a polluting fuel, and its combustion releases sulfur, nitrogen, alkali and halogen compounds, and volatile traces of metals, affecting air quality. Combustion also requires the disposal of significant amounts of solids. Like oil, coal produces SO_2 and NO_2, which contribute to the formation of acid rain.

Much of the natural gas from this project would be used for generating electricity. Coal-fired facilities are a long-lead-time alternative because of the number of issues that require resolution before approval; therefore, they may not constitute a realistic alternative to gas-fired facilities.

3.2.4 Electricity

Electric utilities in the Northeast accounted for more than 50 percent of the 1986 energy demand, with its normal load being supplied by coal, nuclear power, residual fuel oil, hydropower, natural gas, and #2 fuel oil. Natural gas competes with coal, residual fuel oil, and #2 fuel oil in the electric utility market. Existing hydroelectric and nuclear power, because of their high capital cost and low fuel cost, are used preferentially to meet any load. However, new nuclear power plants may be politically and economically infeasible at present. New hydroelectric plants will almost always be the investment of choice when feasible sites can be obtained. Hence, gas does not actually compete with either nuclear fuels or hydropower in generating electricity. To the extent gas is not available to generate increased electricity, the substitute fuels are coal or one of the fuel oils.

In the northeast, natural gas has been used primarily as a peaking fuel to drive gas turbine-driven generators during peak-demand periods. Since it has been available on an interruptible basis, it has also been used as a supplemental fuel in plants with dual-fuel capabilities when competitively priced. When natural gas is not available for new peaking use, it is usually replaced with #2 fuel oil. The NIP Project would provide natural gas on a firm basis for new gas-fired cogeneration plants. The likely replacement choice would be a plant capable of burning residual fuel oil, #2 fuel oil, or possibly coal.

3.2.5 Peak-Shaving

During the winter months in the Northeast, the capacity of existing pipeline transmission facilities is not adequate to meet peak energy demand. Underground gas storage is the first line of defense to meet increased winter base-load demand (see section 3.2.1). During winter, when supplies of natural gas from underground storage are not adequate to meet peak demand, other forms of energy must be dispatched to supplement pipeline suppliers. Normally a propane-air mixture, liquified natural gas (LNG), or synthetic natural gas is used. Selection of an alternative depends on cost. Availability of existing alternative facilities limits these fuels' usefulness to peak-shave for brief periods. Peak-shaving is not a viable alternative to the proposed project.

LNG, propane, and synthetic gases do not compete with natural gas directly in most markets, since they are used to supplement (peak-shave) natural gas only in peak-demand periods and are not considered to be an alternative to increasing the availability of natural gas supplies in general market use. These peak-demand supplies are not cost-competitive fuels in any of the four sectors discussed. Peak-shaving gas is injected into the distribution system on short notice during peak demand periods to satisfy demand needs. Peak shaving storage is generally sized to supply only the coldest 10 to 20 days in a heating season. Availability of this type of service is limited by storage capacity and equipment necessary to provide pipeline available gas. As such, peak shaving cannot be considered a reasonable alternative to the increased deliverability and annual supplies of the proposed project.

The New England Fuel Institute et al. (NEFI) indicated that "the available peaking capacity is far in excess of the amounts reported by the shippers" and that "these supplies must be considered and evaluated by FERC before it publishes its EIS..." We disagree with this position. These issues are not part of the EIS for this project and will be considered by the Commission when the full record has been developed. Nonetheless, we did evaluate expansion of existing systems and did not find them to have any environmental advantage.

3.2.6 Other Energy Sources

Other conventional energy sources (e.g., propane, wood, and synthetic fuels) and nonconventional energy sources (e.g., solar, wind, fuel cells, and photovoltaics) are not viable alternatives to the proposed NIP Project for a reliable, long-term energy supply to the Northeast.

Propane rarely competes directly with natural gas since it is in limited supply and almost always more expensive. Its use is generally restricted to rural areas where natural gas is not available. Still, it is an excellent substitute for natural gas. Propane-air mixtures are frequently added to natural gas streams to meet peak demand. Some additional propane is used in the form of propane-air mixtures to allow utilities to meet peak-day loads.

Wood is used for residential space heating in small amounts. The amount of wood used has increased during the past 15 years because energy prices have soared, but wood still provides only a small portion of the total residential energy consumed in the Northeast. Almost no wood is used in the commercial market; however, considerable amounts of wood and wood products are burned in the industrial sector. In 1986, wood accounted for approximately 4 percent of the total Northeast energy supply. However, this is mainly from paper, pulp, and wood processing industries, where large volumes of waste wood and wood products

are readily available for use as a fuel. Transportation and storage requirements of wood, as well as waste disposal, make it impractical for large-scale use.

Synthetic fuel technology has not been demonstrated on a large scale in the Northeast, but would certainly face environmental and economic uncertainties in the private and public sector.

Nonconventional energy sources have stimulated a lot of interest. These technologies appear to be small-scale in nature, have the potential to be highly efficient, and appear to create little environmental impact. However, as an energy source, they are not expected to be proven reliable, economical, or available in sufficient quantities in the near term to be considered a reasonable alternative to the proposed NIP Project.

3.2.7 Energy Conservation and Electric-Load Management

Residents of the Northeast are well known for their support of energy conservation and protection of their environment. There must be continued effort to provide a realistic approach to the need for continued use of energy, whether it be for current demand or for future expansion to accommodate growth. The continued conservation programs are a significant component in efforts to meet existing and future energy demand in the Northeast.

For conservation to be an alternative to the NIP Project, 392,000 million Btus per day of cost-effective conservation and energy-load management measures must be identified. Many of the Northeast utilities, as well as state agencies and environmental groups, have encouraged active conservation efforts and energy-load management programs. In fact, demand projections for the Northeast reflect the effects of ongoing energy conservation efforts. However, existing technological, institutional, political, and social barriers make it difficult to expand energy savings significantly through these programs. According to the New England Energy Policy Council (NEEPC), obstacles to energy efficiency improvements (in this case electrical efficiency) are lack of information about the availability, cost, and reliability of conservation measures; the fact that consumers cannot capture the direct benefit or do not control usage; the major initial capital expense; and lack of a strong commitment from the utilities (NEEPC, 1987).

Since the publication of Power to Spare, seven of Massachusetts' investor-owned electric utilities, both of Connecticut's utilities, Vermont's two largest utilities, and other utilities in Rhode Island and New Hampshire have all adopted, or are in the process of developing, electricity efficiency programs on a scale that has no precedent in the United States. This cooperative effort by utilities, public, and interest groups is commendable and deserves recognition. The energy savings are significant and further efforts resulting from the replacement of existing residential furnaces with higher efficiency systems would provide increased energy savings.

The implementation of such conservation measures results in energy savings and decreases energy demand. However, while such programs result in changes in load shape and an initial reduction in energy use, they do not necessarily cause a significant reduction in peak requirements unless the growth in number of users is checked. To encourage energy-saving measures, consideration must be given to accelerating or stimulating conservation action and developing energy-load management programs.

The potential benefits of various electric energy-load management programs, such as reducing the system peak demand, building off-peak load, and shifting energy use from on-peak periods to off-peak periods, varies depending upon utility-specific factors such as current and future mix of power generation, fuel sources, load growth, daily and seasonal load shapes, and regulatory policy. Energy-load management increases the base load by reducing peak energy demands while filling in low-demand periods of the load cycle. This results in a more effective use of energy capacity and is accomplished by attempting to alter customers' energy use patterns. A limiting factor is that successful energy-load management efforts require customer participation, which is usually voluntary. While such initiatives have reduced and would continue to reduce energy demands, forecasted demands are still high enough to require significant new sources.

There are existing technological, institutional, political, and social barriers that will inhibit complete implementation of energy conservation and load-management programs. Although individual components of energy conservation programs, when implemented, will reduce energy demand, the effectiveness of energy conservation will be determined by the success rate for implementation of complete programs. Energy conservation is not likely to be effective to the point that future energy demands, i.e., increased demand to accommodate regional growth, will not require continued upgrading and expansion of fuel delivery systems.

3.3 PROJECT SYSTEM ALTERNATIVES

Project system alternatives are those alternatives that meet the stated objectives of the Project, but utilize a different gas import point or delivery system. Great Lakes has proposed to construct and operate pipeline facilities to transport up to 417,500 Mcfd of Canadian natural gas for TransCanada to satisfy market requirements of export customers in the northeastern United States (346,400 Mcfd) and customers in eastern Canada (71,100 Mcfd). Our analysis indicates that no other delivery system in the United States could be utilized to transport this volume of natural gas for delivery by TransCanada at the interconnection with Tennessee at the NIP. An alternative we did not consider would be for TransCanada to deliver the natural gas through modifications to its existing system in Canada. We consider such an alternative to be outside the scope of this EIS.

The other NIP Project applicants propose to construct and operate pipeline facilities to transport up to 346,400 Mcfd of Canadian natural gas received at the NIP to a power plant, cogeneration facilities, LDCs, and for their own system supply. These customers are located in New York, Massachusetts, Rhode Island, Pennsylvania, New Jersey, and Virginia. The applicants have primarily proposed looping, pipeline replacement, and added or new compression facilities at various points along their existing systems. No existing system would service the geographically diverse customers.

Major route alternatives are those that have the same import and delivery points as the proposed project, but follow routes significantly different from those proposed by the applicant. We consider major geographic alternatives when significant problems are identified with proposed pipeline facilities or when the proposed facilities require construction of substantial amounts of new right-of-way. We have found that while site-specific problems occur along the NIP Project's proposed rights-of-way (see section 3.4), none are so significant as to warrant consideration of significantly different routes for long distances.

3.4 ROUTE VARIATIONS

We have analyzed decreasing the length of Great Lakes proposed loops by increasing the diameter of pipe from 36 inches to 42 inches. Increasing the diameter of pipe would require the construction of additional pig launchers and would be an additional burden in operating and maintaining the pipeline. Additionally, the construction of the loops as proposed would result in the completion of 93 percent of the looping of Great Lakes system. This would add to the integrity of Great Lakes system. Moreover, it would not delay the potential for additional facility expansion in the future. Therefore, we have determined that Great Lakes should construct its pipeline as proposed.

Route variations differ from system or major geographic alternatives (see section 3.3) in that they are intended to resolve localized resource issues (e.g., avoidance of wetlands and residential areas). While some route variations may be several miles in length or deviate into different towns, most are short and near the applicant's proposed route.

Installation of new pipeline along existing, cleared rights-of-way (i.e., pipeline loops) is generally environmentally preferable to construction along new cleared rights-of-way. Looping can limit construction effects by partially using previously cleared areas and may limit long-term effects by preventing the creation of new right-of-way through a previously unaffected area. The proposed NIP Project consists almost entirely of pipeline looping or replacement (99 percent). However, issues have been raised through discussions with Federal and state agencies, review of scoping comments, and our own project review that warrant the identification and evaluation of route variations. These resource issues include wetlands, residential areas, habitats associated with fish and wildlife species, public lands, and other natural resource areas. Air and ground reconnaissance, topographic maps, and aerial photography as well as consultation with Federal, state, and local representatives were used to identify and evaluate route variations.

The Section 404 (b) (1) Guidelines (Guidelines) promulgated pursuant to the CWA of 1977 (40 CFR 230) require that the COE, prior to issuance of a Section 404 permit, analyze the use of practicable alternatives that would eliminate or minimize the discharge of dredged or fill material into wetlands or other waters of the United States (40 CFR 230.10). The COE is required to adopt those practicable alternatives that would reduce adverse impact on aquatic ecosystems, as long as the alternative would not have other significant adverse environmental consequences (40 CFR 230.10(a)). To facilitate the COE's analysis of practicable alternatives as required by the Guidelines, as well as to fulfill our requirement of examining alternatives pursuant to NEPA, we have investigated several variations that would minimize or eliminate disruption to wetland areas.

In some parts of the project area, however, particularly in Minnesota and Michigan, wetland areas are so numerous and extensive that identifying alternative routes that would not create greater adverse impact on surrounding wetland areas or forest resources was difficult. In many cases it was obvious that using existing cleared rights-of-way resulted in less impact than deviating from the proposed route and creating new and longer rights-of-way. We did, however, identify route variations where effects to the wetland resources could be reduced. In general, greater consideration was given to avoiding forested wetlands or wetlands containing unique or significant habitat, but only if the resulting new right-of-way would not cause other significant environmental effects.

A total of 17 potential route variations, as identified in table 3.4-1, were evaluated. No sensitive resource issues were identified in connection with the pipelines proposed by Transco, Texas Eastern, National Fuel/Penn-York, or CNG/Texas Eastern. A description of each route variation and the resource issues involved is presented in section 6.0 along with a discussion of a comparison with the corresponding portions of the proposed route. Appendix A contains maps showing the location of route variations.

3.5 COMPRESSOR STATION ALTERNATIVES

The applicants propose to add a total of 33,500 hp of compression at six existing compressor stations and a total of 28,240 hp at three new sites. The expansion of compression facilities at existing sites is generally more environmentally acceptable than the development of a new site.

Our review of the stations where expansion is proposed identified no significant additional environmental impact. Increased noise at the nearest residences due to the new compressor facilities was generally insignificant or consistent with our guidelines.

For new compressor station sites, we considered alternatives where specific problems were identified. Factors considered include proximity to noise-sensitive areas, loss of prime farmland, land use compatibility, wetland disturbance, and presence of endangered or threatened species. Site-specific analysis of the impact of each proposed new compressor station follows in section 4.0 "Affected Environment" and section 5.0 "Environmental Consequences" and is summarized below.

Compressor Station 205

Transco proposes to construct a 12,000-hp Compressor Station 205 on approximately 10 acres of a 99-acre parcel of Transco-owned land in Lawrence Township, New Jersey. Approximately 39 acres of the site is prime farmland. Of this, 2.0 acres would be permanently disturbed. The nearest noise-sensitive receptor, a residence located approximately 1,380 feet east of the proposed compressor building, would not be significantly affected. The Lawrence Township approved construction of the facility. Transco volunteered to dedicate an easement encompassing 85 acres in perpetuity for agriculture and conservation purposes. No FWS National Wetland Inventory (NWI)-mapped wetlands would be affected by construction of the proposed station. However, approximately 0.02 acre of state-recognized wetland would be temporarily disrupted. No Federal-listed threatened or endangered species are known to occur in the vicinity of the proposed station.

Transco indicated that because of engineering criteria, it was limited to a 5.7-mile-long segment of mainline for the review of sites for this proposed compressor. The 5.7-mile-long mainline segment crosses portions of the towns of Hopewell, Lawrence, and Princeton. Our review identified no significant concerns with the proposed site.

Compressor Station 167

Transco proposes to construct a 7,660-hp Compressor Station 167 on approximately a 21-acre parcel of Transco-owned land in Mecklenburg County, Virgina. The site is adjacent to an existing Transco meter station as well as a maintenance shop and warehouse

TABLE 3.4-1

Route Variations Identified for the Proposed NIP Project

Applicant/ Segment	Route Variation/Name	County/State	Mileposts	Resource Issue
GREAT LAKES				
Loops 1 & 2	U.S. Route 59 Wetland	Marshall, MN	59.2 - 60.6	Wetland
Loops 1 & 2	New Solum Wetland	Marshall, MN	62.7 - 64.0	Wetland and Wild land
Loop 3	Pine Lake Wetland	Clearwater, MN	116.0 - 116.9	Wetland
Loop 3	Clearbrook Wetland	Clearwater, MN	118.3 - 119.5	Wetland
Loop 4	Chippewa National Forest	Cass/Itasca, MN	183.7 - 201.1	Forest and Natural Area
Loop 6	Swan River	Itasca, MN	237.1 - 241.2	Wetland & deeryard
Loop 7	Bois Brule River	Douglas, WI	327.0 - 329.3	Fishery
Loop 11	Indian River	Schoolcraft, MI	598.1 - 599.3	Residential
Loop 11	Manistique River Wetland	Schoolcraft, MI	602.6 - 603.6	Wetland
Loop 11	McIntyre Lake Wetland	Schoolcraft, MI	609.3 - 612.0	Wetland
Loop 12	Pointe aux Chenes	Mackinac, MI	671.4 - 677.1	Candidate Research Natural Area
TENNESSEE				
Segment 8	Longmeadow	Hampden, MA	261+1.8 - 261+5.5	Residential
Segment 8	Wolf Swamp Road	Hampden, MA	261+3.8 - 261+5.5	Residential
ALGONQUIN				
E-1 Loop	Wawecus Hill Road	New London, CT	2.5 - 4.89	Residential
Medfield Loop	Medfield Loop	Norfolk/Middlesex, MA	1.0 - 3.2	Residential
Medfield Loop	Medfield Loop Modification	Norfolk/Middlesex, MA	1.7 - 2.2	Residential housing lots
Tiverton Loop	Tiverton Loop	Newport, RI	0.8 - 1.5	Wetland
CNG				
TL-470 Line	River Road	Rensselaer, NY	0.8 - 2.0	Woodland Clearing

facility. Approximately 14 acres of the site is prime farmland, of this 0.6 acre would be permanently disturbed. No Federal-listed threatened or endangered species are known to occur in the vicinity of the proposed station. No streams or wetlands appear to be located within the partially cleared site. The nearest noise-sensitive receptors are located about 1,000 feet north and 1,000 feet southwest of the proposed station.

Based on the fact that the site is already dedicated to utility use and the apparent minimal resource impact, we believe that selecting an alternative site would not be warranted.

Concord Compressor Station

National Fuel/Penn-York propose to construct the Concord Compressor Station in Concord, Erie County, New York. The 8,640-hp compressor station would be located on approximately 6 acres of a 70-acre tract of land. Most of the 70-acre site is prime farmland. Approximately 6 acres of prime soils would be disturbed for construction of the station. The nearest noise-sensitive receptor is located approximately 2,700 feet south of the proposed compressor building and would not be significantly affected. The town of Concord is currently reviewing National Fuel/Penn-York's proposal. The Planning Board has recommended approval. No wetlands would be affected by development at this site. No federally listed threatened or endangered species are known to occur in the vicinity of the proposed station. National Fuel considered several alternative sites primarily along their main transmission system Line "X" and alternative sites in East Eden and Concord. The East Eden site was originally selected primarily due to the lack of sites along Line "X" adequately sized to accommodate the proposed station. Overwhelming public opposition in East Eden led National Fuel to select its alternative site in Concord.

Our evaluation of this site determined that the only potential adverse effect would be to prime farmland. Since the proposed site avoids all other impact and the impact on prime farmland is not extensive, we concluded that selecting an alternative site would not be warranted.

4.0 AFFECTED ENVIRONMENT

4.1 PROPOSED ACTION

4.1.1 Geology

The geologic setting, mineral resources, and potential geologic hazards along the route of the proposed NIP Project are summarized in this section.

4.1.1.1 Physiography

The proposed NIP Project pipelines would cross six physiographic provinces as shown in table 4.1.1-1 (Bloom, 1978). The surficial geology of the project area is a result of glaciation.

The proposed Great Lakes loops in Minnesota, upper Michigan east of Marquette County (MP 546), and lower Michigan are within the Central Lowland Province. The remaining Great Lakes loops, Loops 7, 8, 9, and portions of 10 in Wisconsin and Gogebic, Iron, Dickinson, and Marquette Counties in upper Michigan, are within the Superior Upland Province. Glacial deposits along the proposed Great Lakes loops are usually thick and depth-to-bedrock usually exceeds 5 feet except for scattered areas of western Gogebic, northern Emmet, Delta, and Schoolcraft Counties in Michigan. In Gogebic County, the near-surface bedrock consists of quartzite. In the remaining counties, bedrock near the surface consists of limestone and dolomite. Relief is characteristically low in both provinces.

Most of Great Lakes' proposed loops are within flat to very gently rolling glacial lake terrain or outwash plains characteristic of the Central Lowland Province in Minnesota and Michigan. Topography is steeper, however, along end moraines and in drumlin fields. Drumlin fields along the proposed loops occur in the Superior Upland Province (Loops 9 and 10) and end moraines would be crossed in both provinces.

Tennessee's proposed Segments 1, 2, and 4 and CNG/Texas Eastern's proposed TL-403 replacement would also lie within the Central Lowland Province. Near surface bedrock in this segment consists of sandstone, siltstone, and shale. The remaining proposed NIP Project pipelines are widely scattered with varied physiography and geology (see table 4.1.1−1).

The topography of the New England and Piedmont Provinces that would be crossed by the proposed project is generally flat to gently rolling. Although glacial deposits are usually more than 5 feet thick, on steeper slopes, rock outcrops and thin soils would be crossed. Bedrock in these areas consists of schist, gneiss, and granite.

The topography of the Valley and Ridge and Appalachian Plateau Provinces is very steep or mountainous. Glacial deposits are often thin or nonexistent on steep slopes. Topography is controlled by folded and weathered sedimentary rocks in the Valley and Ridge Province and plateaus of flat sedimentary rocks dissected by streams and rivers in the Appalachian Plateau Province. Bedrock that would be crossed by the proposed pipeline routes in these provinces consists of sandstone, siltstone, shale, and limestone.

TABLE 4.1.1-1

Physiographic Provinces Crossed by Proposed Pipelines

Province	Pipeline	Elevation (ft)
Central Lowland	Great Lakes Loops 1 through 6 and 11 through 17	600 to 1,400
	Tennessee Segments 1, 3, and 4	750 to 1,200
	Tennessee Segment 2	250
	CNG/Texas Eastern TL-403 Replacement	940
Superior Upland	Great Lakes Loops 7 through 10	800 to 1,800
New England	Tennessee Segment 8	40 to 350
	Tennessee Segment 9	340 to 440
	Algonquin G-5 Replacement	50 to 150
	Algonquin G-8 Replacement	35 to 80
	Algonquin E-1 Loop	60 to 380
	Algonquin H-1 Replacement	160 to 270
	Algonquin Medfield Loop	150 to 280
	Algonquin Tiverton Loop	150 to 280
Valley and Ridge	Transco 1.61-Mile Leidy Loop	180 to 600
	Transco 6.79-Mile Leidy Loop	600 to 680
	CNG TL-407 Line	10 to 350
	Texas Eastern Line No. 37	1,060 to 2,100
Piedmont	Algonquin Chaplin Loop	300 to 350
Appalachian Plateau	Tennessee Segment 3	1,150 to 1,600
	National Fuel/Penn-York Y-M54 Line	1,900 to 2,090

4.1.1.2 Mineral Resources

Exploitable deposits of sand and gravel are the most prevalent mineral resources found near the proposed NIP Project pipelines. Rock quarries are located near Transco's 6.79-Mile Leidy Loop (MP 29.8) and Texas Eastern's Line No. 37 (MP 39.3). Table 4.1.1-2 summarizes the identified mining operations that lie within 1,500 feet of the proposed pipeline routes. Great Lakes' Loop 15 would cross the Norwich Oil Field (MPs 776.5 to

TABLE 4.1.1-2

Mining Operations Near Proposed Pipeline Facilities

Applicant Segment/State	MP	Operation	Approximate Distance from Route (ft)	Status
GREAT LAKES				
Loop 3/MN	123.6	Gravel pit	800	Inactive
Loop 5/MN	213.7	Gravel pit	1,200	Inactive
Loop 6/MN	236.8	Gravel pit	200	Inactive
Loop 7/MN	331.2	Sand pit	1,100	Active
Loop 8/WI	391.5	Sand pit	Crossed	Inactive
Loop 11/MI	604.5	Gravel pit	200	Inactive
	617.5	Gravel pit	50	Inactive
	620.6	Gravel pit	50	Inactive
Loop 12/MI	656.4	Sand pit	1,300	Inactive
	678.8	Gravel pit	1,300	Inactive
Loop 13/MI	706.8	Sand pit	50	Inactive
	714.9	Sand pit	200	Inactive
Loop 15/MI	792.9	Gravel pit	500	Inactive
Loop 16/MI	878.0	Sand pit	1,000	Inactive
Loop 17/MI	928.2	Gravel pit	800	Inactive
	933.9	Gravel pit	400	Inactive
	935.2	Gravel pit	800	Inactive
	936.0	Sand pit	Adjacent	Inactive
TENNESSEE				
Segment 1/NY	230B-101+3.5	Gravel pit	800	Inactive
	230B-102+0.5	Gravel pit	500	Inactive
	230B-102+2.3	Gravel pit	120	Inactive
	230B-102+7.6	Gravel pit	800	Active
ALGONQUIN				
G-8 Replacement/MA	3.4	Sand & Gravel	1,500	Active
	4.0	Sand & Gravel	400	Active
E-1 Loop/CT	2.4	Gravel pit	1,000	Active
TRANSCO				
6.79-Mile Leidy Loop/PA/NY	29.8	Quarry	1,000	Inactive
TEXAS EASTERN				
Line No. 37/PA	39.3	Quarry	Adjacent	Active
CNG				
TL-470 Line/NY	0.0	Gravel pit	300	Active
	1.0	Gravel pit	300	Inactive
	2.1	Gravel pit	300	Inactive

779), the Cranberry Lakes Oil and Gas Field (MPs 800.0 to 802.5), and the Freeman and Lincoln Oil and Gas Field (MPs 813.8 to 815.8).

4.1.1.3 Geologic Hazards

Geologic hazards that might affect a natural gas pipeline include seismicity, karst, and landslides. Seismicity includes earthquake-induced phenomena such as soil liquefaction.

Earthquake hazards are virtually nonexistent along the Great Lakes loops. In the Northeastern United States, earthquake occurrences are widespread, but not uniformly distributed. No occurrences of surface ground ruptures associated with earthquake activity or active faults have been identified in the project areas.

The effects of large earthquakes on the proposed pipelines would depend on the size and distance from the pipeline, attenuation of seismic waves because of intermediate and local geologic and soil conditions, and pipeline construction and structural parameters. Most damage occurs to service and distribution lines, not large-diameter transmission lines. Figure 4.1.1−1, a seismic zonation map of the Northeastern United States (Barosh, 1986), indicates that seismic events of Modified Mercalli intensity IX or greater have occurred only off the coast of Massachusetts. None of the proposed pipelines or compressor stations are within Zone VIII. However, Tennessee's Segments 1 and 3 and Compressor Station 230C, CNG/Texas Eastern's TL-403 Replacement in New York, and Algonquin's E-1 Loop in Connecticut are in proximity to Zone VIII.

Liquefaction is not considered a significant hazard, because there are no widespread areas of soils susceptible to liquefaction along the pipeline routes. Liquefaction can occur when saturated clays or sands are subjected to intense seismic shaking. Such soil conditions are rare in the project area, and anticipated levels of ground shaking are not sufficient to cause significant liquefaction for most of the project area.

Karst features, including small sinkholes, disappearing short streams, and a scarcity of small streams have been identified along Great Lakes Loops 11 and 12. Karst formation has been documented in the Burnt Bluff Limestone, which occurs in Schoolcraft and Mackinac Counties in upper Michigan, which include Loops 11 and 12. Also, karst is known to develop in Devonian-age rocks in Michigan's Lower Peninsula, which would be crossed by proposed Loops 13 and 14. No other areas of karst have been identified along the proposed pipeline route. The type of karst in the area of the proposed project does not present a danger to the integrity of the pipeline because collapse does not usually occur suddenly.

Landslide hazards are not widespread. However, portions of the proposed pipelines are within areas of moderate to high landslide susceptibility or high landslide incidence. (Radbruch-Hall et al., 1976). Landslide susceptibility is greater on steep slopes or on slopes that are naturally or artificially cut. Landslide susceptibility may be increased by artificial loading by equipment along the proposed pipeline right-of-way or by abnormally high precipitation. Tennessee's Segment 2 and Texas Eastern's Line No. 37 are in areas of moderate and high landslide susceptibility, respectively. CNG's TL-470 Line is in an area of high landslide incidence (a region where more than 15 percent of the underlying bedrock or earth material is involved in landsliding). Nevertheless, no major deep-seated landslides are known to occur in the immediate project area.

4.1.2 Soils

4.1.2.1 General Soil Conditions

Most of the soils that would be crossed by the NIP Project pipelines have developed from parent materials deposited during the last glacial period. Till, deposited by ice,

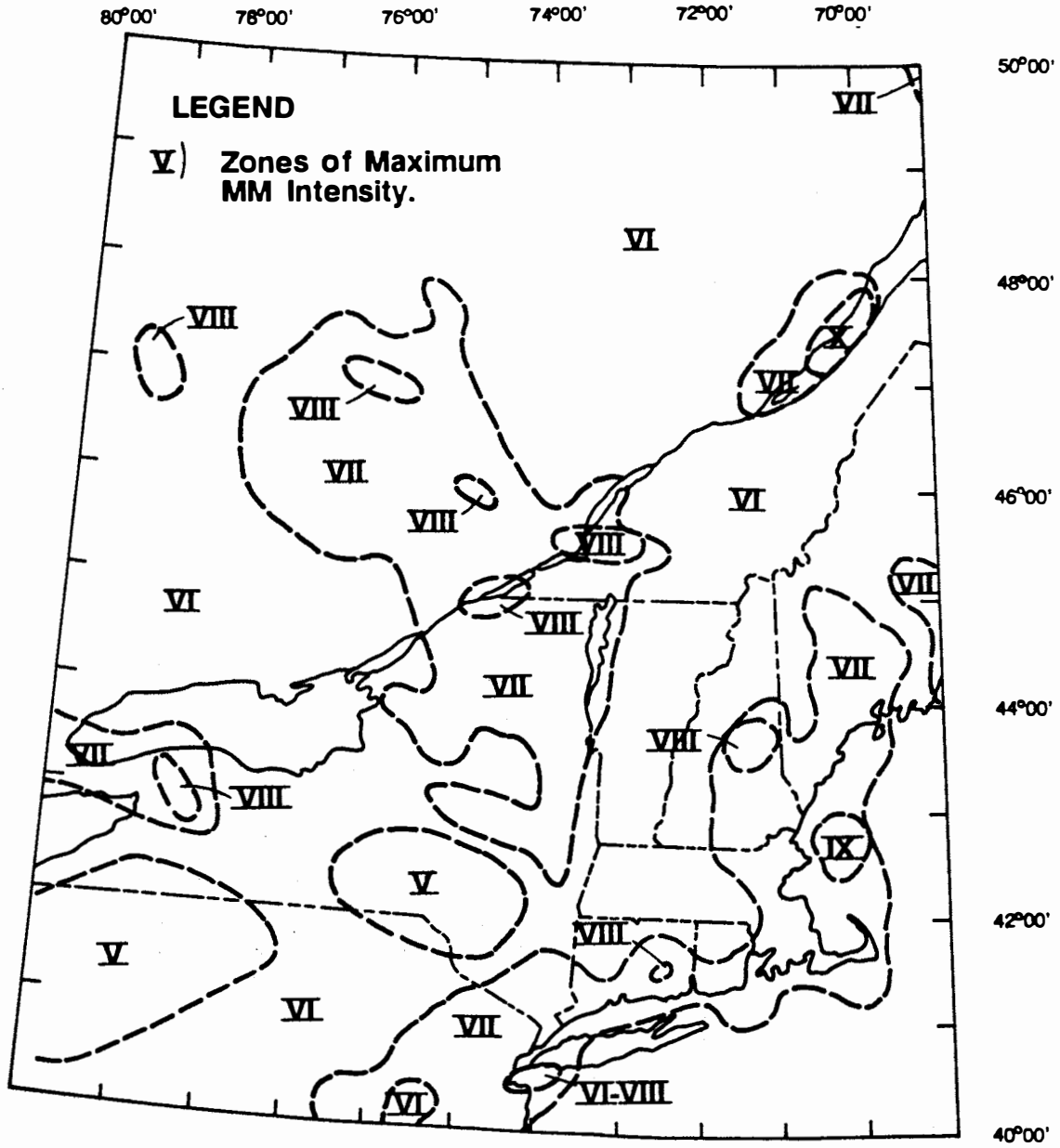

FIGURE 4.1.1-1

SEISMIC ZONATION MAP OF NORTHEASTERN UNITED STATES

(Source: Barosh, Patrick J., August, 1981. Seismic source zones of the Eastern United States and seismic zoning of the Atlantic seaboard and Appalachian regions. State of the Art for Assessing Earthquake Hazards in the United States - Report No. 21, US Army Corps of Engineers, Misc. Paper S-73-1.)

comprises a heterogeneous mixture of rock, gravel, sand, silt, and clay. Deposited in the form of ground moraines, it is the most common parent material in the project area, found from the uplands to the valley bottoms.

Another common parent material is outwash, a material deposited by water flowing from melting glaciers. This material is usually well sorted. Fast moving meltwater deposited coarse materials such as cobbles, gravel, and sand in the headwaters of stream systems. Slower moving water deposited finer materials - silt and clay - in the valley bottoms. Some of the coarsest and driest soils found in the project areas developed from outwash.

The third important parent material is lacustrine, or lake deposits. Lacustrine materials, usually uniformly sorted fine silts and clays, were deposited at the bottom of glacial lakes and inland seas, which have since drained. These are often the parent materials of poorly drained, fine textured soils found in the major valleys of the region.

Organic soils, which have not developed from glacially deposited material, generally occur in wetlands that have developed from partially decomposed plant materials. Other soils have developed from relatively recent alluvial sediments deposited by modern streams.

4.1.2.2 Soil Groups

The soils in the proposed project area have been grouped into seven broad categories based upon characteristics that can affect pipeline construction, environmental impact, and impact mitigation. These soils are the shallow stony soils, deep stony soils, deep soils, wet soils, sandy soils, organic soils, and urban land. The approximate number of miles of each soil group that would be crossed by the proposed pipelines is listed in table 4.1.2-1.

Group 1, the shallow stony soils, which makes up 4 percent (19.7 miles) of the mapped soils that would be crossed by the proposed routes, consists of sandy, usually stony soils (Udorthents, Dystrochrepts, and Haplorthods) where depth-to-bedrock is less than 5 feet and rock outcrops may be common. These acidic, infertile soils have developed in glacial outwash and lake plain deposits in gently sloping areas, on sloping to steep glacial till uplands, and as residuum in sandstone bedrock on steep mountain slopes. These soils are predominantly wooded, although some are used for pasture and hay lands. They most commonly occur in Pennsylvania, New York, Connecticut, and in Gogebic, Schoolcraft, and Emmet Counties in Michigan. The erosion hazard is severe for steeply sloping soils in this group and bedrock is less than 5 feet below the surface.

Group 2, the deep stony soils, which makes up 2 percent (11.7 miles) of the mapped soils that would be crossed, consists of sandy or silty, stony soils (Dystrochrepts, Eutrochrepts, and Haplorthods) where depth-to-bedrock is greater than 5 feet. Each of these soils has developed in glacial outwash and on till uplands. The Dystrochrepts and Haplorthods, like group 1, are acidic and infertile. The Eutrochrepts are slightly acidic to neutral and fertile

TABLE 4.1.2-1

Miles of Soil Groups Crossed by Proposed Pipeline

Pipeline/ County	Group 1 Shallow, Stony Soils (depth-to-bedrock <60")	Group 2 Deep, Stony Soils (depth-to-bedrock >60")	Group 3 Deep Soils	Group 4 Wet Soils	Group 5 Sandy Soils	Group 6 Organic Soils	Group 7 Urban Land
Great Lakes							
Marshall, MN	---	---	2.6	8.7	0.1	0.8	---
Clearwater, MN	---	---	14.2	2.8	2.2	2.1	---
Cass, MN	---	---	---	1.3	7.2	5.6	---
Itasca, MN	---	---	8.3	6.7	---	8.6	---
Douglas, WI	---	---	12.5	---	---	---	---
Bayfield, WI	---	---	5.0	2.2	7.2	0.1	---
Iron, WI	---	---	12.1	---	3.6	---	---
Gogebic, MI	1.6	---	28.5	6.5	5.7	4.9	---
Iron, MI	---	---	12.4	---	1.6	---	---
Dickinson, MI	---	---	1.5	---	2.3	1.2	---
Marquette, MI	---	---	12.7	4.4	---	1.9	---
Delta, MI	0.5	---	7.6	1.5	4.8	6.8	---
Schoolcraft, MI	6.0	---	7.0	3.6	9.6	8.9	---
Mackinac, MI	---	---	0.9	9.4	17.9	3.9	---
Emmet, MI	1.2	---	10.8	1.6	12.9	5.4	---
Otsego, MI	---	---	2.8	---	11.9	---	---
Crawford, MI	---	---	---	1.5	---	---	---
Missaukee, MI	---	---	8.7	5.8	5.4	3.4	---
Clare, MI	---	---	5.8	0.3	8.2	1.6	---
Midland, MI	---	---	1.6	2.2	3.1	0.1	---
Gratiot, MI	---	---	2.6	3.6	0.6	---	---
Saginaw, MI	0.4	---	17.2	19.8	0.2	---	---
Lapeer, MI	---	---	11.5	1.8	2.0	3.8	---
St. Clair, MI	---	---	2.5	3.1	0.2	1.9	---
Subtotal a/	9.7	---	189.8	86.8	106.7	61.0	---
Tennessee							
Niagara, NY	---	---	0.2	---	---	---	---
Erie, NY	1.5	---	11.0	3.1	1.5	---	---

TABLE 4.1.2-1 (cont'd)

Pipeline/ County	Group 1 Shallow, Stony Soils (depth-to-bedrock <60")	Group 2 Deep, Stony Soils (depth-to-bedrock >60")	Group 3 Deep Soils	Group 4 Wet Soils	Group 5 Sandy Soils	Group 6 Organic Soils	Group 7 Urban Land
Tennessee (cont'd)							
Wyoming, NY	0.2	0.3	1.2	1.0	0.5	---	---
Livingston, NY	0.1	---	7.1	1.8	---	0.4	---
Ontario, NY	---	---	3.1	---	---	---	---
Hampden, MA	---	0.2	1.2	1.3	0.8	0.1	1.8
Middlesex, MA	0.9	---	1.1	---	0.9	0.3	---
Subtotal b/	2.7	0.5	24.9	7.2	3.7	0.8	1.8
Algonquin							
Bristol, MA	---	1.7	---	---	3.5	0.3	---
Plymouth, MA	---	---	---	---	4.6	0.4	---
Barnstable, MA	---	---	---	---	0.2	---	---
Middlesex, MA	0.2	0.7	0.4	0.2	0.1	0.5	---
Norfolk, MA	---	1.2	0.9	0.5	0.2	0.1	---
Worcester, MA	---	0.8	---	0.3	---	---	---
New London, CT	1.5	1.8	0.3	---	0.6	0.2	0.5
Windham, CT	---	0.6	---	0.1	0.1	0.6	0.7
Newport, RI	---	0.8	0.3	---	---	---	---
Subtotal	1.7	7.0	2.1	1.1	8.8	2.1	1.2
Transco							
Northhampton, PA	3.7	---	1.4	3.3	---	---	---
Warren, NY	---	---	0.1	---	---	---	---
Subtotal	3.7	---	1.5	3.3	---	---	---

TABLE 4.1.2-1 (cont'd)

Pipeline/ County	Group 1 Shallow, Stony Soils (depth-to-bedrock <60")	Group 2 Deep, Stony Soils (depth-to-bedrock >60")	Group 3 Deep Soils	Group 4 Wet Soils	Group 5 Sandy Soils	Group 6 Organic Soils	Group 7 Urban Land
Texas Eastern							
Centre, PA	1.1	2.6	0.8	0.1	0.4	---	---
Subtotal	1.1	2.6	0.8	0.1	0.4	---	---
CNG							
Albany, NY	---	---	---	---	---	---	0.3
Renssalaer, NY	0.8	---	0.6	0.5	---	0.1	0.1
Subtotal	0.8	---	0.6	0.5	---	0.1	0.4
National Fuel/Penn-York							
Potter, PA	---	1.2	0.1	1.2	---	---	---
Subtotal	---	1.2	0.1	1.2	---	---	---
CNG/Texas Eastern							
Erie, NY	---	0.4	---	---	---	---	---
Subtotal	---	0.4	---	---	---	---	---
TOTAL NIPP	19.7	11.7	219.8	100.2	119.6	64.0	3.4

N.B. In some cases, values are from preliminary soil maps.

a/ Total miles for Great Lakes differs from proposed mileage because Loop 1 parallels Loop 2 and was not included in table. Figures based on county soil association maps.

b/ Total miles for Tennessee differs from proposed mileage due to the 0.3-mile crossing of the Niagara River.

and may be used for growing hay or crops. These soils are more common to Pennsylvania, Connecticut, and Massachusetts. As with group 1, the erosion hazard is severe for steeply sloping soils.

Group 3, the deep soils, which makes up 41 percent (219.8 miles) of all mapped soils that would be crossed, consists of somewhat poorly drained and well drained deep, fertile soils (Eutroboralfs, Haplaquolls, Hapludalfs, Eutrochrepts, and Dystrochrepts) that have developed on ground moraine, end moraine, and lacustrine deposits. Generally, soils in this group, found along the Great Lakes route and the Tennessee segments in New York, are more poorly drained, have seasonally high water tables, and often need to be drained for growing crops. Therefore, damage to drain tiles could occur during construction in these soils. These soils are loamy over a clayey subsoil. The remaining soils of this group are well drained with a gravelly subsoil. Most cultivated lands along the route are in this group. Another concern with this soil group is soil compaction, which could occur if construction is conducted during wet weather.

Group 4, which makes up 19 percent (100.2 miles) of all mapped soils that would be crossed, consists of poorly drained, usually infertile soils (Fragiorthods, Haplaquods, Haplaquents, Fragiaquepts, Fragiaquods, Ochraqualfs, Fluvaquents, Udifluvents, and Psammaquents) on floodplains, lake plains, and in uplands. These wet soils have a seasonally high water table at or within 1 foot of the surface. The Fragiaquepts and Fragiorthods have a dense, compacted subsoil that impedes drainage. The Fluvaquents and Udifluvents are found on floodplains. Because of wetness, these soils are used mostly for pasture, hay, or woodland, although where drained, some can be used for growing crops. This soil group is widespread along the proposed NIP Project pipelines and construction concerns are the same as with group 3.

Group 5, the sand soils, which makes up 22 percent (119.6 miles) of all mapped soils that would be crossed, consists of well to excessively drained, infertile soils (Udipsamments, Haplorthods, and Dystrochrepts) developed on outwash plains, pitted outwash landforms, end moraines, and on dune and shore deposits associated with ancient glacial lakes. Most of these soils are level to gently sloping, although those associated with end moraines and dunes are steep. These soils are sandy, often acidic, and are prone to wind erosion when the vegetative cover is removed. The potential for water erosion on unvegetated steep slopes is also high for soils in this group. They are used primarily for woodland and pasture and are also common along the proposed pipeline routes.

Group 6, which makes up 12 percent (64.0 miles) of all mapped soils that would be crossed, consists of level, very poorly drained organic soils (Borosaprists, Borofibrists, Borhemists, Humaquepts, and humic Psammaquents) in peat bogs and wetlands. These soils occur primarily as extensive deposits of peat and muck in Minnesota and upper Michigan. They are saturated during most of the year, have a low-bearing capacity, and subside when drained.

Group 7, which makes up less than 1 percent (3.4 miles) of all soils that would be crossed, consists of soils that have been extensively altered by urban development. These soils are suitable for pipeline construction because of good drainage and a depth-to-bedrock of greater than 5 feet. These are found along Tennessee's proposed Segment 8, Algonquin's proposed E-1 Loop, and CNG's proposed TL-470 Line.

4.1.2.3 Aboveground Facilities

Table 4.1.2-2 identifies characteristics and agricultural status of soils at proposed compressor stations located at new sites. Algonquin's Bellingham Meter Station would be located within the plant yard of NEA's 300 MW cogeneration facility currently under construction. Transco's new Sayreville Meter Station would be located in an industrially developed area bordered by water line, pipeline, and railroad easement. Other aboveground facilities would be constructed within fenced areas at existing compressor and meter stations.

4.1.3 Water Resources

4.1.3.1 Groundwater

Groundwater resources in the area of the proposed NIP Project alignments include aquifers in shallow, unconsolidated glacial and alluvial deposits; and sedimentary, metamorphic, and igneous rocks. Virtually all portions of the alignments have sufficient groundwater yields for single, domestic use wells (10 gallons per minute (GPM)). Unconsolidated sand and gravel aquifers and some sedimentary rocks along portions of the alignments have been developed for community water-supply systems.

Glacial deposits serve as aquifers along most of the proposed route except in areas where thin or nonexistent in Pennsylvania and upper Michigan. The types of glacial aquifers include sand and gravel in outwash plains, sand and gravel lenses in glacial till, and sandy glacial till. Glacial till is usually used for domestic supply. However, outwash and sand and gravel lenses in till can produce significant groundwater yields if the saturated layer is thick, laterally extensive, coarse-grained, and flow from adjacent streams provides a source of induced recharge. Significant groundwater supplies in areas of thin glacial cover are derived from sandstones, limestones, dolomites, shales, and slates. Table 4.1.3-1 lists all public water supplies within 1.5 miles of the proposed pipeline route.

Typical well yields for various aquifer systems along the proposed route are presented below.

Aquifer	Typical Well Depth Range	Typical Yield
Outwash	25 to 200 ft	1 to 1000 GPM
Till	25 to 200 ft	5 to 200 GPM
Sandstone	25 to 400 ft	5 to 150 GPM
Shale, slate	25 to 300 ft	25 to 300 GPM
Limestone, dolomite	25 to 150 ft	10 to 300 GPM

Groundwater quality is generally a function of the materials that make up the aquifer. Glacial sand and gravel aquifers are usually of good quality with low to medium hardness and dissolved solids. Carbonate aquifers may exhibit higher hardness and more dissolved solids than the glacial aquifers. Water found in sandstones in upper Michigan may be saline. Aquifers located in urban areas may have lower water quality due to industrial and municipal pollution.

TABLE 4.1.2-2

Soils at New Compressor Sites for NIP Project

Proposed Facility	Location	Soil Series	Acres	Engineering Considerations	Agricultural Status
Transco					
Compressor Station 205	Mercer County, NJ	Rowland Silt Loam	6.0	Prone to flooding	
		Chalfont Silt Loam	15.0	High water table, frost heave	
		Doylestown Silt Loam	9.0	High water table	
		Bucks Silt Loam	19.0	Strong slopes, shallow depth-to-bedrock	Prime
		Penn Shaly Silt Loam	30.0	Strong slopes, shallow depth-to-bedrock	Prime
		Readington and Abbottstown Silt Loam	20.0	High water table, frost heave, shallow depth-to-bedrock	
Compressor Station 167	Mecklenburg, VA	Wilkes Undifferentiated	0.8	Shallow depth to bedrock	
		Appling Fine Sandy Loam	2.0	Strong slopes, medium erosion potential	
		Starr Silty Clay Loam	0.3	None	Prime
		Cecil Fine Sandy Loam (undulating)	12.5	Medium erosion potential	Prime
		Cecil Fine Sandy Loam (rolling)	5.2	Strong slopes, medium erosion potential	
National Fuel/ Penn-York Energy					
Concord Compressor Station	Erie, NY	Williamson Silt Loam	30.8	High water table	Prime
		Raynham Silt Loam	13.3	High water table	Prime
		Darien Silt Loam	11.2	High water table	Prime
		Hudson Silty Clay Loam	11.2	Severe erosion potential	
		Erie Channery Silt Loam	1.4	High water table	
		Landfad Channery Silt Loam	0.7	High water table	
		Mardin Silt Loam	0.7	High water table	
		Mardin Channery Silt Loam	0.7	High water table	

TABLE 4.1.3-1

Public Water Supplies Along the Proposed Route

State/County/Town	Milepost	Approximate Distance From Route (mile)	Approximate Population Served	Number of Wells	Community Water System/User
GREAT LAKES					
Minnesota					
Marshall					
Newfolden	56.0	0.8	400	3	Village of Newfolden
Clearwater					
Clearbrook	118.5	0.6	700	2	Village of Clearbrook
Itasca					
Warba	233.0	0.6	80	2	Village of Warba
Michigan					
Gogebic					
Bessemer	403.0	0.6	2,443		City of Bessemer
Wakefield	409.0	1.2	2,829		City of Wakefield
Watersmeet	450.5	0.7	500		Town of Watersmeet
TENNESSEE					
New York					
Erie					
Marilla	230B-101+6.5	0.6	290	2	Busch Gardens Mobile Home Park
	230B-101+3.5	0.4	160	2	Hillside Estates
Wales	230B-101+1.3	0.7	125	3	Circle Court Mobile Park
Newstead	230B-102+6.5	0.3	100	1	Millgrove Mobile Park
	230B-103+1.5	0.5	400	3	Quarry Hill Estates
Livingston					
Lima	234+4.0	0.5	36	1	Alpine Manor Home for Adults
Massachusetts					
Hampden					
Longmeadow	261+2.1	0.2	inactive	1	Longmeadow Water Department
	261+2.3	0.1	inactive	1	Longmeadow Water Department

TABLE 4.1.3-1 (cont'd)

State/County/Town	Milepost	Approximate Distance From Route (mile)	Approximate Population Served	Number of Wells	Community Water System/User
ALGONQUIN					
Massachusetts					
Bristol					
Seekonk	2.7	0.4	13,000	49	Seekonk Water District
Seekonk	3.6	0.7	13,000	1	Seekonk Water District
Seekonk	3.8	0.8	13,000	4	Seekonk Water District
Plymouth					
Plymouth	0.2	1.0	Seasonal	1	Myles Standish State Forest
Wareham	0.3	1.1	5,700	2	Wareham Water District
Wareham	1.1	1.1	5,700	4	Wareham Water District
Plymouth	1.4	0.7	Seasonal	1	Camp Chacolot - Boy Scouts
Barnstable					
Bourne	5.2	0.2	10,000	1	Buzzard Bay Water District
Bourne	5.2	0.4	10,000	1	Buzzard Bay Water District
Bourne	5.2	0.6	10,000	1	Buzzard Bay Water District
Bourne	5.2	1.2	10,000	1	Buzzard Bay Water District
Middlesex					
Holliston	1.3	0.5	Seasonal	1	Holliston Water Department
Holliston	2.5	0.5	12,000	1	Holliston Water Department
Connecticut					
New London					
Norwich	1.4	0.1	Backup supply	1	Norwich Water Department
TRANSCO					
Pennsylvania					
Northampton					
Martins Creek	30.9	1.3	unknown		Berry Hollow Estates
TEXAS EASTERN					
Pennsylvania					
Centre					
Centre Hall	35.91	0.5	150	2	Black Hawk Mobile Home Park
	35.91	1.4	200	1	RUD COR Mobile Home Court
	35.91	1.0	300	2	Meadows Clinic
	36.7	0.5	1,265	4	Centre Hall Borough Water Department
	36.9	0.03	unknown	1	Guenther Trailer Park

Groundwater is an important source of fresh water and many states are in the process of developing strategies to protect existing and potential public groundwater supplies. States along the proposed route that have designated zones of protection around public water-supply wellheads include Massachusetts, Connecticut, Rhode Island, New York, Minnesota, and Michigan.

Specifically, the Massachusetts Division of Water Supply has designated a 400 foot radius (Zone I protection area) and a general 0.5-mile-radius interim wellhead protection area (IWPA) around all existing public well supplies (MADEQE, April 15, 1988). The 0.5-mile radius is effective in lieu of an approved Zone II area that delineates the zone of contribution to the wellhead. Zone I land use activities are restricted to those necessary for operation of the wellfield. The proposed pipeline routes would not traverse any state-designated Zone I protection areas but would cross over Zone II and IWPA areas. Zone II and IWPA areas are typically protected by local aquifer bylaws or ordinances that restrict activities and development considered incompatible with protection of the groundwater supply. The proposed Algonquin pipeline route would cross three of these locally zoned aquifer protection areas; these areas are listed in table 4.1.3-2.

The Plymouth-Carver Regional Aquifer, which is traversed by the proposed Algonquin G-8 Replacement, has been proposed by the MADEP, Division of Water Supply, as a sole-source aquifer. The petition for this designation is currently being reviewed by the EPA and a final decision is expected in the summer of 1990. The sole-source designation authorizes the EPA to review projects that are federally funded that have the potential to degrade aquifers and affect users. The EPA can require groundwater evaluations to be conducted, various mitigation measures to be performed, and can withhold Federal assistance. The major criterion for the sole-source designation is that the aquifer provide 50 percent or more of the drinking water for the aquifer service area and that the volume of water that could be provided by alternative supplies is insufficient to meet demand.

TABLE 4.1.3-2

Locally Zoned
Aquifer Protection Areas Crossed by
the Proposed Routes of the NIP Project

Applicant/Segment	Town/State	Milepost	Water Supply	Distance of Protection Area Crossed (ft)
Algonquin				
G-5 Replacement	Seekonk, MA	1.7 - 3.4	Seekonk Water District	8,976
G-8 Replacement/Loop	Wareham, MA	0.3 - 3.1	Wareham Water District	14,784
	Bourne, MA	5.08 - 5.2	Buzzard Bay Water District	633

The State of Michigan Safe Drinking Water Act (Act 399 P.A. 1976) specifies a standard isolation radius of 200 feet around public wellheads from potential or existing

sources of contamination such as septic tanks, dry wells, or seepage pits. No state-designated protection zones would be crossed by the proposed Great Lakes Project in Minnesota or Michigan. Some Michigan counties may have locally designated aquifer protection areas. Great Lakes has indicated in its data response that it is conducting a review of groundwater supply wells along their route. Wisconsin does not have a state program that specifies groundwater or public well-protection areas. The proposed project would not pass within 1.5 miles of any public supply wells in Wisconsin. There are no known well protection areas crossed by the proposed routes in Connecticut or New York.

4.1.3.2 Surface Waters

The proposed NIP Project pipeline facilities would traverse portions of 19 drainage basins in three Midwestern and five Northeastern states. Table 4.1.3-3 lists the basins that would be crossed and the total number of miles of proposed pipeline facilities in each basin. Average annual precipitation in the portion of the three Midwestern states crossed by the project ranges from 20 inches to 32 inches. Areas that would be crossed by pipeline facilities located in the three New England states exhibit average annual precipitation ranges from approximately 41 to 45 inches.

Typically, surface waters are classified by states according to the most beneficial uses for which the water will be protected. A description of classification systems for states that would be affected by the NIP Project is presented in table 4.1.3-4. In addition, the water quality classifications of the surface waters that would be crossed by the NIP Project are summarized by applicant and state in table 4.1.3-5. In Minnesota, New York, Connecticut, Rhode Island, and Massachusetts, stream classification is based on an alphabetical system that indicates the current suitability or best uses of the water body. Michigan, Pennsylvania, and New Jersey generally classify surface waters according to the type of fishery habitat the surface water will support. Therefore, these water quality classifications are presented in the fishery classification column of table 4.1.3-6. Wisconsin classifies all surface waters in the state as capable of supporting fish and aquatic life, unless specified otherwise in the Wisconsin Administrative Code (Chapter NR 102.05(1)(b)1, 2, 3, and 5). Particular waters may, in addition, be classified as outstanding or exceptional resources, Great Lakes drainage waters, or surface waters that have received a variance from the minimum criteria as specified in Chapter NR 104.05 through Chapter NR 104.10.

Perennial surface waters that would be crossed by the proposed NIP Project pipeline facilities include ponds, reservoirs, rivers, and streams, and are listed in table 4.1.3-6. Surface water classifications and type of fishery supported by those water bodies are also presented in table 4.1.3-6. Major water crossings (those crossings greater than 100 feet wide) are listed in table 4.1.3-7.

Great Lakes

The proposed pipeline loops would cross 141 perennial water bodies – 18 in Minnesota, 24 in Wisconsin, and 99 in Michigan. Fourteen of the crossings would be greater than 100 feet wide. In Minnesota, all but three of the surface waters that would be crossed are class B. Clearwater River (MP 130.2), Blackwater Creek (MP 211.6), and Swan River

Table 4.1.3-3

Major Drainage Basins Traversed
by the Proposed NIP Project

Drainage Basin	Number of Pipeline Miles In Basin	Number of Perennial Water Bodies Crossed in Basin
Great Lakes		
Red River of the North (MN)	35.7	5
Mississippi River (MN, WI)	41.1	13
Lake Superior (WI, MI)	104.9	47
Lake Michigan (MI)	199.7	57
Lake Huron (MI)	78.2	19
Tennessee		
Lake Erie (NY)	20.3	11
Niagara River (NY)	0.5	1
Lake Ontario (NY)	12.5	15
Connecticut River (MA)	5.4	3
Blackstone River (MA)	3.2	5
Algonquin		
Tenmile River (MA)	5.5	5
Buzzards Bay (MA)	5.3	3
Charles (MA)	5.1	5
Thames (CT)	6.0	3
Mount Hope Bay (RI)	2.1	0
Transco		
Delaware River (PA, NJ)	8.4	13
Texas Eastern		
Susquehanna River (PA)	5.31	0
CNG		
Hudson River (NY)	2.7	7
National Fuel/Penn-York		
Susquehanna River (PA)	2.5	1
CNG/Texas Eastern		
Genesee River (NY)	0.38	0

Source: U.S. Geological Survey Water-Data Reports

TABLE 4.1.3-4

Summary of State Surface Water Quality Classifications
in Proposed NIP Project Area

State	Classification	Description
Michigan	CWF I	Supports coldwater fish species, such as trout and salmon; self-sustaining populations.
	CWF II	Supports coldwater fish species, such as trout and salmon. Populations limited by inadequate natural reproduction, competition, siltation, or population.
	WW I	Supports warmwater fish species; self-sustaining populations.
	WW II	Supports warmwater fish species. Populations limited by inadequate natural reproduction, competition, siltation, or population.
Minnesota a/	A	The quality of this class of the waters of the state shall be such as to permit the propagation and maintenance of warmwater or coldwater sport or commercial fishes and their habitats and be suitable for aquatic recreation of all kinds, including bathing, for which the waters may be usable. Dissolved oxygen shall not be less than 7 mg/l and temperature at the surface water shall show no material increase.
	B	The quality of this class of the waters of the state shall be such as to permit the propagation and maintenance of coolwater or warmwater sport or commercial fishes and their habitats and be suitable for aquatic recreation of all kinds, including bathing, for which the waters may be usable. Dissolved oxygen shall not be less than 5 mg/l and temperature fluctuations shall not exceed 5°F in streams and 3°F in lakes based on the monthly average of the maximum daily temperature.
	C	The quality of this class of the waters of the state shall be such as to permit the propagation and maintenance of rough fish or species commonly inhabiting waters of the vicinity under natural conditions, maintain the habitat for such fisheries, and be suitable for boating and other forms of aquatic recreation for which the waters may be usable. Dissolved oxygen and temperature restrictions are as for class B.
Wisconsin		All surface waters classified as supporting fish and aquatic life unless specified otherwise in NR 102.05(1)(b) 1,2,3, and 5.
Massachusetts		
Fresh Waters	A	Waters in this class are designated as a source of public water supply.
	B	Waters in this class are designated for the protection and propagation of fish, other aquatic life, and wildlife; and for primary and secondary contact recreation.
	C	Waters in this class are designated for the protection and propagation of fish, other aquatic life, and wildlife; and for secondary contact recreation.
Saline Waters	SA	Waters in this class are designated for the protection and propagation of fish, other aquatic life, and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration in approved areas.

TABLE 4.1.3-4 (cont'd)

State	Classification	Description
Massachusetts (cont'd)		
	SB	Waters in this class are designated for the protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration (restricted shellfish areas).
	SC	Waters in this class are designated for the protection and propagation of fish, other aquatic life, and wildlife; and for secondary contact recreation.
Connecticut		
Fresh Water	AA	Known or presumed to meet water quality criteria that support existing or potential public drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply, and other purposes. Recreational uses may be restricted.
	A	Known or presumed to meet water quality criteria that support potential drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply, and other legitimate uses, including navigation.
	B/A	May not meet class A water quality criteria in one or more designated areas. The goal is class A.
	B	Known or presumed to meet water quality standards that support recreational use, fish and wildlife habitat, agricultural and industrial supply, and other uses, including navigation.
	C/B	Presently does not meet class B water quality criteria for one or more designated uses. The goal is class B.
Saline Waters	SA	Marine fish, shellfish, and wildlife habitat; shellfish harvesting for direct human consumption, recreation, and all other legitimate uses including navigation.
	SB	Marine fish, shellfish, and wildlife habitat; recreation, industrial, and all other legitimate uses including navigation.
	SC	Certain marine fish, shellfish, and wildlife habitat; recreational boating, industrial, and other legitimate uses, including navigation and swimming; one or more class SB criteria or designated uses impaired; goal is class SB unless a DEP and EPA approved use attainability analysis determines certain uses are nonattainable.
	SC/SB	Presently does not meet SB criteria for one or more designated uses. The goal is class SB.
	ND	Data not available.
New York		
Fresh Waters	AA	Suitable for drinking, culinary or food processing; treatment may be necessary.
	A	Similar to AA; may require more extensive treatment than AA water.
	B	Primary and secondary contact recreation.
	C	Secondary contact recreation (i.e., fishing, boating).
	D	Secondary contact recreation. Not conducive to fisheries propagation.

TABLE 4.1.3-4 (cont'd)

State	Classification	Description
New York (cont'd)		
Saline Waters	SA	Commercial shellfishing; primary and secondary contact recreation.
	SB	Primary and secondary contact recreation.
	SC	Secondary contact recreation.
	SD	Limited recreational use.
	(T)(Suffix)	Suitable trout habitat.
	(S)(Suffix)	Suitable habitat for trout spawning.
	ND	No data available from NYDEC.
Pennsylvania	TSF	Trout stocking; maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna that are indigenous to a warmwater habitat.
	CWF	Coldwater fisheries; maintenance and/or propagation of fish species including the family Salmonidae and additional flora and fauna that are indigenous to a coldwater habitat.
	HQ	High quality waters; a stream or watershed that has excellent quality waters and environmental or other features that require special water quality protection.

a/ The classifications for Minnesota streams crossed pertain to the standards for fisheries and recreation only (see Minnesota Pollution Control Agency, Minnesota Rules, Chapter 7050.0220 Subpart 3).

TABLE 4.1.3-5

Summary of Water Quality Classes Crossed by the Proposed NIP Project

Segment	State Water Quality Classification	Number of Crossings	Percent of Total Crossings
Great Lakes			
Minnesota	B	15	83
	C	3	17
	Total	18	
Wisconsin	CWF	2	8
	CWF I	5	21
	CWF II	8	33
	CWF III	5	21
	CWF I, MF	1	4
	WW F	3	13
	Total	24	
Michigan	CWF I	19	19
	CWF II	35	35
	WWF I	10	11
	WWF II	35	35
	Total	99	
Tennessee			
New York	A	6	22
	B	4	15
	C	2	7
	D	15	56
	Total	27	
Massachusetts	B	8	100
	Total	8	
Algonquin			
Connecticut	B	1	34
	B/A	2	66
	Total	3	
Massachusetts	B	12	92
	SA	1	8
	Total	13	
Transco			
Pennsylvania	HQ-CWF	5	38
	HQ-CWF,M-S	1	8
	CWF	6	46
	WWF,M-S	1	8
	Total	13	
CNG			
New York	C	2	29
	D	5	71
	Total	7	
National Fuel/Penn-York			
Pennsylvania	WWF	1	100
	Total	1	

TABLE 4.1.3-6

Perennial Water Bodies Crossed by the Proposed NIP Project a/

Applicant Segment/State	Milepost b/	Water Body	Fishery Classification c/	State Water Quality Classification d/
GREAT LAKES				
Loop 1/MN		No Streams Crossed		
Loop 2/MN	MP 54.0	Middle River	WWF	B
Loop 3/MN	MP 113.5	Lost River	WWF	B
	MP 114.7	Silver Creek	NI	B
	MP 125.4	Ruffy Brook	WWF	B
	MP 125.6	Ruffy Brook (T)	WWF	B
	MP 130.2	Clearwater River	CWF-S	C
Loop 4/MN	MP 185.6	Unnamed Channel Between Lake Winnibigoshish and Six Mile Lake	NI	B
	MP 189.3	Unnamed Channel Between Demero Lake and Nuska Lake	NI	B
	MP 190.7	Bear Brook	WWF	B
	MP 191.8	Bear Brook (T)	WWF	B
	MP 195.9	Mississippi River (T)	WWF	B
	MP 196.0	Mississippi River	WWF	B,OR
	MP 196.3	Mississippi River (T)	WWF	B
	MP 199.4	Ball Club River	WWF	B
Loop 5/MN	MP 211.6	Blackwater Creek	WWF	C
	MP 213.5	Bass Brook	WWF	B
Loop 6/MN	MP 234.0	Swan River	WWF	C
	MP 237.9	Bruce Creek	CWF	B
Loop 7/WI	MP 317.5	Middle River	WWF	
	MP 318.0	Poplar River	CWF III-S	
	MP 319.1	Lake Creek	CWF II	
	MP 324.0	Anderson Creek	CWF I	ER
	MP 327.9	Bois Brule River	CWF I,M	OR
	MP 329.5	Trask Creek	CWF II	
	MP 330.0	Fish Creek	CWF II	
	MP 331.5	Reefer Creek	CWF I	ER
	MP 334.0	Muskeg Creek	CWF II	
	MP 336.6	Iron River	CWF I-S	ER
	MP 336.9	Iron River (T)	CWF I	ER
	MP 337.9	DeChamps Creek	CWF I	ER
	MP 342.0	Unnamed Pond	CWF	
	MP 342.1	Bladder Lake (T)	CWF	
Loop 8/WI	MP 383.5	Spoon Creek	CWF III	
	MP 384.0	Unnamed Creek	CWF III	
	MP 388.7	Boomer Creek	CWF II-S	
	MP 384.0	Unnamed Creek	CWF III	
	MP 391.9	Flood Creek	CWF II	
	MP 391.9	Flood Creek (T)	CWF II	
	MP 392.3	West Fork Montreal River	CWF III	
	MP 393.8	Unnamed Creek	WWF	
	MP 394.4	Unnamed Creek	WWF	
	MP 395.1	Kaaris Creek	CWF II	
Loop 8/MI	MP 395.2	Montreal River	WWF II	
	MP 395.5	Unnamed Creek	CWF II	
	MP 397.0	Welch Creek	CWF II	
	MP 399.6	Seimens Creek	CWF I	
	MP 401.6	Powder Mill Creek (T)	CWF I	
	MP 401.8	Powder Mill Creek	CWF I	

TABLE 4.1.3-6 (cont'd)

Applicant Segment/State	Milepost b/	Water Body	Fishery Classification c/	State Water Quality Classification d/
	MP 403.1	Kallander Creek	CWF II	
	MP 406.1	Black River	CWF II-S	
	MP 409.3	Planter Creek	CWF II	
	MP 412.3	Jackson Creek	CWF I-S	
	MP 412.7	Alward Creek	CWF II	
Loop 9/MI	MP 434.3	Tenderfoot Creek	WWF II	
	MP 435.5	Grosbeck Creek	CWF II	
	MP 438.5	Cisco Branch Ontonagon River	CWF II	
	MP 441.3	Two Mile Creek (T)	CWF I	
	MP 444.0	Middle Branch Ontonagon River	CWF II-S	
	MP 446.7	Zig Zag Creek	CWF II	
	MP 447.3	Henderson Creek	CWF II	
	MP 448.0	Unnamed Creek	CWF II	
	MP 450.3	Unnamed Creek	CWF II	
	MP 450.6	Duck Creek	CWF I	
	MP 455.5	Cedar Creek	CWF II	
	MP 455.9	Cedar Creek	CWF II	
	MP 456.8	Imp Creek	CWF II	
	MP 460.8	South Branch Paint River	CWF I	
	MP 466.2	Cooks Run	CWF I	
	MP 466.2	Cooks Run	CWF I	
	MP 469.3	McRae Creek	WWF II	
	MP 472.4	Unnamed Creek	CWF II	
	MP 474.6	North Branch Iron River	CWF I	
Loop 10/MI	MP 528.2	North Branch Ford River	CWF I-S	
	MP 534.4	Unnamed Creek	WWF II	
	MP 538.0	Hunters Brook (T)	CWF II	
	MP 538.5	Hunters Brook	CWF II	
	MP 547.0	Escanaba River	CWF I-S	
	MP 548.8	Squaw Creek	CWF II	
	MP 550.1	Indian Creek	WWF II	
	MP 553.5	Days River	WWF II-S	
	MP 558.0	Tacoosh River	CWF II, M	
Loop 11/MI	MP 575.3	Sturgeon River	CWF II, M-S	
	MP 581.9	Fishdam River	CWF II, M-S	
	MP 584.5	Spring Creek	WWF II	
	MP 584.6	Spring Creek	WWF II	
	MP 591.6	Dufour Creek	CWF I	
	MP 592.0	Dufour Creek	CWF I	
	MP 592.5	Dufour Creek	CWF I	
	MP 592.9	Dufour Creek	CWF I	
	MP 598.5	Indian River	WWF I-S	
	MP 599.7	Manistique River	WWF I-S	
	MP 606.6	Merwin Creek	WWF II	
	MP 612.8	Little Bear Creek	CWF II	
	MP 613.7	Unnamed Creek	CWF II	
Loop 12/MI	MP 651.6	Paquin Creek (T)	CWF II	
	MP 652.1	Paquin Creek	CWF II	
	MP 657.1	Cut River	CWF II	
	MP 669.2	Brevoort River	CWF II-S	
	MP 670.3	Point aux Chenes River	WWF I	
	MP 677.5	Moran River	WWF II	

TABLE 4.1.3-6 (cont'd)

Applicant Segment/State	Milepost b/	Water Body	Fishery Classification c/	State Water Quality Classification d/
Loop 13/MI	MP 693.3	Carp Lake River	CWF II-S	
	MP 695.8	Certon Creek	WWF I	
	MP 696.4	Unnamed Creek	WWF I	
	MP 697.3	Unnamed Creek	WWF I	
	MP 697.4	Unnamed Creek	WWF I	
	MP 699.1	Van Creek	WWF II	
	MP 703.4	East Branch Maple River	CWF II	
	MP 705.1	Maple River	CWF I	
	MP 707.4	Crooked River (T)	CWF II	
	MP 707.9	Crooked River	WWF I	
	MP 713.5	Cedar Creek	CWF I	
Loop 14/MI	MP 750.0	Manistee River	CWF I	
Loop 15/MI	MP 779.8	Dead Stream	CWF II	
	MP 781.0	Addis Creek	CWF II	
	MP 783.6	Haymarsh Creek	WWF II	
	MP 786.4	West Branch Muskegon River	WWF II	
	MP 792.1	Butterfield Creek	CWF II	
	MP 800.0	Cranberry Creek	WWF I	
	MP 803.2	Muskegon River	WWF I	
	MP 807.4	Green Creek	WWF II	
	MP 814.1	Shingle Creek	WWF II	
	MP 815.0	McCray Drain	WWF II	
Loop 16/MI	MP 851.9	Little Salt Creek	WWF II	
	MP 854.8	Pine River	WWF II	
	MP 871.3	Beaver Creek	WWF II	
	MP 875.5	Bad River	WWF II	
	MP 877.6	South Fork Bad River	WWF II	
	MP 879.9	Pickerel Creek	WWF II	
	MP 881.5	Shiawassee River	WWF II	
	MP 882.2	Bear Creek	WWF II	
	MP 886.4	Fairchild Creek	WWF II	
	MP 886.9	Misteguay Creek	WWF II	
	MP 891.7	Henry Drain	WWF II	
	MP 893.4	Flint River	WWF II	
	MP 894.5	Pine River	WWF II	
	MP 897.0	Silver Creek	WWF II	
Loop 17/MI	MP 925.0	Murlin Lake Drain	WWF II	
	MP 926.4	Hewson Lanoe Drain	WWF II	
	MP 926.4	Peasley Drain	WWF II	
	MP 935.7	North Branch Belle River	WWF II	
	MP 939.2	Belle River	WWF II	
TENNESSEE				
Segment 1/NY	MP 230B-101+2.9	Buffalo Creek	WWF	D
	MP 230B-101+6.9	Little Buffalo Creek	WWF	B
	MP 230B-102+1.8	Cayuga Creek (T)	WWF	B
	MP 230B-102+4.5	N. Br. Plum Bottom Creek	WWF	B
	MP 230B-103+1.3	Ransom Creek	WWF	D
	MP 230B-102+6.1	Ellicot Creek	WWF	B
Segment 2/NY	MP 230B-107+0.1	Niagara River	WWF, CWF, M	A
Segment 3/NY	MP 232+1.0	Little Tonawanda Creek (T)	CWF	A
	MP 232+1.2	Little Tonawanda Creek (T)	CWF	A

TABLE 4.1.3-6 (cont'd)

Applicant Segment/State	Milepost b/		Water Body	Fishery Classification c/	State Water Quality Classification d/
	MP	232+1.7	Little Tonawanda Creek (T)	CWF	A
	MP	232+2.5	Dale Gulf (T)	CWF	A
	MP	232+2.6	Dale Gulf (T)	CWF	A
Segment 4/NY	MP	234+1.8	Little Conesus Creek (T)	WWF	D
	MP	234+3.7	Little Conesus Creek (T)	WWF	D
	MP	234+5.4	Spring Brook (T)	CWF	C
	MP	234+5.7	Spring Brook	CWF	C
	MP	234+6.6	Spring Brook (T)	WWF	D
	MP	234+6.8	Spring Brook (T)	WWF	D
	MP	234+7.4	Spring Brook (T)	WWF	D
	MP	234+8.0	Spring Brook (T)	WWF	D
	MP	234+8.3	Unnamed Pond	WWF	D
	MP	234+8.5	Unnamed Pond	WWF	D
	MP	234+9.2	Honeoye Creek (T)	WWF	D
	MP	234+9.5	Honeoye Creek	WWF	D
	MP	234+11.3	Honeoye Creek (T)	WWF	D
	MP	235+0.6	Honeoye Creek (T)	WWF	D
	MP	235+1.0	Unnamed Creek	WWF	D
Segment 8/MA	MP	261+3.2	Longmeadow Brook (T)	WWF	B
	MP	261+5.7	Jawbuck Brook	WWF	B
	MP	261+6.1	Freshwater Brook	WWF	B
Segment 9/MA	MP	266+6.5	North Pond (T)	WWF	B
	MP	266+7.1	Indian Brook	WWF	B
	MP	266+7.7	Indian Brook (T)	WWF	B
	MP	266+8.6	Indian Brook (T)	WWF	B
	MP	266+8.8	Unnamed Creek	WWF	B
ALGONQUIN					
G-5 Replacement/MA	MP	0.1	Tenmile River (T)	WWF	B
	MP	0.9	Unnamed Creek	WWF	B
	MP	1.8	Unnamed Creek	WWF	B
	MP	2.6	Coles Brook (T)	WWF	B
	MP	5.3	Runnins River	WWF	B
G-8 Replacement /Loop MA	MP	1.4	Maple Springs Brook East Branch	WWF,M	B
	MP	2.0	Glen Charlie Pond	WWF	B
	MP	3.1	Red Brook	WWF,M	SA
Medfield Loop/MA	MP	0.9	Lake Winthrop (T)	WWF	B
	MP	1.6	Unnamed Creek	WWF	B
	MP	2.3	Unnamed Pond	WWF	B
	MP	2.6	Dirty Meadow Brook	WWF	B
H-1 Replacement/MA	MP	0.1	Hopping Brook (T)	CWF-S	B
Chaplin Loop/CT			No Streams Crossed		
E1 Loop /CT	MP	1.2	Yantic River	CWF-S	B
	MP	4.1	Gardner Brook	CWF-S	B/A
	MP	4.5	Gardner Brook (T)	CWF-S	B/A
Tiverton Loop/RI			No Streams Crossed		

TABLE 4.1.3-6 (cont'd)

Applicant Segment/State	Milepost b/	Water Body	Fishery Classification c/	State Water Quality Classification d/
TRANSCO				
1.61-Mile Leidy Loop/PA	MP 36.9	Little Bushkill Creek (T)	HQ-CWF	
6.79-Mile Leidy Loop/PA	MP 29.6	Delaware River	WWF, M-S	
	MP 30.4	Mud Run	CWF-S	
	MP 31.3	Mud Run (T)	CWF	
	MP 31.4	Mud Run	CWF-S	
	MP 31.5	Mud Run	CWF-S	
	MP 31.9	Mud Run (T)	CWF	
	MP 32.5	Mud Run (T)	CWF	
	MP 34.8	Little Bushkill Creek (T)	HQ-CWF	
	MP 35.3	Little Bushkill Creek	HQ-CWF, M-S	
	MP 35.8	Little Bushkill Creek (T)	HQ-CWF	
	MP 36.0	Little Bushkill Creek (T)	HQ-CWF	
	MP 36.1	Little Bushkill Creek (T)	HQ-CWF	
TEXAS EASTERN				
Line No. 34/PA		No Streams Crossed		
CNG				
TL-470 Line/NY	MP 0.04	Papscanee Creek (T)	CWF	CT
	MP 1.6	Papscanee Creek (T)	WWF	D
	MP 1.7	Papscanee Creek (T)	WWF	D
	MP 1.8	Papscanee Creek (T)	WWF	D
	MP 1.8	Papscanee Creek (T)	WWF	D
	MP 1.9	Papscanee Creek	WWF	D
	MP 2.4	Hudson River	WWF, M	C
NATIONALFUEL/ PENN-YORK				
Y-M54 Line/PA	MP 0.1	Pond on Rose Lake Run	WWF	
CNG/TEXASEASTERN				
TL-403 Replacement/NY		No Streams Crossed		

TABLE 4.1.3-6 (cont'd)

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a/ For wetlands crossed by the NIP Project see appendix E-1.
b/ Approximate milepost of pipeline crossing
c/ CWF - Classified as supporting coldwater fish species
CWF I - All natural reproduction of trout and salmon
CWF II - Some natural reproduction of trout and salmon, with supplemental stocking
CWF III - Marginal habitat, no natural reproduction, stocking necessary
WWF - Classified as supporting a warmwater fish species
WWF I - All natural reproduction of warmwater species
WWF II - Some natural reproduction of warmwater species, with supplemental stocking
WWF III - Marginal habitat, no natural reproduction, stocking necessary
M - Classified as providing habitat for migratory fish species.
S - The stream is stocked with either warmwater or coldwater fish species
NI - Not inventoried by state
d/ See table 4.1.3-4 for a description of the classifications. OR - designated as an outstanding resource by the state.
ER - designated as an exceptional resource by the state.

Sources:
Applicant Resource Reports
USGS Quadrangle Maps of the proposed NIP Project
State Fishery and Water Quality Personnel

TABLE 4.1.3-7

Water Crossings 100 Feet Wide or Greater a/

Applicant State/Segment	Milepost	Water Body	Width of Crossing (ft)
Great Lakes			
Minnesota			
Loop 4	MP 196.0	Mississippi River	125
Loop 6	MP 199.4	Ball Club River	275
	MP 234.0	Swan River	100
Wisconsin			
Loop 7	MP 327.9	Bois Brule River	100
Michigan			
Loop 9	MP 460.8	South Branch Paint River	100
Loop 10	MP 547.0	Escanaba River	130
Loop 11	MP 575.3	Sturgeon River	100
	MP 598.5	Indian River	200
	MP 599.7	Manistique River	300
Loop 13	MP 707.9	Crooked River	150
Loop 15	MP 803.2	Muskegon River	100
Loop 16	MP 854.8	Pine River	100
	MP 881.5	Shiawassee River	100
	MP 893.4	Flint River	100
Tennessee			
New York			
Segment 1	MP 230B-101+2.9	Buffalo Creek	100
Segment 2	MP 230B-107+0.4	Niagara River	1,700
Segment 4	MP 234+9.5	Honeoye Creek	100
Algonquin			
Connecticut			
E1 Loop	MP 1.4	Yantic River	130
Massachusetts			
G-8 Replacement/Loop	MP 2.0	Glen Charlie Pond	250
Transco			
Pennsylvania			
6.79-Mile Leidy Loop	MP 29.6	Delaware River	450
CNG			
New York			
TL-470 Line	MP 0.04	Papscanee Creek (T)	100
	MP 2.4	Hudson River	800

a/ For wetlands crossed by the NIP Project, see appendix E-1.

(MP 234.0) are class C. Coldwater streams make up 91 percent of the streams crossed in Wisconsin. The Bois Brule River (Loop 7, MP 327.9) has been designated by the state as an outstanding resource and is one of Wisconsin's most famous trout streams. The river is also widely used for canoeing and other recreational pursuits. The state also designates class I coldwater trout fisheries as Exceptional Resource Waters (Administrative Code NR 102.11). This designation includes Anderson (MP 324.0), Reefer (MP 331.5), and DeChamps (MP 337.9) Creeks and the Iron River (MP 336.6). In Michigan, where streams are classified by fishery, approximately 54 percent of the streams that would be crossed support coldwater fisheries.

Great Lakes and the Environmental Assessment Section of the MIDNR identified two areas, the Pine and Shiawassee Rivers (Loop 16), where there is the potential for PCB and lead contamination in river sediments. The MIDNR has reviewed the crossing locations and has determined that ecologically signficant contamination would not be encountered at the proposed crossing locations (MIDNR, 1990).

There are no municipal surfacewater-intake structures within 3 miles downstream of any of the proposed crossings.

Tennessee

Tennessee's proposed loops would cross 35 perennial water bodies – 27 in New York, and 8 in Massachusetts. Three of the crossings would be more than 100 feet in length. Fifty-six percent of the water bodies that would be crossed in New York are classified D, which indicates they are suitable for secondary contact recreation and are not conducive to fisheries. This class may not be a true reflection of water quality, however, because the state classifies all streams too small to support a fishery as D. Twenty-two percent of the streams that would be crossed in New York are class A. All of the streams that would be crossed by proposed Tennessee facilities in Massachusetts are class B.

The Niagara River (Segment 2) is classified as an "A" stream Part 702, Special Classifications and Standards Section 702.1, Class A-Special (International Boundary Waters). This crossing would be 1,700 feet wide. Studies have shown recurring detection of toxic substances in the Niagara River such as PCBs, pesticides, and heavy metals which enter the river from United States municipalities, industries, and waste sites. Concentrations of PCBs, arsenic, chromium, copper, lead, mercury, and zinc in the sediments of the lower Niagara River reportedly exceed the dredge spoil disposal criteria. Tennessee has indicated that the Niagara River would be crossed utilizing a horizontal directional drilling method.

No municipal water-supply intake structures are located within 3 miles downstream of the proposed crossings.

Algonquin

The proposed pipeline loops would cross 16 perennial water bodies – 13 in Massachusetts and 3 in Connecticut. Two of the crossings would be more than 100 feet wide. The streams that would be crossed in Massachusetts are all class B. Connecticut has indicated that Gardner Brook (E-1 Loop, MP 4.6) may have experienced pollution from landfills located upstream in the watershed (Banach, 1989). This stream is classified as B/A, which indicates the existing water quality is B. However, the water quality goal is A. The

Chaplin Loop is located in a high quality class AA public water-supply watershed area. The Tiverton Loop, located in Rhode Island, would also be located in a public surfacewater supply watershed (Stafford Pond). However, no streams would be crossed by this loop. No municipal surfacewater intakes have been identified within 3 miles downstream of any of the Algonquin proposed crossings.

Transco

The proposed pipeline loops would cross 13 perennial water bodies – 12 in Pennsylvania and 1 on the Pennsylvania/New Jersey border. The Delaware River (MP 29.6) is the only major river crossing that would be greater than 100 feet wide. The Delaware River is approximately 450 feet wide at the proposed crossing location and is classified as a warmwater fishery utilized by migrating fish species (see section 4.1.4.1). Transco has indicated that the construction method used at the Delaware River crossing would be open trench excavation unless studies prove directional drilling to be technically feasible and cost-effective. Pennsylvania classifies surface water according to the fish it will support. Of the remaining crossings, half are classified as coldwater fisheries and half as high quality coldwater fisheries.

Easton, Pennsylvania, has a surface intake located approximately 4 miles downstream of the proposed Delaware River crossing. The intake structure is located far enough downstream that it should not be affected by increased sediment loads.

Texas Eastern

No streams would be crossed by the proposed pipeline loop.

CNG

The proposed pipeline would cross seven perennial water bodies in New York. The only major crossing would be the Hudson River, which is 800 feet wide and 40 feet deep at the crossing location. The Hudson River is classified by the COE as a navigable river. The waterway receives both barge and pleasure craft traffic during the summer months. The water quality classification of the river at this location is C. All other streams that would be crossed by CNG's facilities in New York are classified CT, C, or D. Papscanee Creek tributary (MP 0.04) is also classified as suitable trout habitat.

The Hudson River is known to be contaminated with PCBs, metals, and organics. During a 30-year period, over 500,000 pounds of PCBs were discharged into the Hudson River. Some of the PCBs were absorbed by the sediments that have accumulated in the area between Fort Edward and Albany, New York. NYDEC has indicated that PCB levels in Hudson River sediments do not reach hazardous levels downstream of the Troy Dam, which is 12 miles upstream of the pipeline crossing (Warrinder, 1989). CNG has indicated that the Hudson River would be crossed using conventional open trench techniques.

No municipal surfacewater intake structures have been identified within 3 miles downstream of any of the proposed stream crossings.

National Fuel/Penn-York

One pond would be crossed by the proposed pipeline loop. The crossing would be less than 50 feet in length. No municipal surfacewater intake structures have been identified within 3 miles downstream of the crossing.

CNG/Texas Eastern

No streams would be crossed by the proposed pipeline route.

4.1.4 Fish and Wildlife

4.1.4.1 Fishery Resources

Three basic fishery resource types exist in the surface waters that would be traversed by the proposed NIP Project: coldwater, coolwater, and warmwater. A listing of representative fish species known to occur in the project area is presented in table 4.1.4-1.

TABLE 4.1.4-1

Representative Fish Species Known to Occur in the Project Areas

Coldwater	Coolwater	Warmwater	Anadromous
Brook trout	Northern pike	Largemouth bass	Striped bass
Rainbow trout	Muskellunge	Bluegill	American shad
Brown trout	Smallmouth bass	Longeared sunfish	Blueback herring
Chinook salmon	Walleye	Brown bullhead	Rainbow smelt
Coho Salmon			

Fishery resources may be considered to be of special concern for a variety of reasons, including exceptional recreational value, habitat for protected species, or particular state management practices. Streams that would be crossed that support fisheries resources of special concern are listed in table 4.1.4-2.

Coldwater fishes are generally found in upland areas in headwater streams and areas characterized by moderate to steep surrounding topography. Currents are typically swift and flow over substrates composed of boulder, cobble, or gravel material. Water temperatures are usually less than 20 degrees centigrade, and dissolved oxygen concentrations are generally greater than 5 ppm due to aeration of the water from the turbulent flows and elevated solubility of oxygen in cold water. Alternating riffles and pools are also characteristic of coldwater environments. Coldwater fisheries are generally more vulnerable to habitat disturbances caused by oxygen depletion, turbidity and siltation, thermal increases, and poor water quality. Reproducing coldwater species include brook, brown, and rainbow trout. These species are all supplemented by stocking in the proposed NIP Project area. Other migratory coldwater fishes that reproduce in waters that would be crossed by the proposed pipeline facilities include steelhead trout and coho, chinook, and pink salmon. Water bodies that would be crossed by the proposed pipeline facilities are presented in table 4.1.3-6.

TABLE 4.1.4-2

Fisheries Resources of Special Concern
Crossed by the Proposed NIP Project

Applicant Segment/State	Milepost	Water Body	Width	Fisheries Issue a/
GREAT LAKES				
Loop 7/WI	327.9	Bois Brule River	100	2,3,4
	334.0	Muskeg Creek		2,3
	336.6	Iron River		2,3
	336.9	Iron River (T)		2,3
	337.9	DeChamps Creek		2,3
Loop 8/MI	397.0	Welch Creek		2,3
	399.6	Seimen's Creek		2,3
	401.8	Powder Mill Creek		2,3
Loop 9/MI	441.2	Two Mile Creek		2,3
	444.0	Middle Branch Ontonagon River		2,3
	447.3	Henderson Creek		2,3
	450.6	Duck Creek		2,3
	460.8	South Branch Paint River		2,3
	466.2	Cooks Run		2,3
	474.6	North Branch Iron River		2,3
Loop 10/MI	558.0	Tacoosh River		2,3,4
	575.3	Sturgeon River	100	2,3,4
	581.9	Fishdam River		2,3,4
Loop 11/MI	592.6	Dufour Creek		2,3
Loop 13/MI	705.1	Maple River		2,3
	713.5	Cedar Creek		2,3
Loop 14/MI	750.0	Manistee River		2,3
TENNESSEE				
Segment 2/NY	MP230B-107+0.2	Niagara River	1700	4
Segment 3/NY	MP232 + 1.7	Little Tonawanda Creek		2
	MP232 + 2.5	Dale Gulf		2
Segment 8/MA	MP261 + 3.2	Longmeadow Brook		1
Segment 9/MA	MP266 + 6.5	North Pond (T)		1
TRANSCO				
Leidy Loop/PA	29.6	Delaware River	450	4
	35.3	Little Bushkill Creek		4
CNG				
TL470 Line/NY	2.4	Hudson River	800	1,4

a/ Codes for fisheries issues:
1 = Contains state- or Federal-listed or proposed endangered, threatened, or special concern or aquatic species
2 = Either designated as exceptional coldwater fishery, or has special fishery regulations, or is given high priority by the state
3 = Good salmonid spawning habitat
4 = Migratory salmon, trout, or steelhead present

Great Lakes

Great Lakes' pipeline facilities would cross 141 surface waters located in Minnesota (18), Wisconsin (24), and Michigan (99). Of the surface waters inventoried by the respective states, 80 (56.7 percent) are classified as capable of supporting coldwater fishes, generally with some supplemental stocking. The streams and rivers that would be crossed in Minnesota support primarily warmwater fisheries, with the exception of Clearwater River (MP 130.2) and Bruce Creek (MP 237.9). The fishery resources in nine (47 percent) of the streams or rivers in Minnesota proposed to be crossed have not been inventoried by the MNDNR. The Mississippi River at the proposed crossing location (MP 196.0) is approximately 100 feet wide and supports warmwater species.

Of the 24 surface waters proposed to be crossed in Wisconsin, 21 (87.5 percent) have been classified by the WIDNR as capable of supporting coldwater fishes. Five of these waters, the Bois Brule River (MP 327.9), Muskeg Creek (MP 334.0), the Iron River System, including the Iron River (MP 336.6) and a tributary to the Iron River (MP 336.9), and the DeChamps Creek (MP 337.9) have been identified by the WIDNR as capable of self-sustainment of its coldwater fishery through natural reproduction and without supplemental stocking.

The proposed Bois Brule River crossing is located approximately 8 miles upstream of western Lake Superior. This river supports resident brook and brown trout as well as migratory strains of brown trout and steelhead from western Lake Superior. Salmon species from Lake Superior that utilize the Bois Brule River for spawning and as nursery habitat include coho, chinook, and pink salmon. Recreationally, the Bois Brule is noted primarily for its steelhead runs. Currently, however, the steelhead populations are smaller than in the recent past and the state is in the process of rebuilding the steelhead fishery through restricted bag limits and supplemental stocking, scheduled to begin in 1990 (Pratt, 1989).

The Iron River and its tributaries and the DeChamps Creek are considered exceptional natural inland water trout fisheries by the WIDNR. Although these rivers contain naturally reproducing populations of brook and brown trout, the main stem of the Iron River also provides a regionally unique fishery for nonmigratory strains of rainbow trout (Kampa, 1989). To maintain current populations of trout in these waters, the WIDNR has lowered the daily bag limit and increased the minimum size limit over the state's general regulations. Some annual stocking of brown trout occurs in portions of the mainstem of the Iron River.

Approximately 44 percent of the water bodies that would be crossed in Michigan are classified by the MIDNR as supporting coldwater fishes. Natural reproduction of trout occurs in all of these streams, while many contain sufficient habitat and water quality to support natural populations of trout.

Streams and rivers proposed to be crossed that are located on Michigan's upper peninsula generally provide good quality brook and/or brown trout habitat. In particular, streams that would be crossed on Loop 8, including Welch Creek (MP 397.0), Seimens Creek (MP 399.6), Powder Mill Creek (MP 401.8), and Planter Creek (MP 409.3) and on Loop 9, including Two Mile Creek (MP 441.3), Middle Branch Ontonagon River (MP 444.0), Henderson Creek (MP 447.3), Duck Creek (MP 450.6), South Branch Paint River (MP 460.8), Cooks Run (MP 466.2), and North Branch Iron River (MP 474.6) have all been

designated by the state as outstanding naturally reproducing trout waters (Schnicke, 1989). The MIDNR, together with local conservation groups, has made considerable economic investments for trout habitat improvement in the Middle Branch Ontonagon River and in Two Mile Creek in the vicinity of the proposed crossings (Juetten, 1989). The proposed facilities (Loops 10 and 11) would also cross the Tacoosh River (MP 558.0), Sturgeon River (MP 575.3), and the Fishdam River (581.9), each well known recreationally for migratory fisheries that include spring-run steelhead, and fall-run chinook and pink salmon. The MIDNR has indicated (Peterson, 1989) that beginning in May 1989, a summer-run strain of steelhead (i.e., Skamnia strain) would be stocked in the Sturgeon River. These fish migrate upstream from Green Bay, Lake Michigan.

Eighteen streams and rivers are proposed to be crossed by Loops 12, 13, and 14. Of these, more than half are capable of supporting coldwater fisheries, generally with supplemental stocking. Several rivers, however, are known for their coldwater sport fisheries. The Brevoort River (Loop 12, MP 669.2) is regionally important as both spawning water for migratory salmonids from Lake Michigan and as a recreational fishery for spring-run steelhead and chinook and pink salmon. Its role in helping to maintain the migratory fishery of Lake Michigan has been exemplified by recent economic investments in salmonid habitat enhancement by the U.S. Forest Service (FS) (Scott, 1990). The Maple River (Loop 13, MP 705.1) and the Manistee River (Loop 14, MP 750.0), two of lower Michigan's top quality trout streams, both contain significant amounts of salmonid spawning habitat. While the Maple River supports one of the regions best steelhead fisheries, the Manistee River has recently been selected by Trout Unlimited as one of the United States' top trout streams (Trout, 1989).

With the exception of Dead Stream (MP 779.8), Addis Creek (MP 781.0), and Butterfield Creek (MP 792.1), all waters that would be crossed by Loops 15, 16, and 17 have been classified by Michigan as supporting warmwater fisheries.

Tennessee

Tennessee's proposed pipeline facilities would cross 27 streams located in New York, 8 streams in Massachusetts, and 1 unnamed pond. Of the surface waters crossed, approximately 50 percent are capable of supporting coldwater fisheries, generally with some supplemental stocking. The Niagara River (Segment 2) generally supports coolwater species such as northern pike, smallmouth bass, and white bass year round, but also contains a seasonal migratory coldwater fishery consisting of coho and chinook salmon, rainbow and brown trout, and smelt from Lake Ontario. The proposed crossing area of the Niagara River, located north of Lewiston, New York, is approximately 1,700 feet wide and 50 feet deep. The area near Lewiston is one of the best smelt fisheries in the Erie-Niagara region.

The streams that would be crossed by Segments 1 and 4 support primarily warmwater recreational fisheries for largemouth bass and northern pike. Various carp species are also found in these streams.

Little Tonawanda Creek and Dale Gulf (Segment 3) are classified as coldwater streams. Little Tonawanda Creek and two of its tributaries would be crossed (MPs 232+1.0, 1.2 and 1.7) and Dale Gulf and one of its tributaries would be crossed (MP 232+2.5). The streams that would be crossed by Segments 8 and 9 in Hampden and Middlesex Counties, Massachusetts, are classified as warmwater fisheries. Longmeadow Brook (Segment 8, MP

261+3.2) is reported to contain populations of immature burbots, a state-listed species of special concern, while a tributary to North Pond (Segment 9, MP 266+6.5) may contain a population of the state-endangered brook lamprey (Halliwell, 1989). These species are discussed in further detail in section 4.1.5.

Algonquin

Algonquin's proposed pipeline facilities would cross 3 surface waters in Connecticut and 11 in Massachusetts. In Massachusetts, Hopping Brook (H-1 Replacement) is classified as a coldwater fishery. All proposed crossings in Connecticut support coldwater fisheries. Other surface waters proposed to be crossed by Algonquin in Massachusetts support only warmwater fisheries.

Transco

Transco's proposed pipeline facilities would cross the Delaware River and 12 smaller streams and tributary streams in east-central Pennsylvania. The proposed Delaware River crossing is approximately 450 feet wide and would be located between Harmony, New Jersey (Warren County), and Lower Mount Bethel, Pennsylvania (Northampton County). The Delaware River in this area supports a year-round warmwater and coolwater fishery consisting of yellow perch, smallmouth bass, northern pike/tiger musky, and various sunfish, shiners, suckers, and carp. It also supports a well-developed and growing American shad fishery.

The shad fishery consists of upstream migrating adults that pass through the crossing area primarily in April, May, and early June. Although most spawning occurs upstream of the project area, fairly high concentrations of shad eggs and larvae have been recorded within 2 miles upstream of the proposed crossing location during spring and summer months (Maurice et al., 1987). Although American shad larvae and young-of-year are present in this area throughout the summer months, a heavy outmigration of young-of-year occurs downstream through the area of the proposed crossing between late August and the end of September.

The 12 streams, in addition to the Delaware River, are classified by Pennsylvania as coldwater fisheries (6) and high-quality coldwater fisheries (6). In addition to its high-quality classification, Little Bushkill Creek is also classified as supporting a migratory fishery consisting of blueback herring. Both Mud River and Little Bushkill Creek are stocked with trout by the state.

CNG

CNG's proposed pipeline facilities would cross Papscanee Creek and five of its tributaries. With the exception of a tributary at MP 0.04, classified as supporting coldwater fish, all other streams associated with Papscanee Creek and its tributaries are classified as warmwater fisheries. CNG's proposed TL-470 pipeline would cross the Hudson River approximately 3,050 feet south of the confluence of Norman's Kill Creek with the Hudson River in Bethlehem, New York (1.5 miles south of Albany, New York). The river at this location is classified as supporting a warmwater as well as an anadromous fishery. Anadromous fish species potentially occurring at this location include striped bass, American shad, alewife, blueback herring, and shortnose sturgeon, a federally designated endangered

species. Smallmouth and largemouth bass are also important fisheries at this proposed crossing location.

National Fuel/Penn-York

The proposed Y-M54 line would cross a small (50-foot-wide) warmwater pond. This pond is assumed to contain populations of sunfishes and largemouth bass.

4.1.4.2 Wildlife Resources

Wildlife species that occur in the area of the proposed NIP Project pipeline facilities are those common to forest, wetland, and agricultural areas, as well as species adapted to urban and suburban areas. Endangered and threatened species that occur in the project area are discussed in section 4.1.5.

A variety of habitats would be crossed along the approximately 546 miles of proposed facilities, which extend from northern Minnesota at the western end of the project through Massachusetts at the eastern terminus of the project. Wetland and woodland habitats predominate in the Great Lakes portion of the proposed project area (especially in Minnesota, Wisconsin, and upper Michigan) while agricultural habitats are more common in the southern portion of lower Michigan. The Tennessee portion of the project in New York and Massachusetts would traverse a mixture of second and third growth wooded upland and wetland habitats. While open land is more common in western New York, urban/suburban habitats predominate in areas of Massachusetts (Hampton County). Natural wildlife habitat in the area of the proposed Algonquin facilities consists mainly of upland hardwood forest plus some wetland areas; but urban and suburban development is also common in the general area of the proposed pipeline.

Agricultural habitats predominate in the area of Transco's proposed pipeline, with wooded areas being the next most common. Forest and agricultural habitats are common in the vicinity of Texas Eastern's proposed pipeline, with a small percentage consisting of urban or developed land.

Woody habitat predominates in the area of the proposed CNG pipeline route, with agricultural and developed land making up the remaining portion.

The wildlife habitat in the vicinity of the proposed National Fuel/Penn-York facilities is slightly more than half forestland. Agricultural fields make up most of the remaining portion, along with some undeveloped land and abandoned fields. The proposed right-of-way for CNG/Texas Eastern's replacement pipeline is in agricultural use.

Wildlife species typical of the forest habitats that occur along the proposed NIP Project facilities include white-tailed deer, coyote, gray fox, black bear, gray squirrel, porcupine, numerous species of small mammals, wild turkey, ruffed grouse, great horned owl, broad-winged hawk, and numerous passerine bird species such as finches, sparrows, and jays. Amphibians and reptiles typical of the forested habitats include the blue spotted salamander, wood frog, tree frog, American toad, and various snake species.

Wildlife species typical of agricultural lands are those adapted to field and old field habitats, as well as forest and forest-edge habitats. These include white-tailed deer, red fox,

woodchuck, skunk, raccoon, eastern cottontail rabbit, and meadow vole. Also common are red-tailed hawk, American kestrel, American goldfinch, bobolink, numerous other passerine birds, and reptiles such as garter, milk, and brown snakes.

Many wildlife species occurring in forest and agricultural habitats also use wetland habitats. Species more directly associated with wetland and open water habitats are the beaver, muskrat, mink, osprey, belted kingfisher, mallard, wood duck, great blue heron, spotted sandpiper, and numerous other ducks, wading birds, and songbirds. Most amphibians and many reptiles require wetland habitats during breeding periods, and many continue to use wetlands for most of their lifecycles.

Developed residential and industrial areas provide habitat for a number of species that benefit from an association with humans. These include the raccoon, Virginia opossum, Norway rat, house finch, European starling, English sparrow, and numerous other songbirds and small mammals.

A number of wildlife species that occur in the area of the proposed NIP Project facilities, including game and nongame species, are of considerable economic and recreational importance. Big game species include the moose, white-tailed deer, and black bear. Important small game and fur-bearing mammals include eastern cottontail, raccoon, gray squirrel, coyote, bobcat, beaver, muskrat, mink, and striped skunk Game birds include geese, ducks, American woodcock, wild turkey, ring-necked pheasant, ruffed grouse, and bobwhite quail.

Nongame species also provide recreational value in that they can be observed, photographed, and fed. Migratory birds (including passerines, raptors, and shorebirds) are the most common nongame wildlife species utilized for recreational purposes within the NIP Project area.

A number of areas that are considered significant habitats by the respective state wildlife management agencies would be crossed by the proposed NIP Project facilities. These are listed in table 4.1.4-3. Significant habitats of endangered and threatened species are described in section 4.1.5. Deer wintering areas (DWAs) or deer yards are a component of white-tailed deer habitat that may be critical to the survival of deer herds in northern regions. These areas provide essential food and cover during severe winters when deer are forced to "yard up" or congregate within these habitats. The proposed NIP Project facilities would cross 33 DWAs, all by Great Lakes components of the project in Minnesota, Wisconsin, and Michigan. Two heron rookeries are known to occur within approximately 0.5 mile of the proposed Great Lakes loops. One rookery is located approximately 0.5 mile north of Loop 4, in Cass County, Minnesota; the second is located approximately 0.5 mile east of Loop 15 in Missaukee County, Michigan.

Two special wildlife management areas would be crossed in Michigan. The southern end of Loop 14 would traverse the Deward tract within the Pere Marquette State Forest. This area contains a DWA and waterfowl habitat along the Manistee River. Loop 15 would traverse the Leota Area Kirtland's Warbler Management Units (LAKWMU), parts of which are managed intensively for Kirtlands' Warbler habitat. Loop 15 would traverse a DWA and waterfowl habitat associated with the Muskegon River.

TABLE 4.1.4-3

Significant Wildlife Habitats Crossed by the Proposed NIP Project Facilities a/

Applicant Segment/State	Beginning Milepost	Habitat Type/Name	Length Crossed (feet)
GREAT LAKES			
Loop 3/MN	128.8	DWA/Clearwater River	12,100
Loop 4/MN	182.8	Heron Rookery	N/A b/
	188.4	DWA/Nushka Lake	12,670
Loop 6/MN	237.2	DWA/Swan River	16,530
Loop 7/WI	327.1	DWA	8,030
Loop 9/MI	434.3	DWA/Black Spur	49,100
	454.4	DWA/Imp-Taylor	21,490
	464.9	DWA/Golden Lake	15,040
Loop 10/MI	524.2	DWA	11,620
	527.2	DWA	174,470
Loop 11/MI	592.8	DWA	11,620
	601.3	DWA	12,140
	608.5	DWA	13,200
Loop 12/MI	646.7	DWA	22,700
Loop 13/MI	687.5	DWA	2,200
	693.5	DWA/Carp Lake River	3,800
	702.2	DWA	15,840
	708.0	DWA/Crooked River	2,000
	713.5	DWA	3,500
Loop 14/MI	747.6	DWA	2,220
	751.2	DWA	8,450
Loop 15/MI	776.5	DWA	27,720
	779.7	Heron Rookery	N/A c/
	783.5	DWA	5,120
	785.2	DWA	3,700
	789.6	DWA	1,800
	790.2	DWA	1,430
	791.4	DWA	4,590
	796.2	DWA	5,200
	799.4	DWA/Cranberry Creek	3,700
	802.9	DWA/Muskegon River	3,700
	806.7	DWA	3,700
	811.4	DWA	8,950
	813.4	DWA	2,600
	814.8	DWA	2,600
CNG			
TL-470 Line/NY	1.6	Waterfowl/Papscanee Marsh	1,200
Other Applicants		No significant habitats known to be crossed.	

a/ Does not include habitat of Federal or state-listed endangered or threatened species. Refer to sections 4.1.5 and 5.1.5 for discussions of these habitats.

b/ Loop 4 would not cross this heron rookery, but would pass within approximately 0.5 mile.

c/ Loop 15 would not cross this heron rookery, but would pass within approximately 0.5 mile.

The proposed CNG pipeline route in Rensselaer County, New York, would cross Papscanee Marsh and Creek, a NYDEC-designated significant coastal fish and wildlife habitat. The marsh is an important resting and feeding area for migratory waterfowl. The area also supports a number of breeding birds, including waterfowl, shorebirds, and passerines (NYDEC, 1989b).

Two privately owned wildlife refuges would be crossed by proposed facilities. Tennessee's Segment 8 would cross approximately 1,050 feet of the Fannie Stebbins Memorial Wildlife Refuge in Longmeadow, Massachusetts. This area is just east of the Connecticut River, and is used by migrating waterfowl. Algonquin's G-5 Replacement would cross approximately 2,750 feet of the Caratunk Wildlife Refuge, owned by the Audubon Society of Rhode Island. This area is a popular educational and recreational facility. The proposed pipeline segments would follow existing utility easements through both of these refuges.

4.1.5 Endangered and Threatened Species

The Endangered Species Act of 1973, as amended, requires the Federal action agency (i.e., FERC) to determine whether the proposed project could affect federally listed or proposed endangered and threatened species and/or their critical habitats. We have consulted with and/or received information concerning the potential occurrence of such species in the vicinity of the proposed project from the following agencies or groups:

- U.S. Forest Service
- U.S. Fish and Wildlife Service
- National Marine Fisheries Service
- Minnesota Department of Natural Resources
- Wisconsin Department of Natural Resources
- Michigan Department of Natural Resources
- Minnesota Natural Heritage Program
- New York Department of Environmental Conservation
- Massachusetts Natural Heritage Program
- Connecticut Department of Environmental Protection
- Connecticut Natural Heritage Program
- New York Natural Heritage Program
- New York State Coastal Management Program
- Pennsylvania Bureau of Forestry
- Pennsylvania Game Commission
- Pennsylvania Fish Commission
- New Jersey Department of Environmental Protection
- Rhode Island Natural Heritage Program

Similar consultation was conducted by the applicants. The following sections contain information on Federal endangered and threatened species and state-listed species that may occur within the project area. This information is based upon the above-mentioned consultations. Although the specific locations of the listed species were determined in most instances, they are not provided in this EIS to protect the species and their habitat. Potential impact on these species is discussed in section 5.1.5 of this EIS.

A total of nine federally proposed or listed and three state-listed threatened and endangered species may exist in the vicinity of the proposed NIP Project facilities. In addition, eight species that are listed by the states as species of special concern may occur in the vicinity of the proposed project facilities. Table 4.1.5-1 lists these species, their status, and general location.

4.1.5.1 Fish and Wildlife

4.1.5.1.1 Fish

Shortnose Sturgeon (Federal-Endangered, NY-Endangered)

The shortnose sturgeon is an anadromous species occurring in estuaries and large rivers along the Atlantic coast. It is a bottom feeder, spawns in mid-May, and migrates up and down rivers as water temperatures change (Smith, 1985). It is known to spawn in the Hudson River, in Albany and Rensselaer Counties, New York, in the vicinity of the proposed CNG crossing. Juveniles also use this reach of river during early-late summer (Ludwig, 1989).

American Brook Lamprey (MA-Threatened)

The American brook lamprey is a nonparasitic freshwater species that occurs in small brooks and streams. It may occur in a tributary to North Pond, which would be crossed by Tennessee's proposed Segment 9.

Burbot (MA-Special Concern)

The burbot, or eelpout, is a freshwater fish of the cod family that occurs in large rivers and lakes. It spawns in shallow waters from November to March. There are only one or two known populations of this species in Massachusetts. The burbot has been confirmed to occur within a tributary of the Connecticut River that would be crossed by Tennessee's proposed Segment 8.

4.1.5.1.2 Wildlife

Bald Eagle (Federal-Threatened, MN-, WI-Threatened, MI-Endangered)

The bald eagle breeds in undisturbed forested and open areas generally located near large bodies of water with abundant fish populations. During winter months, bald eagles congregate at night roosts and feeding areas located near ice-free waters that allow ready access to fish. The region including Minnesota, Wisconsin, and Michigan contains the greatest number of breeding bald eagles in the lower 48 states. An inactive bald eagle nest is located approximately 800 feet from the proposed Great Lakes pipeline Loop 4 in Cass County, Minnesota (MNDNR, 1988). Bald eagle nests are located approximately 1 mile from proposed Loop 9 in Iron County, 0.5 mile from proposed Loop 12 in Mackinac County, and 1 mile from proposed Loop 14 in Otsego County, Michigan (MIDNR, 1989c). Portions of proposed Loops 9, 10, and 11 may also be located within bald eagle nesting habitat in the Michigan Counties of Gogebic, Delta, and Marquette (FWS, 1989b).

TABLE 4.1.5-1

Federal and State-Listed Species
that Potentially Exist in the Vicinity of the Proposed NIP Project

Applicant/Segment	Species	Status a/	Location
GREAT LAKES			
Loops 4, 9, 10, 11, 12, 14	bald eagle	F/T, MI/E, MN/T	Cass County, MN Gogebic, Iron, Marquette, Delta, Mackinac & Otsego Counties, MI
Loops 1 - 12	gray wolf	F/E, MN/T, WI/E	Marshall, Clearwater, Cass, & Itasca Counties, MN Douglas & Iron Counties, WI
Loops 7, 12, 13	piping plover	F/E, WI/E, MI/E	Douglas County, WI Emmet & Mackinac Counties, MI
Loop 15	Kirtland's warbler	F/E	Clare County, MI
Loop 1	sandhill crane	MN/SC	Marshall County, MN
Loops 4, 13	osprey	MN/SC, MI/T	Cass County, MN, Emmet County, MI
Loops 9, 11, 12	wood turtle	MI/SC	Gogebic, Iron, Delta, Schoolcraft & Mackinac Counties, MI
Loop 12	dwarf lake iris	F/T, MI/T	Mackinac County, MI
Loop 12	Pitcher's thistle	F/T	Mackinac County, MI
Loop 12	Houghton's goldenrod	F/T	Mackinac County, MI
Loops 11, 12	Michigan monkey-flower	F/PE	Delta, Schoolcraft & Mackinac Counties, MI
TENNESSEE			
Segment 9	spotted turtle	MA/SC	Middlesex County, MA
	American brook lamprey	MA/T	Middlesex County, MA
Segment 8	many-fruited false loosestrife	MA/T	Hampden County, MA
	common moorhen	MA/SC	Hampden County, MA
	burbot	MA/SC	Hampden County, MA
ALGONQUIN			
G-5 Replacement	wood turtle	MA/SC	Bristol County, MA
	eastern box turtle	MA/SC	Bristol County, MA
G-8 Replacement	broom-crowberry	MA/SC	Plymouth County, MA
TRANSCO	none		
TEXAS EASTERN	none		
CNG	shortnose sturgeon	F/E, NY/E	Albany & Rensselaer Counties, NY
	least bittern	NY/SC	Rensselaer County, NY
NATIONAL FUEL/PENN-YORK			
Y-M54 Line	osprey	PA/E	Potter County, PA
CNG/TEXAS EASTERN	none		

a/ F = Federal; CT = Connecticut; MA = Massachusetts; MI = Michigan; MN = Minnesota; NY = New York; PA = Pennsylvania; WI = Wisconsin; E = Endangered; T = Threatened; SC = Special Concern; PE = Proposed Endangered

Gray Wolf (Federal-Endangered, WI-Endangered, MN-Threatened)

The gray wolf is found in large areas of undisturbed forestland in the northern portion of Minnesota and Wisconsin. This region contains the only known stable population of the gray wolf in the lower 48 states. Its habitat includes remote areas of forests and heavily wooded cut-over lands, and it often utilizes trails, old roads, and borders for travelling and searching for prey. A small pack of wolves may have a home range of 150 to 250 square miles, depending upon habitat limitations (Jackson, 1972). Due to their wide territorial range, they may occur near the proposed Great Lakes pipeline loops in northern Minnesota, northwestern Wisconsin, and northwestern Michigan's upper peninsula. The WIDNR has reported a sighting of a wolf in the vicinity of Loop 7 (Michon, 1989). There have also been sitings in the vicinity of the proposed Loop 9 in Gogebic County, Michigan (Ottawa National Forest Service, 1990).

Piping Plover (Federal-Endangered, MI-, WI-Endangered)

The piping plover is a shorebird that feeds and nests on the shores of Lake Superior, Lake Michigan, and suitable inland lakes. These birds are extremely rare, due to habitat destruction. The FWS indicates that this species may occur in three counties that would be affected by Great Lakes facilities: Douglas County, Wisconsin, and Emmet and Mackinac Counties in Michigan (FWS, 1989b). Proposed Loops 7, 12, and 13 are located in these counties. No suitable nesting or feeding habitat or occurrences of this species are known to be located within the proposed rights-of-way within these counties.

Kirtland's Warbler (Federal-Endangered, MI-Endangered)

The Kirtland's warbler nests in loose colonies in an area about 100 miles long and 60 miles wide in the north-central part of the lower peninsula of Michigan. The habitat consists of groves of young jack pines 5 to 18 feet high with a ground cover of blueberry, bearberry, or sweet fern (Peterson, 1980). The FWS intensively manages Kirtland's warbler habitat within management areas in this region. The proposed Great Lakes pipeline Loop 15 would cross approximately 5 miles of management area in Clare County. However, there have been no reported occurrences of Kirtland's warbler in this management area (DeCapita, 1989).

Sandhill Crane (MN-Special Concern)

Sandhill cranes are generally found in wetland habitats, preferring emergent marshlands for nesting. Sandhill cranes are known to occur in the vicinity of proposed Loop 1 in Marshall County, Minnesota.

Osprey (MN-Special Concern, MI-Threatened, PA-Endangered)

The osprey is a large raptor that feeds almost exclusively on fish and is associated with lakes and large rivers. They place their nests at the top of large trees or on top of utility poles and other structures near water. Within the proposed NIP Project area, this species occurs mainly in the northeastern and north-central regions of Minnesota. An active osprey nest is located approximately 1,500 feet north of proposed Great Lakes pipeline Loop 4 in Cass County. A nest is also located approximately 1 mile west of proposed Loop 13 in Emmet County, Michigan. The osprey has also historically occurred and may presently

exist in the area of the proposed National Fuel/Penn-York Y-M54 Line in Potter County, Pennsylvania.

Wood Turtle (MI, MA-Special Concern)

The wood turtle habitat requirements include wooded river banks, open sandy nesting areas, and fields and woodlands. As a result of field surveys, Great Lakes has identified potential habitat for this species at 14 stream crossings on Loops 9, 11, and 12. This turtle has also been recorded near Algonquin's proposed G-5 Replacement in Bristol County, Massachusetts.

Spotted Turtle (MA-Special Concern)

The spotted turtle is found in flooded woodlands, soft-bottomed streams, wet meadows, and beaver ponds. This turtle may be found in the vicinity of the proposed Tennessee Segment 8 in Middlesex County, Massachusetts.

Common Moorhen (MA-Special Concern)

The common moorhen is a duck-like marsh bird that can be found in both open water and areas of emergent vegetation. This species has been reported to occur in the vicinity of Tennessee's proposed Segment 8 in Hampden County, Massachusetts.

Eastern Box Turtle (MA-Special Concern)

Eastern Box Turtle habitat includes woodlands, field edges, thickets, marshes, bogs, and streambanks. Young turtles of this species are semiaquatic. This species inhabits an area near Algonquin's G-5 Replacement in Bristol County, Massachusetts.

Least Bittern (NY-Special Concern)

The least bittern occurs in marshes with tall vegetation such as cattails and sedges and areas of deep open water. The least bittern is suspected to breed within a wetland complex that would be crossed by the proposed CNG facility in Rensselaer County, New York.

4.1.5.2 Plants

Endangered and threatened plant species that possibly occur in the vicinity of the proposed NIP Project right-of-way are listed in table 4.1.5-1.

Dwarf Lake Iris (Federal-Threatened)

The dwarf lake iris is generally found on gravelly shores and cliffs in calcareous soil around Lakes Superior and Michigan (Gleason and Cronquist, 1963). The MIDNR has reported an occurrence of this plant near proposed Loop 12, in Mackinac County, Michigan.

Pitcher's Thistle and Houghton's Goldenrod (Federal-Threatened)

These two species are endemic to habitats along the shoreline of Lake Michigan. The FS indicated that these species may occur in the vicinity of proposed Loop 12 (FS, 1990).

Michigan Monkey-Flower (Federal Proposed Endangered)

This wetland species occurs along streambanks and seeps. The FS indicated that it may occur within cedar swamps that would be traversed by proposed Loops 11 and 12 (FS, 1990).

Many-Fruited False Loosestrife (MA-Threatened)

The many-fruited false loosestrife flowers from July through September. Its habitat includes swamps, marshes, and wet prairies. This plant is located within the vicinity of the proposed Tennessee Segment 8 and has been reported within the Fannie Stebbins Memorial Wildlife Refuge.

Broom-Crowberry (MA-Special Concern)

This low-growing shrub occurs in dry, sandy soils within pine barrens or areas of relic sand dunes. In Massachusetts, its range is restricted to the southeastern coastal region. A population of this species occurs on the existing right-of-way of the proposed G-8 Replacement/Loop.

4.1.6 Vegetation

The proposed NIP Project facilities would be located within ten states encompassing four general forest regions (Braun, 1950). These regions are identified by differences in dominant forest vegetation caused by differences in climate, soil, and topography. Vegetation associated with nonforest areas also reflects the variation in these controlling factors.

Most of the proposed project area is covered by the hemlock-white pine-northern hardwoods region. This vegetation region is found in Minnesota, Wisconsin, Michigan's upper peninsula, the northern portion of lower Michigan, much of the Appalachian Plateau in New York, and northern Pennsylvania. Facilities located in this region include those from Great Lakes, Tennessee, CNG/Texas Eastern, and National Fuel/Penn-York.

The region is characterized by the pronounced alternation of deciduous, coniferous, and mixed forest communities. In primary deciduous communities, sugar maple, beech, and basswood are the usual dominants, while yellow birch, elm, and red maple are frequent associates. In secondary deciduous communities, aspen, balsam, poplar, paper birch, and gray birch are abundant species. The coniferous communities are two general types: 1) those of more or less dry sand plains and ridges where white pine, red pine, and jack pine prevail; and 2) those of lowlands where black spruce, northern white cedar, and larch prevail.

The hemlock-white pine-northern hardwoods region is made up of two main divisions; the western part, the Great Lakes-St. Lawrence division; and the eastern part, the northern Appalachian Highland division. The former is found in the area of the proposed facilities

through Minnesota, Wisconsin, the upper peninsula of Michigan, and the northern portion of lower Michigan. The northern Appalachian Highland division covers the northern part of the Appalachian Highland from northern Pennsylvania northeastward across New York and Massachusetts.

Most of the proposed Great Lakes facilities, with the exception of those within the southernmost portions, are located within the Great Lakes-St. Lawrence division. This is an area of mainly low relief whose topographic features are almost entirely a result of glaciation. Common deciduous species include sugar maple, yellow birch, beech, basswood, large tooth aspen, quaking aspen, and paper birch. Additional species include red maple, elm, white ash, and oak. Coniferous tree species found in this area include balsam fir, white pine, red pine, jack pine, hemlock, and northern white cedar.

Most of the Tennessee pipeline facilities, and those of National Fuel/Penn-York and CNG/Texas Eastern, are located within the northern Appalachian Highland division. This area has more relief than the former division. The diversity of topography and greater altitudinal range result in local diversity of communities and in distinct altitudinal zonation. This division of the hemlock-white pine-northern hardwoods forests contrasts with the Great Lakes-St. Lawrence division in the presence of red spruce and the abundance of gray birch, plus the absence of jack pine and the relative infrequence of red pine and northern white cedar. This area has been greatly modified by lumbering and fire. Trees characteristic of secondary stands include red and white oak, white ash, basswood, red maple, cherry, butternut, bitternut hickory, and elms.

The beech-maple forest region is located in southern lower Michigan and southwestern New York along Lake Erie and Lake Ontario. Portions of the Great Lakes and Tennessee proposed facilities would be located in this forest region. This region is characterized by the development of a climax forest in which beech and sugar maple are the dominant trees of the canopy. Other species common to this forest type include American elm, basswood, red oak, white oak, black walnut, black cherry, and white ash.

Proposed facilities from Transco, Algonquin, and Texas Eastern are located in the oak-chestnut forest region of Pennsylvania, New Jersey, New York, and Connecticut. Most of the area, especially in Pennsylvania, is characterized by ridges and valleys.

The ridges are covered with secondary forests where upland oaks are prevalent. Forests of lower slopes are usually mixed mesophytic communities containing hemlock, white pine, beech, basswood, sugar maple, tuliptree, ash, red maple, and red oak. White oak is the most predominant tree species of the valley floors.

The southeastern edge of New York, a portion of central eastern Pennsylvania, northern New Jersey, Connecticut, and Rhode Island have been glaciated and the topography varies greatly. This area is characterized by secondary stands of oak or oak-hickory forest types. Mature chestnut trees are no longer a significant part of the forest makeup in this region due to a fungus disease that decimated the population during the early part of the century. Algonquin, Transco, and Tennessee all have facilities located within this area.

The Algonquin G-8 Replacement/Loop would pass primarily through pine barrens in Plymouth and Barnstable Counties, Massachusetts. This vegetation type consists of small, shrubby and crowded trees, dominated by white oak, scrub oak, pitch pine, and white pine.

Transco's proposed Compressor Station 167 and Emporia Metering Station would be within the Oak-pine forest region in Southern Virginia. This community is dominated by upland oaks and loblolly and shortleaf pines.

Nonforest vegetation in the proposed project area includes that found on agricultural and abandoned agricultural areas, cleared forestland, utility rights-of-way, and wetlands. Agricultural vegetation throughout the project area includes row crops (corn, wheat, soybeans), hay, and pasture land.

Vegetation on abandoned agricultural lands and utility rights-of-way consists of shrub and early successional forest species. Shrub species can include raspberries, blackberries, juniper, choke cherry, viburnums, and dogwoods. Tree species can include white pine, northern red cedar, white birch, and aspen.

Cleared forestland that is allowed to revegetate naturally usually contains raspberries, blackberries, and saplings of trees found in the overstory. In the northern hardwood zone, seedlings of most species that were present prior to cutting will appear within 1 to 2 years. The species that grow quickly in full sun (paper birch, choke cherry, aspen, balsam fir) tend to outgrow the slower shade-tolerant species (sugar maple, beech) and dominate the stand until they mature in about 15 - 20 years. Such regenerating stands have very high stem densities. If left undisturbed, the shade-tolerant species will outgrow the faster-growing species and eventually dominate the forest stand.

A small area of relic prairie grove would be crossed by the proposed Great Lakes Loops 1 and 2. This prairie is located on the banks of the Middle River (MP 54) in Marshall County, Minnesota. Characteristic tree species are burr oak, Hill's oak, American elm, box elder, wolfberry, and honeysuckle (Minnesota Environmental Quality Board, 1989).

Loop 4 of the proposed Great Lakes route would pass through the northern portion of Hole-in-the-Bog Peatland, in Cass County, Minnesota. This bog has been designated by the MNDNR as a watershed protection area and contains a vegetative community relatively unique to the region. Species characteristic of the bog include black spruce, sphagnum moss, and various shrubs.

Vegetation located along the Sturgeon River (MP 575.3, Loop 11) consists of the northern-most occurrence of the Silver Maple floodplain eco-system that is still relatively intact. This rare habitat is the basis for this area being a candidate Research Natural Area. The MIDNR Natural Features Inventory indicated the presence of a northern mesic forest natural area that would be crossed by Loop 12 in Mackinac County. This forest area is approximately 120 acres in size and consists primarily of beech and maple with some hemlock. It is a diverse and relatively undisturbed area located in the Cut River gorge (MP 657).

Loop 12 would also cross two areas of a vegetation type known as a wooded dune and swale complex, between MPs 664 and 675.1. The eastern complex is considered by the MIDNR as a significant natural area of 1,000 acres in size. It is currently under consideration by the FS to be classified as a Research Natural Area. The National Park Service (NPS) is also considering it for National Natural Landmark Classification. The western dune and swale complex is not as highly ranked by the MIDNR. The existing right-

of-way crosses at the northern edge of the western area, and through the eastern portion of the eastern-most area.

The type of vegetation found in these areas varies with the wetness of the soil. Wooded vegetation types range from swamp forest to pine/aspen. Herbaceous vegetation in the swale areas are mainly grass and sedge species, with some shrub willows and speckled alder (Weise and Albert, 1990).

4.1.7 Wetlands

Wetlands perform a number of important functions, including water quality improvement, flood and stormwater control, erosion control, recreation, and fish and wildlife habitat. Wetlands help to maintain water quality through the removal and retention of nutrients and the reduction of sediment loads. In their natural undisturbed condition, wetlands act as a temporary storage area for flood waters, protecting downstream areas from damage. The abundant vegetation associated with wetlands acts as the primary erosion deterrent, as root systems bind sediments and reduce wave action and current velocity.

A variety of recreational activities are associated with wetlands. Hunting and fishing are common sports that take place in and around wetlands. Additional activities include hiking, canoeing, bird watching, and photography. Inland wetlands provide breeding, migratory, and winter habitats for a number of birds, mammals, and fish.

The wetlands potentially affected by the proposed NIP Project facilities are all inland freshwater wetlands. The COE and the EPA define wetlands as:

> *Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (COE, 33 CFR 328.3 and EPA, 40 CFR 230.3).*

The U.S. Department of Agriculture Soil Conservation Service (SCS) and the FWS have similar definitions. The FWS definition includes vegetated and nonvegetated areas. All four Federal agencies include three basic parameters in their definitions for identifying wetlands: hydrology, vegetation, and soils (Federal Interagency Committee for Wetland Delineation, 1989).

The number and type of wetlands that would be crossed by the NIP Project were determined by examining the appropriate NWI maps. NWI maps do not exist, however, for Wisconsin and portions of New York and Michigan; therefore, state wetland or land use maps were used to determine wetlands crossed in portions of these states. Where required, the state classification of wetland cover types was converted to the NWI classification. The minimum size of wetlands that appear on these maps generally ranges from 0.5 to 2 acres. However, the Wisconsin state maps only show wetlands greater than 5 acres, and the New York state maps show wetlands of 12.4 acres or larger.

The proposed NIP Project facilities would cross 610 freshwater palustrine (shallow water) wetlands. The location and cover type of each wetland crossed is listed in table E−1 in appendix E. General types of wetlands that would be crossed include marshes and wet

meadows, deciduous shrub swamps, forested swamps, and small ponds. The distribution of these cover types varies throughout the proposed project area, due to differences in topography and natural vegetation zones. Table E-2 in appendix E summarizes the length of each wetland cover type that would be crossed by the proposed facilities.

4.1.7.1 Great Lakes

The proposed Great Lakes facilities would cross 84 miles of wetlands, as identified on the NWI and state maps. This includes 23.4 miles in Minnesota, 1.8 miles in Wisconsin, and 58.8 miles in Michigan. Wetlands make up approximately 18 percent of the total length of Great Lakes' proposed loops. Loops 11 and 10 would cross the greatest amount of wetlands, approximately 15.8 miles (34.6 percent of the loop) and 13.7 miles (37.9 percent of the loop) respectively. Loops 5, 4, and 6 would have the highest percentage of wetlands crossed, with 56.8, 49.2, and 49.2 percent respectively. This reflects the general abundance of wetlands in north-central Minnesota. Loop 14 would cross no mapped wetlands, and Loop 15 would traverse only 3.45 miles of wetland (8.8 percent of loop). Much of the area in the vicinity of these loops is in agricultural use. Loop 16 would also cross no mapped wetlands. However, wetland maps exist for only 19.1 miles of its proposed 51.4-mile length.

Several Minnesota-protected wetlands would be crossed by Loops 1, 2, and 3. Minnesota-protected wetlands have been designated as such by the MNDNR to protect their wetland functions. Major construction activity within these wetlands requires a MNDNR permit. Protected wetlands are generally emergent or shallow water marsh wetlands greater than 10 acres in size. Loops 1 and 2 would cross protected wetlands at MP 59.7, and between MP 62.8 and MP 63.3. Loop 3 would traverse a protected wetland at MP 125.4, where the loop would cross the outlet of Norway Lake.

The MNDNR identified four wetlands along Loop 3 that are a concern (MNDNR, 1989a). One of these is the protected wetland at MP 125.4 mentioned above. Three others (MPs 116.2, 118.7, and 126.8) would have crossing lengths greater than 1,000 feet.

A number of wetlands that would be crossed by Great Lakes' facilities are classified as bogs. Bogs are features of glaciated landscapes on which a specialized group of herbs, low shrubs, and trees grow on a wet, acidic soil composed of peat. Vegetation in bogs includes insectivorous plants, such as pitcher plant, plus sphagnum moss, black spruce, bog rosemary, blueberries, leatherleaf, tamarack, and white cedar. Bogs are also important for some animal species that are highly dependent on bog habitat. Some examples are bird species, such as the palm warbler, Lincoln's sparrow, the Connecticut warbler, and the great gray owl.

Hole-in-the-Bog Peatland is a large bog that would be crossed by Loop 4 (MP 182.3) in Cass County, Minnesota. The MNDNR has designated 3,164 acres of this bog as a watershed protection area. Of this, 1,622 acres make up the core area, which includes the most ecologically significant peatland features. The remaining 1,542 acres surrounding the core area include a sufficient peatland buffer. This buffer should ensure that development outside the watershed protection area would not significantly alter the hydrology of the peatland and disturb the core area (MNDNR, 1984). Loop 4 would traverse approximately 3,200 feet of the designated protection area, outside of the 1,622-acre core area.

Loop 12 would traverse an area of wooded dune and swale complex between MPs 664 and 675.1 known as the Pointe aux Chenes coastal wetland community. Several smaller forested and emergent swales would be crossed near the western end of this complex, and a large forested/scrub-shrub wetland would be crossed between MP 667.8 and MP 669.2. A large scrub-shrub/emergent marsh wetland would be crossed between MP 673.5 and MP 674.5.

Proposed Loop 15 would cross several wetlands within the Dead Stream Swamp between MP 778.8 and MP 780, within the Pere Marquette State Forest in Missaukee County, Michigan. These wetlands are predominantly mixed scrub-shrub/emergent. The Dead Stream Swamp represents one of the best examples of a large, relatively undisturbed northern white cedar swamp in the region. For this reason the NPS has designated portions of the swamp as a National Natural Landmark. Loop 15 would not cross portions of the Dead Stream Swamp that have been designated as a National Natural Landmark.

4.1.7.2 Tennessee

The proposed Tennessee facilities would cross palustrine wetlands at 25 locations, as identified on the NWI and New York state wetland maps. The most common cover types that would be crossed are broadleaved deciduous forest (PFO1) or deciduous forest dominated (PFO/SSI) wetlands. The remaining wetlands are emergent (PEM) or mixed emergent and scrub-shrub (PSSI/EM). One open water area is present in Segment 1. Most of these wetlands are seasonally flooded.

The NYDEC regulates freshwater wetlands larger than 12.4 acres. The New York state system establishes four separate classes that rank wetlands according to their ability to perform wetland functions and provide wetland benefits. Class I wetlands have the highest value.

Segment 1 at MP 230B-103+1.04 would cross the eastern edge of a New York state class I wetland (CL-11). The entire wetland is approximately 208 acres in size and consists mainly of deciduous and coniferous trees. The uniqueness of the area is attributed to the presence of northern white cedar, an evergreen tree not commonly found in Erie County. This wetland also provides habitat for a variety of wildlife species, including muskrat, deer, raccoon, mink, wood duck, and snipe, plus numerous reptiles, amphibians, and songbirds. (NYDEC, 1989b).

4.1.7.3 Algonquin

The proposed Algonquin facilities would cross 33 wetlands, as identified on NWI maps. Most of these wetlands are broadleaved deciduous forested or broadleaved deciduous scrub-shrub sites. Two open water wetlands are located along the proposed E-1 Loop, and one emergent marsh would be crossed by the G-5 Replacement.

4.1.7.4 Transco

A narrow, temporarily wet, broadleaved deciduous forested wetland would be crossed in Pennsylvania. This wetland is associated with a tributary to Little Bushkill Creek.

There are no NWI-mapped wetlands within the construction area of the proposed Compressor Station 205 in Mercer County, New Jersey. However, Transco has indicated that wetlands recognized by the NJDEP may be located within the proposed construction area.

4.1.7.5 Texas Eastern

No NWI-mapped wetlands would be crossed by Line No. 37 in Centre County, Pennsylvania.

4.1.7.6 CNG

The proposed CNG TL-470 Line in New York would cross the northern edge of Papscanee Marsh and Creek, a state-designated class I wetland. The Papscanee Marsh and Creek is designated by the NYDEC as a significant coastal fish and wildlife habitat. The proposed pipeline would also cross several wetlands that drain into this wetland complex. This habitat is primarily a floodplain wetland area, encompassing a large creek, emergent marshes, freshwater tributaries, old fields, and young woodlands. Papscanee Marsh and Creek has been subjected to considerable human disturbance as a result of agricultural use and nearby commercial and industrial developments (see sections 4.1.4.1 and 4.1.4.2).

4.1.7.7 National Fuel/Penn-York

The proposed Y-M54 Line would cross one wetland that is classified by the NWI as a palustrine impoundment with an unconsolidated bottom. This area is considered part of Rose Lake Run.

4.1.7.8 CNG/Texas Eastern

No wetlands would be traversed by the TL-403 Replacement in Erie County, New York.

4.1.8 Air Quality and Noise

4.1.8.1 Air Quality

Air quality can be affected by both pipeline construction and the operation of compressor stations. During pipeline construction, a temporary reduction in the local ambient air quality could result due to fugitive dust and emissions generated by construction equipment. This short-term impact would occur only in proximity to the pipeline right-of-way. As construction is completed, the fugitive emissions would subside; thus the length of time any one area would be exposed to concentrations would be limited. After the pipeline is built, nitrogen oxide (NO_x) would be the primary air pollutant emitted by the compression facilities. Tennessee, Algonquin, Transco, CNG, National Fuel/Penn-York, and CNG/Texas Eastern propose to add compression at existing stations in New Jersey, New York, Pennsylvania, and Rhode Island. Transco proposes to construct new compressor stations in Mercer County, New Jersey, and in Mecklenburg County, Virginia. National Fuel/Penn-York propose to construct a new compressor station in Erie County, New York.

4.1.8.1.1 Regulatory Requirements

Ambient air quality is protected by Federal and state regulations. The EPA has developed ambient standards for certain criteria air pollutants. These standards are referred to as the NAAQS. The primary and secondary NAAQS for nitrogen dioxide (NO_2) concentrations are both 100 micrograms per cubic meter. Air quality standards for each state cannot be less stringent than the NAAQS. New York, Pennsylvania, Rhode Island, New Jersey, and Virginia have established ambient air quality standards for NO_2 that are identical to the NAAQS.

Existing ambient air quality is also protected by EPA's Prevention of Significant Deterioration (PSD) regulations. These regulations are intended to preserve the existing air quality in areas where pollutant levels are below the NAAQS. PSD regulations impose specific limits to the amount that new or modified stationary sources may contribute to existing air quality levels. An air pollutant point source that is subject to PSD review is required to submit a review of existing air quality, use modeling analyses to demonstrate compliance with the NAAQS and applicable increments, apply BACT, and include an analysis of the general impact on the environment.

In addition to Federal regulations, New York, Pennsylvania, Rhode Island, and Virginia have state air quality regulations. New York requires a permit to construct and a certificate to operate pursuant to 6 NYCRR, Part 201. Pennsylvania requires a plan approval prior to construction and a permit to operate pursuant to Chapter 127, Subchapter A, of the Pennsylvania Air Quality Regulations. Rhode Island requires a permit to construct, install, or modify any source or air pollution system prior to construction and an approved operating permit pursuant to Rhode Island Air Pollution Control Regulation No. 9. Virginia requires a permit for new and modified sources pursuant to Virginia State Air Pollution Control Board Regulations for the Control and Abatement of Air Pollution; Part VIII.

4.1.8.1.2 Ambient Air Quality

New Jersey

Transco's proposed Compressor Station 205 would be located in Mercer County, New Jersey. Mercer County is included in the metropolitan Philadelphia (Pennsylvania-New Jersey-Delaware) Interstate Air Quality Control Region. Ambient air concentrations in the vicinity of the proposed compressor station location meet (or are unclassified and presumed to meet) all NAAQS except for ozone. Ozone nonattainment is a regional problem and EPA is researching the situation to develop effective control measures.

The proposed Compressor Station 205 would be electric-powered and no air emissions are anticipated. Because of this, no further air quality analysis of Compressor Station 205 is described herein.

New York

Construction of the new Concord compressor station and the installation of additional compressor units at two existing stations (Utica and 230C) are proposed in New York.

New York operates an air quality monitoring network to measure ambient concentrations of the NAAQS criteria pollutants. The proposed NIP Project facilities are located in the rural regions of this state. These regions are considered to be (or are unclassified and presumed to be) in attainment for all the NAAQS criteria pollutants. The NYDEC estimates the ambient background NO_2 levels in the vicinity of Tennessee's Compressor Station 230C and CNG's Utica Compressor Station to be approximately 22 micrograms per cubic meter. Ambient background NO_2 levels in the vicinity of National Fuel/Penn-York's proposed Concord Compressor Station are estimated to be approximately 11 micrograms per cubic meter.

Compressor Station 230C and the Concord Compressor Station would emit pollutant levels of NO_x below EPA-significant levels and, therefore, would not be subject to Federal PSD requirements but would be subject to state requirements. Utica Compressor Station would emit pollutant levels of NO_x above EPA significant levels and would, therefore, be subject to both Federal PSD review and state requirements.

Pennsylvania

The installation of additional compressor units at three existing stations (Ellisburg, State Line, and 515) is proposed in Pennsylvania.

Pennsylvania operates a statewide air monitoring network to measure ambient levels of NO_2. Monitoring data indicate that the entire state is in attainment for NO_2, with levels that are approximately half the NAAQS. The three NIP Project facilities are located in rural regions of this state.

Transco's Compressor Station 515 is located in rural Luzerne County, Pennsylvania. This region is considered to be in attainment for all NAAQS except for ozone. Based on published data (EPA, 1978), the ambient background NO_2 concentrations in the vicinity of Compressor Station 515 are approximately 20 micrograms per cubic meter. The proposed installation of additional compression at Compressor Station 515 would cause emission of pollutant levels of NO_x below EPA-significant levels and consequently the station would not be subject to Federal PSD requirements but would be subject to state requirements.

National Fuel/Penn-York's Ellisburg Compressor Station is located in a rural area in Potter County, Pennsylvania. This region is considered to be in attainment for all NAAQS. The proposed installation of additional compression to the Ellisburg Compressor Station would cause emission of pollutant levels of NO_x above EPA-significant levels and consequently the station would be subject to Federal PSD requirements. In April 1988, National Fuel instituted an onsite monitoring program at the Ellisburg Compressor Station as part of a PSD monitoring requirement for a 6,000-hp expansion under development at the time. The 1-year monitoring program measured the ambient NO_2 concentrations at a nearby monitoring station equipped with a Thermo Electron Model 14B/E NO/NO_x monitor and 10-meter meteorological tower. The results of the monitoring program show an annual average NO_2 concentration of 20 micrograms per cubic meter. This is considered to be representative of background air quality in the area of the Ellisburg Compressor Station.

Both CNG and CNG/Texas Eastern are proposing to add compression at the State Line Compressor Station located in rural Potter County. This region has been designated as an attainment area for all NAAQS criteria pollutants. The proposed installation of

additional compression at the existing State Line Compressor Station would cause emission of pollutant levels of NO_x below EPA-significant levels so the station would not be subject to Federal PSD requirements but would be subject to state requirements.

Rhode Island

The installation of one additional compressor unit at the Burrillville Compressor Station is proposed in Rhode Island.

RIDEM operates a statewide monitoring network to measure ambient levels of NO_2. RIDEM estimates the annual average ambient background NO_2 levels in the Burrillville area to be approximately 49 micrograms per cubic meter. Algonquin's Burrillville Compressor Station is located in a rural area of Providence County, Rhode Island, and is part of the Metropolitan Providence Interstate Air Quality Control Region. Monitoring data indicate the area in the vicinity of the Burrillville Compressor Station is in attainment for all criteria pollutants except ozone. The proposed installation of additional compression at the Burrillville Compressor Station would cause emission of pollutant levels of NO_x above EPA-significant levels and consequently the station would be subject to Federal PSD requirements.

Virginia

Transco's proposed Compressor Station 167 would be located in Mecklenburg County, Virginia. Mecklenburg County is included in the Central Virginia Intrastate Air Quality Control Region (Virginia Region 3). Ambient air concentrations in the vicinity of the proposed compressor station location meet (or are unclassified and presumed to meet) all NAAQS. The proposed Compressor Station 167 would emit pollutant levels of NO_x below EPA significant levels and would, therefore, not be subject to Federal PSD requirements but would be subject to state requirements.

4.1.8.2 Noise

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 commonly 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 (Leq(24)) and the day-night sound level (Ldn). The Leq(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 Ldn is the Leq(24) with a 10 dBA weighting applied to nighttime sound levels between the hours of 10 p.m. and 7 a.m., to account for people's greater sensitivity to sound during nighttime hours.

Noise associated with pipeline construction activities would be intermittent and brief at any single location. Neighbors may sometimes hear the construction noise, but the overall impact would be temporary. Nighttime noise would normally be unaffected, as most construction would be limited to daylight hours. Therefore, it is unnecessary to provide an analysis of the existing ambient sound levels along the pipeline rights-of-way. During project operation, the noise impact would be limited to the vicinity of the proposed new and additional compression facilities. The existing acoustic environment near the proposed new and additional compression facilities is described below and in table 4.1.8-1.

TABLE 4.1.8-1

Noise-Sensitive Receptors Nearest to the Proposed NIP Project Compressor Stations

Station/Receptor	Dist. From Existing Compr. Bldg. a/ (feet)	Est. Existing Ldn (dBA)
• Tennessee		
Station 230C		
Residence (E)	2,100	63
• Algonquin		
Burrillville		
Residence (NE)	2,000	57
• Transco		
Station 205		
Residence (E)	1,380 b/	40
Station 515		
Residence (SW)	950	51 c/
Station 167		
Residence (N)	1,000 b/	45
• CNG		
State Line (W)		
Residence	860	51
Utica		
Residence (NW)	1,050	56
• National Fuel/Penn-York		
Concord		
Residence (S)	2,250 b/	56
Ellisburg		
Residence (SW)	1,600	53
• CNG/Texas Eastern		
State Line		
Residence (W)	860	51

a/ Approximate distance from existing compressor building to residence, unless noted otherwise.
b/ No existing compressor -- approximate distance from site of proposed building to residence.
c/ Consistent minimum sound level.

Sources: APEC Project EA, TEMCO Project EA, Tennessee, Transco, CNG, National Fuel/Penn-York, and CNG/Texas Eastern.

Tennessee

Station 230C is an existing 4,500-hp compressor station located in a generally agricultural area along Lockport Junction Road, approximately 2 miles west of Lockport, New York, in Niagara County. The compressor building is located approximately 2,000 feet from the roadway. A Conrail line and State Route 31 (SR 31) are located approximately 1,000 feet and 3,500 feet south of the compressor, respectively. A Harrison Radiator manufacturing facility is located approximately 1,500 feet southeast of the proposed compressor building. A salvage yard and a large bus garage are located approximately 500 to 1,000 feet south of the site along Lockport Junction Road. The nearest residence, shown in figure 4.1.8-1, is approximately 2,100 feet east of the proposed compressor building. The site is immediately surrounded to the north, east, and west by idle and cultivated land. Ambient sound levels were measured in the vicinity of the station site (Tennessee Gas Pipeline Company, September 24, 1987). At the location of the nearest noise-sensitive receptor, the measured Ldn was about 63 dBA, due primarily to traffic not the compressor station.

Algonquin

The existing three-unit Burrillville Compressor Station currently includes 8,100 hp of compression located about 2,000 feet west of SR 100 in a rural area of Burrillville, Rhode Island, in the northwest corner of Providence County. Nearby residences are located along SR 100. The nearest home, as shown in figure 4.1.8-2, is located approximately 2,000 feet northeast of the existing compressor building. Other homes and a state forest are located somewhat further from the station. Brief measurements of the existing ambient acoustic environment were obtained for Algonquin in the vicinity of the nearest home during the early morning of October 31, 1989, with and without the existing compressor station operating. The equivalent Leq was 57 dBA, due primarily to traffic along SR 100. Operation of the existing units is reported to have little or no effect on the measured Leq near the local homes. The nighttime Leq was estimated to be about 47 dBA. The Ldn was estimated by Algonquin to be 57 dBA.

Transco

The proposed site for Station 205 is located in a rural agricultural area of woodlands and abandoned fields between Cold Soil Road and Stony Brook in Mercer County, New Jersey. The nearest noise-sensitive receptor is located in a new residential subdivision along Poe Road about 1,380 feet east of the proposed station (see figure 4.1.8-3). The existing baseline ambient Ldn was estimated to be no higher than about 40 to 45 dBA, based on the rural nature of the area surrounding the site.

Compressor Station 515, located about 650 feet northeast of State Highway 115 in a rural area of Luzerne County, Pennsylvania, currently includes 17,000 hp of reciprocating engine driven compression. The closest home, identified in figure 4.1.8-4, is located about 950 feet southwest of the station. Measurements of the existing baseline ambient sound levels were about 51 to 52 dBA (consistent minimum values) near the closest home, due to traffic along State Highway 115. The Ldn was not reported.

Niagara County, NY.

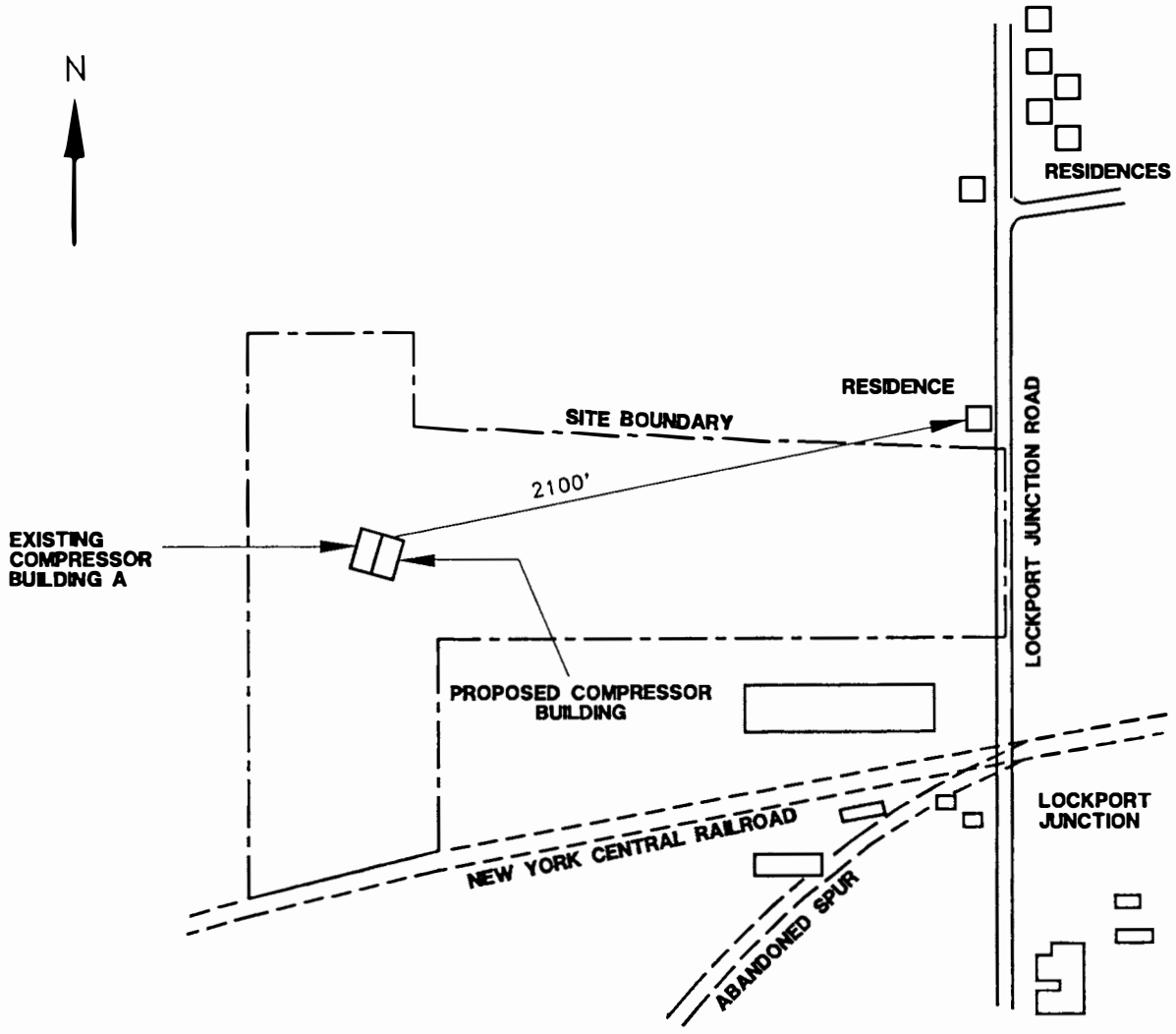


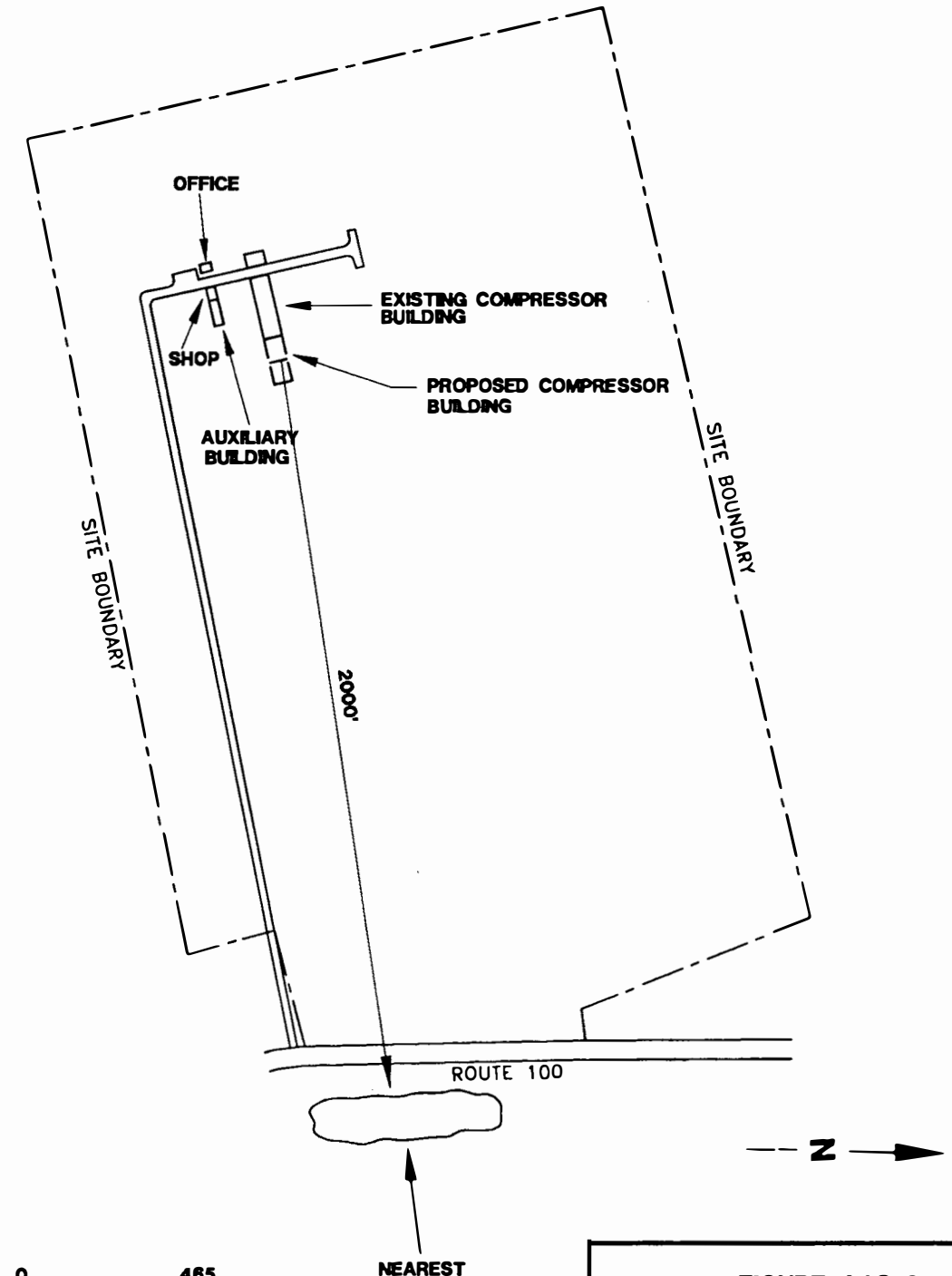
FIGURE 4.1.8-1

COMPRESSOR STATION 230C

SCALE AS SHOWN

DWG: COMP003

PROVIDENCE COUNTY, RHODE ISLAND



DWG: COMP007

FIGURE 4.1.8-2

BURRILLVILLE COMPRESSOR STATION

SCALE AS SHOWN

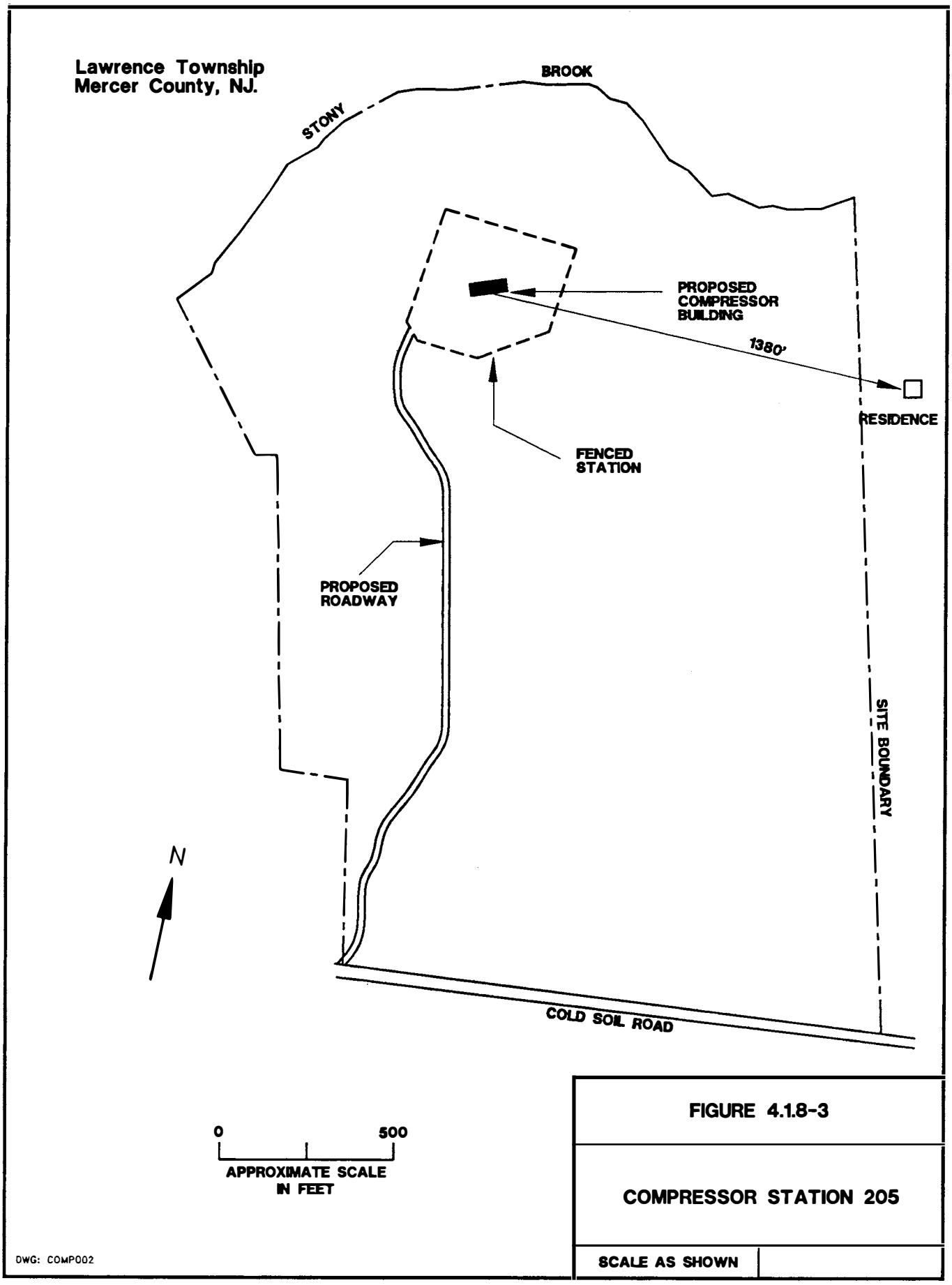


FIGURE 4.1.8-3

COMPRESSOR STATION 205

SCALE AS SHOWN

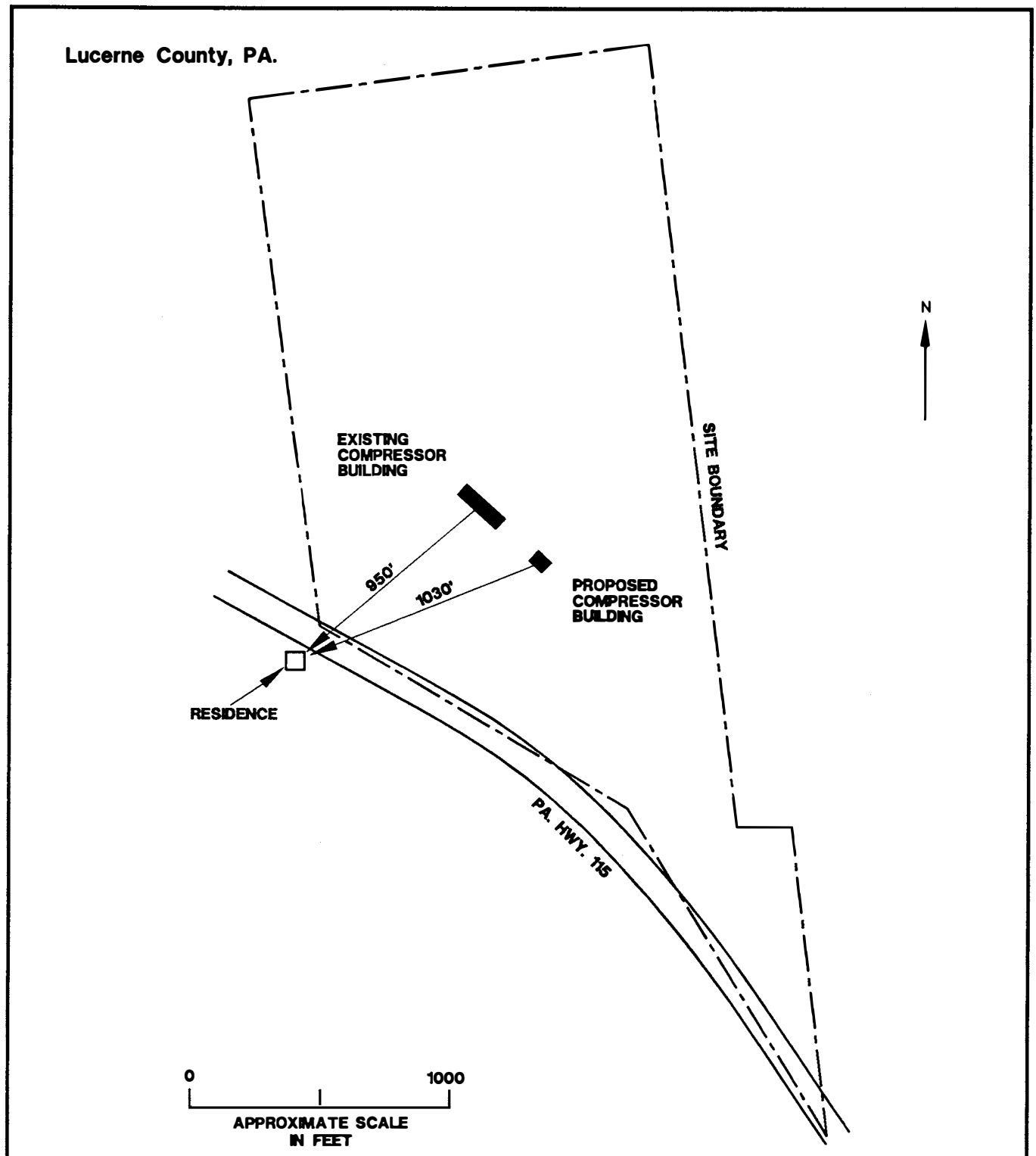


FIGURE 4.1.8-4

COMPRESSOR STATION 515

SCALE AS SHOWN

DWG: COMP001

The proposed site for Station 167 is located in a rural area along the east side of Virginia SR 637, about 3 miles north of the community of South Hill, within Mecklenburg County, Virginia. The existing site has been partially developed with gas metering, regulation, maintenance, and warehouse facilities. The general area of the site includes rural farms and woodlands. The closest home, identified in figure 4.1.8-5, is located along the west side of Route 637, about 1,000 feet north of the proposed station. The existing baseline ambient Ldn was estimated to be in the range of about 45 to 55 dBA or lower, based on the rural nature of the area surrounding the site.

CNG

The State Line Compressor Station, located in a rural area of mixed woods and trees, is approximately 2,000 feet south of the New York state line and 0.5 mile east of Kinney, Pennsylvania, within Potter County. Currently CNG is constructing 1,100 hp of compression approved as part of the Associated PennEast Customer Group (APEC) Project. Widely spaced residences border the local road network, as shown in figure 4.1.8-6. The nearest home is located 860 feet west of the compressor building. CNG has estimated the ambient Ldn at the nearest home at about 51 dBA, attributable to the compressor under construction. Other nearby homes are located 1,000 feet south and 1,150 feet north and south of the compressor building. Ambient sound level measurements obtained for CNG on March 30, 1990, have not been used because prevailing weather conditions rendered the results questionable.

The Utica Compressor Station includes five 1,000-hp reciprocating engine driven compressors located in a rural area about 400 feet north of Higby Road and 0.5 mile northwest of Stewart Corners, New York. The nearest home to the existing compressor building not owned by CNG is located about 1,050 feet to the northwest of the existing compressor building (see figure 4.1.8-7). CNG indicates that the noise from the now operating compressor station dominates the acoustic environment in this rural area and estimates that the existing Ldn at the nearest home is 56 dBA, based on intake and exhaust noise-level specifications of the five existing engines. Measured data of the existing acoustic environment were not provided.

National Fuel/Penn-York

The proposed site for the new Concord Compressor Station is located in a rural residential and agricultural area centrally located between New Oregon and Wyandale Roads and about 3,000 feet north of Genesee Road in Concord, New York. Nearby land uses include woodlands, agricultural fields, and numerous residences along local roads. The nearest residence is located approximately 2,250 feet south of the proposed compressor building (see figure 4.1.8-8). Other homes are located along local roads and are farther from the proposed site. Brief measurements of the existing ambient acoustic environment were taken by National Fuel/Penn-York in the vicinity of the nearest home during August 1988. The results of these measurements confirm that light traffic and local insects produce residual L90 in the range of 46 to 48 dBA and equivalent Leq in the range of 49 to 54 dBA. The Ldn was approximately 56 dBA during the measurement survey.

The Ellisburg Compressor Station is located along the north side of Route 224 in Andrews Settlement within Potter County, Pennsylvania. Nearby land uses are primarily

Mecklenberg County, Virginia

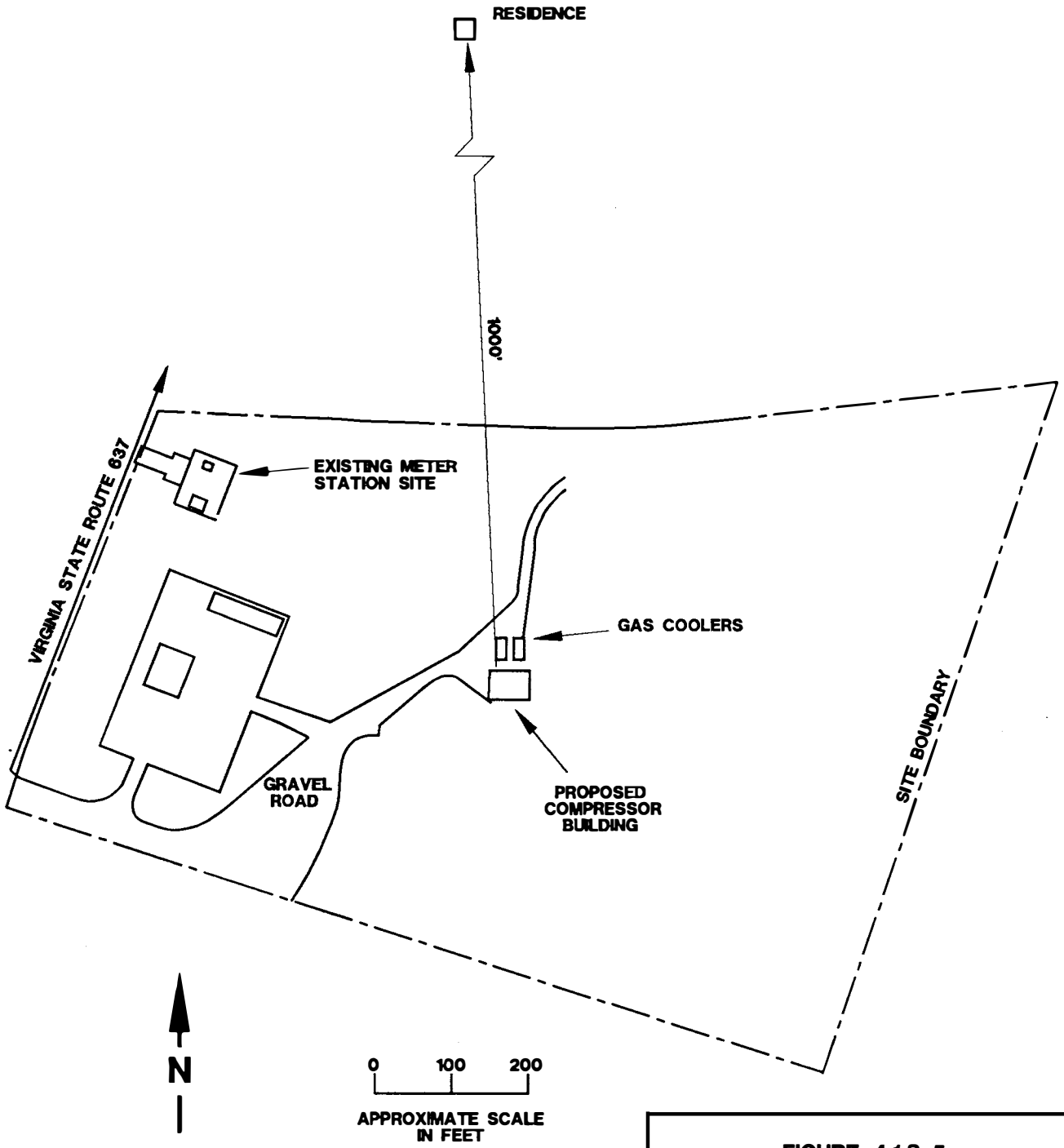


FIGURE 4.1.8-5

COMPRESSOR STATION 167

SCALE AS SHOWN

DWG: COMP009

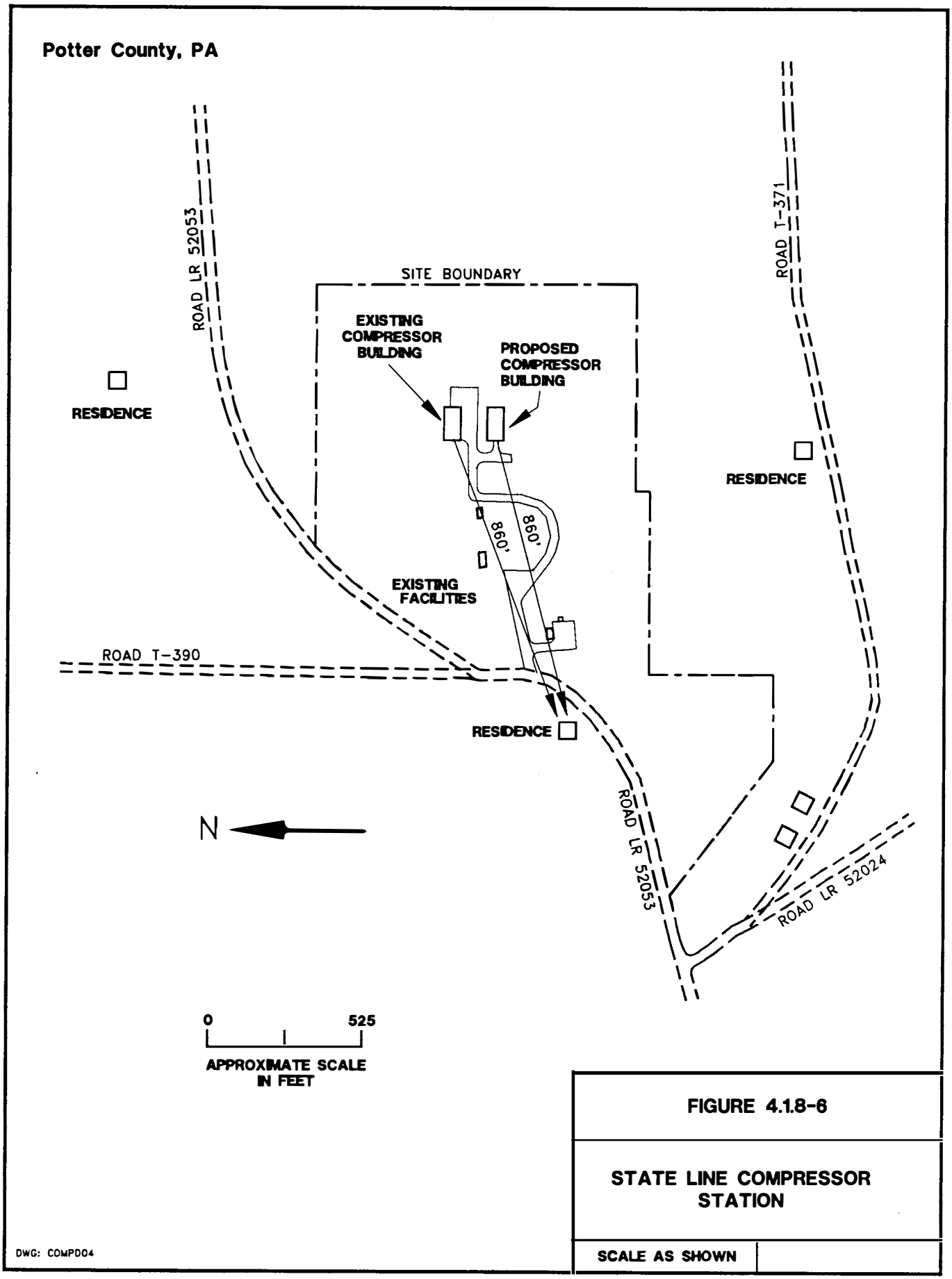


FIGURE 4.1.8-6

STATE LINE COMPRESSOR STATION

SCALE AS SHOWN

Herkimer County, New York

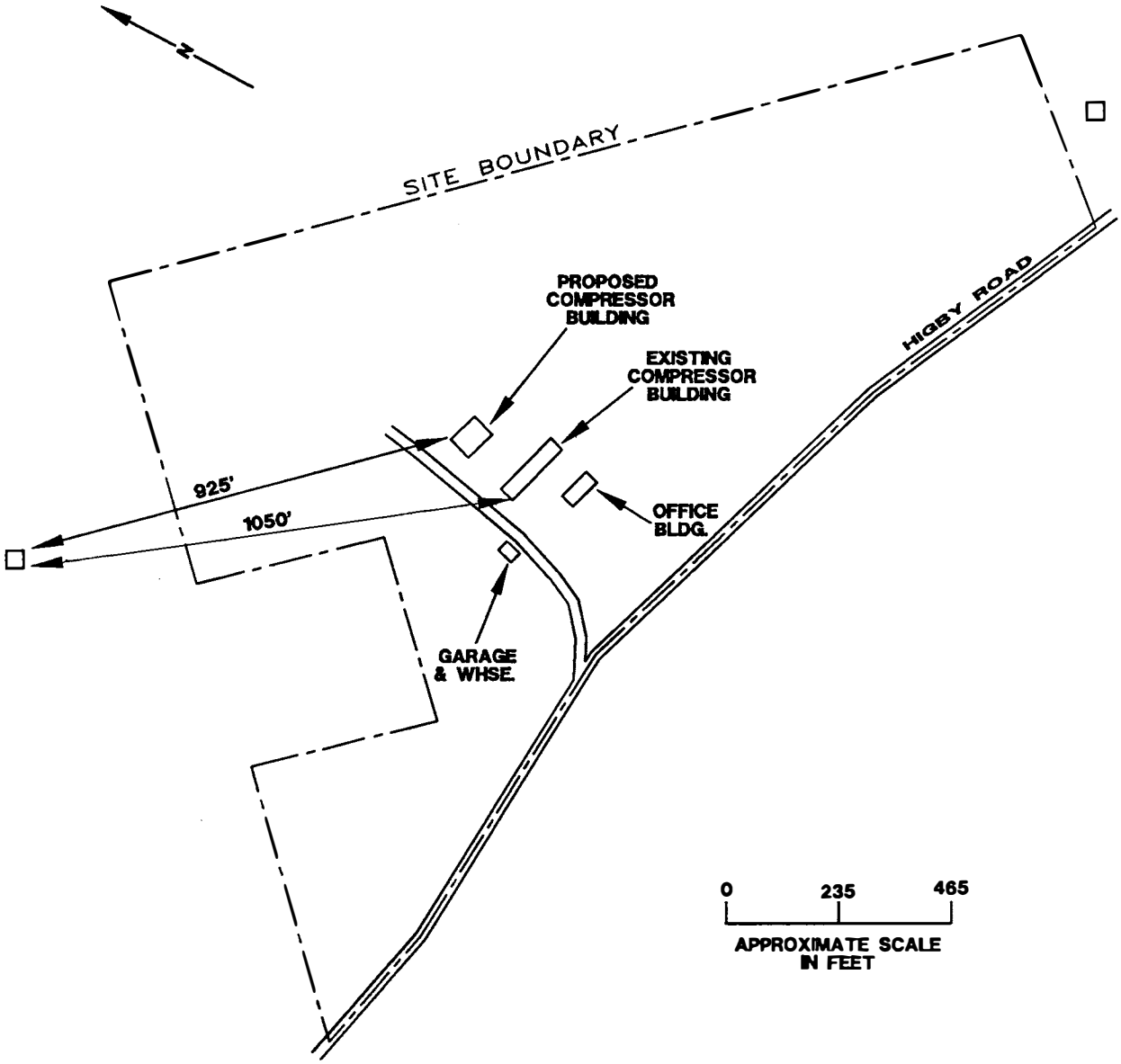


FIGURE 4.1.8-7

UTICA COMPRESSOR STATION

SCALE AS SHOWN

DWG: COMP008

Town of Concord, Erie County, New York

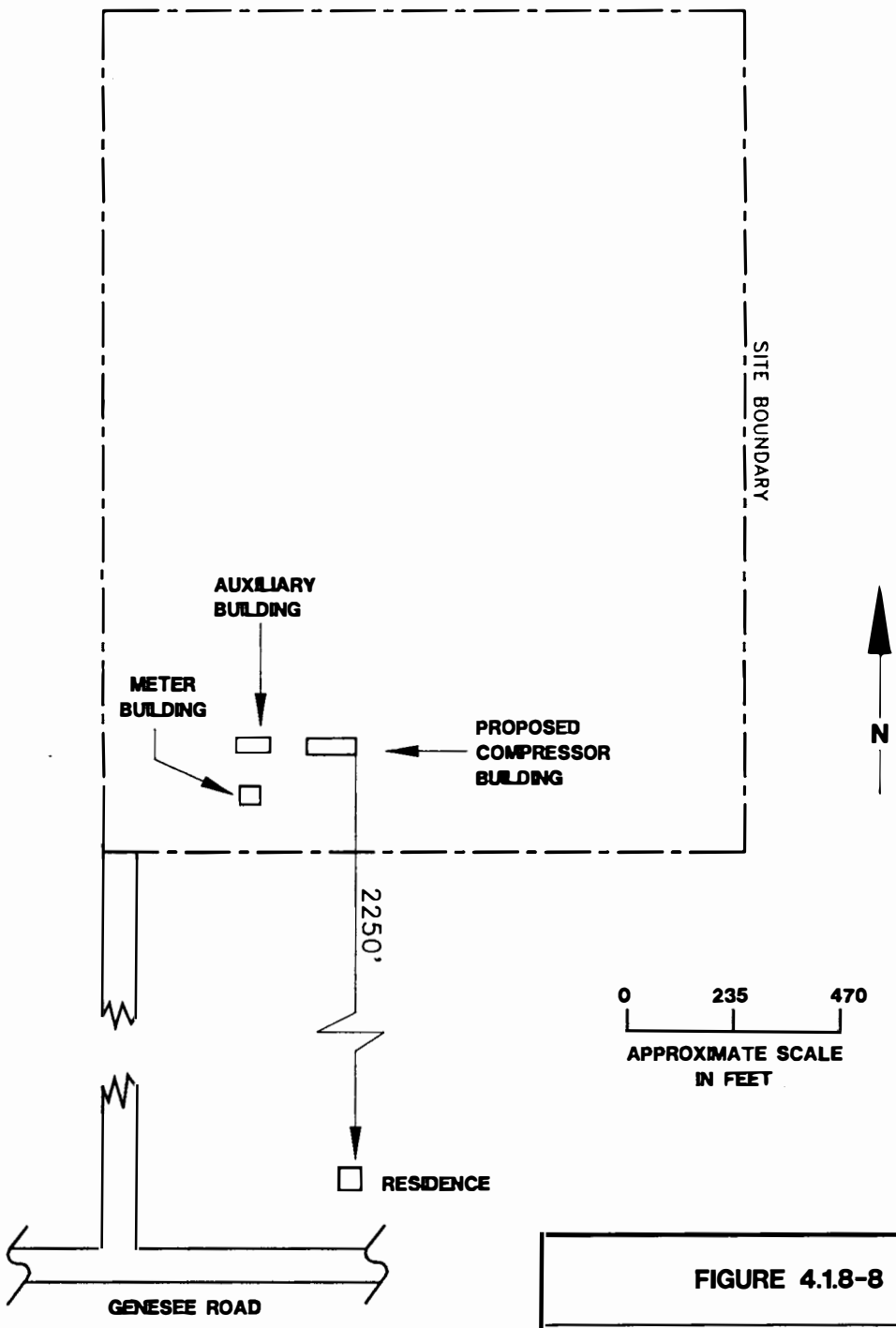


FIGURE 4.1.8-8

CONCORD COMPRESSOR STATION

SCALE AS SHOWN

DWG: COMP005

agricultural including cropland, dairy pastures, farm homesteads, single family homes, and camps. The nearest noise-sensitive receptor is a home located 1,600 feet southwest of the existing compressor building (see figure 4.1.8-9). The next closest receptors include about a dozen homes and the Union Church located in the Andrews Settlement, more than 3,000 feet to the east. A residence that was located within about 225 feet of the station no longer exists. The Ldn at the nearest home is estimated to be about 53 dBA, assuming the operation of a 6,000-hp compressor authorized in the TEMCO Project.

CNG/Texas Eastern

The applicants propose to add 2,200 hp of compression at the State Line Compressor Station adjacent to CNG's proposed compressor addition, discussed previously.

4.1.9 Land Use, Recreation, and Public Interest Areas

4.1.9.1 Land Use

4.1.9.1.1 Pipeline Facilities

The proposed NIP Project would consist of 527.7 miles of pipeline looping, 11.8 miles of pipeline replacement, and 5.2 miles of new pipeline sited through nine states. All of the proposed pipeline facilities would be located adjacent to or within existing pipeline rights-of-way except for 2.7 miles of new pipeline that would be located adjacent to or within a powerline right-of-way for nearly its entire length. Most of the proposed pipeline facilities would be located in Michigan (62 percent) with the remainder distributed in Minnesota (14 percent), Wisconsin (8 percent), New York (7 percent), Massachusetts (4 percent), Pennsylvania (3 percent), Connecticut (1 percent), and New Jersey and Rhode Island (1 percent).

Table 4.1.9-1 tabulates the lengths of land use categories that would be crossed by the proposed NIP Project pipeline facilities. Woodland accounts for 45 percent of the land uses that would be crossed, agriculture for 27 percent, other lands for 27 percent, and residential and commercial/industrial for the remaining 1 percent. Woodland is the largest existing land use category in five of the states that would be traversed by the proposed pipelines. Agriculture land predominates in New York and Pennsylvania, and scrub-shrub lands predominate in Minnesota.

Table 4.1.9-1 also lists the number of homes within 50 feet of the proposed pipeline construction right-of-way. Generally, residential development is characterized by scattered rural residences and farms located primarily at road crossings. Exceptions do occur along portions of five of the proposed pipeline loops in Massachusetts, Connecticut, and Rhode Island. In these areas, the proposed pipelines would cross through or adjacent to existing residential subdivisions.

Great Lakes

Great Lakes proposes to loop 459.6 miles of existing mainline distributed in Minnesota (17 percent), Wisconsin (9 percent), and Michigan (74 percent). Topography is generally flat to gently rolling. Forests interspersed with large wetland, marsh, and bog areas

Potter County, Pennsylvania

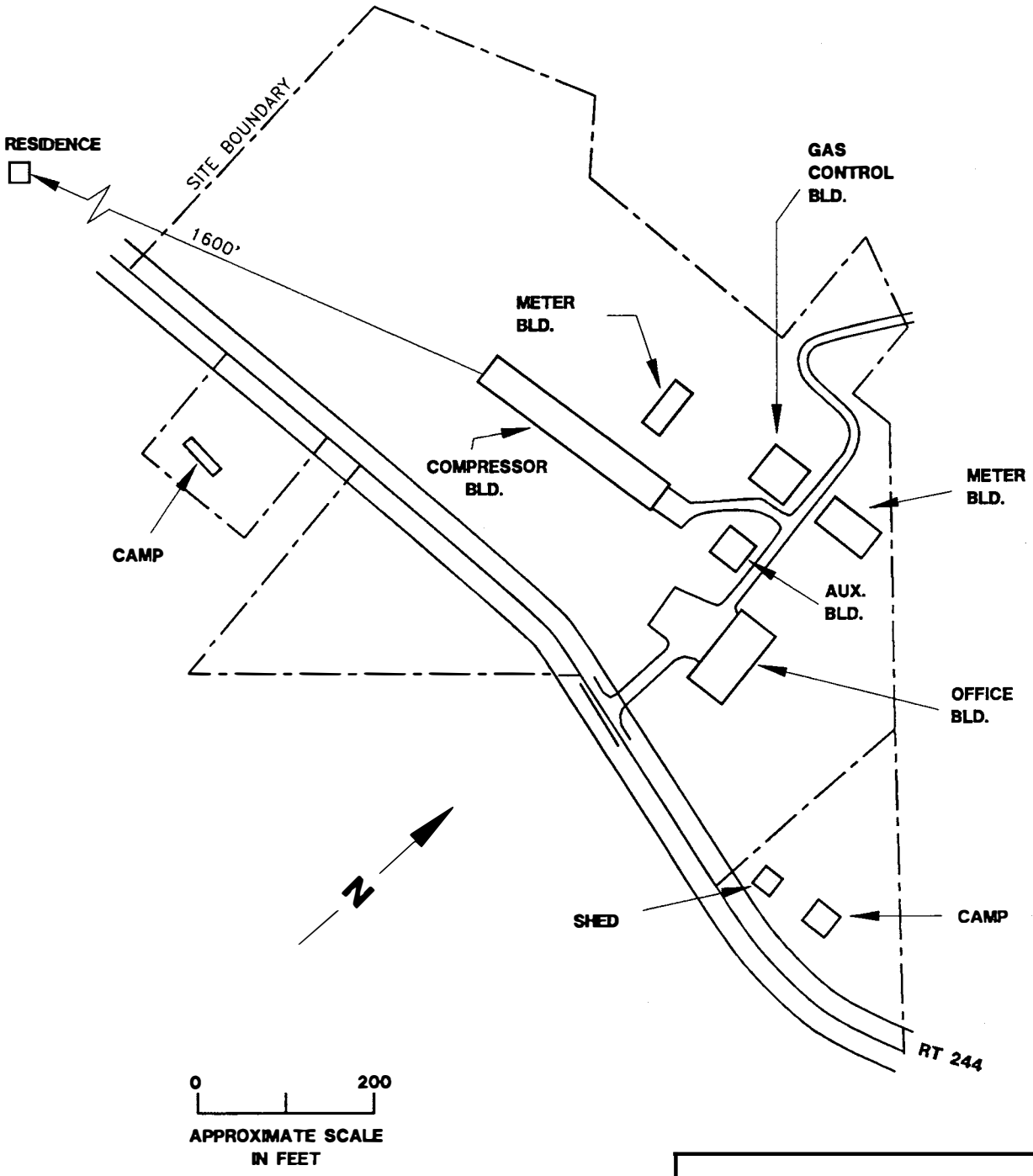


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FIGURE 4.1.9-9

ELLISBURG COMPRESSOR STATION

SCALE AS SHOWN

TABLE 4.1.9-1

Land Use Characteristics That Would Be Crossed
by the Proposed NIP Project Pipeline Facilities

Pipeline Segment/State	Woodland a/ (miles)	Woodland a/ (%)	Agriculture b/ (miles)	Agriculture b/ (%)	Residential c/ (miles)	Residential c/ (%)	Commercial/ Industrial d/ (miles)	Commercial/ Industrial d/ (%)	Other e/ (miles)	Other e/ (%)	Total (miles)	Homes w/in 50 ft of Construction ROW
GREAT LAKES	213.9	46.5	110.9	24.1	0.0	0.0	0.0	0.0	134.8	29.3	459.6	31
Minnesota	28.1	36.6	18.0	23.4	0.0	0.0	0.0	0.0	30.7	40.0	76.8	1
Loop 1	0.1	1.8	5.5	98.2	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0
Loop 2	1.5	12.3	4.0	32.8	0.0	0.0	0.0	0.0	6.7	54.9	12.2	0
Loop 3	7.4	34.7	6.7	31.5	0.0	0.0	0.0	0.0	7.2	33.8	21.3	0
Loop 4	8.2	43.2	0.0	0.0	0.0	0.0	0.0	0.0	10.8	56.8	19.0	0
Loop 5	3.3	84.6	0.5	12.8	0.0	0.0	0.0	0.0	0.1	2.6	3.9	0
Loop 6	7.6	51.4	1.3	8.8	0.0	0.0	0.0	0.0	5.9	39.9	14.8	1
Wisconsin	20.8	48.8	14.0	32.9	0.0	0.0	0.0	0.0	7.8	18.3	42.6	0
Loop 7	13.5	50.0	9.5	35.2	0.0	0.0	0.0	0.0	4.0	14.8	27.0	0
Loop 8	7.3	46.8	4.5	28.8	0.0	0.0	0.0	0.0	3.8	24.4	15.6	0
Michigan	165.0	48.5	78.9	23.2	0.0	0.0	0.0	0.0	96.3	28.3	340.2	30
Loop 8	9.9	47.1	6.1	29.0	0.0	0.0	0.0	0.0	5.0	23.8	21.0	1
Loop 9	34.3	83.1	0.4	1.0	0.0	0.0	0.0	0.0	6.6	16.0	41.3	0
Loop 10	19.4	53.9	2.9	8.1	0.0	0.0	0.0	0.0	13.7	38.1	36.0	2
Loop 11	19.6	43.0	5.5	12.1	0.0	0.0	0.0	0.0	20.5	45.0	45.6	6
Loop 12	26.1	84.7	0.0	0.0	0.0	0.0	0.0	0.0	4.7	15.3	30.8	0
Loop 13	13.5	42.3	6.0	18.8	0.0	0.0	0.0	0.0	12.4	38.9	31.9	5
Loop 14	7.8	48.1	3.2	19.8	0.0	0.0	0.0	0.0	5.2	32.1	16.2	2
Loop 15	20.4	52.0	3.9	9.9	0.0	0.0	0.0	0.0	14.9	38.0	39.2	1
Loop 16	9.7	18.9	33.5	65.2	0.0	0.0	0.0	0.0	8.2	16.0	51.4	10
Loop 17	4.3	16.0	17.4	64.9	0.0	0.0	0.0	0.0	5.1	19.0	26.8	3
TENNESSEE	11.3	27.0	22.7	54.2	2.3	5.5	0.6	1.4	5.0	11.9	41.9	56
New York	7.3	21.9	20.7	62.2	0.7	2.1	0.4	1.2	4.2	12.6	33.3	8
Segment 1	5.3	31.0	8.6	50.3	0.4	2.3	0.4	2.3	2.4	14.0	17.1	4
Segment 2	0.1	20.0	0.1	20.0	0.0	0.0	0.0	0.0	0.3	60.0	0.5	0
Segment 3	1.2	37.5	1.7	53.1	0.0	0.0	0.0	0.0	0.3	9.4	3.2	3
Segment 4	0.7	5.6	10.3	82.4	0.3	2.4	0.0	0.0	1.2	9.6	12.5	1
Massachusetts	4.0	46.5	2.0	23.3	1.6	18.6	0.2	2.3	0.8	9.3	8.6	48
Segment 8	2.8	51.9	0.6	11.1	1.2	22.2	0.2	3.7	0.6	11.1	5.4	40
Segment 9	1.2	37.5	1.4	43.8	0.4	12.5	0.0	0.0	0.2	6.3	3.2	8
ALGONQUIN	14.7	60.7	0.3	1.2	3.3	13.6	0.6	2.5	5.3	21.9	24.2	59
Massachusetts	9.9	61.5	0.2	1.2	1.8	11.2	0.0	0.0	4.2	26.1	16.1	35
G-5 Replacement	3.0	54.5	0.2	3.6	1.1	20.0	0.0	0.0	1.2	21.8	5.5	5
G-8 Replacement/Loop	4.3	77.2	0.0	0.0	0.6	10.9	0.0	0.0	0.6	10.9	5.5	24
Medfield Loop	1.6	48.5	0.0	0.0	0.1	3.0	0.0	0.0	1.6	48.5	3.3	4
H-1 Replacement	1.0	55.6	0.0	0.0	0.0	0.0	0.0	0.0	0.8	44.4	1.8	2
Connecticut	4.1	68.3	0.1	1.7	0.8	13.3	0.5	8.3	0.5	8.3	6.0	9
E-1 Loop	3.0	61.2	0.1	2.0	0.8	16.3	0.5	10.2	0.5	10.2	4.9	9
Chaplin Loop	1.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0
Rhode Island												
Tiverton Loop	0.7	33.3	0.0	0.0	0.7	33.3	0.1	4.8	0.6	28.6	2.1	15

TABLE 4.1.9-1 (cont'd)

Pipeline Segment/State	Woodland a/ (miles)	(%)	Agriculture b/ (miles)	(%)	Residential c/ (miles)	(%)	Commercial/ Industrial d/ (miles)	(%)	Other e/ (miles)	(%)	Total (miles)	Homes w/in 50 ft of Construction ROW
TRANSCO	2.1	25.0	6.1	72.6	0.2	2.4	0.0	0.0	0.0	0.0	8.4	1
Pennsylvania	2.0	24.1	6.1	73.5	0.2	2.4	0.0	0.0	0.0	0.0	8.3	1
1.61-Mi Leidy Loop	0.8	50.0	0.6	37.5	0.2	12.5	0.0	0.0	0.0	0.0	1.6	0
6.79-Mi Leidy Loop	1.2	17.9	5.5	82.1	0.0	0.0	0.0	0.0	0.0	0.0	6.7	1
New Jersey	0.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0
6.79-Mi Leidy Loop	0.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0
TEXAS EASTERN												
Pennsylvania Line No. 37	1.9	38.0	3.0	60.0	0.0	0.0	0.1	2.0	0.0	0.0	5.0	1
CNG												
New York TL-470 Line	1.5	55.6	0.6	22.2	0.0	0.0	0.5	18.5	0.1	3.7	2.7	0
NATIONAL FUEL/ PENN-YORK												
Pennsylvania Y-M54 Line	1.4	56.0	0.5	20.0	0.0	0.0	0.0	0.0	0.6	24.0	2.5	0
CNG/ TEXAS EASTERN												
New York TL-403 Replacement	0.0	0.0	0.4	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0
TOTAL	246.8	45.3	144.4	26.5	5.8	1.1	1.8	0.3	145.9	26.8	544.7	148

a/ Includes deciduous, coniferous, mixed forest, and forested wetland stands.
b/ Includes cropland, pasture, orchards, and nurseries.
c/ Includes rural residences, subdivisions, and yards.
d/ Includes retail/wholesale areas, manufacturing, and utility areas.
e/ Includes large water bodies, nonforested wetlands, undeveloped brush land, golf courses, municipal properties, and roads.

are the predominant existing land use. Agricultural land, primarily cropland, accounts for 110.9 miles of the total land uses that would be crossed, approximately half of which is located along Loops 16 and 17 in southeastern Michigan. The remaining agricultural land is primarily located along Loops 1, 2, and 3 in north-central Minnesota, Loops 7 and 8 in northwest Wisconsin, and Loop 9 in the northwest of the upper peninsula of Michigan where gently sloping, fertile soils predominate.

Isolated rural residences are scattered along the length of the proposed loops with few residences concentrated in any one area. Of the 31 residences identified in table 4.1.9-1, 15 would be located on the construction side of the proposed pipeline. The most congested residential area is in Michigan at the proposed Indian River crossing (Loop 11, MP 598.6) where three residences are located within 50 feet of the proposed pipeline construction right-of-way. Additional residences on either bank of the Indian River would also be affected by construction noise and disruption. One residential development, the Pencil Lake Subdivision, would be crossed by Loop 14 at MP 744. Development within the subdivision has been limited and only one residence would be located within 50 feet of the construction right-of-way.

Tennessee

Tennessee's 41.9 miles of proposed mainline looping would be located in New York (79 percent) and Massachusetts (21 percent). In New York, along proposed loop Segments 1, 2, 3, and 4, the terrain is flat to gently rolling. Land use is primarily agricultural, either cropland or dairyland. Residential development is generally scattered and consists of rural residences and farmhouses.

In Massachusetts, woodland predominates as the existing land use in a more steeply sloping terrain. Agricultural land use is mostly associated with the northern portion of Segment 9 and the Weston Nurseries (MP 266+9.0). Residential development along the proposed pipeline route is denser at road crossings in Hopkinton (Segment 9) and includes a subdivision in Longmeadow (Segment 8, MP 261 +4.0). Of the 48 residences within 50 feet of the proposed construction right-of-way, 40 are located along Wolf Swamp Road (Segment 8, MP 3.8 - 4.6). The original proposed route would have located the pipeline between the existing pipeline and the residences at an average distance of 28 feet. In response to public concerns, Tennessee has proposed placing the proposed loop line on the other side of the existing pipeline under an existing sidewalk that partially parallels Wolf Swamp Road. This alignment would place the pipeline an average of 46 feet from the residences. Along Segment 9 in Hopkinton, five residences and two condominiums are located within 50 feet of the construction right-of-way at road intersections and three residences are located in a cul de sac (Lynn Path) that would be crossed by the proposed pipeline.

No residential developments in the planning or permitting process have been identified along the proposed pipeline loop segments in either New York or Massachusetts.

Algonquin

Algonquin proposes to loop 12.8 miles of existing pipeline and to replace 11.4 miles of the existing G-5, G-8, and H-1 pipelines. The total length of these facilities would be distributed through Massachusetts (66 percent), Connecticut (25 percent), and Rhode Island (9 percent). Woodlands predominate along the proposed pipeline routes in a flat to gently

rolling terrain. Agricultural land use is limited to one Christmas tree nursery (MP 0.4) and one orchard (MP 1.4) located along the proposed E-1 Loop in Connecticut. Along the proposed 5.2-mile G-8 Replacement, the characteristic land use is scrub pine in sandy soils.

With the exception of the 1.1-mile Chaplin Loop, residential subdivisions are located along portions of each proposed pipeline loop or replacement. The G-5 Replacement would cross through a subdivision in the Pine Street/Fairway Drive area (MP 1.5) where five residences would be located within 50 feet of the construction right-of-way. Fairway Drive is a circular drive located off of Pine Street and is bisected by the existing right-of-way. The G-8 Replacement/Loop would cross through the Glen Charlie subdivision (MP 2.1). Twenty-four residences abut the existing right-of-way, which traverses the southern end of the subdivision. Along the Medfield Loop, four residences would be located within 50 feet of the construction right-of-way. Along the H-1 Replacement, two residences would be within 50 feet of the construction right-of-way.

The E-1 Loop would cross adjacent to the eastern edge of a residential development at Browning Road (MP 2.0) where five residences would be located within 50 feet of the construction right-of-way. A second area undergoing residential growth is located at Wawecus Hill Road (MP 4.0) where three new residences are located within 50 feet of the proposed pipeline. One residence at MP 1.3 is also within 50 feet of the proposed construction right-of-way. No residences are located near the proposed Chaplin Loop.

In Rhode Island, the Tiverton Loop would be placed within the roadway of a residential area (MP 1.6 - 2.1).

No residential developments in the planning or permitting process have been identified along the proposed pipeline replacements or loops. However, along the proposed E-1 Loop, a large residential development was planned in the area north of Old Salem Road (MP 4.7 - 4.9). No construction has taken place and the conceptual approval has expired.

Transco

Transco proposes to loop 8.4 miles of the existing Leidy Line between MPs 29.5 and 36.3 (6.79-Mile Leidy Loop) and MPs 36.3 and 37.9 (1.61-Mile Leidy Loop). Only 0.1 mile of the proposed loops would be located in New Jersey while the remainder of the loops would be located in Pennsylvania. Over 73 percent of the land that would be traversed by the proposed loops is agricultural, with some wooded areas occurring along the 6.79-Mile Leidy Loop (primarily adjacent to the Mud River and its tributaries) and along the length of the 1.61-Mile Leidy Loop. Residential development consists of rural farmhouses scattered along the length of the proposed loops. One residence and one fire station would be located within 50 feet of the construction right-of-way at MPs 36.5 and 29.6, respectively. No residential developments in the planning or permitting process have been identified along the proposed pipeline loops.

Texas Eastern

Texas Eastern proposes to loop 5.0 miles of existing pipeline in a predominantly agricultural area in Pennsylvania. The proposed Line No. 37 would traverse rolling hills and Nittany Mountain. A few rural residences are scattered along the length of the proposed loop, with one residence (MP 37.5) located within 50 feet of the proposed construction right-

of-way. No residential developments in the planning or permitting process have been identified along the proposed pipeline loop.

CNG

CNG proposes to construct the new 2.7-mile TL-470 Line in New York, adjacent to or within an existing powerline right-of-way for 75 percent of its length. Woodland constitutes the greatest land use with some agricultural land at the eastern end of the proposed pipeline route (MP 0.1). Commercial/industrial development also occurs along both banks at the proposed Hudson River crossing. Residential development is limited, with no residences located within 50 feet of the proposed construction right-of-way. No residential developments in the planning or permitting process have been identified along the proposed pipeline loop.

National Fuel/Penn-York

National Fuel/Penn-York proposes to construct 2.5 miles of new pipeline adjacent to a Tennessee pipeline right-of-way. The proposed pipeline would be located in a rural area of Pennsylvania where woodland and agriculture/abandoned field are the predominant land uses. No residences are near the proposed loop and no residential developments in the planning or permitting process have been identified along the proposed pipeline loop.

CNG/Texas Eastern

The proposed TL-403 Replacement would be 0.4 mile in length and would be located in an entirely agricultural area in New York. The TL-403 corridor is located within the Erie County Agricultural District Number 5 pursuant to Article 25 of the New York State Agriculture and Markets law. Minimizing adverse impact on farmland is one of the important principals of the law. Land impact is reviewed by the New York Department of Agriculture and Markets to monitor possible disturbance to current farming activities as well as negative impact on soils and drainage. New York State Public Service Commission Regulations, 16 NYCRR Part 255, require a minimum cover of 40 inches for certain pipelines traversing active farm fields (i.e., fields used for commercial farming in at least 2 of the past 5 years) unless the farmland operator agrees to less. Application of this standard is also recommended by the NYDEC. There are, however, no land use restrictions that would prohibit the proposed replacement.

No residences are located near the existing right-of-way that would be used for the replacement and no residential developments in the planning or permitting process have been identified along the right-of-way.

4.1.9.1.2 Aboveground Facilities

The proposed NIP Project would include the construction of three new compressor stations and one new meter station on new sites, as well as modifications and additions to 16 existing stations. Table 4.9.1-2 identifies the location of these facilities in New York, New Jersey, Pennsylvania, Massachusetts, Virginia, and Rhode Island, and the predominant adjacent existing land uses.

TABLE 4.1.9-2

Land Uses Adjacent to Proposed NIP Project Aboveground Facilities

Applicant	Facility	Town, State	Agriculture	Woodland	Commercial/ Industrial
TENNESSEE	Compressor Station 230C	Lockport, NY	X		X
	Meter Station M-2	Lafayette, NY		X	
	Meter Station M-3	Marilla, NY	X		
	Meter Station M-7	Burrillville, RI		X	
ALGONQUIN	Burrillville Compressor Station	Burrillville, RI		X	
	Bellingham Meter Station	Bellingham, MA		X	
TRANSCO	Compressor Station 205	Lawrence, NJ	X	X	
	Compressor Station 167	South Hill, VA	X	X	
	Compressor Station 515	Buck, PA	X	X	
	Sayreville Meter Station	Old Bridge, NJ			X
	Emporia Meter Station	Emporia, VA			X
CNG	State Line Compressor Station	Genesee, PA	X		
	Utica Compressor Station	Frankfort,NY	X	X	
	Brookview Meter Station	Schodack, NY	X	X	
NATIONAL FUEL/ PENN-YORK	Concord Compressor Station	Concord, NY	X	X	
	Ellisburg Compressor Station	Allegany, PA	X		
CNG/ TEXAS EASTERN	State Line Compressor Station	Genesee, PA	X		
	Marilla Meter Station	Marilla, NY	X		
	Ellisburg Meter Station	Genesee, PA	X		
	Leidy Meter Station	Leidy, PA		X	

Great Lakes

Great Lakes proposes aerodynamic replacement for 12 of its existing compressor stations. Mainline valve locations would also be expanded from approximately 15 feet x 20 feet to 43 feet x 50 feet to accommodate the additional loopline valve. Signs would be posted at rail, road, and intersecting right-of-way crossings, and aerial markers would be installed as necessary. Cathodic protection test stations would also be installed at selected locations, usually at road crossings. Since these facilities would be located within the right-of-way, impact on existing land use would be negligible.

Tennessee

Tennessee proposes to add 7,000 hp to Compressor Station 230C, to install a new meter at Compressor Station 241 (Meter Station M-2), and to modify Meter Stations M-3 and M-7. These facilities are located in New York except for Meter Station M-7, which is located in Rhode Island.

The 4,500-hp Compressor Station 230C was reviewed in our Ocean State Power Project FEIS (July 1988), and would be constructed within a 58-acre site located in Lockport, New York. The site is zoned for both industry and agriculture and adjacent land uses are primarily agricultural. The proposed 7,000-hp compression addition would be located within the fencelines of the planned construction. The nearest residence is located 2,100 feet from the proposed compressor building.

The proposed new meter facility (M-2) would be installed within existing Compressor Station 241, which is located in an undeveloped area in Lafayette, New York. Meter modifications are also proposed at Meter Station M-3 in Marilla, New York, and at Meter Station M-7, in Burrillville, Rhode Island. Meter Station M-3 is located in an open agricultural area and modifications would occur within existing fencelines. Meter Station M-7 is located in an undeveloped wooded area on the site of the planned Ocean State Power Plant, which was reviewed in the Ocean State Power Project FEIS. Proposed meter modifications would occur within the fencelines of planned construction.

Algonquin

Algonquin's existing Burrillville Compressor Station is located in a rural area of Burrillville, Rhode Island. The proposed 5,500 hp of additional compression would be located within existing fencelines. The nearest residence is located 2,000 feet from the compressor building.

Algonquin proposes to construct a new meter station in Bellingham, Massachusetts. The proposed Bellingham Meter Station would be located within NEA's cogeneration plant, which is under construction. Approximately 0.5 acre would be developed for the meter station on an approximate 1.0-acre site.

Transco

Transco proposes to construct a new 12,000-hp Compressor Station 205 in Lawrence, New Jersey, on approximately 10 acres of a 99-acre, Transco-owned tract of land. The site is partly wooded and partly used for agricultural purposes (orchards, pasture, and cropland).

The nearest residence is located 1,380 feet from the proposed station. Transco also proposes to construct the new 7,660-hp Compressor Station 167 in a rural area north of the hamlet of South Hill, Virginia. The new station would be constructed on a portion of a 21-acre, Transco-owned tract of land. The site is presently partially developed for Transco metering, maintenance, and warehouse facilities. The nearest residence is located 1,000 feet from the proposed station. The addition of 12,600 hp to the existing Compressor Station 515 would occur within existing fencelines in a rural area of Buck, Pennsylvania. The nearest residence is located 1,030 feet from the compressor building.

The proposed Sayreville Meter Station would be located on 0.7 acre of an approximate 1.5-acre site in Old Bridge, New Jersey. The site is located in an industrial area adjacent to pipeline, waterline, and railroad easements. Expansion of the Emporia Meter Station would occur within the existing station, which is bounded by U.S. Route 301 and Interstate 95 in an area south of the town of Emporia, Virginia.

CNG

CNG proposes to add 1,350 hp to the State Line Compressor Station in Genesee, Pennsylvania, and 2,250 hp to the existing Utica Compressor Station in Frankfort, New York. CNG would also modify metering facilities at the Brookview Meter Station in Schodack, New York.

The 1,100-hp State Line Compressor Station was reviewed in our APEC Project EA (April 1989). It would be constructed on a 124-acre site owned by CNG and adjacent to land previously used by CNG for a compressor station. Older equipment at the site has been removed and the planned construction would occur on a 17-acre site within the existing storage pool area. The site is located in a rural agricultural area of Pennsylvania with the nearest residence 860 feet from the proposed compressor building. The proposed 1,350-hp compression addition would be located within the fencelines of the planned construction.

Addition of 2,250 hp to the existing Utica Compressor Station, which is located in rural area of New York, would occur within existing fencelines. The nearest residence is located 925 feet from the proposed facility. Meter additions to the Brookview Meter Station would occur within existing fencelines of the station, which is also located in a rural area of New York.

National Fuel/Penn-York

National Fuel/Penn-York propose to construct a new 8,640-hp compressor station in Concord, New York, and to add 2,600 hp at the existing Ellisburg Compressor Station in Allegany, Pennsylvania.

The new Concord Compressor Station would be located within an approximate 6-acre fenced area within a larger 70-acre tract of land to be acquired by the applicants. Existing land use on the tract of land is woodland (51 percent), agriculture (40 percent), and scrub-shrub land (9 percent). The 6-acre station would be located in an open field within a wooded portion of the tract and the nearest residence would be located 2,250 feet from the proposed compressor building location. Additions at the existing Ellisburg Compressor Station would occur within the existing fenceline of the station, which is located in a rural agricultural area. The nearest residence is located 1,600 feet from the compressor building.

CNG/Texas Eastern

CNG/Texas Eastern propose the addition of 2,200 hp to the State Line Compressor Station in Genesee, Pennsylvania, and the addition of new metering facilities to the existing Marilla Station in Marilla, New York, the Ellisburg Station in Genesee, Pennsylvania, and the Leidy Station in Leidy, Pennsylvania.

The proposed compression additions at the State Line Station (described above as part of CNG's proposed compression additions) would occur adjacent to planned construction of the station and within existing fencelines. The Marilla Meter Station and Ellisburg Compressor Station are located within agricultural areas; the Leidy Station is located within a wooded area. Meter additions would occur within existing station fencelines.

4.1.9.2 Recreation and Public Interest Areas

Table 4.1.9-3 lists recreation and public interest areas that would be crossed by or immediately adjacent to the proposed NIP Project pipelines. Areas crossed would include 57.7 miles of national forests; 48.6 miles of state forests; 23.2 miles of state, county, town, and other publicly owned land; 1.3 miles of golf courses; 0.7 mile of Indian reservation land; and 18 specially designated or recreational rivers. The majority of the recreational land and river crossings would occur along the Great Lakes portion of the proposed project.

Great Lakes

The proposed Minnesota Loops 1 through 6 would traverse the Chippewa National Forest, the Savanna State Forest, four parcels of state- or county-owned land, and the Leech Lake Indian Reservation. No rivers listed or potential candidates for inclusion in the Nationwide Rivers Inventory (NRI) would be crossed by the proposed loops.

The proposed Wisconsin Loops 7 and 8 would cross the Chequamegon National Forest, the Brule River State Forest, three parcels of state- or county-owned land, and the Bois Brule River.

The proposed Michigan Loops 8 through 17 would cross the Ottawa and Hiawatha National Forests; 6 state forests; 10 land parcels owned by Federal, state, county, or other public groups; 8 rivers listed as potential candidates for the NRI; and 5 rivers proposed for the Michigan inventory of wild and scenic rivers.

National Forests

The national forests crossed by the proposed pipeline are administered by the FS as multiple resource areas. Present uses include: sightseeing; logging; off-road vehicle (ORV), all-terrain vehicle (ATV), snowmobile, cross-country skiing, and hiking trails; hunting; camping; picnicking; fishing and trapping; and boating and canoeing. Forest boundaries include Federal, state, and private holdings with most of the private holdings held by paper companies. Special use permits with an annual fee would be required for all national forests crossed as well as fees for any timber removed. In many areas, the existing right-of-way is

TABLE 4.1.9-3

Recreation and Public Interest Areas
Crossed by or Adjacent to the Proposed NIP Project Pipelines

Pipeline Segment/ State	County	Approx. Milepost	Length of Crossing*	Description
GREATLAKES				
Minnesota				
Loop 1				None
Loop 2				None
Loop 3	Clearwater	130.2-130.6	0.3	Clearwater County land
Loop 4	Cass	182.7-196.0	8.6	Chippewa National Forest
	Cass/Itasca	182.2-201.0	6.4	State of Minnesota land
	Cass/Itasca	196.0	125'	Mississippi River
	Itasca	196.5-200.3	0.7	Leech Lake Indian Reservation
Loop 5	Itasca	209.8-212.1	0.4	State of Minnesota land
Loop 6	Itasca	228.5-240.2	2.4	State of Minnesota land
	Itasca	238.7-238.8	0.1	Savanna State Forest
Wisconsin				
Loop 7	Douglas	327.9	109'	Bois Brule River - fishing, canoeing
	Douglas	327.3-327.4	0.1	Brule River State Forest
	Douglas	327.8-328.6	0.6	State of Wisconsin land
	Bayfield	338.0-341.0	2.7	Bayfield County land
	Bayfield	341.0-344.3	2.7	Chequamegon National Forest
Loop 8	Iron	379.6-394.7	2.1	Iron County land
Michigan				
Loop 8	Gogebic	397.8-398.0	0.2	School District of Ironwood Township
	Gogebic	409.1-409.3	0.3	City of Wakefield
	Gogebic	410.3-415.2	1.4	Ottawa National Forest
	Gogebic	406.1	103'	Black River (potential candidate national inv.)
Loop 9	Gogebic	433.7-474.3	24.7	Ottawa National Forest
	Gogebic	438.5	64'	Cisco Branch - Ontonagon River (potential candidate state/national inv.)
	Gogebic	444.0	19'	Middle Branch - Ontonagon River (potential candidate state/national inv.)
	Iron	460.8	75'	South Branch - Paint River (potential candidate state/national inv.)
	Iron	466.2-466.5	0.4	Iron County land
	Iron	474.0-474.3	0.3	Federal Government
Loop 10	Dickinson	524.3-527.9	2.2	Copper Country State Forest
	Dickinson	528.2	44'	North Branch Ford River (potential candidate national inv.)
	Marquette	536.6-538.7	0.5	Copper Country State Forest
	Marquette	547.0	251'	Escanaba River (potential candidate state inv.)
	Delta	552.4-554.0	1.0	Escanaba State Forest
	Delta	558.8-560.3	1.5	Escanaba State Forest
Loop 11	Delta	575.2-585.5	9.0	Hiawatha National Forest
	Delta	575.3	89'	Sturgeon River (potential candidate national inv.)
	Schoolcraft	588.8-591.9	3.0	Lake Superior State Forest
	Schoolcraft	593.7-594.3	0.9	State of Michigan
	Schoolcraft	594.5-595.7	1.2	Lake Superior State Forest
	Schoolcraft	598.5	209'	Indian River (potential candidate state/national inv.)
	Schoolcraft	599.2-609.9	1.6	Lake Superior State Forest
	Schoolcraft	599.3	363'	Manistique River (potential candidate national inv.)

TABLE 4.1.9-3 (cont'd)

Pipeline Segment/ State	County	Approx. Milepost	Length of Crossing*	Description
Loop 12	Mackinac	649.7-663.8	8.7	Lake Superior State Forest
	Mackinac	663.8-678.0	11.3	Hiawatha National Forest
Loop 13	Emmet	686.2-701.2	5.6	Mackinaw State Forest
	Emmet	699.5-701.7	1.7	University of Michigan land
	Emmet	702.7-703.2	0.5	Emmet County land
	Emmet	707.8-708.0	0.3	State of Michigan land
Loop 14	Otsego	746.1-751.2	4.5	Mackinaw State Forest (Pigeon River Forest)
	Otsego	750.0	40'	Manistee River (potential candidate state inv.)
	Crawford	751.1-752.8	1.7	Au Sable State Forest
Loop 15	Missaukee	776.5-799.8	9.3	Pere Marquette State Forest
	Missaukee	778.5-783.0	--	Dead Stream Swamp (National Natural Landmark)
	Clare	803.2	101'	Muskegon River (potential candidate state inv.)
	Clare	799.8-806.7	5.9	Au Sable State Forest
	Clare	811.5-812.6	0.7	Lincoln Gun Club
Loop 16	Midland	854.8	107'	Pine River (potential candidate state inv.)
	Midland	855.6-855.8	0.2	State of Michigan land
	Saginaw	881.5	150'	Shiawassee River (potential candidate state inv.)
Loop 17	Lapeer	937.9-938.1	0.2	Michigan Dept. of Transportation land
TENNESSEE				
New York				
Segment 1	Erie	230B 102+ 5.4-5.9	0.5	Erie County land
Segment 2	Niagara	230B-107	1700'	Niagara River - boating
Segment 3	Wyoming	232+1.8-3.0	0.8	Carlton Hill Multiple Use Area
Segment 4	Livingston	6.5-7.0	0.5	Lima Golf Course
Massachusetts				
Segment 8	Hampden	261+1.8-2.0	0.2	Fannie Stebbins Wildlife Refuge (National Natural Landmark)
	Hampden	261+3.3-3.7	0.4	The "Meadows" (Longmeadow Conservation Land)
	Hampden	261+3.0-3.2	0.2	Longmeadow Golf Course
	Hampden	261+4.0	--	Wolf Swamp School
Segment 9	Middlesex	266+7.5	--	Elmwood School
ALGONQUIN				
Massachusetts				
G-5 Replacement	Bristol	2.2-2.7	0.5	Audubon Society of Rhode Island - Caratunk Wildlife Refuge
	Bristol	2.8-3.4	0.6	Ledgemont Country Club
G-8 Replacement/Loop	Plymouth	0.0-0.2	0.2	Myles Standish State Forest
	Plymouth	2.0	250'	Glen Charlie Pond
Medfield Loop	Norfolk, Middlesex	2.9	--	Glen Ellen Golf Course
H-1 Replacement				None
Connecticut				
E-1 Loop				None
Chaplin Loop	Windham	0.0-1.1	1.1	Natchaug State Forest
Rhode Island				
Tiverton Loop				None

TABLE 4.1.9-3 (cont'd)

Pipeline Segment/ State	County	Approx. Milepost	Length of Crossing*	Description
TRANSCO				
Pennsylvania				
1.61-Mi Leidy Loop				None
6.79-Mi Leidy Loop	Northhampton	29.6	450'	Delaware River - boating, canoeing
	Northhampton	35.6	20'	Recreational Trail (abandoned Conrail right-of-way)
New Jersey				
6.79-Mi Leidy Loop				None
TEXAS EASTERN				
Pennsylvania				
Line No. 37	Centre	37.9-38.3	0.4	Bald Eagle State Forest
CNG				
New York				
TL-470 Line	Rensselaer	1.8-1.9	--	Hazardous waste site
	Rensselaer/Albany	2.4	800'	Hudson River - boating
	Rensselaer	1.9	0.2	Papscanee Marsh (NYDEC)
NATIONALFUEL/PENN-YORK				
Pennsylvania				
Y-M54 Line				None
CNG/TEXASEASTERN				
New York				
TL-403 Replacement				None

* Actual crossing lengths are shown in miles except river and trail crossings which are shown in feet. Where no length is given, proposed pipeline would be located adjacent and within several hundred feet.

75 feet where the original 25-foot-wide temporary work space was never removed from the special use permit.

Proposed Loop 4 would cross approximately 8.6 miles of the Chippewa National Forest in Minnesota, which includes some 1.6 million acres of Federal, state, and private land. Of this total acreage, 662,730 acres are federally owned, with additional Federal acquisitions anticipated in 1990. Swamp conifers, cedar, and black spruce predominate throughout much of the forest preserve. (McIntire, 1989).

Proposed Loop 7 would cross 2.7 miles of the Chequamegon National Forest in Wisconsin. The forest boundaries include three separate tracts of land encompassing some 1 million acres, of which approximately 850,000 acres are federally owned. The forest is primarily upland forest in the areas that would be traversed by the proposed pipeline. (Kick, 1989).

Proposed Loops 8 and 9 would cross a total of 26.1 miles of the Ottawa National Forest in Michigan. This primarily hardwood forest includes some 1.6 million acres of Federal, state, and private lands of which 953,630 acres are federally owned. U.S. Route 2, which is considered a scenic highway in this area, would be crossed four times within the forest boundaries. (Somerville, 1989). There are also visual concerns about the crossings of U.S. Route 45, south of Watersmeet, and Forest Highway 16 at Golden Lakes.

Proposed Loops 11 and 12 would cross a total of 20.3 miles of the Hiawatha National Forest. The Hiawatha Forest includes two discrete and noncontiguous segments in Michigan and encompasses some 1.3 million acres, of which 880,796 acres are federally owned. Approximately 60 percent of the forest is wetland/swamp with sandy soils. (Crawford, 1989).

State Forests and Other Public Lands

The proposed Great Lakes loops would cross a total of 46.9 miles through eight state forests including:

- Savanna State Forest in Minnesota (0.1 mile)
- Brule River State Forest in Wisconsin (0.1 mile)
- Copper Country State Forest in Michigan (2.7 miles)
- Escanaba State Forest in Michigan (2.5 miles)
- Lake Superior State Forest in Michigan (14.5 miles)
- Mackinaw State Forest in Michigan (10.1 miles)
- Au Sable State Forest in Michigan (7.6 miles)
- Pere Marquette State Forest in Michigan (9.3 miles)

These forests are managed by the respective state's Department of Natural Resources (DNR) as multiple use areas. They are primarily used for fish and wildlife resource management and protection, forestry, and some recreation. Restrictions to protect fish and wildlife resources or to mitigate impact associated with pipeline construction and operation would be detailed during the easement negotiations. Proposed Loop 15 would cross adjacent to the Dead Stream Swamp, a National Natural Landmark, within the boundaries of the Pere Marquette Forest.

The proposed loops would also cross 21.3 miles through 18 parcels of state, county, and other public lands. Present uses of these areas include forestry, fish and wildlife management, conservation, and recreation, with most of the state-owned lands managed primarily for forestry purposes and for wildlife habitat as part of the state forest system. Proposed pipeline crossings of these areas would be generally less than 1 mile with the exception of Minnesota state lands where proposed Loops 4 and 6 would cross two parcels for 6.4 miles and 2.4 miles, respectively; Wisconsin county lands where proposed Loops 7 and 8 would cross 2.7 and 2.1 miles, respectively; and University of Michigan land where Loop 13 would cross 1.7 miles. Proposed Loop 4 would also cross 0.7 mile of the Leech Lake Indian Reservation in Itasca County, Minnesota.

Recreation, Wild and Scenic Rivers

The proposed loops would not cross any rivers listed on the NRI or designated by the states as wild and scenic. However, eight rivers in Michigan are potential candidates for the inclusion in the NRI and four rivers are proposed for the Michigan inventory of wild and scenic rivers as listed below:

- Black River, Gogebic County (national)
- Cisco Branch Ontonagon River, Gogebic County (state and national)
- Middle Branch Ontonagon River, Gogebic County (state and national)
- South Branch Paint River, Iron County (state and national)
- North Branch Ford River, Dickinson County (national)
- Escanaba River, Marquette County (state)
- Sturgeon River, Delta County (national)
- Indian River, Schoolcraft County (state and national)
- Manistique River, Schoolcraft County (national)
- Manistee River, Otsego County (state)
- Muskegon River, Clare County (state)
- Pine River, Midland County (state)
- Shiawassee River, Saginaw County (state)

These rivers have met the criteria of the National Wild and Scenic River Act or state criteria and are proposed for further study. River eligibility requirements vary somewhat between the nationwide and Michigan inventories and individual rivers may be proposed for inclusion in either the nationwide or state inventory or in both. Legislation is pending under the Omnibus Rivers Bill that would include most river segments within Michigan's national forest boundaries in the inventory (Pearson, 1989 and Alexander, 1989).

The NPS administers rivers listed as potential candidates for the NRI and reviews river crossings. The major concern is the preservation of those features for which the river was designated or listed as a potential candidate (Alexander, 1989; Castleberry, 1990). The Natural Rivers Program, Land and Water Management Division, DNR, administers Michigan's designated and proposed wild and scenic rivers and reviews permits required under the Michigan Inland Lake and Streams Act 346. Utility crossings of designated rivers in Michigan include the restoration of a 25- to 100-foot vegetative buffer on the riverbanks and barriers to discourage river crossings by ORVs and ATVs. These guidelines are also requested for potential candidate rivers for designation in the Michigan inventory (Pearson, 1989).

The Mississippi River headwaters would be crossed by proposed Loop 4. The Bois Brule River would be crossed by proposed Loop 7 in Wisconsin. Although development along the banks of the Brule River preclude its eligibility for inclusion in either the NRI or state inventory, it is considered one of Wisconsin's premier rivers for its trout and salmon fishing and for canoeing and kayaking.

Tennessee

Tennessee's proposed Segments 1 through 4 in New York would cross Erie County land, the Niagara River, the Carlton Hill Multiple Use Area, and the Lima Golf Course. Erie County land would be crossed by Segment 1 in Newstead, New York. This land is a part of larger county land holdings, which include the buildings of the County Home and Infirmary located approximately 500 feet east of the proposed segment. The Niagara River, a navigable waterway and the international boundary between the United States and Canada, would be crossed by Segment 2 in Lockport, New York. The Carlton Hill Multiple Use Area, and associated Sulphur Spring Hill Cooperative Hunting Area, would be crossed in two locations by Segment 3 in Middlebury, New York. This 2,700-acre facility is managed by the NYDEC primarily for recreational activities including fishing, horseback riding, cross-country skiing, hunting, trapping, hiking, and bird-watching. One of the areas of the proposed crossings is used for agriculture; the other area is wooded.

In Massachusetts, Tennessee's proposed Segment 8 would cross the Fannie Stebbins Memorial Wildlife Refuge (a National Natural Landmark), the abutting "Meadows" (Longmeadow conservation land), the Longmeadow Golf Course and an area adjacent to the Wolf Swamp School. Proposed Segment 9 would cross adjacent to the Elmwood School.

The Fannie Stebbins Memorial Wildlife Refuge (MP 261+1.8 to 2.0) was designated by the NPS as a National Natural Landmark in 1972. The Refuge encompasses 325 acres of wetlands and floodplain bordering on the eastern bank of the Connecticut River. The "Meadows" (MP 261+2.0 to 2.3), which abuts the Fannie Stebbins Wildlife Refuge and runs north to south through Longmeadow, is town conservation land. The Refuge and "Meadows" are located along a major migration corridor and provide habitat for many species of migrating birds as well opportunities for passive recreation. The Wolf Swamp School (MP 261+4.0) is located approximately 180 feet away from the proposed loop. The proposed loop would also cross the northern perimeter of the newly completed (September 1988) Wolf Swamp athletic field (MP 261+4.8).

The proposed Segment 9 would pass within 200 feet of the Elmwood School. The school is planning to build new school buildings within 100 feet of the proposed loop.

Algonquin

In Massachusetts, the G-5 Replacement would cross the far eastern edge of the Ledgemont Country Club golf course and the Caratunk Wildlife Refuge. The 196-acre refuge, under the management of the Rhode Island Chapter of the Audubon Society, is visited by over 5,000 people a year for hiking, skiing, and educational programs. Summer camp for elementary-school-aged children is provided in July and August. Educational programs are provided throughout the year for both adults and schoolchildren. The G-8 Replacement/Loop would cross the southernmost portion of Myles Standish State Forest (MP 0.1) and Glen Charlie Pond. The existing G-8 pipeline right-of-way through the Myles

Standish forest is a 50-foot-wide sand strip through scrub pines and is used extensively by ORVs and all types of vehicles. Because access to the right-of-way is available by a number of other dirt or sand roads, barriers erected to prohibit or limit ORV use have been largely ineffective. The Glen Charlie Pond is used for recreational boating and fishing and is a reservoir for some of the largest cranberry bogs in the state. The Medfield Loop would cross the northern edge of the Glen Ellen Golf Course.

In Connecticut, the proposed E-1 Loop would cross no identified recreation or public interest areas. The Chaplin Loop would be entirely located within the Natchaug State Forest which is managed as a multiple use area (Gibson, 1990).

Transco

Transco's proposed loops would cross the Delaware River, a 1A priority waterway in Pennsylvania Scenic Rivers Systems, and an abandoned Conrail right-of-way. A boat launch is located on the western bank of the Delaware River. In early 1990, Plainfield proposes to install an 8-foot-wide paved bikeway and adjacent gravel path along the entire Conrail right-of-way through the town. The pathway will be used for biking, hiking, and horseback riding.

Texas Eastern

Texas Eastern's proposed Line No. 37 would cross the Bald Eagle State Forest, administered by the PADER as a multiple use area. Although no natural or wild areas would be crossed, a special use permit would be required for the forest crossing.

CNG

CNG's proposed TL-470 Line would be routed to avoid an abandoned landfill site located in the vicinity of MP 1.8. Groundwater contamination is present at this site and is currently being remediated under the direction of NYDEC. The proposed pipeline would cross 0.2 mile of the Papscanee Marsh along the northern boundary. This area has been nominated for designation by the NYDEC as a "significant coastal fish and wildlife habitat." The proposed pipeline would also cross the Hudson River at MP 2.4 in an industrial area.

National Fuel/Penn-York

No recreation or public interest areas would be crossed by National Fuel's proposed Y-M54 Line.

CNG/Texas Eastern

No recreation or public interest areas would be crossed by CNG/Texas Eastern's proposed TL-403 Replacement.

4.1.10 Socioeconomics

Table 4.1.10-1 summarizes existing socioeconomic conditions for the 10 states and 53 counties that would be affected by construction of the proposed NIP Project pipeline and aboveground facilities. The proposed facilities would be located in areas that range from isolated rural areas with 7.3 persons per square mile (Schoolcraft, Michigan) to heavily

developed urban/suburban areas with 1,663.1 persons per square mile (Middlesex, Massachusetts). The table illustrates the overall population pattern through the counties that would be affected by the proposed NIP Project facilities. Population density is lowest in the western states and counties and greatest in the eastern states and counties.

Population change between 1980 and 1986 in the affected counties ranged between 15 percent (Barnstable, Massachusetts) and -8.0 percent (Iron, Wisconsin) with many of the more rural counties showing population decreases for the 6-year period.

The 1985 per capita income ranged from a low of $6,448 (Clearwater, Minnesota) to a high of $15,169 (Norfolk, Massachusetts). Average overall 1985 per capita income throughout the affected counties was approximately $10,300. Counties in Minnesota, Wisconsin, Michigan, and Pennsylvania were generally below average, and counties in New York, Massachusetts, Rhode Island, Connecticut, and New Jersey above average.

Annual average 1988 unemployment rates in the nine states ranged from a low of 3.0 percent in Rhode Island and Connecticut to a high of 7.6 percent in Michigan. Among the affected counties, the lowest rate was 2.6 percent (Middlesex, Massachusetts) and the highest was 18 percent (Mackinac, Michigan). In the less populous counties of Minnesota, Wisconsin, and Michigan, industrial employment primarily includes logging, timber, paper products, agriculture and agricultural products, and recreation. For the remainder of the states, where the counties are more populous, manufacturing, retail, trade, and services are the most significant employment industries. The major employment industry varies from one county to another.

4.1.11 Cultural Resources

Section 106 of the NHPA requires us to take into account the effect of our undertakings (including issuance of certificates) on any prehistoric or historic sites, buildings, districts, or objects listed in or eligible for listing in the NRHP, and to afford the ACHP an opportunity to comment on the undertakings. The applicants, as non-Federal parties, have agreed to assist us in meeting our obligations under Section 106, as implemented by the ACHP procedures in 36 CFR Part 800. In accordance with the ACHP procedures, the applicants have consulted with the State Historic Preservation Officers (SHPOs) within the appropriate states regarding the potential effects of the proposed undertaking on NRHP-listed or -eligible cultural resources. Table 4.1.11-1 lists the status, as of May 1990, of all studies undertaken to comply with NHPA Section 106 guidelines.

Guidelines were established for collecting and reporting cultural resources information in FERC's July 28, 1988, order. These guidelines require that Phase 1 reports include information on methods and techniques used to identify known and previously unknown cultural resources, including the results of field surveys. Phase 2 reports are to include information necessary to evaluate the NRHP eligibility of historic and archeological properties identified in Phase 1 reports. Phase 1 (identification) studies have been initiated within all portions of the NIP Project and completed for about half of the proposed facilities. Phase 2 (evaluation) studies have been completed for selected areas (see table 4.1.11-1).

TABLE 4.1.10-1

Existing Socioeconomic Conditions in the Proposed NIP Project Area

State / County	1980 Population a/	1986 Est. Population a/	1980-1986 Percent Change a/	1985 Per Capita Income a/	1980 Population Density (Persons/sq mi) b/	1988 Civ. Labor Force c/	1988 Unempl. Rate c/
Minnesota	4,075,970	4,216,000	3.4	$11,186	51.2	2,327,000	4.0
Cass	21,050	21,500	2.1	6,969	10.4	8,611	8.5
Clearwater	8,761	8,700	-0.3	6,448	8.8	3,574	13.0
Itasca	43,069	42,500	-1.3	8,191	16.2	17,472	7.5
Marshall	13,027	12,200	-6.3	7,174	7.4	5,015	11.9
Wisconsin	4,705,642	4,785,000	1.7	10,298	86.5	2,575,000	4.3
Bayfield	13,822	14,200	2.8	7,005	9.5	6,300	6.3
Douglas	44,421	41,600	-6.3	8,430	34.0	18,200	5.8
Iron	6,730	6,200	-8.0	6,490	9.0	2,700	6.7
Michigan	9,262,044	9,155,000	-1.2	10,902	162.6	4,580,000	7.6
Clare	23,822	25,000	4.8	7,176	41.8	10,325	8.8
Crawford	9,465	10,100	6.9	7,763	16.9	6,050	6.6
Delta	38,947	38,600	-0.8	8,111	33.2	16,075	9.0
Dickinson	25,341	26,700	5.6	8,658	32.9	11,525	7.8
Emmet	22,992	24,100	4.7	8,660	49.1	13,450	9.1
Gogebic	19,686	18,800	-4.7	7,011	17.8	6,850	8.5
Gratiot	40,448	39,300	-2.7	8,445	71.0	5,200	10.2
Iron	13,635	14,000	2.9	7,468	11.7	5,200	10.2
Lapeer	70,038	70,400	0.4	10,152	106.4	33,900	10.2
Mackinac	10,178	10,500	2.7	7,177	9.9	6,825	18.0
Marquette	74,101	71,300	-3.7	8,143	40.7	28,975	6.9
Midland	73,578	72,400	-1.6	11,322	140.1	34,875	5.5
Missaukee	10,009	11,000	9.5	7,008	17.7	5,125	8.9
Otsego	14,993	15,800	5.4	8,182	29.1	8,000	6.8
Saginaw	228,059	216,400	-5.1	10,168	279.8	96,025	7.9
Schoolcraft	8,575	8,300	-2.9	7,120	7.3	3,700	13.4
St. Clair	138,802	140,500	1.2	10,007	189.1	66,800	9.4
New York	17,558,165	17,772,000	1.2	$11,765	370.6	8,522,000	4.2
Albany	285,909	283,400	-0.9	12,134	545.6	150,200	2.7
Erie	1,015,472	964,700	-5.0	10,543	970.8	449,700	5.0
Herkimer	66,714	66,900	0.2	10,734	47.5	29,900	5.7
Livingston	57,006	58,600	2.8	9,602	90.1	28,700	4.5
Niagara	227,354	216,900	-4.6	10,211	432.2	94,400	6.4
Onondaga	463,920	463,200	-0.2	11,472	591.0	233,300	3.8
Ontario	88,909	92,200	3.7	10,441	138.1	47,100	4.7
Rensselaer	151,966	151,700	-0.1	9,912	232.0	73,300	3.6
Wyoming	39,895	40,800	2.2	8,413	67.1	17,700	6.2

TABLE 4.1.10-1 (cont'd)

State County	1980 Population a/	1986 Est. Population a/	1980-1986 Percent Change a/	1985 Per Capita Income a/	1980 Population Density (Persons/sq mi) b/	1988 Civ. Labor Force c/	1988 Unempl. Rate c/
Massachusetts	5,737,093	5,832,000	1.7	12,510	733.3	3,143,974	3.3
Barnstable	147,925	170,600	15.3	12,451	369.8	95,964	4.1
Bristol	474,641	484,900	2.2	9,961	852.1	245,389	4.7
Hampden	443,018	444,900	0.4	10,633	716.9	213,844	3.4
Middlesex	1,367,034	1,367,000	0.0	14,697	1663.1	791,713	2.6
Norfolk	606,587	602,500	-0.7	15,169	1516.5	339,557	2.7
Plymouth	405,437	424,400	4.7	11,817	619.0	217,214	3.5
Worcester	646,352	661,100	2.3	11,386	426.9	341,497	3.4
Rhode Island	947,154	975,000	2.9	10,892	897.8	526,000	3.0
Newport	81,383	84,800	4.2	11,921	760.6	47,117	2.8
Providence	571,349	581,700	1.8	10,335	1373.4	309,993	3.3
Connecticut	3,107,564	3,189,000	2.6	14,090	637.8	1,746,000	3.0
New London	238,409	246,400	3.4	12,187	356.4	125,400	3.1
Windham	92,312	96,800	4.9	10,348	179.2	50,211	3.9
New Jersey	7,365,011	7,620,000	3.5	13,129	986.2	3,978,000	3.8
Mercer	307,863	320,800	4.2	13,120	1356.2	172,900	2.9
Warren	84,429	86,800	2.8	12,062	235.2	39,000	3.6
Pennsylvania	11,864,720	11,889,000	0.2	10,288	264.3	5,780,000	5.1
Centre	112,760	114,600	1.6	8,735	102.0	62,500	5.0
Clinton	38,971	38,100	-2.3	7,811	43.7	15,600	7.3
Luzerne	343,079	331,100	-3.5	8,873	385.0	159,900	6.9
Northampton	225,418	234,100	3.9	10,434	599.5	114,700	4.4
Potter	17,726	18,300	3.3	6,964	16.4	7,800	6.2
Virginia							
Greensville	10,903	10,400	-4.7	7,586	36.34	4,834	5.4
Mecklenburg	29,444	29,800	1.1	7,992	48.1	14,027	6.7

a/ U.S. Department of Commerce, Bureau of the Census. 1986 Population and 1985 Per capita Income Estimates for Counties and Incorporated Places (Series P-26, No. 86-NE-SC). March 1988.

b/ U.S. Department of Commerce, Bureau of Census. 1980 Census of Population, Number of Inhabitants, United States Summary (PC80-1-A1). April 1983.

c/ Department of Employment for listed state.

TABLE 4.1.11-1

Status of NHPA 106 Review
(as of May 1990)

Proposed Facilities	State	County	NHPA-106 Status	SHPO Comments	Comments
GREAT LAKES					
Loop 1	MN	Marshall	Preliminary reconnaissance completed in 79-80; project-specific Phase 1 study commenced in Spring 1990	Phase 1 survey needed; work plan approved for Phase 1	
Loop 2	MN	Marshall	"	"	
Loop 3	MN	Clearwater	"	"	
Loop 4	MN	Cass, Itasca	"	"	
Loop 5	MN	Itasca	"	"	
Loop 6	MN	Itasca	"	"	
Loop 7	WI	Douglas, Bayfield	"	"	
Loop 8	WI/MI	Iron/Gogebic	"	"	
Loop 9	MI	Gogebic, Iron	"	"	
Loop 10	MI	Dickenson, Marquette, Delta	"	"	
Loop 11	MI	Delta, Schoolcraft, Mackinac	"	"	
Loop 12	MI	Mackinac	"	"	
Loop 13	MI	Emmet	"	"	
Loop 14	MI	Otsego, Crawford	"	"	
Loop 15	MI	Missaukee, Clare	"	"	
Loop 16	MI	Midland, Gratiot, Saginaw	"	"	
Loop 17	MI	Lapeer, St. Clair	"	"	
TENNESSEE					
Segment 1	NY	Niagara, Erie	Phases 1&2 - 2 prehistoric sites	Avoid Buffalo Terrace site; no effect on other site	Tennessee cannot avoid this site - Phase 3 is planned
Segment 2	NY	Niagara	Phase 1 - 1 prehistoric site	no effect	
Segment 3	NY	Wyoming	Phase 1 - 1 historic site	no effect	
Segment 4	NY	Livingston, Ontario	Phase 1 - 1 prehistoric site	no effect	
Segment 8	MA	Hampden	Phase 1 - partially complete; needs additional locational survey	Needs Phase 1 locational study; work plan approved	Phase 1 study under completion
Segment 9	MA	Middlesex	Phase 1 study initiated	Needs Phase 1; work plan approved	Phase 1 study under way
Compressor Stn. 230C	NY	Niagara	Phase 1 complete	no effect	no additional work
Meter Stn. M-2	NY	Onondaga	Phase 1 complete	no effect	no additional work
Meter Stn. M-3	NY	Erie	Phase 1 complete	no effect	no additional work
Meter Stn. M-7	RI	Providence	Phase 1 completed under another project	no effect	no additional work

TABLE 4.1.11-1 (cont'd)

Proposed Facilities	State	County	NHPA-106 Status	SHPO Comments	Comments
ALGONQUIN					
G-5 Replacement	MA	Bristol	Phase 1 started; work plan approved	Needs Phase 1	Phase 1 underway
G-8 Replacement	MA	Plymouth, Barnstable	Phase 1 started	Needs Phase 1	Phase 1 underway; need SHPO comment on report when available; eroded but some sensitive areas
Medfield Loop (Mainline Loop)	MA	Norfolk, Middlesex	Phase 1 started; work plan approved	Needs Phase 1	Phase 1 underway; highly sensitive areas
H-1 Replacement	MA	Worcester, Norfolk	Phase 1 started; work plan approved	Needs Phase 1	Phase 1 underway; moderately sensitive
E-1 Loop	CT	New London	Needs Phase 1; work plan approved	Needs Phase 1	
Chaplin Loop	CT	Windham	Needs Phase 1; work plan approved	Needs Phase 1	Phase 1 underway; sensitive for prehistoric sites; testing recommended
Tiverton Loop	RI	Newport	Phase 1 started; work plan approved	Needs Phase 1	Phase 1 underway; moderately sensitive
Bellingham Meter Stn.	MA	Norfolk	Phase 1 started; work plan approved	Needs Phase 1	Phase 1 underway; some historic site remains have been identified
Burrillville Compr. Stn.	RI	Providence	No survey because no effect	No survey needed - site recently disturbed	Increased compression will not affect the cultural environment; site previously disturbed
TRANSCO					
1.61-Mi. Leidy Loop	PA	Northampton	Phase 1 complete	Phase 1 needed	No sites identifed; SHPO concluded no effect; no additional work
6.79-Mi. Leidy Loop	PA/NJ	Northampton, Warren	Phase 1 complete in NJ	Phase 1 needed	No sites identified; NJSHPO concluded no effect; FERC must review report
			Phase 1&2 complete in PA	Phases 1 & 2 needed	9 sites identified; awaiting updated Phase 1 and 2 reports; Section 106 compliance must be completed
Compressor Stn. 205	NJ	Mercer	Phase 1 complete	Phase 1 needed	No sites identified; SHPO recommended monitoring during construction (3/90); no additional work planned
Compressor Stn. 515	PA	Luzerne	Phase 1 complete	Phase 1 needed	No sites identified; SHPO concluded no effect; no additional work
Sayreville Meter Stn.	NJ	Middlesex	SHPO consulted	Phase 1 needed	Section 106 compliance must be completed
South Hill Compr. Stn.	VA	Mecklenburg	Phase 1 initiated	No comment received	Awaiting SHPO comments and Phase 1 report
Emporia Meter Stn.	VA	Mecklenburg	SHPO consulted	No comment received	Awaiting SHPO comments and Phase 1 report
TEXAS EASTERN					
Line No. 37	PA	Centre	SHPO consulted; Phase 1 initiated	Phase 1 needed	Background research indicated highly sensitive

TABLE 4.1.11-1 (cont'd)

Proposed Facilities	State	County	NHPA-106 Status	SHPO Comments	Comments
CNG					
TL-470 Line	NY	Albany, Rensselaer	Phase 1 complete; Phase 2 initiated	Phase 1 needed	Phase 1 identified 2 prehistoric and 3 historic sites. Phase 2 being conducted to delineate boundaries to facilitate development of avoidance plans
State Line Compr. Stn.	PA	Potter	SHPO consulted	No effect	No additional work
Utica Compr. Stn.	NY	Herkimer	SHPO consulted	No effect	No additional work
Brookview Meter Stn.	NY	Rensselaer	SHPO consulted	No comments received	Awaiting SHPO's comments
NATIONAL FUEL/PENN YORK					
Y-M54 Line	PA	Potter	Phase 1 complete; for original and redesign	Phase 1 needed; report needs revision	No sites identified; SHPO commented no effect on original design; awaiting additional comments on redesign reports
Concord Compr. Stn.	NY	Erie	SHPO consulted; Phase 1 complete,	Phase 1 needed; no effect	No sites identified; no effect
Ellisburg Compr. Stn.	PA	Potter	SHPO consulted	No effect	No additional work
CNG/TEXAS EASTERN					
TL-403 Replacement	NY	Erie	SHPO consulted	No effect	No additional work recommended.
State Line Compr. Stn.	PA	Potter	SHPO consulted	No effect	No additional work
Marilla Meter Stn.	NY	Erie	Not initiated	No comments received	Section 106 compliance must be completed
Ellisburg Meter Stn.	PA	Potter	"	"	
Leidy Meter Stn.	PA	Clinton	"	"	"

4.1.11.1 Historic and Archeological Resources

The proposed route for the NIP Project passes through an array of natural and cultural environmental zones in Minnesota, Wisconsin, Michigan, New York, Pennsylvania, New Jersey, Connecticut, Rhode Island, and Massachusetts. These areas are associated with human occupation from Paleoindian times to the present (approximately 12,000 years). The proposed route crosses several major river drainages and their tributaries, and parallels portions of the Great Lakes shoreline, thereby encompassing numerous well-documented prehistoric and historic period occupation zones. There are known archeological sites along the project rights-of-way that represent all phases of the Prehistoric Period (Paleoindian, Archaic, Transitional, Woodland), the Contact Period, and the Historic Period from the early 17th century through the 20th century.

Based upon information gathered from basic and applied research within the vicinity of the proposed project right-of-way, both our archeological staff and the eight SHPOs expected that archeological sites from all occupation periods would be found within the project's area of direct environmental impact.

Great Lakes

In 1979 and 1980, Commonwealth Associates, cultural resources consultants to Great Lakes, conducted a cultural resources reconnaissance-level survey of Great Lakes' existing rights-of-way, from St. Vincent, Minnesota, to St. Clair, Michigan, and the Sault Lateral Gas Pipeline. Commonwealth reviewed existing cultural resources information sources (files, published and unpublished reports) and carried out surface inspection and subsurface testing, as appropriate, for the 75-foot-wide, 1,017-mile-long right-of-way. Along the entire route, 82 sites were identified; 17 were recommended as eligible for the NRHP, 36 as not eligible, and 29 remain unevaluated. For the 17 pipeline loops proposed on the NIP Project, four prehistoric sites are considered eligible for the NRHP, 16 prehistoric and historic sites are not considered eligible, and 17 prehistoric sites await NRHP evaluation. The State of Michigan Department of Transportation identified two historic sites that may be affected by the project in Lapeer County, Michigan. These data were provided to Great Lakes' archeological consultants.

In December 1989, Great Lakes submitted a project-specific survey plan for Phase 1 and Phase 2 field investigation of the current pipeline. Conditional upon Great Lakes filing the revisions to the draft plan identified in a March 27, 1990, letter from its archeological consultant to FERC staff, the plan would be approved and necessary fieldwork would commence in early spring 1990. Great Lakes has identified, thus far, approximately 56 possible contractor yard sites and approximately 20 pipe yard sites. Of these, seven pipe yard sites have already been approved for use under the 1989 TCPL-1 Looping Project.

Tennessee

In August 1988 and September 1989, in accordance with the NHPA, Tennessee requested the opinions of the Massachusetts, New York, and Rhode Island SHPOs on the potential effects on historic and archeological properties from construction of Segments 1, 2, 3, and 4 and Compressor Station 230C, Meter Station M-2, and Meter Station M-3 in New York; Segments 8 and 9 in Massachusetts; and Meter Station M-7 in Rhode Island. In October 1988, the Massachusetts SHPO advised Tennessee that because of the high

probability of encountering significant Prehistoric and Historic Period sites, archeological reconnaissance was warranted for all proposed construction areas. In October 1988, the New York SHPO advised Tennessee that unless it could demonstrate substantial prior disturbance of the proposed construction areas, a reconnaissance-level cultural resources survey was warranted. In September 1989, the Rhode Island SHPO stated that meter station expansion would have no effect, based upon Phase 1 survey data from another project.

In September and October 1988, Greenhouse Associates, archeological consultants to Tennessee, conducted preliminary Phase 1 investigations of most of Segment 1 plus Segments 2, 3, and 4 of the New York portions of the proposed project, including the meter and compressor stations. During these studies, Greenhouse located one potentially significant prehistoric site in Segment 1 and one in Segment 4. Additionally, one potentially significant historic site was located in Segment 3. The Public Archaeological Facility of the State University of New York at Binghamton (PAF-SUNYBi) identified one site, the Buffalo Terrace Site in Segment 1 and, after review of the work plan by the SHPO, conducted Phase 2 studies. Tennessee agreed to conduct Phase 2 (evaluation) studies at the two prehistoric sites identified by Greenhouse and to avoid the Historic Period cemetery. The work plans for these studies have not been made available to FERC staff or the New York SHPO for review. The Phase 2 work has been reviewed and approved by the SHPO and FERC and PAF is developing a Phase 3 data recovery plan. No NRHP-listed or -eligible sites were found within the meter and compressor station work areas. The SHPO concurs.

In November and December 1988 and March 1989, University of Massachusetts (UMASS) Archaeological Services of the UMASS at Amherst conducted a reconnaissance-level survey, including documentary research, development of a stratified investigation strategy, and walkover of a 75-foot-wide right-of-way that includes the proposed Segment 8. No NRHP-listed or -eligible properties were encountered. At present, no Phase 1 cultural resources study report has been received for Segment 9. The site of the M-7 Meter Station was surveyed in 1986 for an Ocean State Power Plant project. The study demonstrated that no NRHP-listed or -eligible properties would be affected by the proposed meter station modification. The SHPO concurs.

Algonquin

Most of the facilities proposed by Algonquin are located near or within developed communities. However, archeological sites have been identified in these project areas, including prehistoric sites, dating from Archaic through Contact Period times, and historic sites from the 17th through the 20th century. Thus, it is expected that habitation and special function (e.g., manufacturing and hunting) sites may be found in or adjacent to the proposed right-of-way.

In the fall of 1988, in accordance with the NHPA, Algonquin, through its consultant ENSR Consulting Engineers and archeological subconsultant, The Public Archaeological Facility (PAF), requested the opinions of the Massachusetts, Rhode Island, and Connecticut SHPOs on the potential effects on cultural resources from construction of its proposed facilities. The request for opinions was accompanied by a proposed work plan and survey strategy for the Phase 1 cultural resources study. In January 1989, PAF submitted revised plans for the surveys. The Connecticut and Massachusetts SHPOs commented that the work plan was appropriate to determine the presence or absence of archeological resources within the proposed project's right-of-way. The Rhode Island SHPO requested clarification

on the Tiverton Loop and, upon receipt, issued a permit to PAF for field investigations. Fieldwork is scheduled to commence on May 1, 1990, and a draft report on the findings of the Phase 1 study is scheduled for completion by January 1991. The Rhode Island SHPO has commented that the Burrillville Compressor Station work will have no effect on NRHP-listed or -eligible resources because the site has been extensively disturbed by prior construction.

Transco

In 1985, Transco's consultant, EMANCO Inc., surveyed Transco's Leidy Mainline right-of-way in Northampton County, Pennsylvania. This Phase 1 study included the current proposed 1.61-Mile Leidy Loop in Pennsylvania. No historic or archeological sites listed in or eligible for listing in the NRHP were identified along this loop. In 1989, EMANCO Inc. completed survey work in the immediate environs of Compressor Stations 205 and 515. No historic or prehistoric period archeological sites were identified in this proposed project area.

Prior to initiation of fieldwork in 1985, EMANCO completed a background and documentary study that covered the 6.79-Mile Leidy Loop in Northampton County, Pennsylvania, and Warren County, New Jersey. Phase 1 study was completed in New Jersey in the spring of 1989 and EMANCO concluded that no cultural resources, listed in or eligible for listing in the NRHP were identified. The New Jersey SHPO concurred.

Phase 1 studies of the proposed pipeline right-of-way in 1985 identified nine potentially eligible cultural properties in Pennsylvania. In 1988, the Pennsylvania SHPO reviewed the 1985 Phase 1 report and work plan for Phase 2 studies and expressed concern that previously unidentified prehistoric and early historic period sites might exist within the right-of-way. The Pennsylvania SHPO requested that Transco update the Phase 1 study before submitting a revised Phase 2 work plan.

In the Fall of 1989, EMANCO carried out initial SHPO consultations and Phase 1 survey of Transco's South Hill Compresser Station in Mecklenburg County, Virginia, and consulted with the Virginia SHPO regarding the effects of modifications to the Emporia Meter Station. The results of these investigations have not been filed with FERC.

Texas Eastern

In the spring of 1988, Texas Eastern consulted with the staff of the Pennsylvania Historical Commission regarding the presence or absence of NRHP properties within the proposed project's areas of effect. Because of the expected probability of encountering late prehistoric period and 19th-century archeological resources within the 5-mile right-of-way, the staff of the Pennsylvania Bureau of Historic Preservation advised the applicant to conduct background documentary research. The report of this research was submitted to the SHPO's office in April 1988, and filed with FERC in the form of a resource report in November 1989. No known historic or archeological sites were identified.

CNG

In the summer of 1989, in accordance with the NHPA, CNG requested the comments of the New York SHPO on the potential effects on historic and archeological properties from construction of the 2.7-mile TL-470 Line in Albany and Rensselaer Counties, New

York. This right-of-way includes the historically and archeologically sensitive Papscanee Island. At the same time, CNG initiated its Phase 1 study of this right-of-way. Archaeological Research Specialists (ARS) of Oxford, Connecticut, under the direction of Dr. Lucianne Lavin and Marina Motzi, served as archeological consultants (Lavin, 1989; Huey, 1989). On October 11, 1989, the SHPO responded that based on reported resources, the project area may contain archeological resources (Stokes, 1989).

These resources included two known sites: 1) a prehistoric occupation site (the Black Rock Site) at the western terminus of the pipeline in Albany County, and 2) the early 17th-century Dutch farm settlement known as the Van Buren Site on Papscanee Island.

In January 1990, the report of the Phase 1 study, Phase IA and IB Archaeological Assessment Report for the CNG TL-470 Pipeline Crossing Project, East Greenbush, New York (Archaeological Research Specialists, 1990) was submitted to us by CNG. This report identifies a number of potentially NRHP-eligible archeological sites within the Black Rock Site on the west bank of the Hudson River, two prehistoric or early historic period aboriginal sites in cornfields on Papscanee Island, the Van Buren Site, and a set of 19th-century railroad tracks. CNG has requested the New York SHPO's comments on the study; we have not yet received the SHPO's response.

All of the prehistoric sites and the 17th-century farmstead site appear to be of great research value for the state and region and thus appear to meet the criteria for listing in the NRHP. Because very little is known about prehistoric and early historic period aboriginal and European occupation in the mid-Hudson Valley, and because many known sites have been destroyed by recent development, the research/preservation value of the identified sites appears even greater (ARS, 1990; Feister, 1985; Huey, 1984). The portion of the Black Rock Site within the proposed right-of-way, however, has been highly disturbed by construction and operation of a power plant.

The two prehistoric sites on Papscanee Island contain evidence of a potential for deeply buried, intact cultural remains. Additional Phase 2 evaluation of these sites' NRHP eligibility and boundary definition is needed to determine if impact may be avoided.

The 17th-century Van Buren Site has been termed "one of the most significant Dutch sites in Rensselaerwyck." The site, identified on a 1632 map of Rensselaerwyck and originally researched in 1973, is located within the Niagara Mohawk Company right-of-way. It is believed to be one of the first two farmsteads within the Dutch colony of Rensselaerwyck. The CNG study by ARS found multiple 17th- and 18th-century intact strata and features underlain by at least one prehistoric component with subsurface features (ARS, 1990; Huey, 1984). Additional 18th-century historic occupation remains and a probable British encampment site from 1792 (Huey, 1989; ARS, 1990) also lie within the portions of the Van Buren Site that are within CNG's right-of-way.

The proposed project right-of-way is also within the Hudson River Valley Greenway Council's study area. The Council, formed by the governor of New York in 1988, was charged with identification and protection of natural and cultural resources of the Hudson Valley corridor. The Papscanee Island sites fall under the Council's protection policy.

CNG has provided documentation of prior disturbance at the Utica Compressor Station. No information has been provided on the Brookview Meter Station.

National Fuel/Penn-York

In 1988, National Fuel/Penn-York consulted with the New York SHPO on the potential effects of new construction and horsepower at the Concord Compressor Station and the Pennsylvania SHPO on the additional horsepower at the Ellisburg Compressor Station. The Pennsylvania SHPO stated that the Ellisburg Compressor Station work would constitute no effect. The New York SHPO stated that a cultural resources survey was needed for the area of new construction at the Concord Compressor Station. The Cultural Resources Survey Program of the Rochester Museum and Science Service conducted the study in the fall of 1988. The study identified no NRHP-listed or -eligible prehistoric or historic sites within the proposed project area. In June 1989, because of redesign, National Fuel contracted with the Cultural Resources Survey Program of the Rochester Museum and Science Service to re-evaluate the expanded project area. No cultural resources listed in or eligible for listing in the NRHP were identified. The SHPO reviewed the results of this report and concluded that because no NRHP resources were identified, the new construction would have no effect. FERC concurs.

In the summer of 1988, Archaeological and Historical Consultants, Inc., carried out a Phase 1 cultural resources survey of the proposed 2.5-mile Y-M54 Line. No potentially eligible historic or archeological sites were found within this segment of the study. The Pennsylvania SHPO commented on the report of the Phase 1 study on February 13, 1989. In the opinion of the archeological staff, no additional cultural resources investigations were required. FERC concurs with this finding.

In September 1989, because of proposed redesign, National Fuel/Penn-York contracted with the Cultural Resource Survey Program of the Rochester Museum and Science Service to evaluate the revised Y-M54 Line right-of-way. No cultural properties listed in or eligible for listing in the NRHP were identified. The SHPO has not yet supplied written comments on this study.

National Fuel/Penn-York also arranged for Phase 1 survey of the pipe staging areas in Potter County. The report was sent to the Pennsylvania SHPO in early May. When the SHPO comments are supplied, FERC will make a final finding.

CNG/Texas Eastern

According to a review provided by the NYDEC, and based upon review of published sources, the TL-403 replacement pipeline right-of-way is within an archeologically sensitive zone of Erie County, New York. However, the New York SHPO has reviewed the project and has stated it would not affect cultural resources.

The Pennsylvania SHPO has reviewed the proposed State Line Compressor facilities and has stated they would not affect cultural resources. No project-specific information has been provided for the metering facilities at Leidy and Ellisburg, Pennsylvania, or Marilla, New York.

4.1.11.2 Traditional Cultural Values

In accordance with the ACHP regulations (36 CFR Part 800.1(c)(2)(ii)), every effort should be made to ensure that Indian tribes and other Native American groups are provided full opportunity to participate in the review of Federal undertakings under Section 106. Specifically, the regulations encourage Federal agencies to "be sensitive to the special concerns of Indian tribes in historic preservation issues, which often extend beyond Indian lands to other properties" (36 CFR Part 800.1(c)(2)(iii)). Such traditional tribal concerns might include:

- Interest in ancestral homelands;
- Interest in lands near its present home that may have been transferred to non-Indians;
- Interest in tribal history;
- Cultural or religious interest, such as desire to preserve ancestral or ancient burial places or sacred sites from desecration or the desire to retain access for such religious places for ritual purposes.

The regulations encourage full participation by tribal representatives as interested parties, but no special process is defined.

Great Lakes' proposed Loop 4 would cross the Leech Lake Indian Reservation in Itasca County, Minnesota. In order to ensure that FERC's responsibilities to Native American religious and traditional cultural sites are met, on August 8, 1989, Great Lakes, through its consultant, Braun Environmental Laboratories, sent a letter to the Bureau of Indian Affairs (BIA), Minneapolis Area Office (Wolf and Rowe, 1989), requesting assistance in locating such sites that could be affected by construction of the TCPL-2 Loops. BIA's Area Archeologist distributed the Great Lakes request to 16 tribal contacts. The responses came from the Lac View Desert Band of the Lake Superior Chippewa Band (McGeshick, August 29, 1989), the Lac du Flambeau Band of the Lake Superior Chippewa (Hrabik, August 28, 1989), the Saginaw Chippewa Indian Tribe (Sowmick, September 7, 1989), and the BIA (Barbor, October 5, 1989). Great Lakes, for FERC, was advised that 12 known site areas may be in the right-of-way but that in accordance with Section 106 of the NHPA, additional identification and possibly evaluation surveys (Phase 1 and possibly 2) are needed. The BIA also informed Great Lakes that, by consulting with the agency and incorporating data from tribal responses, it was in compliance with the American Indian Religious Freedom Act. The BIA noted that protection or treatment of any such identified sites is governed under the NHPA.

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 PROPOSED ACTION

5.1.1 Geology

5.1.1.1 General Construction and Operational Impact

Construction and operation of the NIP Project would not materially alter the geologic conditions of the project areas. However, rock excavation by blasting during construction of the proposed pipelines would result in environmental impact. Ground motion from improperly controlled blasting could cause local slope instability or ground subsidence features to develop. Groundwater yield and quality of nearby wells could also be affected by blasting. A small reduction of available sand and gravel resources could occur as a result of pipeline construction along several proposed loops.

Rock Excavation and Blasting

The planned average excavation depth for trenching along most of the proposed pipelines is 6 feet. Where bedrock occurs abovegrade or within 6 feet of the ground surface, blasting may be required. Rock excavation can often be accomplished by ripping, or by mechanical breakdown of relatively soft, weathered, or broken rock with the use of toothed tools in conjunction with bulldozers, trench excavators, and/or backhoes.

The primary concern during blasting would be the effect of ground vibrations on slopes, structures, and wells. If not properly controlled, blasting could damage nearby structures and cause local changes in groundwater flow patterns and water quality. Impact on groundwater is discussed in section 5.1.3.1.

Additional temporary effects of blasting could include hazards posed by uncontrolled fly-rock and nuisances caused by increased dust and venting of gases following blasts. Proper use of blast matting and time-delayed charges would minimize potential fly-rock hazards, while dust and gas venting would both be temporary local phenomena that would not have any long-term effects.

Blasting Regulations

In areas where blasting would be required for construction of the proposed pipelines, all applicable Federal, state, and local stipulations would have to be observed, and necessary permits and authorizations would have to be obtained. State laws generally require that a blasting plan be filed with the appropriate agency prior to the commencement of blasting and that seismic monitoring of blasts be conducted to ensure that vibration limits are not exceeded. Notification of owners of nearby buildings would also be required. Federal and state blasting standards and regulations are described below.

- Federal blasting regulations are issued by the U.S. Bureau of Alcohol, Tobacco and Firearms (27 CFR 55), and U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)(29 CFR 1910.109 and 1926.900-1926.914).

- Blasting in Minnesota is regulated by the Minnesota Department of Public Safety Bureau of Criminal Apprehension under Chapter 7500 of the Minnesota Rules.

- Blasting in Wisconsin is regulated by the Wisconsin Department of Industry, Labor, and Human Relations under Chapter ILHR 7 -Explosive Materials of the Wisconsin Administrative Code.

- Blasting in Michigan is regulated by the Department of State Police under rules R 28.131 to R 28.200 of the Michigan Administrative Code.

- Blasting in New York is regulated by the NYDEC, which is currently in the process of developing a new set of guidelines. Blasting during pipeline construction would likely be regulated by the new guidelines, which are expected to reflect the U.S. Bureau of Mines (USBM) guidelines on structural response and damage because of ground vibration from blasting.

- Pennsylvania regulates blasting through the Mining and Reclamation Bureau of PADER under Title 25, Chapters 209 to 211 of the Pennsylvania Administrative Code.

- Blasting in Massachusetts is regulated by the State Fire Marshal, who must be contacted for permission to blast, and who would then notify individual towns. Contractors must exhibit a blasting bond and a certificate of competency issued by the individual municipalities and the State Fire Marshal, respectively. Specific stipulations are contained in the Massachusetts General Administrative Code, Chapter 148, Sections 9, 10A, 19, 20A-C, and Board of Fire Protection Regulations, Chapter 527, of the Code of Massachusetts, Sections 13.00 et seq.

- The State Fire Marshal regulates blasting in Connecticut in accordance with the Connecticut General Statutes, Title 29, Chapter 530. Individual towns must also be notified prior to blasting. If excessive noise would be generated, the CTDEP must be notified.

- In New Jersey, blasting is regulated by the Department of Labor, Division of Mine Safety. Requirements are outlined in the New Jersey Administrative Code, Title 12, Chapter 190 as amended October 15, 1982, titled "Explosives."

These regulations include limitations on size of explosives charges, safe handling, storage, transportation, and proximity to buildings and highways during use. As discussed in section 2.3, the applicants would use measures such as matting to minimize vibrations and fly-rock. Most of the proposed pipeline in the NIP Project is looping. The measures the applicants must take in order to protect the nearby, high-pressure natural gas pipeline (in addition to the requirements of the various regulations cited above) would likely preclude any potential damage to other structures. Section 5.1.3.1.2 describes our recommended measures for restoring water supplies should any be affected.

If the above measures are adhered to, we feel that blasting impact would be limited to the rights-of-way and would not affect structures in the vicinity of the proposed pipelines. Studies conducted by the USBM (Siskind and Fumanti, 1974) support this conclusion. Blasting in rock generally produces rock fractures within a very small radius surrounding the shot hole. If a typical shot hole is 4 inches in diameter, rock fractures can be expected to extend a distance of 5 to 55 times the shot hole radius, or 1 to 9 feet, depending on the hardness of the rock encountered. Consequently, rock fracturing beyond the limits of the proposed construction right-of-way (typically 75 feet) would be highly unlikely. Section 5.3.1 contains a discussion of the effects of blasting on water wells and our recommendations to minimize impact.

The applicants would identify in advance the preferred method of disposal of any excess rock from trench excavation. This would necessitate coordination with local officials to determine the most appropriate disposal options; a survey of local landowners to determine the potential for use as fill; potential locations for offsite disposal; and determination of appropriate locations for rock-crushing activities. We recommend that excavated rock not be piled along or adjacent to rights-of-way.

5.1.1.1.1 Mineral Resources

A total of 28 sand and/or gravel pits, one quarry, and one strip mine are within 1,500 feet of the proposed pipelines (see table 4.1.1-1). Impact on sand and/or gravel pits adjacent to the NIP Project pipelines could include a reduction in the exploitable sand and gravel reserves of the area, together with attendant economic losses to the owner caused by limitations on the possible future expansion of the affected quarries. However, except for one gravel pit near the terminus of CNG's TL-470 Line, these loops would be constructed primarily in existing rights-of-way. Therefore, incremental impact on these resources is expected to be minimal. Oil and gas fields that would be crossed by the proposed loops would not be affected by pipeline construction or operation.

5.1.1.1.2 Geologic Hazards

As discussed in section 4.1.1.3, geologic hazards in the area of the proposed pipelines include landslides and karst. Karst conditions are not widespread in the proposed project area. Seismicity hazards to pipelines associated with surface faulting and soil liquefaction are not known to occur in the area of the proposed facilities.

Landslides do not pose a widespread hazard throughout most of the proposed project area. No landslide hazards are associated with the proposed Great Lakes loops. In the eastern portions of the project area, most types of earth movement are limited to small earth flows, slumps, and creep. Creep is the slow movement (1 to 2 feet per year or less) of colluvium or large slabs of weathered bedrock up to 8 feet thick. Small earth flows and slumps are associated with lacustrine and alluvial clays in the Connecticut and Niagara River Valleys. Colluvium and bedrock movement are associated with the plateaus and valley and ridge provinces of the Appalachian Mountains in Pennsylvania. Because of the slow movement of these materials, creep would not be of short-term concern for the proposed pipeline. However, over time, this movement could bend and weaken pipelines and would be most significant on sidehill installations of thick colluvial deposits or in areas where

weathered bedrock with the potential for creep is greater than 5 feet thick. Although creep could occur along several proposed pipelines, none of the applicants have experienced movement or damage to any of their existing pipelines in the project area.

5.1.1.2 Site-Specific Impact

Great Lakes

Based on SCS information, bedrock occurs at or within 5 feet of the surface along 9.7 miles that would be crossed by the proposed Great Lakes loops. Most near-surface bedrock occurs in scattered areas along Loops 8, 11, and 13. Great Lakes has stated that in these areas blasting may be necessary to excavate the trench. However, these loops occur in sparsely populated areas of northern Michigan and few structures or wells are anticipated to exist adjacent to the proposed construction right-of-way. Therefore, we feel that if the procedures outlined in section 5.1.1.1 and blasting regulations of the Michigan Administrative Code are followed, there would be little adverse impact from blasting along Great Lakes' proposed loops.

One active sand and gravel pit at MP 391.5 in Loop 8 (Iron County, Wisconsin) would be crossed by the proposed pipeline. Four other recently active sand and gravel pits occur within 500 feet of the proposed route (Itasca County, Minnesota, and Emmet and Lapeer Counties, Michigan). Extensive sand and gravel deposits are common within the vicinity of Great Lakes' loops. Also, each of these operations occurs within or adjacent to the right-of-way of the existing pipeline. Therefore, potential impact on sand and gravel resources would be minimal. Great Lakes has contacted owners/operators of the sand and gravel pits regarding potential pipeline encroachment. For the sand and gravel operations in Itasca and Iron Counties, rights-of-way have been negotiated by Great Lakes with the owners/operators and suitable agreements to ensure that pipeline installation would not adversely affect future gravel removal operations that have been or will be developed. The pits located in Emmet and Lapeer Counties are no longer in use.

Karst is the only identified geologic hazard along the proposed Great Lakes loops. Based on information provided by the applicant and U.S. Geological Survey (USGS) topographic maps, karst conditions occur along proposed Loops 11 and 12. Small sinkholes have been identified near the proposed pipeline in Schoolcraft and Mackinac Counties in upper Michigan. The potential for karst development also exists in bedrock that would be crossed by Loops 13 and 14. However, as discussed in section 4.1.1.3, this type of karst does not seriously threaten the integrity of the pipeline because it does not collapse suddenly.

Tennessee

Segment 8 would be located in an area of moderate landslide incidence and high landslide susceptibility (Radbruch-Hall et al., 1976). Landslides in this area consist primarily of small slumps and earthflows in clays near the Connecticut River. No damage from such earth movement has been identified along the existing pipeline route.

A total of 2.7 miles of Tennessee's proposed pipelines may require blasting. Blasting in Segment 9 could occur near numerous residences. Public concern about possible damage

from blasting has been voiced. Tennessee has agreed to conduct pre- and post-blast foundation inspections and water-well restoration, if necessary, when blasting is required near residential or commercial structures.

Algonquin

Bedrock occurs within 5 feet of the surface along portions of Algonquin's proposed E-1 and G-5 Loops. Algonquin has proposed to use mechanical rippers where possible to excavate the trench in areas where bedrock is near the surface. However, bedrock in these areas consists of granites, schists, and gneiss. These may be too resistant for ripping and blasting may be required. Numerous structures are near the proposed E-1 Loop and blasting activities would have to be closely monitored and limited. However, if the procedures outlined in section 5.1.1.1, the Massachusetts Administrative Code, and the Connecticut General Rules regarding blasting are followed, the potential for impact on structures or water wells would be unlikely.

Transco

Bedrock, which consists of sandstone, siltstone, and limestone, occurs within 5 feet of the surface along approximately 3.7 miles of Transco's proposed 1.61-Mile and 6.79-Mile Leidy Lines. Blasting may be necessary if bedrock cannot be fractured with rippers. However, Transco anticipates that ripping would be successful for excavating the trench and that blasting would not be necessary. Although no specifications were provided, Transco has indicated that it would work with homeowners to correct any damages and/or restore the water quality.

Texas Eastern

Limestone, dolomite, and sandstone bedrock occur near the surface along approximately 1.1 miles of Texas Eastern's Line No. 37. The applicant would use ripping where possible and anticipates that blasting would not be necessary.

Line No. 37 is in an area of high landslide susceptibility. Creep of colluvium and scree is common in this area and heavy rainfall could cause slumps, debris avalanches, or debris flow. Creep over time could bend and weaken the pipeline on hillsides and steep slopes, which occur along most of the proposed loop. The applicant recognizes this hazard and proposes to avoid cross-slope pipe installation and install an improved drainage system.

CNG

Sandstone, limestone, and shale bedrock occur within 5 feet of the surface along 0.8 mile of the proposed pipeline.

One active gravel pit occurs 300 feet from the eastern terminus of CNG's proposed TL-470 Line. However, since the new pipeline would connect into an existing pipeline at this point, the construction and operation of the proposed pipeline would create no new limits on the possible future expansion of the sand and gravel operation.

The proposed pipeline would be located in an area of high landslide incidence. Extensive slumps and earth flows in lacustrine clays in the Hudson River Valley have occurred (Radbruch-Hall et al., 1976). CNG has stated that it would construct the Hudson River crossing between May and July to mitigate impact from flooding and ground slides, and if wet weather conditions persist, the construction period may be altered. As proposed, this 2.35-mile pipeline would avoid sidehill construction by crossing all slopes perpendicular to the contours. This would minimize impact of any of the typical shallow earthflows should they occur.

National Fuel/Penn-York

National Fuel/Penn-York's proposed Y-M54 Line is within an area of high landslide susceptibility and possible creep occurrence. As proposed, the pipeline would parallel a Tennessee pipeline for most of its length. There would be some sidehill construction along this 2.5-mile pipeline, but the slopes involved are only approximately a 15 percent grade. Landslides on grades such as this one are unlikely.

5.1.2 Soils

5.1.2.1 General Construction and Operational Impact

Effects on soils from pipeline construction and operation could result from potential increased water and wind erosion during the construction and early postconstruction phases, loss of soil productivity from soil compaction and damage to soil structure by heavy equipment during construction, loss of soil fertility from mixing of topsoil and subsoil, and interference with agricultural drain tile systems.

Soil Erosion

Construction procedures, including vegetation clearing, grading, trenching, topsoil segregation, and backfilling, destabilize the soil surface and make it susceptible to water and wind erosion, potentially the most severe impact on soils from pipeline construction. The most critical time for soil erosion is after initial clearing and grading and before reestablishment of vegetation. Water erosion primarily occurs in loose soils on moderate to steep slopes. Wind erosion can occur in dry, sandy soils where vegetation cover is difficult to establish and maintain.

Soil erosion can be reduced with temporary and permanent structures such as terraces, berms, hay- or straw-bale sediment barriers, riprap, and trench breakers to divert, dissipate, or slow runoff and trap silt. The soil surface can be stabilized with temporary and permanent planting and mulching. Construction can also be avoided during periods of maximum runoff.

Soil Compaction and Damage to Soil Structure

Movement of heavy construction vehicles along the right-of-way during construction usually results in compaction of the soil, which can have a significant impact on agricultural areas. Within a certain range of moisture content, soil compaction along the construction

right-of-way can be significant, but can be alleviated by tillage. Of greater concern is puddling and damage to soil structure. The soil is especially prone to structural damage during the wettest part of the spring season and in areas with poor drainage. Structurally damaged soil has reduced pore space, which impedes the movement of air and water to plant roots, resulting in lower growth rates. Clodding at shallow depths complicates planting. Also, compaction and rutting can increase the erosion potential.

Mitigation measures to minimize compaction normally include avoiding heavy construction during excessively wet periods. Subsoil compaction may occur, but may be alleviated by deep tillage utilizing subsoilers or deep chisel plows. This technique loosens the soil without mixing horizons.

A widely recognized method of restoring structurally damaged soil is to plant a legume or grass-legume cover crop and plow it under when grown. The addition of organic matter, or "green manure," reduces bulk density and promotes granulation, thereby reversing the effects of wet weather construction. Another method is to plow the damaged area with a "winged" plow, which lifts and loosens soil without turning it over. Significant improvements in productivity have been reported following the use of such a device. The use of a similar tool, called the "paraplow," can also restore damaged soil.

Loss of Soil Fertility

Trenching and backfilling can result in the mixing of topsoil and subsoil, reducing productivity of the soil. If the subsoil is gravelly, water retention capacity within the root zone may be lowered by mixing. Large stones brought to the surface during construction could interfere with operation of agricultural equipment. In areas where blasting is required, noncontained blasted rock could also interfere with equipment.

Soil mixing can be minimized by separating topsoil from subsoil during trenching. The removal of stones having a 4-inch or greater diameter from the upper 12 inches of soil is normally performed in cultivated lands. Fly-rock from blasting can be contained by matting or controlled blasting techniques.

Drainage Tile System Damage

Movement of heavy construction vehicles along the right-of-way could push drain tiles out of alignment or cause breakage. Trenching could also cause drain tile damage. Crop production would be lowered if tile damage is not corrected. Drain tile damage can be reduced by locating the drain lines during preconstruction consultation with landowners and appropriate Federal and state agencies. Tile damage from vehicle movement or trenching can be repaired by probing the tile to determine if misalignment or breakage has occurred and replacing the damaged sections.

Pipeline Depth of Burial

To avoid obstructing drainage, we recommend that the applicants construct pipeline loops at the same elevation as any existing line(s) on the same right-of-way. Where it would be consistent with this requirement, the following burial depths should be used. The

applicants should ensure that the soil-cover depth would be at least 48 inches in rotated and permanent croplands and hayfields and at least 36 inches in unimproved pasture. The pipeline would be buried below the bedrock level in agricultural areas where there is less than 48 inches of soil over bedrock. In areas requiring blasting where bedrock is exposed at the ground surface, the applicants would place at least 24 inches of cover over the pipeline. The applicants would need to coordinate this with the appropriate landowners. Topsoil from adjacent agricultural land should not be used as backfill or additional surface cover material. An example is Algonquin's segment near Yantic, Connecticut; which might affect the proposed Yantic River Watershed Plan of the Soil Conservation Service.

5.1.2.2 Erosion Control, Revegetation, and Maintenance Requirements

The applicants prepared erosion and sedimentation control (E&SC) plans. Some states require that these plans be submitted and approved before construction begins. In Massachusetts, the plan must be submitted to the appropriate town conservation commissions. In New York, New Jersey, and Connecticut, the E&SC plan must be submitted to the affected soil county conservation districts and appropriate town conservation commissions. In Pennsylvania, each county soil conservation office must approve the plan.

We evaluated each applicant's plan, submitted with the original application, to determine if the proposed mitigation measures are adequate. All of the plans have some components that are adequate and some components that are not. Since each plan contains certain aspects that we do not consider sufficient to reduce impact to acceptable levels, we compiled a standard set of procedures that each applicant would be required to implement as part of its erosion control, revegetation, and maintenance procedures (see appendix C, Erosion Control, Revegetation, and Maintenance Plan (Plan)). In data requests sent to each applicant, they were asked to incorporate our standard set of erosion control, vegetation, and maintenance procedures into their own plans and to comment on items of our plan that they felt were inappropriate or ineffective. Topics that commonly were contested included timing of construction, environmental inspection, topsoil segregation, revegetation requirements, and right-of-way maintenance. Some changes were made to our plan, incorporating various suggestions from the commentors. These changes are reflected in the plan now contained in appendix C of this EIS.

Our Plan was reviewed by the applicants in the DEIS. The applicants agreed with some of the requirements, but took exception to other measures and proposed alternative measures. We have reviewed the applicants' comments on the Plan and made changes to it where we feel the applicants have raised a valid concern. In addition, we have made revisions to incorporate comments made by other agencies. The following is a general description of our Plan, presented in appendix C, and major comments and alternative measures made by the applicants along with our evaluations and recommendations. Other reviewers, especially managers of the national forests that would be crossed, have commented on our Plan and the soil erosion and compaction mitigation measures discussed in this section. We have reviewed and responded to these comments in Volume II and have incorporated any appropriate recommendations in our Plan. We recommend that unless the applicant's plan or state or locally approved plans provide for more stringent measures, the measures contained in appendix C be implemented.

Supervision and Inspection

The mitigation measures discussed here and in appendix C could be successfully implemented if the construction process is carefully monitored by environmental inspectors. Our Plan requires that each applicant employ an environmental inspector or other qualified professional knowledgeable of the soil conditions and conservation plantings in the project area to implement the procedures outlined in the Plan. Any noncompliance with the Plan would be reported to the chief inspector by the environmental inspector. We do not recommend giving stop-work authority to the environmental inspectors -- only the chief inspector or resident engineer should have such authority. The inspectors shall interact directly with landowners, Soil and Water Conservation Districts, state representatives, and SCS personnel to ensure compliance during preconstruction, construction, postconstruction, and restoration phases, as well as follow-up inspections. Duties of the inspectors are outlined in appendix C.

Most of the applicants have agreed to use environmental inspectors who would be present at all times during construction. Algonquin stated that because of the relatively small size of segments to be constructed by them this requirement is unwarranted. We note that the environmental inspectors would be responsible for monitoring compliance with other environmental permits and approvals as well as the conditions of the FERC certificate. We have revised the Plan to include these activities as part of the environmental inspectors' responsibilities.

Tennessee commented that the duties outlined in section I of appendix C are beyond the scope of the environmental inspector. They stated that they intend to hire an agricultural/soil conservation specialist who would have local knowledge of soil conditions and vegetation and would work closely with the environmental inspector. We agree with this approach as long as the environmental inspector has the overall responsibility of ensuring that the conditions of the Plan are followed. We have revised the plan to state it shall "be implemented under the supervision of the environmental inspector or other qualified professional with knowledge of soil conditions and conservation plantings in the project area." However, it is still the responsibility of the environmental inspector to monitor and supervise these activities. CNG disagrees with our Plan if it would necessitate hiring outside inspectors. Texas Eastern commented that the reporting requirements would be burdensome, and both Texas Eastern and Algonquin object to our requirement that less protective measures be permitted only after approval of the Director of OPPR. In these matters, we believe the Plan provides for the appropriate level of management and control.

Preconstruction Planning

Timing of Construction - The most common soil-related problem the proposed project would encounter is saturated soils caused by seasonal high water tables. Saturated soils have low weight-bearing capacities and low resistance to disturbance. Extended periods of rain could also result in saturated conditions, typically between April 15 and May 31 for Great Lakes Loops 1 through 14 and between April 1 and May 15 for the remaining project area. However, the wettest part of the season can vary greatly from year to year. For example, in the Midwest in 1988 the soil was dry and being cultivated in the second week of April while in 1989 this activity was prohibited by moist conditions until the first week of June.

Soils in group 4 are seasonally wet and have the greatest potential for structural damage. Of the facilities involved in this project, Great Lakes' would cross the majority of these soils (86.8 miles), which are wet due to poor drainage and/or a seasonally high water table. Soils in group 3 can also be seasonally wet in Minnesota, Wisconsin, Michigan, and western New York. Great Lakes proposes to begin construction in summer. Tennessee, Algonquin, CNG, and CNG/Texas Eastern intend to begin construction before October 31, if possible. National Fuel/Penn-York would begin construction in the fall. Great Lakes commented that rather than preestablished dates within which construction would be restricted, timing should be left up to their environmental inspector. We recommend that to avoid compaction and rutting of soil in agricultural and residential areas, construction be avoided during the wettest time of the year (April 15 to May 31 for Great Lakes Loops 1 through 14 and April 1 to May 15 for the remaining project areas).

If wet weather occurs at other times, follow-up mitigation measures would be needed. Except for CNG, none of the applicants has discussed construction during wet periods or periods of heavy rainfall. CNG proposes to avoid construction during these times to mitigate impact from possible flooding of the Hudson River and ground slides of clays along steep slopes. In the event wet soils cannot be avoided, follow-up mitigation would be needed during cleanup to decrease effects of rutting.

Existing Drain Tile Location - Drainage tiles can be damaged by operation of heavy construction equipment on the right-of-way and by trenching operations. If not repaired, the soil will not drain properly and crop production could be curtailed. Subsurface drain lines would be identified by the applicants during preconstruction surveys. Only Great Lakes objects to locating drain tiles before construction because their location is not presently known. We require that drain tiles be located prior to construction by contacting landowners and local SCS officials.

Landscape Planting Plans - In our Plan we require that the applicants determine the vegetation requirements for screening and landscaping new compression and metering facilities and file a report for our review and approval prior to construction. Some applicants do not feel that we should be involved in approval of screening and landscaping plans for these facilities. Those applicants that commented felt that only local governments should have a review and approval role. Algonquin prefers a performance-based approach where FERC would evaluate the postconstruction results. The applicants would need to work with the local agencies to determine the necessary requirements. However, we still require that the final plans be submitted to us for our review and approval prior to construction.

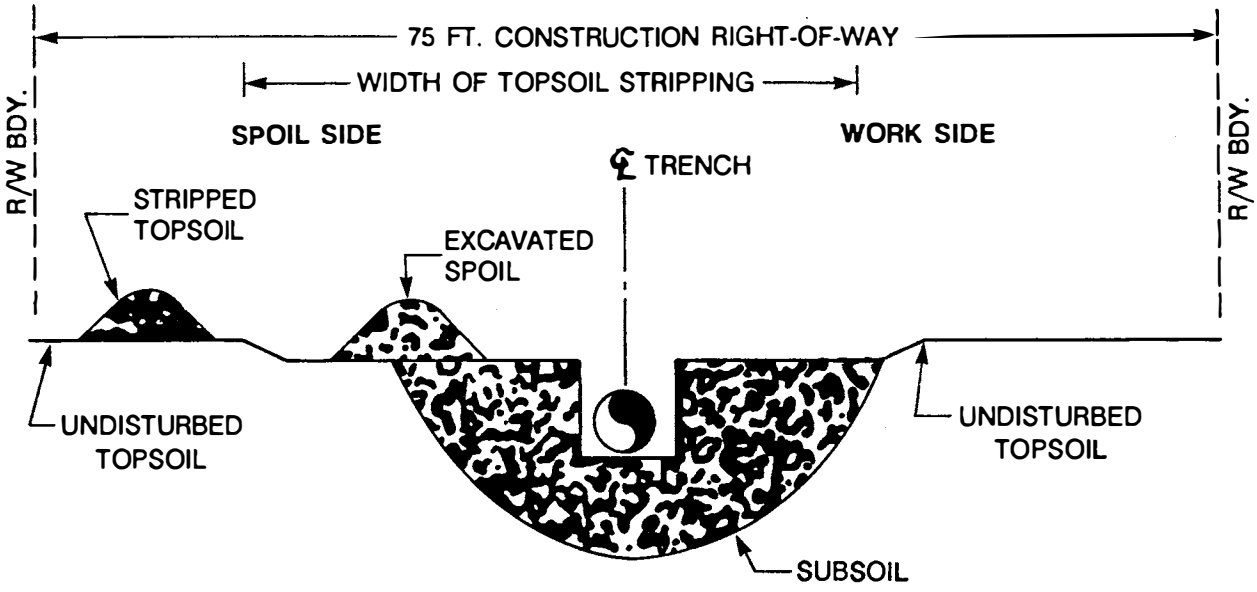
Clearing and Installation

Topsoil Segregation - Trenching and backfilling could result in the mixing of topsoil and subsoil materials, which could degrade chemical and physical properties of the soil profile and potentially result in a loss of crop productivity. Agricultural lands are crossed by the proposed pipelines of each applicant with the majority crossed by Great Lakes (110.9 miles). Much of the cultivated soils crossed by the proposed pipeline have topsoil that is relatively free of gravel, while the subsoil is very gravelly. Mixing these horizons would lower the water retention capacity and organic matter content within the root zone of the soil. Large

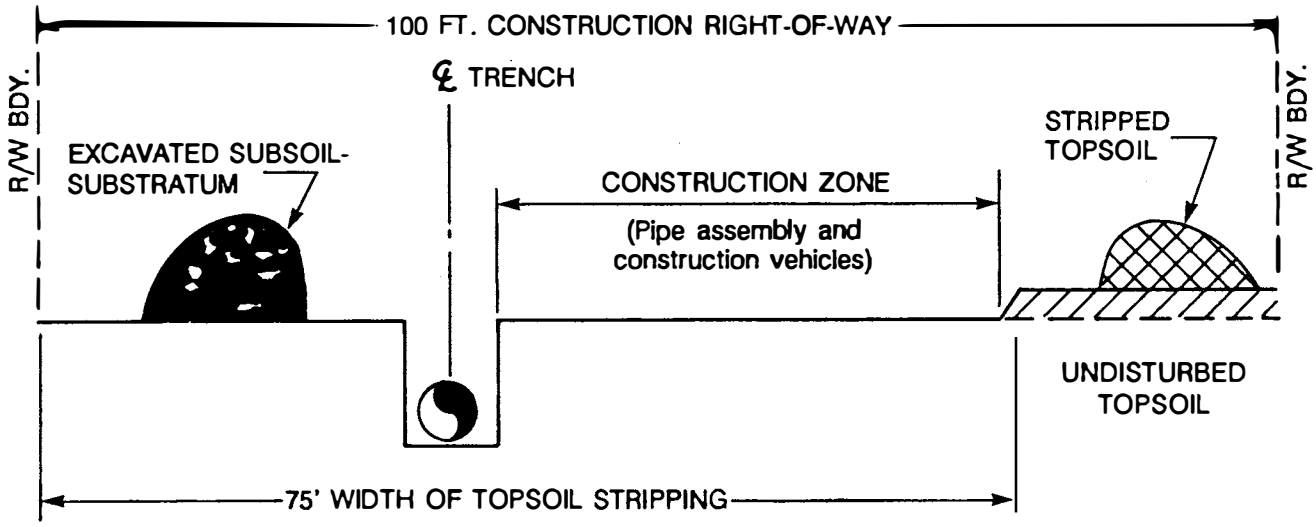
stones brought to the surface during construction could create conditions that would interfere with agricultural operations. Stony soils, groups 1 and 2, would be encountered primarily by Algonquin in New London and Tolland Counties, Connecticut. Transco and Texas Eastern would also cross stony soils in Pennsylvania. In our Plan, this potential impact is mitigated through separation of topsoil and subsoil during trenching and grading, as well as the removal of stones having at least a 4-inch diameter from within the upper 12-inch zone in areas of cultivated land. Texas Eastern and CNG object to removal of stones having at least a 4-inch diameter under all conditions. The Plan requires topsoil be stockpiled onto topsoil and subsoil onto subsoil to prevent mixing of the horizons (see figure 5.1.2-1). In addition to agricultural areas, the applicants would also apply this mitigation technique where landowners request it and in residential areas. For deep soils (such as floodplains and stream terraces), 12 inches of topsoil stripping is required. Tennessee comments that the depth of topsoil to be segregated in wetlands and floodplains depends on the type of wetland and site-specific conditions. We have modified the Plan to exclude wetlands. Where soils are shallow to bedrock or have a stony subsoil, 8 inches of topsoil stripping is required. The applicants have agreed to topsoil segregation in cultivated agricultural areas. The applicants will be required to segregate topsoil in other areas as requested by the landowner. The applicants would be responsible for polling landowners as to whether topsoil segregation measures are required.

The NYSTF commented that in all tillable agricultural land, topsoil segregation should include the working side of the right-of-way as well as the trench area, since the working side of the right-of-way is where the most damaging long-term silting and mixing of the soil would occur (see figure 5.1.2-1). This full-width right-of-way topsoil stripping would require extra space to store the topsoil that could result in a construction right-of-way 100- to 120-feet wide. The NYSTF suggested that full-width right-of-way topsoil stripping be performed in the following areas: where the landowner requests it; in areas of clayey soils that could pose problems during periods of heavy rain in the fall; in agricultural areas where soil structure is vulnerable (based upon soil surveys); in cultivated areas that have steep slopes where areas would have to be cut to create level grade; and in areas where additional work space is required such as boring under roads. The NYSTF also suggested that topsoil segregation be used in areas other than agricultural areas to promote revegetation.

In general, we agree that full right-of-way topsoil stripping would further reduce the damage to soil structure from compaction and settling on the working side of the right-of-way. We do note that, in the diagram the NYSTF submitted depicting full right-of-way topsoil stripping, they showed excavated subsoil being stored on undisturbed topsoil on the spoil side of the trench. To reduce the potential of mixing topsoil and subsoil, we specifically require that topsoil only be stored on top of topsoil and subsoil on top of subsoil. We are also concerned that full right-of-way topsoil stripping requires a substantially wider construction right-of-way than is normally utilized for overland construction. The use of this method of topsoil segregation would need to be strictly limited to actively cultivated agricultural areas, which would include active or rotated cropland and hayfields. We require that for full right-of-way topsoil stripping, the width of the construction right-of-way not exceed 100 feet. In all other improved or residential areas the ditch plus spoilside topsoil segregation method (see figure 5.1.2-1) would be used and the construction right-of-way would be limited to 75 feet. The Plan has been revised to reflect this change. The applicants are required to strip the topsoil to the depths indicated in the Plan. Topsoil



DITCH PLUS SPOIL SIDE TOPSOIL SEGREGATION



FULL RIGHT-OF-WAY TOPSOIL STRIPPING

FIGURE 5.1.2-1

TOPSOIL STRIPPING CROSS-SECTION

NOT TO SCALE

segregation in areas other than those specified in the Plan would be conducted at the landowners' request. CNG suggested that topsoil be segregated and stored on the working side of the trench. We feel this would lead to potential conflicts with the movement of construction vehicles.

Construction in Peat Lands - Peat lands make up approximately 35 to 40 percent of all soils that would be crossed in Minnesota and upper Michigan. The FS has expressed concern about construction in peat lands in the Chippewa and Hiawatha National Forests in Minnesota and Michigan, respectively. The FS recommends that Great Lakes determine the peat depth in the forest to adequately assess the proper bedding needs for the pipe and to determine the safe distance required to offset the new pipe from the existing line. The FS stated that in peat lands and wetlands in general, construction should be limited to the winter months to mitigate impact.

Great Lakes concurs that peat depth should be determined because stability of the existing pipe is dependent on peat depth. Great Lakes agrees to perform soil tests when the ground thaws. Results would be forwarded to the Chippewa National Forest and a construction schedule would be developed. Great Lakes further agrees to implement the recommendations by the MNDNR to restore peat lands including replacing subsoils beneath peat to maintain proper pH, leaving no crown over the ditchline, and allowing disturbed areas to revegetate. Similar mitigation should occur in the Hiawatha National Forest.

Slope Breakers - Steep slopes have been identified by the applicants and would require special mitigative techniques. Soil in Groups 1, 2, 3, and 5 include at least some soil series with moderate to steep slopes, which are particularly prone to erosion. The majority of steeply sloping soils are crossed in Northampton and Centre Counties in Pennsylvania and in New London, Tolland, and Windham Counties in Connecticut. Additional local areas of steeper slopes will be encountered along most portions of the route.

A slope breaker is a berm of soil constructed across the pipeline right-of-way in areas on slopes to reduce erosion caused by water flowing down the cleared right-of-way. Temporary breakers are used after initial grading and permanent breakers are installed during final grading following trench backfilling.

Each of the applicants has proposed the use of temporary and permanent slope breakers. However, spacing was usually less stringent than our requirements. On slopes equal to or greater than 5 percent, our Plan requires temporary slope breakers, terraces, or diversion ditches shall be constructed at the end of each working day according to the following spacing specifications:

Slope	Spacing (ft)
5-15%	300
16-30%	200

Permanent runoff diversions on all slopes greater than 5 percent would be constructed according to the following specifications:

Slope	Spacing (ft)
5-10%	150
11-15%	100
16-30%	75
> 30%	50

The slope breakers would be designed to provide a safe and stable outlet for the runoff, channeling the water to an established vegetated area or rock-lined channels.

Great Lakes commented that the installation of slope breakers at the end of each working day should not be required if winter weather would make the possibility for runoff events minimal. Algonquin comments that site-specific conditions may require a greater or fewer number of temporary or permanent slope breakers. We have no objections to the greater use of erosion control devices, but feel our specification represents a minimum level of environmental protection. We feel that the requirement for temporary slope breakers should not significantly increase construction time and that the benefit of controlling runoff due to unanticipated rainfalls outweighs any impact from an increase in land disturbance in constructing the breakers. Therefore, the applicants are required to follow our Plan for utilizing temporary slope breakers during construction and installation of permanent runoff diversions.

Trench Breakers - Trench breakers are used to prevent water surface erosion or preferential migration of shallow groundwater along the pipe or the pipeline trench. They are usually constructed of sacks of soil or sand placed from the bottom of the trench to the natural ground surface and completely surround the pipe. Trench breaker spacing is based on slope. Each of the applicants agrees to use trench breakers. However, Great Lakes, Algonquin, Texas Eastern, and Transco disagree with spacing requirements. Our Plan requires construction of trench breakers such that the bottom of one breaker is at the same elevation as the top of the next breaker downslope, which agrees with other agency recommendations.

Sediment Control Measures - At stream and road crossings, a buffer strip of natural vegetation, as wide as practicable, should be left undisturbed to prevent erosion in areas such as stream/river banks and road crossings. Where the vegetative strip is inadequate, silt fences which consist of filter fabric attached to a support fence, or sediment barriers constructed of hay bales, should be used to intercept sediment carried by sheet flow from cut slopes, spoil piles, or other areas of exposed soil. We require that temporary silt fences or sediment barriers be used at the base of all slopes adjacent to streams and at the base of slopes adjacent to road crossings where vegetation has been cleared within the following distances from the road:

Slope	Width of Vegetation Strip Required
<5%	25 feet
5-15%	50 feet
16-30%	75 feet
>30%	100 feet

Algonquin stressed that installation of siltation fences across the right-of-way could restrict construction traffic movement. Tennessee does not use a standardized spacing, preferring to use hay bales or silt fences at 100-foot intervals on up slopes. We feel our requirement is prudent to control sedimentation problems and will not severely restrict access along the right-of-way. We require all applicants to follow the Plan specifications.

Drain Tile System Repair/Testing - Our Plan requires that all drainage systems be probed with a sewer rod or pipe snake to determine if damage has occurred. All tiles damaged during construction shall be repaired to their original or better condition. Detailed records of drainage system repairs should be kept and given to the landowner for future reference. In addition, the applicants should as a part of their normal maintenance, monitor and correct any future drainage problems that result from pipeline construction.

Tennessee, Texas Eastern, and Transco propose to probe the tile adjoining the trench by snaking. Great Lakes states that adjoining tiles would be probed or visually inspected and that probing could result in damage or breakage of the tiles. The remaining applicants have not discussed probing of adjoining tiles. Algonquin also feels that probing tiles could result in damage and that visual inspections would be more effective. CNG objects to keeping detailed records of drainage system repairs, preferring to discuss the results with the landowner. FERC requires use of sewer rods or pipe snakes. Such probes should have no more than a 15-percent size reduction than the minimum undamaged drainage system components, and probing should be completed across the entire width of the right-of-way. The suggestion for detailed record keeping is primarily for the company's protection.

Great Lakes proposes to mark tiles cut and damaged during trenching with a flag. The ends of all cut drain tiles would be covered with a filtering material to prevent clogging. A trough would be used to support the tiles across the trench and to protect the tiles from damage during backfill settling. Texas Eastern also proposes using a trough to support tiles. Tennessee and Algonquin propose a pipe sleeve that would extend 2 feet beyond the edge tiles to prevent damage by heavy equipment and to compact soil to its original density prior to replacing the tile to prevent damage due to settling of trench materials after construction. Transco and CNG/Texas Eastern agree to replace and repair drainage tiles. However, no specific design parameters have been given. National Fuel/Penn-York states that either troughs or pipe sleeves would be used to support the drain tiles across the trench. CNG has not discussed the potential for damage to drainage tiles.

NYSTF commented that trench supports for drainages should extend 2 to 3 feet into each trench wall. We believe as a minimum requirement our plan is adequate. We recommend that qualified specialists be used to insure proper repairs and adequate probing/testing of the repaired drainage system.

Future Drain Tiles/Depth of Cover - In areas where there is a potential for future installation of drainage tile, the trench and pipeline must be placed at an elevation so as not to interfere with this future system. We require that the applicants increase the depth of cover over the pipeline to 4 feet or more, if needed, so the pipeline is below the anticipated depth of drain tile installations. The applicants should contact landowners and local soil conservation authorities to determine locations where this increase in cover depth is required.

Cleanup

Timing - Our Plan requires that final cleanup and permanent erosion control measures, as appropriate, would be completed within 10 days after backfilling the trench, weather and soil conditions permitting.

Algonquin stated that if stove pipe construction is being used, the majority of construction equipment would be utilized for construction and would not be available for cleanup. We do not feel this is a valid reason in that arrangements can be made to provide additional equipment or schedule the use of equipment, to have it available for cleanup. Tennessee, Great Lakes, CNG, Algonquin, and Texas Eastern commented that our 10-day requirement is impractical and should, as a minimum, be 10 days after final grading. Keying cleanup to final grading could result in areas remaining disturbed for extended periods of time. Our Plan stands as written.

Restoration of Agricultural Areas - Ruts created by construction equipment can extend into the subsoil, damaging its structure. Mixing of the topsoil with subsoil and shearing soil structure could result in clodding of the dry, surface soil, which would interfere with tillage and reduce soil productivity. This structural damage would have undesirable effects on soil bulk density, water infiltration, and gas exchange. Studies in Ontario, Canada, have shown that pipeline construction during wet periods can significantly reduce cropland productivity, persisting for as long as 5 years in the absence of restorative measures.

Within a certain range of moisture content, soil compaction along the construction right-of-way could be significant, but could be alleviated by tillage. Deep compaction is not common in connection with normal pipeline construction procedures. Inspection of soil compaction across the project right-of-way should be investigated after construction for the same soil type under the same moisture conditions and should include the following areas: soil from undisturbed areas, soil stockpile areas, the trenched zone, the work area, and any traffic areas related to the project. Devices such as COE-style cone penetrometers or other appropriate devices can be utilized to test for compaction.

Care should be taken to insure that the impact from soil structure damage and compaction is minimized. Tracked vehicles, which cause less disturbance than vehicles with tires, should be used wherever possible under saturated soil conditions. Crushed stone pads for at least a 50-foot length or other appropriate measures should be used at all access points to the right-of-way adjacent to public roadways in active agricultural areas to control rutting along the shoulders of roads and debris transference. Crushed stone should be placed on a synthetic fabric material to prevent mixing the stone with the soil and for ease of removal after construction.

Structurally damaged soils may be restored by planting a legume or a grass-legume cover crop and plowing it into the soil when sufficient plant material has grown. This addition of organic matter ("green manure") helps to reverse the effects of wet weather construction by reducing the soil bulk density and promoting granulation. Significant improvements in productivity have also been observed where a "winged" plow, also called a paraplow, was applied. This type of plow lifts and loosens the soil without turning it over.

We require that severely rutted soil be plowed with a paraplow (or similar winged plow) or that the applicant arrange with the landowner to plant a "green manure." The applicants have no objection to deep tillage to alleviate the impact of compaction on soil horizons. However, Great Lakes and Texas Eastern object to being restricted to a paraplow-type device. Green manure or paraplowing should only be used in all active or rotated cropland and hayfields. Our plan stands as written.

In the DEIS we required landowner compensation for a 2-year period in conjunction with a soil structure restoration program. Crop productivity should be monitored along the right-of-way in agricultural land until soil productivity is restored to preconstruction conditions. Great Lakes has proposed to use a 3-year prorated system of reimbursement for crop loss with designs for reimbursing landowners until the land has fully recuperated from construction activity. This plan satisfies FERC's minimum conditions.

Controlled Blasting - Blasting in agricultural areas shall be conducted in a fashion such that fly-rock is contained by use of either matting or controlled blasting techniques so that there will be little additional rock introduced to the plow zone of cultivated lands. Blasted rock shall not be used as backfill in rotated or permanent cropland, though it may be used as such in pastures and hayfields. When used in hayfields and pasture, the blast-rock should only be used to landfill the trench to the top of the existing bedrock. Our Plan requires that all excess loose blast-rock be removed from the top 12 inches of topsoil in all cultivated and improved lands as well as residential areas, pastures, and other areas at the landowners' request. Preferred alternatives for disposal of excess blasted rock would be developed in consultation with local officials and landowners, as discussed in section 5.1.1.1.

Revegetation

Temporary Erosion Control - Any area that is disturbed between October 15 and May 1 or where bare soil is left unstabilized by vegetation should be treated as a winter construction problem and mulched with 3 tons/acre of hay or straw or the equivalent. If construction is completed more than 30 days before the seeding season for perennial vegetation, all areas adjacent to perennial and intermittent streams shall also be mulched with 3 tons/acre straw or hay for a minimum of 100 feet on either side of the waterway. The mulch should be anchored with a mulch anchoring tool or a liquid mulch binder.

Some applicants do not agree with our seeding time periods, the areas that should be mulched, or how much mulch should be applied. They commented that too many variables exist to establish a standard set of specifications. Our Plan is intended to provide a minimum degree of protection. Applicants can file deviations with the Commission for review and approval of the Director of OPPR. Therefore, we require the applicant to follow the seeding dates and to mulch any areas that cannot be seeded within those dates as specified in our Plan.

Permanent Revegetation - We have recommended four seeding mixtures dependent primarily on site drainage conditions within respective regions based on consultations with regional SCS offices. In areas of farmland where the right-of-way interrupts existing crops or pasture, a "green manure" may be planted as recommended above. The applicants have commented that the seed mixtures would be too restrictive given site-specific conditions and

landowner preference. We feel that the use of any seed mixture other than those specified in our Plan should only be used based on the recommendation of the landowner or land managing agency.

Great Lakes, Tennessee, and Texas Eastern stated that soil amendments including chemical fertilizer, and lime would be determined based on site requirements and agency recommendations. Our Plan requires that 2 tons/acre of lime and 300 pounds/acre of 10-20-20 fertilizer be incorporated into the top 2 - 6 inches of soil prior to seeding and planting. This should be considered the minimum requirement to soil amendments to be applied to prepare a seedbed. More stringent measures can be used based on local SCS and landowner requirements. Great Lakes and CNG objected to seeding rights-of-way within 6 working days of final grading. We feel this is an adequate length of time.

Off-Road Vehicle Use

A potential problem along pipeline rights-of-way is the use of these areas by off-road vehicle (ORV) enthusiasts. The use of the right-of-way by ORV users could cause a loss of wildlife, intrude upon the privacy of the landowners, and cause a long-term erosion problem where ORV use is heavy. We require that for each owner and manager of forestlands the applicants offer to install and maintain ORV control measures such as a locking heavy steel gate; a screen of conifers across the right-of-way; slash and timber, boulder, and pipe barriers; and posting of signs saying the area is seeded for wildlife benefit and erosion control.

The applicants questioned the viability of these measures. Tennessee felt that the use of conifers or barriers using large boulders would inhibit access for periodic maintenance. They proposed to install locked steel gates or slash and timber barriers. Algonquin contends planting trees violates DOT regulations and signs are ineffective. CNG comments that trees should only be installed on a site by site basis.

The method of controlling ORV use along pipeline right-of-way has to be resolved between the landowner or land managing agency and the applicants based on state and local requirements. We do not believe DOT regulations would be violated by the use of trees. Our Plan requires that the applicants offer to assist the landowner in controlling the ORV use by using one or more of the methods outlined in appendix C.

Maintenance

Follow-up inspections would be performed after the final and second growing season (approximately 3 - 6 months and 12 - 15 months, respectively) to determine the success of revegetation. Revegetation would be considered successful if perennial vegetation covers 70 percent of each square yard of the right-of-way. Where revegetation has not been successful, a professional agronomist would be used to specify the fertilizer and reseeding mixtures to be used in the next growing season. Tennessee has stated that agricultural/soil conservation specialists will be retained to assist with the environmental inspection requirements.

Vegetation maintenance of the right-of-way would not be done more frequently than every 3 years and not before August 1 of any year. Efforts to control ORV use in

cooperation with the landowner would continue throughout the life of the project. In nonagricultural areas, the environmental inspectors would determine the effectiveness of revegetation. Revegetation would be considered successful if an average perennial revegetation covers 70 percent of each square yard of the right-of-way.

We do not feel aerial inspection is sufficient to determine the effectiveness of revegetation. Per the requirements of our Plan, the applicants must do field inspection to determine the extent of revegetation and the establishment of desirable species. In addition, the effectiveness of revegetation should be based on the coverage of perennial vegetation only, and not perennial and naturally reseeding plants which could include weed species.

Tennessee, Algonquin, CNG, and Texas Eastern commented that to properly maintain their right-of-way they need to mow at least every 2 to 3 years, as opposed to 3 years. Tennessee and Algonquin also felt that limiting right-of-way maintenance to after August 1 is too restrictive due to possible weather limitations and availability of the workforce. We feel that the August 1 limitation is necessary to prevent the disturbance to nesting birds.

There is also a possibility that construction of the pipeline could cause seepage or drainage problems where none previously existed. We require that the applicants, as part of their normal maintenance routine, monitor and correct any future drainage problems in active agricultural areas that would result from pipeline construction.

5.1.2.3 Aboveground Facilities

Transco's Compressor Station 205 would be located on a 99-acre site in Mercer County, New Jersey. Approximately 39 acres at this site are considered prime farmland. Only 2.0 acres of prime soils would be disturbed by construction of the facility. Station 167 would be located on a 21-acre site in Mecklenburg County, Virginia. Approximately 14 acres of this site are considered prime farmland. Of this acreage, 0.6 acre would be permanently disturbed.

The Concord Compressor Station proposed by National Fuel/Penn-York would be located on a 70-acre site. Approximately 55 acres are designated as prime farmland, of which 6.0 acres would be disturbed by construction and operation of this facility.

5.1.3 Water Resources

5.1.3.1 Groundwater

5.1.3.1.1 General Construction and Operational Impact

Although construction activities associated with the proposed pipeline installation could affect groundwater resources, most potential impact would be avoided or minimized by the use of both standard and specialized construction techniques. Shallow aquifers could experience minor impact from changes in overland water flow and recharge caused by clearing and grading of the proposed right-of-way. Enhanced water infiltration provided by a well-vegetated cover would be temporarily lost until successful revegetation has occurred. Near-surface soil compaction caused by heavy construction vehicles could also reduce the

soil's ability to absorb water. This minor impact would be temporary and would not significantly affect groundwater resources.

Refueling of vehicles and storage of fuel, oil, and other fluids during the construction phase of the proposed project could create a potential contamination hazard to aquifers. Spills or leaks of hazardous liquids could contaminate groundwater and affect users of the aquifer. Soil contamination could continue to add pollutants to the groundwater long after the spill has occurred. This type of impact could be avoided or minimized by restricting the location of refueling and storage facilities and by requiring immediate cleanup in the event of a spill or leak. Hazardous materials storage would not be permitted in aquifer protection areas traversed by the proposed routes.

Dewatering of the pipeline trench would be the only activity that would require groundwater pumping and could be necessary in areas where there is a high water table. The potential impact of groundwater withdrawal on users of the aquifer would depend on the rate and duration of pumping. Pipeline construction activities in any one area are typically completed within several days. All water produced from trench dewatering activities would be discharged in an upland area to allow filtration prior to its to return to the aquifer. In this way dewatering during the proposed pipeline construction generally would have minimal impact on local groundwater levels.

Grade and trench blasting would be necessary in areas where bedrock is exposed or is less than 6 feet below the ground surface (see section 5.1.1). Concerns regarding the impact of blasting on aquifers and groundwater supply systems were expressed by the public during the scoping process. Public wells that produce large quantities of groundwater are typically located in high-yield glacial outwash deposits where blasting would not be necessary for trench excavation. However, bedrock wells may be utilized by private residences and may vary in depth from approximately 10 to 250 feet. Generally, blasting can fracture rock only within the immediate area of the blast location (Siskind and Fumanti, 1974). Consequently, no rock fracturing should be expected beyond the pipeline right-of-way and it is unlikely that groundwater quality and supply system yields would be affected. After the completion of the proposed pipeline installation and the successful revegetation of the right-of-way, pipeline operation would not affect groundwater resources.

5.1.3.1.2 Site-Specific Impact

It would be essential to have baseline monitoring data from groundwater wells to determine whether construction of the pipeline project was the cause of adverse impact. In order to protect groundwater resources, which are vital for public and private supply systems, we recommend the applicants be required to submit to FERC for review and approval a groundwater monitoring plan that would identify community and private supply wells and springs located near the proposed routes. The plan would be required to document preconstruction and postconstruction well- and spring-water quality and yields and would be of adequate detail to determine with relative certainty whether the pipeline construction activities had been responsible for any adverse impact on any groundwater user. In the unlikely event that groundwater supply systems are affected by the applicants' activities, the applicants would provide for an emergency potable water source and for the necessary repairs, replacement, and/or relocation of the affected facilities to restore the

supply system to its former capacity. The groundwater monitoring plan should provide protocols for determining how compensation would be provided to homeowners in the event damage does occur as a result of pipeline construction, including measures that would be taken if it were not technically possible to repair a well to its original capacity and not possible to install a new well. Though most of the applicants propose to perform various groundwater monitoring and remediation for damaged wells, we believe it is necessary to develop further details and documentation to make such plans effective.

Portions of the proposed Algonquin Replacements G-5 and G-8 would cross designated aquifer-protection areas of the public well supplies listed in table 4.1.3-1. These areas are zoned districts that are protected in town bylaws from specified land uses and activities that may result in adverse impact on groundwater supplies. The applicants may need to apply for a special-use permit to install pipeline in these areas. The proposed Algonquin replacements would not cross the state-designated 400 foot wellhead protection radius of the public supply wells located in these aquifer protection areas. Although no protection areas would be crossed, Great Lakes, Transco, Texas Eastern, and Tennessee loops in New York pass within 1.5 miles of public groundwater supplies (see table 4.1.3-1). The following section describes potential impact on groundwater supplies and the measures that should be taken to avoid or mitigate this impact.

Contamination of Aquifers

We recommend that refueling of vehicles and storage of potentially hazardous materials be prohibited within all designated well-protection area(s) or within a 200-foot radius of all private, municipal, or community supply wells identified prior to construction, according to our recommended groundwater monitoring plan. We recommend that each of the applicants submit to FERC for review and approval by the Director of OPPR a spill prevention and containment plan specific to pre-identified equipment maintenance and storage areas and a plan detailing specific measures that would be taken to clean up and dispose of any accidental discharge. The plan should require construction contractors to have available sufficient supplies of absorbent and barrier materials to allow the rapid containment and recovery of accidental spills and to be able to demonstrate their ability to implement the spill prevention and containment plan. These precautions would eliminate and/or reduce potential impact on groundwater resources.

Blasting

During scoping, the public expressed concern about blasting near residences along Tennessee's proposed Segment 9. Tennessee has agreed to the use of multiple delays and reduced charges to minimize potential blasting impact. In addition, the applicant has indicated that if private groundwater supply facilities are damaged by pipeline activities, the facilities would be repaired, replaced, and/or relocated to restore the system to its original capacity. We recommend, as discussed earlier in this section, that the applicants identify and monitor private wells that could be affected by blasting prior to construction.

Groundwater Contamination

The New York State Pipeline Task Force has indicated to FERC that a plume of contaminated groundwater from a landfill is located at MP 1.85 to 1.95 of the proposed TL-470 Line. We recommend that CNG consult with the appropriate state agency(s) regarding depth to groundwater and the level of contamination present at this location. Prior to construction, CNG should submit to FERC for review and approval by the Director of OPPR a mitigation plan for this area together with comments from the appropriate state agency.

5.1.3.2 Surface Water

5.1.3.2.1 General Construction and Operational Impact

Impact on surface waters could occur due to pipeline construction and hydrostatic testing. Construction impact could be caused by clearing and grading of streambanks, in-stream trenching, trench dewatering, backfilling, and blasting. Potential impact includes modification of aquatic habitat, increased sedimentation, turbidity, decreased dissolved oxygen concentrations, stream warming, releases of chemical and nutrient pollutants from sediments, and introduction of chemical contaminants such as fuels and lubricants.

The greatest potential for impact on surface waters is from suspension of sediments caused by in-stream construction or by erosion of cleared streambanks and rights-of-way. The extent of the impact depends on sediment loads, stream velocity, turbulence, streambank composition, and sediment particle size. Deposition of large amounts of silt and clay particles in the interstitial openings in streambed gravel would result in suffocation of benthic organisms and fish eggs. The impact of suspended sediments on aquatic populations is discussed in more detail in section 5.1.4.1.

Turbidity resulting from suspension of sediments during in-stream construction or erosion of cleared right-of-way areas could reduce light penetration, possibly affecting photosynthetic oxygen production. This impact is expected to be minimal to nonexistent in trout streams that generally have gravelly, rubble streambottoms and high dissolved oxygen levels resulting from atmospheric exchange (Smith, 1977). Resuspension of organic and inorganic materials can cause an increase in biological and chemical uptake of oxygen, causing a decrease in dissolved oxygen. Ponds, lakes, reservoirs, and slow-moving streams that have thick organic sediment deposits often experience a decrease in oxygen at the sediment - water interface, particularly during the summer months when bacterial respiration is high and chemical oxidation is greatest (Wetzel, 1975). Resuspension of this type of sediment could result in a localized depletion of oxygen throughout the water column, which would result in a temporary displacement of fish from the area. These water bodies generally provide habitat for warmwater species, which are less susceptible to decreased levels of dissolved oxygen.

Clearing and grading of the streambanks would expose large amounts of soil to erosional forces and would reduce fish cover along the cleared section of the stream. Impact on water temperature is not expected because of the limited length (50 feet) of streambank canopy that would be cleared for the pipeline crossing. The use of heavy equipment for

construction could cause compaction of near-surface soils, an impact that could result in increased runoff into surface water bodies. The increased runoff could cause erosion of streambanks, resulting in increased levels of turbidity and sedimentation rates of the receiving water body. Erosion prior to revegetation would be controlled through various soil stabilization procedures discussed in section 5.1.1.

Refueling of vehicles and storage of fuel, oil, or other fluids near surface waters could create a potential for contamination if a spill were to occur. Immediate downstream users of the water would experience a degradation in water quality. Acute and chronic toxic effects on aquatic organisms could result from such a spill. Similar adverse water quality impact could result from the resuspension of pollutants from previously contaminated sediments during in-stream excavation activities (Macek et al., 1977). The amount of contamination released from resuspended sediments would depend on the existing concentration and on the sorptive capacity of the surrounding sediments. Site-specific locations of potentially contaminated sediments are discussed in section 5.1.3.2.2.

Pipeline integrity is verified by hydrostatic testing, which is conducted by pumping high-quality water into the pipe under pressure and checking for losses in pressure resulting from leakage. Large quantities of water are needed for testing (approximately 280,000 gallons per mile of 36-inch-diameter pipe). Diversion of such volumes from streams and rivers could impact downstream users and aquatic organisms, primarily fish, if the diversion constitutes a large percentage of the source's total flow. Impact could include temporary disruption of surface water supplies, loss of habitat, warming of water, depletion of dissolved oxygen levels, and interruption of spawning, depending on time of withdrawal and current downstream uses. However, the sources of water for testing generally contain large volumes, and withdrawal would be conducted at a rate that would minimize downstream impact.

Potential impact that could result from discharge of hydrostatic test waters into streams and upland vegetated areas would be generally limited to erosion of soils and subsequent degradation of water quality from increased turbidity and sedimentation. High-velocity flows could cause erosion of the streambanks and bottom, resulting in a temporary release of sediment. Continued erosion of the discharge area during pipeline operation could occur, if the discharge area were not properly stabilized. This impact would be minimized by the use of energy dissipation devices, and regulation of the discharge velocity and location.

Stream Construction and Mitigation Procedures

In response to concerns raised by Federal, state, and local agencies regarding the potential environmental impact of the construction of pipeline projects, we have developed general stream and wetland construction and mitigation procedures (Procedures) (see appendix B). We recommend that each of the applicants be required to comply with the Procedures in order to provide the minimum level of protection for the surface waters that would be affected by the proposed projects. Upon review of the NIP Project, the COE and the state of Michigan could require applicants to apply for an individual Section 404/10 permit and could require additional measures to prevent or reduce impact on surface waters. The Procedures would, at a minimum, require that each applicant comply with nationwide Section 404 permit conditions Nos. 12 and 14 (33 CFR 300). State jurisdictional permits, including Section 401 water quality certification, would be acquired as needed. Stream

encroachment permits from state and local agencies could require the applicants to follow more stringent procedures.

Our Procedures were reviewed by the applicants, who agreed that they would comply with most of the requirements. The applicants took exception to some general measures of the Procedures and proposed alternative measures that we have reviewed. The following is a general description of the Procedures presented in appendix D, the applicants' alternative measures, and our evaluations and recommendations. The Procedures have been revised as appropriate, based on information presented to FERC by various Federal, state, and local authorities and the applicants.

Staging Areas

Our Procedures require that all staging areas be located at least 50 feet from streambanks where topographic conditions permit. Potential contamination of surface water by spills of fuels, oil, or other hazardous materials would be minimized or eliminated by restricting the refueling of construction vehicles and the storage of hazardous materials to areas further than 100 feet from all surface waters. In addition, our Procedures require that these activities be prohibited in all municipal surface water supply watershed areas. Several of the applicants have taken exception to guidelines for refueling equipment further than 100 feet from streambanks, indicating that under certain topographic situations, it would be more environmentally harmful to move equipment for refueling. These applicants also pointed out that refueling within 100 feet of the streambank would be necessary where equipment is engaged in continuous operation and where floatation equipment (i.e., barges) are employed. We believe that refueling of construction vehicles greater than 100 feet from a surface water can be accomplished at most crossing locations. In situations where this requirement is technically infeasible, our recommendation allows the applicants to request an exemption on a site-specific basis. Great Lakes has proposed to refuel small equipment within the 100 foot restriction zone using 5 gallon containers. We have reviewed this proposal and have agreed to permit refueling of small, continuously operating equipment, such as pumps and generators, in the restriction zone provided fuel containers no larger than 5 gallons are used.

Spoil Placement

Our Procedures require that spoils from trench excavation in streams be placed at least 10 feet from the streambank and that silt fence and/or haybale filters be used to prevent the flow of silt-laden water into streams. All applicants, except Tennessee and Transco, felt these requirements were acceptable. Tennessee indicated that the location of spoil piles should be determined on a site-specific basis, and that at crossings where the spoil has a high gravel and rock content, it would be preferable to store the material in-stream, taking care not to restrict flow conditions. Transco indicated that placing the spoils 10 feet from the streambank would create a larger workspace; hence, more land would be disturbed during construction. We understand that this requirement may not be technically feasible at all stream crossings because of topographic conditions or other constraints. In these cases, our recommendation would allow the applicant to provide site-specific reasons why this is not feasible. Excavation spoils should not be placed in-stream except at major stream, river, and lake crossings where storage of spoils on the streambank or on a flotation device is not

feasible. In these cases, site-specific crossing plans would be submitted to FERC for review and approval.

Time Window for Construction

To minimize impact on reproducing fish populations, the proposed in-stream construction would be prohibited during spawning periods and periods of high water flows. Although Tennessee, Algonquin, Transco, and CNG have taken exception to this requirement, our Procedures recommend that in-stream construction be allowed only from June 1 to September 30 unless otherwise permitted or restricted by the appropriate state permitting agencies on a site-specific basis. The states crossed by the NIP Project may, during review of the project, attach conditions to any state-issued stream-crossing permit in order to protect individual streams and fisheries. Site-specific state review may result in additional information that would form the basis for a reasoned judgment regarding construction windows and procedures. In this regard, we would defer to the state's site-specific review and allow changes to the recommended windows if they find it appropriate. More detailed mitigative procedures and more restrictive construction windows concerning impact on fish populations on a site-specific basis are discussed in section 5.1.4.1.

We also require that the applicants notify authorities of public surface water supplies located less than 3 miles downstream of any crossing location prior to FERC certification and 72 hours before in-stream construction commences. Although Algonquin, Tennessee and CNG have indicated that the 3-mile requirement is excessive, we maintain that it is a reasonable and appropriate protective measure. Texas Eastern and Algonquin disagree with our recommendation that water supply authorities should be notified prior to certification. However, we believe this requirement is not burdensome and would provide the water supply authorities time to review the applicants' crossing procedures, if desired.

Crossing Procedures

Our Procedures for stream crossings require that the applicant provide us with a copy of the COE's determination regarding the project's need for individual Section 404 and/or Section 10 permits. Although Tennessee has stated that this requirement is "burdensome," we maintain that it is a reasonable request.

Pipe installation at minor stream crossings containing coldwater or significant warmwater fisheries (less than 10 feet wide and 2 feet average depth) would be accomplished by a "dry crossing" technique. This technique involves routing the stream flow through a flume pipe prior to excavation. Trenching, pipe installation, and backfilling activities would then proceed across a "dry" trench, thereby minimizing suspension of sediments downstream. Tennessee, Algonquin, and Transco have taken exception to our recommended procedures for minor stream crossings, indicating that it may be appropriate to use other crossing methods based on site-specific information such as stream configuration, water quality, and sensitive aquatic species. We maintain that our dry crossing "flumed" procedures should be used unless otherwise permitted or restricted by the appropriate state agency on a site-specific basis. We recognize that some states may prefer other construction methods at certain streams; however, FERC would defer to these recommended procedures only if they are more stringent than our Procedures. In addition, certain streams that may support

sensitive aquatic species, and that would not normally be flumed due to their larger size have been recommended for fluming, as discussed in section 5.1.4.1.

At all minor stream crossings that contain fisheries, construction equipment would be required to cross the stream on a temporary bridge consisting of equipment pads, clean rockfill over culvert pipe(s), or on portable or flex-float bridges. For crossings of minor perennial streams that do not contain fisheries, fluming and equipment bridges are not required; however, in-stream construction should be completed within 24 hours.

Great Lakes has proposed the installation of sheet piling on both sides of a proposed trench to support trench walls during excavation in minor and major stream and rivers where unstable soils exist. In cases where the applicants propose to deviate from our Procedures, our recommendations allow for the applicants to provide detailed site-specific stream crossing plans to FERC for review and approval by the Commission staff and Director of the OPPR.

Algonquin and Great Lakes have proposed an alternative dry crossing procedure for minor streams that would involve damming the stream and pumping water around the construction right-of-way. We have reviewed this proposed procedure and find it acceptable, as long as easily moveable devices, such as sandbags, are used to block water flow. We do not find Great Lakes proposed use of sheet pile for the dam/pump method acceptable for additional construction equipment would be needed to install the sheetpile into the streambed, resulting in unnecessary disturbance of the right-of-way area.

Major streams (greater than 10 feet wide or 2 feet average depth and less than 100 feet wide) would be crossed by constructing a temporary equipment bridge consisting of a portable bridge, equipment pads, or crushed rock fill over pipe culverts. All construction vehicles would be required to utilize the temporary bridge, with the exception of in-stream equipment needed to construct the crossing. We prefer the use of portable bridges as specified by Great Lakes and using existing bridges and roads as points of access as indicated by Tennessee. Tennessee has also indicated that based on site-specific conditions, fording of major streams may cause less disturbance than construction of culvert bridges. We maintain that in-stream equipment should be limited to that necessary for construction of the crossing.

Tennessee and Texas Eastern have indicated that the time requirement for completion of in-stream trenching and backfilling is unnecessary because it is their experience that water clarity returns soon after trenching. We recognize that this may be the case in some streams with gravelly or rubble stream bottoms, however, due to differences in stream bottom substrates that occur at crossing locations, we maintain this requirement is appropriate.

Our Procedures require the applicants to submit site-specific crossing plans for rivers greater than 100 feet wide to FERC for review and approval prior to construction. It is in the applicants' best interest to develop these plans as early as possible to avoid any construction delays while waiting for FERC review and approval. Great Lakes has indicated that if a proposed river crossing could be crossed with a culvert bridge and the spoils stored on the banks, it should not be necessary to submit site-specific construction procedures to FERC for review and approval. Our experience in pipeline construction has shown that the use of culverts for water crossings greater than 100 feet wide is not practicable or

environmentally sound and we do not recommend such procedures unless approved on a site-specific basis through the submittal of detailed plans for our review.

We believe that notification of state authorities 48 hours prior to trenching across major streams is necessary to ensure the applicant's compliance with the recommended stream crossing procedures; therefore, we recommend that the applicants comply with these notification requirements. Although Tennessee, Transco, and CNG have stated that our sign-off on procedures altered after certification is not necessary, we would require the applicants to notify us and provide details of any major changes to our required Procedures.

Silt fences and other filter devices would be installed at streambanks and around spoil piles. Although Algonquin, Tennessee, and National Fuel have suggested the frequency of inspection of these devices be based on weather conditions, storm events, and sensitivity of the area, we believe this is inadequate and recommend daily inspections as a minimum for adjustment and/or repair of these devices as needed.

Bank Stabilization/Revegetation

Streambank stabilization would be enhanced by allowing native herbaceous and woody plant species to permanently revegetate the right-of-way along the embankment. Algonquin and Texas Eastern have indicated that woody growth would be allowed to return only in the temporary workspace so that the right-of-way would remain accessible for maintenance and emergencies. Our procedures require that a 10-foot-wide zone across the entire right-of-way adjacent to the streambank be allowed to revegetate with native woody plants. FERC maintains that because this requirement affects a relatively small area, access would not be severely limited.

Trench Dewatering/Hydrostatic Testing

Trench dewatering and discharge of hydrostatic test waters could temporarily affect water quality in the project area. Our Procedures require that the discharge of silt-laden water from dewatering of pipeline trenches be allowed only in upland vegetated areas. We recognize that it may not be possible to always dewater into upland or well vegetated areas and would approve the use of various filter devices provided they are removed upon completion of dewatering. Under no circumstances should silt-laden waters be permitted to flow directly into surface waters. Discharge of hydrostatic test waters would be conducted at a controlled rate and energy dissipation devices would be utilized to prevent erosion, streambottom scour, suspension of sediments, and excessive stream flows. Most of the applicants have found these procedures to be acceptable. With the exception of Algonquin, all applicants have indicated that the requirement to notify state water-quality and fishery management agencies of the intended source of hydrostatic test water 48 hours prior to withdrawal is acceptable. We maintain that this requirement is a reasonable and appropriate mitigative measure. Water sources that the applicants propose to use for their hydrostatic tests are listed in table 5.1.3-1.

The applicants would have to comply with Federal regulations regarding withdrawal and discharge activities in surface waters as prescribed by the NPDES regulations. In some cases it may be necessary to analyze water samples for various water quality parameters upon

TABLE 5.1.3-1

Proposed Sources of Hydrostatic Test Water
for the NIP Project

Water Source Segment/State	Estimated Water Required (gal)	Milepost Segment Tested		
GREATLAKES				
Minnesota				
Middle River	3,416,000	51.9	to	64.1
Lost River Silver Creek Ruffy Creek Clearwater River	5,964,000	110.1	to	131.4
Mississippi River Ball Club River	5,208,000	182.6	to	201.2
Bass Brook	1,092,000	209.8	to	213.7
Swan River	4,144,000	226.4	to	241.2
Wisconsin				
Middle River Bois Brule River Muskeg Creek Iron River	7,560,000	317.4	to	344.4
Wisconsin/Michigan				
Montreal River Black River	10,250,000	379.6	to	416.2
Michigan				
Middle Branch Ontonagon River S. Branch Paint River	11,560,000	433.4	to	474.7
North Branch Ford River Escanaba River Days River Tacoosh River	10,080,000	524.3	to	560.3
Sturgeon River Fishdam River Indian River Manistique River	12,770,000	575.2	to	620.8
Brevoort River	8,620,000	649.7	to	680.5
Maple River Crooked River	8,930,000	685.1	to	717.0
Manistee River	4,536,000	736.6	to	752.8
Haymarsh Creek Muskegon River W. Branch Muskegon River	10,980,000	776.5	to	815.7
Bush Creek Pine River Shiawassee River	14,390,000	850.3	to	901.7

TABLE 5.1.3-1 (cont'd)

Water Source Segment/State	Estimated Water Required (gal)	Milepost Segment Tested		
TENNESSEE				
New York				
Buffalo Creek	795,000	230B-101	to	230B-101+4.1
Unnamed Pond	465,000	230B-101+4.1	to	230B-101+6.5
Unnamed Pond	524,000	230B-101+6.5	to	230B-102+1.5
Cayuga Creek, Ellicott Creek Tonawanda and/or Mud Creek	5,448,000	230B-102+1.5	to	230B-105+5.0
Niagara River	97,000	230B-107+0.2	to	108
Genesee River, Honeoye Creek	4,284,000	234	to	235+1.0
Massachusetts				
Connecticut River	853,000	261+1.8	to	261+7.2
North Pond	620,000	266+6.2	to	267
ALGONQUIN				
Massachusetts				
Municipal Source	690,000			G-5 Replacement
Glen Charlie Pond	475,000			G-8 Replacement/ Loop
Dirty Meadow Brook/Municipal Source	920,000			Medfield Loop
Hopping Brook Trib/Municipal Source	40,000			H-1 Loop
Connecticut				
Yantic River	152,000			E-1 Loop
E. Branch Stonehouse Brook	310,000			Chaplin Loop
Rhode Island				
Stafford Pond or other Municipal Source	120,000			Tiverton Loop
TRANSCO				
Pennsylvania				
Delaware River	Pending			1.61-Mile Leidy Loop
Delaware River Mud Run Little Bushkill Creek	Pending			6.79-Mile Leidy Loop
TEXAS EASTERN				
Pennsylvania				
Water Tanks	700,000			Line No. 37

TABLE 5.1.3-1 (cont'd)

Water Source Segment/State	Estimated Water Required (gal)	Milepost Segment Tested
CNG		
New York		
Hudson	430,000	TL-470
NATIONALFUEL/PENN-YORK		
Pennsylvania		
Rose Lake	310,188	Segment 2
CNG/TEXASEASTERN		
New York		
Water Tanks	32,000	TL-403

the completion of hydrostatic testing and prior to discharge. Algonquin and Texas Eastern indicated that it would be burdensome to provide a copy of test results to FERC. We disagree that this is a burdensome request because the purpose of our review would not be to approve the discharge.

5.1.3.2.2 Site-Specific Impact

Great Lakes

Eighteen water bodies would be crossed in Minnesota by the proposed facilities. The Mississippi River (Loop 4, MP 196) has been designated as an outstanding resource by the Minnesota Pollution Control Agency (MPCA). To preserve the value of designated outstanding resource waters, the MPCA may prohibit or stringently control new or expanded discharges from either point or nonpoint sources of pollution. The maintenance of existing high quality in waters of outstanding resource value to the state is essential to their function as exceptional recreational, cultural, aesthetic, or scientific resources. For the Mississippi River crossing we recommend that Great Lakes file a site-specific construction mitigation plan with the Commission Secretary, along with comments from the MPCA, for the review and approval of the Director of OPPR prior to construction.

Licenses from the MNDNR would be necessary for crossing public waters, pursuant to the requirement of Minnesota Rules chapter 6135. In addition, the applicant would be required to obtain conditional use permits from county zoning agencies. The applicant would also need to apply for Temporary Water Appropriation and Dewatering permits from MNDNR and a NPDES permit for discharge of hydrostatic test wastes from the MPCA.

The Bois Brule River (Loop 7, MP 327.9) is Wisconsin's most famous and scenic trout stream. Fishing and canoeing are the most popular activities. In the vicinity of Loop 7, the stream meanders and comes within proximity of the existing pipeline corridor at two locations in addition to the crossing site. Because the river is a significant fishery, construction procedures would be restricted and would be permitted only during designated periods (see section 5.1.4.1).

In Wisconsin, the applicant would be required to apply for individual permits for all navigable water crossings. The Wisconsin DNR may require specific conditions to be met to adequately protect the resources involved. Navigable waterways in Wisconsin are defined as those that have a definable bank and bed and can float a canoe during the high water period. The state has also indicated that this definition would probably include all 32 streams that would be crossed by the Great Lakes Project in Wisconsin (Lahti, 1989).

Wisconsin requires submittal of stream crossing plans that show cross-sectional and plan views along with other pertinent information as part of the stream crossing applications. Additional state requirements would include detailed erosion-control and site-stabilization plans that outline methods that would be used to control sedimentation at each stream crossing site during and following construction (Lahti, 1989). In section 5.1.4.1.2, we have recommended additional construction procedures to be implemented at several proposed crossings of exceptional value trout fisheries.

A total of 99 water bodies would be crossed by the proposed pipelines in Michigan. Approximately 54 percent of these surface waters are designated by Michigan as coldwater streams capable of supporting coldwater fish species such as trout and salmon. Our recommended procedures for protecting these fisheries from potential adverse impact resulting from pipeline construction are presented in section 5.1.4.

Michigan would require Great Lakes to obtain stream crossing permits for perennial and intermittent water bodies pursuant to 1972 Public Act 346 as amended. The application process involves submittal of site-specific crossing plans for each perennial water body and a typical cross-section for each intermittent water body crossed.

Tennessee

In New York, 5 class A streams designated by the state as coldwater fisheries would be crossed by Segment 3. Our Procedures would require that these high quality streams, which are all less than 10 feet wide, be crossed using the dry-ditch method.

Tennessee has indicated that the pipeline would be installed across the Niagara River (Segment 2) using directional drilling methods. The drilling rig would be located on the United States side of the river and the pipe staging area would be located across the river in Canada. Tennessee has indicated that drilling muds would be stored onsite in an earthen pit or storage facility prior to removal in a vacuum truck for disposal at a "certified dump site." We recommend that Tennessee submit copies of construction plans indicating the location of storage areas for drilling fluids and muds to FERC. We also recommend that drilling muds be stored only in nonleaking, covered tanks or similar containment facilities and that Tennessee submit a drilling fluids management plan that describes methods for collection of drilling muds and measures to prevent them from entering the Niagara River by accidental spills or runoff to FERC.

Eight class B streams would be crossed in Massachusetts by the proposed Segments 8 and 9. Massachusetts would require an Order of Condition License under the Massachusetts Wetlands Protection Act for all perennial and intermittent stream crossings. Tennessee has indicated that the MADEP has determined that the stream crossed are not navigable and would not require a Chapter 91 permit.

Algonquin

Eleven class B streams would be crossed by Algonquin's proposed facilities in Massachusetts. A Chapter 91 Permit determination and an Order of Condition License for the Massachusetts Wetland Protect Act would be needed from the state for these crossings.

The Chaplin Loop is located in a high quality class AA watershed that feeds Mansfield Hollow Lake, a municipal water supply. Our recommended Erosion Control, Revegetation and Maintenance Plan (appendix C) and Stream and Wetland Construction and Mitigation Procedures (appendix D) would adequately protect the watershed from potential adverse impact on water quality.

The use of any perennial water bodies for sources of hydrostatic test water would require a permit from the Water Resources Unit of the CTDEP.

Transco

Transco has indicated that the Delaware River crossing would be constructed using conventional open-cut trench methods. This waterway is designated as a navigable river and the applicant would be required to apply for a Section 10 permit from the COE. Blasting would be required to excavate bedrock at the crossing location. Blasting impact on fish populations is discussed in section 5.1.4.1. Aquatic organisms would be temporarily affected by turbidity and sedimentation. However, due to the absence of fine, silty sediments in this river segment, this impact would not be severe.

CNG

The Hudson River (MP 2.4) is approximately 800 feet wide at the proposed crossing location. CNG has indicated the river would be crossed by conventional open-cut trenching techniques. No site-specific construction plans have been submitted to FERC at this time. The applicant would be required by our Procedures to submit construction plans that provide details of the Hudson River crossing for review and approval by the Director of the OPPR prior to construction.

The Hudson River has had a history of contamination by PCBs and pollutants from industrial and agricultural sources. Although PCB contamination is reportedly not at toxic levels in the vicinity of the crossing (Warrinder, 1989), as a part of the individual Section 404 permit application process, CNG may be required to conduct testing of river sediment for the presence of toxic contaminants. FERC recommends that CNG conduct testing of surficial and subsurface sediments at the proposed crossing location. Chemical parameters should include metals, PCBs, pesticides and priority pollutant volatile and semivolatile organic compounds. The results of the analyses should be filed with the Secretary of the Commission for review by the Director of OPPR, with the COE, and with the appropriate state water quality agency. If contaminants are found at the crossing location, CNG would be required to comply with conditions determined by the COE to prevent further degradation of this navigable waterway. FERC recommends that sediments containing high levels of contamination not be used as backfill, but be disposed of in accordance with Federal and state regulations. In addition, CNG would be required to obtain a Section 10 permit from the COE for this crossing.

National Fuel/Penn-York

National Fuel/Penn-York would cross one small pond and several intermittent streams. On July 26, 1989, the PADER Bureau of Dams and Waterway Management issued a general Permit No. 5 to National Fuel/Penn-York for the proposed stream crossings. The applicant is responsible for complying with the general conditions of the permit and any additional conditions as required by the County Conservation District.

5.1.4 Fish and Wildlife

5.1.4.1 Fishery Resources

5.1.4.1.1 General Construction and Operational Impact

Impact on fishery resources, such as sedimentation and turbidity, acoustic shock, destruction of stream cover, introduction of water pollutants, or entrainment of fish could result from pipeline construction activities. To minimize this impact, the applicants would be required to comply with the Procedures. In addition to our minimum requirements, other Federal, state, or local agencies may require the applicants to follow more stringent procedures. No activities that violate existing Federal or state water quality standards would be allowed.

Sediment and Turbidity

Increased sedimentation and turbidity from the proposed construction have the greatest potential to adversely affect fisheries resources. However, impact from construction-induced sedimentation and turbidity would be reduced to short-term, temporary disturbances if our recommended Procedures are strictly followed. Section 5.1.3.2.1 describes our recommended Procedures to reduce impact from the proposed construction across streams. Construction of stream crossings would be limited to the low-flow period of June 1 through September 30, unless otherwise permitted or further restricted by state agencies. This would minimize sedimentation and turbidity induced by high flow and limit impact on salmonid spawning areas that may be present in or downstream from crossing areas. Soils would be stored on or above the streambanks and would be protected with silt fences, hay bales, or other erosion control devices that would prevent or significantly reduce sediment runoff from entering the stream. Additionally, all staging areas would be located at least 50 feet back from the streambank, where topographic conditions permit, to reduce loss of riparian vegetation and limit the probability that these additional cleared areas would contribute to sediment runoff.

Permits would be required from state agencies for stream crossings to ensure that proper construction methods would be used relative to the fisheries resource present. Minor streams (less than 10 feet wide) with coldwater or significant warmwater fisheries would be flumed prior to in-stream activities. Construction equipment would cross streams less than 100 feet wide on equipment bridges to minimize stream disturbance. Most in-stream work would occur in less than 48 hours or within a maximum of 72 hours.

The applicants would be required to prepare and submit site-specific plans for in-stream construction work across large rivers to FERC. Where possible, in-stream and shoreline vegetation would be left in place. After construction, all stream shoreline areas would be mulched and revegetated. All substrate material excavated from trenching the stream would be stored in upland areas at least 10 feet from the banks of perennial streams. Surface waters would be further protected from substrate spoil areas by silt fences, which would be inspected on a daily basis until restoration was complete.

Salmonid spawning areas (redds) are especially susceptible to increased sedimentation of fines (e.g., sand, silt), which may affect the survival of eggs and emerging fry. Increase of fines composition less than 3 mm in size, or greater than 10 to 15 percent of the redd substrate, reduces survival of eggs and emerging fry (Canadian Department of Fish and Oceans (CDFO), 1983). Increases of only a few percent of fines less than 0.85 mm in size have been found to significantly reduce in-gravel fry survival (CDFO, 1983). Undoubtedly, some impact on in-gravel fry survival would occur if construction was done during this period. Thus, our Procedures require that stream crossings be restricted to the period between June 1 and September 30 to ensure that construction does not occur during salmonid spawning periods. Further time restrictions have been recommended, where appropriate, for a greater level of protection on a site-specific basis.

During construction of stream crossings, the concentration of suspended solids would be relatively high for only short periods and short distances downstream from the crossing. In one study of a major pipeline crossing in an Alaskan river, levels ranged from 10 to 648 mg/l 450 feet below the site (Robinson, 1979). The higher values occurred only during actual construction activity in the channel. One mile downstream maximum values had decreased to 115 mg/l. This construction was at a major pipeline crossing with in-stream construction occurring for 17 days.

In another study, on the Little Miami River near Yellow Springs, Ohio, the effects of a pipeline construction project on physical, chemical, and biological characteristics were evaluated. This river has a smallmouth bass fishery, with diverse fish and macro-benthos communities. Suspended-sediment concentration, generally less than 25 mg/l for 1 month prior to construction, reached a maximum of 1,461 mg/l during trenching, and decreased to less than 50 mg/l within 12 hours following trenching activities (Schubert et al., 1985). Although sand and silt were found 175 meters downstream 1 month after construction, complete benthic recolonization of the affected area occurred within 2 to 7 months, and fish species became reestablished within several months, although at lower densities (Schubert et al., 1985). Overall, impact on benthos and fish associated with construction was minimal and short-term.

Mitigation methods outlined in our Procedures would be employed at all stream crossings to minimize suspended sediment levels. All crossings, except those of major rivers (greater than 100 feet wide), would be constructed in less than 3 days unless otherwise permitted by state agencies. Increased suspended sediment concentration levels could increase invertebrate drift and reduce fish feeding for brief periods. Following our recommended stream crossing procedures, impact would be temporary, and suspended sediment concentrations would return to background levels soon after construction in the river was completed.

If the stream crossing area contains trout or salmon spawning habitat, the substrate would be directly disturbed for a maximum in-stream construction-area width of 75 feet. Spawning areas directly downstream of these proposed crossing sites could receive increased fines in the substrate. Much of these fines would be washed away during subsequent fall and spring high flows, reducing the impact on spawning success during the following season.

Acoustic Shock

Some stream crossings would require blasting of bedrock, which, due to acoustic shock, could be harmful to fish that are in the immediate vicinity of the explosion. The degree of blasting impact on fish would depend on the type of explosive, blasting technique, fish species, and timing. Teleki and Chamberlain (1978) conducted experiments on the survival of various species following detonation of charges placed in bedrock or mud of a lake bottom. These experiments revealed that laterally compressed fish species (e.g., pumpkinseed, crappies) were most sensitive to blast-related acoustic shock, while those with more rounded body forms (e.g., rainbow trout, white sucker) were least affected.

The distance at which fish would suffer mortalities in the stream from underwater detonation can be estimated based on several assumptions. Robbins (1988) described techniques and quantity of blasting material used for a major gas pipeline crossing on the Susquehanna River. Assuming similar techniques would be utilized for a major stream crossing on the NIP Project pipeline allows us to estimate distances to which fish mortality could occur. Based on Robbins' described methods, a double row of drill holes, with the holes spaced 5 feet apart, and 60 pounds of explosive placed in each hole would be used. This method would use 2,400 pounds of explosive per 100 feet of excavation. Most streams that would be crossed are much less than 100 feet wide, so we will assume a 50-foot-wide crossing area would be detonated at one time, which equals 1,200 pounds of explosive detonated. Based on the data presented by Teleki and Chamberlain (1978), the most sensitive laterally compressed fish (e.g., crappie) would suffer 95 percent mortality within 213 feet of the detonation, decreasing to 10 percent mortality at 472 feet of the detonation. The least sensitive rounded fish (e.g., salmonid species) would suffer 95 percent mortality within 174 feet of the blast, dropping rapidly to 10 percent mortality at 194 feet.

Effects of these explosions would be mitigated by several factors. Teleki and Chamberlain (1978) suggest that active construction in the stream area (i.e., drilling) would scare most fish out of the area prior to detonation.

Under the worst case scenario described above, a 95 percent mortality of laterally compressed fish inhabiting the stream would occur within a distance of 213 feet from the detonation, while a 95 percent mortality of salmonids would occur within 174 feet; other species such as walleye, northern pike, and smallmouth bass would be affected between this range. These effects would be short term and localized and would result in some fish mortality but should not be significant with utilization of the proposed and our recommended mitigative methods. Redistribution of fish within the affected areas should occur soon after construction.

Cover Loss

Some in-stream and shoreline cover would be altered or lost at the proposed stream crossings. Streambank vegetation, in-stream logs, rocks, and undercut banks provide important cover for fish. Fish that normally reside in these areas could be displaced. Our Procedures recommend that mitigation include long-term revegetation of shoreline areas with native herbaceous and woody plant species, and where stream flow rates preempt vegetative stabilization of streambanks, that large riprap should be used for stabilization and to add

cover to the area. Effects on fish from cover loss would be minor because of the small area affected on each stream (a maximum of 75 feet wide).

Other Impact

Other potential impact includes interruption of fish spawning migration, fish entrainment, and fish mortality from toxic substance (fuel) spills. Some fish, including salmonid species and shad, migrate during spawning runs in the spring and fall and could be briefly interrupted during installation of pipelines across water bodies. Most fish migrate over several days or weeks in small streams. Consequently, migration would, in the worst case, only be briefly interrupted, since our Procedures require that installation across streams less than 100 feet wide would take less than 3 days, and would occur during nonspawning periods for most fish (i.e., June 1 to September 30).

Entrainment of fish would not likely occur when water would be withdrawn for hydrostatic testing, since intakes would be screened. To eliminate impingement of small fish during water withdrawal, our Procedures recommend that intake devices be designed so that velocity across the screens does not exceed 0.5 feet per second. Because water would only be taken from large streams for the hydrostatic testing (see table 5.1.3-1), the quantity of water would not significantly reduce in-stream flow.

Direct spills into streams could be toxic to fish, depending on the type, quantity, and concentration of the spill. To reduce the potential for surface water contamination, our Procedures recommend that fuel and other potentially toxic materials should be stored away from streams (at least 100 feet), minimizing the chance of direct surfacewater contamination.

Because of the narrow width of shoreline vegetation that would be removed during the proposed construction (50 feet maximum), temperature increases from increased solar insolation would be insignificant. Refer to section 5.1.3.2.1 for a discussion of the effects of vegetation clearing on stream temperatures.

5.1.4.1.2 Site-Specific Impact

As previously discussed, construction impact would generally be short-term at stream and pond crossings. The primary concern involves increased turbidity, sedimentation of spawning areas, disruption of spawning areas, modification of aquatic habitat, and acoustic shock from blasting.

Streams of major concern relative to impact on fishery resources are those with salmonid spawning areas at or immediately below the proposed crossings, those considered to contain exceptional fishery resources, those with important recreational fish species of limited distribution, those containing endangered or threatened species or species of special concern, and those likely to have contaminated bottom sediments.

Since trout and salmon are the fish most sensitive to the major impact from stream crossings (sedimentation and disturbance of spawning gravel), and because these are the major recreational species in the upper Midwest and Northeast, concern is directed mainly

to these fish species. Even minor impact on trout and salmon spawning areas may have significant effects on fish populations if spawning habitat is already limited. Given the relatively short life spans of some species (3 to 5 years for brook trout), the loss of a year class could significantly alter a population.

Great Lakes

Streams and rivers that would be crossed in Minnesota support primarily coolwater and warmwater species. Very limited natural reproduction of salmonids occurs in the waters proposed to be crossed and, consequently, the impact on spawning areas associated with downstream sedimentation would not be significant. The Clearwater River (MP 130.2), located along Loop 3, has been reported to have some natural reproduction of trout, but is stocked with brown and rainbow trout and is considered a put-and-take fishery by MNDNR. Adherence to our recommended Procedures, especially the recommended June 1 through September 30 time window for construction, should effectively prevent adverse impact on local populations of fishes in these waters.

Most streams and rivers in northern Wisconsin contain some spawning habitat and populations of naturally reproducing salmonids. Those with significant spawning habitat and state-recognized exceptional fisheries are found along proposed Loop 7 and include the Bois Brule River (MP 327.9), Trask Creek (MP 329.5), Muskeg Creek (MP 334.0), Iron River and its tributary (MPs 336.6 and 336.9), and DeChamps Creek (MP 337.9).

Because of the exceptional value of Trask Creek, Muskeg Creek, Iron River, and DeChamps Creek as naturally reproducing trout fisheries, we recommend additional construction procedures to supplement those presented in appendix D for these proposed crossings. In order to reduce the amount of suspended sediments introduced into these waters, all in-stream work (e.g., trenching, pipe installation, backfilling) should be completed within a maximum of 48 hours. This means all preparation activities (e.g., pipe bending, welding, coating) should be completed prior to initiating trenching. Excavation and backfilling should be conducted with backhoes simultaneously from both streambanks, if required, and no equipment should be permitted in the stream.

As discussed in section 4.1.4.1, the Bois Brule River supports an exceptional migratory, as well as resident, coldwater fishery. The Bois Brule is considered to be one of the premier trout streams in, Wisconsin and, in addition, has been rated by Trout Unlimited as one of the United States' top trout streams (Trout, 1989). The proposed crossing site is approximately 100 feet wide and is located within an extensive area of spawning habitat (Pratt, 1989).

The WIDNR has indicated that, in addition to migratory runs of steelhead and salmon, brown trout from Lake Superior begin upstream migration into the Bois Brule River during early July (Pratt, 1989). The WIDNR has consequently recommended that construction be limited to the month of June. We recommend that Great Lakes file with the Secretary of the Commission a site-specific construction mitigation plan, along with comments from the WIDNR, for crossing of the Bois Brule River, for review and approval by the Director of OPPR prior to construction.

Further east along Great Lakes' proposed Loops 8, 9, and 10, most streams or rivers that would be crossed support naturally reproducing salmonid populations. These 58 proposed water crossings consist of many small creeks with some larger streams and small rivers located in northeastern Wisconsin and the upper peninsula of Michigan. These streams would be crossed between June 1 and September 30 unless expressly permitted or further restricted by the respective state resource agencies. All small streams less than 10 feet wide with coldwater or significant warmwater fisheries would be flumed and dry-ditched. Most of the streams in this region, because of their small size and narrow width, would be disturbed for relatively short periods of time, since most crossings could be completed in less than 2 days of in-stream activities.

Several highly productive spawning tributary and nursery streams in this region include Welch (MP 397.0), Seimens (MP 399.6), Powder Mill (MP 401.8), and Planter (MP 409.3) Creeks along Loop 8, and Henderson Creek (MP 447.3) and Cooks Run (MP 466.2) along Loop 9. Because of the sensitivity and importance of these streams to the regional fishery, we recommend that Great Lakes file a construction mitigation plan, together with comments on these stream crossings from the WIDNR and MIDNR, with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction.

Other highly productive native brook trout streams and migratory fisheries in this region include Two Mile Creek (MP 441.3), Middle Branch Ontonagon River (MP 444.0), South Branch Paint River (MP 460.8) and North Branch Iron River (MP 474.6), all located along Loop 9, and the Tacoosh River (MP 558.0) and Sturgeon River (MP 575.3), located along Loops 10 and 11, respectively. With the exception of the Tacoosh and Sturgeon Rivers, we recommend that all in-stream construction activities be completed within 48 hours of commencement. During discussions with MIDNR (Peterson, 1989), we were informed that the existing rights-of-way across the Tacoosh and Sturgeon Rivers contain exposed bedrock and would probably require in-stream blasting. Since both of these rivers contain spring and fall migratory runs of steelhead and salmon, respectively, we recommend construction be restricted to the low-flow summer months of July and August. Another river containing migratory salmonids, the Manistique River along Loop 11 (MP 599.7) would be crossed upstream of a dam in the town of Manistique and, consequently, would not affect these species.

The Brevoort River would be crossed by Loop 12 near MP 669.2. Since most spawning of salmonids would occur upstream of the proposed crossing location, the potential for impact would be limited to possible blockage of upstream migration during spawning runs. Since spawning migration in the Brevoort River occurs in early spring (steelhead) and mid-September (chinook), we recommend a construction window from June 15 through September 1 for crossing of this river. Because construction would occur in 1990, potential impact on pink salmon, which generally run from the Great Lakes on odd years only, would not occur.

Along the loops proposed to be constructed in the lower peninsula of Michigan (Loops 13-17), only 11 of 52 streams and rivers have been designated as trout-supporting. These coldwater fisheries are found mostly in Emmet and Kalbaska Counties. Those of major spawning importance include the Maple River (MP 705.1) and the Manistee River (MP 750.0). These rivers are two of lower Michigan's top quality trout streams. They

provide high quality spawning habitat and recreational fishing for brown and brook trout. The Maple River also supports one of the region's best steelhead fisheries. It is approximately 35 feet wide at the proposed crossing and may vary in depth from 2 to 12 feet (Fenske, 1990). We recommend Great Lakes file with the Secretary of the Commission a construction mitigation plan, together with comments from the MIDNR, for review and approval by the Director of OPPR prior to construction across the Maple River. Since the proposed crossing location of the Manistee River is near its headwaters, the fishery consists primarily of brook trout. The proposed crossing area is approximately 20 to 25 feet wide, consisting of shallow, riffle waters. To prevent possible downstream siltation of brook trout spawning habitat, we recommend, in addition to following our recommended stream crossing procedures, that Great Lakes file a construction mitigation plan, together with comments from the MIDNR, with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction across the Manistee River.

Tennessee

Of the 27 water crossings proposed by Tennessee in New York State, only 8 provide suitable habitat for coldwater fisheries. In response to our data request, Tennessee has indicated that it would directionally drill the crossing of the Niagara River, one of western New York's most significant migratory coldwater fisheries. Consequently, there would be no in-stream work and the fishery in this river would not be affected. Other streams of concern because of coldwater fisheries habitat include Little Tonawanda Creek, Dale Gulf, and Spring Brook. Each of these streams is relatively small and would be crossed between June 1 and September 30 using the flumed dry-ditch procedure. In Massachusetts, all of the streams crossed would be warmwater streams and construction is not expected to result in significant impact on local fish populations. Two streams, however, have been reported to possibly contain populations of a state-listed species. Longmeadow Brook along Segment 8 (MP 261 + 3.2) may contain seasonal populations of the burbot (MA-Special Concern), while a tributary to North Pond along Segment 9 (MP 266 + 6.5) may contain habitat for the brook lamprey (MA-Endangered). These species are described in further detail in section 4.1.5.

Algonquin

Along the Algonquin loops, only Hopping Brook (H-1 Replacement) in Massachusetts is capable of supporting stocked trout. In Connecticut, all streams that would be crossed are capable of supporting stocked trout but none have been determined to provide natural reproduction for salmonids. These streams would be crossed between June 1 and September 30, unless otherwise restricted or permitted by Massachusetts or Connecticut and smaller streams, such as the East Branch Stonehouse Brook in Connecticut and those found along the G-5 and G-8 Replacement Loops in Massachusetts, would be crossed utilizing a flumed dry-ditch construction procedure.

Transco

As discussed in section 4.1.4.1, the Delaware River in the vicinity of Transco's proposed crossing supports a varied warmwater and coolwater fishery including a well-

developed American shad fishery. Transco has indicated that this 450-foot crossing of the Delaware River would be constructed utilizing an open-trench procedure.

Since open-cut trenching at this location would require dredging with a high probability of blasting, potential impact on the American shad fishery in the Delaware River could result, depending on the time of year construction would occur. Impact could include blockage of upstream or downstream migrating fish due to construction activity and noise, and avoidance of turbidity plumes by the fish. Other impact on migrants and resident summer populations could occur from acoustic shock during underwater blasting.

The FWS, in a letter dated December 28, 1989, indicated that construction across the Delaware River in July and August or between December 1 and April 1 would not affect the American shad. The National Marine Fishery Service (NMFS) has reviewed this crossing and in a letter dated January 3, 1990, recommended that no in-stream construction activity occur between April 1 and December 1. This would prevent impact on upstream migrating adults in the spring, downstream migrating young-of-year during late summer and fall, and immature populations during the summer months. The NJDEP, Division of Fish and Game (Lupine, 1990), and the FWS (Zich, 1990 and Miller, 1990) agree with NMFS' recommended construction schedule to protect American shad. Therefore, we recommend that Transco's proposed crossing of the Delaware River occur between December 1 and April 1.

The remaining 12 stream crossings proposed by Transco consist of primarily small streams and tributaries supporting trout, either through stocking or natural reproduction, and various warmwater species. Most of the streams along these proposed Leidy Loops, because of their small size and narrow width, would be disturbed for relatively short periods of time, since most crossings could be completed in less than 2 days of in-stream activity. If our recommendations for construction across streams are followed, including construction during June through September, we feel that the fisheries in these streams would not be seriously affected.

CNG

CNG's proposed 800-foot crossing of the Hudson River would be constructed utilizing an open-cut trench. This construction technique could affect a variety of anadromous and resident warmwater fish species, including those discussed in section 4.1.4.1. Scheduling this crossing to avoid seasons of spawning migration, growth of immatures, and out-migration of juveniles would minimize impact. Of special concern at this crossing is the federally endangered shortnose sturgeon. This species spawns in the area between Coxsackie and the Troy Lock from mid-April until late May. Although adults move downstream after spawning, young-of-year and sub-adults will stay in the area and feed in the near-bottom zone and on the near-shore flats and marshes along the shorelines (Gorski, 1990).

The NMFS has reviewed this crossing site and in a letter dated September 22, 1989, recommended avoidance of any in-stream construction in the Hudson River from April until the fall to midwinter season. We concur with NMFS's recommendation. CNG would be required to provide FERC with site-specific construction techniques for review and approval prior to construction across the Hudson River. If the open-cut trench technique is proposed,

we will recommend the construction time period. The use of the directional drill technique would eliminate the need for a specific construction time period.

On the east side of the Hudson River, the proposed TL-470 line would cross Papscanee Creek and five of its tributaries. These streams provide good spawning habitat for many of the anadromous species found in the Hudson River. The use of our Procedures outlined in appendix D should significantly decrease potential impact on these species. Of prime consideration in this assessment is the short construction time for each of the crossings (less than 2 days each) and the recommended window for construction.

National Fuel/Penn-York

The proposed Y-M54 line in Pennsylvania would cross a 50-foot-wide pond containing warmwater fishes, primarily sunfishes and bass, and several intermittent streams. This proposed crossing would not be expected to significantly affect the population of warmwater fishes in this pond (Zich, 1990).

5.1.4.2 Wildlife

5.1.4.2.1 General Construction and Operational Impact

Impact on wildlife species due to construction and operation of the proposed NIP Project facilities would largely result from temporary and permanent alteration of habitats. Impact on individuals could include disturbance, displacement, and direct mortality. During construction, the more mobile species would be temporarily displaced from the right-of-way and surrounding areas to nearby similar habitats. Wildlife displaced from the construction right-of-way would return to adjacent, undisturbed habitats soon after construction is completed. Less-mobile species, such as small mammals, reptiles, and amphibians, and bird nesting areas located in the proposed right-of-way may be destroyed by construction activities. Regardless of mobility, some individuals would be affected by loss of cover, nesting, and foraging habitat. Similar effects, although less extensive, could result from routine vegetation maintenance during project operation, depending on the time of year.

We have reviewed the Migratory Bird Treaty (MBT) (16 U.S.C.A. § 701-718) to determine its applicability to the proposed project. We believe the MBT seeks to prohibit activities that intentionally harm or destroy migratory bird species, particularly those resulting from hunting migratory birds or trading in bird eggs, nests, or body parts. The act was not intended to apply to activities that result in incidental impact on migratory birds, such as those related to highway construction, commercial and residential development, and agricultural and forestry management practices. The provisions of the act do not, therefore, apply to the proposed pipeline project, as any impact on individuals of migratory bird species that would result from the project would be incidental and unintentional.

In a letter dated January 5, 1990, the FWS commented that the proposed project would be an "unlawful activity" under the MBT because it would result in the periodic clearing of nesting habitat. If this were true then all of the activities mentioned above would be illegal. The FWS states:

The Service believes that if the Commission does not incorporate the Service's Migratory Bird Treaty [Act] provisions then the Commission would be purporting to authorize an unlawful activity.

We note that the FWS states in the same letter that application of the recommended "provisions" would minimize, not eliminate, takings of individuals. Since the FWS interprets the MBT as prohibiting any takings, the FWS would be condoning an illegal activity even if we were to apply the "provisions."

In light of the other conditions we have recommended, we believe the "provisions" are excessive. However, in order to minimize impact on bird species that would use the permanent right-of-way for breeding purposes, we recommend that the applicants not conduct vegetation maintenance of the right-of-way prior to August 1 of any year, and that vegetation maintenance be performed no more frequently than once every 3 years.

The most significant impact on wildlife would result from the long-term or permanent alteration of vegetative cover types. The cover types most altered by the proposed construction and maintenance would include forested lands and wetlands. For the proposed project, approximately 1,135 acres of forestland, of which approximately 290 acres are wooded wetlands, would be cleared adjacent to the existing right-of-way during construction. Clearing would decrease the available forest habitat, and also contribute to the fragmentation of forest tracts. In areas of increasing development, forestland habitat has been fragmented into patches or "islands" surrounded by residential or industrial developments, which could limit even common woodland species. Forest habitat on the additional permanently maintained right-of-way would be converted to open shrub and herbaceous cover. Forest cleared for the temporary construction right-of-way would be allowed to naturally revegetate following construction, and return to a young even-aged forest stand within 20 to 40 years.

Breeding success of some forest interior species, primarily songbirds (various warblers, wood thrush, veery), has been shown to be limited by the size of available unbroken forest tracts (Robbins, 1979; Robbins et al., 1989). For these species, additional loss of forest habitat in tracts of already marginal size may further reduce suitable habitat. The actual effect of the loss of habitat may, therefore, be underestimated. The potential for this type of impact could be greatest where the existing rights-of-way and proposed loops pass through smaller, isolated woodlots (Galli et al., 1976). In larger forested areas, the increase in early successional and edge habitats would decrease the quality of habitat for forest interior species in the additional right-of-way, and possibly up to 100 to 300 feet on either side (Anderson et al., 1977, Temple, 1986). This may reduce the density of forest interior species in a corridor wider than the actual cleared right-of-way. However, the increased width of permanent right-of-way would not be a barrier to the movement of most forest interior species.

While forest interior species could be negatively affected by the clearing of forest habitats, species that use early- and mid-successional stage habitats would benefit from increased right-of-way clearing in large forested areas. Density and diversity of small mammal and bird species often increase after the initial clearing of forest tracts (Monthey and Soutiere, 1985; Anderson et al., 1977) and remain high for about 3 years. Other species that would use the widened right-of-way during various seasons include numerous songbirds,

ruffed grouse, wild turkey, white-tailed deer, and black bear. White-tailed deer could benefit from the proposed increased width of right-of-way, particularly in forested areas where available browse is limited.

Predatory species including red-tailed hawk, great horned owl, coyote, and gray fox commonly use utility rights-of-way for hunting. However, little benefit to these species would result from additional clearing adjacent to existing rights-of-way.

Cleared pipeline rights-of-way also provide human access to otherwise isolated areas. Unauthorized ORV use can disturb wildlife (contributing to the edge effect of forest fragmentation), prolong erosion, and prevent revegetation along the right-of-way. A variety of methods would be suitable for limiting ORVs; specific recommendations are discussed in section 5.1.9.2.

Nonforested habitats that could be affected by construction and operation of the proposed NIP Project facilities include nonforested wetlands (see section 5.1.7 for detailed discussion), agricultural lands, and industrial and residential developments. Impact on these habitat types and associated wildlife species would be relatively minor and short-term. We have recommended techniques for construction through nonforested wetlands that would allow emergent wetland vegetation to recover within one or two growing seasons following construction. Agricultural habitats (cultivated land, pasture, hay fields) on the right-of-way would also recover within one or two growing seasons following pipeline construction. The temporary alterations to these habitats would not be expected to have significant impact on wildlife species.

The permanent or temporary loss of habitat could have the greatest impact on wildlife where the habitat type supports a significant life history function (i.e., breeding, migration, overwintering) or is otherwise a limiting factor for a wildlife population. Such habitats identified in the project area that may be affected by the proposed construction include DWAs, waterfowl concentration areas, heron rookeries, and habitat for endangered and threatened species. Refer to section 5.1.5 for discussion of endangered and threatened species habitat.

Widening an existing right-of-way through a DWA would reduce the amount of suitable winter cover available to deer. It also may reduce travel by deer between areas on either side of the right-of-way. It would not, however, eliminate travel across the right-of-way. Studies have shown that during winter, deer will cross an open right-of-way as wide as 450 feet (Doucet et al., 1981, 1987). Construction activity in or near a DWA in winter when deer are congregated may, due to increased levels of activity and possible displacement from the DWA, stress the animals enough to increase winter mortality.

Pipeline construction through some wetland areas may affect breeding or migrating waterfowl. In general, wetlands or ponds with standing water less than 3 feet deep with abundant aquatic, emergent, or scrub-shrub vegetation are valuable as waterfowl habitat. These areas may be used during late spring and summer as breeding and brood production areas for resident waterfowl, or during early spring and fall as stopover or staging areas for migrating waterfowl. Certain wetlands, because of their quality or location, receive intense use by large concentrations of waterfowl, particularly during migration. The greatest impact

would occur if construction was conducted during high-use times or if it significantly altered the hydrology, causing a wetland to be drained or flooded, making it unsuitable as waterfowl habitat. This type of impact would be prevented through strict construction scheduling and use of our recommended wetland construction and mitigation procedures. Other impact on waterfowl would be short-term, and could include temporary disruption of resident individuals, loss of nests, and short-term alteration of habitat.

The potential impact on heron rookeries resulting from pipeline construction would include clearing of nest trees and disturbance of nesting birds. Because of the high concentration of nests in the rookeries, this impact could have a significant effect on local populations of herons.

5.1.4.2.2 Site-Specific Impact

Great Lakes

Construction of the 459.6 miles of the Great Lakes portion of the proposed project would take place adjacent to existing pipeline right-of-way. This would result in the clearing of approximately 874 acres of upland and lowland forested habitats, of which 648 acres would be allowed to revegetate. The proposed route would pass through extensive forested areas in the vicinity of Loops 4 through 6 in Minnesota, Loop 8 in Wisconsin, and Loops 8 through 15 in Michigan. In these areas, the effects of additional forest clearing on wildlife species would be limited, since the clearing would occur adjacent to already existing cleared and maintained rights-of-way.

The MNDNR has identified an area of sharptail grouse habitat that would be crossed by Loops 1 and 2 between MPs 59 to 64 in Marshall County, Minnesota. Sharptail grouse habitat includes sedge meadows and brushlands. Although several emergent marsh and scrub-shrub wetlands would be crossed in this area, specific habitat has not been delineated and the MNDNR did not identify any potential adverse impact on this species.

The proposed Great Lakes loops would cross a number of active beaver impoundments. These would be crossed predominantly by Loops 10 and 11, but beaver activity has also been identified on Loops 9 and 13. Pipeline construction through a beaver impoundment would temporarily disturb resident beavers, but would not result in significant adverse effects. If a dam were breached during construction, portions of an impoundment could be temporarily drained. Although impact on resident beavers would generally be short-term, as they would rebuild a broken dam relatively quickly, other wildlife utilizing the impoundment may also be affected. Because the areas where beaver impoundments may be affected have a high degree of beaver activity, and wetlands and impoundments are generally common, impact on specific beaver impoundments as a result of construction would not be significant.

The proposed Great Lakes pipeline loops would cross 33 DWAs. Table 4.1.4-3 lists each DWA that would be crossed. All DWAs that would be crossed are adjacent to existing pipeline rights-of-way. DWAs have been mapped by the Minnesota, Wisconsin, and Michigan DNRs, although some of the information is as much as 20 years old. Some of the

mapped DWAs also include deer winter ranges, which are areas generally larger than DWAs that are used during milder winter conditions.

The largest of the DWAs that would be crossed is located at MP 527.2 of Loop 10 in Michigan. Most of the area in the vicinity of Loops 10 and 11 is DWA or deer winter range. Other long DWA crossings would be required at MP 434.3 of Loop 9, MP 646.7 of Loop 12, and MP 776.5 of Loop 15. In addition, Loop 6 would cross the Swan River Deer Yard (MP 237.2) and parts of the Swan River Deer Yard Wildlife Management Area.

In general, the Minnesota, Wisconsin, and Michigan DNRs have not indicated a high level of concern for the loss of some forest cover within DWAs. These agencies have indicated that in the project area, the addition of open areas may benefit deer by increasing available browse (Chesness, 1990; Wilson, 1989; Weise, 1990; McCaffery et al., 1981). The greatest potential for impact on deer, according to these agencies, would occur if construction within DWAs occurred during extended periods of deep snow, or if construction resulted in an increase in human access to DWAs. Based on these agency concerns we recommend that if construction within state-identified deer yards is scheduled to occur between December and March, Great Lakes shall consult with regional DNR personnel and develop mitigation measures, where appropriate, to minimize potential impact on wintering deer.

Two heron rookeries are located approximately 0.5 mile from the proposed Great Lakes Loops 4 and 15. No habitat within these rookeries would be directly affected by pipeline construction. In addition, the distance between these rookeries and pipeline construction activity would be great enough so that no disturbance to nesting herons would occur.

Loops 14 and 15 would cross special wildlife management areas which contain notable waterfowl habitat. Areas along the Manistee River that would be crossed and paralleled at the southern end of Loop 14, and the Muskegon River that would be crossed between MPs 803.0 and 803.5 of Loop 15, support both breeding and migrating waterfowl. The MIDNR stressed the importance of minimizing impact on wetlands during construction and restoring them following construction. We feel that our recommended Procedures would accomplish this to the maximum extent practicable. The MIDNR stated that the project would have no significant effect on waterfowl staging areas (MIDNR, 1980).

Many bird species nest in open areas, including pipeline rights-of-way, between the spring thaw and August 1. In response to a data request for the Midland Cogeneration Ventures Pipeline Project EA, Great Lakes stated that it intends to refrain from mowing pipeline rights-of-way during this time period to reduce the impact on nesting birds. However, Great Lakes indicated that certain routine right-of-way maintenance procedures, such as cathodic protection surveys and line inspection, require limited mowing to gain access.

Tennessee

Construction of the 41.9 miles of the Tennessee portion of the proposed project would loop the existing pipeline adjacent to the existing right-of-way. This would result in the clearing of approximately 73.3 acres of upland and lowland forested habitat, of which 33.8 acres would be allowed to revegetate. In these areas, the effects of additional forest clearing on wildlife would be limited since the alignments are adjacent to existing rights-of-way.

The proposed Segment 8 would cross approximately 1,050 feet of the 325-acre Fannie Stebbins Memorial Wildlife Refuge in Longmeadow, Massachusetts. This refuge is located within the Connecticut River Valley, an important corridor for migratory birds, and provides important staging and stopover habitat. Approximately 1.5 acres of land within this refuge would be disrupted during pipeline construction. Segment 8 would also cross the "Meadows" conservation lands owned by the town of Longmeadow. Approximately 2.2 acres of town conservation land would be disrupted by construction. The town of Longmeadow has expressed concern regarding pipeline construction in these wildlife habitats.

Algonquin

Proposed construction of the Algonquin portion of the project would be located within or adjacent to existing rights-of-way. This would result in the clearing of approximately 43.9 acres of upland and wetland forest habitat. In most of these areas, the effects of additional forest clearing on wildlife would be limited since the alignment is adjacent to or within existing right-of-way.

The proposed G-5 Replacement would cross a 7.4-acre parcel of town conservation land within Seekonk, Massachusetts. This area is primarily forested wetland, with some scrub-shrub and herbaceous wetland on the existing pipeline easement. Because the G-5 pipeline would be a replacement, and most of the construction activity would be confined to the existing cleared easement, impact on the vegetation and wildlife within this area would be minimal.

The G-5 Replacement would also cross approximately 2,750 feet of the Caratunk Wildlife Refuge in Seekonk, owned by the Audubon Society of Rhode Island. This refuge is known to contain two Massachusetts-listed special-concern wildlife species. It is also a popular and well-used education and recreational facility. The Audubon Society has expressed concern regarding direct impact on special-concern species, as well as the potential for widening the existing easement, and further fragmenting and isolating portions of the refuge (Audubon Society of Rhode Island, 1990). To avoid affecting wildlife habitat, as well as recreational enjoyment of this refuge, we have recommended that construction activity within the refuge boundaries be confined to the existing cleared easement, and that construction be confined to non-peak-user activity times of the year (see section 5.1.9.2). Therefore, impact on vegetation, wildlife, and recreational use within this refuge would be minimal.

Transco

Approximately 12.7 acres of forested habitat would be cleared for the construction of the proposed Transco facilities, one half of which would be allowed to revegetate naturally. No DWAs or other state-identified significant habitats are present in the vicinity of Transco's proposed facilities. The FWS expressed a concern that a large forested seasonal wetland area may be crossed (Zich, 1990). During a joint site review between FERC and FWS staff members, it was determined that the forested wetland would not be affected.

Texas Eastern

Almost 40 percent (11.5 acres) of the habitat that would be disrupted by the proposed Texas Eastern Line No. 37 is forested. The remaining portion is primarily agricultural. No DWAs or other critical wildlife habitats are known to occur in the area of Texas Eastern's proposed right-of-way.

CNG

Construction of the proposed TL-470 Line would require a 75-foot-wide construction right-of-way and would result in the clearing of 13.6 acres of forestland. CNG proposes to maintain the entire 75-foot-wide corridor as its permanent right-of-way. We recommend that CNG maintain only 50 feet free of woody vegetation. This would allow 3.3 acres of cleared forestland to revegetate.

The proposed right-of-way would traverse portions of the Papscanee Marsh wetlands between MPs 1.6 and 2.4 in Rensselaer County, New York. Part of this wetland complex has been designated by the NYDEC as significant coastal fish and wildlife habitat. The area provides important habitat for migratory and nesting waterfowl. The TL-470 Line would traverse approximately 1,200 feet of the designated significant habitat at its extreme northern edge, where the proposed route parallels an existing right-of-way. Approximately 750 feet of the designated significant habitat that would be crossed is a state-designated wetland. An additional 100 feet of emergent wetland outside the significant habitat would also be crossed. The crossing of Papscanee Marsh would have a minimal short-term impact on waterfowl using the area. Some waterfowl habitat may not be used during the 1 to 2 years following construction while the shrub and herbaceous wetland vegetation would revegetate. The pipeline crossing of the designated significant habitat would be at its northernmost boundary, therefore the right-of-way would not bisect the marsh or potentially isolate an area during the time the right-of-way was revegetating following construction. If our recommended Procedures are followed, impact on water quality and vegetation in this area would be minimal and short-term.

National Fuel/Penn-York

More than half of the proposed 2.5-mile-long Y-M54 Line right-of-way is forested. Construction of this line would result in the clearing of approximately 11.2 acres of forested habitat. National Fuel/Penn-York propose to maintain all of the 11.2 acres of forestland that would be cleared for construction free of woody vegetation. However, we recommend that National Fuel/Penn-York reduce the width of its permanent right-of-way from 66 feet to 50

feet immediately adjacent to the Tennessee right-of-way. This would result in 7 acres of cleared forestland that would be allowed to naturally revegetate. The remaining wildlife habitat that would be affected is a mixture of agricultural land and abandoned fields. No DWAs or other significant habitats are known to be present in the vicinity of these proposed facilities. In addition, approximately 3 acres of forested habitat would be cleared for the construction of the proposed Concord Compressor Station.

CNG/Texas Eastern

The habitat along the proposed right-of-way for the TL-403 Replacement is entirely agricultural. No forested or significant habitats would be affected.

5.1.5 Endangered and Threatened Species

Section 7 of the Endangered Species Act, as amended, states that any project authorized, funded, or conducted by any Federal agency (e.g., 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 USC § 1536(a)(2)(1988)]. FERC is required to consult with the FWS or the NMFS 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, FERC determines that these species or habitats may be affected by the proposed project, then FERC is required to prepare a biological assessment to identify the nature and extent of adverse impact, and to recommend mitigation measures that would reduce potential impact to acceptable levels. If, however, FERC determines that no federally listed or proposed endangered or threatened species or their designated critical habitat would be affected by the proposed project, then no further action is necessary.

To comply with Section 7 requirements, FERC and the project applicants have conducted informal consultations with the FWS and the NMFS regarding the presence of federally listed or proposed species in the project area. Nine federally listed or proposed species are known to occur or possibly occur within the proposed project area. These species are the bald eagle, gray wolf, piping plover, Kirtland's warbler, dwarf lake iris, Pitcher's thistle, Houghton's goldenrod, Michigan monkey-flower, and shortnose sturgeon.

Through informal consultations with the FWS, the NMFS, and appropriate state agencies, we have determined that, with our recommended mitigation measures, construction and operation of the NIP Project facilities would not affect the gray wolf, piping plover, Kirtland's warbler, or shortnose sturgeon. There is currently not enough site-specific information concerning the location of the dwarf lake iris, Pitcher's thistle, Houghton's goldenrod, Michigan monkey-flower or essential bald eagle nesting habitat within several sections of the proposed construction right-of-way. Consequently, we have recommended that field surveys be conducted. Should we determine that the dwarf lake iris, Pitcher's thistle, Houghton's goldenrod, Michigan monkey-flower or essential bald eagle nesting habitat would be affected by the proposed construction, we would recommend additional mitigation measures. If effects on the species are unavoidable, we would initiate formal consultation with the FWS and prepare a biological assessment to determine the degree of impact on

these species and to recommend potential mitigation. Each of these species is discussed further in section 5.1.5.2.

5.1.5.1 General Construction and Operational Impact

The general construction and operational impact of the proposed NIP Project as discussed in section 5.1.4.2.1 also applies to endangered and threatened wildlife species. Since the distribution and occurrence of threatened and endangered species are limited or in decline, any impact would have a greater effect on the size or viability of the populations. Habitat availability is often the limiting factor for endangered and threatened species, and the loss of suitable habitat can contribute to the decline of individuals or populations, since displacement into surrounding areas can result in conditions unsuitable for survival.

The endangered and threatened plants that occur in the vicinity of the proposed project occur in both wetland and upland areas. The primary impact on these species during construction and operation would be destruction of individual plants or communities of plants located in the construction right-of-way. The ability of these plants to become reestablished following the proposed construction depends on the viability of seeds, rootstock or rhizomes retained in the topsoil, the number and health of nearby undisturbed plants, and whether or not the species can survive in the modified habitat of a cleared right-of-way.

5.1.5.2 Site-Specific Impact

Species discussed in this section, their general location, and their Federal or state status are listed in table 4.1.5-1. At the request of the various Federal and state agencies that have provided this information, exact locations of each site have been omitted to prevent further disturbance or degradation of the habitat. The following discussions describe potential impact and recommended mitigation for the individual species listed in section 4.1.5.

Great Lakes

In October 1989, Great Lakes conducted a fall field survey for threatened and endangered plant species for the proposed loop segments in the Ottawa and Hiawatha National Forests. A report of the results of this survey is in preparation. A spring plant survey is scheduled to begin in May 1990, through all of the national forestlands that would be affected by proposed pipeline construction. A winter and spring animal survey in national forest areas that would be affected is scheduled to begin in January 1990. We recommend that Great Lakes file the results of all surveys within the national forests, along with comments from the FS and appropriate mitigation plans, with the Secretary of the Commission for the review and approval of the Director of OPPR prior to construction in the Ottawa and Hiawatha National Forests.

Bald Eagle (Federal-Threatened, MN-, WI-Threatened, MI-Endangered)

The proposed Great Lakes loops could affect six current or historic bald eagle nest sites. Potential impact from pipeline construction includes the direct removal of nesting trees (active or inactive) or roosting trees and nest abandonment due to disturbance during critical periods of breeding activity.

The FWS has identified two areas, along Loop 10 in Marquette County, Michigan, and along Loop 12 in Mackinac County, Michigan, where the proposed pipeline route may directly affect nesting habitat (FWS, 1989b). We concur with the FWS in recommending that Great Lakes, in consultation with the FWS and MIDNR, conduct a field survey of these two sites to determine the level of potential impact on nesting habitat. A report of this survey, including comments by the FWS and proposed plans for mitigation of potential impact, if appropriate, should be submitted to the FERC for the Director of OPPR's review and approval prior to construction.

Potential bald eagle nest sites occur at five other locations within 1 mile of the proposed Great Lakes facilities. These are along Loop 4 in Cass County, Minnesota; Loop 9 in both Iron and Gogebic Counties, Michigan; Loop 11 in Delta County, Michigan; and Loop 14 in Otsego County, Michigan. The FWS recommends that in these areas pipeline construction activities not take place within 1 mile of active nest sites between February 1 and August 1, and that Great Lakes consult with the FWS prior to construction to verify the status of these nest sites. We recommend that Great Lakes follow the above FWS conditions. The FWS has indicated that following its recommendations would preclude the need for further consultation concerning the bald eagle (FWS, 1989b).

Gray Wolf (Federal-Endangered; WI-Endangered; MN-Threatened)

The FWS indicated to us in a letter dated January 30, 1989, that the gray wolf may be present in the project area although there is no designated critical habitat in the project area. Wolves are very mobile, have a wide territorial range, and would generally avoid an area of pipeline construction activity. The Wisconsin Bureau of Endangered Resources recorded a gray wolf sighting in 1978 near the eastern end of Loop 7. The WIDNR also reports that the northern edge of the current range of the Rainbow Wolf Pack is located approximately 11 miles south of Loop 7. The WIDNR does not anticipate any adverse impact on wolves as a result of the proposed pipeline construction (WIDNR, 1989c; Michon, 1989). In addition, the Minnesota Environmental Quality Board's assessment of the proposed Great Lakes Project found it unlikely that pipeline construction would affect the range of wolves in Minnesota (MNEQB, 1989). Therefore, we have determined that the proposed project would not affect the gray wolf.

Piping Plover (Federal-Endangered; WI, MI-Endangered)

The FWS records indicate that the piping plover occurs in three counties in which the proposed pipeline would be located; Douglas County, Wisconsin, and Emmet and Mackinac Counties, Michigan. There is no designated critical habitat for this species (FWS, 1989). Consultation with the WIDNR and MIDNR has confirmed that piping plover habitat is present in the vicinity of the proposed loop in Mackinac County, but not in Douglas or

Emmet Counties (WIDNR, 1989c; Weise, 1990). However, this species is restricted to lake shoreline habitats, and this habitat does not occur within the existing pipeline right-of-way or the proposed construction right-of-way within Mackinac County (Weise, 1990). Therefore, we have concluded that there would be no impact on this species.

Kirtland's Warbler (Federal-Endangered; MI-Endangered).

In a letter dated January 30, 1989, the FWS indicated that the proposed Loop 15 would cross the Leota Area Kirtland's Warbler Management Units (LAKWMU) between MPs 800 and 806. This area does not contain designated critical habitat, although it does contain essential habitat of the Kirtland's warbler. This area is intensively managed for Kirtland's warblers, but no Kirtland's warblers are known to presently occur there (DeCapita, 1989). However, because the LAKWMU is managed with the intent to attract Kirtland's warblers, we recommend that Great Lakes contact the FWS to verify that the area is still unoccupied by the Kirtland's warbler, and file the FWS's comments with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction. In addition, we recommend that Great Lakes use the following measures recommended by the FWS:

- Pipeline construction shall be accomplished in such a manner that the management of essential habitat along the right-of-way through the use of prescribed burning is not precluded. This includes:

    - burying the pipeline to a safe depth, and
    - locating storage facilities outside of essential habitat;

- Construction crews shall gate and lock access roads if these roads promote increased activity that could disturb nesting birds.

The FWS stated in a January 30, 1989, letter that should its recommended conditions be incorporated into Great Lakes' construction plan, no further consultation concerning the Kirtland's Warbler would be required.

Dwarf Lake Iris (Federal-Threatened; MI-Threatened).

The dwarf lake iris may occur in the vicinity of Loop 12 in Mackinac County, Michigan (FWS, 1989b). The FWS and the MIDNR have recommended that a field survey be conducted to determine if this species occurs within the proposed construction right-of-way. Great Lakes has agreed to conduct a field survey in spring 1990 in consultation with the MIDNR (Great Lakes, 1990). We recommend that the results of this survey, and appropriate mitigation plans, be submitted to the FERC for review and approval by the Director of OPPR prior to construction. The survey results should include survey dates and methods, exact area surveyed, and names and qualifications of those conducting the survey.

Pitcher's Thistle and Houghton's Goldenrod (Federal - Threatened)

These two plant species may occur in National Forest lands in the vicinity of proposed Loop 12. The FS has noted its potential presence, but no specific areas of

concern have been identified. We recommend that Great Lakes incorporate a search for these two species into its scheduled rare plant surveys within National Forest lands.

Michigan Monkey-Flower (Federal-Proposed Endangered)

This plant species may occur in wetland areas within National Forest lands crossed by Loops 11 and 12. No known occurrences or specific areas of concern have been identified; however, we recommend that Great Lakes incorporate a search for this species into its scheduled rare plant surveys within National Forest lands.

Sandhill Crane (MN-Special Concern)

Sandhill cranes are found in the vicinity of Loop 1 in Marshall County, Minnesota. The MNDNR has indicated that pipeline construction through several large marshes and adjoining habitats could disrupt sandhill crane breeding (Eliason, 1990). We recommend that Great Lakes, in consultation with the MNDNR, conduct a survey of the area of concern to determine the need for further mitigation measures. If the state recommends route changes, or if Great Lakes proposes route changes as a result of this process, Great Lakes should file the changes with the FERC for review and approval by the Director of OPPR prior to construction.

Osprey (MN-Special Concern, MI-Threatened)

The MNDNR has reported that an active osprey nest is located near Loop 4. The MIDNR has reported the presence of an osprey nest approximately 1 mile from Loop 13 and indicated that a pair of ospreys could move to a site near the proposed loop. We recommend that Great Lakes, in consultation with the MIDNR and MNDNR, conduct a field survey of these areas to determine potential impact on nesting ospreys. If active nests are located within 0.25 mile of the proposed construction, we recommend that the nest trees and buffer zones of at least 330 feet be protected from cutting and that no construction activity take place within 0.25 mile of the nests between February 15 and June 15. This recommendation would ensure that the project would not adversely affect the osprey.

Wood Turtle (MI-Special Concern)

Great Lakes has conducted field surveys within National Forest lands that would be crossed and has identified potential wood turtle habitat at 14 stream crossings on Loops 9, 11, and 12. They have indicated that they will conduct surveys within this potential habitat to determine if the habitat is occupied by the wood turtle. If wood turtles are found within this habitat, we recommend that Great Lakes consult with the MIDNR and the FS to determine appropriate mitigation measures to prevent adverse impact on the species.

Tennessee

No federally listed threatened or endangered species are known to occur in the vicinity of the proposed Tennessee pipeline loops (FWS, 1989d; NYDEC, 1988b, 1989c; MNHESP, 1988). Five state-listed species may occur in the vicinity of the pipeline loops in Massachusetts.

Spotted Turtle (MA-Special Concern)

The proposed Segment 9 pipeline loop would pass within approximately 1,000 feet of a recorded occurrence of the spotted turtle. According to the Massachusetts Natural Heritage and Endangered Species Program (MNHESP), if the proposed work stays within the existing right-of-way, the project would not adversely affect this species at this site (MNHESP, 1989a). We believe that Tennessee's proposal to clear an additional 50 feet along the existing right-of-way in this area would not affect this species.

Common Moorhen (MA-Special Concern)

The common moorhen is found in the "Meadows" area (the Longmeadow conservation lands and the Fannie Stebbins Memorial Wildlife Refuge) that would be crossed by the proposed Segment 8. We recommend that Tennessee, in consultation with MNHESP, conduct a nesting survey prior to construction to determine the need for further mitigation. If any route changes are proposed as a result of this process, Tennessee should file the changes with the FERC for review and approval by the Director of OPPR prior to construction.

Many-fruited False Loosestrife (MA-Threatened)

The many-fruited false loosestrife has been reported within the Fannie Stebbins Memorial Wildlife Refuge (MNHESP, 1987). We recommend that Tennessee conduct a survey for this species, to determine if it is located on the proposed construction right-of-way. If so, Tennessee should consult with the MNHESP to determine appropriate mitigation measures. If any route changes are proposed as a result of this process, Tennessee should file the change with the FERC for review and approval by the Director of OPPR prior to construction.

Burbot (MA-Special Concern)

The burbot has been reported to occur in Longmeadow Brook, within the reach that would be crossed by Segment 8. This species is a winter spawner. To minimize potential impact on spawning burbot, we recommend that construction across Longmeadow Brook not take place during February. Stream crossing techniques required by our stream and wetland construction and mitigation procedures (see appendix D) would minimize potential impact on this species during nonspawning periods.

American Brook Lamprey (MA - Endangered)

The American brook lamprey may occur within a tributary to North Pond that would be crossed by Segment 9. Construction activity in this stream during April and May could affect spawning lamprey. Construction at other times of the year may affect young lamprey (ammocoetes) more so than adults, as the young are less mobile. We recommend that Tennessee, in consultation with MNHESP, survey the crossing location to determine the need for further mitigation. If any route changes are proposed as a result of this, Tennessee

should file the changes with the Secretary of the Commission for the review and approval of the Director of OPPR prior to construction.

Algonquin

With the possible exception of transient endangered bald eagles and peregrine falcons, no federally listed or proposed listed threatened or endangered species are known to occur within the area of Algonquin's proposed pipeline loops or replacement pipelines in Connecticut, New York, Massachusetts or Rhode Island (FWS, 1988c, 1989e). No New York-, Connecticut-, or Rhode Island-listed species have been reported in the vicinity of the proposed Algonquin loops in these states (NYDEC, 1988b; CTDEP, 1989; RIDFW, 1989). Three state-listed special-concern species occur in the vicinity of Algonquin's proposed facilities in Massachusetts.

Broom-Crowberry (MA-Special Concern)

The MNHESP, in a letter dated December 7, 1989, identified the presence of broom-crowberry on the right-of-way of the proposed G-8 Replacement/Loop pipeline. The MNHESP has stated that this species survives, and even prefers, disturbed sites. Therefore, the broom-crowberry should not be adversely affected by the proposed project.

Wood Turtle and Eastern Box Turtle (MA - Special Concern)

These two species have been reported to occur in the vicinity of the proposed G-5 Replacement in Bristol County, Massachusetts. Impact on these species would be limited because construction activity would be restricted to the existing cleared easement. To further minimize potential impact, we recommend that Algonquin have a qualified biologist walk the area in question immediately prior to construction, and find and remove any wood or eastern box turtles from the proposed construction right-of-way.

Transco

The FWS, in a letter dated April 5, 1988, stated that except for occasional transient species, no federally listed or proposed threatened or endangered species were known to occur in the vicinity of the Leidy Loops in Northampton County, Pennsylvania. No state-listed species are known to occur in the vicinity of the proposed Transco facilities (Culp, 1989a; Pennsylvania Natural Diversity Inventory, 1989, 1990; New Jersey Natural Heritage Program, 1989).

Texas Eastern

No Federal- or state-listed or proposed threatened or endangered species are known to be present in the area of Texas Eastern's proposed pipeline (FWS, 1988a; Pennsylvania Fish Commission, 1988; Pennsylvania Natural Diversity Inventory, 1988, 1989).

CNG

One federally listed endangered species is known to exist, and one state-listed special-concern species may exist in the area of the CNG TL-470 Line.

Shortnose Sturgeon (Federal Endangered; NY-Endangered)

The CNG TL-470 Line would cross the Hudson River south of Albany, New York, approximately 40 miles downriver of the Troy Dam, the upstream limit of this anadromous species. This proposed crossing location is within the reach of river considered important adult spawning and juvenile feeding habitat. Spawning occurs between mid-April and late May, and juveniles congregate in this area between May and September. The NMFS, which has jurisdiction over this species, has indicated that an open-cut river crossing conducted between fall and early spring would not adversely affect this species (NMFS, 1989; Gorski, 1990). Therefore, we recommend that this river crossing be conducted between November 1 and April 1 (see section 5.1.4.1). This recommendation would ensure that the shortnose sturgeon is not affected by the proposed crossing.

Least Bittern (NY-Special Concern)

The Papscanee Marsh is a suspected breeding site of the least bittern. Pipeline construction through this area may, therefore, adversely affect breeding least bitterns. We recommend that CNG, in consultation with the NYDEC, conduct a nesting survey prior to construction, if construction through the marsh would occur prior to June 30. If least bitterns are found to be nesting in the vicinity of the proposed pipeline, CNG should not begin construction through this area until after June 30.

National Fuel/Penn-York

The FWS, in a letter dated November 27, 1989, stated that except for occasional transient species, no federally listed or proposed threatened or endangered species are known to exist in the project area. One state-listed species, the osprey, may exist along the proposed Y-M54 Line in Potter County, Pennsylvania (PGC, 1988).

Osprey (PA-Endangered)

The osprey has been found in Potter County, Pennsylvania. The Pennsylvania Game Commission (PGC) has requested a field review of the project site to determine if ospreys or osprey nests occur in the project area (PGC, 1988). We recommend that, prior to construction, National Fuel/Penn-York conduct a survey in the area that would be cleared for the Y-M54 Line in Potter County to determine the presence of osprey nests. National Fuel/Penn-York would submit the results of these surveys to the PGC to determine the need for further mitigation measures. If any route changes are proposed as a result of this process, National Fuel/Penn-York should file the change with FERC for review and approval by the Director of OPPR prior to construction.

CNG/Texas Eastern

No Federal- or state-listed threatened or endangered species are known to occur in the CNG/Texas Eastern replacement project area in Erie County, New York (FWS, 1987; NYDEC, 1989a).

5.1.6 Vegetation

5.1.6.1 General Construction and Operational Impact

The primary impact on vegetation during construction and routine maintenance of the proposed NIP Project would be both temporary and permanent alteration and loss of vegetative cover. The cover type most affected by construction would be forestland. Approximately 1,040 acres of forestland (including forested wetlands) are proposed to be cleared for this project, of which 334 acres are proposed to be maintained as permanently cleared right-of-way.

In upland areas, the proposed construction right-of-way would be cleared of all woody vegetation and then graded to allow access for construction equipment. After construction, up to 50 feet of right-of-way width in upland areas is proposed to be kept free of woody vegetation (maintained right-of-way). The remaining construction right-of-way would be allowed to revegetate naturally. Construction techniques through forested wetlands would depend on site conditions, but in general, all woody vegetation within the construction right-of-way would be cut at ground level. Grading would not occur, but vegetation at the trench location and adjacent work pad would be grubbed. Refer to sections 5.1.7.1 and 5.1.7.2 for discussions of wetland construction impact and mitigation measures, respectively.

Throughout most of the proposed NIP Project route, clearing of woody and nonwoody vegetation would take place adjacent to an existing, maintained pipeline right-of-way. All vegetation types would be affected, including mature forest, successional wooded areas, wetlands, agricultural land, old fields, and vegetation associated with residential areas.

Mature forest cleared during the proposed construction would take the longest time to reestablish itself on the temporary construction right-of-way. Periodic maintenance of the maintained right-of-way on upland areas would prevent reestablishment of woody tree species, which would permanently convert the forest to shrub and herbaceous vegetation. In addition, the reestablishment of tree seedlings on the construction right-of-way would be retarded due to damage to residual seeds and root stock caused by grading, soil compaction, and soil mixing. These factors could also reduce the ability of new seeds to germinate. Therefore, the revegetation of forest tree species on the temporary construction right-of-way could take longer than it would in a similarly cleared area with limited soil disturbance (e.g., for a timber operation clear cut).

In addition to direct impact from vegetation clearing, there could be secondary impact on uncleared vegetation. Construction of a right-of-way through forested areas would create new sharp vegetation edges on one side of the existing right-of-way. This may expose the new edge trees to elevated levels of sunlight and wind, which could increase moisture evaporation and the probability of wind throws. Root damage or soil erosion near the root

zone could also occur as a result of construction activity near the new right-of-way edge. Increasing the cleared area in large tracts of mature forestland could result in a change of forest community in forested areas adjacent to the right-of-way. Shade-intolerant species may become established and persist in the understory along the right-of-way edge (Carvell and Johnston, 1978). Maintaining an open right-of-way may also allow early successional vegetation to invade the construction and maintained rights-of-way, as well as the edges of the uncleared forest.

Impact on herbaceous vegetation should be relatively short-term. Herbaceous wetlands should return to preconstruction condition in one or two growing seasons. Construction through agricultural land, in most cases, would result in the loss of only one growing season. Landowners would be compensated for any lost crops. Abandoned agricultural land in early successional stages could also revert back to preconstruction conditions in a relatively short time (one to three growing seasons). Impact on vegetation in residential areas should be short-term, except in those instances where mature trees would be removed for construction.

Another potential impact from vegetation clearing during construction could result from inadequate stump disposal. Burial of large volumes of tree stumps at specific locations could result in a change in ground-level elevations. In addition, when large volumes of stumps decompose under anaerobic conditions, methane and toxic leachates may be generated. To reduce this potential impact, we recommend that where stump burial has been approved by the landowner, stumps be buried individually. Where approved by the landowner, stumps may also be left on the right-of-way ground surface, exposed to the weather to deteriorate. This would minimize the bulk waste disposal problem in the project area. Many comments were raised about the disposal of bulky construction wastes. Disposal of those materials on the right-of-way would ease the landfill space problem. However, if onsite stump disposal was not agreed to by the landowner, the applicants would be responsible for removing all stumps offsite, to an acceptable disposal site.

Onsite disposal of brush and slash would also be done at the discretion of the landowner. This material would be piled at the edge of the right-of-way, or chipped and spread on the right-of-way if done so in accordance with appropriate provisions of appendix C. At the landowner's request, the applicants would be responsible for removing this material to an acceptable disposal site.

To avoid potential impact on wildlife species that use the right-of-way for breeding, nesting, and brood-rearing purposes, appendix C requires that no vegetation maintenance be conducted prior to August 1 of any year, and that vegetation maintenance be conducted no more frequently than once every 3 years.

5.1.6.2 Site-Specific Impact

The acreages of forest vegetation that would be affected by each segment of the NIP Project are listed in table 5.1.6-1.

TABLE 5.1.6-1

Vegetation Disturbance by the Proposed NIP Project a/

Applicant Segment/State	Forested Upland to Be Cleared Temporary (acres)	Forested Upland to Be Cleared Permanent (acres)	Forested Wetland to Be Cleared b/ Temporary (acres)	Forested Wetland to Be Cleared b/ Permanent c/ (acres)
GREATLAKES	421.9	0.0	451.7	225.7
Minnesota				
Loop 1	0.3	0.0	0.0	0.0
Loop 2	4.3	0.0	0.3	0.1
Loop 3	19.1	0.0	6.6	3.3
Loop 4	6.7	0.0	36.2	18.1
Loop 5	3.7	0.0	12.6	6.3
Loop 6	1.7	0.0	42.5	21.2
Wisconsin				
Loop 7	40.6	0.0	0.6	0.3
Wisconsin/Michigan				
Loop 8	42.9	0.0	18.5	9.3
Michigan				
Loop 9	82.9	0.0	42.0	21.0
Loop 10	17.6	0.0	82.4	41.2
Loop 11	13.4	0.0	92.0	46.0
Loop 12	58.0	0.0	42.2	21.1
Loop 13	22.3	0.0	37.2	18.6
Loop 14	23.6	0.0	0.0	0.0
Loop 15	52.5	0.0	18.5	9.2
Loop 16	29.4	0.0	0.0	0.0
Loop 17	2.9	0.0	20.1	10.0
TENNESSEE	59.2	31.3	14.1	7.8
New York				
Segment 1	26.2	13.1	5.9	3.0
Segment 2	0.6	0.3	0.0	0.0
Segment 3	6.7	3.3	0.6	0.3
Segment 4	4.2	2.1	0.0	0.0
Massachusetts				
Segment 8	15.0	8.7	5.4	3.2
Segment 9	6.5	3.8	2.2	1.3
ALGONQUIN	34.3	24.5	9.6	7.6
Massachusetts				
G-5 Replacement	5.0	2.4	2.3	1.2
G-8 Replacement/Loop	9.8	5.0	0.1	<0.1
Medfield Loop	4.7	4.7	3.1	3.1
H-1 Loop	1.0	0.0	0.8	0.0
Connecticut				
E-1 Loop	7.1	7.1	0.2	0.2
Chaplin Loop	3.6	3.6	0.4	0.4
Rhode Island				
Tiverton Loop	3.1	1.8	2.7	2.7

TABLE 5.1.6-1 (cont'd)

Applicant Segment/State	Forested Upland to Be Cleared Temporary (acres)	Forested Upland to Be Cleared Permanent (acres)	Forested Wetland to Be Cleared b/ Temporary (acres)	Forested Wetland to Be Cleared b/ Permanent c/ (acres)
TRANSCO	12.6	6.2	0.1	<0.1
Pennsylvania				
1.61-Mile Leidy Loop	4.8	2.4	0.0	0.0
Pennsylvania/New Jersey				
6.79-Mile Leidy Loop	7.8	3.8	0.1	<0.1
TEXASEASTERN	11.5	5.8	0.0	0.0
Pennsylvania				
Line No. 37	11.5	5.8	0.0	0.0
CNG	13.6	13.6	0.0	0.0
New York				
TL-470 Line	13.6	13.6	0.0	0.0
NATIONALFUEL/PENN-YORK	11.2	11.2	0.0	0.0
Pennsylvania				
Y-M54 Line	11.2	11.2	0.0	0.0
CNG/TEXASEASTERN	0.0	0.0	0.0	0.0
New York				
TL-403				
Replacement	0.0	0.0	0.0	0.0
TOTAL	564.3	92.6	475.5	241.1

a/ This table represents acreage of vegetation proposed to be cleared by the applicants. Our recommendations will reduce the total acreage of vegetation that would be cleared.

b/ Includes forested (PFO) and scrub-shrub (PSS) wetlands.

c/ As proposed by the applicants. We have recommended that the entire right-of-way through wetlands be allowed to revegetate, with only minimal vegetation maintenance (refer to section 5.1.7.2).

Great Lakes

All of Great Lakes' loops would be constructed adjacent to an existing cleared right-of-way. Approximately 80 percent of the existing right-of-way has been maintained free of woody vegetation for a width of at least 75 feet. Great Lakes has proposed to utilize a 75-foot-wide construction right-of-way. For its construction right-of-way in upland areas, Great Lakes would utilize 50 feet of existing cleared right-of-way, and would clear an additional 25 feet of new, temporary right-of-way. In some wetland areas where soil instability may require a larger separation between the new pipeline and the existing pipeline, Great Lakes has proposed to clear up to 50 feet of new right-of-way. For the purpose of this EIS, we have analyzed Great Lakes' proposal on a worst case basis, and have assumed that 25 feet of vegetation on upland areas and 50 feet of vegetation on all wetland areas would be cleared for Great Lakes' temporary construction right-of-way.

Approximately 874 acres of previously undisturbed forestland (including forested and scrub-shrub wetlands) would be cleared for construction of Great Lakes' proposed loops. In Minnesota, 134 acres of woodland would be cleared, primarily in the area of Loops 3 through 6, 68 acres of woodland would be cleared in Wisconsin, and in Michigan 672 acres of woodland would be cleared, primarily in the area near Loops 8 through 15. All of these figures include both upland and wetland forest. Refer to section 5.1.7 for specific recommendations regarding revegetation of forested wetlands. In addition, by following our wetland mitigation procedures, the 138.2 acres of forested wetland that Great Lakes has proposed to maintain free of woody vegetation would not be maintained clear, but would be allowed to revegetate to a scrub-shrub condition.

Where areas are cleared, erosion control measures would be employed. Great Lakes would revegetate the entire, disturbed right-of-way with herbaceous plant and grass species. See section 5.1.2 for further information on revegetation.

Because of comments received from the Minnesota Environmental Quality Board (MNEQB, 1989), Great Lakes has agreed that cut timber would not be pushed off the right-of-way into growing trees where it could do damage. In addition, the affected landowners could have all of the cut timber if desired.

Where Loops 1 and 2 would cross the Middle River (MP 54), small amounts of relic prairie grove could be affected. Relic prairie grove vegetation occurs along the relatively undisturbed banks of the Middle River (MNEQB, 1989). Approximately 0.9 to 1.2 acres of forest vegetation, and up to 1.2 acres of herbaceous vegetation on the existing right-of-way could be disrupted within the band of vegetation along the Middle River. We recommend that Great Lakes, in consultation with the MNDNR, have a qualified botanist survey this area prior to construction to determine if relic prairie grove species would be impacted. Should relic prairie species occur within the construction right-of-way, we recommend that Great Lakes consult with the MNDNR to determine appropriate native seed mixtures to use when reseeding the right-of-way. Construction of Loop 12 across the Cut River Gorge (MP 657.0) would cross approximately 500 feet of northern mesic forest, a relatively unique community type within the region. This vegetation type occurs within the gorge from near the mouth of the Cut River at Lake Michigan to approximately 1.5 miles upriver. Within this reach the gorge is traversed, and the vegetation cleared, by four existing linear rights-

of-way. The installation of Loop 12 along one of these rights-of-way would widen the right-of-way, and result in the additional clearing of approximately 0.6 acre of this vegetation type.

Loop 12 would also traverse two areas of a vegetation type known as wooded dune and swale complex. These areas are located just to the north of Lake Michigan between MPs 664 and 670, and between MPs 672 and 674.5. The pipeline loop would follow existing Great Lakes right-of-way through these areas, which is along the northern edge of the westernmost area. Review of Great Lakes' aerial photographs of the line indicates that the existing maintained right-of-way through these areas is between 100 - 150 feet wide. Therefore, to restrict impact on the dune and swale areas, we recommend that Great Lakes not clear additional vegetation between MPs 664 and 674.5.

In addition, the MIDNR has expressed concern regarding the potential for soil mixing and alternation of hydrology within the wetlands of the wooded dune and swale complexes (Weise, 1990). Adherence to our recommended Stream and Wetland Construction and Mitigation Procedures (see appendix D) should minimize this potential impact.

Tennessee

Approximately 37.7 acres of forested upland and 6.5 acres of forested wetland would be cleared for the proposed Tennessee pipeline loop segments in New York. Approximately 18.8 acres of upland forest and 3.3 acres of forested wetland are proposed to be maintained as part of the proposed permanent right-of-way. In Massachusetts, approximately 21.5 acres of upland forest and 7.6 acres of forested wetland would be cleared on the 60-foot-wide construction right-of-way adjacent to the existing right-of-way. Of this, approximately 12.5 acres of upland forest and 4.5 acres of forested wetland are proposed to be maintained as part of the permanent right-of-way. All clearing along the Tennessee facilities would be located adjacent to existing rights-of-way. This would reduce the amount of clearing required and would not create new forest openings. In addition, by following our Procedures (see appendix D), the 7.8 acres of forested wetland that Tennessee has proposed to maintain free of woody vegetation would not be maintained clear, but would be allowed to revegetate to a scrub-shrub stage.

The proposed construction of Segment 8 along Wolf Swamp Road (MP 261+3.9 to MP 261+4.6) in Longmeadow, Massachusetts, may affect nearly 70 ornamental crabapple trees, which are approximately 6 inches diameter at breast height (dbh). Tennessee has proposed to install the pipeline underneath the sidewalk along Wolf Swamp Road, approximately 3 - 10 feet away from the trees. No trees would be cut but root damage could occur as a result of trench cutting. Tennessee has proposed to replace any trees that die as a result of construction.

Algonquin

Approximately 34.3 acres of upland forest and 9.6 acres of forested wetland would be cleared for pipeline construction. The vegetation in the vicinity of all seven proposed segments of pipeline is predominantly forested. Of the forest area that would be affected, 24.5 acres of upland forest would be maintained in an herbaceous or shrubby vegetative cover. Approximately 7.6 acres of the forested wetland has been proposed to be maintained

in a herbaceous vegetative condition. However, by following our Procedures (see appendix D), this 7.6 acres would be allowed to revegetate to a scrub-shrub condition.

The proposed G-8 Replacement/Loop in Plymouth and Barnstable Counties, Massachusetts, would pass primarily through pine barrens, a relatively common vegetation type in that portion of the state.

Transco

Approximately 12.6 acres of forested upland and 0.1 acre of forested wetland would be cleared by the construction of Transco's proposed loops. Of this, 6.2 acres of upland would be maintained as permanent right-of-way and less than 0.1 acre of wooded wetland is proposed to be maintained in a permanent non-forested vegetative cover type. However, by following our Procedures (see appendix D), no forested wetland would be maintained free of woody vegetation. The remaining vegetation along these loops consists mainly of agricultural fields and crops that would be replaced within one growing season. Owners would be compensated for lost crops. Approximately 5 acres of upland forest would be cleared for construction and operation of the proposed Compressor Station 167.

Texas Eastern

Approximately 11.5 acres of upland forest would be cleared for pipeline construction, of which 5.8 acres would be maintained as part of the permanent right-of-way. Most of the remaining cover type consists of agricultural vegetation.

CNG

Approximately 13.6 acres of upland forest have been proposed to be cleared and permanently maintained as pipeline right-of-way. However, we have recommended that CNG maintain only 50 feet of its proposed 75-foot-wide right-of-way free of woody vegetation. This would allow approximately 3.4 acres of cleared forestland to revegetate. The remaining vegetation along the CNG TL-470 Line consists of agricultural vegetation, with some vegetation associated with commercial/industrial lands.

National Fuel/Penn-York

Approximately 11.2 acres of upland forest would be cleared for construction of the proposed pipeline. This would be cleared for a 66-foot-wide construction right-of-way, all of which National Fuel/Penn-York has proposed to maintain permanently free of woody vegetation. We have recommended that National Fuel/Penn-York maintain only a 50-foot-wide right-of-way where it would be located adjacent to Tennessee's existing right-of-way. This would allow approximately 7.0 acres of cleared forestland to revegetate.

CNG/Texas Eastern

The proposed CNG/Texas Eastern TL-403 Replacement would be located on an existing right-of-way which is in agricultural use. No other vegetation types would be affected by construction of this pipeline.

5.1.7 Wetlands

5.1.7.1 General Construction and Operational Impact

The primary impact on wetlands as a result of pipeline construction and operation would be the alteration of wetland vegetation. Additional impact may include temporary changes to wetland hydrology, water quality, aesthetic values, and the quality of wildlife habitat. In general, however, pipeline construction through wetlands would not significantly alter the wetland functions, as no wetlands would be filled or drained. Therefore, no wetland loss would occur.

As discussed in section 5.1.7.2, the applicants would be required to follow specific wetland construction and mitigation procedures developed and recommended by the Commission. Woody vegetation on the proposed construction right-of-way would be cleared prior to pipeline installation. Following construction through wetlands, the entire right-of-way would be allowed to revegetate. As revegetating forested wetlands mature, only limited vegetation maintenance could be conducted. Trees greater than 15 feet high and located within 15 feet of the proposed pipeline would be selectively hand cut, which would maintain forested wetlands over the pipeline in a scrub-shrub stage. The vegetation in some mature forested wetlands would therefore be permanently altered. Scrub-shrub and young forested wetlands would not be permanently altered. Following construction through emergent marsh wetlands, original herbaceous vegetation would revegetate within one or two growing seasons, so there would be little or no permanent change in vegetation. However, the introduction or spread of undesirable plant species (i.e., purple loosestrife, *Phragmites*) into an emergent wetland could occur.

Pipeline construction could alter wetland hydrology and water quality by changing surface and subsurface drainage patterns and by disturbing soils. Surface runoff could be altered if excessive crowning of backfill is allowed over the trench. Soil compaction and rutting as a result of spoil pile placement and travel by heavy machinery could alter surface water drainage patterns. The proposed pipeline trench could act as a subsurface drainage conduit. The pipe and backfill could also block subsurface water movement thus changing the speed or direction of water moving through the wetland. Trench excavation could also break through an impermeable soil layer responsible for maintaining an elevated or perched water table and wetland. This could cause drier soil conditions and an eventual change in vegetation. Conversely, in otherwise dry or borderline conditions, soil compaction by heavy machinery could create an impermeable soil layer, which could promote the eventual establishment of wetland vegetation. Trench excavation and the temporary storage of spoil could also erode, therefore, increasing sediment loads in water moving through a wetland. Refer to sections 5.1.2 and 5.1.3 for further discussion of soils and water quality, respectively. Measures to prevent or minimize this possible impact are discussed in section 5.1.7.2.

Due to rapid revegetation, impact on the aesthetic value of wetlands would be short-term where the pipeline would pass through scrub-shrub or herbaceous wetlands. Aesthetic impact would be long-term where the pipeline would cross mature forested wetlands, since regrowth of the vegetation in the right-of-way would take from 10 to 20 years. The majority of aesthetic impact would only be apparent during construction.

5.1.7.2 Construction and Mitigation Procedures

At a minimum, the applicants would comply with the requirements of the nationwide Section 404 permit conditions and would be required to obtain Section 401 water quality certifications from the appropriate state or local agency. The state or local agency issuing the 401 certification could also impose additional conditions on a site-specific basis. Compliance with state or local agency-imposed conditions would further ensure that the quality of each wetland crossed would not be degraded. In a letter dated February 1990, the COE's St. Paul District Office issued Section 404 Nationwide Permit No. 12 for Great Lakes proposed loops in Wisconsin and Minnesota.

We have received comments from two COE district offices regarding proposed facilities within their jurisdiction. The Buffalo District commented that pipeline construction involving the discharge of fill material to construct temporary access roads or work pads would not be covered under Nationwide Permits No. 12 or 14, but would require individual permits (see comment and response F2-5). Proposed facilities within the jurisdiction of the Buffalo District include the Tennessee, CNG/Texas Eastern, and National Fuel/Penn-York facilities in Erie, Livingston, Niagara, Ontario, Onondaga, and Wyoming Counties, New York.

The Philadelphia District commented that construction of Transco's proposed Leidy Loop, which is within its jurisdiction, must be in compliance with Nationwide Permit No. 12 conditions.

In addition to satisfying COE permit requirements, we have recommended that the applicants satisfy conditions of our Stream and Wetland Construction and Mitigation Procedures (Procedures) (appendix D). These procedures are intended to minimize to the greatest practicable extent any long term impact on wetlands. The applicants have reviewed and commented on the Procedures, and, in general, have agreed to comply with the majority of its measures. The applicants have not agreed to all of the procedures, however, and in some cases have proposed alternatives which we have reviewed. Our recommended procedures, the alternatives proposed by the applicants, and our evaluation and recommendations are described below. If the applicants determine that they cannot comply with one or more procedures, they may submit site-specific alternative measures for our review and approval prior to construction. Where these alternative measures are significant they would need to be submitted to the Director of OPPR for review and approval prior to construction. All of the project segments, with the exception of those proposed by Texas Eastern and CNG/Texas Eastern, would require construction within wetlands.

Staging Areas

The Procedures require that all staging areas be located at least 50 feet from wetland edges where topographic conditions permit, and that these areas be limited in size to the minimum area needed for prefabrication of pipe segments. Potential contamination of surface water by spillage of fuels, oil, or other hazardous materials would be minimized or eliminated by restricting the refueling of construction equipment and the storage of hazardous materials to areas further than 100 feet from all wetland boundaries. All applicants have agreed in general to the 50-foot setback for staging areas but emphasize that topographic

and/or soil conditions may frequently prohibit a full 50-foot setback without additional grading of the right-of-way. Algonquin and Tennessee have commented that staging areas must be large enough to accomodate activities other than the prefabrication of pipe. The emphasis in this recommendation is on limiting the size of the staging area to the minimum area required. It is implied that a number of activities are associated with the prefabrication of pipe; these activities are not listed, but should be included when interpreting this recommendation.

Tennessee and Algonquin take exception to guidelines for refueling equipment further than 100 feet from wetland boundaries, indicating that under certain topographic situations, or in large wetland areas, it could be more environmentally harmful to move construction equipment in order to refuel. They also note that the additional movement of equipment in and out of large wetlands would increase the time and cost associated with construction. Great Lakes has indicated that it would refuel portable construction equipment that is in continuous service (e.g., pumps) within the boundaries of large wetlands. Great Lakes would use sealed containers no larger than 5 gallons. They indicate that this would limit the size of potential spills, and allow for quick containment and cleanup. We find Great Lakes' proposal acceptable, but maintain that moveable construction vehicles should not be refueled within 100 feet of wetland boundaries.

Spoil Placement

The Procedures require that sediment filter devices be used to prevent the flow of trench excavation spoils off of the right-of-way. Great Lakes takes exception to the universal use of sediment filter devices within wetlands, indicating that such devices would only be required where the topography, hydrology, and lack of surrounding vegetation would make spoil flow off the right-of-way likely. Tennessee has indicated that this restriction would generally not be met in long wetland crossings where spoil is sidecast, or in wetlands with deep standing water, except to isolate specific sensitive areas. Algonquin commented that this would be unnecessary, costly, and ineffective, particularly in areas of deep standing water. Algonquin also indicated that installation, maintenance, and removal of sediment filter devices would increase construction time and traffic within wetlands, causing additional siltation. We do not feel that activities associated with using sediment filter devices would substantially increase sedimentation when compared to pipeline installation activities. Because of the potential for large amounts of sediment to enter surrounding undisturbed wetland areas, we maintain that sediment filter devices should be used around all spoil piles and at the edges of the right-of-way within all wetland areas, whenever standing or flowing water is on or adjacent to the construction right-of-way.

Crossing Procedures

Our Procedures for wetland crossings require that the applicant notify the COE concerning the proposed construction activities, and submit to us a copy of the COE's determination regarding the project's need for individual Section 404 and/or Section 10 permits. Although Tennessee has stated that this requirement is burdensome, we maintain that it is a reasonable request.

Our Procedures require that construction through wetlands comply with nationwide Section 404 permit conditions (33 CFR § 330) at a minimum, and that applicants apply for state-issued wetland-crossing permits, where appropriate, and obtain Section 401 water quality certification or waiver. The procedures include a requirement that if a wetland cannot be avoided, the route should be located to minimize disturbance to the wetland. One method of minimizing disturbance to wetlands is to locate the route adjacent to existing rights-of-way, which is the case for the majority of the proposed NIP Project facilities.

In order to minimize the area of wetland vegetation that would be affected during construction, our Procedures require that the construction right-of-way width be limited to 75 feet or less in wetlands. This has been modified from previous requirements of 50 feet or less. Evidence submitted by the applicants, as well as from numerous pipeline companies and independent contractors, indicates that pipeline construction within a 50-foot right-of-way, especially with topsoil segregation, could not be safely or adequately accomplished in the majority of wetlands. Concentrating activity to within 50 feet may also result in greater impact on wetland soils and vegetation. Some applicants have indicated that maintaining a right-of-way width of 75 feet may even be too restrictive in some wetlands, especially for long wetland crossings. We feel that by using appropriate methods to temporarily stabilize the right-of-way, the majority of wetlands could be crossed while limiting right-of-way clearing to 75 feet or less.

During right-of-way clearing, woody wetland vegetation would be cut off at ground level, leaving root systems intact. Only stumps and roots directly over the trench would be removed where required for pipe installation. Following this procedure rather than pulling root systems or grading the entire right-of-way would allow for a more rapid revegetation of woody plants.

In order to maximize revegetation of the area over the trench, the Procedures specify that the top 1 foot of topsoil from the area to be disturbed by trenching be segregated and replaced as the top layer after installation is complete, except in areas with standing water or saturated soils. Great Lakes has indicated that some wetlands may have a topsoil horizon less than 1 foot deep, and that in such cases less than 1 foot of topsoil would be segregated. This is acceptable to us. Algonquin has suggested that topsoil segregation may require additional right-of-way width, and may result in greater disturbance to the wetland. We disagree on both counts. Because of the value of returning the seeds, roots, and rhizomes that are within the topsoil to the surface where they can rapidly revegetate, we stand by this recommendation. Texas Eastern has suggested that topsoil segregation would not be practical if cutting of vegetation and stump removal restrictions are enforced. We disagree on both points. If trees are flush-cut at ground level, soil segregation activities could still be conducted.

To minimize the disturbance and compaction of wetland soils, the Procedures require that the applicants limit construction equipment operating in wetlands to that needed to dig the trench, install pipe, backfill the trench, and restore the right-of-way. Tennessee, Algonquin, and Texas Eastern agree to the general principle of this, but indicate that it would not be possible in all cases (e.g., pipeline bends and very long wetlands). We intend this recommendation to minimize construction traffic in wetland areas and to prohibit construction equipment travel through wetlands as a means of accessing nonwetland right-

of-way areas. We recognize that in some instances there may be no available off right-of-way access around long wetlands. In these cases, our recommendation allows the applicants to provide site-specific information for our review and approval prior to construction.

The use of fill to stabilize working areas within wetlands may permanently alter wetland characteristics. Our Procedures require that no dirt, rock, stumps, or brush be used as temporary or permanent fill within wetlands. Great Lakes, Tennessee, Algonquin, and CNG all take exception to this, indicating that use of some combination of trench spoil, stumps, or brush to stabilize the right-of-way is standard industry practice. Great Lakes, Tennessee, and Algonquin have indicated they would remove temporary fill. CNG indicated that it would not remove brush fill following construction. If these materials are used and not removed after construction, wetlands may be permanently altered; therefore, the practice is unacceptable. In addition, we question the ability of the applicants to effectively remove these materials after they have been driven on by heavy equipment.

We have determined that the use of crushed stone over geotextile fabric is an acceptable method to temporarily stabilize the right-of-way. This material must be removed following construction. In addition, any timber used as a base for the geotextile fabric must also be removed following construction. Great Lakes has also stated that it would utilize subsoil from trench excavation, placed over timber riprap, to stabilize the working area. Because numerous extensive and unavoidable wetlands would be crossed by Great Lakes, this practice would be acceptable to us, provided that only subsoil from trench excavation within the wetland is used, the soil is placed only on timber (not vegetative slash) riprap, all such soil is returned to the trench during backfilling, and the timber riprap is removed following construction.

To minimize impact on wetlands with standing water or saturated soils, the Procedures require that the applicants use wide-track or balloon-tire construction equipment, or operate normal equipment off of timber riprap or prefabricated equipment pads, where these conditions exist. In addition, only trees within the right-of-way are to be cut for use as riprap or equipment pads, and no more than two layers of these materials are to be used to stabilize the right-of-way. Also, these materials must be removed upon completion of construction. Great Lakes notes that riprap or equipment pads would not be required during winter construction when wetlands with standing water or saturated soils are frozen. Great Lakes has indicated that potential areas for winter construction include Loop 4 between MPs 182.2 and 201.2 and Loop 5 between MPs 226.4 and 241.2.

Great Lakes and Tennessee indicate that for some wetland crossings, there may not be enough timber on the right-of-way, and timber outside of the right-of-way may need to be cut with the landowner's permission. The Procedures require that in such cases, prefabricated pads be used. Tennessee also takes exception to removing timber riprap, except where it would impede drainage, suggesting that removing material would cause more damage than leaving it. We believe that leaving timber riprap in any wetland would have significant impact, and that by laying riprap over a series of cables, it may be removed without a great deal of additional disturbance to the wetland. If the applicant feels it cannot remove timber riprap without causing more environmental damage than by leaving it, it should not plan to use it. In addition, in some areas along Great Lakes' proposed route, old timber riprap (corduroy roads) remains on or adjacent to existing rights-of-way. Utilizing old

riprap where it exists would reduce the need for new riprap, and this practice is encouraged wherever possible. Great Lakes has indicated that it would assess the condition of the existing corduroy roads for use during this proposed project.

The "push-pull" or "float" technique would be used to place the pipe in the trench wherever standing water and other site conditions allow. This would reduce impact on wetlands by minimizing equipment traffic through the wetland.

Temporary Erosion and Sediment Control

Silt fences and other filter devices would be installed around the edge of all wetlands. Although Algonquin and Tennessee have suggested the frequency of inspection of these devices be based on weather conditions, storm events, and sensitivity of the area, the Procedures specify daily inspections as a minimum for adjustment and/or repair of these devices as needed.

Revegetation Techniques

Following construction through wetlands, no lime or fertilizer would be added to disturbed areas, unless required by the appropriate state permitting agency, and where there is no standing water the topsoil would be returned to its original horizon and then seeded with annual ryegrass. Tennessee indicates it would develop wetland revegetation techniques for each wetland crossed, based on site surveys. This is acceptable to us providing the techniques meet these minimum requirements. CNG and Texas Eastern indicate that their reseeding practices are based on state or county specifications, Great Lakes indicates that seeding would not occur in wetlands due to negligible erosion potential, and Transco indicates that seeding would not occur in all situations.

To minimize permanent alteration of wetland vegetation, the Procedures specify that the entire disturbed right-of-way be allowed to revegetate with herbaceous and woody vegetation. Tennessee, Algonquin, and Texas Eastern have stated that they would not allow woody vegetation to become permanently established on all or part of the maintained right-of-way. Because maintaining the right-of-way free of woody vegetation would be a permanent alteration of wooded wetlands, all herbaceous and woody vegetation should be allowed to reestablish itself on the rights-of-way. Maintenance of woody vegetation shall be limited to those procedures described below under Right-of-Way Maintenance Practices.

The invasion and spread of undesirable plant species (i.e., purple loosestrife) in disturbed wetland areas may significantly alter the plant composition in the wetlands. To prevent or minimize this potential effect of pipeline construction, the Procedures require that each applicant develop specific measures to prevent introduction of undesirable vegetation, in coordination with appropriate state agencies. Tennessee and Algonquin have commented that the currently available means of control for purple loosestrife (chemical control and hand pulling) are neither environmentally acceptable nor cost-effective. We recognize that there are no easy solutions to this problem, yet it remains a concern for most states. The applicants should consult with the appropriate state agency to determine the most appropriate or best available technique to be used within each state.

Right-of-Way Maintenance Practices

To minimize permanent alteration of forested or scrub-shrub wetlands, our Procedures recommend that no mowing or other vegetation maintenance practices occur on the right-of-way within wetlands. The only exception to this would be the selective cutting of trees greater than 15 feet in height that are located within 15 feet of the pipeline. Tennessee, Texas Eastern, Algonquin, and Transco take exception to this, indicating that they would mow the permanent right-of-way through wetlands. CNG would not mow within wetlands, but would hand-cut all woody vegetation on a regular basis. These applicants stress that woody vegetation maintenance is required to maintain access and to prevent physical damage to the pipeline caused by root systems. Considering the type of vehicles that would be used in wetlands during pipeline reconnaissance or maintenance, we believe that allowing all woody vegetation to regenerate may limit, but would not prohibit access through wetlands. In addition, aerial surveillance would still be possible. Because regular vegetation maintenance would have a permanent impact on forested or scrub-shrub wetlands, we stand by our above mitigation measure.

Trench Dewatering

Water that collects in the pipeline trench would be pumped out (where required) in such a manner that no silt-laden water flows into wetland areas off of the construction right-of-way. This would reduce impact on the water quality in the surrounding, undisturbed wetlands.

5.1.7.3 Site-Specific Impact

Great Lakes

Table E-1 (see appendix E) lists the length of each wetland crossed and table E-2 lists the acreage of each wetland vegetation type that would be affected by Great Lakes' proposed construction and permanent rights-of-way. Through wetland areas, Great Lakes has proposed to clear a new 50-foot-wide right-of-way, and utilize 25 feet of existing right-of-way for construction purposes. For the purpose of this analysis it has been assumed that 50 feet of new vegetation would be cleared, and 25 feet of existing cleared right-of-way would be utilized for construction right-of-way through wetlands.

Approximately 509 acres of wetlands would be affected by construction of Great Lakes' proposed loops. Great Lakes has proposed to maintain an additional 25 feet of the new right-of-way adjacent to the permanent right-of-way, which would result in approximately 255 acres of wetland maintained free of woody vegetation. We have recommended that Great Lakes not obtain any new permanent right-of-way where a minimum 75-foot-wide permanent right-of-way currently exists. This would allow the entire newly cleared right-of-way to revert back to its previously wooded state.

On aerial reconnaissance of the proposed route, we observed that a crown is in place over the existing pipeline in some wetlands and that upland species of vegetation have grown along the crown. The construction personnel may have assumed that it was necessary to overfill, or crown, the trench when backfilling to account for settlement. This is a common

practice in upland mineral soils. However, wetland soils do not settle or consolidate nearly as much as mineral soils following excavation and backfilling. The Procedures specify that Great Lakes restore original contours (i.e., leave no crown) when backfilling the trench in wetlands.

Several Minnesota-protected wetlands would be crossed by Great Lakes Loops 1, 2, and 3. Approximately 5.1 acres of emergent marsh (2.9 acres as mapped by NWI and 2.2 acres of additional wetland identified by the state) would be affected by construction of Loops 1 and 2 between MPs 59.7 and 60.2. We have recommended a route variation to avoid this protected wetland (see section 6.1.1). Because of the type of vegetation within this wetland, the effects of construction activity would be relatively short term. A permit for construction through this wetland would be required from the MNDNR (MNDNR, 1987). Construction of Loops 1 and 2 would also affect approximately 7.4 acres of scrub-shrub and emergent marsh wetlands within two adjacent Minnesota-protected wetlands between MPs 62.8 and 63.7. A route variation to avoid these wetlands was investigated, and appears to be environmentally preferable to the proposed route (see section 6.1.2). The route variation would not cross the protected wetlands, but would affect approximately 0.3 acre of nonprotected wetland.

Construction of Loop 3 would affect approximately 0.2 acre of Minnesota-protected wetland where the loop would cross emergent marsh and emergent marsh/scrub-shrub wetlands at the outlet of Norway Lake (MP 125.4). This wetland was identified as a concern by the MNDNR, which stated that limiting construction to the existing right-of-way through this wetland would be preferred (MNDNR, 1986b). Due to the instability of wetland soils, additional right-of-way width, and therefore additional vegetation clearing, would probably be required through this wetland. Because the wetland extends for a great distance on either side of the proposed crossing, a route variation would result in greater impact than constructing along the existing right-of-way. Because of the type of vegetation within this wetland, the effects of construction activity along the existing right-of-way would be relatively short-term. A permit for construction through this wetland would be required from the MNDNR (MNDNR, 1987).

Additional route variations that would eliminate or reduce the length of wetlands that would be crossed have been considered. Refer to sections 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.1.6, 6.1.9, and 6.1.10 for discussions of these route variations. Sections 6.1.2 and 6.1.3 recommend route variations that would avoid wetlands identified by the MNDNR (MNDNR, 1989b) as possible concerns. We were unable to identify environmentally preferable route variations to avoid another wetland that was identified by the MNDNR (MP 118.7) as a concern. Following the existing right-of-way through this area would result in the least overall environmental impact.

Hole-in-the-Bog Peatland would be crossed by Loop 4 in Cass County, Minnesota. Approximately 3.5 acres of Minnesota-designated watershed protection area within this peatland would be affected by construction. Hole-in-the Bog Peatland is a raised bog in which water moves from the core area, located in the southeastern portion of the bog, outward to the northwest. The core area is the most sensitive portion of the bog. Concerns were raised by the MNDNR regarding alteration to the hydrology of the area, especially water level, flow, or chemistry, all of which could have a significant effect on the sensitive

bog conditions. Because Loop 4 would cross the northern end of the bog, where water movement at the point of crossing would be away from the core area, the MNDNR did not anticipate any alteration to the hydrology of the core area (Aaseng, 1989). The MNDNR also indicated that inorganic and organic soils should be replaced at their original depth during backfilling and the fill should not restrict drainage, or alter the preconstruction ground elevation. Our Procedures, with which Great Lakes must comply include provisions for topsoil segregation and restoration of ground contours. Construction using these procedures would satisfy the MNDNR's conditions.

Construction of Loop 12 would affect approximately 19.3 acres of forested, scrub-shrub, and emergent wetlands within the wooded dune and swale complex between MPs 664 and 675.1. Several smaller forested and emergent swales would be crossed at the western end of this complex, and the northern edge of a large, mixed forested/scrub-shrub wetland would be crossed between MPs 667.8 and 669.2. A large mixed scrub-shrub/emergent wetland would be crossed between MPs 673.5 and 675.1. We have recommended that Great Lakes utilize only portions of the existing cleared right-of-way through this area for its construction right-of-way. This would eliminate the need for additional vegetation clearing, and would restrict impact to the previously disturbed and maintained wetlands on the existing right-of-way. Refer to section 5.1.6.1 for additional discussion of this area.

A site survey of the proposed Loop 15 where it would cross the Dead Stream Swamp (MPs 779 to 783) was conducted by Great Lakes' environmental consultant in January 1990. Great Lakes reports that the area that would be affected by construction is not part of the large northern white cedar swamp for which the Dead Stream Swamp is noted. Consequently, Great Lakes has not proposed any nonstandard mitigation measures for this area (Great Lakes, 1990). Construction using the Stream and Wetland Construction and Mitigation Procedures should not result in adverse impact on wetlands within the Dead Stream Swamp.

Tennessee

The acreage of each type of wetland vegetation that would be affected by Tennessee's proposed pipeline segments is listed in appendix E, table E-2. Tennessee has proposed to clear a 50-foot-wide construction right-of-way in New York and a 60-foot-wide construction right-of-way in Massachusetts adjacent to existing cleared right-of-way. This would result in the disruption of 15.6 acres of wetland. Tennessee has proposed to maintain 25 feet of this area as permanent right-of-way in New York and 35 feet in Massachusetts, which would result in 8.5 acres of wetland kept as emergent or scrub-shrub vegetative cover. In addition, 7.8 acres of wetland on existing maintained right-of-way would be disturbed during construction of the proposed segments. Most of the wetlands that would be affected are forested. Some scrub-shrub wetlands would also be affected.

Segment 1 would cross the eastern edge of a cedar swamp at MP 230B-103 + 1.04, a NYS class I wetland. The crossing would be approximately 850 feet in length and would affect 1.0 acre of wetland. Tennessee has proposed to maintain 0.5 acre of this as part of the permanent right-of-way.

Segment 8 would cross one NWI-mapped wetland (MP 261 + 2.3) within the Fannie Stebbins Memorial Wildlife Refuge near the Connecticut River in Longmeadow, Massachusetts. Approximately 800 feet of this PFO1 wetland would be crossed, with approximately 1.1 acres cleared for construction. The MNHESP considers this forested wetland an "exemplary floodplain forest community," and indicates that construction within or immediately to the south of the existing cleared right-of-way would be preferable to construction to the north of the right-of-way (MNHESP, 1987). Longmeadow town officials have also expressed concern about potential impact on wetlands in this area (Longmeadow Board of Selectmen, 1989).

In response to concerns raised about potential impact on the meadows area, Tennessee has stated it would use specialized construction techniques to reduce the width of construction right-of-way that would be required. This would reduce the area of wetland that would be affected. Tennessee and the staff have also examined several potential route variations to avoid or minimize the area of the meadows that would be crossed (see sections 3.4 and 6.2.1). None of the route variations were found to be environmentally preferable to the proposed route. Consequently, we recommend that Tennessee prepare a site-specific mitigation plan for construction and restoration in the Fannie Stebbins Memorial Wildlife Refuge and "Meadows" area, and file it with the Commission for review and approval by the Director of OPPR prior to construction in the refuge.

Algonquin

The acreage of each type of wetland vegetation that would be affected by Algonquin's proposed facilities is listed in appendix E, table E-2. Algonquin has proposed to clear new right-of-way from 20 to 45 feet wide, depending on the proposed loop or replacement (see section 5.1.9.2). Most of the wetlands that would be crossed are forested or scrub-shrub types. A total of 6.6 acres would be disrupted in Massachusetts, 4.6 of which Algonquin has proposed to maintain as permanent right-of-way. In Connecticut, 0.8 acre is proposed to be cleared for construction, all of which is proposed to be maintained as permanent right-of-way. Wetlands that would be disrupted by construction in Rhode Island total 2.7 acres, all of which is proposed to be maintained as permanent right-of-way.

The proposed Tiverton Loop would cross Pocassett Cedar Swamp (MP 0.8) in Tiverton, Rhode Island, which is identified as a wetland of potential concern by the Rhode Island Office of Environmental Coordination. The proposed new right-of-way would be adjacent to an existing cleared right-of-way through this wetland. Approximately 2.1 acres of NWI-classified deciduous forested wetland would be cleared. The Rhode Island Division of Fish and Wildlife has indicated that no rare wildlife or plants are known to be in this wetland and that the wetland type is relatively common in the state. No significant long-term impact on this wetland is expected to result from the proposed construction or operation of the Tiverton Loop. No NWI-mapped wetlands would be affected by the proposed modifications to the Burrillville Compressor Station.

Transco

One NWI-mapped wetland would be disrupted by Transco's proposed Leidy Loop in Pennsylvania. This is a forested wetland located along a tributary of Little Bushkill Creek.

Approximately 0.1 acre would be disrupted by construction activities in the 50-foot right-of-way. Construction activity within this wetland must be in compliance with the COE's Nationwide Permit No. 12, which requires that there is no change in preconstruction bottom contours following construction. Transco has proposed to maintain approximately half of that area in an emergent or scrub-shrub vegetative cover as part of the permanent right-of-way. No NWI-mapped wetlands would be affected by construction of the proposed Compressor Station 205 in Mercer County, New Jersey. However, Transco has indicated that approximately 0.02 acre of wetland recognized by the NJDEP would be temporarily disrupted during the installation of a drainage pipe and outfall structure. A NJDEP Freshwater Wetlands General Permit may be required for this activity. No NWI-mapped wetlands would be affected by construction of the proposed Sayreville Meter Station.

Texas Eastern

No wetlands would be affected by construction of the proposed Texas Eastern facilities.

CNG

Four wetland crossings would be required for construction of the proposed CNG TL-470 Line. Two of these wetlands (MP 1.6 and MP 1.8) are part of a NYS Class I wetland, Papscanee Marsh. Approximately 1.5 acres of emergent marsh wetland would be disrupted by construction through this area. The new right-of-way would cross narrow swales near the northernmost boundary of the NYDEC designated significant coastal fish and wildlife habitat within Papscanee Marsh wetland complex. The right-of-way would follow an existing transmission line right-of-way. Impact on this wetland would be minimized by following the Procedures. Refer to sections 5.1.4.1 and 5.1.4.2 for additional discussion of impact on this wetland.

National Fuel/Penn-York

The proposed Y-M54 Line would require construction through one wetland. This wetland is an impoundment associated with Rose Lake Run (MP 0.03). No vegetation would be removed due to its aquatic nature. The property limits of the proposed Concord Compressor Station would encompass portions of two NWI-mapped linear, forested wetlands that occur along intermittent streams. These wetlands are not within the proposed construction area for the compressor station, and therefore would not be affected.

CNG/Texas Eastern

No wetlands would be crossed by the proposed CNG/Texas Eastern TL-403 Replacement.

5.1.8 Air Quality and Noise

5.1.8.1 Air Quality

5.1.8.1.1 General Construction and Operational Impact

Construction of the proposed NIP Project pipelines would cause a temporary reduction in local ambient air quality due to fugitive dust and emissions generated by construction equipment. The extent of dust generation would depend on the level of construction activity and on soil composition and dryness. If proper dust suppression techniques were not employed, dry and windy weather would create a nuisance for nearby residents. The emissions from construction vehicles and equipment would have an insignificant impact on the air quality of the region. However, under certain unusual meteorological conditions, high concentrations of pollutants might remain in the immediate vicinity of the proposed construction while these conditions exist.

During operation, the compressor stations would emit varying amounts of nitrogen oxide (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), and hydrocarbons (HC). Of these, the pollutant of concern would be NO_x. Emission of CO and HC would be below significant Federal impact levels established by the EPA. Emissions of SO_2 would be proportional to the amount of sulfur in the fuel; because the fuel would be natural gas containing very little sulfur, the amount of SO_2 emitted would be low.

Regulatory Requirements

The Federal New Source Performance Standards (40 CFR Part 60, Subpart GG (C)) limit NO_x emissions in the exhaust gases from stationary gas turbines with a heat input greater than 10 million Btus per hour (approximately 1,000 hp) to 150 parts per million by volume (ppmv) at 15 percent oxygen on a dry basis and at a turbine heat-rate of 14.4 kJ/W-hr. Proportional increases in the 150 ppmv are permitted with higher efficiencies. Emissions from gas-fired reciprocating engines are regulated through the state permitting process.

The Federal PSD regulations (40 CFR 52.21) require that any proposed facility that would emit more than 250 tons per year of any pollutant be classified as a major stationary source and be subject to PSD review. If an existing facility is already classified as a major stationary source, then an increase in emissions of more than 40 tons per year of NO_x would cause it to be classified as a major modification and require PSD review. PSD regulations for major stationary sources and major modifications include a review of the existing air quality, the use of a modeling analysis to demonstrate compliance with NAAQS, an analysis of the incremental increase in air pollution levels, application of BACT, and an assessment of the impact of new emissions on the environment.

BACT requires the applicant to use a top-down approach to demonstrate the use of the best available technology in controlling emissions from major stationary sources and major modifications. This approach requires that the applicant first consider the most stringent controls available and either use this technology or demonstrate why it is not feasible to do so. The process is then repeated for the second most stringent control, then the third, etc., until a feasible solution is reached.

Dispersion modeling analysis is required to demonstrate that the new emissions would not result in a significant incremental increase over existing ambient air quality and that the emissions would comply with the NAAQS. Assessment of the impact of the new emissions is required to ensure the health and welfare of the general public.

Tennessee's Compressor Station 230C, CNG's Utica Compressor Station, and National Fuel/Penn-York's Concord Compressor Station would be required to comply with the air pollution control regulations of New York. These regulations are similar to the Federal regulations with the same limits for classification of major stationary sources as the types proposed.

Algonquin's Burrillville Compressor Station would be required to comply with air pollution regulations of Rhode Island. These regulations are similar to Federal regulations with the same limits for classification of major stationary sources as the types proposed.

Transco's Compressor Station 515, National Fuel/Penn-York's Ellisburg Compressor Station, and compressor additions proposed by both CNG and CNG/Texas Eastern at the State Line Compressor Station would be required to comply with the air pollution regulations of Pennsylvania. These regulations are similar to the Federal regulations with the same limits for classification of major stationary sources. An application for plan approval must be submitted to the state to obtain a state air permit prior to construction of the proposed additions.

Transco's Compressor Station 167 would be required to comply with the air pollution control regulations of Virginia. These regulations are similar to Federal regulations with the same limits for classification of major stationary sources as the types proposed.

5.1.8.1.2 Site-Specific Impact

Tennessee

Tennessee's Compressor Station 230C is located 2 miles west of Lockport in Niagara County, New York. The existing 4,500-hp compressor station currently emits 74 tons per year of NO_x and is considered a minor stationary source. Tennessee proposes to install two identical 3,500-hp simple-cycle Solar Model T-4500 turbine-driven compressors. The proposed compressor units would each have an estimated emission rate of 15 pounds of NO_x per hour, which corresponds to a total increase of 131 tons of NO_x per year for continuous operation. Existing and proposed compressor station air emissions are shown in table 5.1.8-1. The addition would not be considered a major modification requiring PSD review. Tennessee has not applied for a state permit to construct at this station.

Algonquin

Algonquin's Burrillville Compressor Station is located in a relatively rural area in the northwestern corner of Providence County, Rhode Island. The existing 8,100-hp compressor station is considered a major stationary source of air pollutant, emitting 790 tons of NO_x per year. Algonquin proposes to install one Solar Centaur "H" turbine-driven compressor to

TABLE 5.1.8-1

Existing and Proposed Compressor Station Air Emissions

Compressor Station	Location County	State	Existing Compression Existing hp	Existing Compression NO_x Emission (tpy)	Existing Ambient NO_2 Levels (ug/m3)	Proposed Expansion Proposed Hp	Proposed Expansion Emission (tpy)
Tennessee							
230C	Niagara	NY	4,500	74	22	7,000	131
Algonquin							
Burrillville	Providence	RI	8,100	790	49	5,500	116
Transco							
515	Luzerne	PA	17,000	910 a/	20	12,600 b/	73 c/
205	Mercer	NJ	0	0	20	12,000	0 d/
167	Mecklenberg	VA	0	0	20	7,660	172
CNG and CNG/Texas Eastern							
Stateline	Potter	PA	1,100 e/	30	20	3,550	118
CNG							
Utica	Oneida	NY	5,500	531	22	2,250	54
National Fuel/Penn-York							
Concord	Erie	NY	0	0	11	8,640	167
Ellisburg	Potter	PA	15,140	959	20	2,600	75

a/ Based on 162 days of annual operation.
b/ Includes installation of a new compressor with 100 days of annual operation.
c/ Overall emission from the station would decrease by 51 tpy based on 162 days of annual operation of modified existing compressor engine and 100 days of annual operation of proposed compressor.
d/ Proposed station would be electric-powered.
e/ Compression approved as part of APEC Project and assumed to be in operation for purposes of this analysis.

provide a total of 5,500 hp of additional compression. Based on continuous operation, the proposed compressor unit would emit an estimated 116 tons per year of NO_x (27 pounds per hour). Because the proposed NO_x emissions exceed 40 tons per year of NO_x, the addition is considered a major modification and is subject to PSD review. Algonquin has not applied for preconstruction approval or a state permit to construct the addition at this station. An application for plan approval to construct, install, or modify the existing source must be submitted to RIDEM prior to the proposed station expansion before an operating permit can be issued.

Transco

Transco's Compressor Station 515 is located in rural Luzerne County, approximately 15 miles southeast of Wilkes-Barre, Pennsylvania. In its data response filed January 24, 1990, Transco indicated that it would install one 12,600-hp Solar Mars turbine unit and convert one of five existing 3,400-hp reciprocating engine units to a clean-burn engine unit. The existing 3,400-hp unit to be modified currently emits 93.7 pounds of NO_x per hour, which corresponds to 182 tons per year based on 3,888 hours of operation per year. Assuming the same operating conditions for all five existing units, the total existing NO_x emission rate is 910 tons per year.

Transco indicated that it would limit operations of the proposed 12,600-hp unit to 2,400 hours per year. With an NO_x emission rate of 60.6 pounds per hour, this corresponds to 73 tons per year. The modified 3,400-hp reciprocating unit would emit 30.0 pounds of NO_x per hour which corresponds to 58 tons per year. Based on Transco's limited hours of operation, the total annual NO_x emission rate of the proposed 12,600-hp unit and the modified and existing 3,400-hp units would decrease by 51 to 859 tons/year. The operating limits must be included in the state permit as a legally enforceable condition. An application for plan approval must be submitted to the state prior to construction of the proposed station expansion and before an air permit can be issued.

Transco proposes to install two gas turbines at Compressor Station 167 on its existing natural gas pipeline lateral in Mecklenburg County, near South Hill, Virginia. Transco proposes to install two 3,830-hp Solar Centaur Model T-4500 turbine-driven centrifugal compressor units with a manufacturer's guaranteed maximum NO_x emission rate of 19.66 lbs/hr. With this configuration, Station 167 would have a maximum annual NO_x emission rate of 172 tons/year for continuous operation. This emission rate is below the 250 tons/year threshold for PSD review. Transco will need a state air emissions permit and a permit to construct from the Virginia State Air Pollution Control Board. A copy of the air permit application has been provided by Transco.

Transco's proposed Compressor Station 205 is located in Mercer County, New Jersey. Because the proposed compressor installation would be electric-powered, no air emissions are anticipated.

CNG and CNG/Texas Eastern

CNG's State Line Compressor Station is located approximately 2,000 feet south of the New York state boundary and 0.50 mile east of Kenney, Pennsylvania, in Potter County.

In Docket No. CP88-195-002, CNG/Texas Eastern propose to add two 1,100-hp Ingersoll-Rand KVG-104 compressor units, and in Docket No. CP89-712-000, CNG propose to add one 1,350-hp compressor unit at the State Line Compressor Station. The State Line Compressor Station is currently authorized as part of the APEC Project in Docket No. CP87-5-002 with one 1,100-hp compressor unit that would emit an estimated 30 tons of NO_x per year. The proposed 1,350-hp and the two 1,100-hp compressor units would emit an estimated 54.3 tons and 64 tons of NO_x per year, respectively. Therefore, the station site would have a maximum potential NO_x emission rate of approximately 148.3 tons/year and would not be considered a major source of air pollution. CNG has obtained plan approvals from the PADER for both 1,100-hp engines.

In Docket No. CP89-712-000, CNG proposes to add one 2,250-hp Cooper Bessemer GMVH-10-C2 compressor unit at the existing Utica Compressor Station in Herkimer County, New York. The five existing 1,100-hp Cooper Bessemer GMVC-6 compressor units at the Utica Compressor Station have an estimated NO_x emission rate of 531 tons/year; this is considered an existing major source of air pollution by exceeding an emission rate of 250 tons of NO_x per year. The proposed 2,250-hp compressor unit has an estimated NO_x emission rate of 54.3 tons/year. Therefore, the Utica Compressor Station would have a maximum potential NO_x emission rate of 585.3 tons/year. Because NO_x emissions would exceed 40 tons/year, the new addition would be considered a major modification and subject to PSD review. The Utica Compressor Station would be required to comply with both Federal and New York state regulations. A state permit to construct is required prior to construction of the proposed facility. A state air permit, which is required prior to operation of the facility, would require a modeling analysis be performed to demonstrate that operation of the proposed source would not prevent attainment or maintenance of any applicable ambient air quality standard.

National Fuel/Penn-York

National Fuel/Penn-York's proposed Concord Compressor Station would be located in Concord, Erie County, New York. National Fuel/Penn-York propose to install four new clean-burn reciprocating engine-driven compressors (e.g., Cooper-Bessemer Model #10 GMVH) with a total rating of 8,640 hp. Based on an emission rate of 2.0 g NO_x/BHP assuming the use of the Cooper-Bessemer Model #10, each compressor would emit 9.5 lbs NO_x/hr or 41.7 tons NO_x/yr. Total NO_x emissions from the Concord Compressor Station would be 38.6 lb/hr or 166.7 tons/year assuming continuous operation. Based on the projected NO_x emission rate of 167 tons/year, the new Concord Compressor Station is a minor source and would not be subject to Federal PSD review. National Fuel/Penn-York have applied for a state permit to construct this station.

National Fuel/Penn-York's Ellisburg Compressor Station is located within an area of dairy pastures and cropland in a small valley north of SR 244 between Lewis Corner and Andrews Settlement, in Ellisburg, Potter County, Pennsylvania. The existing Ellisburg Station currently emits in excess of 785 tons of NO_x/year. A 6,000-hp compressor addition pending approval in the TEMCO Project in Docket No. CP88-94-001 would increase NO_x emissions by 174 tons/yr for continuous operation or by 83 tons/yr with a proposed permit restriction of 6,300 hrs/yr. Because the NO_x emissions would exceed 250 tons a year, the site is considered a major source of air pollution. National Fuel/Penn-York have applied for a state

permit to install either one or two clean-burn reciprocating engine(s) to provide a total of 2,600 hp. National Fuel/Penn-York propose to install either one Cooper-Bessemer Model 12 GMVH or two Cooper-Bessemer Model 6 GMVH compressor unit(s). The total projected NO_x emissions are estimated to be 17 pounds per hour NO_x for either selection. This corresponds to an increase of 75 tons/year NO_x, assuming continuous operation. Because NO_x emissions would exceed 40 tons/year, the new addition would be considered a major modification and subject to PSD review. On December 29, 1989, National Fuel/Penn-York submitted an application for a PSD permit and state plan approval to construct a 2,600-hp compressor at the Ellisburg Compressor Station.

5.1.8.2 Noise

5.1.8.2.1 General Construction and Operational Impact

Noise would affect the local environment during both construction and operation of the proposed facilities. Pipeline construction would proceed at rates ranging from several hundred feet to 0.5 mile per day. The open-trench phase of construction in rural areas would last approximately 3 to 5 weeks. Construction equipment would be operated on an as-needed basis during this period. Although individuals in the immediate vicinity of the work might experience temporary annoyance, the impact on the environmental noise level at any specific location along the route would be short-term. Nighttime noise levels normally would be unaffected, since most construction would be limited to daylight hours.

During the operational phase of the project, the impact on the noise environment would be limited to the vicinity of the compressor stations. Principal noise sources at the compressor stations would include the air inlet, exhaust, and casing of the engine or turbine. Secondary noise sources would include the compressor casing, cooling fans, and yard piping valves. Noise from the vents, blowdown stacks and emergency electrical generation equipment would be infrequent. The amount of silencing required for the equipment and piping depends on the station's location, size, and proximity to noise-sensitive receptors.

The basis for evaluating the operational impact of compressor station noise is an Ldn of 55 dBA, the sound level which protects the public from activity interference and annoyance in residential areas. Although no state or local noise regulations would affect the proposed compressor stations, the New York Public Service Commission (NYPSC) has issued a proposed guideline policy (October 28, 1986) that gas compressor stations be designed to an Leq of 40 dBA at the nearest residences in areas where the existing L90 is less than 40 dBA. According to the NYPSC, typical L90 levels in rural areas are 35 dBA or less. If the existing L90 exceeds 40 dBA (permanently elevated), the compressors should be designed to increase the L90 at the nearest residence by no more than 10 dBA.

5.1.8.2.2 Site-Specific Impact

Tennessee

The existing compressor building at Station 230C, the proposed new compressor addition, and locations of the nearest homes are shown in figure 4.1.8-1. Tennessee proposes to install two Solar Model T-4500 turbine-driven compressors, each rated at 3,500 hp. The

turbine inlets would be equipped with Solar Model AX-3263 mufflers and Solar Model AX-4005 filter/mufflers. The turbine exhausts would be equipped with Solar Model AX-3530 mufflers. The proposed turbine-driven compressors would be located inside an acoustically treated extension to the existing building. Additional gas coolers are not proposed.

The distance between the proposed new compressor building and the nearest residence, the existing ambient noise levels, and the projected additional noise level are listed in table 5.1.8-2. Tennessee has predicted an Ldn of 45 dBA at the residence located 2,100 feet to the east, due to the additional two compressor units. The noise level estimate is based on a sound prediction and propagation analytic model using noise data that were provided by equipment vendors. Far-field sound level data for the turbine was not identified. We feel that the noise attributable to the proposed compressors would be less than an Ldn of 55 dBA as long as the building is constructed with appropriate noise control. Therefore, we recommend that Tennessee file with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction an acoustical noise analysis based on field noise data for the actual turbines, compressors, and buildings being proposed at Compressor Station 230C.

Algonquin

The existing compressor building at the Burrillville Compressor Station, the proposed new compressor addition, and the location of the nearest homes are shown in figure 4.1.8-2. Algonquin proposes to install a Solar Centaur "H" turbine-driven compressor rated at 5,500 hp. The turbine unit would include a noise-control enclosure and would be installed within an insulated compressor building. The turbine inlet and exhaust would include mufflers. Inlet and outlet gas piping would include noise-control insulation lagging. The new unit blowdown vent and emergency generator would both be equipped with high-performance exhaust mufflers. The identification and specified acoustic performance of the turbine noise control treatments to be employed were not provided.

The distance between the proposed compressor building and the nearest residence, the estimated existing ambient noise level, and the projected additional noise level are listed in table 5.1.8-2. The projected noise level provided by Algonquin is based on noise data that was measured at two existing stations and was scaled based on horsepower and distance. Specific supporting information about the measured noise data and turbine noise abatement treatments were not provided.

Algonquin's acoustic analysis predicts a day-night Ldn of 37 dB(A) at the nearest home, due to operation of the proposed new compressor unit. This analysis is based on two unidentified referenced compressor stations. This is significantly less than the guideline Ldn of 55 dBA and would be expected to result in a negligible increase in the existing Ldn at the nearest home.

We recommend that prior to commencing any construction activity at the Burrillville Compressor Station, Algonquin shall file the measured noise data obtained and referenced by the applicant with the Secretary of the Commission, for review and approval of the Director of OPPR. In addition, Algonquin shall file the manufacturer's specifications and acoustic performance for the equipment installed at those stations and the turbine noise

TABLE 5.1.8-2

Noise Impact at Nearest Noise-Sensitive Receptor from NIP Project New or Additional Compression

Applicant Station/Receptor	Dist. From Proposed Compr. Facilities (feet)	Existing Ldn (dBA)	Additional Ldn (dBA)	Total Ldn (dBA)	Noise Increase (dBA)
Tennessee					
Station 230C					
Residence (E)	2,100	63	45	63	0
Algonquin					
Burrillville					
Residence (NE)	2,000	57	37	57	0
Transco					
Station 205					
Residence (E)	1,380	40	<55	<55	<15
Station 515					
Residence (SW)	1,030	51	<55	<57	<6
Station 167					
Residence (N)	1,000	45	52	53	8
CNG and CNG/Texas Eastern					
Stateline a/					
Residence (W)	860	51	53	55	4
CNG					
Utica					
Residence (NW)	925	56	49	57	1
National Fuel/Penn-York					
Concord					
Residence (S)	2,250	56	37	56	0
Ellisburg					
Residence (SW)	1,600	53	38	53	0

Sources: Tennessee, Algonquin, Transco, CNG, National Fuel/Penn-York, and Texas Eastern.

a/ Data provided by CNG assume additional Ldn based on the 1,100-hp unit under construction,

controls proposed for the Burrillville Compressor Station.

Transco

The proposed site for Compressor Station 205 and location of the nearest home are shown in figure 4.1.8-3. Transco's noise analysis is based on installing two 7,000-hp Ansaldo electric-motor driven compressors located within a fully enclosed building. The compressor building would consist of an 18-gauge steel exterior surface, acoustically insulated with an air space between a layer of 4-inch-thick 6 pounds per cubic foot density mineral wool and 2-inch-thick, 0.6 pounds per cubic foot density glass fiber. The interior surface would consist of a 26-gauge, corrugated, perforated liner. The building would be ventilated with three acoustically-insulated intake fans and two acoustically insulated roof ventilators. Insulation would be applied to the piping inlets to and discharge outlets from the compressor. The inlet and exhaust air ducts for cooling the electric motor would be equipped with silencers, if necessary. Noise data and calculations would be submitted at a later date for review.

Transco estimates that the existing Ldn is no higher than 40 to 45 dBA and states that the sound attributable to the proposed compression facilities would be no greater than an Ldn of 55 dBA. Since the use of electric-motor driven compressors would eliminate the principle noise sources (engine intake, exhaust, and casing noise) the proposed compressor should not increase the noise level at the nearest residence by more than 15 dBA.

The existing compressor building at Station 515, the proposed expansion, and location of the nearest home are shown in figure 4.1.8-4. Transco proposes to install a 12,600-hp Solar Mars turbine-driven compressor within a new building. The compressor building would consist of an 18-gauge steel exterior surface, acoustically insulated with an air space between a layer of 4-inch-thick 6 pounds per cubic foot density mineral wool and 2-inch-thick, 0.6 pounds per cubic foot density glass fiber. The interior surface would consist of a G^D-gauge, corrugated, perforated liner. The building would be ventilated with three acoustically insulated intake fans and two acoustically insulated roof ventilators. Insulation would be applied to the piping inlets to and discharge outlets from the compressor. The turbine exhaust would be equipped with at 16-foot-long silencer and the intake would be equipped with two 7-foot-long silencers. The cooler would have low fan tip speed in order to minimize the noise generated by the fan. Noise data and calculations would be submitted at a later date for review.

The existing consistent minimum noise level at the nearest home was 51 dBA and Transco indicates that the sound attributable to the new compression facilities would be no greater than an Ldn of 55 dBA. We recommend that Transco submit its noise calculations prior to construction for both Stations 205 and 515 with the Secretary, for the review and approval by the Director of OPPR. Further, the analysis shall be based on far-field noise data from the manufacturer or a similar installation in service elsewhere (such as Station 520).

The proposed site for Compressor Station 167 and location of the nearest home is shown in figure 4.1.8-5. Transco proposes to install two 3,830-hp Solar Centaur T-4500 turbine-driven centrifugal compressor units within a fully enclosed building. The compressor building's walls and roof would consist of at least 24-gauge exterior steel, 2-inch-thick

insulation, and 24-gauge interior perforated panels constructed on a foundation that is to be separate from the turbine-compressor units. Penetrations through the compressor building walls and roof will be sealed or gasketed. No windows would be installed in the building. Openings to provide building ventilation will include effective noise control treatments. The three ventilation supply fans will be specified and installed so as to not produce a noise level exceeding 50 dBA at 50 feet from each fan. The turbine-compressor units are to include standard skid-mounted acoustical enclosures manufactured by Solar and rated to reduce the casing noise from each turbine-compressor to not exceed 78 dBA at 50 feet. The gas turbines would be equipped with AX-3263 inlet mufflers, AX-4005 inlet filters, and 15-908-XB exhaust mufflers that are to reduce the composite inlet and exhaust noise so that it will not exceed 37 dBA at 1,000 feet from the proposed station. Each of two gas coolers and each of two lube oil coolers are expected to produce noise levels not exceeding about 68 dBA and 57 dBA at 50 feet, respectively.

In addition, the aboveground exterior suction and discharge piping and associated components would be lagged with 2-inch-thick glass fiber insulation covered with a heavy lead-aluminum outer jacket. Transco previously reported that the operating noise from their proposed Station 167 would not exceed an Ldn of about 45 dBA at the nearest home. Most recently, their consultant reported that the operating noise would be an Ldn of 52 dBA at the nearest homes. This projected noise level is 3 dBA less than the guideline Ldn of 55 dBA and would increase the estimated existing Ldn by about 8 dBA at the nearest homes.

We recommend that Transco conduct postconstruction sound surveys at Compressor Stations 515 and 167 to verify that the station operating noise at the nearest residence does not exceed an Ldn of 55 dBA; if that level is exceeded, Transco shall implement additional noise control measures to reduce the operating noise level at the nearest residences to or below an Ldn of 55 dBA; and file a copy of the postconstruction sound survey with the Secretary of the Commission within 30 days after the date the proposed facilities are placed in service.

CNG and CNG/Texas Eastern

In Docket No. CP88-195-002, CNG/Texas Eastern propose to add two 1,100-hp Ingersoll-Rand KVG-104 reciprocating compressor units, and in Docket No. CP89-712-000, CNG proposes to add one 1,350-hp reciprocating compressor unit at the existing State Line Compressor Station. The State Line Compressor Station has one existing 1,100-hp compressor unit previously authorized in the APEC Project in Docket No. CP87-5-002. The nearest residence is located approximately 860 feet west from the compressor facilities (see figure 4.1.8-6). The distance between the proposed compressor building and nearest residence, the estimated ambient noise level, and the projected additional noise level are listed in table 5.1.8-2.

The proposed compressor would be housed in a building constructed of 22-gauge corrugated sheet metal with acoustical absorption treatment. The compressor unit would be fitted with intake and exhaust silencers. CNG provided an acoustic analysis based on near-field noise data of the units from the air intake at 4 feet and exhaust at 6 feet from the existing and proposed compressor units and one dehydration heater at 3 feet. The analysis considered a noise level of 85 dBA from all 3 sources. CNG estimated a total Ldn of 55

dBA due to the operation of the existing and proposed compressor units, an increase of approximately 4 dBA over the existing noise level.

We recommend that prior to commencing any construction activity at the State Line Compressor Station, CNG and CNG/Texas Eastern shall file with the Secretary, for review and approval by the Director of OPPR, manufacturer specifications and attenuation data of the proposed noise control equipment. Further, we recommend that CNG conduct a post-construction sound survey to verify that the noise at the nearest residence does not exceed an Ldn of 55 dBA and if that level is exceeded, CNG and CNG/Texas Eastern shall implement noise control measures to reduce the noise level at the nearest residence to or below an Ldn of 55 dBA.

CNG proposes to add one 2,250-hp Cooper Bessemer GMVH-10-C2 reciprocating compressor unit at the existing Utica Compressor Station (see figure 4.1.8.7). The existing units consist of five 1,000-hp Cooper Bessemer GMVC-6 reciprocating units. The nearest noise-sensitive area is a residence located approximately 925 feet northwest of the compressor facilities. The distance between the proposed compressor building and nearest residence, the estimated ambient noise level, and the projected additional noise level are listed in table 5.1.8-2.

The proposed compressor would be housed in a building constructed of 22-gauge corrugated sheet metal with acoustical absorption treatment. The compressor unit would be fitted with intake and exhaust silencers. CNG provided an acoustic analysis based on near-field data from the air intake at 4 feet and exhaust at 6 feet from the existing and proposed compressor units. The analysis considered a noise level of 85 dBA from the intake and exhaust. CNG estimated a total Ldn of 57 due to the operation of the existing and proposed compressor units, an increase of 1 dBA over the existing Ldn of 56 dBA.

We recommend that prior to commencing any construction activity at the Utica Compressor Station, CNG file with the Secretary, for review and approval by the Director of OPPR, manufacturer specifications and attenuation data of the proposed noise control equipment. Further, we recommend that CNG conduct a postconstruction sound survey to verify that the noise at the nearest residence does not exceed an Ldn of 55 dBA. If that level is exceeded, CNG shall implement noise control measures to reduce the noise level at the nearest residence to or below an Ldn of 55 dBA.

National Fuel/Penn-York

The proposed site for the Concord Compressor Station and locations of the nearest homes are shown in figure 4.1.8-8. National Fuel/Penn-York propose to install four reciprocating engine-driven compressors with a total rating of 8,640 hp. The engine inlets would be equipped with mufflers and the exhausts would be equipped with hospital-grade mufflers located on the rear side of the compressor building. The proposed compressor units would be installed inside an industrial-grade metal building with interior thermal/acoustic insulation and exterior 22-gauge metal walls. The proposed compressor station will use four Cooper-Bessemer Model #10 GMVH engines or equivalent engines.

The distance between the proposed compressor building and the nearest residence, the existing ambient noise levels, and the projected additional noise level are listed in table 5.1.8-2. The noise level estimate was provided by the applicant and is based on far-field noise levels of an unspecified 3,500-hp engine-compressor unit and an analytic model that considers engine power, distance, and atmospheric attenuation.

National Fuel/Penn-York's acoustic analysis predicted a noise level component of an Ldn of 37 dBA at the nearest residence, due to the proposed 8,640-hp of additional compression. In response to our inquiry, National Fuel/Penn-York was unable to verify the source of data and specifications for the unspecified 3,500-hp engine in order to confirm that its acoustic analysis actually represents the engine/compressor unit to be installed. Therefore, we recommend that prior to commencing any construction activity for the Concord Compressor Station, National Fuel/Penn-York shall file with the Secretary, of the Commission, for the review and approval of the Director of OPPR, manufacturer specifications and attenuation data for the noise control equipment on the proposed 8,640-hp compressor station and verify the noise predictions based on the unspecified 3,500-hp compressor unit. In its January 16, 1990 data response, National Fuel/Penn-York agreed to conduct a postconstruction sound survey to verify that the noise level from operating the proposed compression facilities would not exceed an Ldn of 55 dBA at the nearest residence, and National Fuel/Penn-York would implement corrective measures if that level is exceeded. National Fuel/Penn-York would also file a copy of the noise survey with the Secretary of the Commission as soon as possible after completion, but no later than 30 days after the date the proposed facilities are placed in service.

The existing compressor building at the Ellisburg Compressor Station, the proposed new compressor addition, and locations of the nearest homes are shown in figure 4.1.8-9. National Fuel/Penn-York propose to install one or two additional reciprocating engine-driven compressor units (such as Cooper-Bessemer Model 12 and 6) rated at 2,600 hp. The engine inlet would include a muffler and the engine exhaust would be equipped with a hospital-grade muffler located on the rear side of the compressor building. The proposed compressor unit would be installed inside an industrial-grade metal building with interior thermal/acoustic insulation and exterior 22-gauge metal walls.

The distance between the proposed compressor building and the nearest residence, the existing ambient noise levels, and the projected additional noise level are listed in table 5.1.8-2. The noise level estimate was provided by the applicant and is based on far-field noise levels of an operating engine compressor unit measured by National Fuel (1987) and an analytic model that considered engine power, distance, and atmospheric attenuation.

National Fuel/Penn York's acoustic analysis predicted a noise level component of an Ldn of 38 dBA at the nearest residence, due to the proposed 2,600-hp of additional compression. In response to our inquiry, National Fuel/Penn-York was unable to verify the source of data and specifications for the unspecified 3,500-hp engine in order to confirm that its acoustic analysis actually represents the engine/compressor unit to be installed. Therefore, we recommend that prior to commencing any construction activity at the Ellisburg Compressor Station, National Fuel/Penn-York shall file with the Secretary, for the review and approval of the Director of OPPR, manufacturer specifications and attenuation data for the noise control equipment on the proposed 2,600-hp compressor unit to verify the noise

predictions based on the unspecified 3,500-hp compressor unit. In its January 16, 1990, data response, National Fuel/Penn-York agreed to conduct a postconstruction sound survey to verify that the noise level from operating the proposed compression facilities would not exceed an Ldn of 55 dBA at the nearest residence, and National Fuel/Penn-York would implement corrective measures if that level is exceeded. National Fuel/Penn-York would also file a copy of the noise survey with the Secretary of the Commission as soon as possible after completion, but no later than 30 days after the date the proposed facilities are placed in service.

5.1.9 Land Use, Recreation, Public Interest Areas, and Visual Resources

5.1.9.1 Land Use

5.1.9.1.1 General Construction and Operational Impact

A general discussion of the impact anticipated as a result of construction of the proposed NIP Project pipeline and related facilities is presented below. Specific recommendations for mitigation are presented in the following section.

Pipeline

Impact on land use along the proposed pipeline would result from clearing of a temporary construction right-of-way for the installation of the new pipeline and from the maintenance of a new permanent pipeline right-of-way. In addition, temporary staging areas would be required for pipeline construction work space in areas of steep side hills; for crossings of rivers, streams, railroads, and major roadways; and occasionally at the beginning and end of each loop to allow for mobilization and demobilization of contractor's equipment. Laydown areas for the storage of centralized equipment and materials would be located near existing rail and highway transportation hubs that are convenient to the proposed pipeline route. Access to the pipeline during construction would be via existing roads and the pipeline right-of-way.

Typically, construction of the proposed NIP Project pipelines would require a 75-foot-wide construction right-of-way (see figures 2.2-1 through 2.2-7). Where proposed loops would be located parallel to existing pipeline or powerline rights-of-way, the existing rights-of-way would be used for part of the construction right-of-way and would account for a minimum of one-third of the total construction right-of-way requirements. Operation of the proposed loops would require between 20 and 45 feet of the construction right-of-way, which would be converted to new permanent right-of-way and would be kept cleared in a generally grassy condition. No trees, large shrubs, or other nonrelated pipeline structures would be allowed on the permanent right-of-way. The remaining construction right-of-way would be considered temporary work space and, following construction, would be allowed to entirely revert to its previous use and condition. Where the proposed pipeline would replace existing pipeline, an additional 20 to 35 feet adjacent to the replacement pipeline right-of-way would be temporarily required for construction. Where the proposed pipeline would be located on new right-of-way, between 50 and 75 feet would be retained for permanent pipeline right-of-way.

The actual space required for temporary staging areas at river, stream, railroad, and road crossings or areas requiring construction on steep side slopes would be determined during detailed design based on site-specific conditions. These areas would require varying additional temporary construction work areas: streams and rivers that are less than 100 feet wide at the pipeline crossing would require between 0.1 and 0.2 acre, larger rivers would require between 0.6 and 10 acres, roads and railroads that are bored would require between 0.2 and 0.6 acre, and construction on steep hills or sideslopes could require up to 50 feet of additional construction right-of-way. In most cases, additional work areas for mobilization and demobilization of contractor's equipment at the beginning and end of each pipeline loop would be required and would affect approximately 0.5 acre.

The pipe and material storage laydown yards would generally be leased in commercially available open storage areas or in suitably zoned commercial/industrial sites, or they would be located on land presently owned by the applicants. These pipe storage laydown yards may also serve as parking areas for nonresident or local workers who would be bused daily to the work site or for additional contractor shop or equipment storage areas. Land requirements would vary from 1 acre up to 27 acres depending on the length of the pipeline segment.

Woodlands cleared during construction of the proposed pipeline would represent long-term impact of the project. Although woodlands cleared within the temporary work space would be allowed to eventually grow to mature forests, woodland resources within the temporary work space would be considered lost for approximately 20 to 40 years or more. Woodlands removed for either the temporary or permanent rights-of-way could include marketable timber for lumber products or firewood and additional compensation would be provided for these losses.

Agricultural lands affected by the proposed project would include cultivated land, pasture, orchards, and tree nurseries. Cultivated land and pastureland that would be used for the construction right-of-way would be taken out of production for up to one growing season and would be allowed to revert to previous use following construction. Pastureland would take approximately 2 years to return to previous production levels. Applicants would compensate the owners for any crop damage caused during construction or during routine pipeline maintenance. Section 5.1.2 contains a complete discussion of mitigation measures that would be used to minimize construction impact associated with loss of topsoil, soil compaction, and damage to drainage tile systems in these areas. Construction through orchards and tree nurseries would necessitate the removal of all trees within the construction right-of-way. Following construction, immature trees could be planted within the temporary construction right-of-way, although no trees would be allowed to mature within the permanent right-of-way. Applicants would provide compensation to the owners for losses during construction.

Some commercial/industrial land would be affected by construction of the proposed pipeline facilities. Impact on these areas would generally be limited to the construction period, when activities could cause disruption, inconvenience, and loss of potential revenue. This impact could be minimized either by providing access across the construction right-of-way during construction or by timing construction activities to avoid normal peak business periods.

Pipeline construction in residential areas would result in temporary impact that would include:

- Inconvenience caused by noise and dust that would be generated by construction equipment and personnel, and by trenching of roads and driveways;
- Ground disturbance and the removal of trees, landscaping, and other plantings;
- Potential damage to existing septic systems or wells;
- Removal of any aboveground structures, such as garages, sheds or pools, from within the construction right-of-way.

Generally, the proposed pipeline rights-of-way would not be located in residential areas. However, since most of the proposed NIP Project pipelines would loop existing pipelines, avoidance of all residential areas is not always feasible. The amount of residential land required for new pipeline right-of-way could be minimized by reducing the separation between the existing and the proposed pipelines, by crossing over the existing pipeline and locating the proposed pipeline at a greater distance from the affected residence, or by rerouting the proposed pipeline.

Construction disruption through residential areas could be minimized by limiting work space requirements, reducing the size of work crews, increasing the use of fencing, and backfilling the trench as rapidly as possible. Residential construction techniques include sewer line/stove pipe construction or dragline construction. In sewer line/stove pipe construction, the trench is dug, a section of pipe is laid and welded into place, and the trench is backfilled immediately. In dragline construction, a separate work space is required for assembly of several sections of pipe that are welded together. Once the trench has been dug, the sections are laid in the trench, welded into place, and the trench backfilled immediately. Either technique would limit the amount of time the trench would be left open and the duration of the construction disruption.

No residential developments in the planning or permitting process have been identified along the NIP Project pipeline route. Should any be identified prior to construction, centerline modifications to minimize encumbrance of additional residential land should be incorporated in the final design. This would require close coordination with the developer to ensure consistency with site plans.

Long-term impact associated with operation of the proposed pipeline would include the land easement encumbrance for the permanent pipeline right-of-way and its restrictions. The easement encumbrance would prohibit certain types of continued residential use such as the construction of any aboveground structures (e.g., house additions, garages, patios, sheds, pools) or the planting of any tree over 5 feet tall. Additionally, the necessary inspection and maintenance activities of the pipeline company could be considered a minor nuisance.

An easement, usually negotiated with the landowner, is used to convey natural gas pipeline right-of-way to the utility. The easement gives the pipeline company the right to maintain the permanent pipeline right-of-way and, in return, compensates the landowner for the use of the land. The easement negotiations between the utility and the landowner would include compensation for loss of use during construction, loss of nonrenewable or other resources, and the restoration of or unavoidable damage to property during construction.

If an easement cannot be negotiated with the landowner and the project has been certificated by the FERC, the pipeline company may use the right of eminent domain, granted to it under section 7(h) of the Natural Gas Act and the Rules of Civil Procedure, to obtain a right-of-way. The pipeline company would still be required to compensate the landowner for the right-of-way, as well as for any damages incurred during construction. However, the level of compensation would be determined by the court according to state laws that set out procedures for the use of eminent domain once a FERC certificate is issued. The company has the right to file for condemnation in either Federal or state court.

In Massachusetts, the company would file a petition with Massachusetts Department of Public Utilities for the right to take land by eminent domain under Chapters 79 and 164 of the General Laws. In New York, after making a final offer of compensation, the company would file an acquisition map with the County Clerk pursuant to an Order of Condemnation. The New Jersey and Pennsylvania state codes provide for court appointment of three disinterested persons to determine what the compensation would be for the easement. In a Connecticut state proceeding, damages are awarded by the Superior Court for the judicial district in which the property is located based on the recommendation of a committee of three disinterested citizens appointed by the court. The level of compensation determined as a result of condemnation proceedings could be the same, more, or less than the amount of money offered during earlier negotiations with the company. In Minnesota, the company would petition the County District Court who would appoint three commissioners to determine fair compensation. In Wisconsin, a County Condemnation Commission would establish fair compensation. If appealed, by either the company or the landowner, the County Circuit Court would determine compensation through jury trial. In Michigan, the company would petition the local County Circuit Court.

Since the majority of the proposed NIP Project pipelines would be located adjacent to existing pipeline rights-of-way, the applicants have pipeline easements with most of the affected landowners. These easements can range from single line to multiple-line rights on right-of-way varying from 10 feet in width to an unspecified width.

Generally, the applicants would construct a second pipeline adjacent to a single existing pipeline. Where there is a single pipeline easement, the applicant would have to obtain additional easement to install and maintain a second pipeline. Where there are multiple-line easements, the applicant has the right to install additional pipelines. Where the existing right-of-way width is sufficient for the proposed pipeline, no new right-of-way would have to be obtained. In cases where the existing right-of-way is not wide enough to accommodate the proposed pipeline, the applicants would have to obtain additional new right-of-way. Special permits would be required for pipeline crossings of roads, railroads, and

streams, as well as for pipeline right-of-way through many local, county, state, or Federal agency lands.

Aboveground Facilities

Where construction and operation of new compressor stations or metering stations would occur on undeveloped sites, the continuance of existing land use would be permanently precluded within the area developed for these facilities. Where the additions or modifications to existing compressor and metering stations would occur within the fencelines of existing facilities or facilities under construction, utility land use would not be altered. However, residences in the area of all proposed construction could be affected by noise, dust, and visual intrusion during construction and by noise and visual intrusion during operation. Impact associated with noise is discussed in section 5.1.8; impact associated with visual intrusion is discussed in section 5.1.9.3.

5.1.9.1.2 Site-Specific Impact

Potential site-specific impact of the proposed NIP Project was determined from review of aerial photographs; air and ground reconnaissance; maps; and comments and information received from Federal, state, and local regulatory agencies, local interest groups, and private citizens. Our recommendations for specific mitigative measures to address issues raised during the review period or to mitigate site-specific concerns are presented in the following sections.

Pipeline

Table 5.1.9-1 shows the types and acreage of land that would be affected by construction and operation of the proposed pipeline based on typical right-of-way cross-sections for each applicant as shown on figures 2.2-1 through 2.2-7 in section 2.2.

Construction of the proposed 544.7 miles of pipeline would affect a total of approximately 5,161 acres of land, comprising 2,739 acres of existing pipeline right-of-way, scrub-shrub and other lands (53 percent), 1,314 acres of agricultural land (25 percent), 1,040 acres of forest (20 percent), 52 acres of residential land (1 percent), and 16 acres of commercial/industrial land (<1 percent). Except for Great Lakes, the majority of the applicants proposed pipeline would be located adjacent to existing pipeline rights-of-way. These rights-of-way would account for approximately one-third of the acreage affected by construction. Where Great Lakes maintains a cleared 75-foot-wide right-of-way for its existing mainline, this right-of-way would account for approximately two-thirds of the affected construction acreage.

Following construction, the proposed NIP Project pipelines would require a maximum of approximately 1,898 acres of land for permanent operational pipeline right-of-way. This includes approximately 334 acres of forestland (18 percent), 108 acres of agricultural land (6 percent) and 1,455 acres of other land including existing pipeline right-of-way and residential and commercial/industrial land (76 percent). Forestland would be permanently converted to a cleared condition, agricultural land used for the permanent right-of-way would be entirely returned to previous use, and most other land uses would generally be allowed to

TABLE 5.1.9-1

Land Uses That Would Be Affected by the Proposed NIP Project Pipeline Facilities a/

Pipeline Segment/ State	Woodland b/		Agricultural c/		Residential d/		Commercial/ Industrial e/		Other f/		TOTAL	
	Const.	Opera.	Const.	Opera.	Const.	Opera.	Const.	Opera.	Const.	Opera.	Const.	Opera.
GREAT LAKES	873.6	225.7	1008.2	0.0	0.0	0.0	0.0	0.0	2521.8	1392.8	4403.6	1618.5
Minnesota	134.0	49.0	163.6	0.0	0.0	0.0	0.0	0.0	449.4	232.7	747.0	281.7
Loop 1	0.3	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.6	17.0	50.9	17.0
Loop 2	4.6	0.1	36.4	0.0	0.0	0.0	0.0	0.0	70.0	37.0	111.0	37.1
Loop 3	25.7	3.3	60.9	0.0	0.0	0.0	0.0	0.0	110.3	64.5	196.9	67.8
Loop 4	42.9	18.1	0.0	0.0	0.0	0.0	0.0	0.0	147.9	57.6	190.8	75.7
Loop 5	16.3	6.3	4.5	0.0	0.0	0.0	0.0	0.0	20.9	11.8	41.7	18.1
Loop 6	44.2	21.2	11.8	0.0	0.0	0.0	0.0	0.0	99.7	44.8	155.7	66.0
Wisconsin	67.9	4.9	127.3	0.0	0.0	0.0	0.0	0.0	197.0	129.1	392.2	134.0
Loop 7	41.2	0.3	86.4	0.0	0.0	0.0	0.0	0.0	118.2	81.8	245.8	82.1
Loop 8	26.7	4.6	40.9	0.0	0.0	0.0	0.0	0.0	78.8	47.3	146.4	51.9
Michigan	671.7	171.8	717.3	0.0	0.0	0.0	0.0	0.0	1875.4	1031.0	3264.4	1202.8
Loop 8	34.7	4.7	55.5	0.0	0.0	0.0	0.0	0.0	105.5	63.6	195.7	68.3
Loop 9	124.9	21.0	3.6	0.0	0.0	0.0	0.0	0.0	267.9	125.2	396.4	146.2
Loop 10	100.0	41.2	26.4	0.0	0.0	0.0	0.0	0.0	242.1	109.1	368.5	150.3
Loop 11	105.4	46.0	50.0	0.0	0.0	0.0	0.0	0.0	305.2	138.2	460.6	184.2
Loop 12	100.2	21.1	0.0	0.0	0.0	0.0	0.0	0.0	200.9	93.3	301.1	114.4
Loop 13	59.5	18.6	54.5	0.0	0.0	0.0	0.0	0.0	194.5	96.7	308.5	115.3
Loop 14	23.6	0.0	29.1	0.0	0.0	0.0	0.0	0.0	94.5	49.1	147.2	49.1
Loop 15	71.0	9.2	35.5	0.0	0.0	0.0	0.0	0.0	259.1	118.8	365.6	128.0
Loop 16	29.4	0.0	304.5	0.0	0.0	0.0	0.0	0.0	133.3	155.8	467.2	155.8
Loop 17	23.0	10.0	158.2	0.0	0.0	0.0	0.0	0.0	72.4	81.2	253.6	91.2
TENNESSEE	73.3	39.1	206.4	71.2	20.8	8.9	5.4	2.0	74.8	16.0	380.7	137.2
New York	44.2	22.1	188.2	62.8	6.3	2.1	3.6	1.2	60.3	12.7	302.6	100.9
Segment 1	32.1	16.1	78.2	26.1	3.6	1.2	3.6	1.2	37.9	7.3	155.4	51.9
Segment 2	0.6	0.3	0.9	0.3	0.0	0.0	0.0	0.0	3.0	0.9	4.5	1.5
Segment 3	7.3	3.6	15.5	5.2	0.0	0.0	0.0	0.0	6.4	0.9	29.2	9.7
Segment 4	4.2	2.1	93.6	31.2	2.7	0.9	0.0	0.0	13.0	3.6	113.5	37.8
Massachusetts	29.1	17.0	18.2	8.4	14.5	6.8	1.8	0.8	14.5	3.3	78.1	36.3
Segment 8	20.4	11.9	5.5	2.5	10.9	5.1	1.8	0.8	10.5	2.5	49.1	22.8
Segment 9	8.7	5.1	12.7	5.9	3.6	1.7	0.0	0.0	4.0	0.8	29.0	13.5
ALGONQUIN	43.9	32.2	2.7	0.4	29.1	8.6	5.1	1.6	123.4	14.8	204.2	57.6
Massachusetts	26.8	16.4	1.8	0.2	16.4	2.5	0.0	0.0	90.7	10.0	135.7	29.1
G-5 Replacement	7.3	3.6	1.8	0.2	10.0	1.3	0.0	0.0	29.1	1.5	48.2	6.6
G-8 Replacement/ Loop	9.9	5.0	0.0	0.0	5.5	0.7	0.0	0.0	30.3	0.7	45.7	6.4
Medfield Loop	7.8	7.8	0.0	0.0	0.9	0.5	0.0	0.0	20.4	7.8	29.1	16.1
H-1 Replacement	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9	0.0	12.7	0.0
Connecticut	11.3	11.3	0.9	0.2	7.3	1.9	4.5	1.2	28.0	1.2	52.0	15.8
E-1 Loop	7.3	7.3	0.9	0.2	7.3	1.9	4.5	1.2	22.7	1.2	42.7	11.8
Chaplin Loop	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	9.3	4.0
Rhode Island												
Tiverton Loop	5.8	4.5	0.0	0.0	5.4	4.2	0.6	0.4	4.7	3.6	16.5	12.7

TABLE 5.1.9-1 (cont'd)

Pipeline Segment/ State	Woodland b/		Agricultural c/		Residential d/		Commercial/ Industrial e/		Other f/		TOTAL	
	Const.	Opera.	Const.	Opera.	Const.	Opera.	Const.	Opera.	Const.	Opera.	Const.	Opera.
TRANSCO	12.7	6.3	55.5	18.5	1.8	0.6	0.0	0.0	6.3	0.0	76.3	25.4
Pennsylvania	12.1	6.0	55.5	18.5	1.8	0.6	0.0	0.0	6.0	0.0	75.4	25.1
1.61-Mi Leidy Loop	4.8	2.4	5.5	1.8	1.8	0.6	0.0	0.0	2.4	0.0	14.5	4.8
6.79-Mi Leidy Loop	7.3	3.6	50.0	16.7	0.0	0.0	0.0	0.0	3.6	0.0	60.9	20.3
New Jersey												
6.79-Mi Leidy Loop	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.9	0.3
TEXAS EASTERN												
Pennsylvania												
Line No. 37	11.5	5.8	27.3	9.1	0.0	0.0	0.9	0.3	5.8	0.0	45.5	15.2
CNG												
New York												
TL-470 Line	13.6	13.6	5.5	5.5	0.0	0.0	4.5	4.5	0.9	0.9	24.5	24.5
NATIONAL FUEL/ PENN-YORK												
Pennsylvania												
Y-M54 Line	11.2	11.2	4.0	4.0	0.0	0.0	0.0	0.0	4.8	4.8	20.0	20.0
CNG/TEXAS EASTERN												
New York												
TL-403 Replacement	0.0	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	0.0
TOTAL	1039.8	333.9	1314.4	107.7	51.7	18.1	15.9	6.9	2738.7	1430.2	5160.5	1898.3

a/ All areas shown in acres.
b/ Includes deciduous, coniferous, mixed forest, and forested wetland stands.
c/ Includes cropland, pasture, orchards, and nurseries.
d/ Includes some rural residences, subdivisions, and yards.
e/ Includes retail/wholesale areas, manufacturing, and utility areas.
f/ Includes large water bodies, nonforested wetlands, undeveloped brush land, existing pipeline rights-of-way, golf courses, and municipal properties and roads.

NOTE: See section 2.2 for typical cross-sections of existing construction and operation rights-of-way. The amount of woodland affected by construction was reduced to reflect use of existing cleared right-of-way as shown on typical right-of-way cross-sections.

return to previous use with some restrictions, such as the erection of buildings or the planting of large trees.

To minimize impact on specific residential areas we recommend that the applicants be required to use the construction procedures identified on tables 5.1.9-2 and 5.1.9-3 for the locations specified in those tables.

Great Lakes

Based on Great Lakes' typical right-of-way cross-section (see figure 2.2-1) and its existing 75-foot-wide right-of-way, construction of 459.6 miles of the proposed pipeline loops would affect approximately 4,403.6 acres of land, of which approximately 1,618.5 acres would be used for operational right-of-way for the new pipeline. Approximately 1,392.8 acres of the land that would be affected by the construction and operational rights-of-way are presently maintained as right-of-way for the existing Great Lakes pipeline.

Construction would remove approximately 873.6 acres of woodland of which 225.7 acres would remain permanently cleared. Approximately 1,008.2 acres of agricultural land would be disturbed during construction. Recommendations for mitigation measures to protect soils and to minimize damage to drainage tile systems are addressed in section 5.1.2. Following construction, the agricultural lands would be returned to their former use. No orchards are located along the proposed loops, although one small tree nursery is located on and adjacent to the existing pipeline right-of-way. Following construction, trees could be planted within the temporary construction right-of-way. Approximately 2,521.8 acres of other land, primarily existing cleared right-of-way, undeveloped brush land, marsh, and bog land would also be affected by construction.

Great Lakes has proposed to maintain 75 feet of permanent right-of-way for the existing pipeline and new loop line where a defined 75-foot-wide pipeline easement exists. This would be consistent with normal industry standards for two 36-inch-diameter pipelines. Where existing pipeline easements are undefined or insufficient in width, Great Lakes proposes to obtain up to 125 feet of additional pipeline right-of-way. We believe a 100- to 125-foot-wide right-of-way is excessive for a permanent right-of-way width for two pipelines. We therefore recommend that Great Lakes be limited to a maximum 75-foot-wide permanent cleared right-of-way where there are two pipelines. Where a third pipe would be placed within the right-of-way (i.e., Loops 1 and 2), we recommend that Great Lakes be limited to a 100-foot-wide permanent cleared right-of-way.

The proposed Great Lakes construction right-of-way would be located within 50 feet of 31 residences. Of these, 16 residences would be located on the opposite side of the existing pipeline or at a great enough distance (over 70 feet from the proposed pipeline centerline) so that impact from proposed construction would be limited. The remaining 15 residences are located within 19 to 66 feet of the proposed pipeline centerline and potential construction impact would be greater. Four of the nearest residences are trailer houses, nine are generally isolated (either singly or in pairs), and two are within a residential area located on the east and west banks of the Indian River.

TABLE 5.1.9-2

Types of Residential Mitigation Techniques

Type	Name	Description
Type A	Route Variation	See section 6.0 for description of route variation.
Type B	Residential Construction Techniques	Residential construction techniques to include: • Snow-fence the work area. • Avoid removal of trees wherever possible. • Reduce construction ROW width to 50 feet. • Reduce working crew. and, one or more of the following as specified in table 5.1.9-3: • Use drag-line construction technique (i.e., pipe joints are welded into sections in a staging area as the trench is excavated just ahead of the pipe-laying operation, the pipe sections are lowered into the trench, welded to the previously installed pipe, and the trench is backfilled immediately). • Use stove- or sewer-pipe construction technique (i.e., same as drag-line construction, except that no staging area is available and the pipe is laid one or two joints at a time). • Pad and work over existing pipeline ROW to limit temporary construction requirements.
Type C	Residential Construction Techniques	Residential construction techniques to include: • Snow-fence the work area. • Avoid removal of trees where possible. and, one of the following: • Reduce construction ROW width to 50 feet. • Reduce pipeline separation to maintain at least 50 feet between residences and the edge of the permanent ROW.

TABLE 5.1.9-3

Mitigation Techniques for Residential Areas that Would Be Affected by the Proposed NIP Project Pipeline

Applicant/ Segment	Town/ State	MP	No. of Residences a/	Distance (ft) b/	Mitigation Technique	Specific Recommendation
GREAT LAKES						
Loop 6	Feeley, MN	231.1	1	61	C	
Loop 10	Maple Ridge, MI	552.2	1	65	C	
	Baldwin, MI	556.2	1	44	C	Use reduced pipeline separation.
Loop 11	Hiawatha, MI	598.2	1	45	B	
		598.4	1	23	B	
Loop 13	McKinley, MI	701.8	1	29	B	
		701.8	1	34	B	
Loop 14	Elmira, MI	737.0	1	46	C	Use reduced pipeline separation.
	Hayes, MI	744.8	1	54	C	
Loop 16	Jasper, MI	852.8	1	66	C	
		852.8	1	19	B	
	Taymouth, MI	892.3	1	48	B	Also use reduced pipeline separation.
	Birch Run, MI	898.2	1	30	B	Also use reduced pipeline separation.
		898.6	1	43	C	Use reduce pipeline separation.
Loop 17	Mayfield, MI	927.5	1	60	C	
TENNESSEE						
Segment 1	Newstead, NY	202+1.5	1	51	C	Reduce pipeline separation and construction right-of-way by 15 feet each. c/
	Alden, NY	201+6.7	1	49	B	Drag-line construction using field to the south and reduce pipeline separation.
Segment 4	Avon, NY	234+1.4	1	83	B	
Segment 8	Longmeadow, MA	261+3.8	1	59	B	Replace all ornamental trees removed during construction.
		261+3.7 to 5.5	40	12 to 70	B	

TABLE 5.1.9-3 (cont'd)

Applicant/ Segment	Town/ State	MP	No. of Residences a/	Distance (ft) b/	Mitigation Technique	Specific Recommendation
Segment 9	Hopkinton, MA	266+6.3 to 6.5	5	20 to 100	B	Reduce construction and permanent ROW; work over existing pipeline; use drag-line construction. c/
	Hopkinton, MA	266+7.3 to 7.5 266 + 7.5	2-condos 1	20 to 50 50	B B	Work over existing pipeline; minimize permanent right-of-way requirements. c/
	Hopkinton, MA	266+9.1	1	40	B	Reduce construction and permanent right-of-way; use drag-line construction; work over existing pipeline. c/
ALGONQUIN						
G-5 Replacement	Seekonk, MA	1.6, 1.9, 2.1	3	30 to 50	B	Reduce construction right-of-way; work over existing pipeline; use stovepipe or drag-line construction; replant vegetation c/; offer to install and maintain barriers across right-of-way c/.
G-8 Replacement/ Loop	Plymouth, MA	2.0 to 2.6	24	50	B	Minimize tree removal for temporary work space and replace those trees removed; use stovepipe construction; replace barriers across right-of-way following construction; minimize temporary construction right-of-way.
Medfield Loop	Holliston, MA	0.8	2	50	B	Use electric transmission ROW.
	Holliston, MA	1.3	1	50	B	Use electric transmission ROW
	Holliston, MA	2.8	1	50	C	
E-1 Loop	Norwich, CT	4.3	3	30 to 60	A	See Section 6.3.1.
TRANSCO						
6.79-Mile Leidy Loop	Plainfield, PA	36.5	1	50	C	
TEXAS EASTERN						
TL-470 Line	Spring, PA	37.5	1	44	B	Work over existing pipeline; use drag-line construction. c/

a/ All residences are located on the construction side of the proposed pipeline right-of-way.
b/ All distances are expressed in feet from the proposed pipeline centerline.
c/ Applicant proposed mitigation measures.

We determined that there would be no preferred routing alternative for the nine residences and four trailer houses since such routing would either surround the affected residence with pipeline rights-of-way or would transfer construction impact to non-affected residences located on the opposite side of the proposed construction right-of-way. However, to minimize proposed construction and operational impact, we have recommended use of residential mitigation construction techniques as identified in tables 5.1.9-2 and 5.1.9-3 for the 15 residences that, due to their proximity, could be particularly affected by construction. Since construction within the Pencil Lake subdivision (Loop 14, MP 744) has been slow and the development has been laid out around the existing pipeline, no impact would be expected with the proposed construction.

Tennessee

Construction of Tennessee's proposed 41.9 miles of pipeline loops would affect approximately 380.7 acres of land, of which 137.2 acres would be retained by Tennessee for new permanent pipeline right-of-way. Of the total land affected by construction, approximately 73.3 acres of woodland would be removed, of which 39.1 acres would be retained for the permanent right-of-way and 34.2 acres would be allowed to return to its former vegetated state. Approximately 206.4 acres of agricultural land would be affected by construction but would be allowed to revert to its former use following construction. No orchards or tree nurseries would be affected by Tennessee's proposal.

Approximately 20.8 acres of residential land would be affected by the proposed pipeline, with 56 residences located within 50 feet of the proposed construction right-of-way. Along proposed Segments 1, 3, and 4 in New York, eight residences would be affected by construction. Impact on three of these residences would be greater due to their proximity to the construction right-of-way. We determined that a preferred routing alternative for these three residences would offer limited advantage over the proposed alignment and that construction impact could be better minimized through residential construction procedures as specified on tables 5.1.9-2 and 5.1.9-3.

In the Tennessee Boundary/Looping Project FEIS (February 1983), we recommended an alternative to prevent impact on a residence located at MP 230B-102+0.0 on Segment 1. Tennessee has proposed a different alignment in this area, which would mitigate impact on the residence and would also minimize the distance of the tie-over line between the existing and proposed loop. A tie-over line is required at each mainline valve location. The tie-over at MLV 230B-102+0.0 would be reduced in this area by 450 feet through use of Tennessee's proposed alignment. Construction impact on the residence has also been effectively mitigated by Tennessee's proposed alignment in this area.

Along Segments 8 and 9 in Massachusetts, the affected residences are more concentrated at road crossings or along roads paralleled by the proposed pipeline. One area of particular concern includes 40 residences located along Wolf Swamp Road in Longmeadow, Massachusetts (Segment 8, MPs 3.8 - 4.6). The proposed pipeline would be located through the front yards of this residential street which is lined with ornamental crabapple trees. The town has planted and maintained its tree population over the years and has expressed particular concern about tree removal or tree damage resulting from construction (Longmeadow, 1989 and Vinchesi, 1989). In response to the town's concerns,

Tennessee revised its alignment to locate the proposed pipeline under an existing sidewalk which partially parallels Wolf Swamp Road and to relocate the existing water main. Tennessee has further proposed to remove and replace the ornamental tree belt. This alignment would increase the distance of the proposed pipeline to the residences from 29 to 46 feet.

We evaluated two route variations to avoid or minimize impact on this residential area. The first would follow pipeline and powerline rights-of-way to the south of and around Longmeadow (see section 6.2.1). Because of the potential for increased impact on other resources such as the Fannie Stebbins Wildlife Refuge, a National Natural Landmark, as well as on active wellfields in Enfield, Connecticut, we determined that this variation offered no advantage over the proposed alignment.

The second route variation would place the proposed pipeline within Wolf Swamp and Denslow Roads (see section 6.2.2). Tennessee and the Town of Longmeadow have indicated that such placement may potentially damage abandoned or unidentified utilities within these roadways and may potentially close the road for several months. We believe that Tennessee's proposal would probably result in the least impact, provided the treebelt is restored or replaced.

Another area of concern occurs along proposed Segment 9 in Hopkinton, Massachusetts. Two residences at Pond Street and three residences along Lynn Path (MP 266+6.3 to 6.5), two condominium buildings, a residence (MP 266+7.3 and 7.5), and a dormitory at the Weston Nursery (MP 266+9.1) would be affected by construction.

Algonquin

Construction of Algonquin's proposed pipeline facilities would affect 204.2 acres during construction, of which 57.6 acres would be retained for new permanent right-of-way. Of this total, approximately 43.9 acres of woodland would be removed during construction and 32.2 acres would be converted from woodland to cleared permanent right-of-way. Approximately 2.7 acres of agricultural land, mostly pasture and open fields, would be affected by construction. One nursery (MP 0.4) and one orchard (MP 1.4) would be crossed along the proposed E-1 Loop. Approximately 50 2- to 3-foot high Christmas trees would be removed within the nursery and 10 apple trees would be affected in the orchard. Alternative alignments would offer limited advantage due to existing development in the area. In addition, the use of crossovers would not reduce impact since the existing pipeline right-of-way passes through the middle of the nursery and the orchard. We therefore recommend that the use of the existing right-of-way be maximized for construction right-of-way requirements and that construction right-of-way be limited to 50 feet to reduce tree removal.

The proposed loops would affect approximately 29.1 acres of residential land and 59 residences. The majority of the residences within 50 feet of the proposed construction right-of-way would be located along the portion of the G-8 Replacement/Loop that passes through the Glen Charlie subdivision (MPs 2.1-2.8).

Along the G-5 Replacement, five residences are located within 50 feet of the proposed construction right-of-way on Fairway Drive (MP 1.8). In letters submitted to the

Massachusetts Energy Facility Council (EFSC), owners have expressed concern over the proximity of the proposed pipeline to their homes as well as unauthorized access along the right-of-way (EFSC, 1989). Although Algonquin proposes to replace the proposed pipeline within the same ditch as an existing pipeline, Algonquin would require an additional 45 feet in this area for temporary construction workspace and has proposed to retain 10 feet for permanent right-of-way. Three residences (both on the east, or construction side, of the right-of-way at MPs 1.6, 1.9, and 2.1) would be affected by proposed construction due to their proximity and potential loss of existing landscaping and vegetation. To minimize construction disruption through the Fairway Drive area (MPs 1.6 to 2.1), we have recommended that Algonquin limit construction work space, work over the existing pipeline, use stovepipe or dragline construction, replace vegetation where removed, and that they offer to install and maintain barriers across the right-of-way to prevent unauthorized access and use (see tables 5.1.9-2 and 5.1.9-3).

Construction of the proposed G-8 Replacement/Loop through the Glen Charlie subdivision would occur primarily within the existing right-of-way, although Algonquin proposes to use an additional 20 feet for temporary construction work space. The right-of-way is composed of sand and occasional stands of scrub pine. Slash barriers have been erected at road crossings to prevent vehicles from using the right-of-way. We recommend that within the Glen Charlie subdivision Algonquin utilize stove pipe construction, minimize removal of any existing tree screening for construction work space requirements and replace those trees removed, limit construction work space requirements, and replace any slash barriers removed during construction (see tables 5.1.9-2 and 5.1.9-3).

From MPs 4.1 to 5.0, Algonquin proposes to place the pipeline on a 50-foot-wide right-of-way adjacent to a powerline and highway right-of-way. To reduce clearing, we recommend that Algonquin place its permanent right-of-way within the existing electric transmission right-of-way between MPs 4.1 and 5.0. Additionally, the proposed pipeline construction right-of-way should extend no more than 25 feet outside of the existing electric transmission right-of-way. However, where it is not possible to place the entire 50-foot-wide permanent right-of-way within the electric transmission rights-of-way because of safety or environmental issues, Algonquin should file with the Secretary of the Commission for review and approval by the Director of OPPR the specific reasons for proposed variance to this recommendation. However, the intent is for the pipe to be placed within the electric transmission right-of-way.

Construction along the proposed Medfield Loop would affect four residences. A number of concerns were identified along the proposed Medfield Loop and we evaluated a route variation with several alternatives and a route modification (see section 6.3.2). We have recommended the route modification and further recommend that Algonquin place the permanent right-of-way within the existing electric transmission right-of-way between MPs 0.0 and 1.8. Additionally, the proposed pipeline construction right-of-way should extend no more than 25 feet outside of the existing electric transmission right-of-way. However, where because of safety or environmental issues it is not possible to place the entire 50-foot-wide permanent right-of-way within the electric transmission right-of-way, Algonquin should file with the Secretary of the Commission for review and approval by the Director of OPPR the specific reasons for proposed variance to this recommendation. However, the intent is for the pipe to be placed within the electric transmission right-of-way.

Two residences would be within 50 feet of the construction right-of-way along the proposed H-1 Replacement. However, since Algonquin would place the proposed pipeline within the same ditch of an existing pipeline, proposed construction right-of-way requirements would use the existing 30-foot-wide right-of-way and an additional 25 feet and 10 feet on either side of the existing right-of-way. Both residences are located beyond the 35-foot temporary construction right-of-way and construction impact would be limited.

Proposed construction would affect nine residences along the length of the proposed E-1 Loop. One residence is located at West Town Street (MP 1.4), five residences are located at the Browning Road (MP 2.0) area, and three new residences are located in the Wawecus Hill Road area (MP 4.0). Algonquin has proposed crossovers at West Town Street and Browning Road that would minimize impact by maximizing the distance between the proposed pipeline and the residences, and minimizing the loss of tree screening. Although Algonquin has proposed residential construction techniques to mitigate impact on the Wawecus Hill Road residences, we believe impact on these residences could be better reduced through our route variation (see section 6.3.2).

No residences would be affected along the proposed Chaplin Loop.

The proposed Tiverton Loop would be placed within the streets of a residential area. Although construction would cause noise and disruption in this neighborhood, residential properties would not be affected. One residence in the vicinity of MP 1.5 would lose mature trees screening the right-of-way. However, use of our recommended route variation (see section 6.3.3) would relocate the pipeline through open residential yards and would avoid impact on this residence.

Transco

Transco would require approximately 76.3 acres of land for construction of the Leidy Loops, of which 25.4 acres would be retained for new permanent right-of-way. This would include approximately 12.7 acres of woodland, of which 6.3 acres of woodland would be permanently converted to cleared right-of-way, and 55.5 acres of agricultural land, which would be allowed to revert to its former use following construction.

Approximately 1.8 acres of residential land would be affected by the proposed pipeline and one residence would be located within 50 feet of the construction right-of-way (MP 36.5). As shown in table 5.1.9-3, we recommend reducing pipeline separation or the construction right-of-way to maintain maximum distance between the proposed construction right-of-way and the residence. A fire station, located on the west bank of the Delaware River (MP 29.6), would be located approximately 60 feet from the proposed pipeline centerline. Since SR 611 would be bored, construction disturbance should not affect operation of the fire station.

Texas Eastern

Construction of Texas Eastern's proposed loop Line No. 37 would affect approximately 45.5 acres of land, of which 15.2 acres would be required for new permanent right-of-way. Approximately 11.5 acres of woodland would be cleared, of which 5.8 acres would be permanently converted to cleared right-of-way. Approximately 27.3 acres of agricultural land would be affected during construction.

One residence would be located within 50 feet of the proposed construction right-of-way. This is an isolated residence located within a cultivated, agricultural area. Texas Eastern has proposed satisfactory mitigation as shown in table 5.1.9-3.

CNG

CNG proposes a 75-foot construction and permanent right-of-way for the new TL-470 pipeline. This would affect approximately 24.5 acres of land comprising approximately 13.6 acres of woodland, 5.5 acres of agricultural land, and 4.5 acres of industrial/commercial land.

Although CNG proposes to place the new pipeline within Niagara Mohawk's powerline easement, preliminary alignment drawings indicate that CNG would use up to a 55-foot-wide temporary construction right-of-way and a 75-foot-wide permanent right-of-way and would not necessarily place its right-of-way adjacent to Niagara Mohawk's cleared right-of-way. We believe that a 75-foot-wide permanent right-of-way is excessive for a single pipeline. We therefore recommend that CNG be limited to 75 feet of clearing for construction purposes between MPs 0.8 and 1.4, and that they maintain no more than 50 feet of cleared permanent right-of-way. Furthermore, we recommend that between MP 0.0 to 0.8 and MPs 1.4 to 2.7, CNG place its permanent right-of-way within Niagara Mohawk's cleared right-of-way. Additionally, the proposed pipeline construction right-of-way should extend no more than 25 feet outboard from the existing electric utility right-of-way. Where it is not possible to place the entire 50-foot-wide permanent right-of-way within the electric transmission rights-of-way, for safety or environmental reasons, we recommend that CNG file with the Secretary of the Commission for review and approval by the Director of OPPR the specific reasons for the proposed variance to this recommendation. However, the intent is for the pipe to be placed within the electric transmision right-of-way. This recommendation would not apply between MPs 1.85 to 1.95 where the proposed pipeline right-of-way may need to deviate to avoid an abandoned landfill. Dependent on the results of CNGs cultural resource survey, this recommendation may not apply in the area of the Van Buren Site.

No residential land or residences would be affected by construction of the proposed pipeline.

National Fuel/Penn-York

Construction and operation of National Fuel's proposed Y-M54 Line would require a 66-foot-wide construction right-of-way and would affect 20.0 acres of land, which would include 11.2 acres of woodland, 4.8 acres of open land, and 4.0 acres of agricultural lands.

The proposed pipeline right-of-way would be located adjacent to a Tennessee pipeline right-of-way.

We believe that a 66-foot-wide permanent right-of-way for the proposed 24-inch-diameter pipeline is excessive. We have therefore recommended that National Fuel/Penn-York limit the width of the permanent right-of-way to 50 feet immediately adjacent to the existing Tennessee right-of-way.

No residential land or residences would be affected by construction of the proposed pipeline.

CNG/Texas Eastern

CNG/Texas Eastern propose to place the TL-430 Replacement pipeline within the same ditch as an existing pipeline pending receipt of an EPA permit. If the EPA permit is not approved the proposed pipeline would be constructed immediately adjacent to the existing pipe which would be placed in idle service. Construction would affect approximately 5.8 acres of agricultural land and would use the existing 50-foot-wide right-of-way plus an additional 45 feet for temporary construction work space. No additional permanent right-of-way would be required. No residential land or residences would be affected by construction or operation.

Aboveground Facilities

All but four of the proposed aboveground facilities would be constructed within fencelines of existing facilities or facilities under construction. No significant adverse land use impact would be associated with their construction. Four aboveground facilities would be located on non-utility land. These include Transco's Compressor Station 205, Compressor Station 167, and Sayreville Meter Station, and National Fuel/Penn-York's Concord Compressor Station. These proposed facilities are discussed below.

Transco

The proposed Compressor Station 205 would be located on approximately 10 acres of a 99-acre, Transco-owned tract of land. The 10-acre site for the proposed station would be located within a cultivated field on the 99-acre site, which is partially wooded and partially used for agricultural purposes. Construction would permanently remove 7 acres of land from agricultural production. The town of Lawrence has made appropriate changes in zoning and has approved the proposed construction (Lawrence, 1989). Transco has also indicated that it is presently finalizing negotiations with the Lawrence Planning Board to dedicate an easement in perpetuity for agriculture and conservation purposes for those lands not utilized by the proposed facility. No other significant land use impact would be associated with the proposed construction.

The proposed Compressor Station 167 would be located on a portion of a 21-acre, Transco-owned site. The site is presently used by Transco for metering, maintenance, and warehousing facilities. Approximately 14 acres are considered prime farmland. An estimated

0.6 acre of this prime farmland would be removed by construction. No significant adverse land use impact would be associated with proposed construction.

The proposed Sayreville Meter Station would occupy a 1.5-acre site near Sayreville, New Jersey. Approximately 0.7 acre would be disturbed for construction in an industrial area bordered by water line, pipeline, and railroad easements. No significant adverse land use impact would be associated with construction of this facility.

National Fuel/Penn-York

The proposed Concord Compressor Station would be located on 6 acres of a larger 70-acre tract of land which is partially wooded and partially used for agriculture. Proposed construction would permanently convert approximately 5 acres of agricultural land to utility land use.

Although concerns have been raised over noise impact on a residence on Genesee Road and several residences on New Oregon Road, we do not believe these residences would be affected. The closest residence would be 2,700 feet to the south on Genesee Road and the residences to the east in the valley on New Oregon Road are further away. The site is zoned agricultural/residential and no rezoning would be necessary to construct the proposed station. However, the town would have to approve construction of the facility. No other issues or adverse environmental impact have been identified with the site. It is expected that the town of Concord will approve construction. (Hill, 1990).

5.1.9.2 Recreation and Public Interest Areas

5.1.9.2.1 General Construction and Operational Impact

Recreation and public interest areas that would be crossed by the NIP Project pipeline include: national and state forests; Federal, state, county, and other public owned lands; Indian reservation lands; golf courses; and specially designated rivers. These areas are listed in table 4.1.9-3.

One of the primary concerns in crossing recreational areas is the impact during construction on recreational activities. Disruption and noise during construction would temporarily restrict the activities of hikers, fishermen, campers, and boaters, and wildlife species. Since pipeline construction is generally scheduled for the summer season when recreational activities are at their peak, this impact is to a large extent unavoidable although actual construction disruption in any one area is usually limited to between several days to a week.

Following construction, the areas would be restored as much as possible to their former use and recreational activities would continue as before construction. Removal of existing woodland for the construction of the pipeline would be the most significant long-term impact. Some mitigation would be possible through reduction of the size of the construction right-of-way and minimization of the amount of woodland removed. Although the temporary construction right-of-way would be allowed to revegetate, return to

preconstruction conditions in woodlands would take years, and those portions of the permanent right-of-way would be permanently altered.

There are varying opinions on the ultimate public use of the proposed new pipeline right-of-way. Although the pipeline right-of-way would provide an opportunity for the development of trails for recreational purposes, these trails introduce human activity along the right-of-way that could result in loss of, or disturbance to, wildlife, security problems for abutting landowners, unauthorized use of the right-of-way for dumping, and erosion problems where ORV or ATV use is heavy. We have recommended that for each owner or manager of forestland the applicants offer to install and maintain at all access points ORV, ATV, and pedestrian control measures as specified in section VI of appendix C.

Although no known hazardous-waste sites would be crossed by the proposed NIP Project, one is located near the proposed CNG TL-470 Line. In addition, the NYSTF has indicated that several sites are located within 0.5 mile of Tennessee Loops 1, 3, and 4. The greatest concern involving hazardous waste or landfill sites would be the potential of encountering unknown hazardous substances during construction of the proposed pipeline. Disturbance to these areas during construction could cause hazardous substances to migrate, contaminating surface water and groundwater and exposing nearby residents and construction workers to potentially hazardous fugitive dust. Known hazardous waste areas should, therefore, be avoided. If hazardous areas are encountered during construction, all activity in the area should stop and appropriate state and local agencies should be notified to determine the appropriate course of action.

5.1.9.2.2 Site-Specific Impact

Recreation areas that would be crossed by the proposed NIP Project pipeline facilities are listed in table 4.1.9-3. These include approximately 57.7 miles of national forests; 48.6 miles of state forests; 23.2 miles of state, county, town, and other publicly owned land; 1.3 miles of golf courses; 0.7 mile of Indian reservation land; and 18 specially designated or recreational rivers.

Great Lakes

The proposed Great Lakes loops would traverse 125.9 miles of recreational or special resource areas as well as 15 specially designated or recreational rivers.

National Forests

The proposed Great Lakes loops would traverse a total of 57.7 miles through the Chippewa, the Chequamegon, the Ottawa, and the Hiawatha National Forests (see table 4.1.9-3). Discussions with national forest personnel identified no major overriding concerns. Generally, ORV/ATV use has not been a problem except where there is a potential for soil erosion. In these areas, efforts are usually made to direct the use elsewhere. Other areas of concern included minimizing the width of the right-of-way, maintaining access to recreation and logging areas, and aesthetics, especially at road crossings.

Representatives from the Ottawa National Forest expressed concern regarding crossings of U.S. Route 45, Forest Highway 16, and U.S. Route 2, which is considered a scenic highway in the area where it traverses the forest (Bodine, 1989 and Somerville, 1989). U.S. Route 2 would be paralleled by the proposed Loops 8 and 9 and would be crossed four times within the Ottawa National Forest boundaries. Where the proposed pipeline would be constructed south of the existing pipeline and north of U.S. Route 2, concern was also expressed over visibility of the right-of-way from the highway during winter leaf-off conditions (Somerville, 1989).

Concerns were also expressed with increasing visual corridors at road crossings within the Chippewa National Forest. These crossings include County Road 8, South of Bena Forest Road 2102 and Forest Road 2127 near Six Mile Lake and near the Mississippi River. Additional concerns were also raised about maintaining screening along the banks of the Mississippi River.

Special-use permits would be required for all proposed pipeline crossings of national forests. These permits would identify areas of site-specific concern and the appropriate mitigation techniques. However, due to the concerns expressed by forest representatives, we recommend that construction and permanent right-of-way requirements be minimized to reduce unnecessary tree removal within all national forests, that access to recreational and remote forest areas be maintained when crossing forest roads, that the pipeline be sufficiently reinforced where it is placed under roads supporting logging traffic, and that screen plantings, where requested by forest managers, be maintained at road crossings within FS lands. In addition we recommend that, when crossing FS lands, Great Lakes comply with all conditions set forth in the FS special-use permit issued for each individual National Forest crossed. In areas where the FS special-use permit conditions differ from our recommendations or plans and procedures, the FS conditions would take precedence.

Because of specific concerns raised by the Ottawa National Forest, we recommend that screen plantings be maintained or restored at U.S. Route 45, Forest Highway 16, and the four U.S. Route 2 crossings within the Ottawa National Forest following construction. Additionally, tree removal should be minimized to the maximum extent possible and the temporary construction right-of-way should be replanted in areas where U.S. Route 2 is south of the proposed pipeline right-of-way (MPs 446.5 to 448.5, and 454.6 to 455.1). In the Chippewa National Forest, we recommend that screen plantings be maintained or restored at County Road 8, Forest Road 2102, the two crossings of Forest Road 2127, and along the banks of the Mississippi River.

State Forests and Other Public Lands

The proposed Great Lakes loops would cross eight state forests for a total of 46.9 miles and 18 parcels of state, county, and other public lands for a total of 21.3 miles. Most of these lands are used primarily for fish and wildlife resource management, forestry, and some recreation. The state forests are managed by the respective state's Department of Natural Resources and restrictions to protect fish and wildlife resources or to mitigate impact associated with pipeline construction and operation would be detailed during the easement negotiations. Concerns identified by state forest managers included minimizing right-of-way requirements and discouraging ORV/ATV use.

In all state forestland or other public lands, we recommend minimizing construction and permanent right-of-way to reduce woodland clearing and impact on fish or wildlife resources.

The proposed Loop 4 would traverse 0.7 mile of the Leech Lake Indian Reservation (MP 196.5) in three small, separate crossings. All three crossings would occur in wooded, swampy areas. No adverse impact would be associated with these crossings.

Recreational, Wild, and Scenic Rivers

The proposed Great Lakes loops would cross the Mississippi and Bois Brule Rivers, as well as 13 rivers that have been proposed as potential candidates for inclusion in the national or Michigan inventories of wild and scenic rivers (see table 4.1.9-3). For those rivers proposed as potential candidates for the national inventory, the greatest concern would be the preservation of those features for which the river was listed (i.e., recreation, fisheries, geologic formations)(Alexander, 1989; Castleberry, 1990). Restoration of a natural vegetative strip 25- to 100-feet-wide would be required along the river banks of rivers designated on the Michigan inventory. Barriers would also be required to discourage ATV/ORV use. Generally, similar procedures are recommended for rivers that are potential candidates (Pearson, 1989).

We recommend that Great Lakes file a mitigation and restoration plan for construction across all rivers listed as potential candidates for national or Michigan inventories (i.e., Black River, Cisco Branch Ontonagon River, Middle Branch Ontonagon River, South Branch Paint River, North Branch Ford River, Escanaba River, Sturgeon River, Indian River, Manistique River, Manistee River, Muskegon River, Pine River, and Shiawassee River) for review and approval of the Director of OPPR prior to construction.

Tennessee

Tennessee's proposed loops would cross the Niagara River, 0.8 mile of the Carlton Hill Multiple Use Area, two golf courses, and the Fannie Stebbins Wildlife Refuge and associated "Meadows."

The Carlton Hill Multiple Use Area (Segment 3, MP 232+2.8) would be crossed in two places within an area designated for multiple use. Existing land use at one crossing is open field and is used for agricultural purposes; at the other crossing, it is wooded. Tennessee has contacted NYDEC and no adverse impact has been identified with these crossings (Kiel, 1989).

The Fannie Stebbins Memorial Wildlife Refuge and the bordering "Meadows" (Segment 8, MP 262+1.8-2.3) provide habitat for rare species and migrating birds (see sections 5.1.9.4 and 5.1.9.5). The existing right-of-way is approximately 30 feet wide. Tennessee has agreed to reduce the offset of the proposed pipeline to 20 feet from the existing pipeline, to minimize temporary work space, and to use either dragline construction or the push-pull method for pipe installation. We have recommended that, prior to construction, a mitigation plan showing proposed construction through the Fannie Stebbins

Memorial Wildlife Refuge and bordering "Meadows" be filed with the Secretary of the Commission for review and approval by the Director of OPPR. The plan should specify temporary and permanent construction right-of-way requirements, method of pipeline installation, and restoration plans.

The Lima Golf Course (Segment 4, MP 234+6.4) would be crossed along the northern edge. We identified an alternative in the Tennessee/Boundary Looping Project FEIS (February 1983) to minimize impact from construction on the golf course and two residences. This alternative would be located immediately adjacent to Jenks Road and would minimize interference with plans for future residential development along this road. Tennessee's present alignment generally follows our recommended alternative but would be located at a greater distance from Jenks Road (between 150 and 250 feet) to avoid a new residence. The golf course owner identified no concerns with Tennessee's proposed alignment as no trees or greens would be affected and tree removal along the fairways would be limited (Checho, 1989). However, we recommend that Tennessee coordinate with the owner to determine the need for scheduling construction during the offseason from December 1 to April 1.

Although Tennessee would not cross any known hazardous waste sites, several are within 0.5 mile of the pipeline right-of-way. Because of concerns expressed by the New York State Task Force, we recommend that if Tennessee encounters hazardous wastes during construction, Tennessee should stop work and notify state and local agencies to determine the appropriate course of action.

The Longmeadow Golf Course (Segment 8, MP 261+3.0) would be crossed on the inside edge of one of its outer fairways (St. Pierre, 1989). For part of the crossing of the golf course, Tennessee has proposed removing an abandoned pipeline and installing the proposed pipeline within the same ditch. Although this would minimize impact on the golf course, proposed construction would interfere with play. Therefore, we recommend that Tennessee coordinate with the owner to determine the need to schedule construction during the off-season from December 1 to April 1.

Because of concerns raised by the respective towns, we recommend that construction in the vicinity of the Wolf Swamp (Segment 8, MP 261+4.0) and Elmwood (Segment 9, 266+7.5) Schools be conducted when school is not in session to minimize any potential impact due to construction noise and disruption. We recommend that, prior to construction, Tennessee file a construction mitigation plan along the Wolf Swamp athletic field with the Secretary of the Commission for review and approval by Director of OPPR prior to construction.

Algonquin

Algonquin would cross 0.5 mile of the Caratunk Wildlife Refuge, which is managed by the Audubon Society of Rhode Island, along the proposed G-5 Replacement. Algonquin's proposed construction alignment through the Refuge would be entirely located within the Algonquin pipeline and the powerline rights-of-way for 0.3 mile. For the remaining 0.2 mile, Algonquin proposes to acquire an additional 10 feet for one 0.1 mile segment and 20 feet for the second 0.1 mile segment for new permanent right-of-way. Because the Refuge

provides wildlife habitat, educational programs, and summer camp for children, we recommend that Algonquin confine construction activities to the existing pipeline and powerline rights-of-way. We recommend that construction through the refuge be conducted between September 1 and June 30. In addition, we recommend that Algonquin not acquire any new permanent right-of-way within the refuge.

Algonquin would cross 0.6 mile of the Ledgemont Country Club (G-5 Loop, MP 2.8) along its eastern boundary and on the other side of a powerline right-of-way. No playing areas would be affected and no adverse impact would be associated with the crossing. Algonquin would also cross 150 feet of the Glen Ellen Golf Course. The proposed crossing would be along the northern edge of the course, and no fairways or tees would be affected.

The Myles Standish State Forest would be crossed along the G-8 Replacement/Loop (MP 0.0). Approximately 0.4 acre of scrub pine would be removed for temporary construction right-of-way. Discussion with forest representatives indicates there is a concern regarding use of the right-of-way by all types of vehicles (MacKenzie, 1989). Barriers have generally proved ineffective and have been removed, or access is accomplished by numerous other paths or roadways. We recommend that Algonquin coordinate with forest representatives to determine appropriate vehicle control measures.

The proposed G-8 Replacement/Loop would cross the Glen Charlie Pond at MP 2.0. This pond is used for recreation as well as a reservoir for nearby cranberry bogs. We recommend that Algonquin schedule construction across the Glen Charlie Pond between September 30 and May 1.

Because of concerns expressed by the City of Norwich, we recommend that Algonquin replace or restore all stone walls removed during construction of the proposed E-1 Loop.

The proposed Chaplin Loop would be located entirely within the Natchaug State Forest in Connecticut which is managed by the CTDEP as a multiple use area. No significant concerns were identified by the CTDEP along the proposed 1.1-mile segment (Gibson, 1990).

Transco

Transco would cross an abandoned Conrail right-of-way that will be paved by the town of Plainfield in the spring of 1990 for use as a bikeway (Morykin, 1989). We recommend that Transco coordinate with Plainfield town officials to minimize construction impact on this trail. Transco would cross the Delaware River, which is a priority waterway in Pennsylvania's scenic rivers system. We recommend that Transco coordinate with appropriate state officials to develop a construction and mitigation plan for the Delaware River crossing.

Texas Eastern

Texas Eastern's proposed pipeline would cross 0.4 mile of the Bald Eagle State Forest. Texas Eastern has contacted PADER regarding the special permit for the forest crossing. No natural or wild areas would be crossed by the proposed pipeline and no

significant adverse impact would be anticipated (Kelley, 1989 and Laubach, 1988). Any site-specific concerns and mitigative measures would be identified prior to issuance of the special permit.

CNG

CNG's proposed pipeline has been routed to avoid an abandoned landfill site (MP 1.8) known to be generating groundwater contamination and currently under remediation. We recommend that CNG coordinate with NYDEC on construction procedures in this area and that they file copies of all correspondence with the Secretary of the Commission for the review and approval of the Director of OPPR prior to construction.

National Fuel/Penn-York

No recreational or public interest areas would be crossed by the proposed pipeline.

CNG/Texas Eastern

No recreational or public interest areas would be crossed by the proposed pipeline.

5.1.9.3 Visual Resources

Potential visual impact associated with pipeline facilities is primarily of two types: those resulting from alteration of terrain and vegetative patterns from pipeline construction and right-of-way maintenance, and those resulting from the placement of aboveground facilities such as compressor and metering stations.

Visual impact resulting from construction of the proposed NIP Project pipelines would generally be confined to the construction period. Only minor, incremental visual impact would be associated with the proposed pipeline during operation since the majority of the proposed pipeline would be located on or adjacent to existing pipeline rights-of-way. Additionally, the proposed pipeline would generally be located in remote areas with few potential viewers. In the more populated areas, where the number of potential viewers increases, the landscape tends to be dominated by other manmade features.

Construction and operation of the proposed NIP Project aboveground facilities would have no visual impact where the proposed facilities are located within existing stations or stations under construction. The proposed new compressor stations and metering stations would have limited visual impact because of their isolated location, the vegetative screening, and the low numbers of potential viewers. Transco's proposed Compressor Station 205 would be located within a larger site. Existing vegetation would screen the proposed facility on all sides from potential stationary or mobile viewers on nearby roads. Transco's proposed Compressor Station 167 would be located in a rural area on a site presently used for metering and maintenance facilities. Visual impact would be incremental since the proposed facilities would be viewed in conjunction with similar existing facilities. Transco's Sayreville Metering Station would be located within an industrial area where visual impact would be negligible. National Fuel/Penn-York's proposed Concord Station would be visible only from

Genessee Road to the south. Visual impact would be low to minimal because of the low number of potential viewers.

5.1.10 Socioeconomics

5.1.10.1 General Construction and Operational Impact

Socioeconomic impact associated with the construction and operation of the proposed NIP Project would be expected to be minimal. This is primarily because of the relatively short construction period and the relatively rapid rate at which construction crews would pass through any one area. Population influx as a result of the proposed construction would occur over the length of the pipeline route, which would limit local impact on housing, town infrastructure services (fire, medical, education, police), and transportation. Some beneficial economic impact would be realized through local and non-local construction payroll expenditures, purchases of construction goods and materials, and the increased property tax base generated by the proposed project.

When available, local workers would be employed for the proposed construction. Additional construction personnel hired from outside the project area would usually include pipeline construction specialists and supervisory personnel. These non-local workers would relocate temporarily to within the project area. Due to the short term of construction, these workers do not usually bring their families and prefer temporary quarters (i.e., hotels/motels, rental housing, campgrounds) in the more populated, service-oriented areas within a convenient commuting distance of the pipeline. Additional demand on housing supply and town infrastructure services would therefore be minimal and limited to the construction period.

Impact on the transportation network would result from the proposed pipeline crossings of roads and highways, and the movement of construction equipment and material from the storage/laydown areas to the pipeline work areas. Crossings of high volume roadways and railroads would be accomplished by boring and casing under the road or railway and traffic flow would be unaffected. Lower volume roadways would be crossed by trenching; however, at least one traffic lane would be maintained except for brief periods essential to laying of the new pipeline. Typically, construction disturbance at each of these road crossings would be less than one day. Once equipment and materials are transported to the pipeline right-of-way, equipment would move along the construction right-of-way and would not affect area-wide traffic operations.

5.1.10.2 Site-Specific Impact

Great Lakes

Typically, construction of 30 miles of pipeline would require 5 months from clearing to final restoration. During winter construction, the total time may extend to 7 months. Great Lakes has not determined the number of construction spreads that would be required for construction.

Tennessee

Tennessee proposes to use six construction spreads, one for each proposed segment. Construction would require 2 to 4 months depending on the segment: proposed Segments 2, 3, and 9 would span a 2-month construction period; proposed Segments 4 and 8 would span 3 to 3.5 months; and proposed Segment 1 would span a 4 month period. Construction at Compressor Station 230C would be accomplished within 6 months and would require a maximum of 90 workers during peak construction.

Algonquin

Construction of the Algonquin facilities would require between 50 and 100 workers over a 3- to 4-month period for each proposed loop or replacement: the proposed H-1 Replacement would require a construction work force of approximately 52 for 3 months; the proposed Chaplin Loop and G-8 Replacement would respectively require a construction work force of approximately 78 and 52 workers for a 4-month period; and the proposed G-5 Replacement and E-1 Loop would respectively require a construction workforce of 72 and 52 workers for approximately 4.5 months. Construction of the proposed Bellingham Meter Station would require approximately six workers over a 2-month period.

Transco

Transco proposes to use an average of 30 and 55 construction workers for construction of the respective proposed 1.61-Mile and 6.79-Mile Leidy Loops. Construction would require 2 and 3.5 months, respectively. Construction at the proposed Compressor Station 205 would require an average of 50 workers for a 6-month period. Construction at proposed Compressor Station 5.5 would require an average of 35 workers for approximately 3.5 months.

Texas Eastern

Texas Eastern would require a peak work force of 240 workers to construct 5.0 miles of proposed pipeline in Centre County, Pennsylvania. The construction period would not exceed 6 months.

CNG

CNG would require one construction spread of 75 to 100 workers for construction of the proposed TL-470 Line. Construction of the proposed project would take approximately 3 months.

National Fuel

National Fuel would require one construction spread to construct the proposed Y-M54 Line. Construction would require approximately 2 months. Construction of the new Concord Compressor Station would require 21 workers for approximately 1 year. All but four of the required work force would be hired from the local labor pool. The non-local workers would most likely be welders, specializing in high-pressure pipefitting for the

compressor units, and would be stationed at the site for less than 2 months. Approximately 12 construction workers for a 3-month period would be required for the proposed expansion of the Ellisburg Compressor Station.

CNG/Texas Eastern

Approximately 40 workers would be required for the construction of the proposed TL-403 Replacement. Construction would be scheduled between May 1 and October 31 of any year to limit environmental impact associated with adverse weather conditions.

5.1.11 Cultural Resources

5.1.11.1 General Construction and Operational Impact

Staging, construction, and operation of the proposed project could affect historic, archeological, and/or architectural properties in or eligible for listing in the NRHP. Project impact could include the physical disturbance of archeological sites within the proposed project right-of-way during construction; destruction, demolition, or alteration of historic structures; or the introduction of visual elements (e.g., compression or metering structures, removal of forest or landscape features) that could alter the settings associated with historic properties. Mitigative measures could include looping or rerouting the pipeline right-of-way; data recovery (e.g., scientific excavation of archeological sites); and/or use of landscape techniques to screen, reduce, or eliminate visual impact.

In accordance with the ACHP procedures for implementing Section 106 of the NHPA, for each NRHP-listed or -eligible property that lies within the project area, FERC, in consultation with the appropriate SHPO, will determine if the property would be affected and if the effect would be adverse. In accordance with FERC's general operating policy, every effort would be made to avoid adverse effects.

At present, Great Lakes has conducted a baseline background study of its right-of-way and prepared project-specific work plans for the Phase 1 study of the proposed loops and facilities. Tennessee has conducted Phase 1 studies for all proposed segments and is preparing work plans for Phase 2 studies where needed, in consultation with FERC and the SHPOs. Transco has completed Phase 1 studies for the 1.61-Mile Leidy Loop, Compressor Station 205, and Compressor Station 515. No potentially eligible cultural resources were found. Transco has completed Phase 1 and Phase 2 studies for the 6.79-Mile Leidy Loop. Texas Eastern has carried out background research for its Line No. 37 Loop, and FERC has requested that it conduct Phase 1 identification and field study. CNG has conducted Phase 1 study and is investigating the feasibility of avoidance of identified sites or need for Phase 2 study. National Fuel has completed the Phase 1 study and no additional study is necessary. CNG/Texas Eastern has consulted with the New York and Pennsylvania SHPOs regarding the TL-403 Replacement and the State Line Compressor Station and it was determined that there would be no effect on cultural resources.

In order to ensure that FERC's responsibilities under Section 106 of the NHPA and implementing regulations are met, we recommend that all applicants defer construction of the proposed facilities (and use of any staging and storage areas) until 1) FERC staff and

SHPOs have reviewed and approved all Phase 1 and Phase 2 cultural resource survey reports and Phase 2 mitigation plans and reports, if required, and have considered any comments of the respective SHPOs and ACHP; and 2) the Director of OPPR has informed the applicant that construction may begin. This recommendation would not pertain to any facilities determined to have no effect or for which no additional work is recommended (see table 4.1.11-1).

5.1.11.2 Site-Specific Impact

5.1.11.2.1 Historic and Archeological Resources

Great Lakes

In December 1988, Braun Environmental Laboratories (Braun), consultant to Great Lakes, wrote to the Michigan, Minnesota, and Wisconsin SHPOs, noting that, based upon the 1980 survey report, none of the currently proposed loops passed through NRHP-listed properties. Braun requested the SHPO's comments on the potential effects of construction on cultural resources. In January 1989, the Minnesota and Wisconsin SHPOs responded that they agreed that no known NRHP-listed properties would be affected by the proposed pipeline project. However, they commented that additional identification and evaluation might be necessary to meet the standards of Section 106 compliance. We have no record of a Michigan SHPO response. At present, Great Lakes has prepared project-specific work plans for Phase 1 study of the proposed loops. We have reviewed and approved these plans.

After consultation with us, Great Lakes has agreed to conduct Phase 1 and, as needed, Phase 2 investigations, at all staging areas and access road locations. Great Lakes has agreed to conduct basic documentary and cartographic research, and necessary field investigations beyond those conducted in 1980 to assure that all NRHP-eligible sites within the right-of-way have been located and evaluated.

Tennessee

Tennessee has carried out Phase 1 studies for Segments 1, 2, 3, and 4. During Phase 1 studies, Tennessee identified prehistoric sites in Segments 1 and 4. We recommend that Tennessee submit work plans for cultural resources for Phase 2 studies of the two prehistoric sites in Segments 1 and 4 to FERC for review and approval. Phase 1 study of the compressor and meter stations demonstrated the proposed work will have no effect on resources listed in or eligible for listing in the NRHP. The New York and Rhode Island SHPOs concurred.

While no NRHP-listed properties were encountered in Segment 8, the background research revealed that over 50 percent of the right-of-way had a high probability of containing archeological sites. Consequently, UMASS Archaeological Services recommended to Tennessee that a Phase 2 archeological study with subsurface testing be conducted for the entire length of the right-of-way. UMASS Archaeological Services presented a stratified sampling strategy that calls for shovel testing of high, medium, and low probability areas and

backhoe testing to look for deeply buried prehistoric sites. We have reviewed and approved the work plan and received the agreement of the Massachusetts SHPO.

At present, no Phase 1 cultural resources study report has been received for Segment 9. Tennessee has agreed to carry out Phase 1 and, as needed, Phase 2 investigations for Segment 9 and at all staging areas and access road locations.

Algonquin

We have reviewed the background study and proposed Phase 1 survey strategy for all of Algonquin's proposed pipelines except the new 1.8-mile H-1 Replacement, the 0.1-mile deviation of the G-8 Replacement Loop in the Cranberry Bog area, and the northernmost portions of the Chaplin Loop. The strategy for identification of prehistoric sites seems appropriate to us, and the Connecticut, Massachusetts, and Rhode Island SHPOs have determined that the plan is appropriate for identification of all potentially eligible cultural resources.

Transco

Transco has completed Phase 1 studies for the 1.61-Mile Leidy Loop and Phase 1 and 2 studies for the 6.79-Mile Leidy Loop. Subsequent to submission of the final reports on the background and field studies, the Pennsylvania SHPO commented that it was the opinion of the state that construction of the 1.61-Mile Leidy Loop would have no effect on cultural resources. We concur that, in accordance with Section 106, construction of this segment of the pipeline and increased compression at Compressor Stations 205 and 515 would have no effect.

According to Transco, nine potentially eligible historic and prehistoric period sites have been identified during the course of preliminary Phase 1 study of the 6.79-Mile Leidy Loop. We are awaiting receipt of the Phase 1 and 2 report from Transco prior to rendering a decision on the adequacy of these Section 106 studies, the eligibility of identified resources, and the need for additional work to avoid or minimize harm to identified eligible sites.

We are awaiting receipt of the results of consultation with the Virginia SHPO on the Emporia Meter Station and Compressor Station 167 and the Phase 1 and Phase 2 reports on South Hill (if needed), prior to rendering a decision on eligibility, need to assess effect, and treatment of eligible sites.

We have asked that Transco review all the proposed staging and storage areas and access roads in consultation with the SHPOs of New Jersey and Pennsylvania, and provide us with plans concerning potential effects on eligible cultural resources.

Texas Eastern

Texas Eastern has performed background research for its Line No. 37. The background documentary research identified no known resources within the right-of-way. No field work has been reported. We have asked Texas Eastern to provide the comments of the SHPO on the potential effects on cultural resources from construction of Line No. 37.

Because of the potential sensitivity of this project area, we recommend that Texas Eastern conduct Phase 1 identification and field study. We further recommend that a field survey, based upon a stratified sampling strategy, be conducted to determine the presence or absence of cultural resources within the project area.

CNG

CNG provided a Phase 1 study and is currently investigating methods to avoid or minimize effects on the Van Buren Site and nearby historic and prehistoric sites within the right-of-way of the TL-470 Line on Papscanee Island. The report on these investigations is scheduled for completion on July 1, 1990. If effects cannot be completely avoided, or if site boundaries must be determined first, Phase 2 evaluation studies would be conducted in order to gather sufficient information to delineate site boundaries and the opinion of the SHPO regarding the eligibility of the affected properties for listing in the NRHP would be requested. If FERC, in consultation with the SHPO, finds any of the properties to be eligible and determines that disturbance by project construction cannot be avoided, CNG would be asked to develop and execute a Phase 3 mitigation or data recovery plan. The Pennsylvania SHPO has indicated that the State Line Compressor facilities would have no effect on NRHP-eligible cultural resources. We concur with this finding. CNG has been asked to provide the New York SHPO's comments on the additional compressor at the Utica Compressor Station and the modifications to the Brookview Meter Station.

National Fuel/Penn-York

Phase 1 cultural resources studies of the Y-M54 Line right-of-way and the Concord Compressor Station property identified no NRHP-listed or -eligible prehistoric or historic sites within the project area. After discussion with the Pennsylvania and New York SHPOs' staff and consultants, we have concluded that the proposed pipeline and compressor station addition in Potter County, Pennsylvania, and the compressor station work in Erie County, New York, would have no effect on cultural resources. National Fuel/Penn-York has completed Phase 1 survey on all storage and staging areas. The applicant will file a report on this work and provide the review comments of the SHPOs when available. If NRHP-eligible sites are identified, we will work with National Fuel/Penn-York to avoid or minimize harm. If necessary, we will implement a Phase 3 (mitigation) plan after consultation with the NRHP.

CNG/Texas Eastern

CNG/Texas Eastern consulted with the New York and Pennsylvania SHPOs regarding the TL-403 Replacement and the State Line Compressor Station. The SHPOs stated that these facilities would have no effect on cultural resources. We concur. CNG/Texas Eastern has also been asked to provide the review comments of the two SHPOs on the metering stations at Leidy and Ellisburg, Pennsylvania, and Marilla, New York, and on all storage and staging areas associated with this project.

5.1.11.3 Traditional Cultural Values

Both direct and indirect impact on historic and archeological properties of traditional cultural value, as identified during the consultation process in accordance with 36 CFR Part 800.4(a)(1)(iii) and 800.1(c)(2)(iii), will be considered. FERC, in accordance with its planning processes and the ACHP regulations, will treat traditional cultural concerns as those of interested parties. Applicants have been asked to notify appropriate "acknowledged" traditional tribal leaders and other potentially interested ethnic groups identified by the SHPOs.

Great Lakes has provided pertinent details regarding its project to 16 tribal groups, including residents and reservation leaders of the Leech Lake Indian Reservation through the Minneapolis Area Office of the BIA. This information was filed with FERC. The Saginaw Chippewa Indian Tribe has responded that 12 known burial sites may exist within the Great Lakes right-of-way. BIA advised that in accordance with Section 106 of the NHPA, an additional survey to identify and evaluate unknown sites must be carried out. This survey is scheduled to start in late Spring 1990. Should NRHP-eligible sites be identified, the applicant will be asked to investigate alternatives that would avoid such sites, in consultation with the SHPO, FERC, the BIA, and concerned tribal leaders. If the sites cannot be avoided, the applicant must, in consultation with these parties, assess the effects of the project. If there are effects, a treatment or mitigation plan will be developed and implemented in accordance with the ACHP procedures.

Tribes or other ethnic groups or individuals that disagree with FERC's determinations may seek ACHP review of the decisions under 36 CFR Part 800.6(e)(i). No other specific Federal process for review of cultural properties of traditional value exists for FERC projects.

5.1.12 Reliability and Safety

5.1.12.1 Safety Standards

The proposed pipelines in the NIP Project would be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR Part 192. The regulations are intended to ensure adequate protection for the public from natural gas pipeline failures. Part 192 specifies material selection and qualification, minimum design requirements, and protection from internal, external, and atmospheric corrosion.

Part 192 also defines area classifications, based on population density in the vicinity of the pipeline, which determine more rigorous safety requirements for populated areas. The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. The four area classifications are defined as follows:

Class 1	Location with 10 or fewer buildings intended for human occupancy.
Class 2	Location with more than 10 but less than 46 buildings intended for human occupancy.

Class 3 Location with 46 or more buildings intended for human occupancy or where the pipeline lies within 100 yards of any building, or small, well-defined outside area occupied by 20 or more people during normal use.

Class 4 Location where buildings with four or more stories aboveground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Pipelines constructed in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil, and 18 inches in consolidated rock. Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require a minimum cover of 36 inches in normal soil and 24 inches in consolidated rock. Class locations also specify the maximum distance to a sectionalizing block valve (e.g., 10 miles in Class 1, 7.5 miles in Class 2, 4 miles in Class 3, and 2.5 miles in Class 4). Pipeline design pressures, hydrostatic test pressures, maximum allowable operating pressure, inspection and testing of welds, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas. The proposed pipeline segments in the NIP Project contain Class 1, 2, and 3 locations.

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Under Section 192.615, each pipeline operator must also establish an emergency plan that includes procedures to minimize the hazards in a gas pipeline emergency. Key elements of the plan include procedures for:

- receiving, identifying, and classifying emergency events--gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- making personnel, equipment, tools, and materials available at the scene of an emergency;
- protecting people first and then property, and making safe from actual or potential hazards; and
- emergency shutdown of system and safe restoration of service.

Each operator must establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a gas pipeline emergency, and coordinate mutual assistance in responding to emergencies. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials.

5.1.12.2 Potential Hazards

The transportation of natural gas by pipeline involves some risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a major pipeline rupture.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiant, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death.

Methane has an ignition temperature of 1,000 degrees Fahrenheit and is flammable at concentrations between 5.0 percent and 15.0 percent in air. Unconfined mixtures of methane in air are not explosive. However, a flammable concentration within an enclosed space in the presence of an ignition source can explode. The specific gravity of methane is 0.55 and, therefore, it is buoyant at atmospheric temperatures and disperses rapidly in air.

5.1.12.3 Pipeline Accident Data

Since February 9, 1970, 49 CFR Part 191 has required all operators of transmission and gathering systems to notify DOT of any reportable incident and to submit a report on form F7100.2 within 20 days. Reportable incidents are defined as any leaks that:

- caused a death or personal injury requiring hospitalization;
- required taking any segment of transmission line out of service;
- resulted in gas ignition;
- caused estimated damage to the property of the operator, or others, or both a total of $5,000 or more;
- required immediate repair on a transmission line;
- occurred while testing with gas or another test medium; or
- in the judgment of the operator was significant, even though it did not meet the above criteria.

DOT changed reporting requirements after June 1984 to reduce the amount of data collected. Since that date, operators must only report incidents that involve property damage of more than $50,000, injury, death, release of gas, or that are otherwise considered significant by the operator. To avoid combining dissimilar data sets, only incidents reported during the 14.5-year period from 1970 through June 1984 are used in this analysis. 1/

1/ Jones, D.J., G.S. Kramer, D.N. Gideon, and R.J. Eiber, 1986. "An Analysis of Reportable Incidents for Natural Gas Transportation and Gathering Lines 1970 Through June 1984." NG-18 Report No. 158, Pipeline Research Committee of the American Gas Association.

During the 14.5-year period, 5,862 service incidents were reported over the approximately 300,000 total miles of natural gas transmission and gathering systems nationwide. Service incidents, defined as failures that occur during pipeline operation, have remained fairly constant over this period with no clear upward or downward trend in annual totals. In addition, 2,013 test failures were reported. Correction of test failures removed defects from the pipeline prior to operation.

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 5.1.12-1 provides a percentage distribution of the causal factors as well as the annual frequency of each factor per 1,000 miles of pipeline in service.

TABLE 5.1.12-1

Service Incidents by Cause

Cause	Percentage	Incidents/1000 mi-yr
Outside forces	53.5	0.70
Corrosion	16.6	0.22
Material defect	16.9	0.21
Construction defect	4.8	0.06
Other	8.2	0.11
Total	100.0	1.30

The dominant incident cause is outside forces, constituting 53.5 percent of all service incidents. Outside forces incidents result from the encroachment of mechanical equipment such as bulldozers and backhoes; from earth movements due to soil settlement, washouts, or geologic hazards; from weather effects such as winds, storms, and thermal strains; and from willful damage. The breakdown of outside forces incidents in table 5.1.12-2 shows that human error in equipment usage was responsible for approximately 75 percent of outside forces incidents. Since April 1982, operators have been required to participate in "One Call" public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines. The "One Call" program is a service utilized by public utilities and some private sector companies (e.g., oil pipelines and cable television) to provide preconstruction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts.

Table 5.1.12-1 identifies an average annual service incident frequency of 1.30 failures per 1,000 miles per year for all natural gas transmission and gathering lines. The pipelines

TABLE 5.1.12-2

Outside Forces Incidents by Cause

Cause	Percent
Equipment operated by outside party	67.1
Equipment operated by or for operator	7.3
Earth movement	13.3
Weather	10.8
Other	1.5

included in the data set vary widely in terms of age, pipe diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

The frequency of service incidents is strongly dependent on pipeline age. While pipelines installed since 1950 exhibit a fairly constant level of service incident frequency, pipelines installed prior to that time have a significantly higher rate, partially due to corrosion. Older pipelines have a higher frequency of corrosion incidents, since corrosion is a time-dependent process. Further, new pipe generally uses more advanced coatings and cathodic protection to reduce corrosion potential.

Older pipelines have a higher frequency of outside forces incidents partly because the their location may be less well-known and less well-marked than newer lines. In addition, the older pipelines contain a disproportionate number of smaller diameter pipelines, which have a greater rate of outside forces incidents. Small diameter pipelines are more easily crushed or broken by mechanical equipment or earth movements.

Table 5.1.12-3 clearly demonstrates the effectiveness of corrosion control in reducing the incidence of failures caused by external corrosion. The use of both an external protective coating and a cathodic protection system, required on all pipelines installed after July 1971, significantly reduces the rate of failure compared to unprotected or partially protected pipe. The data shows that bare, cathodically protected pipe actually has a higher corrosion rate than unprotected pipe. This anomaly reflects the retrofitting of cathodic protection to actively corroding spots on pipes.

TABLE 5.1.12-3

External Corrosion by Level of Control

Corrosion Control	Incidents/1,000 mi-yr
None - bare pipe	0.42
Cathodic protection only	0.97
Coated only	0.40
Coated and cathodic protection	0.11

5.1.12.4 Impact on Public Safety

The service incident data summarized in table 5.1.12-1 include pipeline failures of all magnitudes with widely varying consequences. Approximately two-thirds of the incidents were classified as leaks, and the remaining third classified as ruptures, implying a more serious failure. Fatalities or injuries occurred in 4 percent of the service incidents reported in the 14.5-year period.

Table 5.1.12-4 presents the annual fatalities that occurred on natural gas transmission and gathering lines from 1970 to 1987. Fatalities between 1970 and June 1984 have been separated into employees and nonemployees, to better identify a fatality rate experienced by the general public. Fatalities among the public averaged 2.5 per year nationwide over this period. The simplified reporting requirements in effect after June 1984 do not differentiate between employees and nonemployees.

The nationwide totals of accidental fatalities because of various manmade and natural hazards are listed in table 5.1.12-5 in order to provide a relative measure of the industry-wide safety of natural gas pipelines. Direct comparisons between accident categories should be made cautiously since individual exposures to hazards are not uniform among all categories. Nevertheless, the average 2.5 public fatalities per year is relatively small considering the more than 300,000 miles of transmission and gathering lines in service nationwide. Furthermore, the fatality rate is approximately two orders of magnitude lower than the fatalities from natural hazards such as lightning, tornados, floods, earthquakes, etc.

Based on approximately 311,000 miles in service, the rate of public fatalities for the nationwide mix of transmission and gathering lines in service is 0.008 per 1,000 miles per year. The proposed pipeline loops, consisting of a new pipeline adjacent to existing pipelines, would cause only a slight increase in risk to the nearby public.

TABLE 5.1.12-4

Gas Transmission and Gathering System Fatalities a/, b/

Year	Employees	Nonemployees	Total
1970	1	0	1
1971	2	1	3
1972	3	3	6
1973	1	1	2
1974	1	3	4
1975	5	2	7
1976	1	6	7
1977	5	3	8
1978	1	0	1
1979	4	8	12
1980	0	1	1
1981	5	1	6
1982	4	6	10
1983	1	1	2
1984 c/	-	-	9
1985 c/	-	-	6
1986 c/	-	-	4
1987 c/	-	-	0
Annual Average	2.5	2.5	5

a/ 1970 through June 1984 - American Gas Association, 1986.

b/ U.S. DOT Hazardous Materials Information System.

c/ Employee/nonemployee breakdown not available for years 1984 through 1987.

TABLE 5.1.12-5

Nationwide Accidental Deaths a/

Type of Accident	Fatalities
All accidents	92,000
Motor vehicles	46,000
Falls	11,600
Drowning	5,700
Poisoning	5,200
Fires and burns	4,800
Suffocation by ingested object	3,100
Tornado, flood, earthquake, etc. (1980-82 avg.)	132
Lightning (1980-82 avg.)	94
All liquid and gas pipelines (1978-87 avg.) b/	27
Gas transmission and gathering lines Nonemployees (1970-84 average) c/	2.5

a/ All data, unless otherwise noted, reflects 1984 statistics from the National Safety Council, "Accident Facts - 1985 Editions," Chicago, Illinois.

b/ U.S. Department of Transportation, "Annual Report on Pipeline Safety - Calendar Year 1987."

c/ American Gas Association, 1986.

5.1.12.5 Specific Impact

In the event of fire because of a gas leak or rupture, the pipeline company would be responsible for shutting off the supply of gas to the leaking section of pipeline. For large leaks or ruptures, automatic shutoff valves would close immediately; for smaller leaks, shutoff valves would close manually. Once the leaking pipeline section is isolated, the fire would be allowed to burn itself out, which usually takes several minutes. Local fire departments would be responsible only for controlling the spread of smaller fires to any dwellings, structures, and property in the general area at risk.

As discussed in section 2.4 of this EIS, a contingency plan would be prepared by the pipeline company, working with local fire departments and other agencies, to identify personnel to be contacted, equipment to be mobilized, and procedures to be performed to respond to a hazardous condition caused by the proposed pipeline.

5.1.13 Polychlorinated Biphenyls (PCBs)

This section evaluates the procedures for decontaminating, removing, and storing a segment of potentially contaminated pipeline in conformance with EPA regulations. The control of potentially contaminated liquid and vapor releases that may occur during construction and tie-in of loops is also evaluated. The handling and disposal of PCB-contaminated liquids generated during normal operations of existing portions of the applicants' systems are beyond the scope of this EIS.

5.1.13.1 Properties and Effects

The chemical mixtures of PCBs used in industry are extremely stable, viscous fluids that are resistant to degradation, heat, oxidation, acids, and bases. These physical and chemical properties made PCBs valuable to industry as dielectric, heat transfer, and ignition retardant fluids, and they were widely used by industry in electrical transformers and capacitors and in lubricating oils and compressor case sealants for potentially explosive environments.

However, the chemical properties that make PCBs desirable for industrial uses also make them hazardous to human health. PCBs are extremely stable and can persist in the environment for decades with little to no degradation. PCBs are lipid-soluble (preferentially accumulate in fatty tissues) and are subject to bioaccumulation and biomagnification. Exposure to PCBs may result in skin lesions, liver and brain damage, and reproductive abnormalities.

The TSCA of 1976 addresses the dangers posed by the unregulated use of PCBs, specifically their production, use, and disposal. The use of PCBs by industry is currently prohibited by TSCA, except in a totally enclosed manner, and specific disposal requirements are described in 40 CFR 761.60.

5.1.13.2 Regulatory Requirements

In a March 17, 1988, letter, the Interstate Natural Gas Association of America requested the EPA promulgate a general policy for the removal and retirement of pipelines exposed to PCBs. EPA's June 1988 response highlights the specific requirements of the PCB regulations that apply to pipeline abandonment and removal operations. EPA has determined that the 13 interstate natural gas transmission companies that found PCBs in excess of 50 ppm in their systems in 1981 have not demonstrated that PCB concentrations are below 500 ppm. For regulatory purposes, EPA considers the liquids in these 13 systems to exceed 500 ppm.

Under 40 CFR 761.60(b)(5), a natural gas pipeline that is contaminated with condensate greater than 500 ppm of PCBs may only be disposed in a TSCA-permitted incinerator or a hazardous waste landfill. However, contaminated pipelines may be stored for up to a year in a facility that meets the requirements of 40 CFR 761.65(b) prior to disposal. Pipelines contaminated above 500 ppm may not be abandoned in place or distributed in commerce for reuse, without an exception under 40 CFR 761.80.

Under 40 CFR 761.60(e), alternative methods of disposal are permitted for a pipeline that is contaminated above 500 ppm. The EPA headquarters' Office of Toxic Substances would review applications for alternative methods that specify procedures for excavation, removal, sampling, storage, and disposal of pipeline segments. Decontamination of the pipeline segments may be demonstrated to be an alternative to disposal.

As a result, three options may be pursued in removing pipeline facilities to comply with TSCA:

1) remove and dispose of facilities in a TSCA-permitted incinerator or chemical waste landfill;

2) secure an alternative disposal method permit from EPA prior to removing facilities; or

3) remove and store equipment in a facility meeting the requirements of 40 CFR 761.65(b). Within 1 year of removal, dispose of facilities in a TSCA-permitted incinerator, chemical waste landfill, or by an EPA-permitted alternative disposal method.

In the event of a spill of liquids during removal operations, cleanup of any liquids, contaminated soil and impervious solid surfaces must comply with 40 CFR Part 761, Subpart G - PCB Spill Cleanup Policy.

5.1.13.3 General Construction and Operational Impact

Before the pipe segments to be removed are taken out of service, they would be thoroughly cleaned and dried. A series of pipeline cleaning pigs would be launched into the pipeline from the nearest upstream compressor station. The pigs would push any free condensate liquids within the pipe to the next compressor station where the liquids would

be collected in the station's inlet scrubber (and a small amount at the pig receiver). Liquids would be secured and stored for future disposal. Containment trays and cleaning pigs would be decontaminated with solvent, and the liquid also contained and stored, in accordance with 40 CFR 761.60.

After cleaning, the pipeline would be taken out of service by depressurizing the appropriate segments between compressor stations. The pipeline gas would be vented at the downstream station through a diffuser-collector and a noise silencer until the gas reaches atmospheric pressure. The residual gas and condensate in the depressurized pipe segments would be forced out of the pipe by tight fitting polyurethane pigs propelled through the segment by nitrogen gas or air. The nitrogen or air purge displaces the combustible gas and dries the pipe.

The right-of-way would be cleared and graded, and the pipe trench would be opened above the pipe and each side. At selected low points, such as drainage ditches or stream crossing banks, holes would be drilled in the top of the pipe to permit dip sticks (rods) to check for settled liquids. If liquids are present, an inspection window would be cut in the top of the pipe to determine the amount of liquid and the method of removal. Liquids may be pumped from the pipe or drained into an appropriate container placed under the pipe cut or flanged connection.

After the inspection, pipe cradles would be placed under the pipe and sideboom tractors would lift the cradles and walk the pipe out of the trench and place it on timber skids. At river or stream crossings, the pipe segment would be cut and capped at each bankside, and pulled through the crossing to one bank for inspection. The open trench would then be backfilled and, if necessary, the rights-of-way regraded in preparation for the retrenching, stringing, bending, welding, and other construction procedures for installing new pipe segments.

The removed pipe would be cut into 40-foot lengths and marked on the upper interior surface of the upstream end with a permanent identification number. A wipe sample would be taken on the bottom center of a statistically valid, randomly selected, representative number of pipe sections for analysis in an EPA-approved laboratory. The pipe sections would then be plastic capped and moved to a temporary storage yard for segregation by sample test results. Pipe that is determined to have a PCB surface contamination would be disposed of as follows:

- Concentrations greater than 1.0 micrograms per square centimeter ($\mu g/cm^2$) are regulated for disposal in a PCB-permitted disposal facility.

- Concentrations between 1.0 and 0.1 ($\mu g/cm^2$) are not regulated for disposal, but are limited to commercial distribution and use where long-term dermal contact is possible.

- Concentrations less than 0.1 ($\mu g/cm^2$) are unregulated.

5.1.13.4 Site-Specific Impact

5.1.13.4.1 Great Lakes and National Fuel

The NIP Project Pipeline facilities proposed by Great Lakes and National Fuel include new pipeline loops only and do not include the removal, replacement, or abandonment of existing pipe or related facilities that have been determined to contain PCBs in excess of 50 ppm in pipeline liquids.

5.1.13.4.2 Tennessee, Algonquin, Transco, CNG, Texas Eastern, and CNG/Texas Eastern

Most of the facilities proposed by Tennessee, Algonquin, CNG, Texas Eastern, and CNG/Texas Eastern consist of new pipeline materials and related equipment for which PCB decontamination requirements do not apply. With regard to replacement or removal of existing pipelines and related equipment, these five applicants propose the following modifications to their existing system:

- Tennessee proposes to replace abandoned pipeline between MP 261+4.75 and 261+6.18 on Loop 8 and MP 266+7.35 and 266+7.52 on Loop 9.

- Algonquin proposes to construct 5.2 miles of 20-inch-diameter replacement pipeline in Plymouth and Barnstable Counties, Massachusetts; 5.5 miles of 24-inch-diameter replacement pipeline in Bristol County, Massachusetts, and 1.8 miles of 10-inch diameter replacement pipeline in Worcester.

- CNG/Texas Eastern proposes to construct 2,000 feet of 20-inch replacement pipeline on Line No. 546 Extension in Erie County, New York.

- Modifications to CNG/Texas Eastern's Leidy Meter Station in Clinton County, Pennsylvania.

- Replacement of sections of pipe approximately 20 feet long at each tie-in point.

In March 1989, Tennessee applied for an Alternate Method of Disposal permit under TSCA section 6(c). Demonstrations of the proposed procedures were carried out in June 1989, and the Demonstration Test Reports have been submitted to EPA. Upon approval, Tennessee proposes to apply this permit system-wide, covering all new construction and maintenance activities involving the removal of facilities potentially contaminated with PCBs.

CNG/Texas Eastern applied to EPA for a removal permit in January 1989. Algonquin has requested a similar permit from the EPA by modifying the current Texas Eastern Pipe Removal Permit to cover its own construction in Massachusetts. Algonquin has indicated that the EPA concurred with this approach pending the resolution of several peripheral issues. Algonquin plans an expeditious submittal of its response to the EPA in view of an early grant of a TSCA permit. We recommend that these applicants furnish copies of their applications and EPA permits to the Secretary of the Commission prior to

issuance of the Certificate of Convenience and Necessity for the review and approval of the Director of OPPR prior to construction.

For the construction of its pipeline loops, Transco has stated that its PCB-monitoring data have consistently shown that 50 ppm is not exceeded in the area of proposed construction. However, it would voluntarily open inspection ports in the pipeline to check for liquids before cutting the pipe to tie-in its new facilities. Transco would capture and store the liquids removed from the pipeline and test them for PCB contamination prior to disposal. If PCB contamination is found, the liquid would have to be disposed of according to the requirements of TSCA, as discussed in section 5.1.13.2. There is a potential that PCB contamination may exist at Transco's Compressor Station 515. Transco is in the process of performing a site characterization at Compressor Station 515 to identify any site contamination. We recommend that copies of this site characterization study be provided to the Secretary of the Commission and submitted to the PADER. If contamination is found, we recommend that Transco:

a. Prepare a detailed plot plan that would identify all locations onsite, all downgradient locations offsite, offsite pig receivers and major valves, and streams or drainage ditches within 0.2 kilometer of any compressor station that would either be directly disturbed by excavation and soil storage, or be indirectly disturbed by construction equipment traffic, worker access and parking, construction support facilities, and staging areas.

b. Prior to construction, sample all locations identified above for PCBs and other contaminants in accordance with procedures approved by the PADER to ensure that an unacceptable level of contamination does not exist, and isolate any contaminated areas from the construction area with 4-foot orange plastic safety fencing or the equivalent for the entire duration of construction activities. Sampling plans would be submitted to and approved by PADER prior to commencement of sampling activities.

c. Secure concurrence from PADER that the construction areas identified above are not in areas of unacceptable contamination, and file the concurrence with the Secretary of FERC for the Director of OPPR's review and written approval prior to construction.

5.2 RELATED NONJURISDICTIONAL FACILITIES

FERC consideration of significant environmental impact extends to nonjurisdictional facilities when construction and operation of such facilities would not take place without the jurisdictional project. This EIS assesses the impact of related nonjurisdictional facilities on federally listed or proposed endangered and threatened species and cultural resources. In addition, we recommend that the applicants be required to certify that all necessary permits and approvals to construct and operate the nonjurisdictional facilities have been obtained prior to construction of those nonjurisdictional facilities that are not under construction at the time the FERC certificate is issued.

Endangered and Threatened Species

Section 7 of the ESA, as amended (50 CFR Part 402), requires FERC to determine if a proposed project would jeopardize the continued existence of any federally listed or proposed endangered or threatened species, or result in the destruction or adverse modification of a species' designated critical habitat. FERC's responsibilities under Section 7 apply to jurisdictional and related nonjurisdictional facilities. As discussed below, endangered species review is only necessary for the GAS cogeneration plan and pipeline and the Commonwealth related facilities.

To comply with our Section 7 requirements, we requested information from the FWS regional and appropriate field office pertaining to the presence of Federal-listed or proposed endangered or threatened species in the proposed project area (FWS, 1990a, 1990b, and 1990c). Based on this informal review, FERC determined that except for two nonjurisdictional facilities no Federal-listed or proposed endangered or threatened species would be affected by the construction of the related nonjurisdictional facilities. Additional review for the GAS cogeneration plant and pipeline (see section 5.2.1.2), and Commonwealth pipelines (see section 5.2.4.2) would be required.

Cultural Resources

Section 106 of the NHPA requires FERC to assess the potential effect of a proposed project on any cultural property (prehistoric or historic sites, buildings, districts, or objects) listed in or eligible for listing in the NRHP, and to afford the ACHP an opportunity to comment on the project.

Assessment of potential impact or effects from construction and operation of the proposed pipeline requires substantive information on the historic value of each cultural property within the proposed right-of-way and the criteria used for evaluating such property.

Based on the data developed from prior research in the vicinity of some of the proposed nonjurisdictional facilities, archeological sites from all phases of the prehistoric, contact, and historic periods may be found within the project area. These sites would include a broad range of functional types, from small single-function activity areas to major multicomponent occupation sites.

Following our review and SHPO's review of the construction of the nonjurisdictional facilities, we would recommend, where applicable, implementation of Phase 1 cultural resources studies. If potential NRHP resources or sites that might contain such resources are identified, it would be necessary to carry out Phase 2 studies. Further, any concerns expressed by the SHPOs regarding potential temporary or long-term effects on NRHP-listed or -eligible structural resources would have to be discussed and resolved.

To ensure compliance with Section 106 of the NHPA, we recommend the following:

a. In all cases where cultural resources in or eligible for the listing in National Register of Historic Places (NRHP) are found within the project area, applicants shall attempt to avoid these resources. Any modifications, including

route realignments, shall be filed with the Secretary of the Commission for review and approval by the Director of OPPR in accordance with condition no. 1.

b. Where cultural resources such as archeological sites, historic districts, and significant standing structures that are in or meet the criteria for NRHP eligibility are located in the proposed project area and cannot be avoided or would be visually affected by the project, applicants shall prepare Phase 3 mitigation or data recovery plans and submit the plans to the SHPO for comment and to the Secretary of the Commission for review and approval by the Director of OPPR.

c. No construction shall begin in those portions of the proposed project area or any other areas that would be disturbed (e.g., staging areas, storage and maintenance areas, access roads) that contain significant cultural resources until the Director of OPPR has reviewed and approved all cultural resource surveys and mitigation plans, and has considered any comments by the appropriate SHPOs and the Advisory Council on Historic Preservation and has provided written approval.

Site-Specific Impact

The following is an assessment of related nonjurisdictional customer facilities. A map showing the general location of these facilities is contained in appendix A, figure A-9. Where appropriate, detailed location maps are also included. In most instances these facilities are undergoing state and local review. We recommend that, prior to construction of the nonjurisdictional facilities, the applicants certify that all necessary permits and approvals to construct and operate the nonjurisdictional facilities have been obtained.

Several shippers have identified no need for new nonjurisdictional facilities. In these cases we feel no specific discussion in this EIS or further environmental review is required. These shippers include ConEdison, Elizabethtown, EME, and UGI.

5.2.1 Tennessee Deliveries

5.2.1.1 Ocean State Power II

The OSP II plant is under construction and the Tennessee delivery line was previously certified. Our evaluation of the environmental effects of each are addressed in detail in the Ocean State Power Project FEIS (July 1988). We have complied with Section 7 of the ESA and Section 106 of the NHPA for these facilities. We found the proposed facilities overall would have only a limited adverse impact. No further NEPA review is required.

5.2.1.2 Gas Alternative Systems

GAS plans to construct a 9.4-mile-long pipeline to supply a new 80-MW cogeneration plant at Syracuse University in Syracuse, New York. The cogeneration plant, as shown on figure A-9-1, would be located adjacent to the existing Syracuse University Steam Station. The plant site would be separated from the university campus by Route 81 to the east. Residential land use predominates in all other directions.

The new pipeline would generally follow existing easements and roadways from its interconnection with Tennessee's mainline system just east of Compressor Station 241. Beginning at the compressor station, the pipeline would proceed north following a combination of telephone, highway, water company, and electric company rights-of-way. In some instances, private access roads would be followed. The pipeline route south of Route 481 would be through agricultural or open lands or existing utility or public rights-of-way. There are several small areas where trees or brush would be cleared. North of Route 481 the pipeline would generally follow public and university roads to the power plant site.

The cogeneration plant is undergoing review at the local and state level. This review includes city building permits and county approval of process waste/cooling water. NYDEC approval of air plans as well as compliance with New York State Quality Review Act (SEQRA) are required. The pipeline has received Article VII certification by the NYPSC.

One federally listed threatened plant species (American hart's tongue fern) was identified as possibly occurring in the vicinity of the proposed GAS cogeneration plant and pipeline. Except for occasional transient individuals, no other federally listed or proposed endangered or threatened species or critical habitats were identified (FWS, 1990a, 1990b, and 1990c).

We recommend that GAS have a qualified botanist conduct a survey for the American hart's tongue fern within its project area. Results of this survey along with comments from the FWS should be submitted to FERC, Director OPPR, for review and approval prior to construction. Tennessee should not deliver the proposed gas volumes to GAS until the Director has indicated approval.

5.2.2 CNG/Texas Eastern/Transco/Algonquin Delivery

5.2.2.1 NorthEast Energy Associates

NEA's 300-MW cogeneration plant would be located on a 77-acre, undeveloped parcel of industrially zoned land in Bellingham, Massachusetts (see figure A-9-2). All of the environmental and regulatory approvals needed to commence construction have been received, including air quality permits, wetlands permits, Federal Aviation Administration (FAA) stack height approval, zoning and site plan approvals, Department of Public Utility approval, and the Energy Facilities Siting Council approval. The only approvals that have not been obtained are those which, by their nature, cannot be received in advance of final design and/or construction. The Executive Office of Environmental Affairs approved a Final Environmental Impact Report finding the proposed facility adequately and properly in compliance with the Massachusetts Environmental Policy Act. Presently the site is cleared,

grubbed, and levelled, and excavation is underway in preparation for pouring of foundations. It is currently expected that the plant will be started up and tested in early 1991, in preparation for commercial operation in mid-1991. If constructed and operated in accordance with relevant Federal, state, and local regulations, the proposed project would not have a significant effect on the environment.

5.2.3 CNG/Texas Eastern/Transco Delivery

5.2.3.1 North Jersey Energy Associates

NJEA's 300-MW cogeneration facility is planned to be constructed on 20 acres of land in Sayreville, New Jersey (see figure A-9-3). The land use surrounding the cogeneration facility is industrial. The nearest residential area is more than 1 mile from the proposed site. Approximately 1,400 feet of natural gas pipeline would be constructed following the existing site access road. This pipeline would connect the cogeneration facility with an existing Transco pipeline at the proposed Sayreville Meter Station.

The facility is undergoing regulatory review at the Federal, state, and local levels. At the Federal level, the facility received FAA stack height approval and COE wetlands approval. The FWS reviewed the NJDEP draft air quality permit and commented to the NJDEP. At the state level, the NJDEP issued various air quality permits, wetlands approvals, dewatering approval, and NPDES Stream Encroachment permits. The New Jersey State House Commission issued approval of a land swap involving land purchased with Green Acres Funds. The New Jersey Department of Community Affairs has reviewed all building permit applications. NJEA reports that no state historic preservation review is required for the facility. The Middlesex County Planning Board has issued approvals of the Subdivision and Site Plan and Sayreville has issued its approvals of the Subdivision and Site Plan.

The 1,400 feet of 16-inch-diameter PSE&G pipeline would be constructed within existing access and utility easements. The planned route is undergoing environmental review. To date, PSE&G reports that no wetlands would be affected and there is no record of historic or archeological sites within the proposed work area. Further cultural surveys are planned. No records of rare plants, animals, or natural communities are reported onsite by the NJDEP.

If constructed and operated in accordance with relevant Federal, state, and local regulations, the proposed project would not appear to have a significant effect on the environment.

5.2.4 National Fuel/Penn-York/Transco Delivery

5.2.4.1 Long Island Cogeneration Limited Partnership

Long Island Cogen plans to construct a 79.3-MW cogeneration facility at an industrially zoned site in Oyster Bay, New York (see figure A-9-4). The land use surrounding the site is industrial. A municipal waste incinerator and landfill are located just to the west and southwest. The closest non-industrial land use is a horse farm approximately

800 feet south of the proposed site. The Bethpage State Park is also located to the south of the cogeneration plant site. The closest park boundary is 1,300 feet from the site.

An 8-inch-diameter pipeline 8,500 feet in length would be constructed from an existing LILCO pipeline to deliver natural gas to the plant site. The pipeline route would be entirely within existing public road rights-of-way. The proposed route would leave the plant site and then follow Winding Road southward to its intersection with Round Swamp Road. The route would then continue south on Round Swamp Road to the interconnection point with the existing LILCO gas transmission line. Winding Road is bordered on the west by the municipal landfill and on the east by the state park. Round Swamp Road passes through the state park.

The cogeneration facility would also require the construction of a steam line 4,600 feet in length to connect the power plant with the SUNY Farmingdale campus. The steam line would initially follow 2,800 feet of existing power transmission right-of-way. The final 1,800 feet would pass through undeveloped land to the university campus.

The facility is in the preliminary stage of licensing with state and local agencies. Because of the lack of information pertaining to these facilities, we cannot at this time determine the potential for environmental impact.

5.2.4.2 Hopewell Cogeneration Limited Partnership

Hopewell is constructing a 356-MW cogeneration facility in Hopewell, Virginia (see figure A-9-5). The facility is reported to be about 90 percent complete and undergoing testing. Commonwealth Gas Pipeline and Commonwealth Gas Services propose to construct about 52 miles of nonjurisdictional pipeline to supply the plant (see figure A-9-6). Because of the lack of information pertaining to the proposed pipeline we cannot at this time determine the potential for environmental impact.

5.2.5 National Fuel/Penn-York/CNG Delivery

5.2.5.1 Indeck Energy Services of Oswego, Inc.

Indeck/Oswego is constructing a 49-MW cogeneration plant in Oswego, New York (see figure A-9-7). The plant would provide steam and electricity to International Paper Company's Oswego Mill. The cogeneration facility is located at a site adjacent to the Oswego Mill complex on the shore of Lake Ontario. The proposed plant is nearing completion with an anticipated in-service date of May 1990. All major state and local approvals, including NYDEC air permit and SEQRA determination, have been obtained.

The planned route for the natural gas pipeline would initially follow mill and public roads for approximately 1.5 miles. The next 8.5 miles of the proposed pipeline route would follow electric power transmission rights-of-way, which would require public road, wetlands, and stream crossings. The final 3 miles of pipeline would follow County Route 4, crossing several streams, wetlands, and surface water bodies. The 12-inch-diameter 13-mile-long pipeline to be constructed by Niagara Mohawk is currently under Article VII review by the NYPSC. To date, the staff of the New York Department of Public Service, NYDEC, and

New York Department of Agriculture and Markets (NYDAM) have stipulated that the route and construction and restoration methods proposed represent the minimum adverse environmental impact including effects on agricultural lands, wetlands, and river corridors traversed. Oswego County objects to the location of the pipeline within its roadway rights-of-way.

If constructed and operated in accordance with relevant Federal, state, and local regulations, the proposed project would not have a significant effect on the environment.

5.2.6 Tennessee/CNG Delivery

5.2.6.1 Cogen Energy Technology, Inc.

CETI plans to construct a new 60-MW cogeneration plant at Fort Orange Paper Company in the village of Castleton-on-Hudson, New York. The cogeneration plant (see figure A-9-8) would replace Fort Orange's existing boiler, which is fueled by oil and coal. The planned cogeneration facility would be built on plant property.

A new pipeline would extend from the Brookview Meter Station southward along Niagara Mohawk's existing electric and gas right-of-way. The line would then proceed west along the same Niagara Mohawk right-of-way, cross Brookview Road, and then rejoin existing rights-of-way at the intersection of Seaman Avenue and Harris Road in the village of Castleton-on-Hudson. The line would then follow an existing Niagara Mohawk underground natural gas line to Fort Orange property. From there, the pipeline would run to the plant.

Plans for the construction of the cogeneration plant are still in the conceptual stage although CETI has received NYDEC air permits and local zoning approval. Niagara Mohawk is in the process of preparing an NYPSC Article VII application for approval to construct the natural gas pipeline. Because of lack of information pertaining to these facilities, we cannot at this time determine the potential for environmental impact.

5.2.7 National Fuel/Penn-York Delivery

5.2.7.1 Indeck - Yerkes Services Inc.

Indeck/Yerkes is constructing a 53-MW cogeneration plant in Tonawanda, New York (see figure A-9-9). The proposed plant is scheduled for operation in early 1990. All major state and local approvals including NYDEC air quality permit and SEQRA determination have been obtained. If constructed and operated in accordance with relevant Federal, state, and local regulations, the proposed project would not have a significant effect on the environment.

5.3 CUMULATIVE IMPACT

Cumulative impact could result when a new project is added to an area where other projects exist or are proposed. In such a situation, although the impact from the separate projects might be minor, the cumulative impact from all the projects in the area could be significant.

As described in section 1.0, in 1989 the Commission issued an order establishing four projects from the settlement proceeding to be discrete. Subsequently, the Commission suspended processing of the Champlain application. The discrete projects are Niagara Settlement, Iroquois/Tennessee, and ANR. The three projects involve pipelines, associated aboveground facilities, and related nonjurisdictional facilities proposed to be located in 19 states. Each is being addressed in detail in one or more environmental documents.

As shown in table 5.3-1, pipeline facilities for these three remaining discrete projects include approximately 1,654 miles of pipeline in 16 states. There are no locations where pipelines of more than one project would be constructed at the same location. However, in some instances, a new pipeline looping in one project would be extended in another project.

A total of 261,310 hp of compression would be constructed in 13 states. In a number of cases, proposed compression of one project would be added to new or existing sites proposed for compression in another project. However, the incremental impact of added compression is generally limited to air and noise resources. In no instance would these additions result in locally significant cumulative effects. Applicants must comply with Federal NSPS and PSD regulations as well as state air permit requirements. We limit noise increases to a Ldn of 55 dBA, the level which protects the public from activity interference and annoyance in residential areas.

Related nonjurisdictional facilities that are currently known include those for electric power generation, cogeneration, local distribution and system supply. Electric power generation and cogeneration plants include new plants and existing plants converting to natural gas as a primary fuel or those increasing their use of natural gas. No power plants or cogeneration plants would be located adjacent to or close to each other within the six-state area where they are proposed. No locally significant cumulative impact would occur. New facilities for local distribution of natural gas or system supply are minor and serve discrete markets, which would preclude significant cumulative impact at the local level.

The combination of pipelines, aboveground facilities, and related nonjurisdictional facilities would have regional effects. Detailed analyses have been completed for all Niagara Settlement projects, Iroquois/Tennessee Phase I, and ANR Phase I. These comprise about 76 percent of the pipelines associated with these three discrete projects. No significant cumulative regional impact is reasonably likely for any general resource area and these are not discussed below. Sensitive resources including forestland, wetlands, endangered and threatened species, water resources, air quality, and land use are briefly discussed with respect to regional cumulative impact of the projects that have been analyzed in detail.

The majority of forestland clearing (1,954 acres) would take place in New York and Connecticut, primarily from the clearing of 368.6 miles of new right-of-way required for the proposed Iroquois/Tennessee Project. Both the NIP and the SS-2 project would require the clearing of 1,040 acres and 376 acres, respectively, primarily in the midwest. The TEMCO Project is the only other project that would require substantial clearing of forestland (157 acres) in the northeast, primarily spread over 76 miles of pipeline loop in both Pennsylvania and New York. The ANR Phase I project would clear approximately 35 acres of forestland in ten mid-west and northeast states. Since the Iroquois/Tennessee Project is the only

TABLE 5.3-1

Cumulative Facilities - Major Open Season Projects

FACILITIES	Unit	KS	MO	ID	MN	MI	WI	IL	IN	OH	KY	VA	MD	PA	NJ	NY	CT	RI	MA	NH
IROQUOIS/TENNESSEE																				
Phase I																				
Pipelines	(Mi)														0	308.7	59.9	2.3	28.9	45
Compression	(HP)														0	5600	0	0	3050	0
Power/Cogen Plants	(No)														0	2	0	1	1	0
LDCs	(No)														0	7	4	1	4	1
Phase II																				
Pipelines	(Mi)															64.0	10.7	5.5	43.1	
Compression	(HP)															1000	12600	0	6500	
Power/Cogen Plants	(No)															0	0	1	1	
LDCs	(No)															0	3	0	2	
NIAGARA SETTLEMENT																				
SS-2																				
Pipelines	(Mi)													58.5	7.1	0				
Compression	(HP)													0	0	0				
Power/Cogen Plants	(No)													1	1	0				
LDCs	(No)													2	2	2				
TEMCO																				
Pipelines	(Mi)													15.7		60.0			2.0	
Compression	(HP)													7000		6100			0	
Power/Cogen Plants	(No)													0		0			2	
LDCs	(No)													0		3			0	
NIP																				
Pipelines	(Mi)				76.8	337.5	45.3					0		12.5	3.4	36.0	6.0	2.1	24.5	
Compression	(HP)				0	0	0					7660		18750	12000	17890	0	5500	0	
Power/Cogen Plants	(No)				0	0	0					1		2	2	4	0	0	0	
LDCs	(No)				0	0	0					0		0	1	4	0	1	1	
ANR																				
Phase I																				
Pipelines	(Mi)	52.8	20.2	14.8				0		0.3			0	8.3	8.9			3.4	11.0	
Compression	(HP)	8000	3000	6000				2000		1600			9600	1200	0			0	0	
Power/Cogen Plants	(No)	0	0	0				2		0			0	0	1			1	1	
LDCs	(No)	0	0	0				0		0			0	0	1			0	0	
Phase II																				
Pipelines	(Mi)						21.7	0	9.5	15.8	63.2	0		137.7	12.1	19.0				
Compression	(HP)						0	2200	0	66960	0	600		54500	0	0				
Power/Cogen Plants	(No)						0	0	0	0	0	0		0	0	0				
LDCs	(No)						0	0	0	0	0	0		0	0	0				
CUMULATIVE																				
Pipelines	(Mi)	52.8	20.2	14.8	76.8	337.5	67.0	0	9.5	16.1	63.2	0	0	232.7	31.5	487.7	76.6	13.3	109.5	45.0
Compression	(HP)	8000	3000	6000	0	0	0	4200	0	68560	0	8260	9600	81450	12000	32590	12600	5500	9550	0
Power/Cogen Plants	(No)	0	0	0	0	0	0	2	0	0	0	1	0	3	4	6	0	3	5	0
LDCs	(No)	0	0	0	0	0	0	0	0	0	0	0	0	2	4	16	7	2	7	1

project clearing primarily new rights-of-way, we do not expect any cumulative impact due to forest fragmentation from pipeline construction in the Northeast. As noted in section 5.1.6, approximately 68 percent of the forestland cleared during construction would be allowed to permanently revegetate to a forested condition.

The NIP and the SS-2 Project would disturb 536 acres and 9 acres of wetland (both emergent and forested), respectively; this would occur primarily in Minnesota, Wisconsin, and Michigan. The Iroquois/Tennessee Pipeline Project would disturb 257 acres of wetland in the Northeast, primarily in New York. The TEMCO Project would disturb 31 acres of mixed wetland type in both Pennsylvania and New York, while ANR Phase I Project would disturb 21 acres of wetland. Since pipeline construction would not result in the loss of wetlands or an appreciable alteration of their functional value, we do not feel there would be a significant cumulative impact on this resource. Although forested wetland habitat values would change temporarily, regrowth of woody vegetation across most of the right-of-way would preclude this from being a significant cumulative impact over a 19-state area.

Five federally listed species have been identified in the vicinity of the proposed Iroquois/Tennessee Phase I Pipeline Project. For this project, we have determined that by incorporation of our recommended mitigation measures, no effect would occur to these species or any individuals of these federally listed species. The same determination has been made for the projects associated with the Niagara Settlement and ANR. Consequently, there would be no cumulative impact on the populations or distributions of any federally listed species within the United States.

A total of 380 perennial water bodies would be crossed by the Iroquois/Tennessee Project in New York and throughout New England. The NIP would cross 213 water bodies, primarily in the midwest, while the TEMCO Project would cross an additional 56 water bodies in Pennsylvania and New York and the SS-2 project would cross 26 streams in Pennsylvania and New Jersey. The ANR Phase I Project would cross 27 streams located throughout seven midwest and northeast states. The temporary nature of the impact from pipeline construction on surface waters and the wide geographic distribution of the above mentioned projects would preclude any significant cumulative impact on the water resources of any region.

The projects analyzed in detail would have both negative and beneficial effects on air quality. No significant adverse regional cumulative effects would occur. NO_x emissions from compressor stations would total approximately 2,624 tons/year, assuming continuous operation, dispersed over a 11-state area. This compares with total regional NO_x emissions of appproximately 6.3 million tons/year (EPA, 1986). However, construction of the projects would have a net beneficial effect by allowing for increased use of natural gas by local distribution companies, cogeneration, and power generation customers. For all the projects, the beneficial effect of using natural gas would be to reduce emissions of NO_x by 37,600 tons/year and SO_2 by 93,500 tons/year relative to fuel oil, coal, and wood under the 100 percent subsitution scenario (see section 3.1).

Approximately 370 residences within 50 feet of the construction rights-of-way and 157 public interest areas would be affected in the 14 state area where pipelines would be constructed. Construction related effects on residential and public interest areas would be

temporary and would be minimized through the mitigative techniques described in section 5.1.9. These resources are by their nature local and not regional and, therefore, regional cumulative effects would not occur.

In summary, where specific features of an individual project could be significant, we have recommended route variations or other measures to minimize potential adverse effects. Similar actions would be taken for facilities yet to be analyzed in detail. We believe that because of our recommended mitigation measures there are no resources within the 19-state area that would experience significant cumulative impact.

6.0 COMPARISON OF PROPOSED ACTION WITH ALTERNATIVE ROUTE VARIATIONS

Our review of the proposed NIP Project pipeline facilities, combined with discussions with Federal and state agencies and comments received during scoping, identified a number of sensitive environmental areas of concern where variations could reduce or avoid proposed construction impact. A description of these areas, the resource issues involved, and the analyzed variations is presented in the following sections by applicant. No environmental resource issues that warranted analysis of variations were identified for the proposed pipeline construction for Transco, Texas Eastern, National Fuel/Penn-York or CNG/Texas Eastern.

Where variations to the proposed route were identified, a comparison of the affected environmental resource factors for each variation and the corresponding portion of the proposed route is presented in table 6-1. Location maps of each variation are included in appendix A.

6.1 GREAT LAKES

Great Lakes proposes to construct 459.6 miles of pipeline, all of which would loop the existing Great Lakes mainline. For several reasons, we found relatively few locations where variations were warranted. In general, the environmental impact of constructing a pipeline loop on or adjacent to an existing right-of-way is less than constructing a new pipeline along new right-of-way. This is particularly true of the proposed Great Lakes looping where environmentally sensitive areas that would be crossed often span several miles in either direction from the proposed route. To avoid these areas, longer new rights-of-way, which could potentially have greater adverse impact than the route proposed by Great Lakes, would be required.

A second factor that influenced our analysis was that many of the comments we received from Federal and state agencies in Minnesota, Wisconsin, and Michigan reflected a desire to restrict new construction activities on or adjacent to existing cleared rights-of-way. Appropriate construction techniques and mitigation procedures, combined with appropriate construction timing, were perceived by these agencies as a more effective mitigative measure for construction impact than the creation of new pipeline right-of-way.

Third, half of the proposed Great Lakes pipeline (Loops 4 through 12) would be located within the U.S. Route 2 corridor through Minnesota, Wisconsin, and the upper peninsula of Michigan. This transportation corridor is presently used for a variety of linear facilities including other gas pipelines, oil pipelines, and power transmission lines. Existing land use patterns are therefore compatible with keeping utility rights-of-way within the corridor rather than creating new right-of-way outside of the corridor.

Lastly, wetlands account for approximately 18 percent of the land that would be crossed by the proposed Great Lakes pipeline. In many cases, these wetland areas are so numerous and extensive that alternative routing would potentially have greater adverse impact on surrounding wetland or forest resources than use of an expanded existing right-of-way. However, we did evaluate wetland variations in areas where effects on the wetland area, particularly forested wetlands, could be reduced, and where wetlands provided unique or significant habitat.

TABLE 6-1

Comparison of NIP Project Route Variations with Proposed Route Segments

Applicant Segment/State	EIS Section	Variation Name/ Environmental Factor	Unit	Variation	Proposed Route
GREAT LAKES					
Loops 1 & 2 MN	6.1.1	U.S. Route 59 Wetland MP 59.2 - 60.6			
		• Total Length	mi.	1.5	1.4
		• Parallel to existing ROW	mi.	0.0	1.4
		• River/stream crossings	no.	0	0
		• Forest cleared	ac.	4.4	2.3
		• Wetlands	ac.	0.0	5.1
		• Cropland	ac.	7.7	5.5
		• Houses within 50 feet	no.	0	0
		• ROW requirements	ac.	13.6	8.5
Loops 1 & 2 MN	6.1.2	New Solum Wetland MP 62.7 - 64.0			
		• Total length	mi.	1.4	1.3
		• Parallel to existing ROW	mi.	0.0	1.3
		• River/stream crossings	no.	0	0
		• Forest cleared	ac.	2.3	0.9
		• Wetlands	ac.	0.3	7.4
		• Cropland	ac.	6.9	0.0
		• Houses within 50 feet	no.	0	0
		• ROW requirements	ac.	12.7	7.3
		• Wild land	ac.	0.9	2.6
Loop 3, MN	6.1.3	Pine Lake Wetland MP 116.0 - 116.9			
		• Total length	mi.	1.1	0.9
		• Parallel to existing ROW	mi.	0.0	0.9
		• River/stream crossings	no.	0	0
		• Forest cleared	ac.	1.5	1.1
		• Wetlands	ac.	0.0	1.4
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	0	0
		• ROW requirements	ac.	6.7	2.7
Loop 3, MN	6.1.4	Clearbrook Wetland MP 118.3 - 119.5			
		• Total length	mi.	1.5	1.2
		• Parallel to existing ROW	mi.	0.0	1.1
		• River/stream crossings	no.	0	0
		• Forest cleared	ac.	0.0	0.4
		• Wetlands	ac.	0.0	2.6
		• Cropland	ac.	7.4	3.4
		• Houses within 50 feet	no.	0	0
		• ROW requirements	ac.	9.1	3.3

TABLE 6-1 (cont'd)

Applicant Segment/State	EIS Section	Variation Name/ Environmental Factor	Unit	Variation	Proposed Route
Loop 4, MN	6.1.5	Chippewa National Forest MP 183.7 - 201.1			
		• Total length	mi.	17.6	17.4
		• Parallel to existing ROW	mi.	16.0	17.3
		• River/stream crossings	no.	6	9
		• Forest cleared	ac.	46.6	25.1
		• Wetlands	ac.	40.2	51.0
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	2.5	0
		• ROW requirements	ac.	106.7	52.4
Loop 6, MN	6.1.6	Swan River MP 237.1 - 241.2			
		• Total length	mi.	5.2	4.1
		• Parallel to existing ROW	mi.	0.0	4.1
		• River/stream crossings	no.	1	1
		• Forest cleared	ac.	10.8	2.0
		• Wetlands	ac.	7.0	13.6
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	0	0
		• ROW requirements	ac.	31.5	13.3
		• Management area	mi.	0.0	3.3
Loop 7, WI	6.1.7	Bois Brule River MP 327.0 - 329.3			
		• Total length	mi.	2.4	2.3
		• Parallel to existing ROW	mi.	2.0	2.3
		• River/stream crossings	no.	1	1
		• Forest cleared	ac.	10.6	6.3
		• Wetlands	ac.	0.0	0.0
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	0	0
		• ROW requirements	ac.	13.9	6.7
Loop 11, MI	6.1.8	Indian River MP 598.1 - 599.3			
		• Total length	mi.	1.4	1.2
		• Parallel to existing ROW	mi.	1.4	1.2
		• River/stream crossings	no.	1	1
		• Forest cleared	ac.	3.3	1.7
		• Wetlands	ac.	4.4	3.4
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	0	3
		• ROW requirements	ac.	8.5	3.6

TABLE 6-1 (cont'd)

Applicant Segment/State	EIS Section	Variation Name/ Environmental Factor	Unit	Variation	Proposed Route
Loop 11, MI	6.1.9	Manistique River Wetland MP 602.6 - 603.6			
		• Total length	mi.	1.1	1.0
		• Parallel to existing ROW	mi.	0.0	1.0
		• River/stream crossings	no.	0	0
		• Forest cleared	ac.	7.6	0.3
		• Wetlands	ac.	0.6	3.8
		• Cropland	ac.	0.3	2.2
		• Houses within 50 feet	no.	0	0
		• ROW requirements	ac.	6.7	3.0
Loop 11, MI	6.1.10	McIntyre Lake Wetland MP 609.3 - 612.0			
		• Total length	mi.	3.0	2.7
		• Parallel to existing ROW	mi.	2.1	2.7
		• River/stream crossings	no.	0	0
		• Forest cleared	ac.	7.6	1.1
		• Wetlands	ac.	4.8	10.6
		• Cropland	ac.	5.7	3.1
		• Houses within 50 feet	no.	0	0
		• ROW requirements	ac.	18.2	8.2
Loop 12, MI	6.1.11	Pointe aux Chenes MP 671.4 - 677.1			
		• Total length	mi.	6.1	5.7
		• Parallel to existing ROW	mi.	0.0	5.7
		• River/stream crossings	no.	1	0
		• Forest cleared	ac.	28.8	21.3
		• Wetlands	ac.	21.9	13.4
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	0	0
		• ROW requirements	ac.	40.0	17.3
		• Candidate Research Natural Area	mi.	0.0	2.6
TENNESSEE					
Segment 8, MA	6.2.1	Longmeadow MP 261+1.8 - 261+5.5			
		• Total length	mi.	5.2	3.7
		• Parallel to existing ROW	mi.	5.2	3.7
		• River/stream crossings	no.	2	1
		• Forest cleared	ac.	19.1	4.1
		• Wetlands	ac.	3.4	2.6
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	1	45
		• ROW requirements	ac.	31.5	15.3
		• Fannie Stebbins	mi.	0.7	0.4
Segment 8, MA	6.2.2	Wolf Swamp Road MP 261+3.8 - 261+5.5			
		• Total length	mi.	1.7	1.7
		• Parallel to existing ROW	mi.	0.0	1.4
		• River/stream crossings	no.	0	0
		• Forest cleared	ac.	0.0	0.0
		• Wetlands	ac.	0.0	0.0
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	0	45
		• ROW requirements	ac.	NA	NA

TABLE 6-1 (cont'd)

Applicant Segment/State	EIS Section	Variation Name/ Environmental Factor	Unit	Variation	Proposed Route
ALGONQUIN					
E-1 Loop, CT	6.3.1	Wawecus Hill Road			
		MP 2.5 - 4.8			
		• Total length	mi.	2.6	2.3
		• Parallel to existing ROW	mi.	2.6	2.3
		• River/stream crossings	no.	3	2
		• Forest cleared	ac.	13.9	9.8
		• Wetlands	ac.	0.7	0.8
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	1	3
		• ROW requirements	ac.	12.6	5.6
Medfield Loop, MA	6.3.2	Medfield Loop			
		MP 1.0 - 3.2			
		• Total length	mi.	2.2	2.2
		• Parallel to existing ROW	mi.	1.8	0.9
		• River/stream crossings	no.	0	0
		• Forest cleared	ac.	11.3	14.5
		• Wetlands	ac.	2.2	4.3
		• Cropland	ac.	0.0	1.0
		• Houses within 50 feet	no.	7	3
		• ROW requirements	ac.	11.2	10.6
		Medfield Modification			
		MP 1.7 - 2.2			
		• Total Length	mi.	0.5	0.5
		• Parallel	mi.	0.0	0.0
		• River/stream crossings	no.	1.0	1.0
		• Forest cleared	ac.	4.5	4.2
		• Wetlands	ac.	0.3	0.3
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	0.0	0.0
		• ROW requirements	ac.	3.3	3.0
Tiverton Loop, RI	6.3.3	Tiverton Loop Variation			
		MP 0.8 - 1.6			
		• Total length	mi.	0.8	0.7
		• Parallel to existing ROW	mi.	0.0	0.7
		• River/stream crossings	no.	0	0
		• Forest cleared	ac.	5.3	1.0
		• Wetlands	ac.	0.0	2.4
		• Cropland	ac.	0.0	0.0
		• Houses within 50 feet	no.	1	1
		• ROW requirements	ac.	4.8	1.7
CNG					
TL-470, NY	6.4.1	River Road			
		MP 0.8 - 2.0			
		• Total length	mi.	1.1	1.2
		• Parallel to existing ROW	mi.	0.8	0.7
		• River/stream crossings	no.	3	3
		• Forest cleared	ac.	3.1	5.8
		• Wetlands	ac.	0.7	0.7
		• Cropland	ac.	2.1	0.7
		• Houses within 50 feet	no.	0	0
		• ROW requirements	ac.	6.7	7.3
		• Papscanee Marsh	mi.	0.3	0.2

6.1.1 U.S. Route 59 Wetland Variation

We evaluated a variation for a 1.4-mile segment in Marshall County, Minnesota, along proposed Loops 1 and 2 to avoid a state-protected emergent wetland identified by the MNDNR (Forester, 1989). The variation would deviate from the proposed route at MP 59.2, prior to the U.S. Route 59 crossing, and would continue south on the western side of U.S. Route 59, along the western edge of a NWI-mapped wetland. It would then turn southeast, cross U.S. Route 59 and the SOO Line Railroad approximately 1.1 miles south of the proposed crossing, and rejoin the proposed route at MP 60.6 (see figure A-1-18).

As shown on table 6-1, the U.S. Route 59 Wetland Variation would be approximately 0.1 mile longer than the proposed route. It would require an additional 2.1 acres of forest clearing and 2.2 acres of cropland but would avoid impact on 5.1 acres of emergent wetland (2.9 acres as mapped by the NWI and 2.2 acres as identified by the state). In a letter dated May 16, 1990 (see Volume II, comment letter S12), the MNDNR indicated that this wetland area consisted of emergent vegetation and was not a locally unique or otherwise significant wetland area. MNDNR felt that, with appropriate mitigation, utilizing the proposed route would be preferable to clearing new right-of-way. Their primary concern was possible disturbance of nesting sandhill cranes. Consequently, we recommended that no construction take place between MPs 59.0 and 60.6 or MPs 62.4 and 63.6 between April 1 and June 30. We believe that this recommendation and our recommended wetland construction procedures would reduce impact on this wetland while still utilizing the existing right-of-way. Consequently, we do not recommend use of this wetland variation.

6.1.2 New Solum Wetland Variation

We identified a variation for a 1.3-mile segment in Marshall County, Minnesota, near the end of proposed Loops 1 and 2 to avoid a state-protected emergent wetland and to minimize impact on state-designated wild land located immediately north of the Thief River Falls Compressor Station (MNDNR, 1989b). The wild land is habitat for large numbers of sharptail grouse and some sandhill cranes. The New Solum Wetland Variation would deviate from the proposed route at MP 62.7 and would continue southward for 6,000 feet, approximately 1,000 to 2,000 feet west of the proposed route around the edge of several small emergent wetlands. It would then turn east and rejoin the proposed route at MP 64.0 (see figure A-1-19).

The New Solum Wetland Variation would be 0.1 mile longer than the proposed route, would require an additional 1.4 acres of forest clearing, and would affect 6.9 acres of cropland (see table 6-1). However, it would affect 7.1 fewer acres of wetlands and 1.7 fewer acres of state-designated wild land than the proposed route. The MNDNR indicated (MNDNR, 1990) that, although this wetland is sensitive habitat for the sandhill crane, a pipeline could be constructed in it with little, if any, impact on this species by adhering to a restricted construction time window. Since the wetland consists of emergent vegetation, revegetation of existing species would occur rapidly after construction. The MNDNR expressed concern over the loss of upland forestland in surrounding isolated woodlots that would occur along this potential variation, as these forestlands provide windbreaks and are useful for aesthetic reasons. MNDNR also indicated that the wild land in the area of the proposed pipeline supports primarily sharptail grouse, but the grouse would not be affected as long as the right-of-way was revegetated with native grasses.

For these reasons, we do not recommend this variation be utilized. We do, however, recommend that Great Lakes conduct no construction activities between MPs 63 and 64 of this wetland between April 1 and June 30, and that an appropriate seed mixture, consisting of native grasses, be utilized to reseed the right-of-way through the nonwetland areas between MPs 63-64.

6.1.3 Pine Lake Wetland Variation

We identified a variation for a 0.9-mile segment of proposed Loop 3 in Clearwater County, Minnesota, to avoid a 1,200-foot crossing of a mixed forested/scrub-shrub wetland area. The variation would deviate from the proposed route at MP 116.0 and proceed southeast through open, nonforested land for a distance of approximately 3,000 feet. The variation would then utilize an unimproved dirt road through a forested area and head east, rejoining the proposed route at MP 116.9 (see figure A-1-20).

As shown on table 6-1, this variation would be approximately 0.2 mile longer than the proposed route and would require an additional 0.4 acre of forest clearing. Although it deviates from an existing right-of-way and would require an additional 4.0 acres for the right-of-way, it would cross an open area and utilize an existing road corridor through forest areas. Consequently, it would not create a new cleared right-of-way through forestland and would avoid the clearing of 1.4 acres of forested wetland habitat. However, the roadway is a section of the old Jefferson Highway, an historical route extending from Minnesota to New Orleans. Furthermore, the route would also pass through a potential gravel area that county engineers are considering leasing from adjacent landowners for a new county road project. Since the MNDNR does not support this variation and it would increase the amount of upland forest to be cleared and could potentially affect an historic roadway, we do not recommend that the Pine Lake Wetland Variation be used.

6.1.4 Clearbrook Wetland Variation

This variation for a 1.2-mile segment of proposed Loop 3 in Clearwater County, Minnesota, was identified to avoid crossing a 2,500-foot section of forested wetland. The Clearbrook Wetland Variation would deviate from the proposed route at MP 118.3, would cross over to the northeast side of the existing mainline, and would proceed east through open cropland for a distance of approximately 3,600 feet. It would then turn to the south for approximately 4,100 feet through open pasture before crossing over to the south side of the existing mainline and rejoining the proposed route at MP 119.5 (see figure A-1-21).

The proposed variation would be 0.3 mile longer than the proposed route and would affect 4.0 additional acres of cropland. It would also require an additional 5.8 acres for the right-of-way. However, since it traverses primarily open, agricultural land, it would require no forest or wetland clearing and would reduce the impact of the proposed route by 0.4 acre and 2.6 acres, respectively (see table 6-1). MNDNR (1990) has indicated that the proposed crossing is on the fringe of this large wetland, and that impact on the wetland resources would be less than the impact that would result from the construction of the pipeline through the surrounding cropland. However, we believe that disturbance to cropland would be temporary (generally limited to one growing season) and agricultural use would be allowed to continue following construction, whereas clearing of forested wetland would represent a long-term impact requiring years to return to preconstruction conditions. Since we disagree

that the proposed route is "on the fringe" of the wetland, we recommend use of the Clearbrook Wetland Variation.

6.1.5 Chippewa National Forest Variation

In response to comments received from the Chippewa National Forest officials, several alternatives along proposed Loop 4 in Cass and Itasca Counties, Minnesota, were evaluated to reduce the length of crossing through the Chippewa National Forest (Spinner, 1989). The entire proposed 19-mile loop would be located within the eastern half of the Forest. The Forest boundaries extend for approximately 20 miles to the east and west of the start of the proposed loop and 30 miles to the north and south of the proposed loop. Approximately 8.7 miles of federally owned land would be crossed with most of the remaining land owned by the State of Minnesota. Sensitive areas within the Chippewa National Forest near the proposed loop include the Hole-in-the-Bog Peatland Natural Area and associated watershed protection area, eagle and osprey nesting sites, and a deer yard (Eliason and Balcom, 1989).

Given the location of the Great Lakes mainline within the Chippewa National Forest, no feasible variation would entirely avoid the Forest. Further constraints include two large lakes to the north (Lake Winnibigoshish and Ball Club Lake) and one large lake (Sixmile Lake) to the south of the proposed loop. We looked at potential variations that would minimize the use of federally owned lands for the proposed pipeline without increasing impact on other National Forest landowners.

U.S. Route 2, the Burlington Northern Railroad, and the Lakehead Pipeline Company (Lakehead) are presently located on separate but adjacent rights-of-way within a 2,000-foot-wide east/west corridor which includes the Great Lakes mainline right-of-way. A variation that would locate the proposed pipeline to the south of U.S. Route 2 and to the north of the Burlington Northern Railroad could partially minimize impact on the Chippewa National Forest by using land previously disturbed by the roadway and railway. However, this 100-foot-wide strip of land is presently forested and pipeline construction would require a cleared 75-foot-wide right-of-way. Since construction would remove most of the vegetative screening between U.S. Route 2 and the railroad, this variation would offer limited advantage over the proposed route and could introduce adverse visual impact on motorists on U.S. Route 2. Therefore, it was dropped from further consideration. Construction of the proposed pipeline to the north of U.S. Route 2 was also determined to be of no advantage due to the potential effect of such routing on residential development along the southern banks of Lake Winnibigoshish and Ball Club Lake, as well as the crossings of U.S. Route 2.

A third potential variation identified by Chippewa National Forest officials would place the proposed pipeline adjacent to the southern edge of the Lakehead pipeline right-of-way (McIntire, 1989). The Lakehead pipeline right-of-way is located 100 to 200 feet south of the Burlington Northern Railroad and generally between 500 and 1,000 feet north of the Great Lakes mainline.

The Chippewa National Forest Variation would leave the proposed route at MP 183.7, cross to the north side of the existing mainline and proceed in a northeasterly direction for approximately 3,000 feet before turning northward for approximately 4,000 feet to the Lakehead pipeline right-of-way. At this point, the variation would turn east following the southern edge of the Lakehead pipeline right-of-way across the Mississippi and Ball Club

Rivers to a point 1,500 feet west of the Deer River Compressor Station. The variation would then leave the Lakehead pipeline right-of-way, turn southeast to cross to the south side of the existing Great Lakes mainline, and rejoin the proposed route at MP 201.1 (see figure A-1-22).

As shown on table 6-1, the Chippewa National Forest Variation would be 0.2 mile longer than the proposed route, and would require an additional 21.5 acres of forest clearing and an additional 54.3 acres for the right-of-way. It would also affect two to five residences that would be within 50 to 100 feet of the construction right-of-way. It would, however, affect 10.8 fewer acres of mixed forested, scrub-shrub and emergent wetlands and would cross three fewer streams/rivers. All other environmental factors (i.e., types of wetlands crossed, the Mississippi River and Ball Club River crossings, the crossing of the Hole-in-the-Bog watershed protection area, the deer yard crossing, and proximity to eagle and osprey nesting sites) would be comparable for the two routes.

Although the reduction in wetland clearing is significant, additional forest clearing and the potential for impact on two to five residences lowers the overall advantage of this variation over the proposed alignment. Furthermore, the variation would remain within the Chippewa National Forest boundaries and generally within 1,000 feet of the proposed route. Since the variation provides no significant advantage over the proposed route, we do not recommend use of the Chippewa National Forest Variation.

6.1.6 Swan River Variation

We evaluated a variation for a 4.1-mile segment of proposed Loop 6 in Itasca County, Minnesota to avoid the Swan River Deer Yard Wildlife Management Area (Management Area) as delineated by the MNDNR (Balcom, 1989). The proposed loop would cross 3.3 miles of the northern portion of the Management Area, which not only provides winter habitat for deer but is also located within an extensive forested/scrub-shrub wetland complex. The northern boundary of the Management Area parallels U.S. Route 2.

The Swan River Variation would deviate from the proposed route at MP 237.1, would cross to the northeast side of the existing mainline and would proceed in an easterly direction for approximately 6,000 feet to the south of and around the hamlet of Swan River to U.S. Route 2. It would then turn southeast and proceed parallel and adjacent to U.S. Route 2 for approximately 8,500 feet before turning southwest and following as much upland terrain as possible before crossing over to the south side of the existing mainline and rejoining the proposed route at MP 241.2 (MLV 4-3-2) (see figure A-1-23).

This variation would be approximately 1.1 miles longer than the proposed route, and would require an additional 8.8 acres of forest clearing and an additional 18.2 acres for the right-of-way. However, clearing within the forested/scrub-shrub wetlands would be reduced by 6.6 acres (see table 6-1). Although this variation would circumvent the delineated MNDNR boundaries of the Management Area, similar habitat extends to the northeast beyond U.S. Route 2 as well as to the south of the existing Great Lakes mainline. Therefore, greater impact may occur as a result of the creation of a new third corridor within this habitat than the impact that would be associated with widening of the existing right-of-way. Because we could identify no significant environmental advantage with the use of this variation without a potential for additional adverse environmental impact, we do not recommend its use.

6.1.7 Bois Brule River Variation

We evaluated a variation for a 2.3-mile segment along proposed Loop 7 in Douglas County, Wisconsin, at the proposed crossing of the Bois Brule River within the Brule River State Forest. The variation was identified to avoid a trout spawning area at the proposed crossing as identified by the representatives of the Brule River State Forest and the WIDNR (Zozel, 1989; Pratt, 1989).

The Bois Brule River Variation would deviate from the proposed route at MP 327.0, would cross over to the north of the existing mainline and proceed in a northeasterly direction for approximately 2,000 feet to the Lakehead pipeline right-of-way. It would then turn east, follow the southern edge of the Lakehead right-of-way across the Bois Brule River and continue on the Lakehead right-of-way to the point where the Lakehead and Great Lakes pipeline rights-of-way intersect. The variation would then cross over to the south side of the mainline to rejoin the proposed route at MP 329.3 (see figure A-1-24).

This variation is approximately 0.1 mile longer than the proposed route and would require an additional 4.3 acres of forest clearing as well as an additional 7.2 acres of right-of-way (see table 6-1). All other environmental resource factors would remain the same except that the Bois Brule River would be crossed at a location separate from the trout spawning area. However, the variation pipeline crossing would occur in an area of steeper slope and river rapids. Therefore, the variation offers no significant environmental advantage and could result in increased construction difficulty and in-stream construction time. Furthermore, representatives from the Brule River State Forest and the WIDNR stated that appropriate timing and construction procedures for the proposed crossing (see section 5.1.4.1) would offer a better solution to mitigate potential pipeline construction impact on the trout spawning area than creation of new cleared right-of-way. Therefore, we do not recommend the Bois Brule River Variation.

6.1.8 Indian River Variation

We identified this variation for a 1.2-mile segment along proposed Loop 11 in Schoolcraft County, Michigan, to avoid residential development that occurs along both banks of the proposed crossing of the Indian River. Of all the Great Lakes proposed pipeline loops, this area has the largest concentration of residences within 100 feet of the proposed route. Three residences would be located less than 50 feet from the proposed pipeline centerline and others would be affected by noise and disruption during construction.

The Indian River Variation would deviate from the proposed route at MP 598.1 at the intersection of the Great Lakes and Lakehead pipeline rights-of-way. After crossing over the Lakehead pipeline, the variation would cross the Great Lakes mainline and continue along the northern edge of the Lakehead right-of-way to the south of the proposed route. It would then cross the Indian River south of the Indian River dam and head northeast for approximately 4,000 feet along the Lakehead pipeline right-of-way. At the point where the Lakehead pipeline right-of-way turns east, the variation would continue north for approximately 200 feet and cross over to the north side of the existing mainline to rejoin the proposed route at MP 599.3 (see figure A-1-25).

The Indian River Variation would be 0.2 mile longer than the proposed route. It would require an additional 1.6 acres of forest clearing, an additional 1.0 acre of forested wetland clearing and an additional 4.9 acres of right-of-way (see table 6-1). Although the variation would avoid passing through an established residential area, only three residences within a short distance would be affected. Impact on these residences is better mitigated through residential mitigation construction techniques as identified in table 5.1.9-3. Since avoidance of the established residential area would create an additional environmental impact on forest and wetland resources, we do not recommend use of the Indian River Variation.

6.1.9 Manistique River Wetland Variation

We identified a variation for a 1.0-mile segment in Schoolcraft County, Michigan, along proposed Loop 11 to minimize the crossing length of a forested wetland complex associated with the Manistique River. The variation would deviate from the proposed route at MP 602.6, cross over to the south side of the existing mainline, and continue in a southeasterly direction. The variation would then cross the wetland at a narrower location before turning northward crossing over to the north side of the existing mainline and rejoining the proposed route at MP 603.6 (see figure A-1-26).

The variation would be approximately 0.1 mile longer than the proposed route and would require an additional 7.3 acres of forest clearing and an additional 3.7 acres of right-of-way. It would reduce forested wetland clearing by 3.2 acres and cropland disturbance by 1.9 acres (see table 6-1). Since pipeline construction through cropland generally results in a lesser long-term impact than construction through mature forestland, we do not consider the reduced crossing of active cropland an advantage especially when additional forestland would require clearing. Although the Manistique River Wetland Variation would result in less disturbance to wetland habitat, it would result in the creation of new right-of-way, and would significantly increase the amount of upland forest clearing. For these reasons, we do not recommend use of this variation.

6.1.10 McIntyre Lake Wetland Variation

This variation was identified for a 2.7-mile segment in Schoolcraft County, Michigan, along proposed Loop 11 to minimize impact on a series of forested wetland complexes associated with the Bear Creek Swamp and the Manistique River. The McIntyre Lake Wetland Variation would deviate from the proposed route at MP 609.3 and would cross to the south side of the existing mainline. It would proceed to the east along new right-of-way for approximately 1,700 feet to the Lakehead pipeline right-of-way. It would then turn northeast and parallel the northern edge of the Lakehead right-of-way for approximately 10,000 feet. At that point, it would turn directly north and proceed along new right-of-way for approximately 2,900 feet before crossing over to the north side of the existing mainline and rejoining the proposed route at MP 612.0 (see figure A-1-27).

This variation would be approximately 0.3 mile longer than the proposed route, would require an additional 6.5 acres of forest clearing, and an additional 10.0 acres of right-of-way. However, it would reduce clearing within forested wetlands by 5.8 acres. Although the McIntyre Lake Wetland Variation would affect an additional 2.6 acres of cropland, construction impact in cropland is generally considered short-term in comparison to the long-term impact of woodland clearing. Since most of the upland forest clearing would occur adjacent to an existing cleared right-of-way and greater use would be made of cropland for

right-of-way requirements as opposed to forested wetland clearing, we recommend the use of the McIntyre Lake Wetland Variation.

6.1.11 Pointe aux Chenes Variation

We evaluated a variation for a 5.7-mile segment along proposed Loop 12 in Mackinac County, Michigan, to avoid the Pointe Aux Chenes Candidate Research Natural Area in the Hiawatha National Forest. Due to its unique vegetation type known as a wooded dune and swale complex, this area is currently being considered by the MIDNR as a significant natural area and by the FS for classification as a National Natural Landmark. In response to the DEIS, representatives from the Hiawatha National Forest expressed concern that the proposed loop would cross within the boundaries of the designated candidate area and that no alternative had been evaluated.

The variation would deviate from the proposed route at MP 671.4, would cross over the existing pipeline, and proceed in a southeasterly direction to the ridges along the outer boundaries of the Pointe aux Chenes Candidate Research Natural Area. The variation would follow the boundary to the east, cross over the existing pipeline and rejoin the proposed route at MP 677.1 (see figure A-1-28).

The Pointe aux Chenes Variation would be 0.4 mile longer than the proposed route. It would cross an additional stream and would require clearing an additional 7.5 acres of forestland and an additional 8.5 acres of wetlands. Furthermore, it would require an additional 22.7 acres of new right-of-way. Although the variation would avoid the boundaries of the Candidate Research Natural Area, the creation of new right-of-way within similar terrain and the additional impact on forest and wetland resources diminish its viability as a suitable alternative. For this reason, we do not recommend the Pointe aux Chenes Variation.

6.2 TENNESSEE

Tennessee proposes to construct 41.9 miles of pipeline looping in New York and Massachusetts. Our review identified no areas of significant environmental concern along proposed Segments 1, 3, and 4 in New York and Segment 9 in Massachusetts. Several residences would be affected by construction. Tennessee has agreed to use residential techniques which are set forth in table 5.1.9-3. We believe that proposed mitigation would adequately minimize impact on the affected residences.

However, a number of environmental issues were raised over the location of proposed Segment 8 in Longmeadow, Massachusetts. These concerns included the crossing of the Fannie Stebbins Memorial Wildlife Refuge and abutting "Meadows" (Longmeadow conservation land), impact on wetlands and two inactive town wells, the proximity of 45 residences at an average distance of 28 feet from the proposed pipeline centerline along Wolf Swamp Road, potential damage to ornamental crabapple trees that line Wolf Swamp Road, and adverse construction impact on the recently completed Wolf Swamp Athletic Field. In response to public comment, Tennessee realigned its proposed route along Wolf Swamp Road to locate the proposed pipeline underneath an existing sidewalk at an average distance of 46 feet from the residences. Although the new alignment would reduce construction impact on the Wolf Swamp Road residences to some degree, it did not address the other areas of concern. Consequently, we evaluated two variations as described in the following sections.

6.2.1 Longmeadow Variation

The Longmeadow Variation was originally evaluated by Tennessee as an alternative to the proposed routing. It would replace a 3.7-mile segment of the proposed route by parallelling existing pipeline and powerline rights-of-way through the southwestern portion of Longmeadow, Massachusetts, and the northern portion of Enfield, Connecticut. The variation would deviate from the proposed route at MP 261+1.8 and would proceed to the southeast parallel to an existing Algonquin pipeline right-of-way for approximately 3,800 feet to the Longmeadow-Enfield town line and the powerline right-of-way. At that point, it would cross to the south side of the powerline right-of-way and would follow the powerline generally northeast for approximately 23,700 feet, to rejoin the proposed route at MP 261+5.5 (see figure A-2-11).

The Longmeadow Variation would be approximately 1.5 miles longer than the proposed route and would require an additional 15 acres of forest clearing, an additional 0.8 acre of forested wetland clearing, and an additional 16.2 acres for the right-of-way. It would also cross an additional 1,500 feet of the Fannie Stebbins Memorial Wildlife Refuge and Raspberry Brook, which is known habitat for the spotted turtle, a Massachusetts-listed species of special concern. The variation would also cross approximately 2,700 feet of the Connecticut Water Service's Spring Lots Wellfield, where five active wells produced 308,950,000 gallons in 1989 (Kells, 1990). The wellfield supplies water to Enfield, Connecticut and also serves as a reserve for Longmeadow, Massachusetts. Two of these wells are located adjacent to the powerline right-of-way and the remaining three are south of the powerline right-of-way. The variation would affect 44 fewer residences (see table 6-1).

Although the Longmeadow Variation would avoid impact on the "Meadows," the two inactive Longmeadow town wells, and the concerns in the Wolf Swamp Road area, it could have a greater impact on a number of other significant environmental resources such as the longer crossing of Fannie Stebbins Memorial Wildlife Refuge and the crossing of the Connecticut Water Service's Spring Lots Wellfield. It would also affect an additional 3.1 acres of wetlands based on a survey conducted by Tennessee during 1989 at the request of the Longmeadow Conservation Commission. Impact from the Longmeadow Variation would generally be greater than the environmental impact from the proposed route, consequently we do not recommend its use.

6.2.2 Wolf Swamp Road Variation

This variation was identified to specifically address the remaining concerns along Wolf Swamp Road, which include the proximity of 45 residences to the proposed pipeline (generally, within 50 feet of the centerline), the tree belt along the road, and the Wolf Swamp Athletic Field. Tennessee has proposed mitigation measures for the crossing of the Fannie Stebbins Memorial Wildlife Refuge, which are described in section 5.1.9.2, and we believe these mitigation measures would minimize impact on that resource. In addition, we have recommended that Tennessee submit a mitigation plan detailing its proposed mitigation measures. Since the two town wells are located north of the proposed route and are presently inactive, we believe that the proposed construction would not affect these wells.

The Wolf Swamp Road Variation would deviate from the proposed route at MP 261+3.8 and would be relocated to within the Wolf Swamp and Denslow Roads to a point just past the Wolf Swamp Athletic Field at MP 261+5.5. At that point it would turn south to rejoin the proposed route (see figure A-2-11). Since all construction would occur within the roadways, which are approximately 10 to 40 feet north of the proposed route, impact on the residences, their front yards, and to the Wolf Swamp Athletic Field would be avoided as well as any potential damages to the trees that line Wolf Swamp Road (see table 6-1).

Tennessee has indicated that, based on its discussions with the town, there are a number of active and inactive utilities within Wolf Swamp and Denslow Roads. A water main is presently located just south of Wolf Swamp Road between the edge of the roadway and the tree belt. Placement of the proposed pipeline within the roadway would require that the pipeline be placed an average of 16 feet deep. Discussions between the Town of Longmeadow and Tennessee have determined that the preferred placement for the pipeline would be beneath the sidewalk that partially parallels Wolf Swamp Road (see comments G10-22 and L8-2 in Volume II of this EIS). Tennessee has proposed to relocate a water main presently located along a portion of the preferred alignment, and to replace ornamental trees removed or damaged during construction. Since the Town of Longmeadow supports that alignment, we do not recommend the Wolf Swamp Road Variation.

6.3 ALGONQUIN

Algonquin proposes to construct 24.2 miles of pipeline that would either loop or replace existing pipeline. Where 11.4 miles of pipeline would be replaced, we identified no variations, since the existing land use pattern would not change and environmental impact would be confined to the construction period. For the remaining 11.6 miles of proposed pipeline loops, two variations were identified to address residential concerns. No other environmental issues necessitating variations were identified.

6.3.1 Wawecus Hill Road Variation

This variation was identified for a 2.3-mile segment in Norwich, Connecticut, along the proposed E-1 Loop to avoid three newly constructed residences located at the intersection of Wawecus Hill Road and the pipeline right-of-way. The proposed pipeline would pass through the front yards of two of the residences and the backyard of another, which has a large retaining wall on a steep slope abutting the right-of-way. A large residential subdivision is located approximately 2,000 feet to the east of the proposed route and on the other side of the Connecticut Turnpike. As evidenced by the new construction on Wawecus Hill Road, residential development may be expanding to the west along Wawecus Hill and North Wawecus Hill Roads.

The variation would deviate from the proposed route at MP 2.5 at the point where the pipeline and powerline rights-of-way intersect. The variation would turn west and parallel the south side of the powerline right-of-way and continue for approximately 600 feet to a second powerline right-of-way. At this point, it would turn south and parallel the east side of the second powerline right-of-way until the powerline and pipeline rights-of-way intersect. The variation would then rejoin the proposed route at MP 4.8 (see figure A-3-10).

The Wawecus Hill Variation would be approximately 0.3 mile longer than the proposed route and would require an additional 4.1 acres of forest clearing and an additional

7 acres for right-of-way. It would require 0.1 acre less clearing of primarily forested wetland and would avoid impact on two residences (see table 6-1). The variation would also cross one less road, thereby minimizing the potential for residential encroachment. Although this variation would be longer and would require additional forest clearing, it would continue to make use of existing utility rights-of-way and would avoid disturbance to three new residences. For these reasons, we recommend use of the Wawecus Hill Variation. However, we recommend that Algonquin place the proposed permanent pipeline right-of-way within the existing electric transmission right-of-way between MPs 2.5 and 4.8. Additionally, the proposed pipeline construction right-of-way should extend no more than 25 feet outside of the existing electric transmission right-of-way. However, where, because of safety or environmental issues, it is not possible to place the entire 50-foot-wide permanent right-of-way within the electric transmission right-of-way, Algonquin should file with the Secretary of the Commission for review and approval by the Director of OPPR, the specific reasons for proposed variance to this recommendation. However, in no circumstance would it be acceptable for the pipe to be placed less than 5 feet within the edge of the electric transmission right-of-way.

6.3.2 Medfield Loop Variation

The Medfield Loop Variation was recommended in the DEIS for two primary reasons: 1) it would use existing rights-of-way for 82 percent of its length, thus reducing clearing requirements and the creation of new pipeline easements; and 2) it would affect approximately 50 percent less wetland acreage. However, it was noted that the route variation would affect an additional four residences and would cross through the fairways of the Glen Ellen Golf Course. Comments received on the DEIS from the town of Medway, landowners in the Skyview and Chestnut Hill Estates subdivision, and Algonquin have identified concerns about our recommendation of the Medfield Loop Variation.

To address these concerns, we have reevaluated the proposed route, the Medfield Loop Variation, and a number of potential route realignments submitted or recommended by the affected towns, the EFSC, and the affected landowners. The objective of the analysis was to identify a route that could feasibly resolve concerns associated with either the proposed route or the route variation (see figure A.3.10).

Medfield Loop Variation

The Holliston Town Engineer originally expressed concern that the proposed route would be constructed on new right-of-way requiring additional clearing, that the proposed route would affect more landowners, would affect more wetlands, and would possibly prohibit development of residential lots in Holliston where large lot sizes are required for sanitary sewer systems. The EFSC concurred and added that the proposed route would affect two residences at Hill Street (MP 0.8) and one residence at Norfolk Street (MP 1.3). Subsequent to the recommendation of the Medfield Loop Variation in the DEIS, the Town of Medway and landowners within the Skyview and Chestnut Hill Estates subdivision (MP 0.5) expressed concern about the proximity (15 to 50 feet) of the variation right-of-way to eight residences within the subdivision. The variation right-of-way would also reduce acreage of four unbuilt residential lots. To resolve concerns in the Skyview and Chestnut Hill Estates subdivision area, we looked at three potential alternatives to the Medfield Loop Variation (figure A-3-10).

The first potential alternate was identified by the Town of Medway. The Hill Street Alternate No. 1 would turn east off of the powerline right-of-way at Hill Street (MP 1.8), would proceed east on Hill Street to Holliston Street, and turn south on Holliston Street, and east to rejoin the Medfield Loop Variation. The pipeline would be placed within the streets along this approximate 2,000 foot alternate. Although no residential properties would be disturbed by construction of this alignment, seven residences would be indirectly affected by traffic disruption during construction.

The second potential alternate was identified by the Holliston Town Engineer to resolve the impact on the Skyview and Chestnut Hill Estates subdivision. Hill Street Alternate No. 2 would deviate from the proposed route and the powerline right-of-way approximately 250 feet south of Hill Street (MP 1.7). The potential alternate would turn east, follow the southern edge of residential lots along Hill Street, and rejoin the Medfield Loop Variation. Trees would be removed along the rear lot lines of four residences along this alternate.

The third alternate, the Skyview Drive Alternate, was identified by a resident of the Skyview and Chestnut Hill Estates, and would leave the powerline right-of-way and the proposed route at MP 0.4, would turn east to follow Skyline Drive to the intersection with Holliston Street, and then turn north along Holliston Street to rejoin the Medfield Loop Variation. The proposed pipeline would be placed within the streets for the entire approximate 2,500 foot segment. Although this alternate would avoid direct impact on residences within the Skyview and Chestnut Hill Estates subdivision, it would indirectly affect over 12 residences on Skyline Drive as well new construction that is occurring on the east side of the powerline right-of-way on a cul-de-sac at the end of Skyline Drive. Traffic disruption would also occur on Holliston Street during construction.

Although these potential route alternates would avoid or minimize impact on the Skyview and Chestnut Hill Estates subdivision and the concerns originally identified by the EFSC and the Holliston engineer, no one alternate proved superior and each ultimately transferred impact on other residences or to residences previously unaffected. Furthermore, we remained concerned about the crossing the Glen Ellen Golf Course and the impact on 5 residences in Millis: one off of Orchard Street at approximate MP 1.7, and four off of Propect and Walnut Streets between approximate MPs 2.7 - 3.0. Based on the above, we do not recommend the Medfield Loop Variation or any of the potential alternates.

Medfield Loop Modification

The concerns identified with the proposed Medfield Loop included two residences at Hill Street, one residence at Norfolk Street, a forested wetland between MPs 0.8 to 1.3, and the residential building lots at MP 1.8. The residences at Hill and Norfolk Streets are located adjacent to the powerline right-of-way; the forested wetland abuts the western edge of the powerline right-of-way between Hill and Norfolk Streets. Tree screening between the residences and the powerline right-of-way presently exists only at the residences on Hill Street. We have recommended in section 5.1.9.1.2 and on table 5.1.9-3 that Algonquin place the proposed pipeline within the existing powerline right-of-way and limit the pipeline construction right-of-way to a maximum of 25 feet outside of the powerline right-of-way. This recommendation would reduce or eliminate impact on the three residences and the wetland.

To minimize impact on potential residential building lots near MP 1.6, we identified the Medfield Loop Modification as shown on figure A.3.10. The modification would deviate from the proposed route at MP 1.7 and would deviate to the south passing along the southern edge of the affected residential building lots before rejoining the proposed route at MP 2.2.

The modification would be 100 feet longer than the proposed route, would require approximately 0.3 acre of additional forest clearing, and would cross approximately 200 feet of scrub-shrub wetland instead of 200 feet along the edge of a forested wetland (see table 6-1). Since this modification would reduce impact on the residential buildings lots without additional impact to other resources, we recommend the Medfield Loop Modification.

6.3.3 Tiverton Loop Variation

We evaluated a variation for a 0.7-mile segment along the Tiverton Loop in response to comments received on the DEIS from RIDEM regarding the proposed crossing of approximately 2,950 feet of wetlands. Most of the wetland crossing (2,600 feet) would be associated with crossing through the southwestern portion of the forested Pocasset Cedar Swamp. Additionally, we noted a residence adjacent to the existing right-of-way on Fish Street (MP 1.8) where mature tree screening would be removed by construction of the proposed Tiverton Loop.

The Tiverton Loop Variation would deviate from the proposed route at MP 0.8 approximately 200 feet south of Eagleville Road. The variation would cross over the existing pipeline, continue in a northwesterly direction across Eagleville Road and along the southern edge of the Pocasset Cedar Swamp. It would then turn northwest through scrubland to Fish Street, would cross Fish Street through an open field area between two residences, turn directly north through open yards adjacent to Fish Street and to two duplexes, and cross over the existing pipeline to rejoin the proposed route at MP 1.6 (see figure A-3-12).

The Tiverton Loop Variation would be 0.1 mile longer than the proposed route, would require 4.3 additional acres of scrub/woodland clearing, and 3.1 additional acres of right-of-way. Wooded wetland clearing would be reduced by 2.4 acres. One residence would be affected along the proposed route and one duplex along the variation (see table 6-1). However, the variation would not require the removal of tree screening as it would be placed through open lawn areas. Since the variation would eliminate all but one 350 foot wooded wetland crossing and would eliminate the removal of mature tree screening adjacent to a residence, we recommend the use of the Tiverton Loop Variation.

6.4 CNG

CNG proposes to construct most of its 2.7 miles of pipeline adjacent to two existing Niagara Mohawk Power Company rights-of-way. The proposed route would parallel the first powerline right-of-way for approximately 0.8 mile from the inception point, would then utilize new right-of-way for approximately 0.5 mile to the intersection with the second existing powerline right-of-way that would parallel to its terminus west of the Hudson River. Our review of the proposed route indicated that an alternative crossing between the two powerline rights-of-way could reduce forest clearing and avoid the creation of new right-of-way through forestland.

6.4.1 River Road Variation

The River Road Variation was identified for a 1.2-mile segment in East Greenbush, New York, to maximize use of agricultural land for the new right-of-way and to minimize the creation of new right-of-way through forestland. The variation would deviate from the proposed route at MP 0.8 and would continue to parallel the south side of the powerline right-of-way for approximately 4,400 feet. At that point, it would turn northwest crossing an agricultural field for a distance of approximately 1,200 feet before rejoining the proposed route at MP 2.0 (see figure A-8-4).

As shown on table 6-1, the variation would be approximately 0.1 mile shorter than the proposed route and would parallel an additional 0.1 mile of powerline right-of-way. It would require 2.7 fewer acres of forest clearing, 0.6 acre less right-of-way, and would make use of an additional 1.4 acres of cropland. Wetland clearing and stream crossings would be similar for either route. However, the variation would cross an additional 0.1 mile (affecting approximately 0.6 acre) of the Papscanee Marsh and Creek, a NYDEC-designated significant coastal fish and wildlife habitat. The proposed route would coincide with the northern boundary of the designated area. Although there are advantages to the use of the River Road Variation, we believe these advantages are outweighed by the potential impact associated with pipeline construction through the Papscanee Marsh and Creek, and therefore we do not recommend use of the variation.

7.0 STAFF'S CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations presented herein are those of the staff of the Federal Energy Regulatory Commission (FERC or Commission).

Information provided by the applicants and further developed from field investigations, literature research, route deviation analysis, and contacts with Federal, state, and local agencies and individual members of the public indicates that construction of the proposed Niagara Import Point (NIP) Project would result in a limited, adverse environmental impact. However, if constructed and operated in accordance with our recommendations, it would be an environmentally acceptable action. To ensure compliance with all mitigation measures proposed or ultimately imposed as certificate conditions, we recommend that all applicants be required to employ at least one environmental inspector per construction spread.

Several important factors were considered closely in our determination. A major consideration was the extent to which the proposed facilities would make use of the existing pipeline rights-of-way. Of the 544.7 miles of proposed pipeline, 541.8 miles would be on or adjacent to existing pipeline rights-of-way. The use of existing rights-of-way generally minimizes environmental impact. Another consideration was the extent to which we were able to recommend mitigative construction techniques. In some instances, we have recommended alternative routes for the proposed pipelines to avoid impact on wetlands, residential areas, and other areas of concern. Finally, we have developed, in conjunction with other Federal cooperating agencies, a clearly defined, standardized set of construction procedures for stream and wetland crossings that would significantly reduce the impact of pipeline construction on these valuable resources. Specific erosion control, revegetation, and right-of-way maintenance procedures are also recommended.

Our responsibility in this proceeding is to identify significant potential environmental effects so that they can be considered in the decision-making process. We have developed and recommended additional mitigative measures that we believe to be appropriate and reasonable for the construction and operation of the natural gas pipeline facilities. We believe that these measures would significantly reduce the environmental impact that would otherwise result from construction of the project as proposed. We recommend that these measures be attached as conditions to any certificate issued by the Commission.

7.1 SUMMARY OF THE STAFF'S ENVIRONMENTAL ANALYSIS OF THE PROPOSED ACTION

The following discussion describes effects on resources associated with the proposed action that are of particular concern.

Overall impact on geologic resources would be minimal. Where exploitable mineral resources are crossed, the applicant would compensate lease owners. Geologic hazards should not significantly affect pipeline construction and operation. There are no active faults in the proposed project area and any reasonable anticipated level of seismic activity would be limited to moderate ground shaking and would not cause a modern welded steel pipeline to rupture. Landslide and karst hazards exist along several proposed loops in the project area. However, no adverse effects from these hazards are known to be associated with the existing pipelines in these areas. Blasting would be necessary along a portion of the proposed route and in some areas would occur in areas near several residences.

Each of the applicants' proposed facilities would cross some steeply sloping soils where erosion is likely. The proposed routes crossed by Transco, Texas Eastern, CNG, and National Fuel/Penn-York are within the most rugged terrain that would be crossed by the proposed pipelines. Each of the applicants would cross some wet soils, because of a seasonal high water table, that would be susceptible to soil structure and drainage impact. The greatest portion of this soil type would be crossed by Great Lakes (86.8 miles). A total of 13.4 miles of these soils would be crossed by the remaining applicants. Great Lakes would also cross 61 miles of wet, organic peats and mucks, which would also be susceptible to soil structure impact. Most of the applicants would cross soils where depth-to-bedrock is less than 5 feet and blasting may be required, including Great Lakes (9.7 miles), Tennessee (2.7 miles), Algonquin (1.7 miles), Transco (3.7 miles), Texas Eastern (1.1 miles), and CNG (0.8 mile). Blasting would necessitate stone removal and pipeline padding.

Construction of Transco's and National Fuel/Penn-York's proposed compressor stations would affect 39 acres and 55 acres of prime farmland, respectively. However, only a total of 8 acres on each site would be permanently disturbed by construction of the compressor stations. Less than 1 acre would be permanently disturbed by Transco's Compressor Station 167.

If mitigative measures in the applicants' proposed erosion and sedimentation control plans are followed, as well as our recommendations, effects such as erosion, soil structure, and drainage alteration would not be significant.

The proposed Algonquin facilities would traverse three locally zoned aquifer well-protection areas in the towns of Seekonk, Wareham, and Bourne, Massachusetts. Potential impact on public groundwater supplies includes contamination from spills of hazardous substances and damage to groundwater supply systems resulting in altered yields and water quality. The mitigative measures we recommend would avoid or greatly reduce potential impact on these groundwater resources. In the unlikely event that private or public supply systems are determined to be damaged by pipeline installation activities, the applicants would be required to provide compensation.

The proposed Great Lakes facilities would traverse a total of 141 water bodies, the majority of which are classified as good quality coldwater streams capable of supporting cold-water fish species such as trout. The Bois Brule River is considered to be an outstanding recreational resource and we recommend that site-specific procedures for pipeline installation across this river be submitted to FERC for review and approval by the Director of the Office of Pipeline and Produce Regulation (OPPR).

A total of 72 surface water bodies, including the Niagara, Hudson, and Delaware Rivers, would be crossed by the remaining applicants' facilities. Tennessee has indicated that the Niagara River (Segment 2) would be crossed using directional drilling methods. We recommend that, prior to construction, Tennessee submit to FERC copies of its construction plans and a drilling fluids management plan to be reviewed and approved by the Director of OPPR. CNG and Transco have indicated that the pipelines would be installed across the Hudson and Delaware Rivers, respectively, utilizing open-cut trenching construction methods.

To avoid resuspension of potentially contaminated sediments, we have recommended that CNG conduct chemical testing of surficial and subsurface sediments at the proposed Hudson River crossing. The results of the testing should be filed with the Secretary of the Commission for review by the Director of OPPR, with the COE and with appropriate state water quality management agency.

The stream construction procedures and timing restrictions we recommend would reduce or eliminate potential impact on surface waters. Turbidity, sedimentation, and related impact on larger surface waters would be locally significant, but temporary. Impact would occur primarily during pipeline installation, which may take from 1 to 3 days for streams less than 100 feet wide. Effects from turbidity and sedimentation on sensitive streams and streams less than 10 feet wide containing coldwater or significant warmwater fisheries would be greatly reduced by requiring the applicants to flume the streamflow prior to excavation.

Our determination that construction of the proposed facilities would not result in unacceptable environmental impact is based on the assumption that the pipeline construction would strictly conform to proposed construction methods, mitigative measures, and to our additional recommendations, including the "Erosion Control, Revegetation, and Maintenance Plan" as outlined in appendix C and the "Stream and Wetland Construction and Mitigation Procedures" (Procedures) as outlined in appendix D.

The proposed Great Lakes facilities would cross 22 water bodies containing fisheries of special concern while Tennessee, Transco, and CNG would cross 5, 2, and 1 special concern fisheries, respectively. Our recommended Procedures would minimize potential adverse impact on fisheries resources. In addition to these procedures, we recommend the applicants comply with site-specific restrictions and mitigative measures to protect fishery resources. We recommend that site-specific procedures be used for the following surface water crossings: Mississippi River, Bois Brule River, Welch Creek, Seimens Creek, Powder Mill Creek, Planters Creek, Henderson Creek, Cooks Run, Tacoosh River, Sturgeon River, Brevoort River, Maple River, Muskeg Creek, Trask Creek, Iron River, DeChamps River, Two Mile Creek, Middle Branch Ontonagon River, South Branch Paint River, North Branch Iron River, Manistee River, Delaware River, and Hudson River.

The proposed NIP Project facilities would traverse approximately 93 miles of state-designated significant wildlife habitats. These include deer wintering areas (DWAs), which would be traversed by Great Lakes, and the Papscanee Marsh waterfowl habitat, which would be traversed by CNG. Although DWAs are an important component of deer habitat in northern Minnesota, Wisconsin, and Michigan, suitable DWA habitat is relatively abundant within the Great Lakes project area, and is therefore not a limiting factor for the deer populations. The greatest potential impact on deer using DWAs would be the disturbance created by construction or increased public access during midwinter. We recommend that if construction is scheduled to take place within state-identified DWAs between December 1 and March 1, Great Lakes consult with regional DNR personnel and develop mitigation measures, where appropriate, to minimize potential impact on wintering deer.

Two privately owned wildlife refuges would be traversed by proposed NIP Project facilities: the Fannie Stebbins Memorial Wildlife Refuge by Tennessee's Segment 8 and the Caratunk Wildlife Refuge by Algonquin's G-5 Replacement. Although we evaluated route variations to avoid the Fannie Stebbins Wildlife Refuge, no route variation was identified that would significantly reduce environmental impact (see section 6.2.1). For the Caratunk

Wildlife Refuge, we recommend that no additional right-of-way be cleared and that construction be limited to a low-use time of year.

Nine federally listed or proposed endangered or threatened wildlife, fish, and plant species may occur within the vicinity of the proposed NIP Project facilities. Although no designated critical habitat for these species would be affected, several proposed Great Lakes loops would pass near bald eagle nesting habitat or known nest sites. The U.S. Fish and Wildlife Service (FWS) has recommended that mitigation measures be incorporated into construction plans to prevent adverse impact on this species. We recommend that Great Lakes implement these measures. In addition, the FWS has identified two locations where field surveys are required to determine if proposed construction would directly affect bald eagle nesting habitat. We recommend that Great Lakes conduct field surveys of these areas and incorporate minor route variations if required to avoid direct impact on nesting habitat. Great Lakes would be required to file results of the surveys with the Secretary of the Commission for the review and approval of the Director of OPPR prior to construction.

Two federally listed endangered bird species, the piping plover and Kirtland's warbler, may occur in several counties that would be traversed by the proposed Great Lakes loops. No suitable habitat for the piping plover would be crossed by the proposed facilities. A Kirtland's warbler management area would be crossed. However, the habitat in this area is not currently suitable, and no Kirtland's warblers have been recorded within this management area. We have concluded that there would be no impact on these species. However, we recommend Great Lakes consult with FWS to determine if any occupied habitat for the Kirtland's warbler occurs within 0.5 mile of any planned construction activity. If Kirtland's warblers are determined to be within this area, Great Lakes must provide comments from FWS for review and approval by the Director of OPPR prior to construction.

The proposed Great Lakes facilities in Minnesota and Wisconsin would be within the range of the federally listed gray wolf. Because of the mobility and large home range of this species, we have concluded that the proposed pipeline construction would have no adverse effect on the gray wolf.

One federally listed plant, the dwarf lake iris, occurs in the vicinity of Great Lakes' proposed Loop 12. The federally listed Pitcher's thistle and Houghton's goldenrod may also occur in the vicinity of Loop 12, and the Michigan monkey-flower, which is proposed for Federal listing, may occur in the vicinity of Loops 11 and 12. Great Lakes plans to conduct a field survey in spring 1990 to determine if the dwarf lake iris would be affected by the proposed construction. We recommend that Great Lakes also survey for the Pitcher's thistle, Houghton's goldenrod, and Michigan monkey-flower, and submit the results of these surveys, as well as appropriate mitigative measures, to FERC for review and approval of the Director of OPPR prior to construction.

The federally listed endangered shortnose sturgeon occurs in the Hudson River within the reach that would be crossed by the proposed CNG TL-470 Line. Based on consultation with the National Marine Fisheries Service (NMFS), we recommend that the river crossing be conducted between November 1 and April 1. This timing restriction would ensure that the proposed Hudson River crossing would not affect the shortnose sturgeon.

The proposed NIP Project facilities could affect several state-listed fish, wildlife, and plant species. Construction activities could result in loss of habitat and/or some individuals

of these species. We recommend that the applicants, in consultation with the appropriate state agencies, conduct field surveys of known and suspected sites of state-listed species to determine the need for further mitigative measures. Where mitigative measures would involve route realignment, we recommend that plans be submitted to FERC for review and approval prior to construction.

Construction of the 17 proposed Great Lakes loops would result in the clearing of approximately 874 acres of forestland (including forested wetland). Great Lakes proposes to maintain approximately 226 acres of forestland permanently free of woody vegetation, while the remaining 648 acres of cleared forestland would be allowed to revegetate. Construction of the facilities proposed by the seven remaining applicants would result in the clearing of approximately 166 acres of forestland (including forested wetlands). Approximately 93 acres of upland forest and 15 acres of forested wetland would be maintained permanently free of woody vegetation, while the remaining 58 acres of cleared forestland would be allowed to revegetate. Our Procedures would require that forested wetland areas also be allowed to revegetate to a scrub-shrub state.

Construction of the proposed Great Lakes loops would require crossing approximately 84 miles of wetlands, and the disruption of approximately 509 acres of wetland habitat. Construction of the facilities proposed by the seven remaining applicants would require crossing approximately 5.6 miles of wetlands, and the disruption of approximately 26.5 acres of wetland habitat. In general, impact on wetlands would be temporary. The only significant long-term impact would be the alteration of forest vegetation.

Use of recommended Procedures would mitigate the effect of construction activities on wetland resources. These Procedures include: segregating topsoil during trenching for redistribution after pipe placement, restricting construction access, and using wooden mats as working platforms for construction equipment in wetland areas. In addition, rights-of-way through forested wetlands would be allowed to revegetate, except for the selective cutting of trees within 15 feet of the pipeline that are greater than 15 feet in height. These Procedures, in addition to several route variations recommended to either completely avoid wetlands or to reduce the amount of clearing, would significantly reduce the disturbance of this resource.

Construction of the proposed NIP Project pipelines would temporarily affect a total of 5,160.5 acres of land: 4,403.6 acres for Great Lakes, 380.7 acres for Tennessee, 204.2 acres for Algonquin, 76.3 acres for Transco, 45.5 acres for Texas Eastern, 24.5 acres for CNG, 20.0 acres for National Fuel/Penn-York, and 4.8 acres for CNG/Texas Eastern. Scrub-shrub and other land would account for approximately 53 percent of the affected acres, woodland for 20 percent, agricultural land for 25 percent, and residential with some commercial/industrial land for the remaining 2 percent.

Operation of the proposed pipelines would require approximately one-third, or 1,898.3 acres, of the land affected by construction for the new permanent pipeline right-of-way. Where the applicants have proposed to maintain pipeline rights-of-ways that are greater than normal industry standards (Great Lakes, CNG, and National Fuel), we recommend limiting the right-of-way widths.

A total of 148 residences would be located within 50 feet of the proposed construction right-of-way: 31 along Great Lakes' proposed loops, 56 along Tennessee's

proposed segments, 59 along Algonquin's pipeline facilities, and 1 each along Texas Eastern's and Transco's proposed loops. Our specific recommendations to minimize construction disturbances to these residences are outlined in tables 5.1.9-2 and 5.1.9-3.

Construction of the proposed NIP Project aboveground facilities would have minimal adverse impact on existing land uses and nearby residences since most of the facilities would be constructed within existing fencelines. Where new facilities would be constructed (i.e., Transco's Compressor Stations 205 and 167 and Sayreville Meter Station, and National Fuel/Penn-York's Concord Compressor Station), approximately 9 acres of woodland and 17 acres of agricultural land would be permanently converted from existing use to utility land use.

Recreation or special interest areas crossed by the proposed NIP Project pipelines include: 57.3 miles through four national forests, 48.6 miles through 11 state forests; 23.2 miles through various parcels of state, county, town, and other publicly owned land; 1.3 miles through golf courses; 0.7 mile through the Leech Lake Indian Reservation; three navigational rivers; one of Wisconsin's premier rivers (Bois Brule River); and 18 potential candidate or recreational rivers. Most of these crossings would occur along the Great Lakes proposed loops.

We recommend that construction and new permanent pipeline right-of-way be minimized through national and state forests and some of the more environmentally sensitive publicly owned land (i.e., Fannie Stebbins Memorial and Caratunk Wildlife Refuges). We also recommend that the applicants offer to install and maintain barriers or fences to prevent or limit vehicular access to the pipeline right-of-way. At the crossing of all potential candidate rivers nominated for inclusion in the national or Michigan inventories of wild and scenic rivers, we recommend that mitigation and restoration plans be submitted prior to construction. Proposed construction through two of the golf courses would have minimal effect as they would be crossed along the course boundaries; for two of these golf courses, we recommend Tennessee determine the need to construct during the off-peak season.

Because not all Phase 1 and Phase 2 cultural resources identification and evaluation studies and analyses have been completed, it is not possible to discuss the actual number or density of those properties listed in or eligible for listing in the National Register of Historic Places (NRHP) that would be affected by project construction and operation. However, based upon the studies that have been completed for segments of the project, overall impact on cultural resources for the entire proposed NIP Project would not be significant.

Three areas of concern that have been identified are the Leech Lake Indian Reservation within a proposed Great Lakes Minnesota loop; and the complex of 17th-century and possible prehistoric sites on Papscanee Island within the proposed CNG right-of-way. At present, we are working with the applicants to identify and measure potential effects on these resources and investigate means to avoid adverse effects.

7.2 ALTERNATIVES

Alternatives we consider to satisfy the need to construct the NIP Project include no-action and energy alternatives. The no-action alternative would avoid all the environmental effects of the proposed project. The Northeast would forego the

environmental benefits associated with the use of natural gas. Potential users of the project's natural gas would be required to use other energy sources, most of which, when combusted, are not as clean as natural gas.

In assessing system alternatives, we did not find another delivery system in the United States that could be used to deliver the volume of gas that would be transported by Great Lakes for TransCanada. Because the other applicants have primarily proposed looping, pipeline replacement, and new and additional compression facilities at various points along their existing systems, no alternative systems exist that would service the diverse geographic locations of their customers.

Major route alternatives, following routes significantly different from those proposed, were not considered because site-specific problems along the proposed rights-of-way are not significant enough to warrant consideration of significantly different routes.

Route variations were identified and assessed to avoid or reduce impact associated with pipeline construction and operation of various resources, including residential areas, sensitive or significant habitats or water crossings, recreational areas, and wetlands. A total of 18 variations were considered. Of those considered, 5 have been recommended for adoption (see table 7.2-1).

7.3 FERC STAFF RECOMMENDED MEASURES

To further mitigate the environmental impact associated with the construction and/or operation of the proposed pipeline facilities, we recommend that the following mitigative measures be included as specific conditions to any certificate issued by the Commission. Recommendations 1 through 19 pertain to multiple applicants and 20 through 86 to individual applicants. The number found at the end of each recommendation refers back to the Draft Environmental Impact Statement (DEIS) so that the reader can compare between the draft and final easily.

For the following recommendations (2, 3, 4, 7, 8, 9, 11, 14, 16, 17, 18, 19, 22, 23, 24, 26, 32, 34, 39, 45, 46, 51, 52, 54, 56, 62, 67, 68, 72, 75, 76, 79, 82, 83, 84, 85, 86) the applicants would be required to file with the Secretary of the Commission specific information for the review and approval of the Director of OPPR prior to construction.

Multiple Applicants

1. All applicants shall adhere to the construction procedures and mitigative measures described in their respective applications and in their responses to the staff's data requests, except as otherwise modified by these certificate conditions. (DEIS recommendation 1)

2. All applicants shall submit detailed alignment maps and aerial photography at a scale not smaller than 1:6,000 that identifies all staging areas, pipe storage yards, access roads, and other areas that would be used or disturbed. Any alteration to the mapped route or aboveground facility locations as shown on the 1:6,000 scale aerial photographs filed with the Commission with their respective applications as well as reflected by the EIS route maps, other than the staff's recommended variations and minor field realignments per landowner needs and requirements, shall be clearly

TABLE 7.2-1

Summary of Route Variations

Applicant/ Segment	Route Variation Name	County/State	Location	Status
GREAT LAKES				
Loops 1 & 2	U.S. Route 59 Wetland	Marshall, MN	MPs 59.2 - 60.6	Not Recommended
Loops 1 & 2	New Solum Wetland	Marshall, MN	MPs 62.7 - 64.0	Not Recommended
Loop 3	Pine Lake Wetland	Clearwater, MN	MPs 116.0 - 116.9	Not Recommended
Loop 3	Clearbrook Wetland	Clearwater, MN	MPs 118.3 - 119.5	Recommended
Loop 4	Chippewa National Forest	Cass/Itasca, MN	MPs 183.7 - 201.1	Not Recommended
Loop 6	Swan River	Itasca, MN	MPs 237.1 - 241.2	Not Recommended
Loop 7	Bois Brule River	Douglas, WI	MPs 327.0 - 329.3	Not Recommended
Loop 11	Indian River	Schoolcraft, MI	MPs 598.1 - 599.3	Not Recommended
Loop 11	Manistique River Wetland	Schoolcraft, MI	MPs 602.6 - 603.6	Not Recommended
Loop 11	McIntyre Lake Wetland	Schoolcraft, MI	MPs 609.3 - 612.0	Recommended
Loop 12	Point aux Chenes	Mackinac, MI	MPs 671.4 - 677.1	Not Recommended
TENNESSEE				
Segment 8	Longmeadow	Hampden, MA	MPs 261+1.8 - 261+5.5	Not Recommended
Segment 8	Wolf Swamp Road	Hampden, MA	MPs 261+3.8 - 261+5.5	Not Recommended
ALGONQUIN				
E-1 Loop	Wawecus Hill Road	New London, CT	MPs 2.5 - 4.8	Recommended
Medfield Loop	Medfield Loop	Norfolk/ Middlesex, MA	MPs 1.0 - 3.2	Not Recommended
Medfield Loop	Medfield Loop Modification	Norfolk/ Middlesex, MA	MPs 1.7 - 2.2	Recommended
Tiverton Loop	Tiverton Loop	Newport, RI	MPs 0.8 - 1.6	Recommended
CNG				
TL-470 Line	River Road	Rensselaer, NY	MPs 0.8 - 2.0	Not Recommended

identified and must be filed with the Secretary of the Commission and approved by the Director of the Office of Pipeline and Producer Regulation (OPPR) prior to implementation.

Alterations requiring approval shall include all route changes resulting from implementation of cultural resource mitigation measures; endangered, threatened, or special-concern species mitigation measures; further route modifications that may be recommended by the state regulatory authorities; final alignments through ongoing and planned developments; and those agreed to for individual landowners that also affect the route on adjacent properties. (DEIS recommendation 2, modified)

3. The authorized pipeline routes and aboveground facility locations shall include all of the staff's recommended route variations and construction procedures identified on tables 5.1.9-2, 5.1.9-3, and 7.2-1 of this Environmental Impact Statement (EIS). Where types "B" and "C" construction are specified on table 5.1.9-3, the applicants shall file, prior to construction, detailed construction and right-of-way restoration plans with the Secretary of the Commission for review and approval by the Director of OPPR. (DEIS recommendation 3)

4. Within 30 days of the issuance of a certificate for this project, each applicant shall file with the Secretary of the Commission for review and approval by the Director of OPPR a plan describing how the mitigative measures identified in section 7.3 of this EIS will be implemented. The plan must identify dates for 1) the completion of cultural resource requirements and other required surveys, 2) the start of construction, and 3) start and completion of restoration. (DEIS recommendation 18)

5. All applicants shall implement the "Erosion Control, Revegetation, and Maintenance Plan" contained in appendix C for all disturbed areas, and shall implement the "Stream and Wetland Construction and Mitigation Procedures" contained in appendix D when constructing across flowing streams, rivers, and wetlands. Where a site-specific certificate condition conflicts with a requirement of these procedures, the site-specific condition takes precedence. Any other deviation from these procedures must be reported to and approved by the Commission staff at least 2 weeks prior to implementation. Any deviation that the staff determines to be significant cannot be implemented without the prior written approval of the Director of OPPR. Timber needed for work pads may also be obtained from the National Forests through the Forest Service permitting process. (DEIS recommendation 8, modified)

6. All applicants shall employ at least one environmental inspector per construction spread to monitor compliance with all mitigative measures. The environmental inspector's duties and responsibilities shall also include those described in section 5.1.2.2. of this EIS and the Erosion Control, Revegetation, and Maintenance Plan (see appendix C). (DEIS recommendation 5, modified)

7. Prior to initiating service to the nonjurisdictional customers identified in this EIS, the applicant that makes the delivery shall certify that all necessary permits to construct and operate the associated nonjurisdictional facilities have been obtained. Copies of all applicable permits, including any conditions and stipulations, shall be filed with the Secretary of the Commission. No gas service shall be rendered until the Director of

OPPR has reviewed this material and approved the commencement of the service. (DEIS recommendation 7, modified)

8. Great Lakes, CNG, Tennessee, and Algonquin shall not construct facilities within state coastal zone management areas until they have filed proof with the Commission that the responsible state agencies concur that the proposed facilities are consistent with the state's coastal zone management program. In addition, no delivery of gas shall begin until such proof has been filed for the nonjurisdictional facilities prior to their construction.

9. Prior to commencing pipeline construction, all applicants shall prepare, and file with the Secretary of the Commission, for review and approval by the Director of OPPR, a proposed groundwater monitoring plan designed to provide a program for site-specific identification of community and private water supply wells and springs located near the proposed routes. The plan shall also provide for documentation of pre- and post-construction well- and spring-water quality and yields and should be of adequate detail to determine with relative certainty whether the pipeline construction was responsible for any adverse impact on the groundwater user. In the event that private wells or springs identified as a result of the groundwater monitoring program are damaged by pipeline construction activities, the applicants shall provide an emergency source of potable water and shall restore the system to its original capacity. (DEIS recommendation 10, modified)

10. No applicant shall conduct refueling activities or store hazardous material within any designated well protection area(s) or within 200 feet of any private, municipal or community water supply well. (DEIS recommendation 10, modified)

11. All applicants shall prepare and file with the Secretary of the Commission a Spill Prevention, Containment, and Control Plan which describes the preventive and mitigative measures to be employed to minimize the impact associated with such occurrences. These measures should include but not be limited to: requiring all fueling and lubrication to be done in areas designated for such purposes, with such areas to be located away from all water bodies; requiring each construction crew to have on-hand sufficient supplies of absorbent and barrier materials to allow the rapid recovery of any spills; and development of standing procedures regarding excavation and off-site disposal of any soil materials contaminated by spillage. (DEIS recommendations 11 and 12, modified)

12. To prevent compaction and rutting of soil in agricultural and residential areas, construction shall not be conducted during the wettest time of the year (April 15 to May 31 for Great Lakes Loops 1 through 14 and April 1 to May 15 for the remaining project areas). (DEIS recommendation 13)

13. All applicants shall conduct a comprehensive preconstruction survey to locate soil drainage systems. This survey should include input from landowners, state agencies, and the U.S. Department of Agriculture Soil Conservation Service (SCS). Further, both shall repair traversed soil drainage systems and demonstrate the effectiveness of such repairs. Qualified specialists shall be used to insure proper repairs and adequate probing/testing of the repaired drainage systems. In addition, the applicants shall, as part of their normal maintenance, monitor and correct any future drainage

problems that have resulted from pipeline construction. (DEIS recommendation 14, modified)

14. Prior to construction, all applicants shall identify, and file with the Secretary of the Commission for review and approval by the Director of OPPR, the preferred method of disposal for construction-related bulk waste and provide an identification of landfills to be used. (New recommendation)

15. No applicant shall pile excavated rock on or adjacent to the existing rights-of-way without approval of the landowner. (DEIS recommendation 16, modified)

16. All applicants shall complete all Phase 1 and Phase 2 cultural resource reports required under the Commission's July 27, 1988, order, and forward copies to the Director of OPPR and the appropriate State Historic Preservation Officers (SHPOs). This requirement shall apply to the proposed action and to the related nonjurisdictional projects identified in this EIS.

    a. In all cases where cultural resources in or eligible for the listing in National Register of Historic Places (NRHP) are found within the project area, applicants shall attempt to avoid these resources. Any modifications, including route realignments, shall be filed with the Secretary of the Commission for review and approval by the Director of OPPR in accordance with condition no. 1.

    b. Where cultural resources such as archeological sites, historic districts, and significant standing structures that are in or meet the criteria for NRHP eligibility are located in the proposed project area and cannot be avoided or would be visually affected by the project, applicants shall prepare Phase 3 mitigation or data recovery plans and submit the plans to the SHPO for comment and to the Secretary of the Commission for review and approval by the Director of OPPR.

    c. No construction shall begin in those portions of the proposed project area or any other areas that would be disturbed (e.g., staging areas, storage and maintenance areas, access roads) that contain significant cultural resources until the Director of OPPR has reviewed and approved all cultural resource surveys and mitigation plans, and has considered any comments by the appropriate SHPOs and the Advisory Council on Historic Preservation and has provided written approval. (DEIS recommendation 6, modified)

    This condition does not apply to any facilities or segments that have been found to have no effect on NRHP-listed or -eligible resources, as identified in table 4.1.11-1.

17. All applicants, after consultation with the State Historic Preservation Officer (SHPO) and the U.S. Department of Interior, shall provide pertinent details regarding the project to Indian tribes (including for Great Lakes the Leech Lake Indian Reservation), identified interested Native American groups, and other interested individuals and ethnic groups identified by the SHPO. The applicants shall consult with these parties regarding potential impact of the project on sacred areas, archeological sites, burial, and other ethnographic use areas, with particular reference

to traditional plants, animals, and ritual areas. The applicants shall provide copies of all correspondence with the above parties and all documentation on traditional Native American concerns resulting from the consultations in the cultural resources technical report. Due to the sensitive nature of this information, all such data shall be provided to the appropriate SHPOs marked "Sensitive - Do not release to general public," and filed with the Commission marked "Privileged - Do not release." (DEIS recommendation 17)

18. All applicants shall file documentation with the Secretary of the Commission regarding notification and consultation of potential impact of this project to appropriate "acknowledged" traditional tribal leaders. Documentation should be provided to the FERC in the form of a technical report. (DEIS recommendation 19)

19. CNG, Tennessee, Algonquin, and Texas Eastern shall not abandon or replace any facilities until they have received an Alternative Disposal Permit (Permit) pursuant to 40 CFR § 761.60(e), from the U.S. Environmental Protection Agency, and have submitted a copy of the Permit to the Secretary of the Commission for review and approval by the Director of OPPR. (DEIS recommendation 20, modified)

Great Lakes

20. Great Lakes shall be limited to maintaining a maximum of 75 feet of permanent right-of-way where there will be two pipelines. Where a third pipeline would be placed within the right-of-way (i.e., Loops 1 and 2), Great Lakes shall maintain a cleared permanent right-of-way of 100 feet. (DEIS recommendation 25)

21. When crossing U.S. Forest Service (FS) lands, Great Lakes shall comply with all the conditions set forth in the FS special use permit issued for each individual national forest crossed. In areas where the FS special-use permit conditions differ from our recommendations or plans and procedures, the FS conditions take precedence. (New recommendation)

22. Great Lakes shall file copies of all surveys for endangered and threatened species within national forests, along with comments from the Forest Service and appropriate mitigation plans, with the Director of OPPR for review and approval prior to construction in the national forest. (DEIS recommendation 26)

23. Great Lakes shall conduct a field survey of two eagle nesting areas located along Loop 10 in Marquette County, Michigan, and along Loop 12 in Mackinac County, Michigan, to determine the level of potential impact on nesting habitat. A report of this survey, including comments by the U.S. Fish and Wildlife Service (FWS) and proposed plans for mitigation of potential impact, if appropriate, shall be submitted to the Secretary of the Commission for review and approval by the Director of OPPR prior to construction. (DEIS recommendation 27)

24. Great Lakes shall not conduct construction activities within 1 mile of active bald eagle nesting sites along Loop 4 in Cass County, Minnesota; Loop 9 in Gogebic County, Michigan; Loop 10 in Marquette County, Michigan; Loop 11 in Delta County, Michigan; Loop 12 in Mackinac County, Michigan; and Loop 14 in Otsego County, Michigan, between February 1 and August 1. Great Lakes shall also consult

with the FWS prior to construction to verify the status of these nest sites. The FWS comments and the results of any required surveys shall be filed with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction. (DEIS recommendation 28, modified)

25. Great Lakes shall consult with the FWS to determine if any occupied habitat for the Kirtland's warbler occurs within 0.5 mile of any planned construction activity and shall file with the Secretary of the Commission for review and approval by the Director of OPPR the FWS comments prior to construction. Additionally, we recommend:

    a. Pipeline construction shall be accomplished in such a manner that the management of essential habitat along the right-of-way through the use of prescribed burning is not precluded. This includes:

        - burying the pipeline to a safe depth, and
        - locating storage facilities outside of essential habitat.

    b. Construction crews shall gate and lock access roads if these roads promote increased activity that could disturb nesting birds. (DEIS recommendation 29)

26. In consultation with the FWS and Michigan Department of Natural Resources (DNR), Great Lakes shall conduct a field survey for the presence of the dwarf lake iris, Pilcher's thistle, and Houghton's goldenrod along Loop 12, and likewise for the Michigan monkey-flower along Loops 11 and 12. The results of these surveys, along with appropriate mitigation plans, shall be submitted to FERC for review and approval by the Director of OPPR prior to construction. The survey results shall include survey, along with methods, exact area surveyed, and names and qualifications of those conducting the survey. (DEIS recommendation 30)

27. Between April 1 and June 30, Great Lakes shall not construct between MP 59.0 and 60.6 or MPs 62.4 and 63.6 to avoid disturbance of possible nesting sandhill cranes. (New recommendation)

28. Great Lakes, in consultation with the Minnesota DNR, shall conduct a survey of the sand hill crane habitat within the proposed project area to determine the need for further mitigation measures. If the state recommends route changes, or if Great Lakes proposes route changes as a result of this process, Great Lakes will file the changes with FERC for review and approval by the Director of OPPR prior to construction. (DEIS recommendation 31)

29. For the osprey nests along Loop 4 and Loop 13, Great Lakes shall, in consultation with the Minnesota and Michigan DNRs, conduct a field survey of these areas to determine the potential impact on nesting ospreys. If active nests are located within 0.25 mile of the proposed construction, Great Lakes shall not cut the nest trees or any trees within a 330-foot buffer zone of the nests, and shall avoid construction activities within 0.25 mile of the nests between February 15 and June 15. (DEIS recommendation 32)

30. If construction within state-identified deer yards is scheduled to occur between December and March, Great Lakes shall consult with regional DNR personnel and

develop mitigation measures where DNR deems it appropriate, to minimize potential impact on wintering deer. (DEIS recommendation 33, modified)

31. For permanent revegetation of non-wetland areas between MPs 60.0 and 64.0, Great Lakes shall use a native seed mixture consisting of at least 60 percent big bluestem with the remainder consisting of little bluestem, switchgrass, Indian grass, and prairie dropseed. (New recommendation)

32. Great Lakes shall consult with MNDNR about removing the existing crown of soil from the adjacent pipeline during construction of the proposed loops in wetlands between MPs 56.0 and 61.0, 63.0 and 64.0, and 116.0 and 117.0. In addition, Great Lakes shall file the results of this consultation with the Secretary of the Commission. (New recommendation)

32a. Great Lakes shall file with the Commission a mitigation plan that specifies the wetlands where existing corduroy roads would be used by construction equipment. The plan shall specify the location of the corduroy road, including its width, and the location of the existing pipeline and proposed trench. These items shall be shown on a cross-sectional diagram that also indicates the existing cleared right-of-way width and any required temporary right-of-way. This plan shall be reviewed and approved by the Director of OPPR prior to construction. (DEIS recommendation 43)

33. Because of the exceptional value of Trask Creek, Muskeg Creek, Iron River, DeChamps Creek, Two Mile Creek, Middle Branch Ontonagon River, South Branch Paint River, and North Branch Iron River, Great Lakes shall implement the following additional construction procedures to supplement those presented in appendix D. In order to reduce the amount of suspended sediments introduced into these waters, all in-stream work (e.g., trenching, pipe installation, backfilling) shall be completed within a maximum of 48 hours. This means all preparation activities (e.g., pipe bending, welding, coating) should be completed prior to initiating trenching. Excavation and backfilling shall be conducted with backhoes simultaneously from both streambanks, and no equipment shall be permitted in the stream. (DEIS recommendation 35)

34. Because of the sensitivity and importance to the regional fishery of the Manistee, Mississippi, Bois Brule, and Maple Rivers, the Welch, Seimens, Powder Mill, Planter, and Henderson Creeks, and Cooks Run, Great Lakes shall file with the Secretary of the Commission a site-specific mitigation plan, together with comments on these stream crossings from the appropriate state agencies, for review and approval of the Director of OPPR prior to construction. The mitigation plan shall include the construction time period, amount of time required for in-stream construction, and restoration measures that would be used. (DEIS recommendation 36)

35. Since the Tacoosh and Sturgeon Rivers contain spring and fall migratory runs of steelhead and salmon, respectively, Great Lakes shall restrict construction across these rivers to the low-flow summer months of July and August. (DEIS recommendation 37)

36. Great Lakes shall limit construction activities across the Brevoort River to the period between June 15 and September 1. (DEIS recommendation 38)

37. Great Lakes shall utilize a qualified botanist to survey the area in the vicinity of the Middle River (MP 54) in Minnesota, prior to construction, to determine what, if any, relic prairie grove species occur on the right-of-way. If relic prairie grove species are found, Great Lakes shall consult with the MNDNR to determine appropriate native seed mixtures to use when reseeding the right-of-way. (DEIS recommendation 40)

38. Great Lakes shall file with the Secretary of the Commission copies of all necessary permits and approvals, including all stipulations and conditions thereto, for construction of the facilities within the wooded dune and swale complex along Loop 12 between MP 664 and MP 674.5. Construction and mitigation procedures required by the Hiawatha National Forest shall also be implemented for portions of this pipeline segment which are outside the National Forest. (DEIS recommendation 41 modified)

39. Great Lakes shall reduce construction and permanent right-of-way requirements to minimize unnecessary tree removal within all national forests, shall maintain access to recreational and remote forest areas when crossing forest roads, and shall sufficiently reinforce the pipeline when placed under roads supporting logging traffic. Clearing at road crossings shall be held to a minimum and screen plantings shall be installed and/or maintained at road crossings within the national forestland as specified in the FS special-use permit. Additionally, screen plantings shall be maintained or restored at U.S. Route 45, Highway 16 and the four U.S. Route 2 crossings within the Ottawa National Forest. Furthermore, Great Lakes shall replant the temporary construction right-of-way in areas where U.S. Route 2 is south of the proposed pipeline right-of-way (MPs 446.5 to 448.5 and 454.6 to 455.1). In the Chippewa National Forest, Great Lakes shall maintain or restore screen planting at County Road 8, Forest Road 2102, and two crossings of Forest Road 2127. (DEIS recommendation 44, modified)

40. In all state forestland or other public lands, Great Lakes shall minimize construction and permanent right-of-way to reduce woodland clearing and impact on fish and wildlife resources. (DEIS recommendation 45, modified)

41. For the construction across the 13 rivers that have been proposed for inclusion in Federal or state inventories of wild and scenic rivers, Great Lakes shall file a mitigation and restoration plan including screen plantings, for the review and approval of the Director of OPPR, prior to construction. (DEIS recommendation 46, modified)

42. For the inactive sand pits located at MPs 391.5, 706.8, 714.9, 936.0, and the inactive gravel pit at MP 236.8, Great Lakes shall contact the owner/operator of these mining operations regarding proposed pipeline encroachment and negotiate suitable agreements to ensure that pipeline installation would not adversely affect future mining operations. Any route realignments shall be filed with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction. (DEIS recommendation 47, modified)

43. Great Lakes shall file the March 27, 1990 revisions to the December 1989 draft cultural resources survey plan filed with the Commission. (New recommendation)

44. Great Lakes shall provide copies of all cultural resources survey reports and SHPO comments for studies within the national forests to the FS regional office and subject forest supervisor. (New recommendation)

Tennessee

45. Tennessee shall file with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction an acoustical noise analysis based on field noise data for the actual turbines, compressors, and buildings being proposed at Compressor Station 230C. (DEIS recommendation 21)

46. Tennessee shall submit to the Secretary of the Commission for review and approval by the Director of OPPR prior to construction, copies of construction plans for crossing the Niagara River, indicating the location of storage areas for drilling fluids and muds, and a drilling fluids management plan that describes methods for collection of drilling muds and measures to prevent them from entering the Niagara River by accidental spills or runoff. Drilling muds shall be stored only in non-leaking, covered tanks or similar containment facilities. (DEIS recommendation 48)

47. Tennessee shall, in consultation with the MNHESP, conduct a nesting survey for the common moorhen prior to construction of Segment 8 to determine the need for further mitigation. If any route changes are proposed as a result of this process, Tennessee will file the change with the Secretary of the Commission for review and approval of the Director of OPPR prior to construction. (DEIS recommendation 49)

48. Prior to construction of Segment 8, Tennessee shall conduct a survey for the many-fruited false loosestrife to determine if it is located on the proposed construction right-of-way. If it is found, Tennessee shall consult with MNHESP to determine appropriate mitigation measures. If any route changes are proposed as a result of this process, Tennessee shall file the route changes for the Director of OPPR's review and approval prior to construction. (DEIS recommendation 50)

49. Tennessee shall not construct across Longmeadow Brook in February to avoid impact on the burbot, a Massachusetts species of concern. (DEIS recommendation 51)

50. Tennessee, in consultation with MNHESP, shall survey the crossing location of the North Pond Tributary to determine the need to mitigate for disturbance of the American brook lamprey. If any route changes are proposed as a result of this process, Tennessee shall file the route changes for the Director of OPPR's review and approval. (DEIS recommendation 52)

51. Tennessee or GAS shall have a qualified botanist conduct a survey for the American hart's tongue fern within the area that would be disturbed by the GAS cogeneration facility. Results of this survey, along with comments from the FWS, shall be submitted to FERC, for review and approval by the Director of OPPR, prior to construction of the nonjurisdictional facility. No delivery shall occur until the Director of OPPR has informed Tennessee that gas delivery may proceed. (New recommendation)

52. Tennessee shall file a site-specific mitigation plan for construction and restoration in the Fannie Stebbins Memorial Wildlife Refuge and the "Meadows" area. Tennessee shall make a good faith effort to consult with the Longmeadow Conservation Commission in development of the final plan. The plan shall be filed with the FERC for review and approval by the Director of OPPR prior to construction. A copy of the final plan shall be submitted to the Longmeadow Board of Selectmen when it is filed with the FERC. The plan shall specify temporary and permanent construction right-of-way requirements, method of pipeline installation, and restoration. (DEIS recommendation 53, modified)

53. Construction in the vicinity of the Wolf Swamp and Elmwood Schools shall be conducted during days when school is not in session to minimize any potential impact from construction noise and disruption. (DEIS recommendation 54, modified)

54. Tennessee shall file a mitigation plan for construction along the Wolf Swamp athletic field with the Secretary of the Commission for review and approval by the Director of OPPR, prior to construction. (New recommendation)

55. For the Lima Golf Course and the Long Meadow Golf Course, Tennessee shall coordinate with the owner to determine the need to schedule construction during the off-season from December 1 to April 1. In addition Tennessee shall construct across the golf courses in the minimum time practicable. (DEIS recommendation 55)

56. Tennessee shall submit to FERC for review and approval by the Director of OPPR work plans for cultural resources for Phase 2 studies of the two prehistoric sites along Segments 1 and 4. (DEIS recommendation 56)

57. If hazardous wastes are encountered during construction of Segments 1, 3, and 4, Tennessee shall stop construction in the vicinity of the wastes and notify Federal, state and local agencies, as appropriate, to determine the appropriate course of action. (New recommendation)

Algonquin

58. For the E-1 Loop, Algonquin shall maximize the use of existing right-of-way for construction and shall limit the construction right-of-way to 50 feet in the nursery and orchard at MPs 0.4 and 1.4. (DEIS recommendation 57)

59. Algonquin shall schedule the construction across the Glen Charlie Pond between September 30 and May 1. (DEIS recommendation 58)

60. In the Myles Standish State Forest, Algonquin shall coordinate with the forest representative to determine appropriate vehicle control measures per the procedures outlined in appendix C. (DEIS recommendation 59)

61. Algonquin shall confine construction activities to the existing pipeline and transmission line rights-of-way within the Caratunk Wildlife Refuge with the exception of the first 0.1 mile of the Caratunk crossing (MPs 2.1 to 2.2) where a maximum 10 feet of vegetation will be removed for temporary right-of-way. In addition, Algonquin shall acquire no new permanent rights-of-way within the refuge. All construction

activities within the refuge shall be conducted between September 1 and June 30. (DEIS recommendation 60, modified)

62. Prior to commencing any construction activity at the Burrillville Compressor Station, Algonquin shall file with the Secretary of the Commission, for review and approval of the Director of OPPR, the measured noise data obtained and referenced by the applicant as well as the manufacturer's specifications and acoustic performance for the equipment installed at the unidentified referenced stations and the turbine noise controls proposed for the Burrillville Compressor Station. (DEIS recommendation 61)

63. Algonquin shall have a qualified biologist walk the G-5 Replacement immediately prior to construction and find and remove eastern box and wood turtles from the right-of-way. (DEIS recommendation 62)

64. For the E-1 Loop, Algonquin shall restore all stonewalls removed during construction. (New recommendation)

65. Algonquin shall place the permanent right-of-way within the existing electric transmission right-of-way between MPs 4.1 and 5.0 of the G-8 Replacement/Loop between MPs 0.0 and 1.6 of the Medfield Loop, and between MPs 2.5 and 4.8 of the Wawecus Hill Road Variation. Additionally, the proposed pipeline construction right-of-way shall extend no more than 25 feet outside of the existing electric transmission right-of-way. However, where, for safety or environmental issues, it is not possible to place the entire 50-foot-wide permanent right-of-way within the electric transmission right-of-way, Algonquin file with the Secretary of the Commission, for review and approval by the Director of OPPR, the specific reasons for proposed variance to this recommendation. However, the intent is for the pipe to be placed within the electric transmission right-of-way. (New recommendation)

Transco

66. In accordance with the National Marine Fisheries Service (NMFS) and FWS recommendations on minimizing impact on the American shad fishery, Transco shall not conduct any in-stream construction activity in the Delaware River between April 1 and December 1. (DEIS recommendation 63)

67. Transco shall defer gas delivery to Commonwealth Gas Pipeline and Commonwealth Gas Services until we have completed our review of these facilities, prior to their construction, under section 7 of the Endangered Species Act, as amended. No delivery shall occur until the Director of OPPR has informed Transco that gas delvery may proceed. (New recommendation)

68. Transco shall submit its noise calculations prior to construction for both Stations 205 and 515 with the Secretary of the Commission, for review and approval by the Director of OPPR. The analysis shall be based on far-field noise data from the manufacturer of a similar installation in service elsewhere (such as Station 520). (DEIS recommendation 64)

69. Transco shall conduct postconstruction sound surveys at Compressor Stations 515 and 167 to verify that the station operating noise at the nearest residence does not exceed an Ldn of 55 dBA. If that level is exceeded, Transco shall implement additional noise control measures to reduce the operating noise level at the nearest residences to or below an Ldn of 55 dBA, and file a copy of the postconstruction sound survey with the Secretary of the Commission as soon as reasonable after completion, but no later than 30 days after the date the proposed facilities are placed in service. (New recommendation)

70. Transco shall coordinate with Plainfield, Pennsylvania, officials to minimize construction impact on the proposed bike trail. (DEIS recommendation 65)

71. Transco shall coordinate with appropriate state officials to develop a construction and mitigation plan for the Delaware River crossing.

72. Transco is in the process of performing a site characterization at Compressor Station 515 to identify any site contamination by PCBs. Copies of this site characterization study shall be provided to the Secretary of the Commission and submitted to the Pennsylvania Department of Environmental Resources (PADER). If contamination is found, Transco shall complete the following:

    a. Prepare a detailed plot plan that shall identify all locations onsite, all downgradient locations offsite, offsite pig receivers, and major valves, and streams or drainage ditches within 0.2 kilometer of any compressor station that would either be directly disturbed by excavation and soil storage, or be indirectly disturbed by construction equipment traffic, worker access and parking, construction support facilities, and staging areas.

    b. Prior to construction, sample all locations identified above for PCBs and other contaminants in accordance with procedures approved by PADER to ensure that an unacceptable level of contamination does not exist, and the contaminated areas shall be isolated from the construction area with 4-foot orange plastic safety fencing or the equivalent for the entire duration of construction activities. Sampling plans should be submitted to and approved by PADER prior to commencement of sampling activities.

    c. Secure concurrence from PADER that the construction areas identified above are not in areas of unacceptable contamination, and file the concurrence with the Secretary of the Commission for the Director of OPPR's review and written approval prior to construction. (New recommendation)

Texas Eastern

73. Texas Eastern shall conduct a Phase 1 identification and field study and a field survey, based upon a stratified sampling strategy, to determine the presence or absence of cultural resources within the project area. (DEIS recommendation 66)

CNG

74. CNG shall construct the proposed TL-470 Line within a 75-foot-wide construction right-of-way, except where staging areas are required, and maintain no more than 50 feet of permanent right-of-way between MPs 0.8 and 1.4. CNG shall place its permanent right-of-way within Niagara Mohawk's cleared right-of-way between MPs 0.0 and 0.8 and 1.4 and 2.7. Additionally, the proposed pipeline construction right-of-way shall extend no more than 25 feet outside of the existing electric transmission right-of-way. However, where, for safety or environmental issues, it is not possible to place the entire 50-foot-wide permanent right-of-way within the electric transmission right-of-way, CNG shall file with the Secretary of the Commission for review and approval by the Director of OPPR the specific reasons for proposed variance to this recommendation. However, the intent is for the pipe to be placed within the electric transmission right-of-way. (DEIS recommendation 67, modified)

75. CNG shall consult with and provide comments from the appropriate state agency(s) regarding the depth to groundwater and the level of contamination present in the vicinity of MPs 1.85 to 1.95 along the proposed TL-470 Line. Prior to construction, CNG shall submit to FERC for review and approval by the Director of OPPR a mitigation plan to prevent potential impact as a result of construction within this contaminated area. (DEIS recommendation 68)

76. CNG shall conduct chemical testing of surficial and subsurface sediments at the proposed Hudson River crossing. Test parameters shall include priority pollutant metals and organics. The results of such testing, together with comments from the U.S. Army Corps of Engineers (COE) and the appropriate state water quality management agency, shall be filed with the Secretary of the Commission for review and approval by the Director of OPPR, prior to construction across the Hudson River. (New recommendation)

77. In accordance with NMFS recommendations on minimizing impact on the federally endangered shortnose sturgeon, CNG shall limit in-stream construction of the Hudson River to the time period between November 1 and April 1. (DEIS recommendation 69)

78. CNG, in consultation with the New York Department of Environmental Conservation (NYDEC), shall conduct a nesting survey for the least bittern prior to construction, if construction through Papscanee Marsh would occur prior to June 30. If least bitterns are found to be nesting in the vicinity of the proposed pipeline, CNG shall not begin construction through this area until after June 30. (DEIS recommendation 70)

79. We recommend that prior to commencing any construction activity at the Utica Compressor Station, CNG shall file with the Secretary of the Commission for review and approval by the Director of OPPR, manufacturer specifications and attenuation data of the proposed noise control equipment. Further, CNG shall conduct a post-construction sound survey to verify that the noise at the nearest residence does not exceed an Ldn of 55 dBA and if that level is exceeded, CNG shall implement noise control measures to reduce the noise level at the nearest residence to or below an Ldn of 55 dBA. (DEIS recommendation 71)

National Fuel/Penn-York

80. National Fuel shall limit the width of the permanent right-of-way to 50 feet immediately adjacent to the existing Tennessee right-of-way. (DEIS recommendation 72)

81. Prior to construction, National Fuel/Penn-York shall conduct a survey in the area that would be cleared for the proposed Y-M54 Line to determine the presence of ospreys or osprey nests. National Fuel/Penn-York shall submit the results of this survey to the Pennsylvania Game Commission to determine the need for further mitigative measures. If any route changes are proposed as a result of this process, National Fuel/Penn-York will file the change with FERC for review and approval by the Director of OPPR prior to construction. (DEIS recommendation 73)

82. Prior to commencing any construction activity of the Concord Compressor Station, National Fuel/Penn-York shall file with the Secretary of the Commission for the review and approval of the Director of OPPR, manufacturer specifications and attenuation data for the noise control equipment on the proposed 8,640 hp of compression and to verify the noise predictions based on the unspecified 3,500-hp compressor unit. (DEIS recommendation 74)

83. National Fuel/Penn-York shall file a copy of its postconstruction noise surveys for the Concord Compressor Station and the Ellisburg Compressor Station, referenced in its January 16, 1990, data response to FERC, with the Secretary of the Commission as soon as possible after completion, but no later than 30 days after the date the proposed facilities are placed in service. (DEIS recommendation 75)

84. Prior to commencing any construction activity at the Ellisburg Compressor Station, National Fuel/Penn-York shall file with the Secretary of the Commission for the review and approval of the Director of OPPR, manufacturer specifications and attenuation data for the noise control equipment on the proposed 2,600-hp compressor unit to verify the noise predictions based on the unspecified 3,500-hp compressor unit. (DEIS recommendation 76)

CNG and CNG/Texas Eastern

85. Prior to commencing any construction activity at the State Line Compressor Station, CNG and CNG/Texas Eastern shall file with the Secretary of the Commission, for review and approval by the Director of OPPR, manufacturer specifications and attenuation data for the proposed noise control equipment. (DEIS recommendation 23, modified)

86. Upon start-up and operation of the proposed compressor additions at the State Line Compressor Station, CNG and CNG/Texas Eastern shall conduct a noise survey to verify that the noise attributable to the compressor operation does not exceed an Ldn of 55 decibels (dBA) at the nearest residence. The results of this survey shall be submitted to the Secretary of the Commission no later than 30 days after placing each compressor addition into service. If the noise from the new additions is found to exceed an Ldn of 55 dBA, CNG and CNG/Texas Eastern shall, within 1 year,

install additional noise controls to meet an Ldn of 55 dBA. (DEIS recommendation 77)

APPENDIX A

PIPELINE ROUTE/NONJURSIDICTIONAL LOCATION MAPS

APPENDIX A

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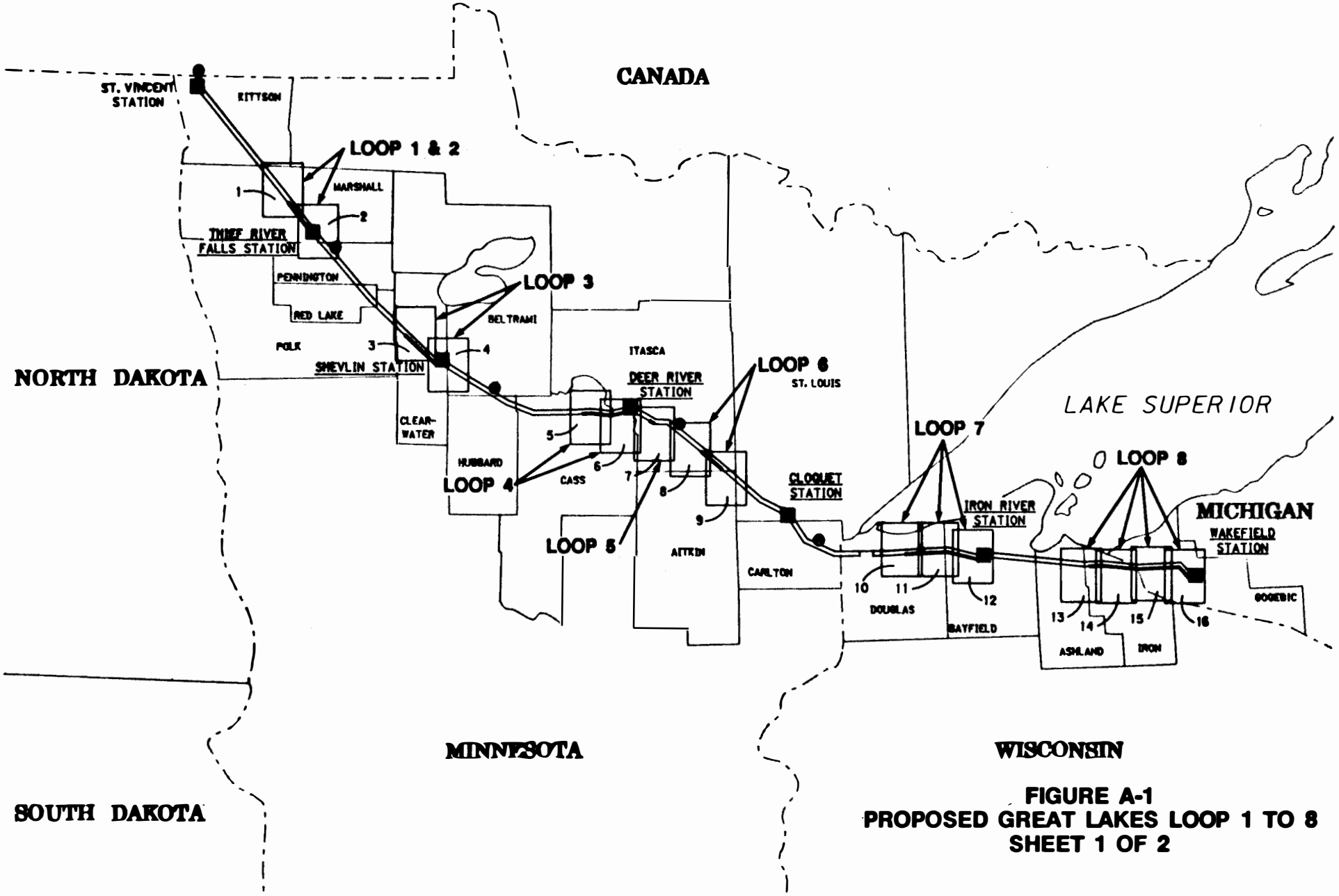


FIGURE A-1
PROPOSED GREAT LAKES LOOP 1 TO 8
SHEET 1 OF 2

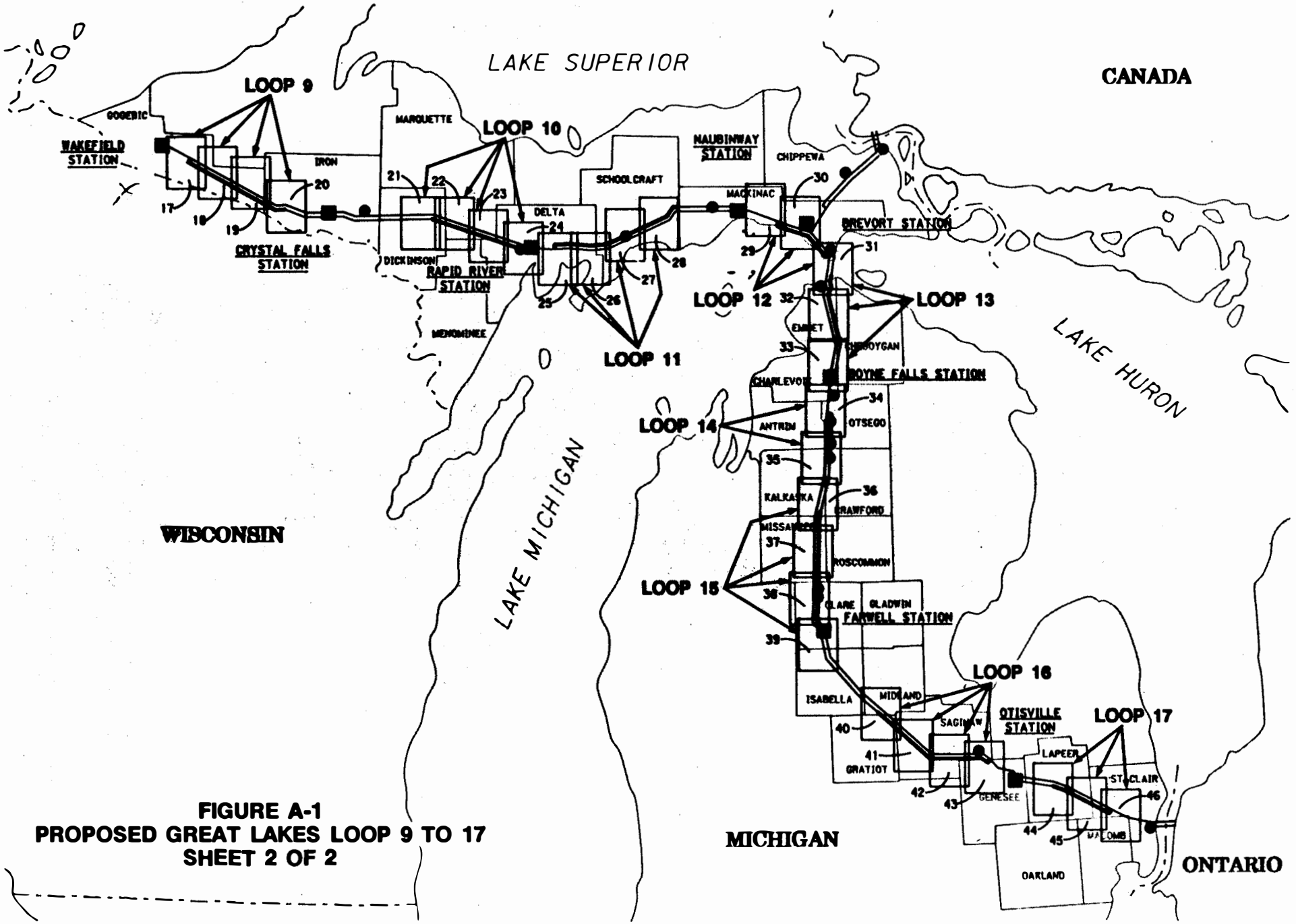
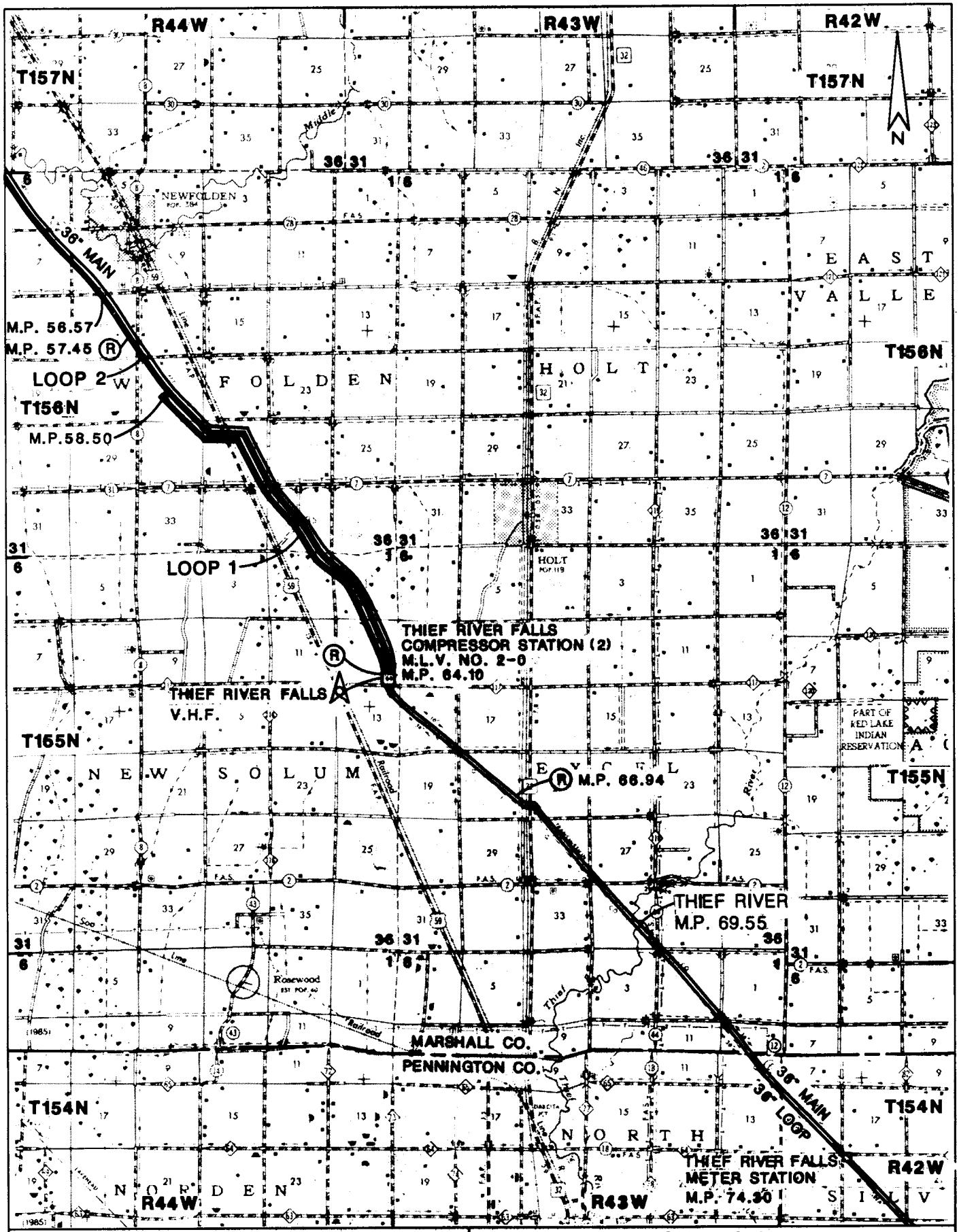


FIGURE A-1
PROPOSED GREAT LAKES LOOP 9 TO 17
SHEET 2 OF 2

M.P. 56.57 to M.P.64.10



GREAT LAKES GAS TRANSMISSION CO.

DETROIT, MICHIGAN

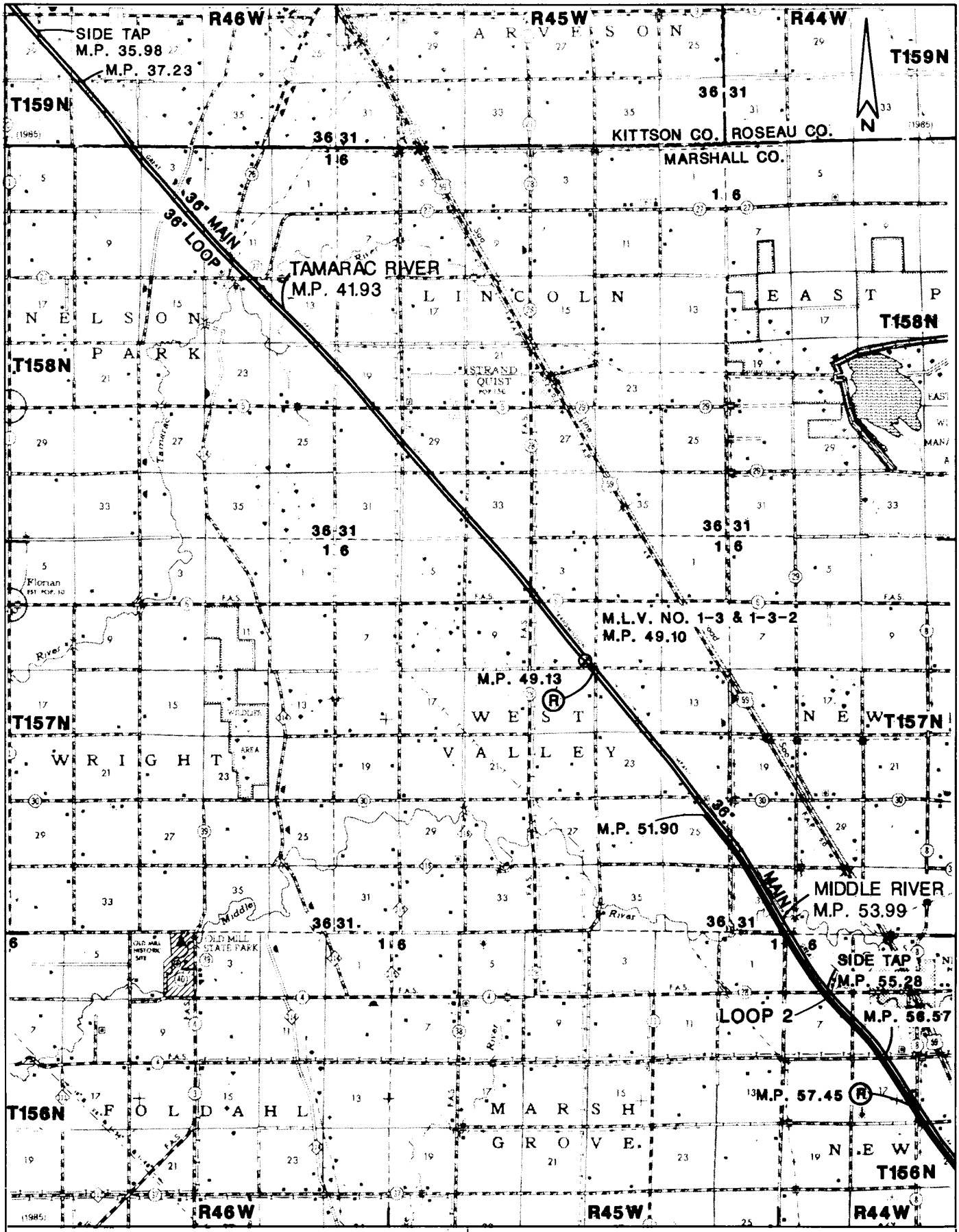
1 0 1 2 3 4

SCALE IN MILES

FIGURE A-1-1

LOOP 1 & LOOP 2

SHEET 1 OF 46



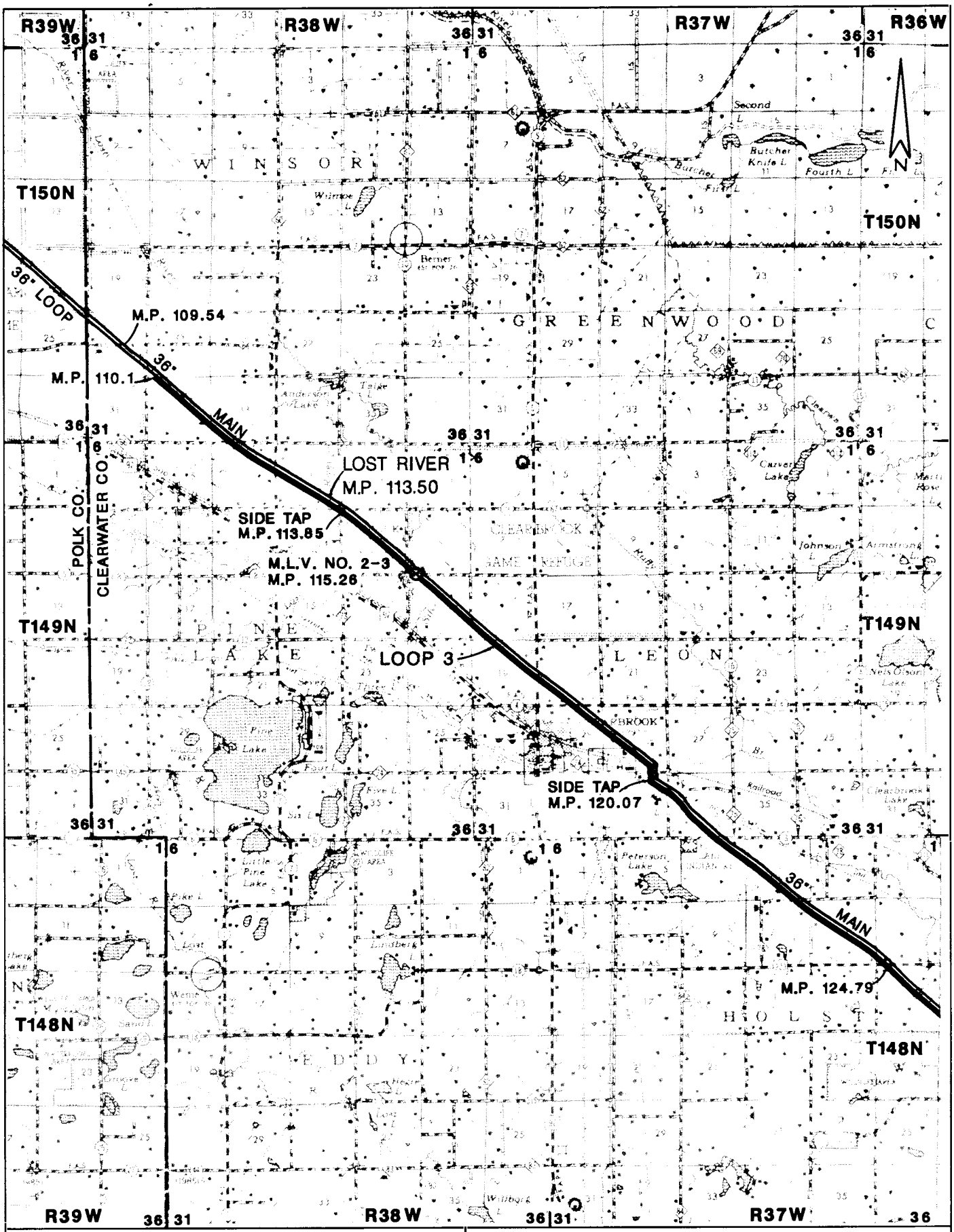
GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-2

LOOP 2

SHEET 2 OF 46



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

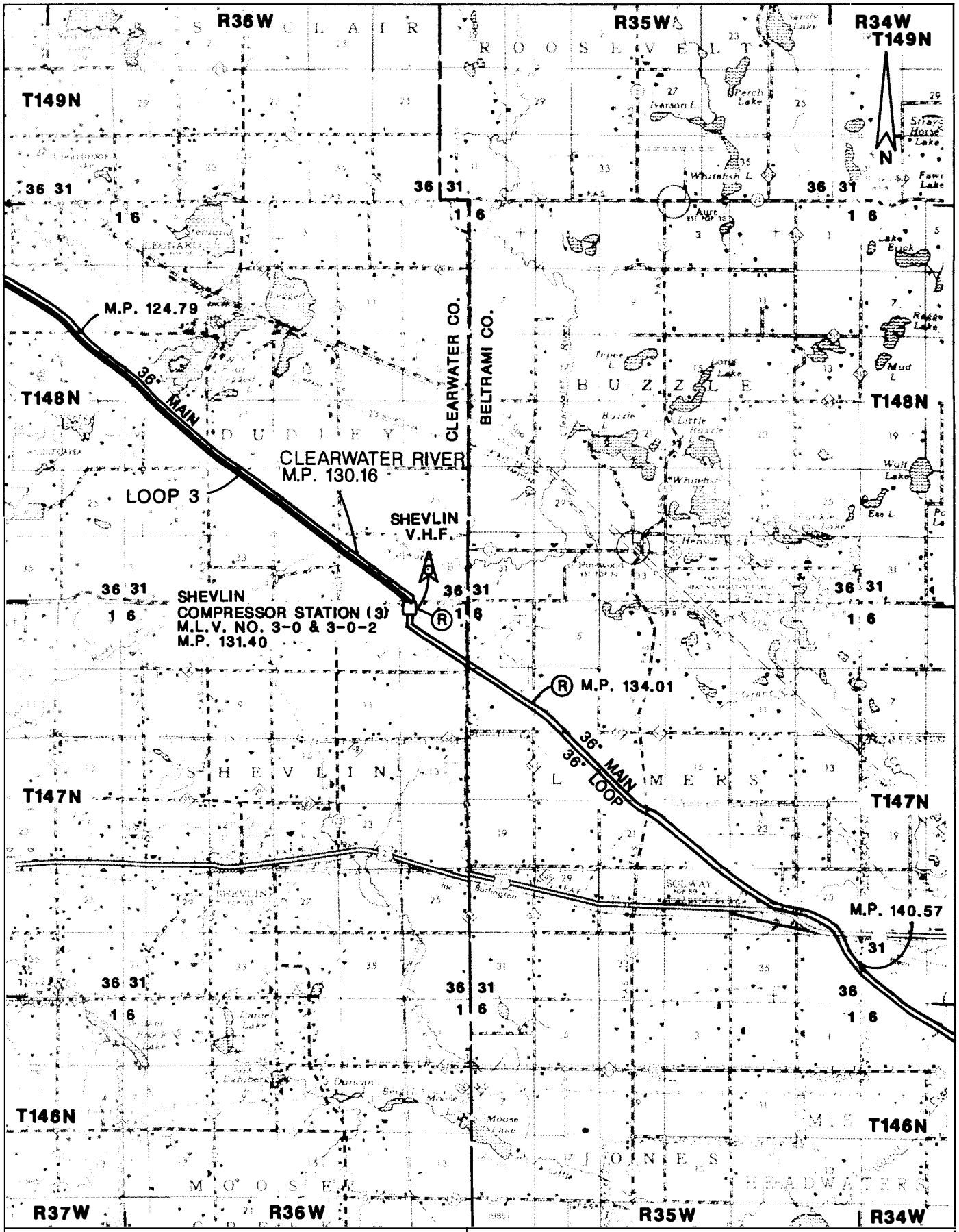
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-3

LOOP 3

SHEET 3 OF 46

M.P. 124.79 to M.P. 131.40



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

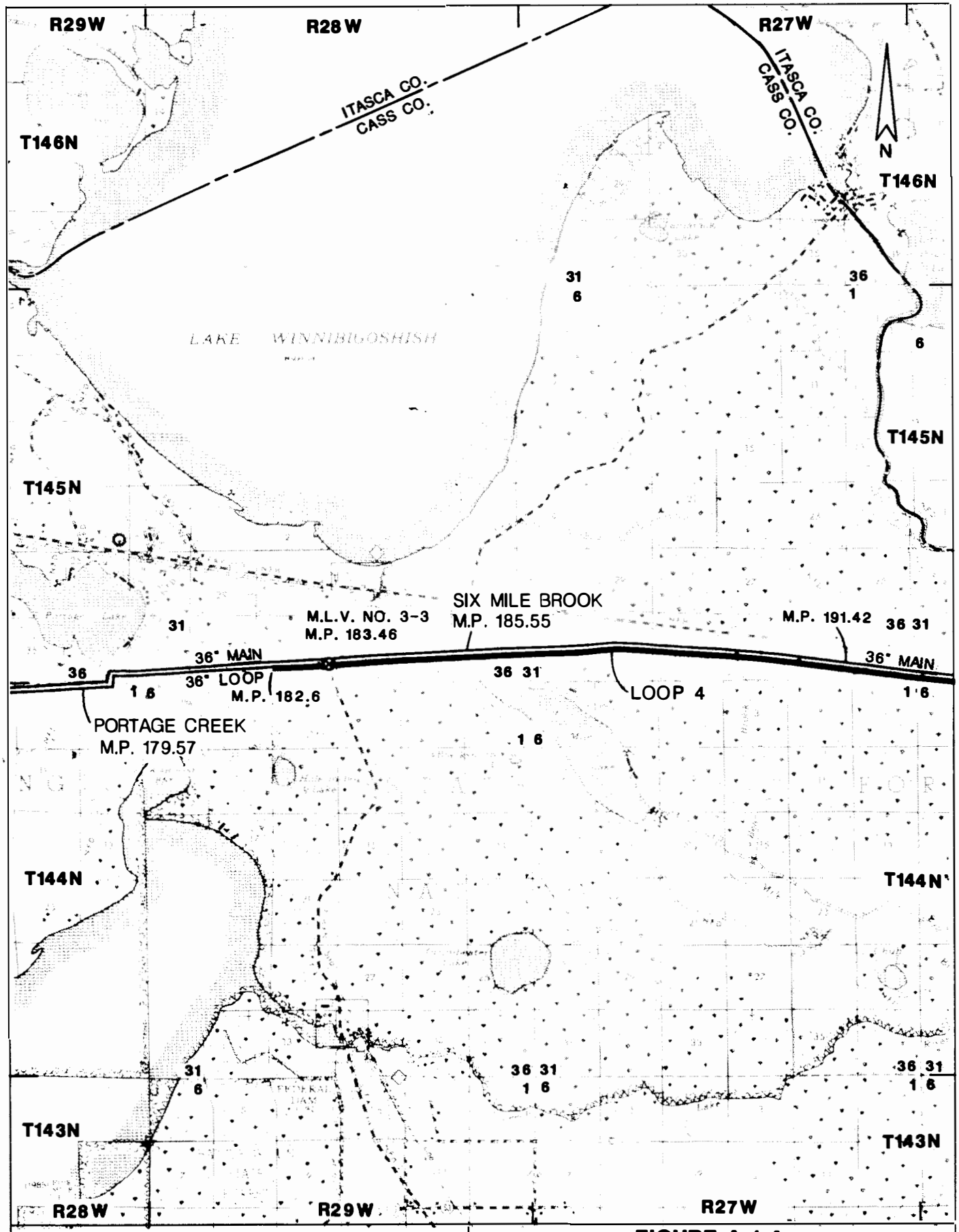
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-3

LOOP 3

SHEET 4 OF 46

M.P. 182.60 to M.P. 191.42



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

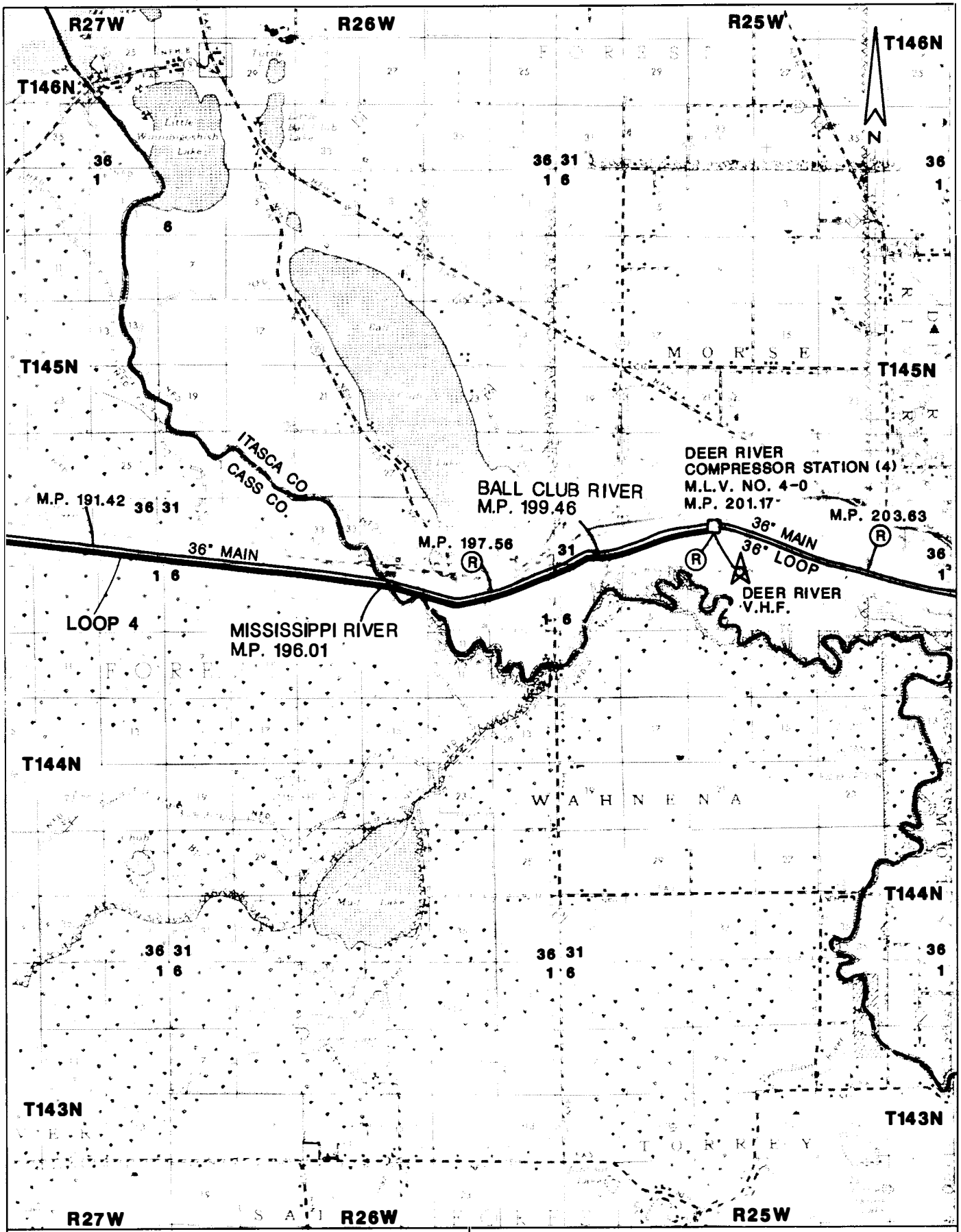
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-4

LOOP 4

SHEET 5 OF 46

M.P. 191.42 to M.P. 201.17



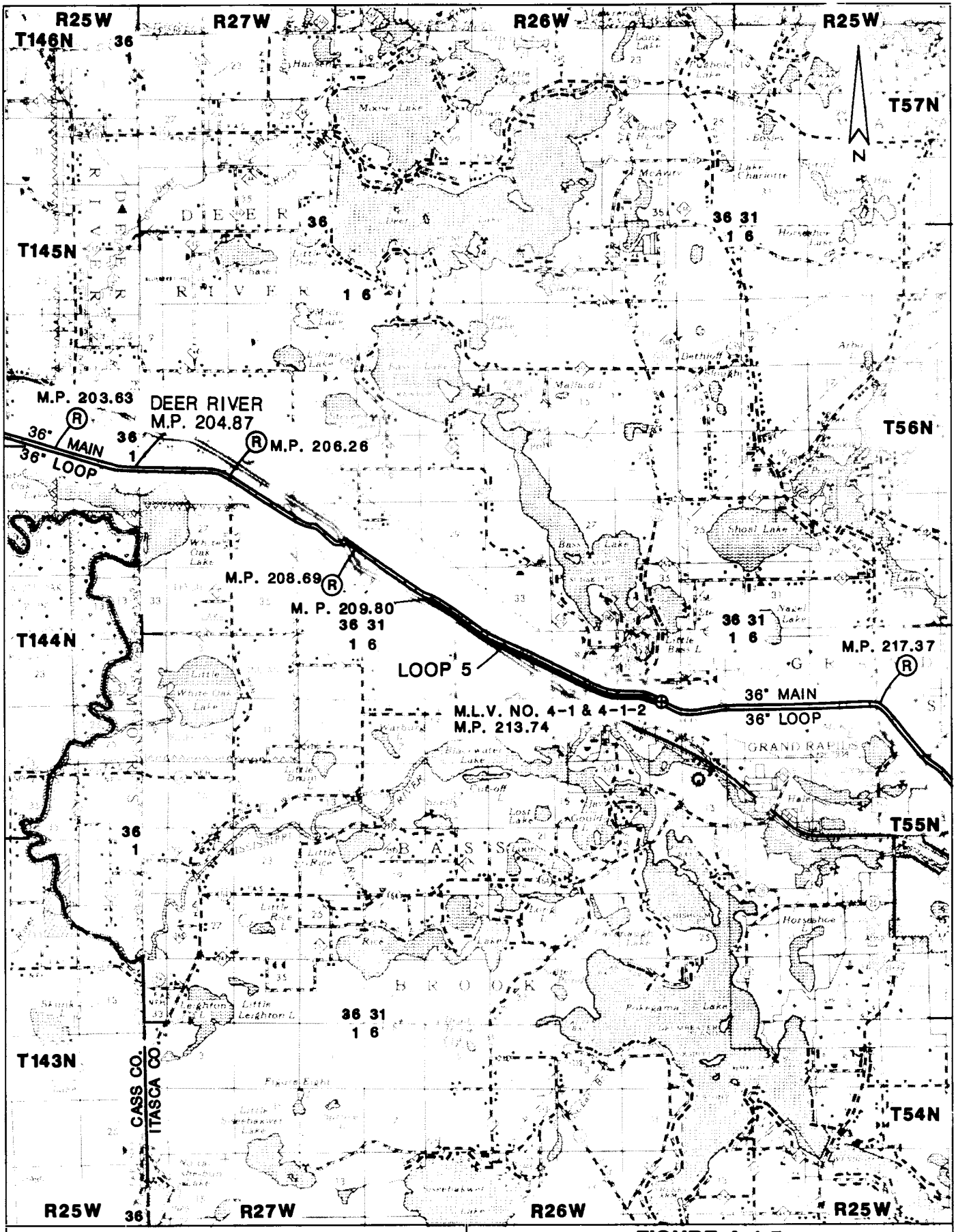
GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-4

LOOP 4

SHEET 6 OF 46



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

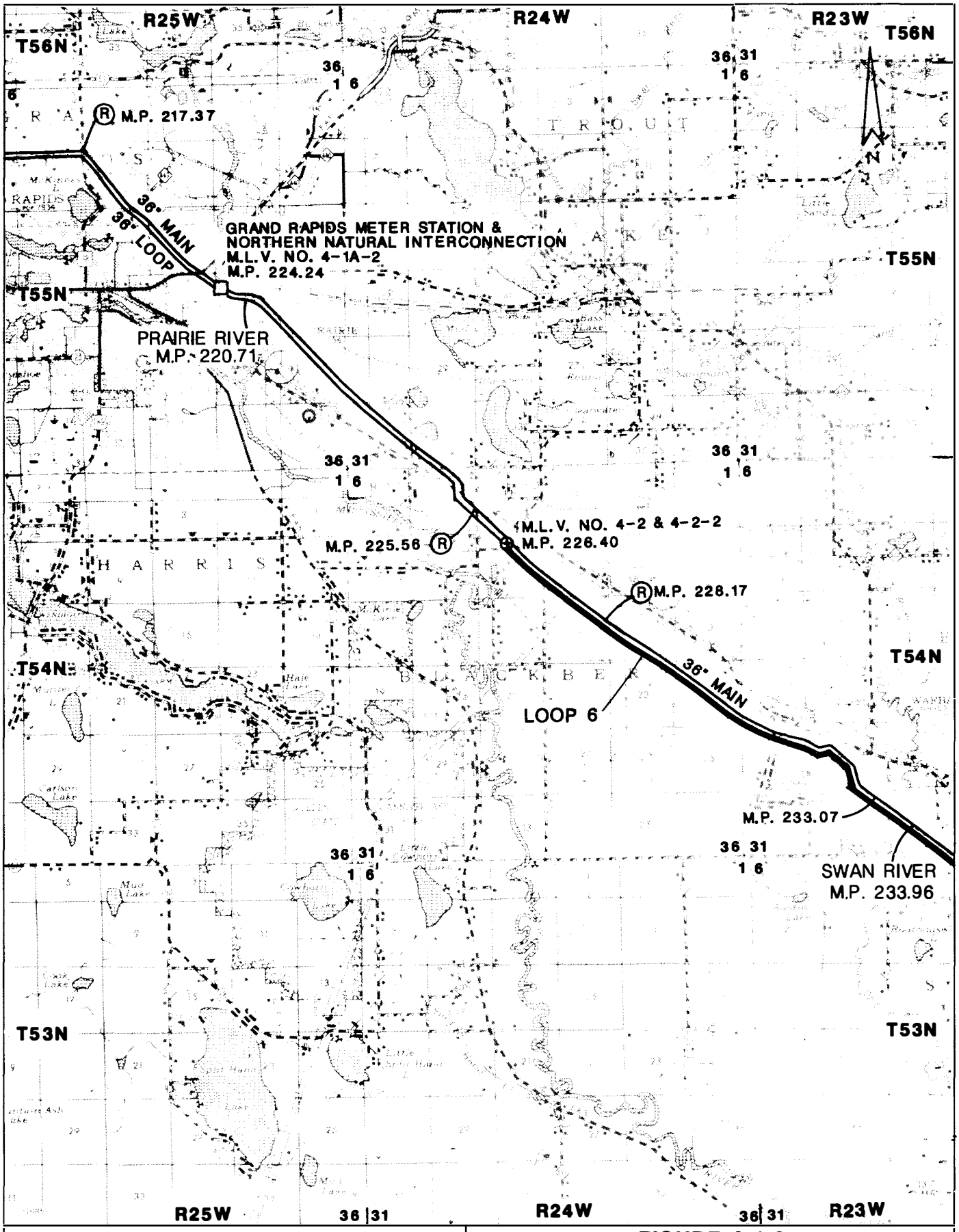
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-5

LOOP 5

SHEET 7 OF 46

M.P. 226.40 to M.P. 233.07



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

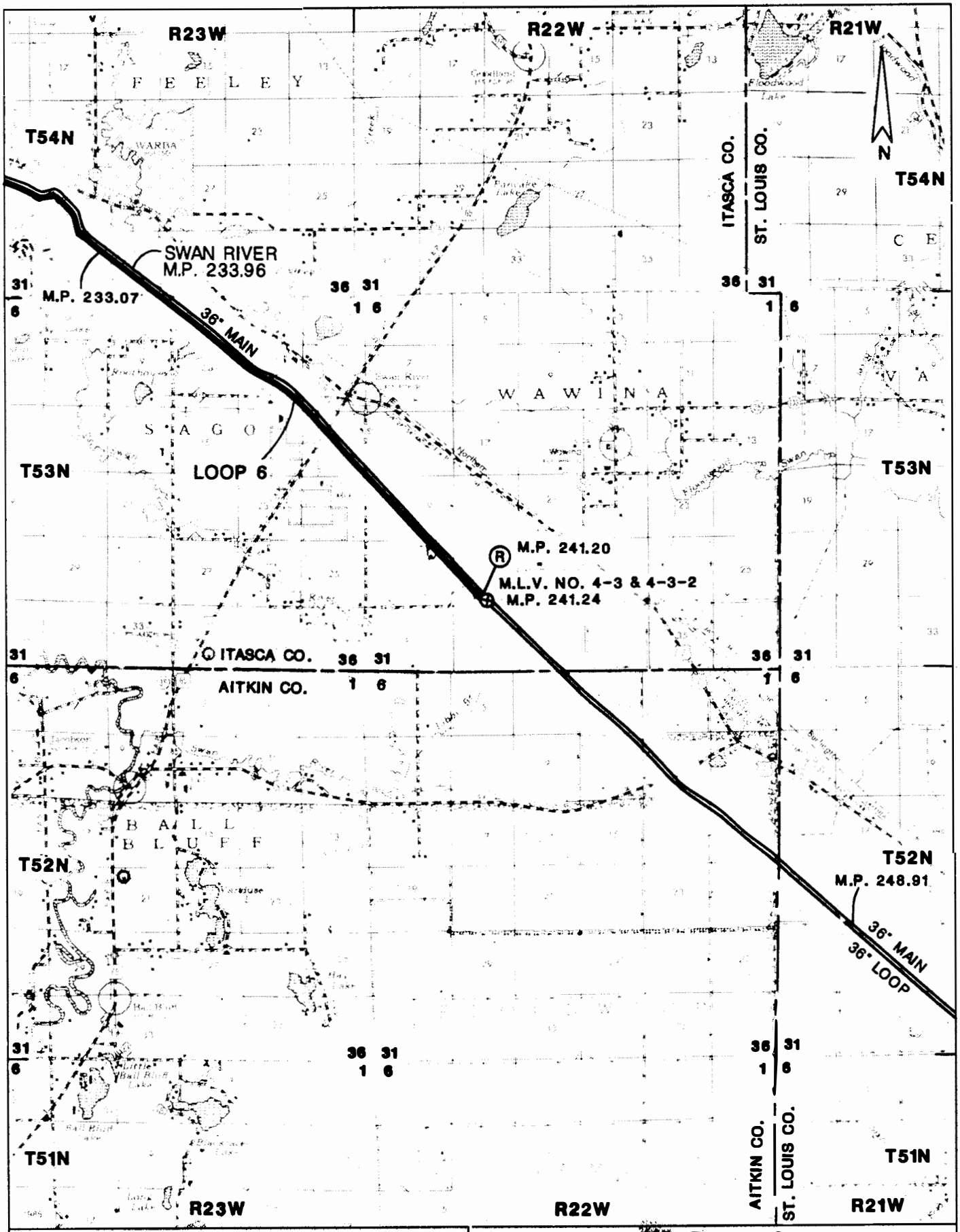
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-6

LOOP 6

SHEET 8 OF 46

M.P. 233.07 to M.P. 241.24



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

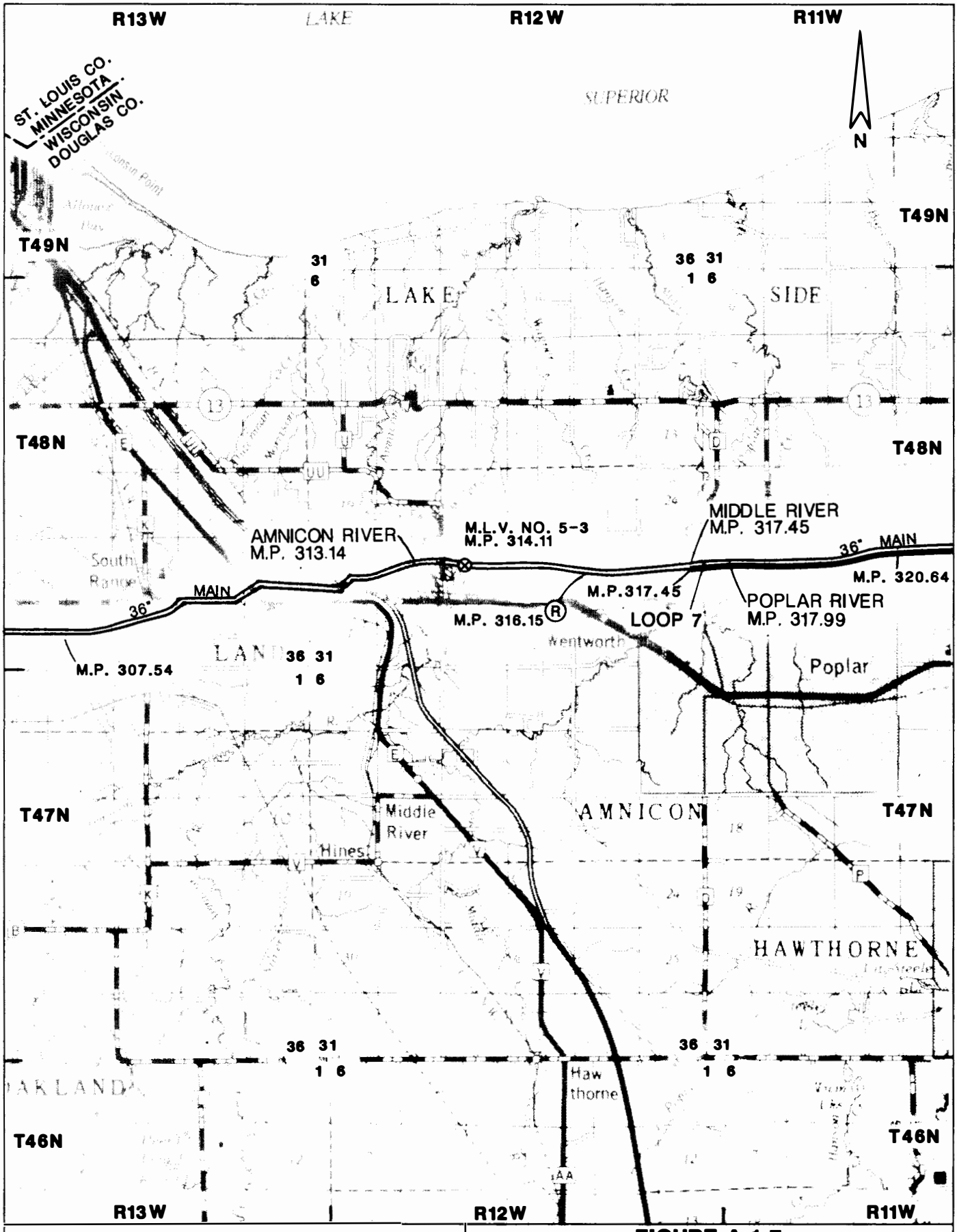
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-6

LOOP 6

SHEET 9 OF 46

M.P. 307.54 to M.P. 320.64



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

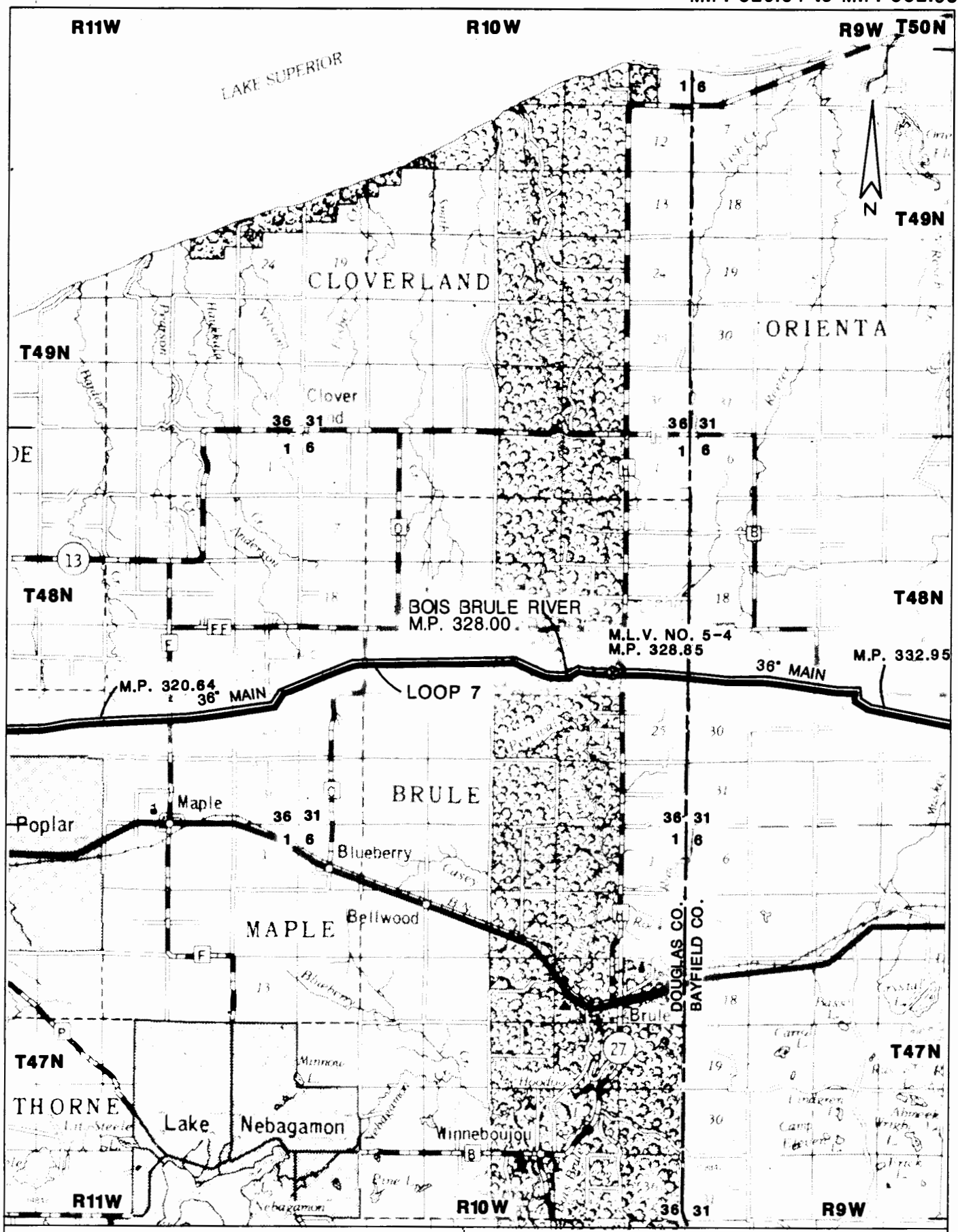
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-7

LOOP 7

SHEET 10 OF 46

M.P. 320.64 to M.P. 332.95



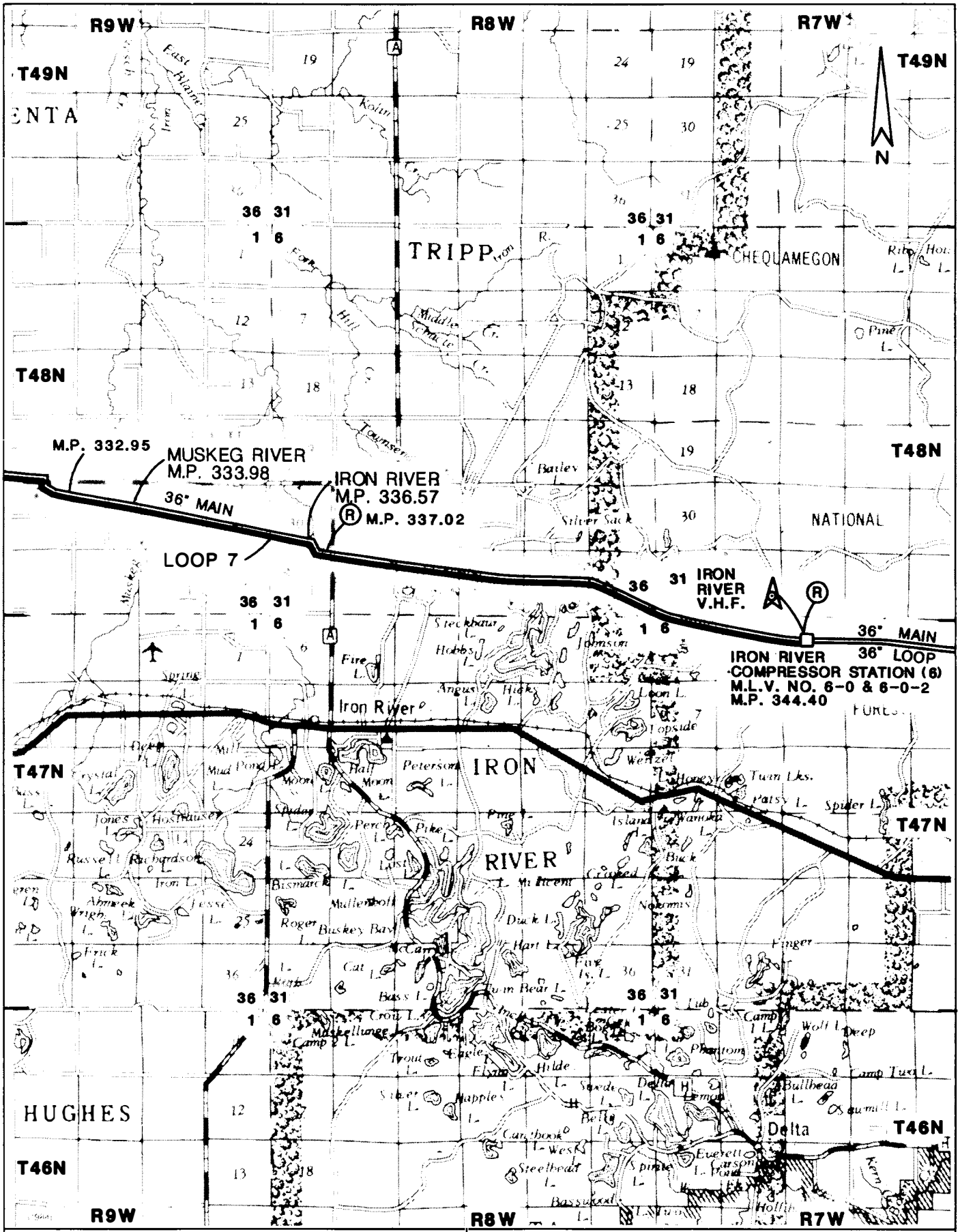
GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-7

LOOP 7

SHEET 11 OF 46



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

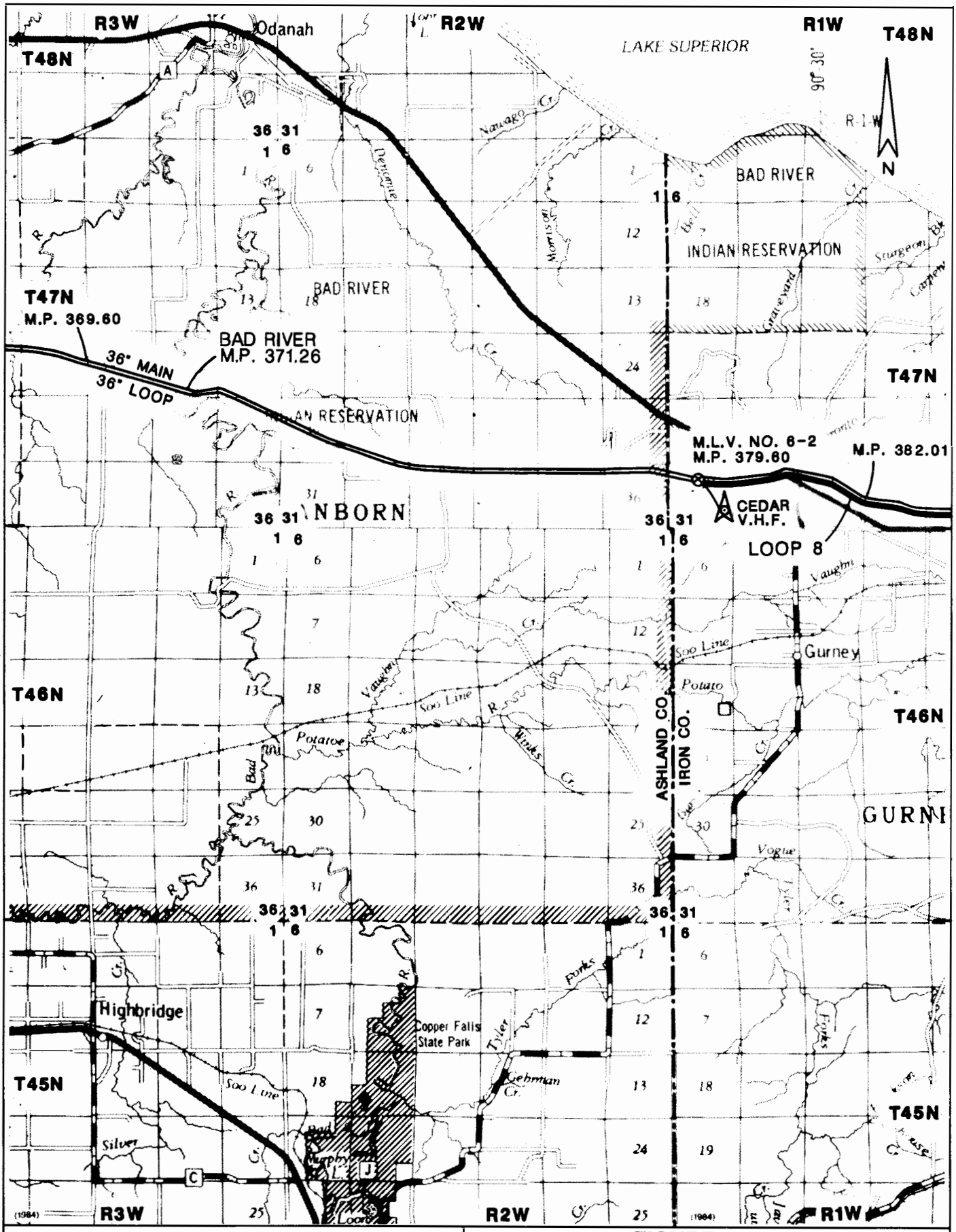
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-7

LOOP 7

SHEET 12 OF 46

M.P. 379.60 to M.P. 382.01



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

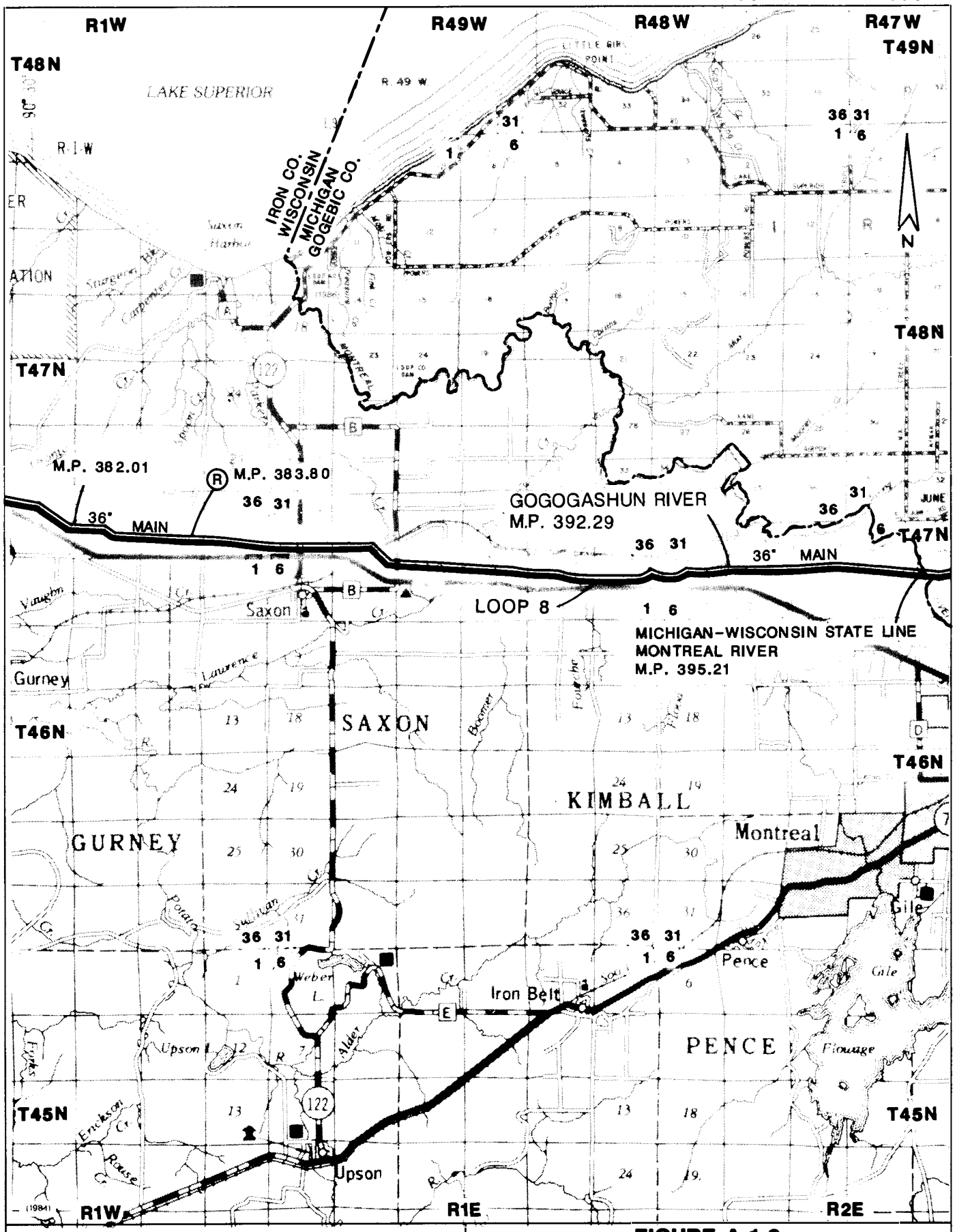
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-8

LOOP 8

SHEET 13 OF 46

M.P. 382.01 to M.P. 395.21



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

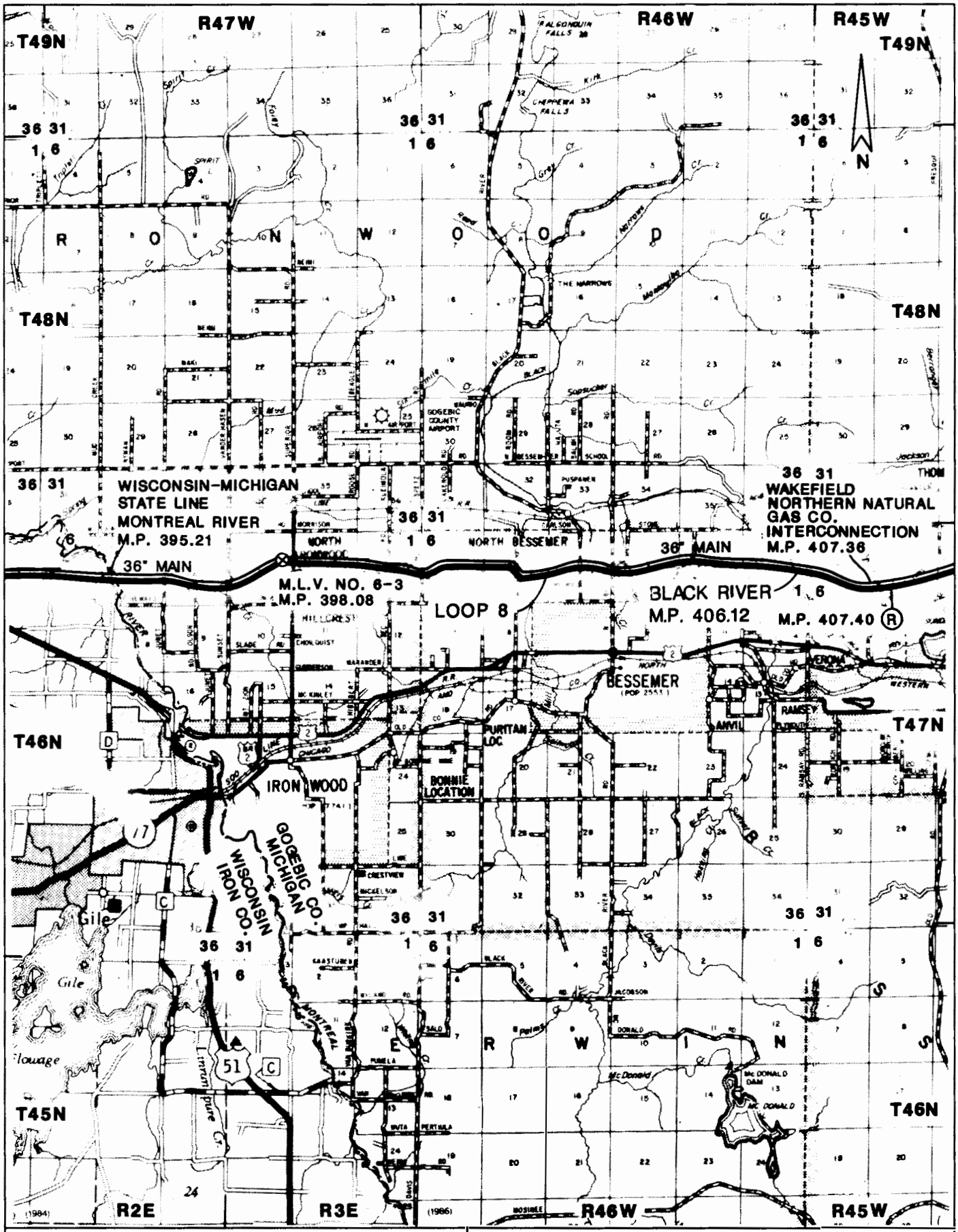
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-8

LOOP 8

SHEET 14 OF 46

M.P. 395.21 to M.P. 407.40



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

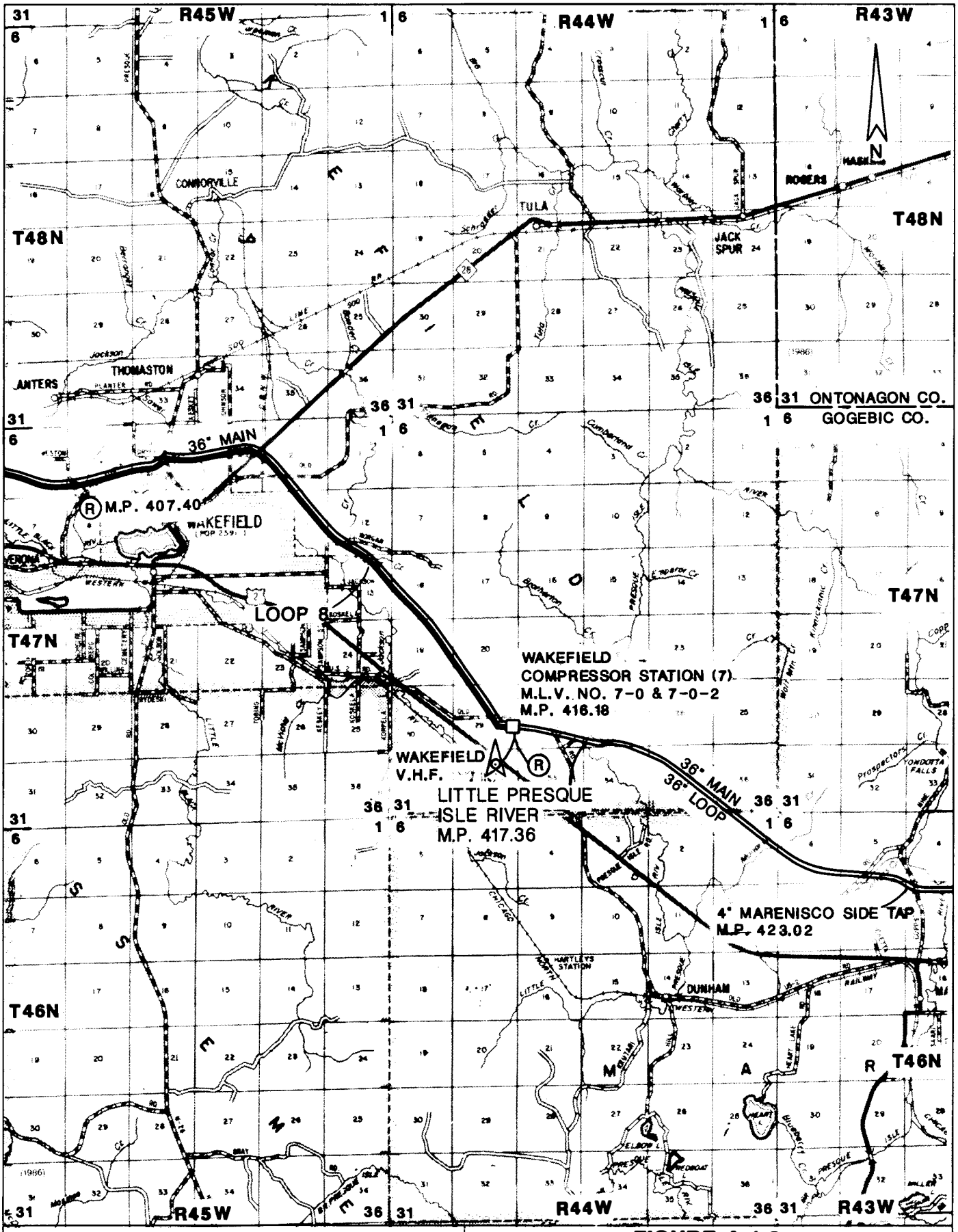
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-8

LOOP 8

SHEET 15 OF 46

M.P. 407.40 to M.P. 416.18



GREAT LAKES GAS TRANSMISSION CO.

DETROIT, MICHIGAN

1 0 1 2 3 4

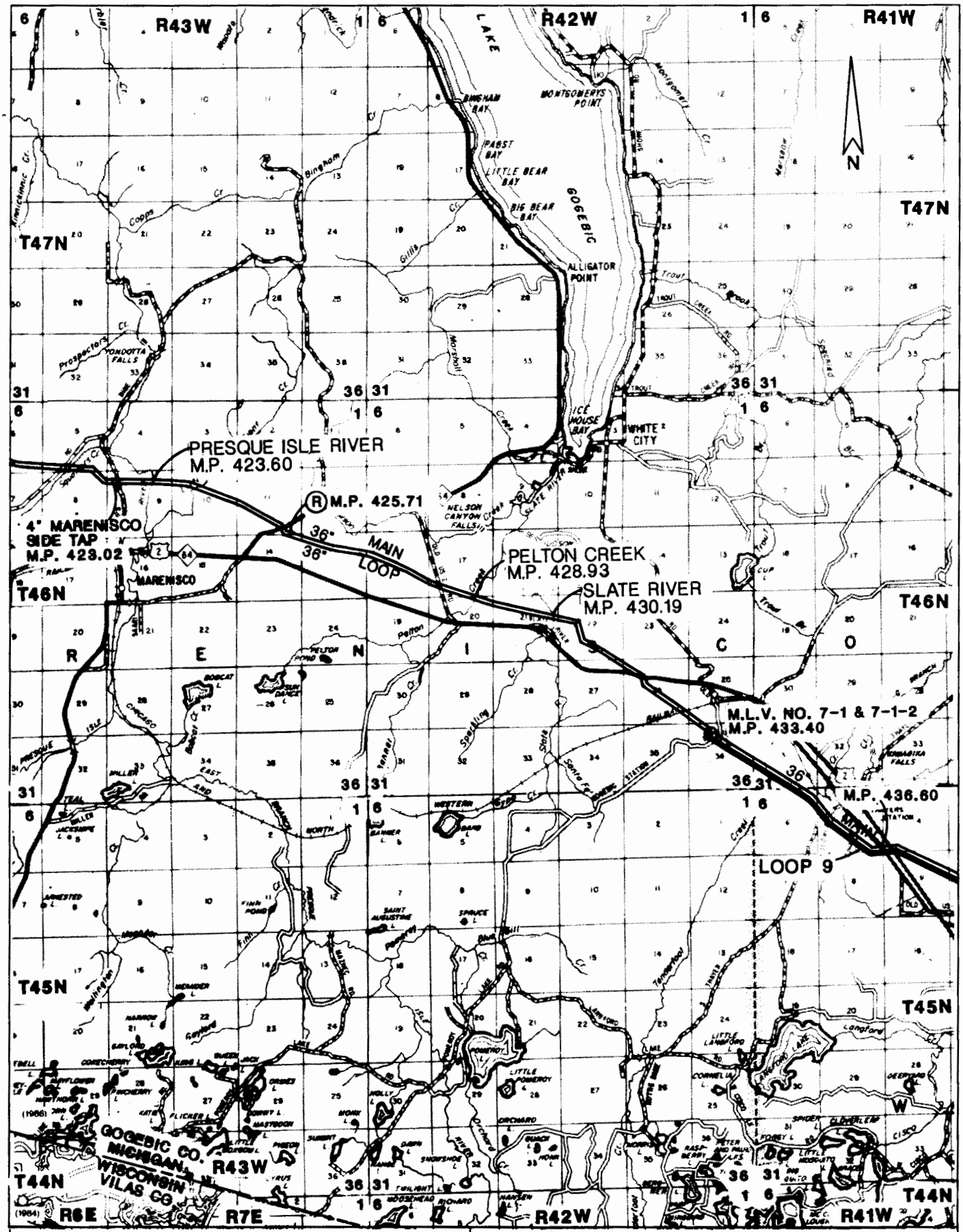
SCALE IN MILES

FIGURE A-1-8

LOOP 8

SHEET 16 OF 46

M.P 433.40 to M.P. 436.60



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

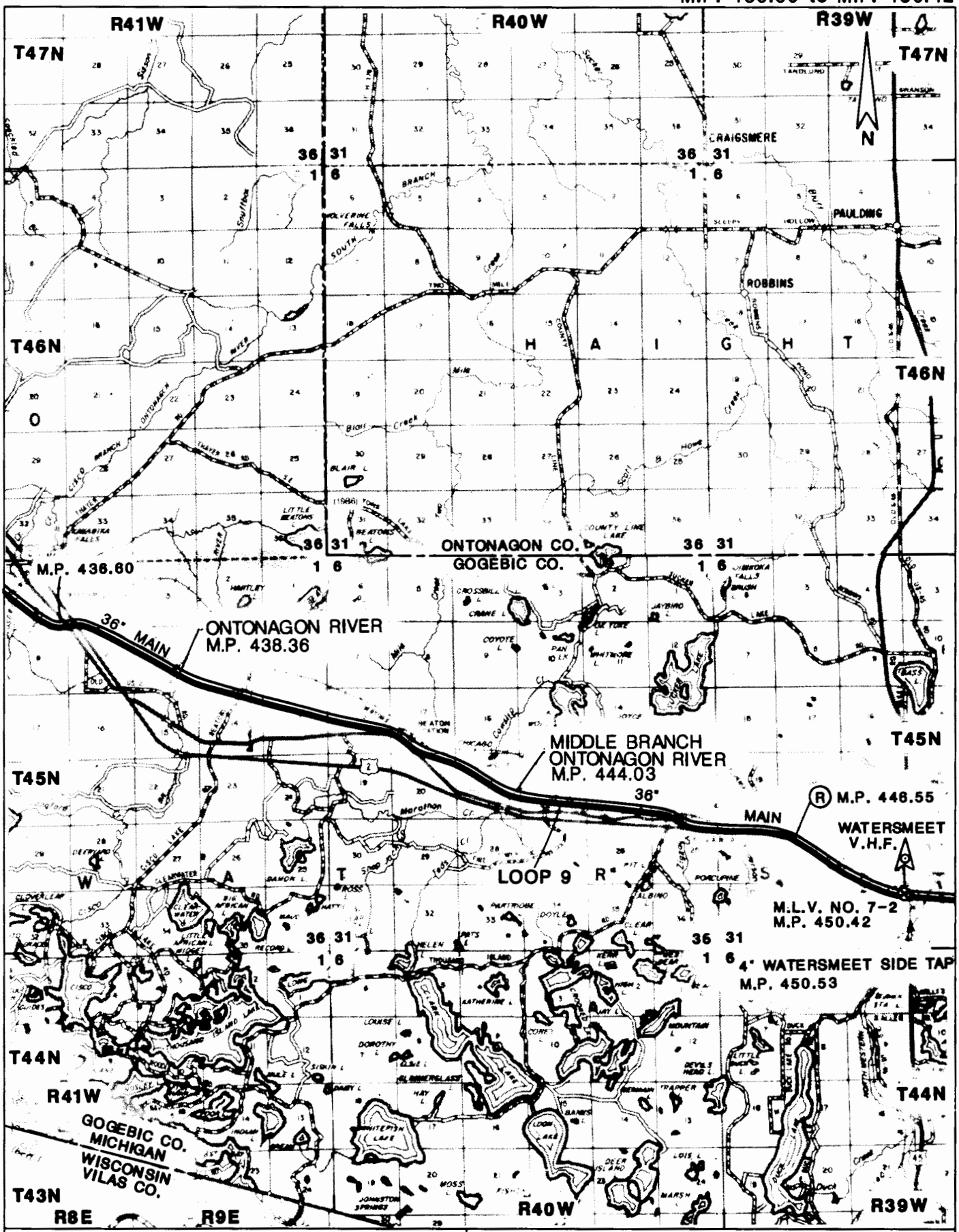
SCALE IN MILES 1 0 1 2 3 4

FIGURE A-1-9

LOOP 9

SHEET 17 OF 46

M.P. 436.60 to M.P. 450.42



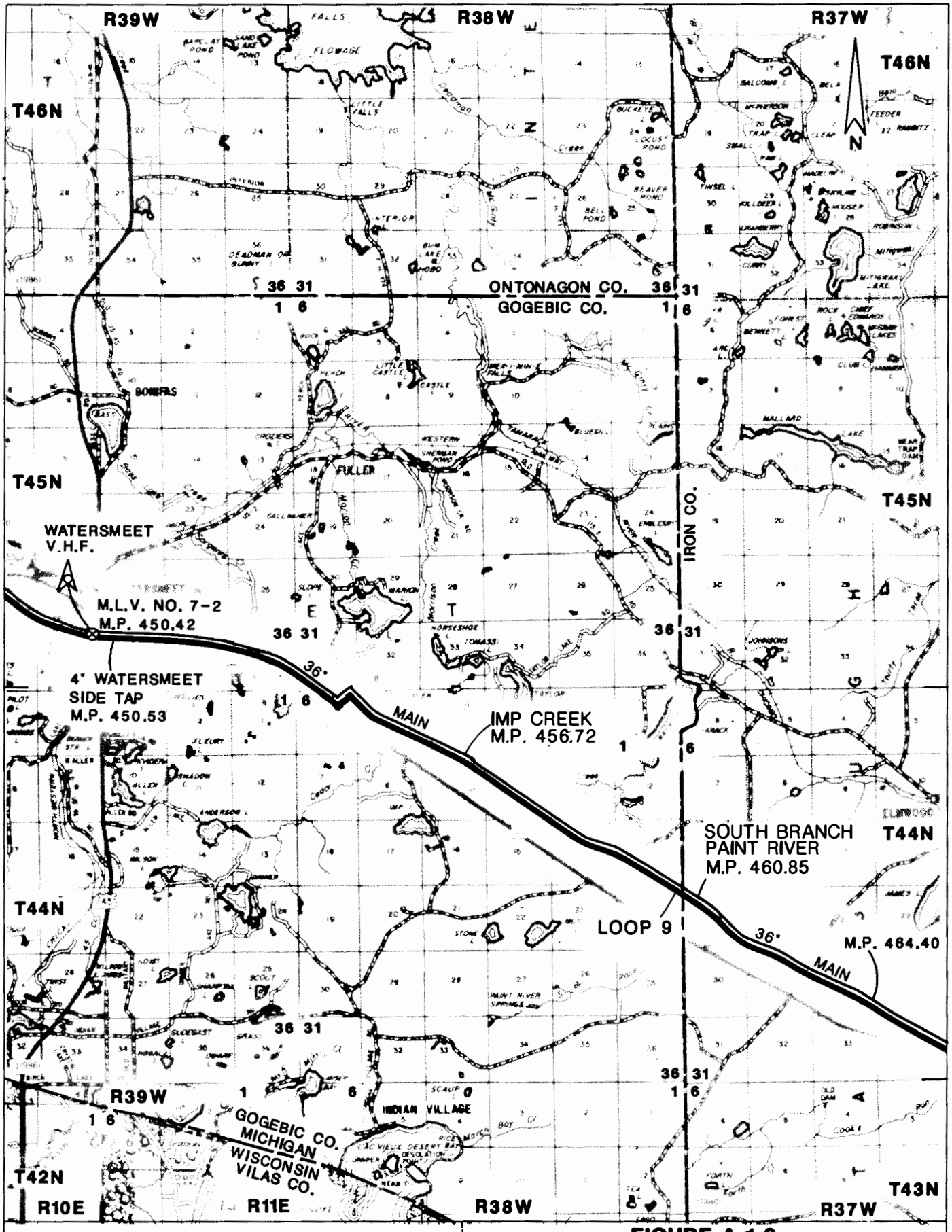
GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

SCALE IN MILES

FIGURE A-1-9

LOOP 9

SHEET 18 OF 46



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

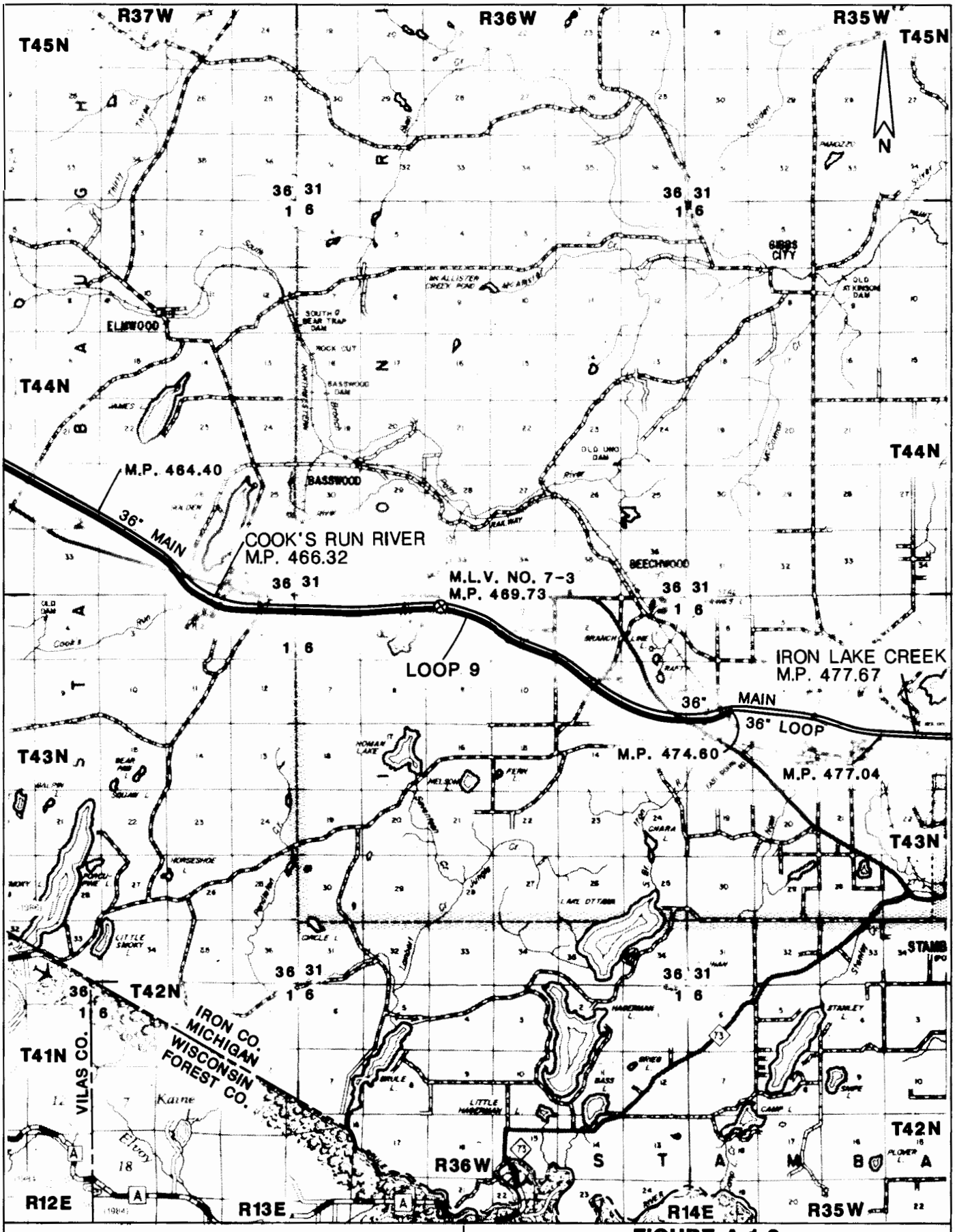
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-9

LOOP 9

SHEET 19 OF 46

M.P. 464.40 to M.P. 474.60



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

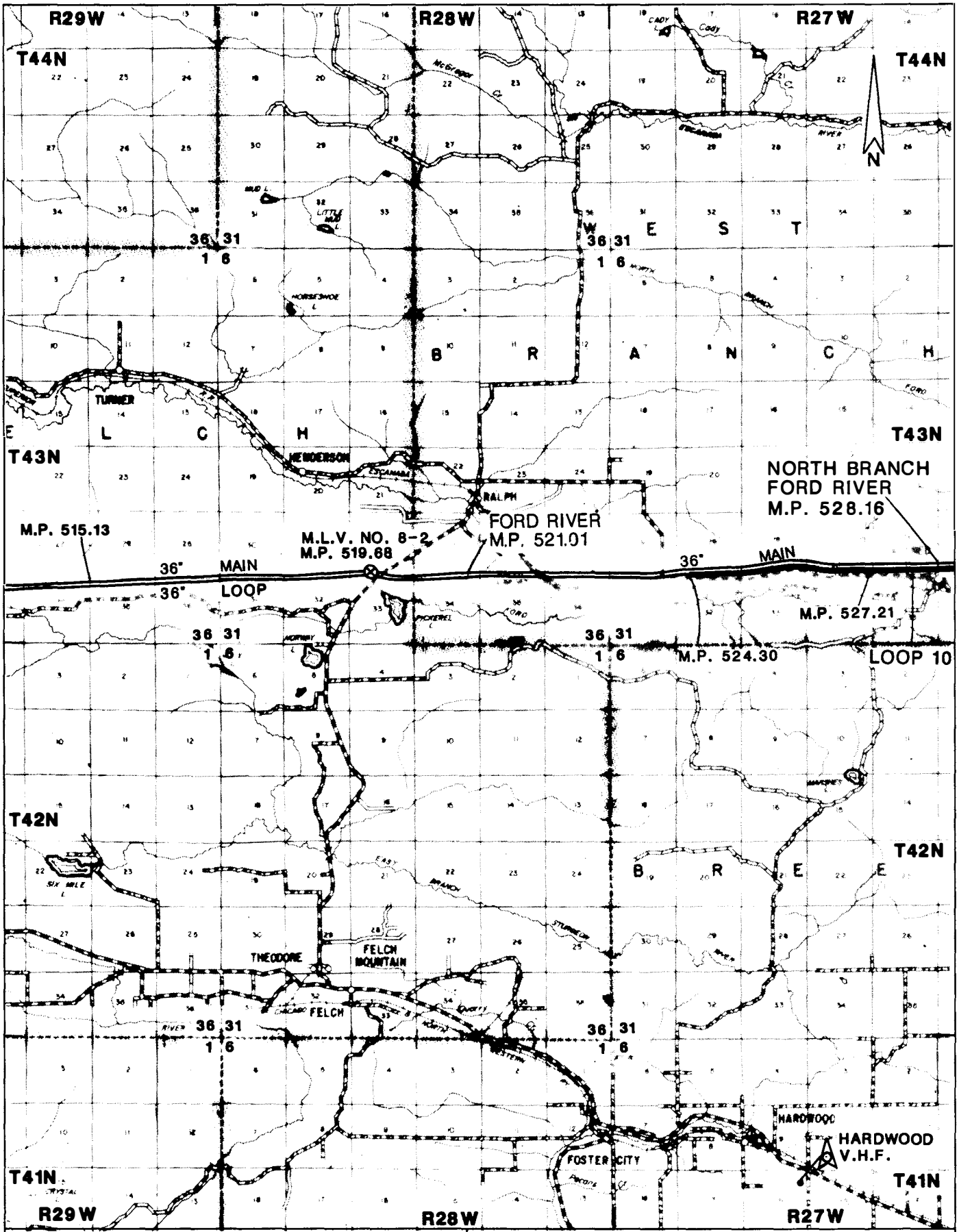
SCALE IN MILES

FIGURE A-1-9

LOOP 9

SHEET 20 OF 46

M.P. 524.30 to M.P. 527.21



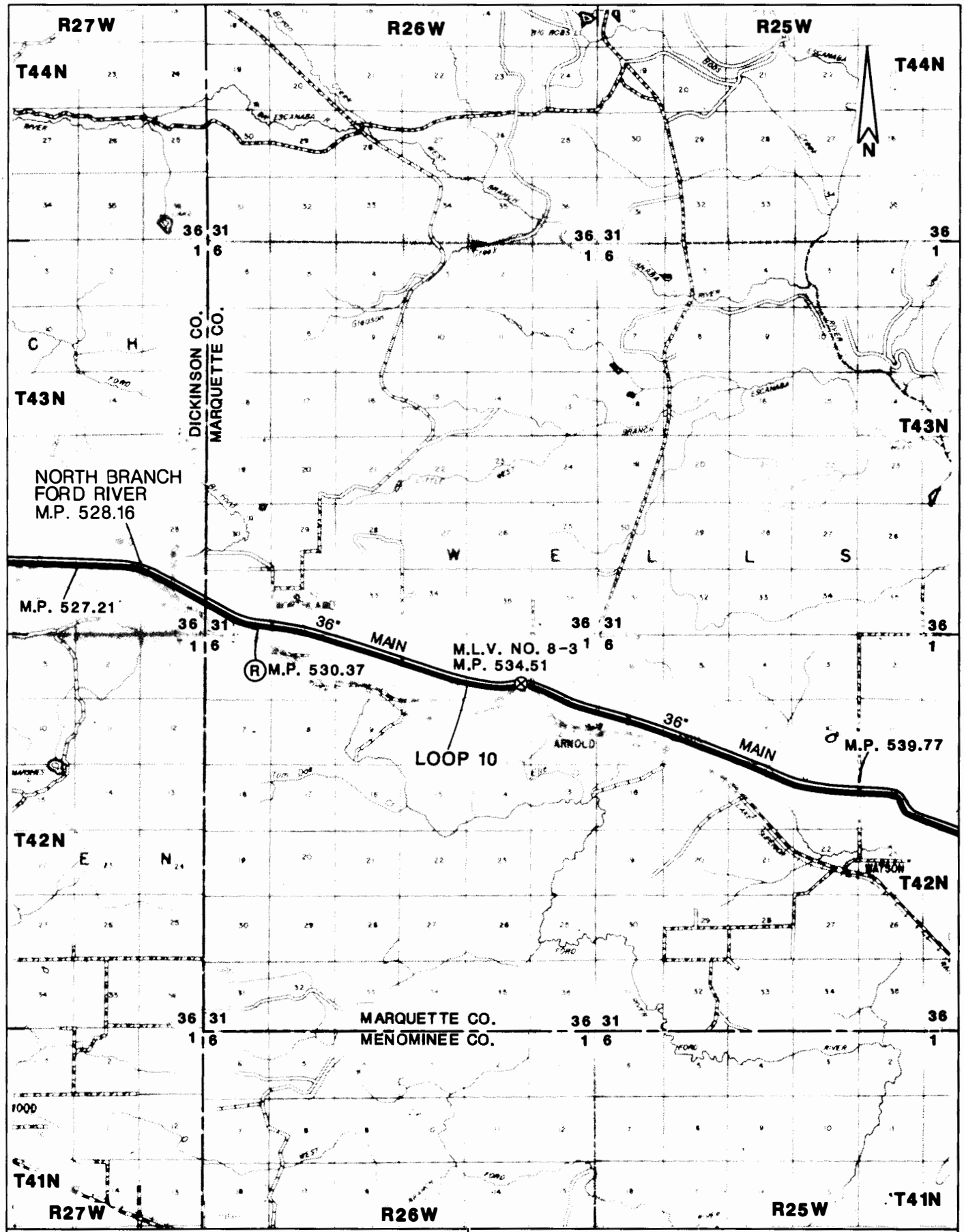
GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-10

LOOP 10

SHEET 21 OF 46



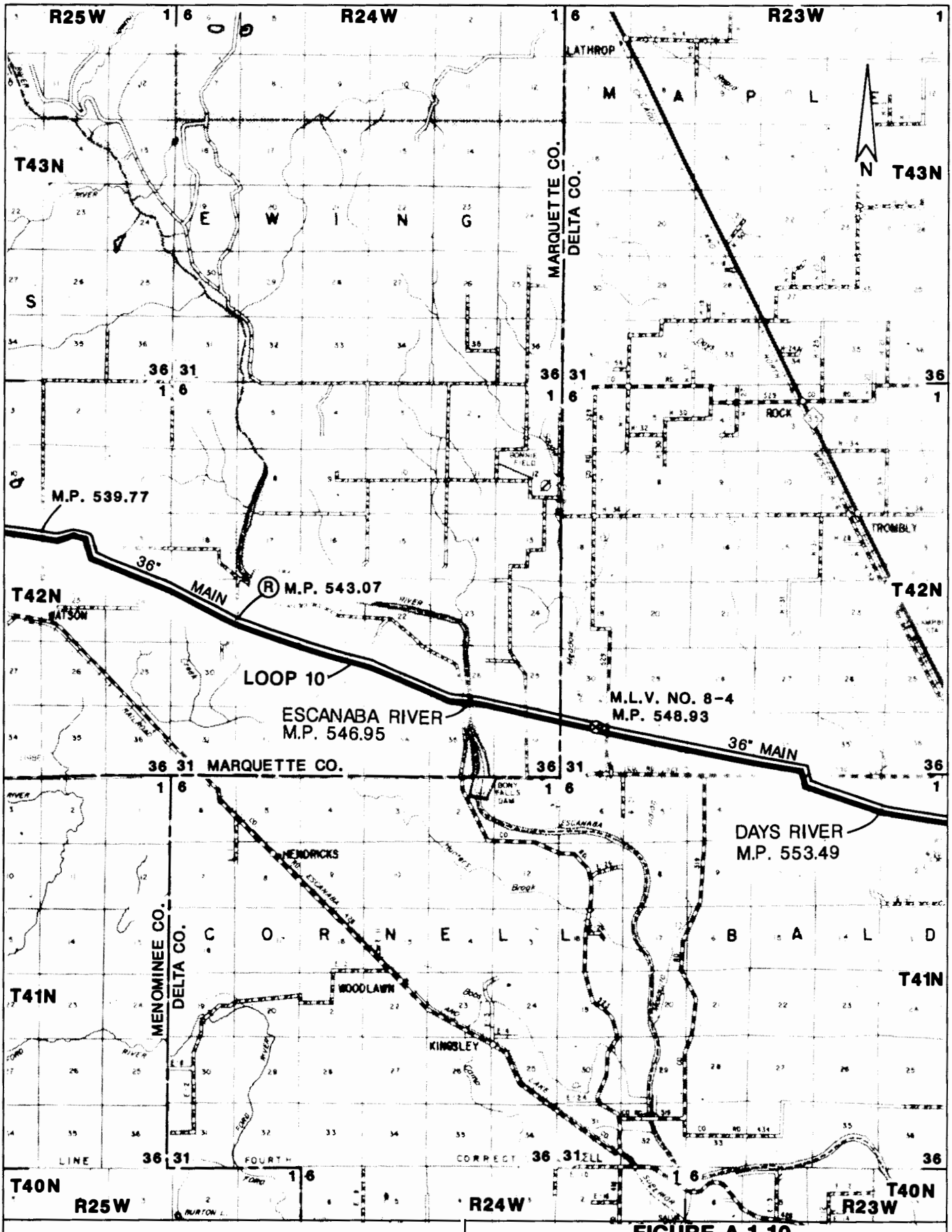
GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-10

LOOP 10

SHEET 22 OF 46

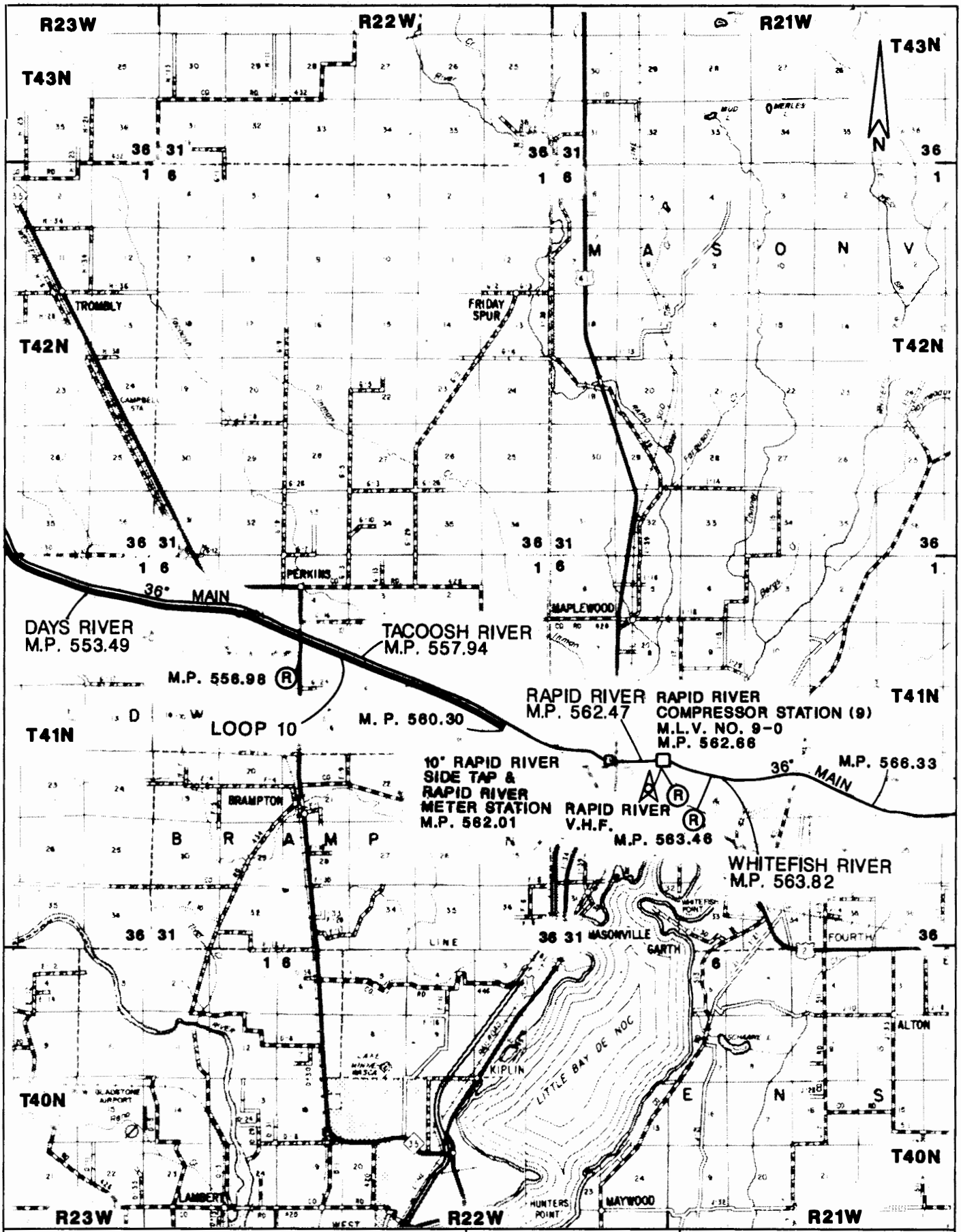


GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

FIGURE A-1-10

LOOP 10

SHEET 23 OF 46



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

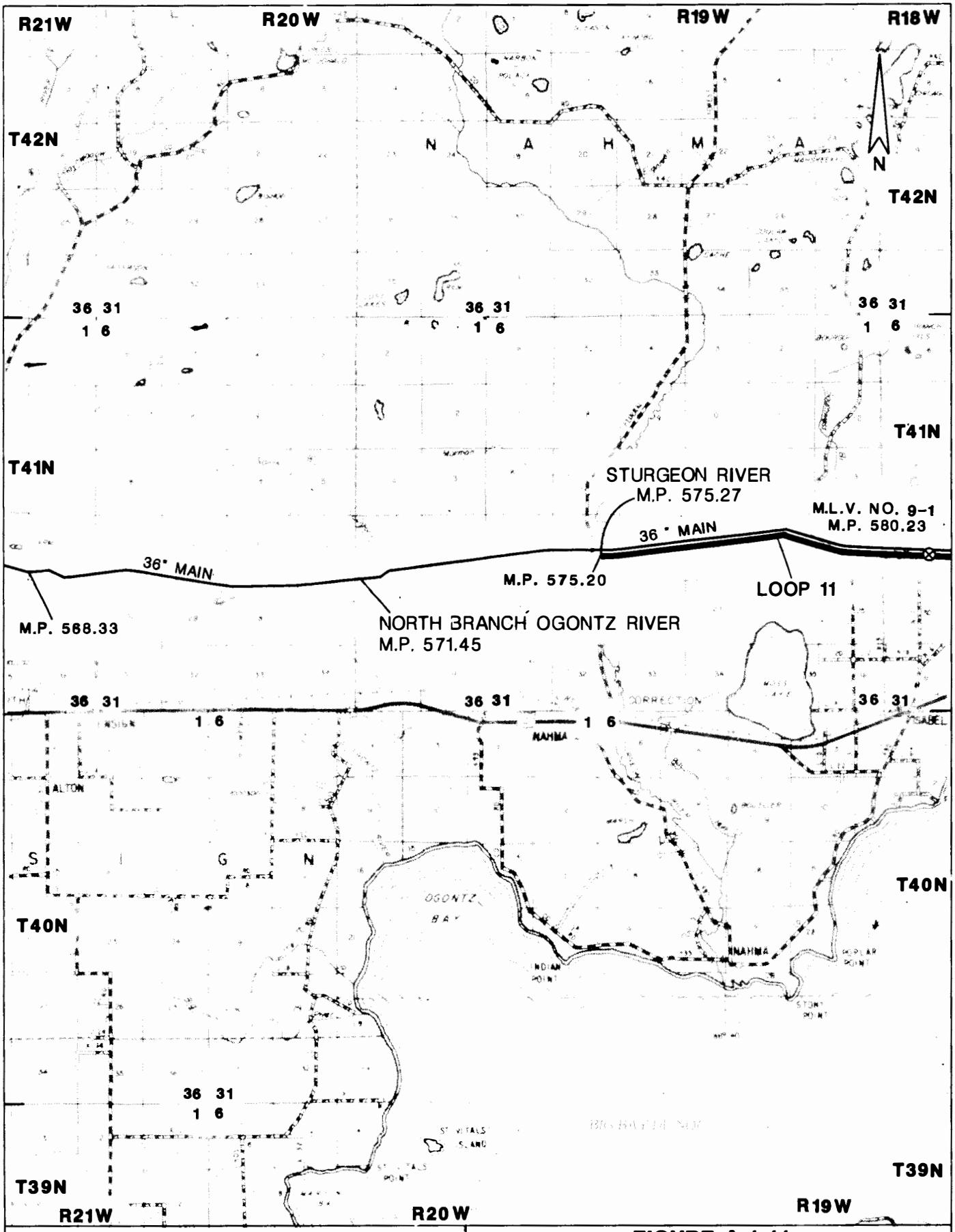
SCALE IN MILES 1 0 1 2 3 4

FIGURE A-1-10

LOOP 10

SHEET 24 OF 46

M.P. 575.20 to M.P. 580.23



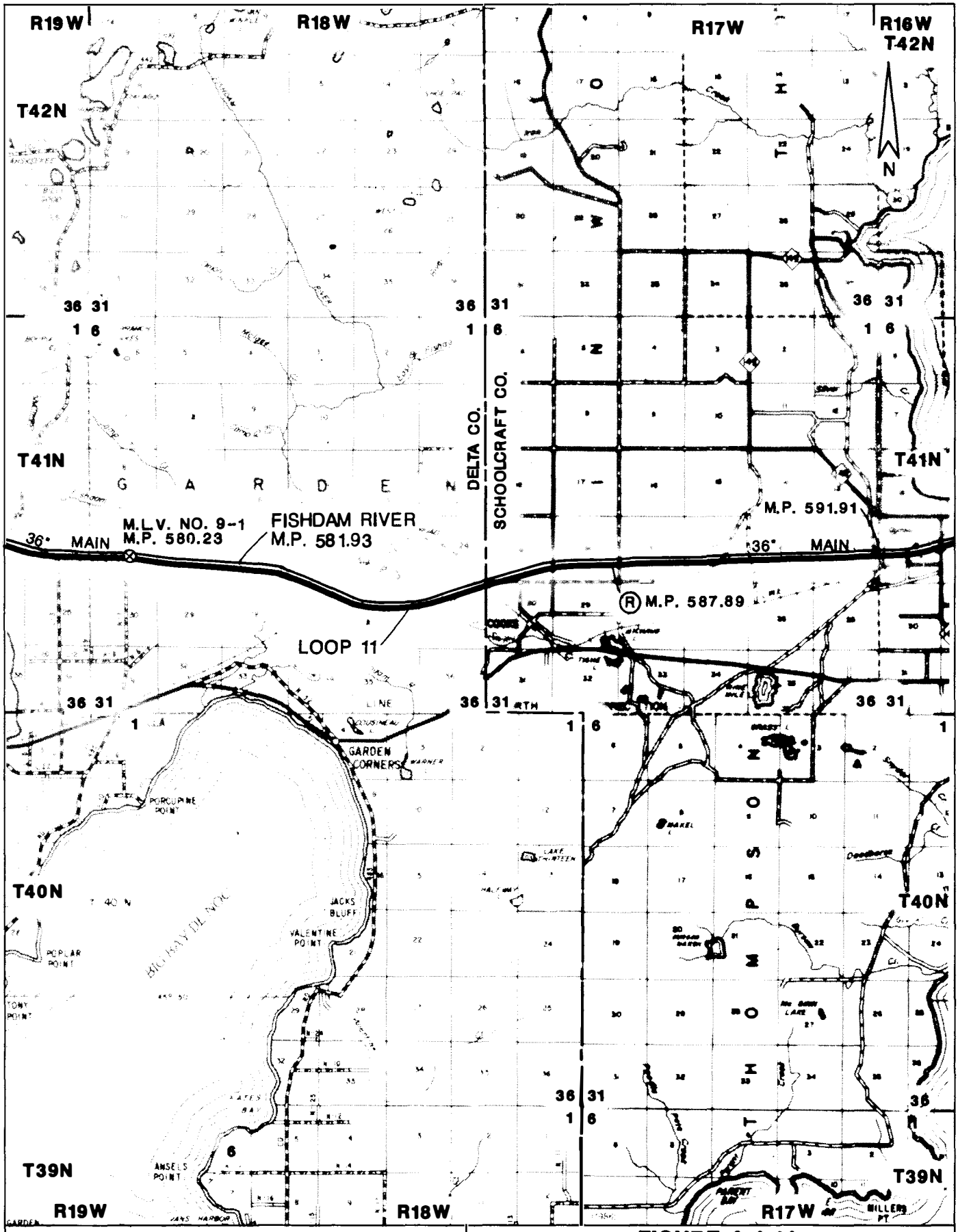
GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-11

LOOP 11

SHEET 25 OF 46



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

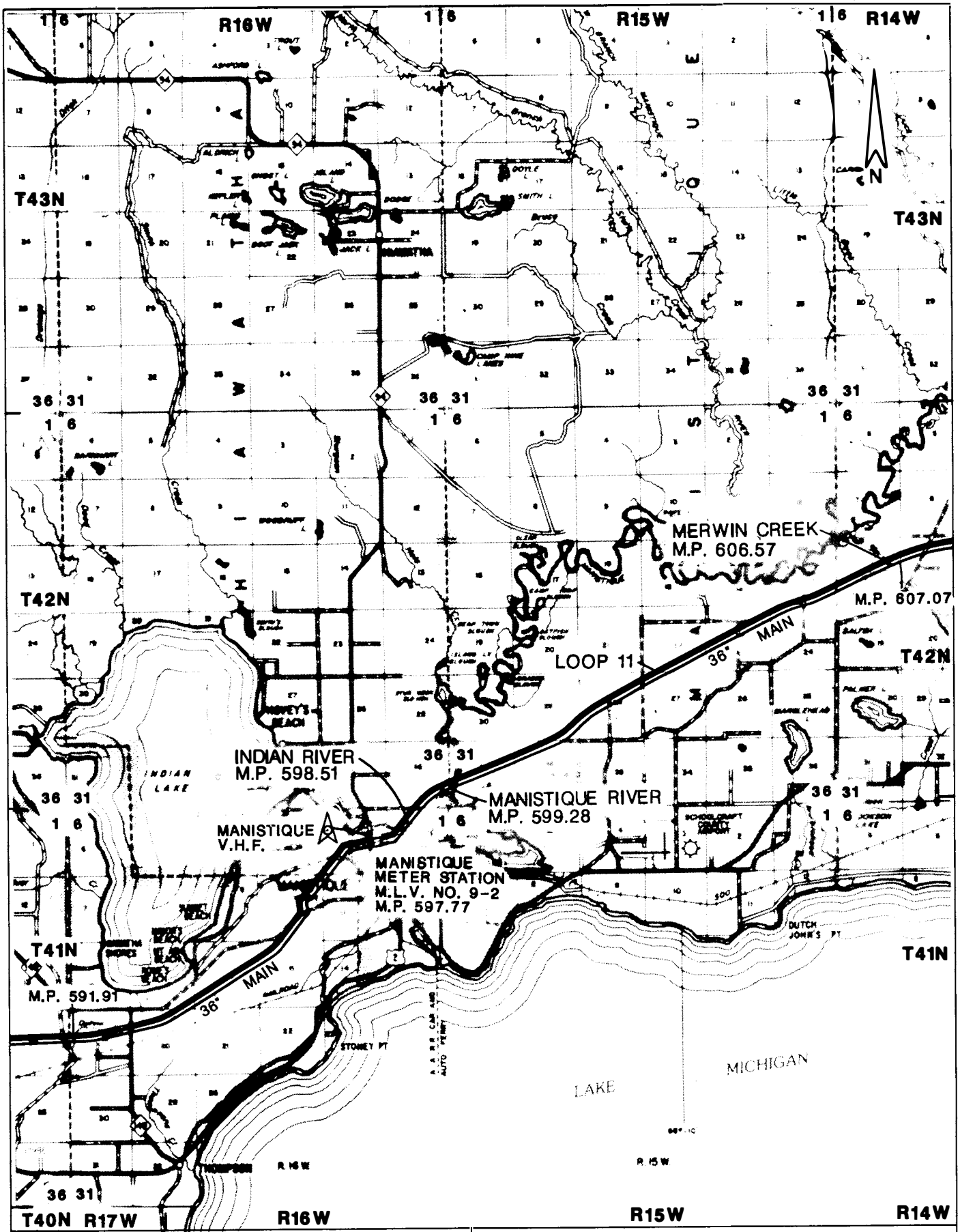
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-11

LOOP 11

SHEET 26 OF 46

M.P. 591.91 to M.P. 607.07



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

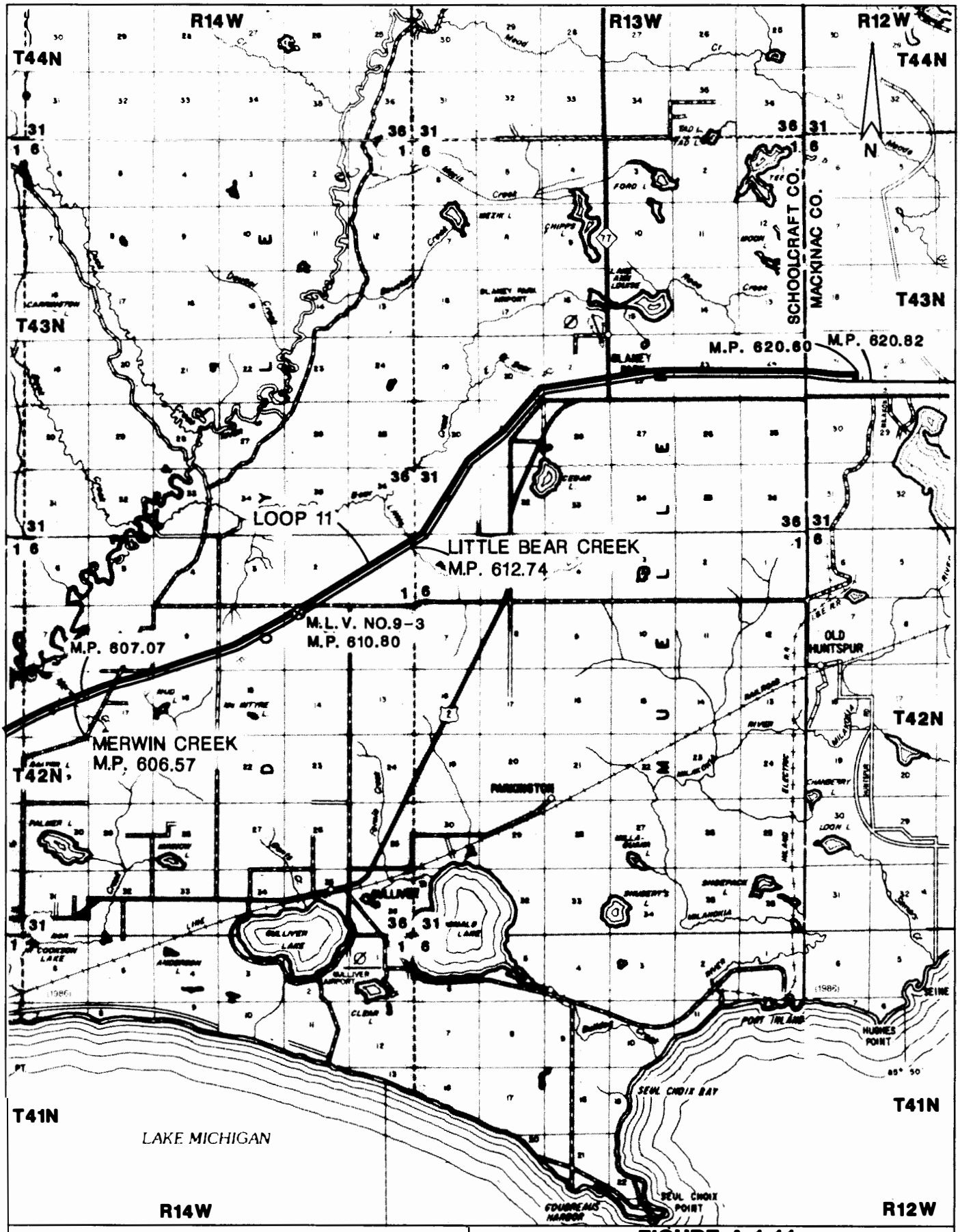
SCALE IN MILES

FIGURE A-1-11

LOOP 11

SHEET 27 OF 46

M.P. 607.07 to M.P. 620.80



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

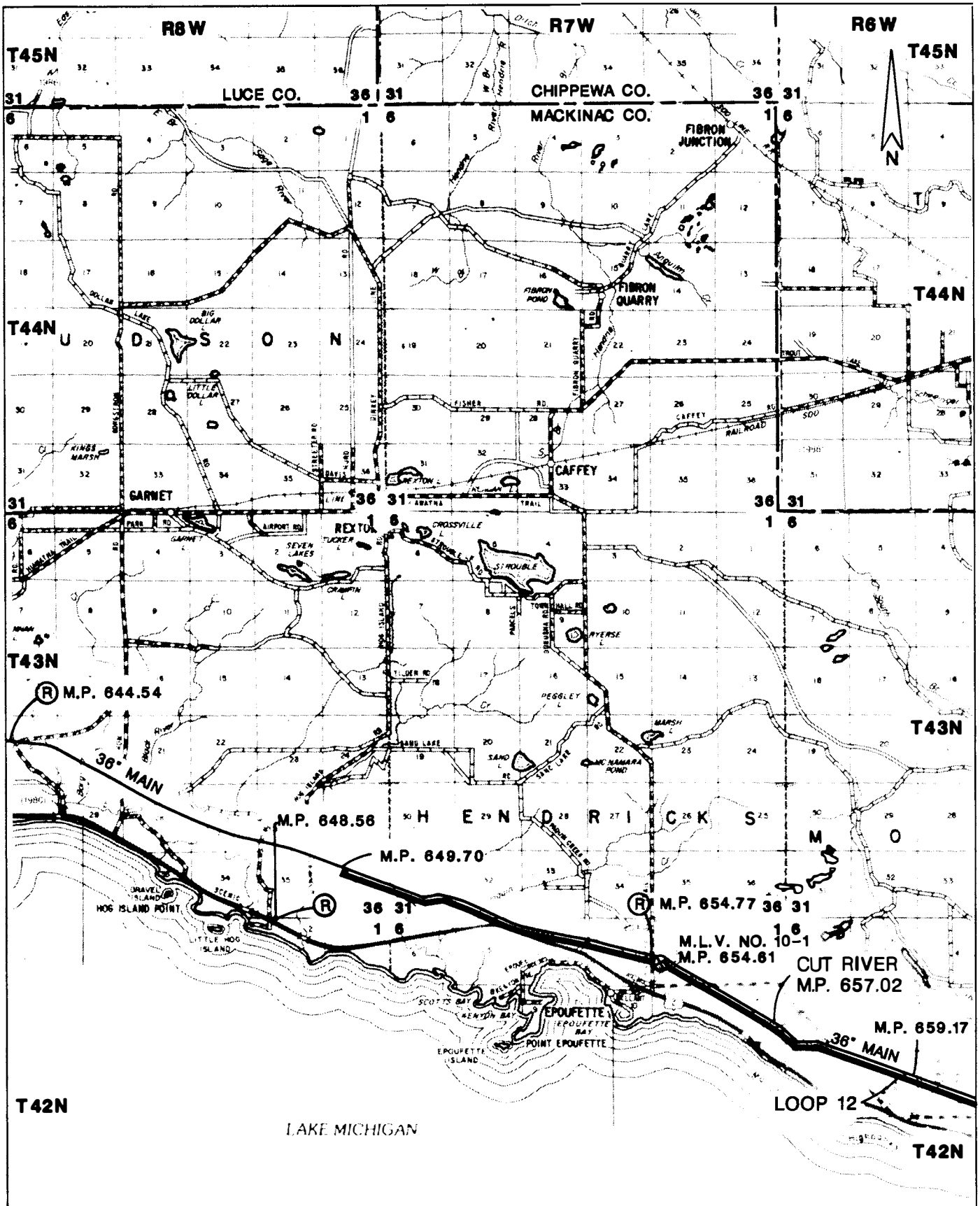
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-11

LOOP 11

SHEET 28 OF 46

M.P. 649.70 to M.P. 659.17



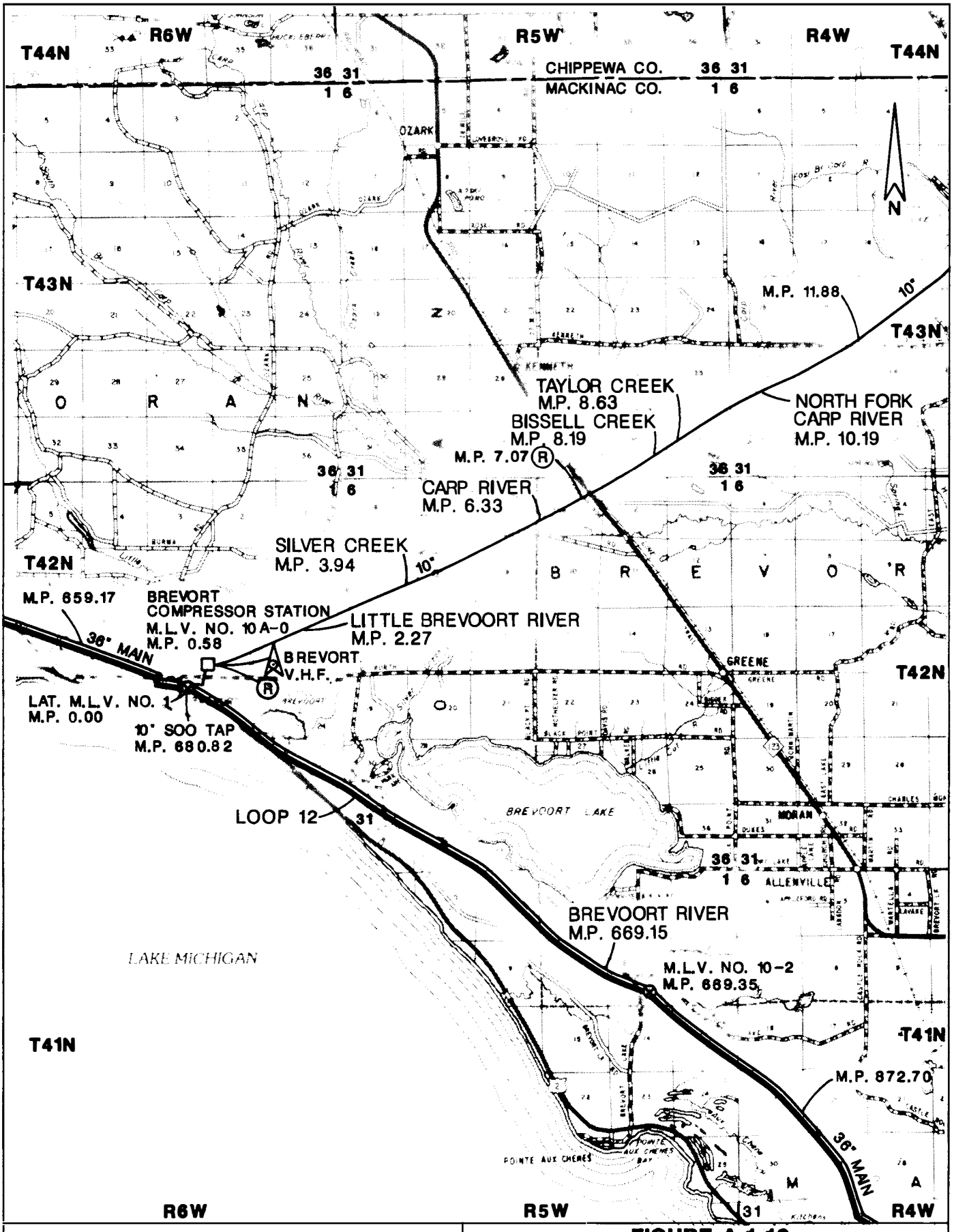
GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-12

LOOP 12

SHEET 29 OF 46

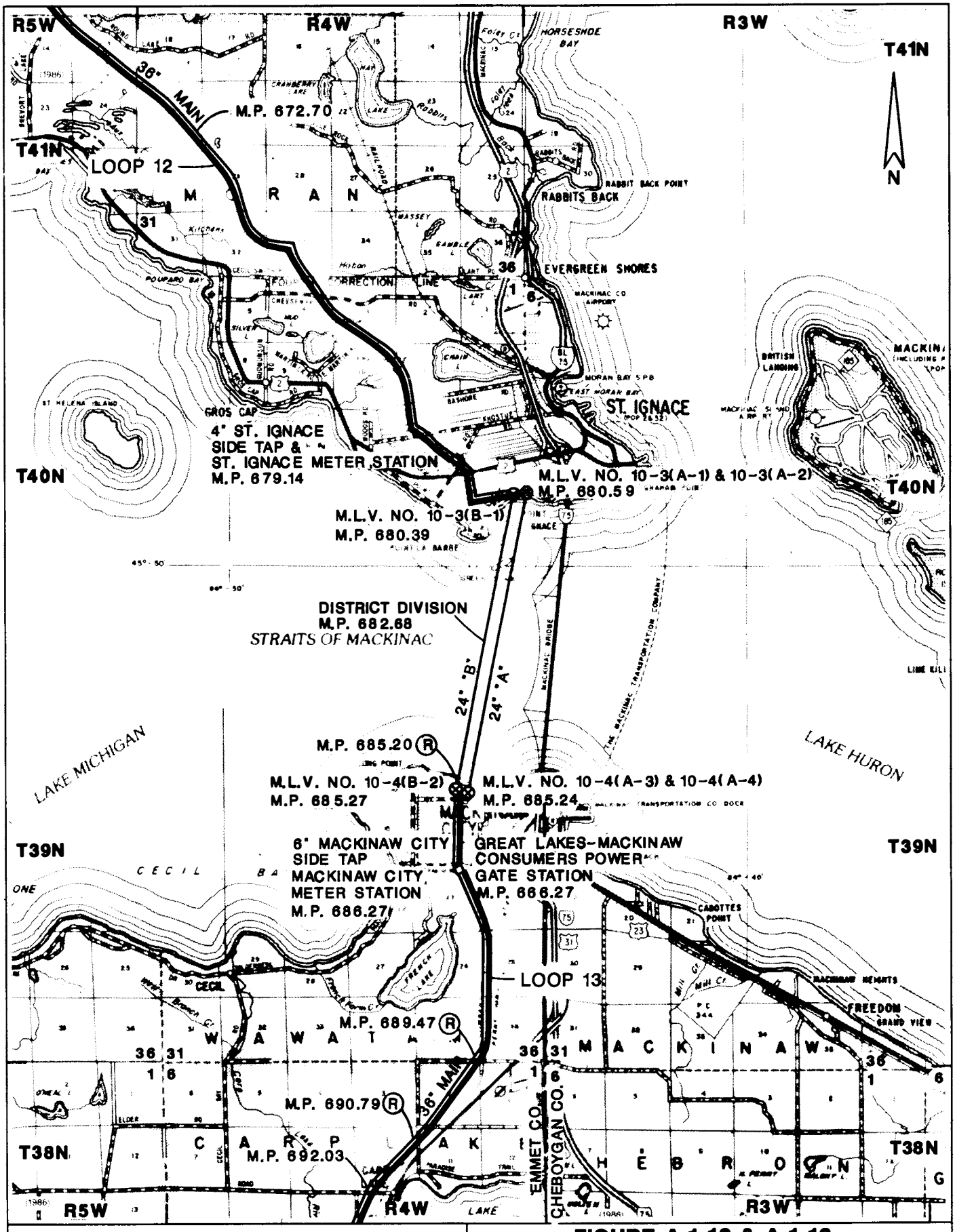


GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-12

LOOP 12



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

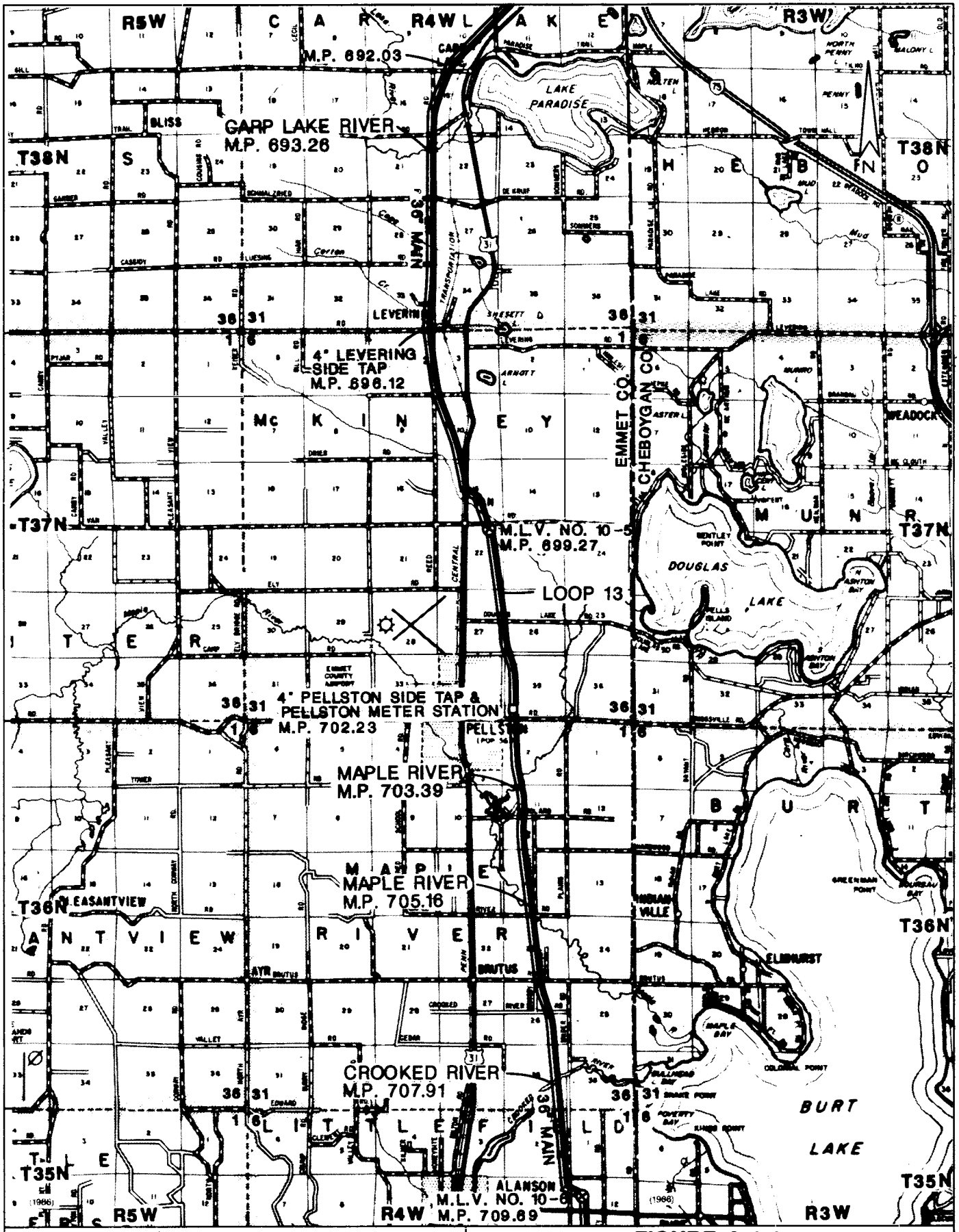
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-12 & A-1-13

LOOP 12 & LOOP 13

SHEET 31 OF 46

M.P. 692.03 to M.P. 709.69



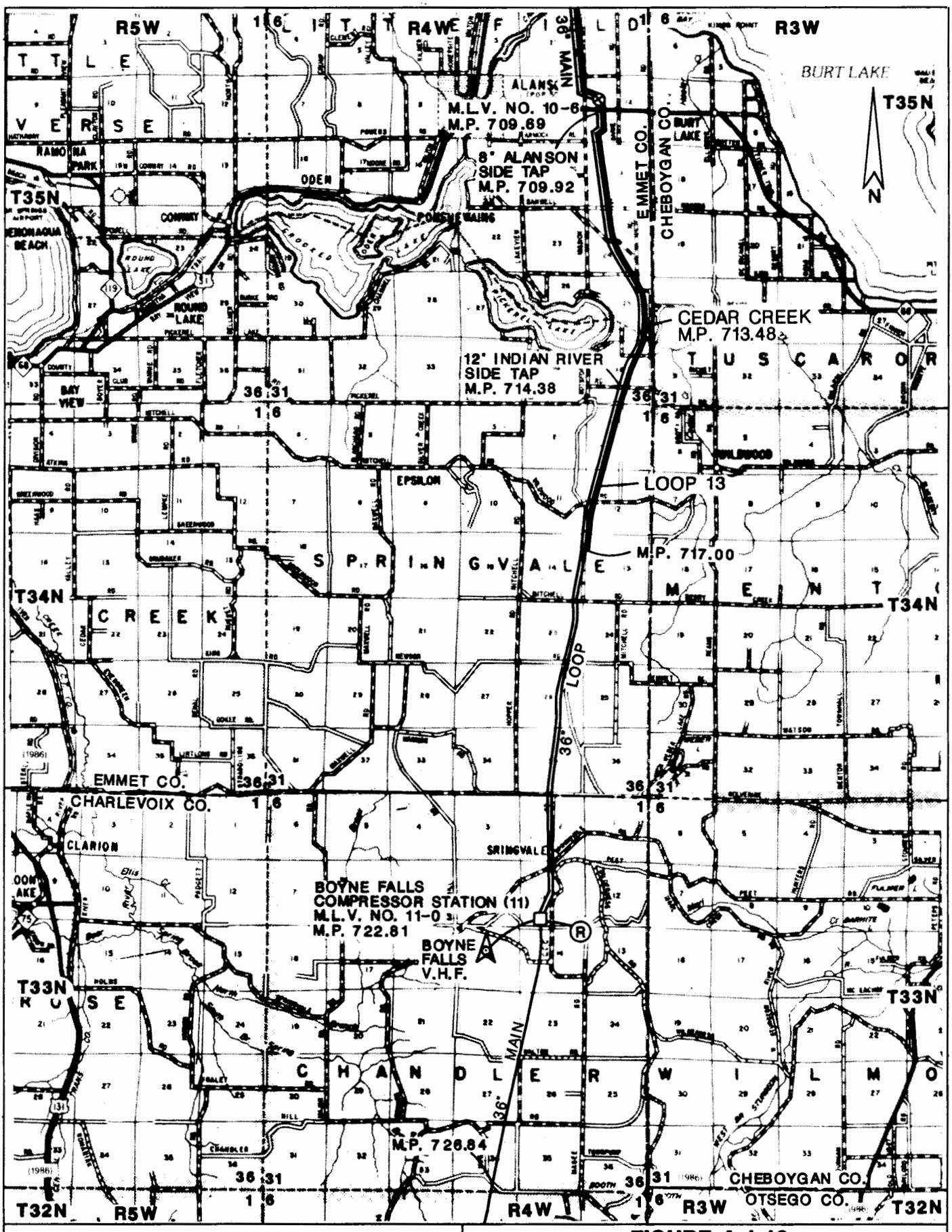
GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-13

LOOP 13

SHEET 32 OF 46



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

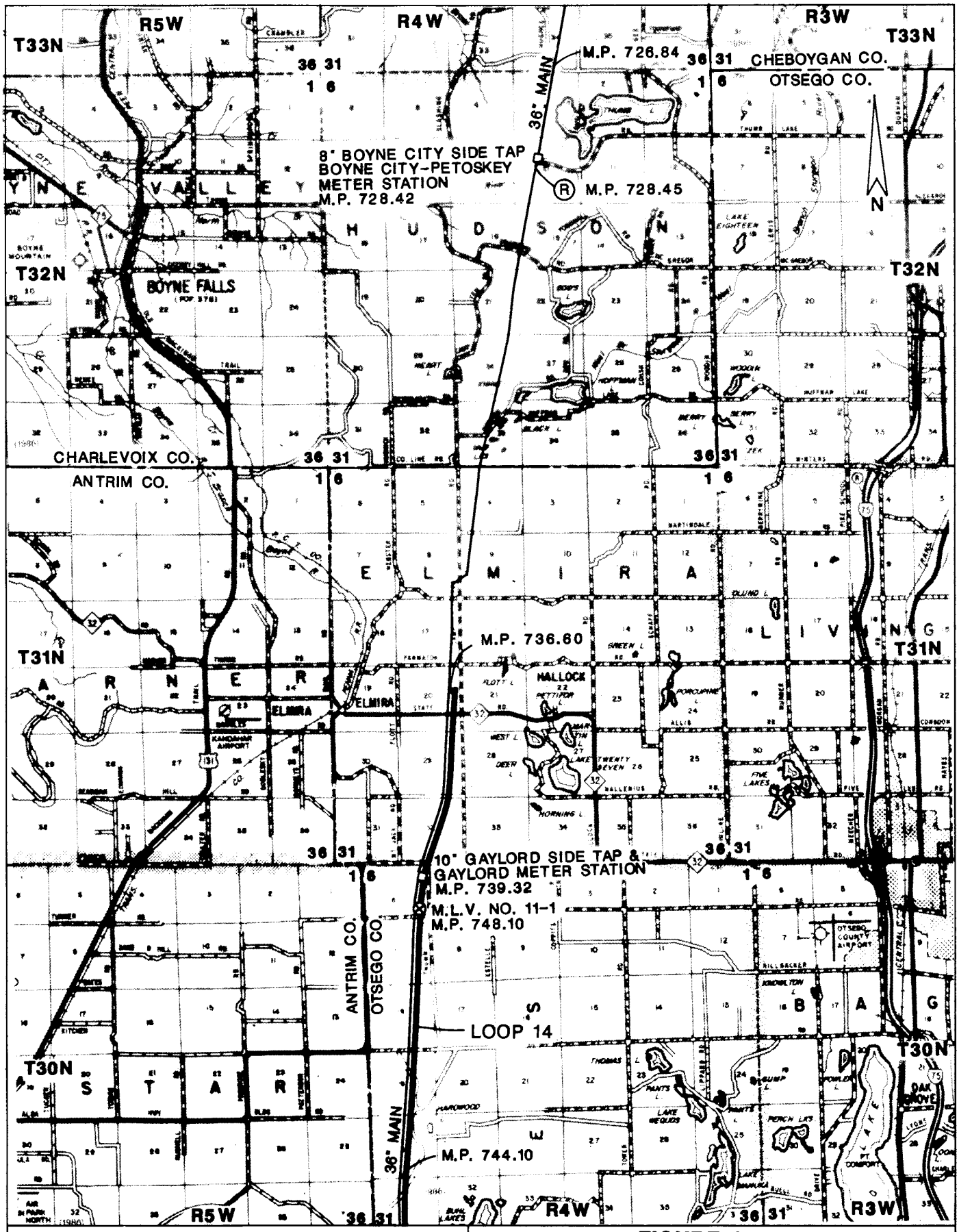
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-13

LOOP 13

SHEET 33 OF 46

M.P. 736.60 to M.P. 744.10



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

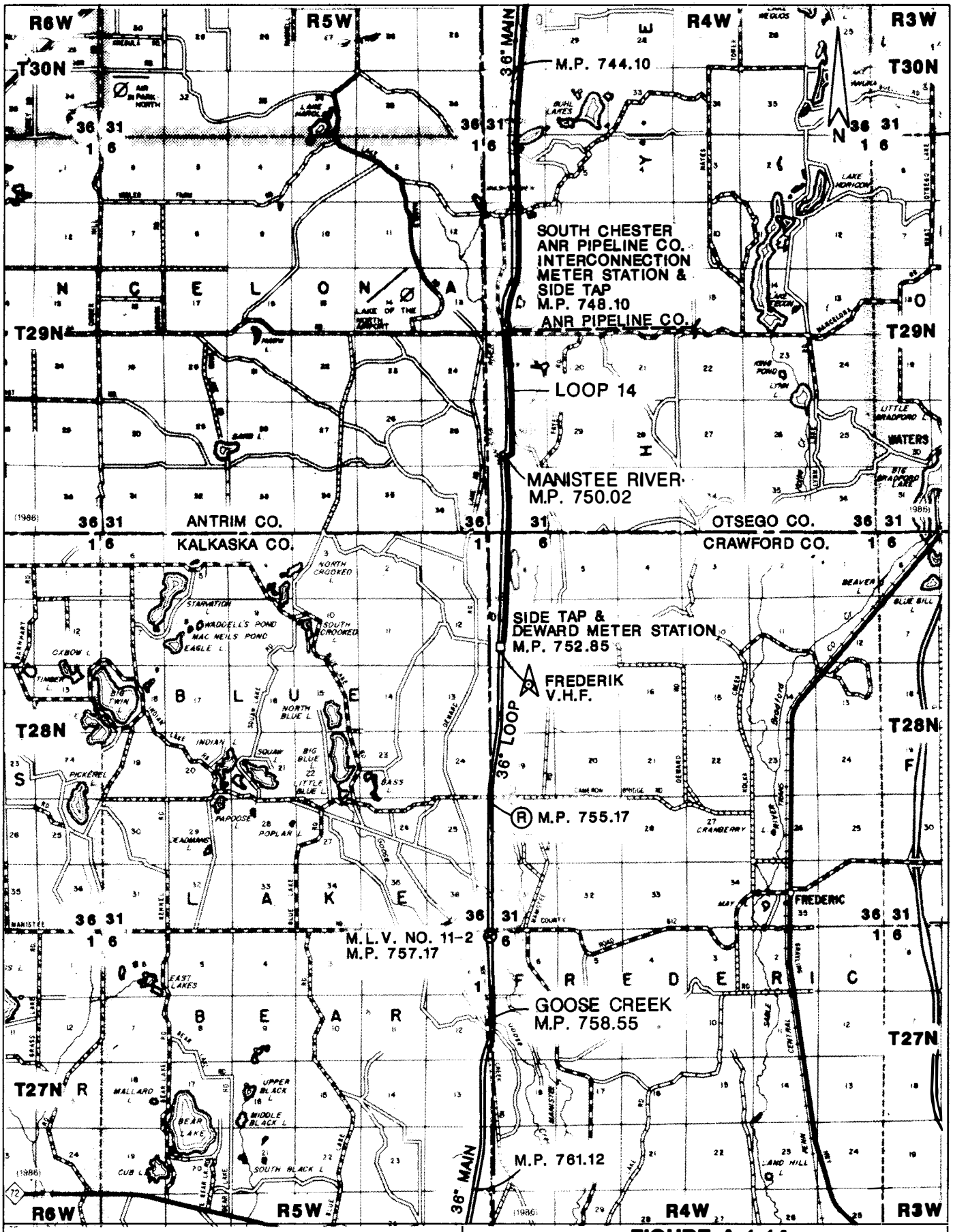
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-14

LOOP 14

SHEET 34 OF 46

M.P. 744.10 to M.P. 752.85



GREAT LAKES GAS TRANSMISSION CO.

DETROIT, MICHIGAN

1 0 1 2 3 4

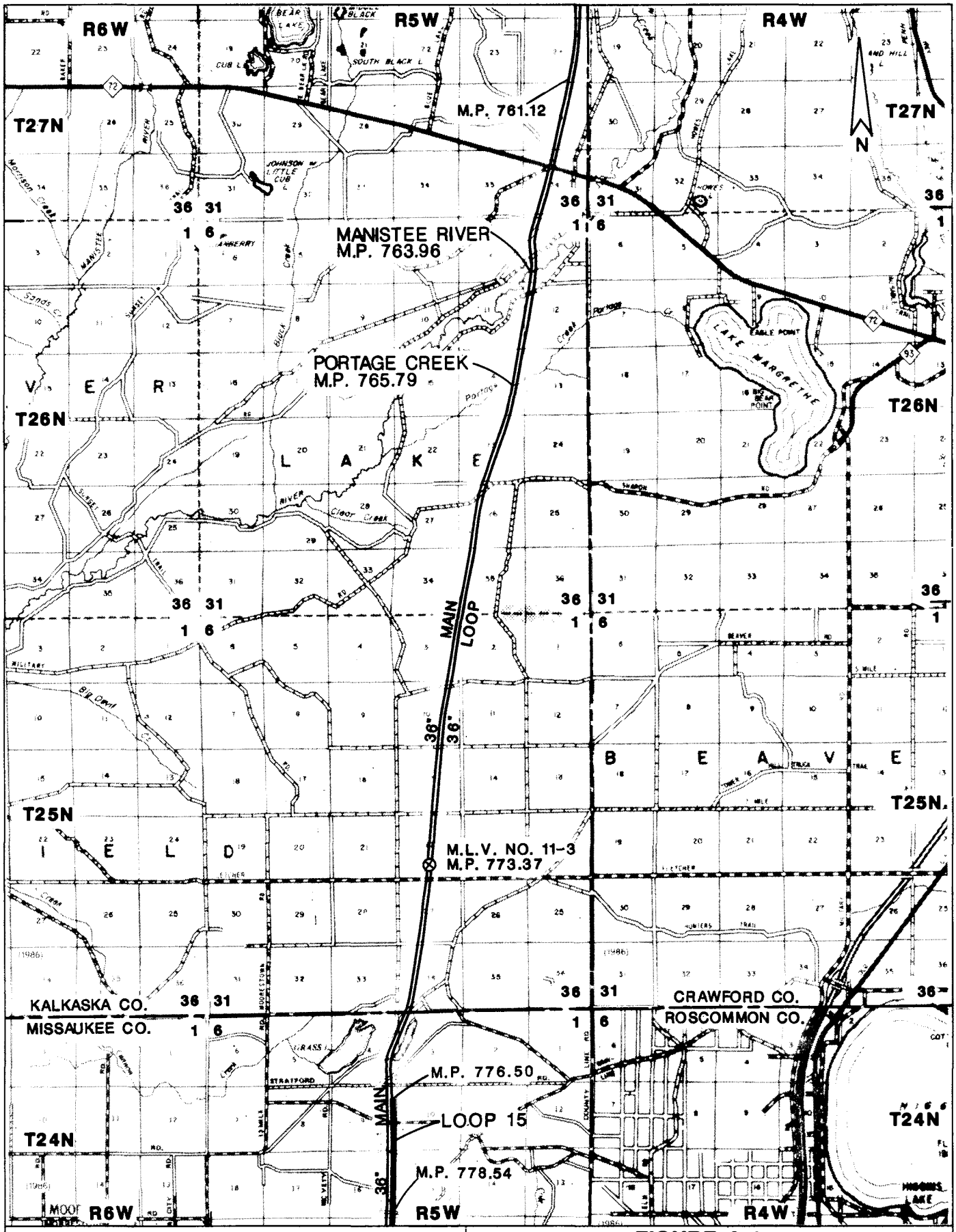
SCALE IN MILES

FIGURE A-1-14

LOOP 14

SHEET 35 OF 46

M.P. 776.50 to M.P. 778.54



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

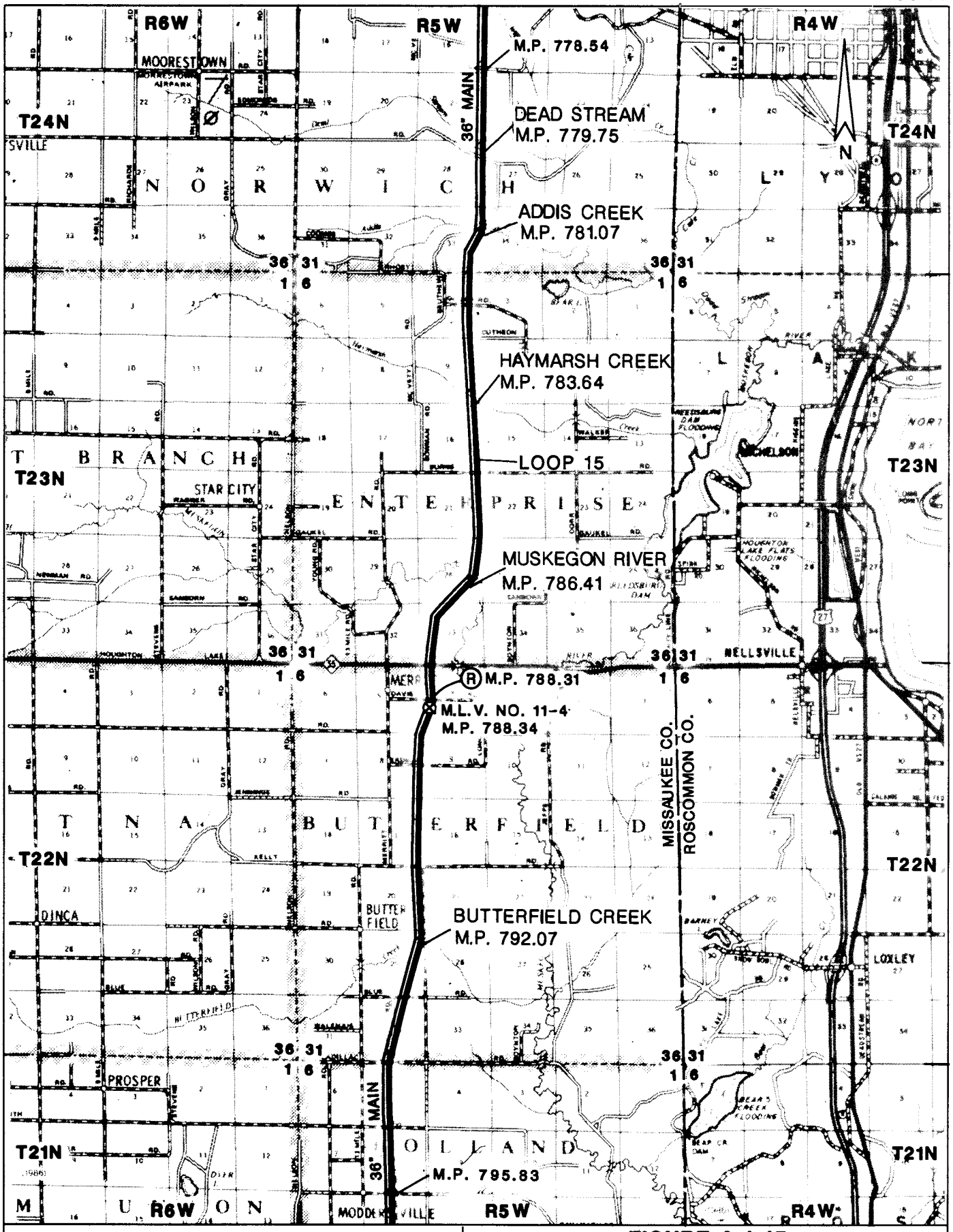
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-15

LOOP 15

SHEET 36 OF 46

M.P. 778.54 to M.P. 795.83



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

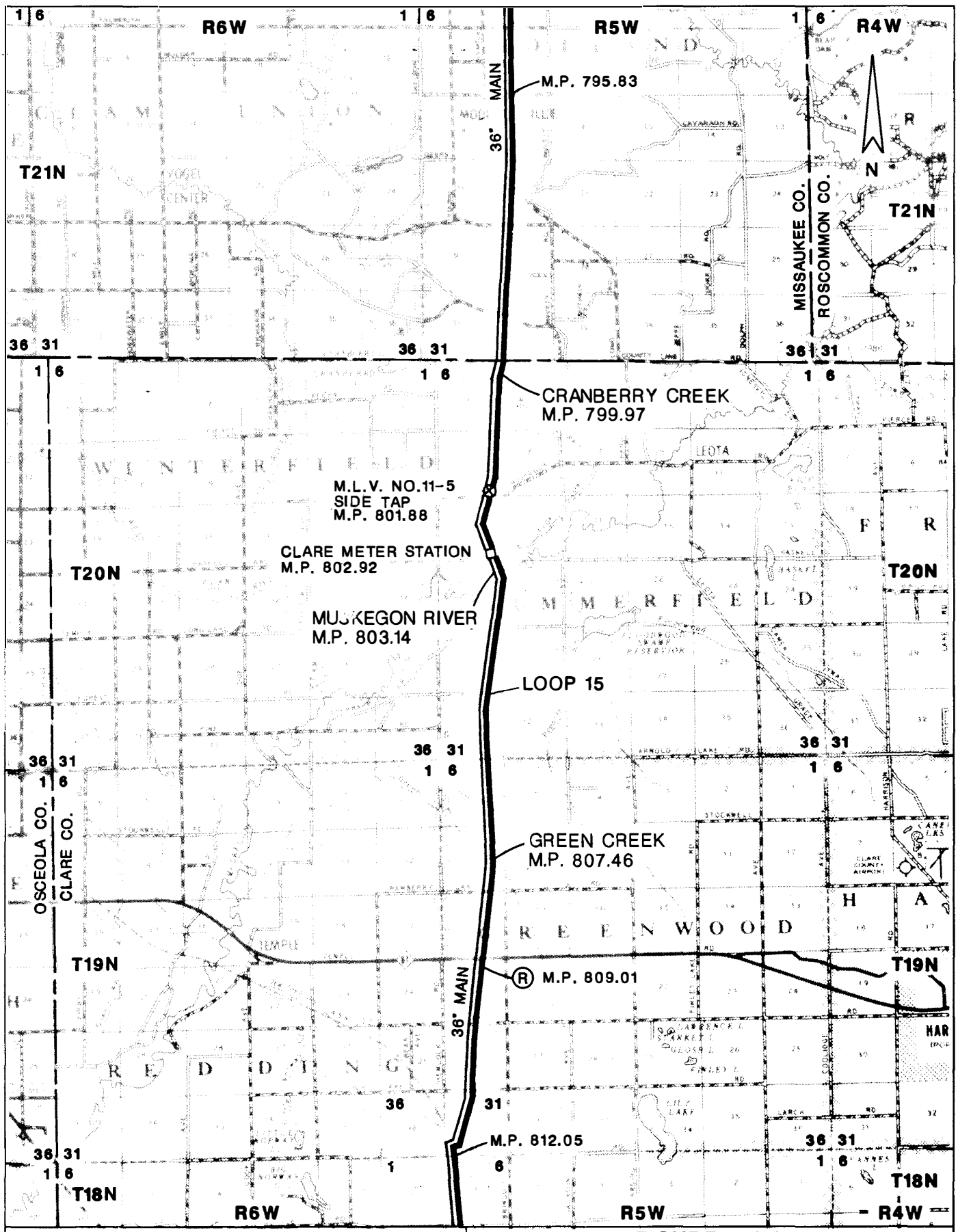
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-15

LOOP 15

SHEET 37 OF 46

M.P. 795.83 to M.P. 812.05



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

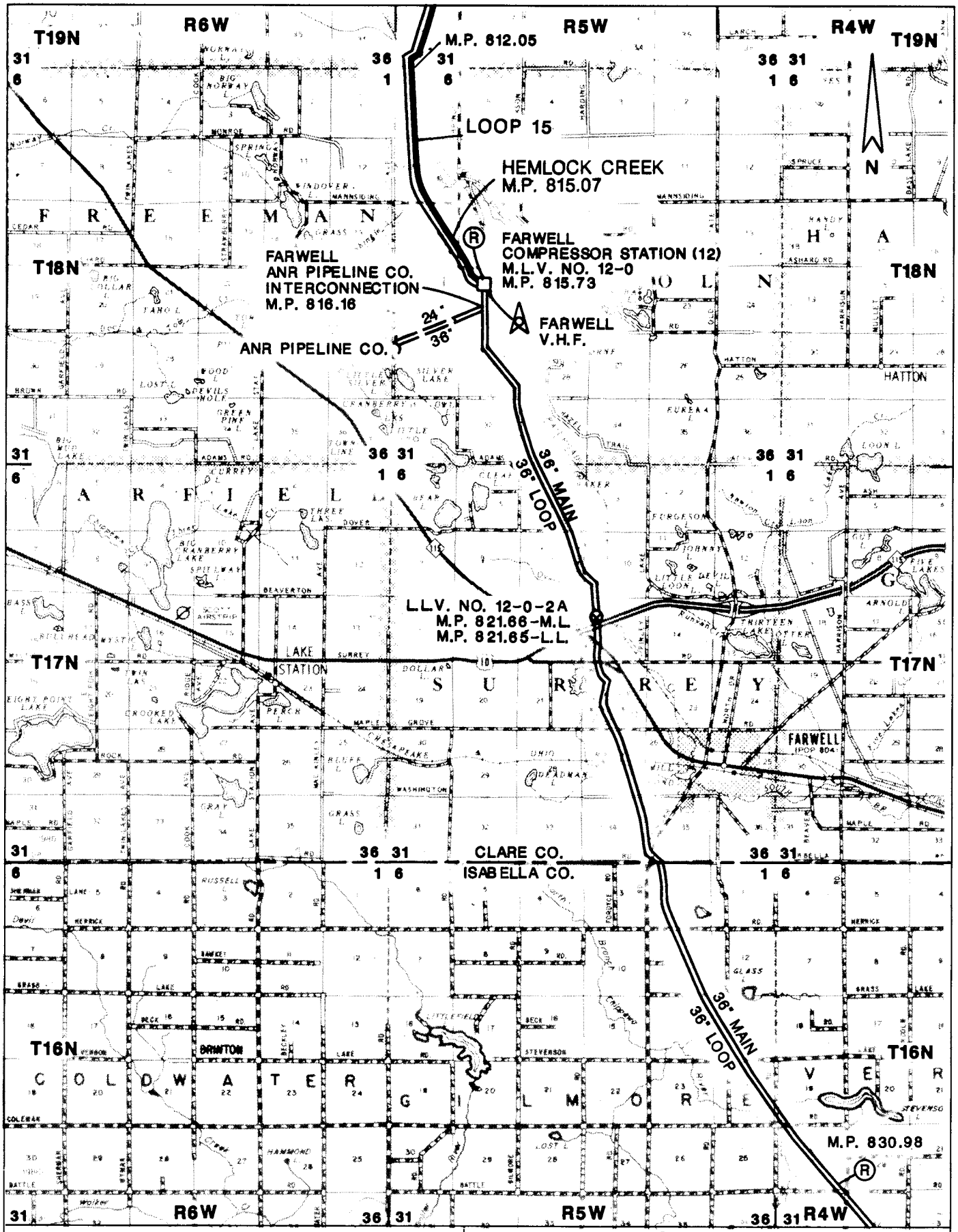
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-15

LOOP 15

SHEET 38 OF 46

M.P. 812.05 to M.P. 815.73



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

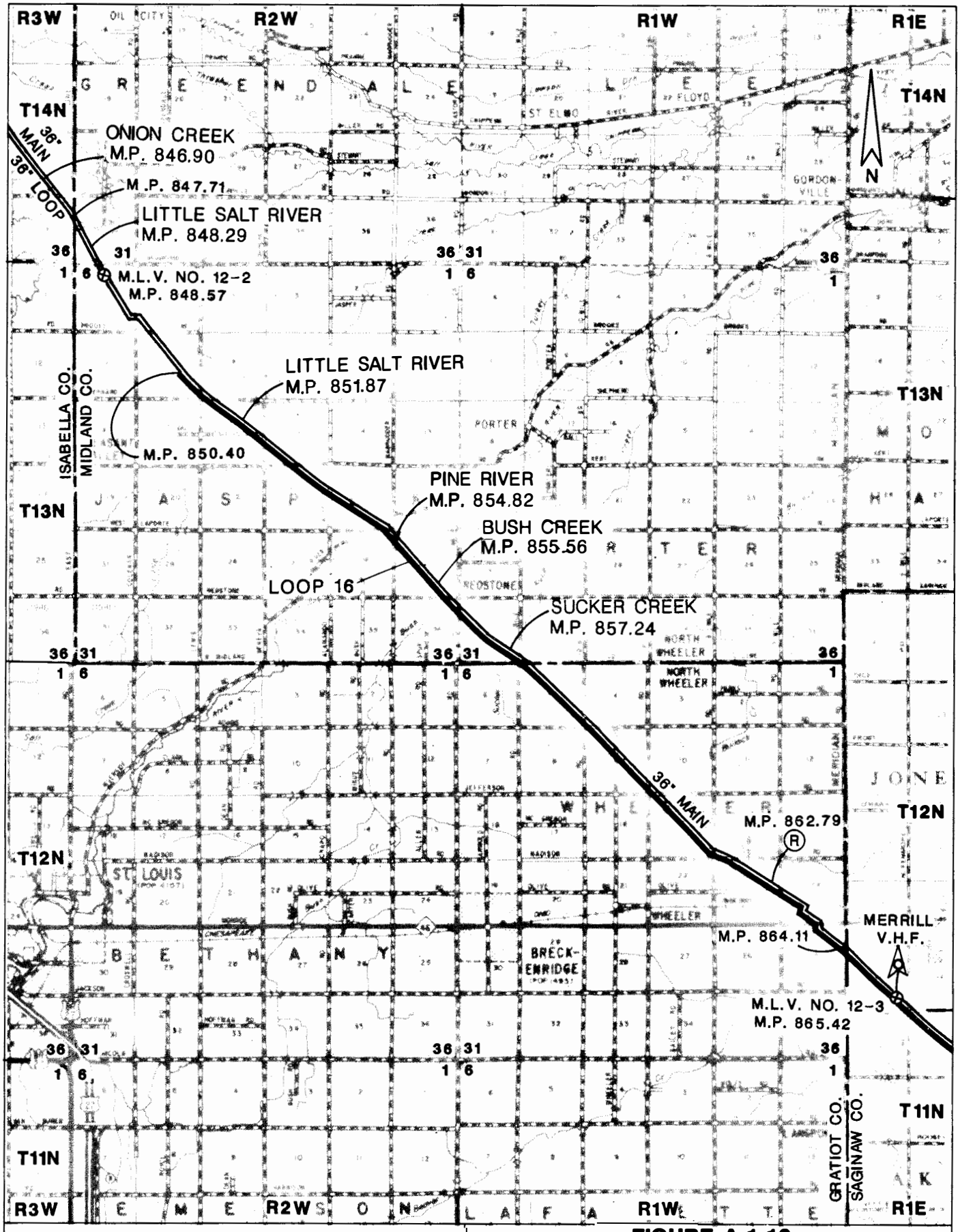
0 1 2 3 4
SCALE IN MILES

FIGURE A-1-15

LOOP 15

SHEET 39 OF 46

M.P. 850.40 to M.P. 864.11

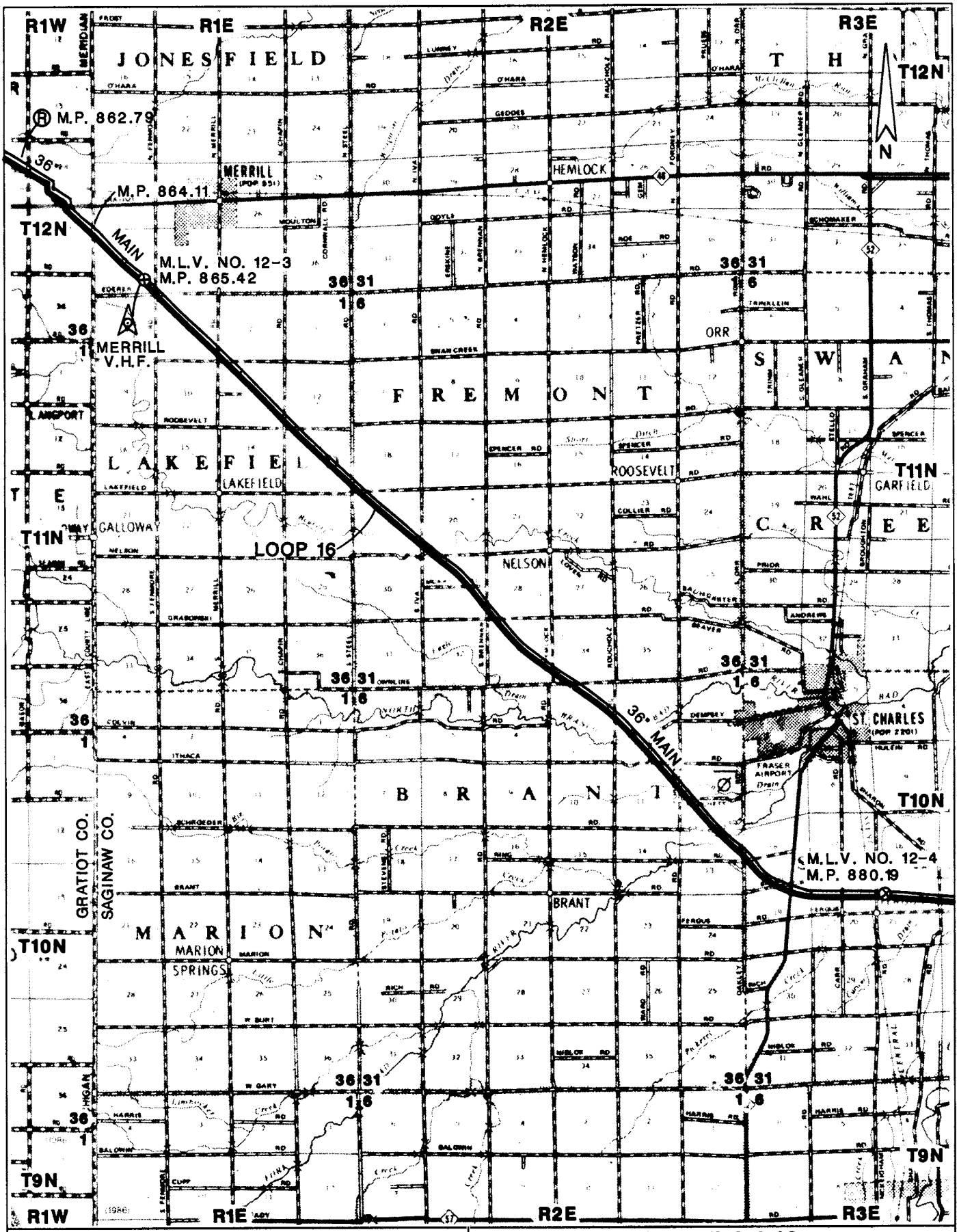


GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

FIGURE A-1-16

LOOP 16

SHEET 40 OF 46



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

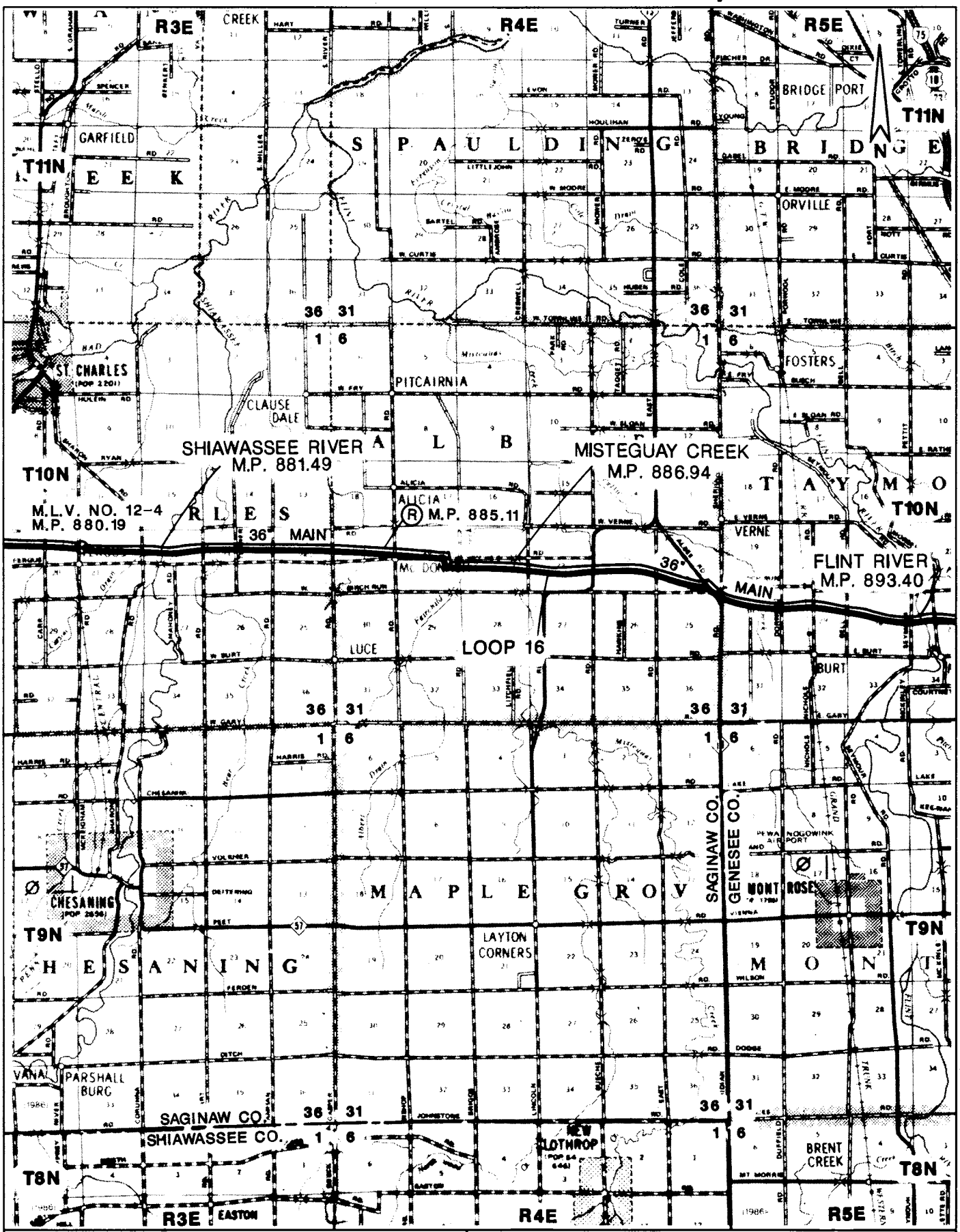
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-16

LOOP 16

SHEET 41 OF 46

M.P. 880.19 to M.P. 893.40



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

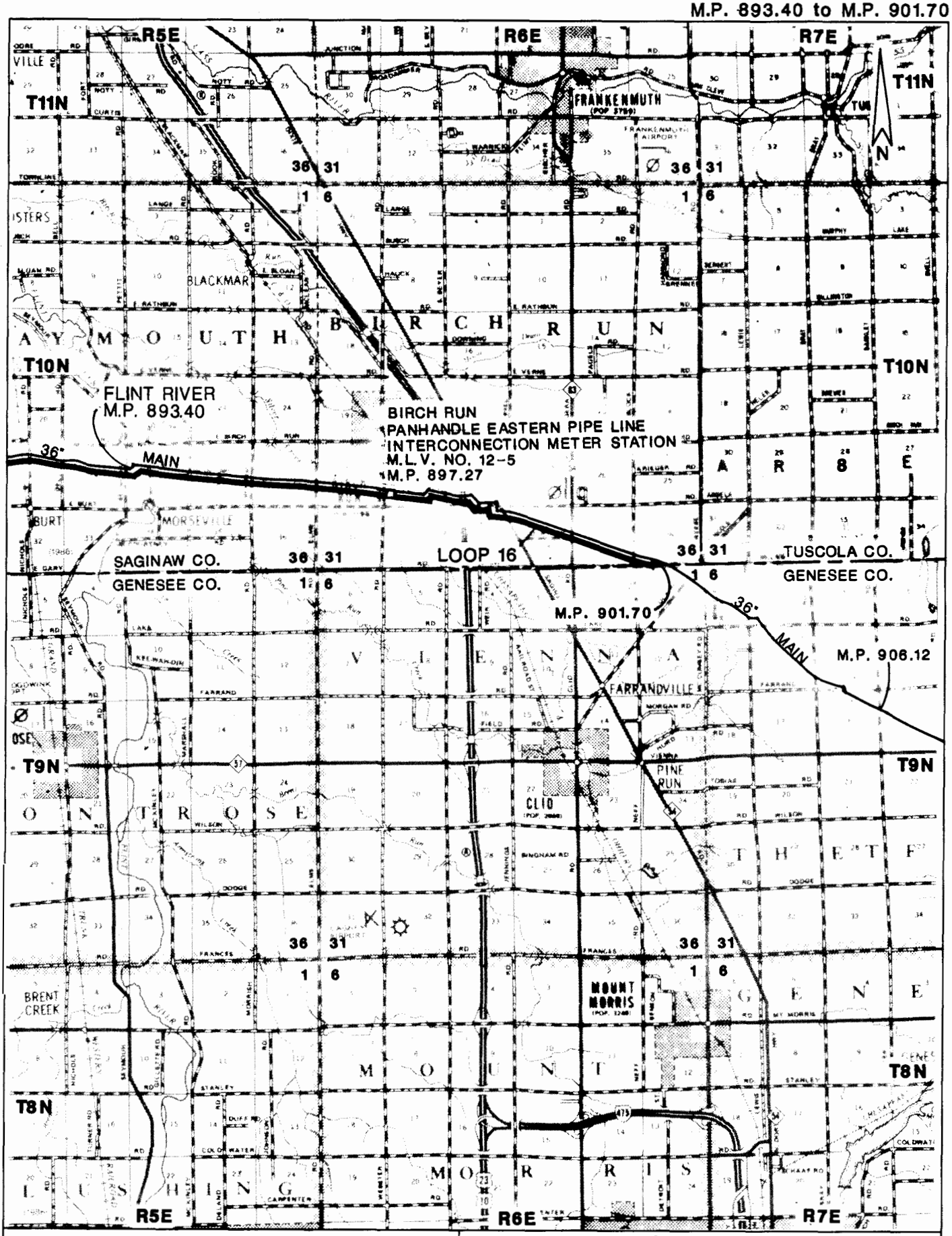
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-16

LOOP 16

SHEET 42 OF 46

M.P. 893.40 to M.P. 901.70



GREAT LAKES GAS TRANSMISSION CO.

DETROIT, MICHIGAN

1 0 1 2 3 4

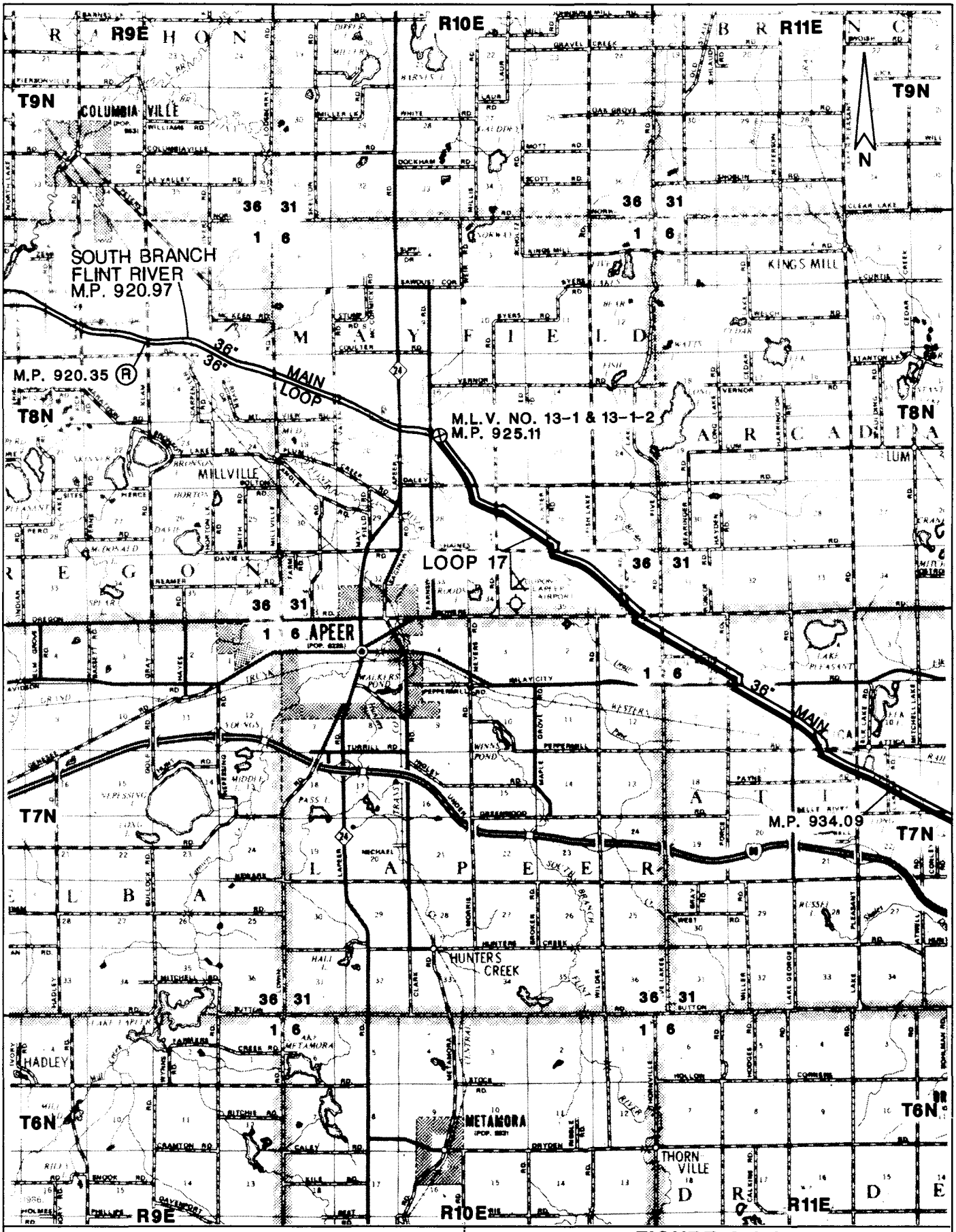
SCALE IN MILES

FIGURE A-1-16

LOOP 16

SHEET 43 OF 46

M.P. 925.11 to M.P. 934.09



GREAT LAKES GAS TRANSMISSION CO.

DETROIT, MICHIGAN

1 0 1 2 3 4

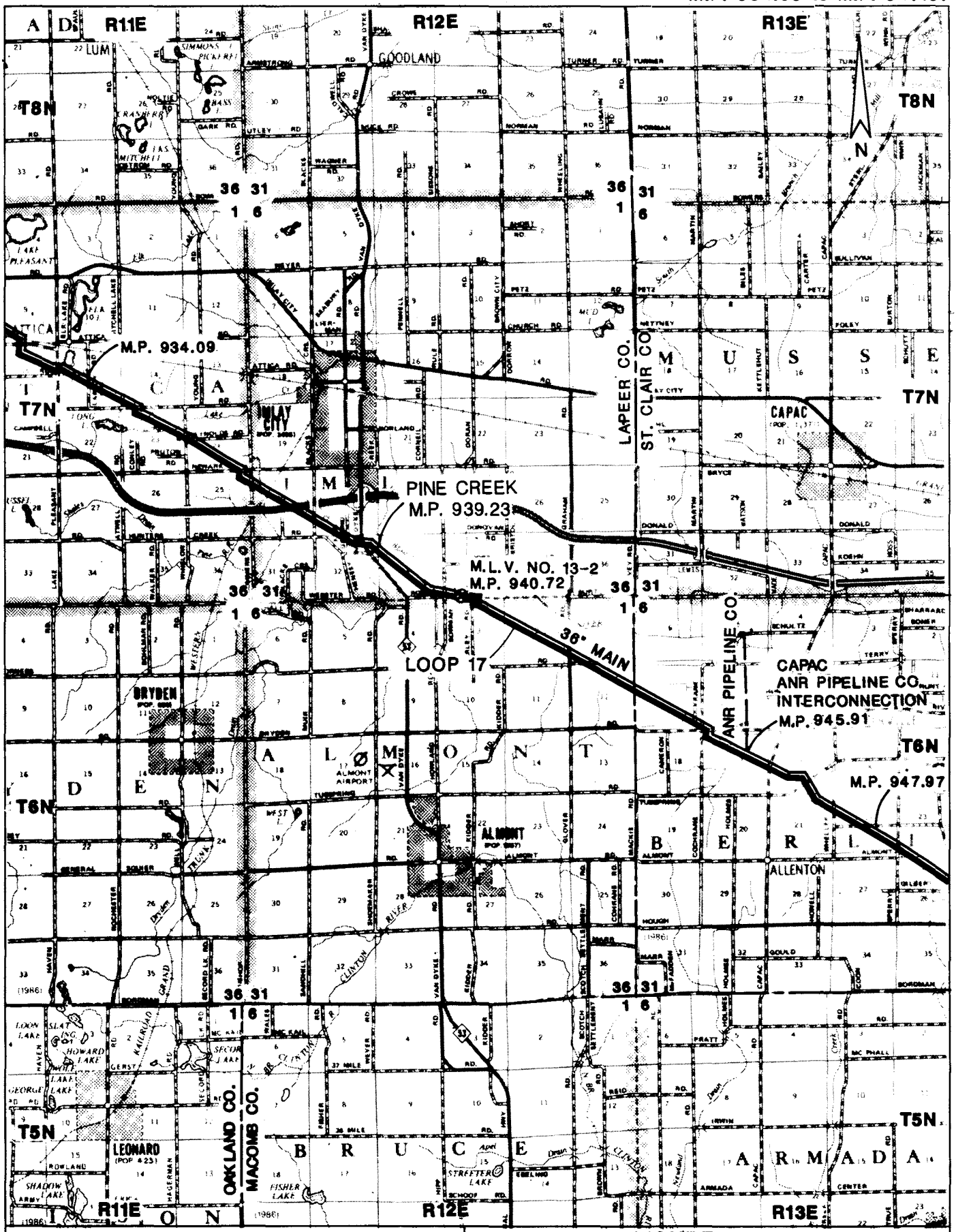
SCALE IN MILES

FIGURE A-1-17

LOOP 17

SHEET 44 OF 46

M.P. 934.09 to M.P. 947.97



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

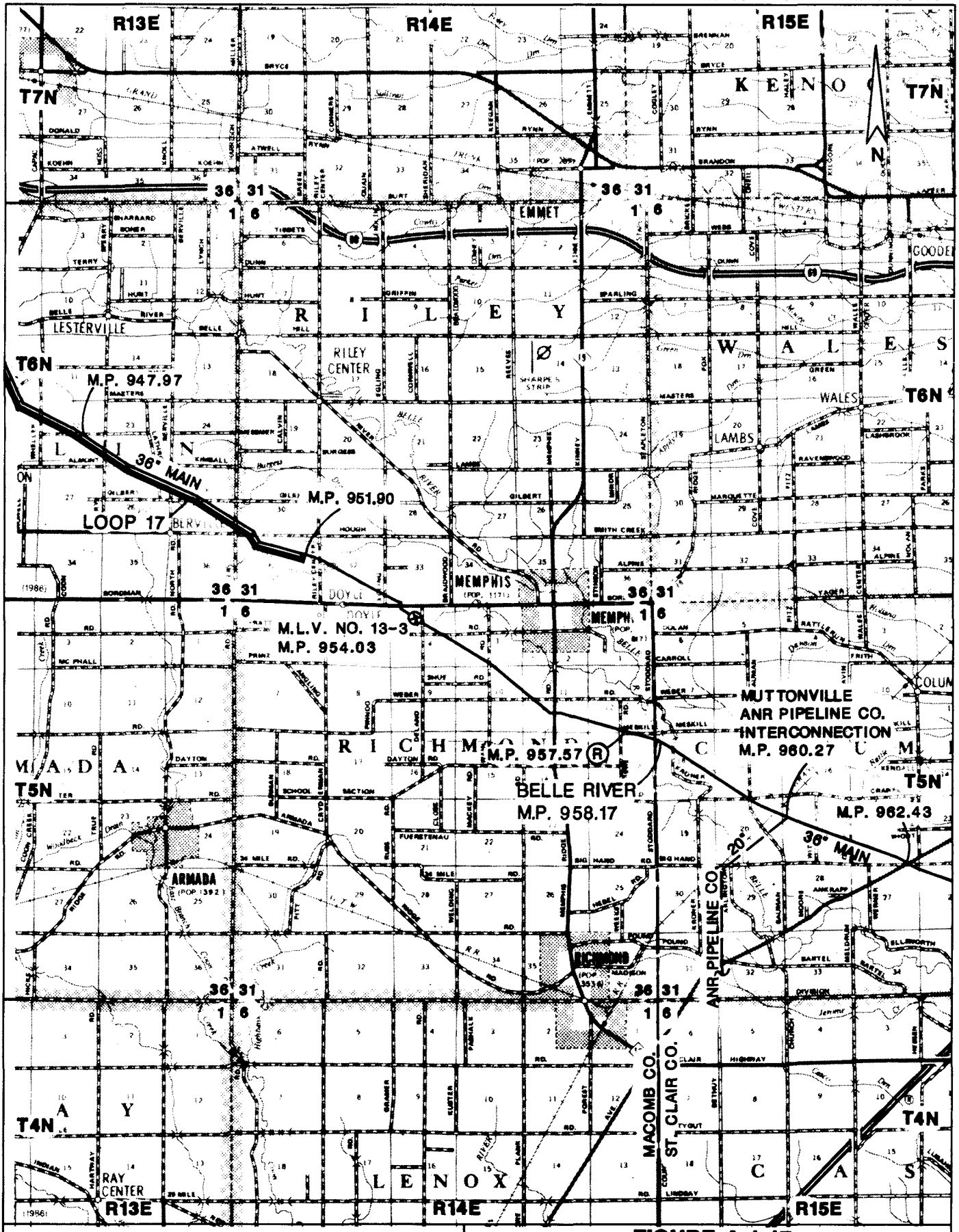
1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-17

LOOP 17

SHEET 45 OF 46

M.P.947.97 to M.P. 951.90



GREAT LAKES GAS TRANSMISSION CO.
DETROIT, MICHIGAN

1 0 1 2 3 4
SCALE IN MILES

FIGURE A-1-17

LOOP 17

SHEET 46 OF 46

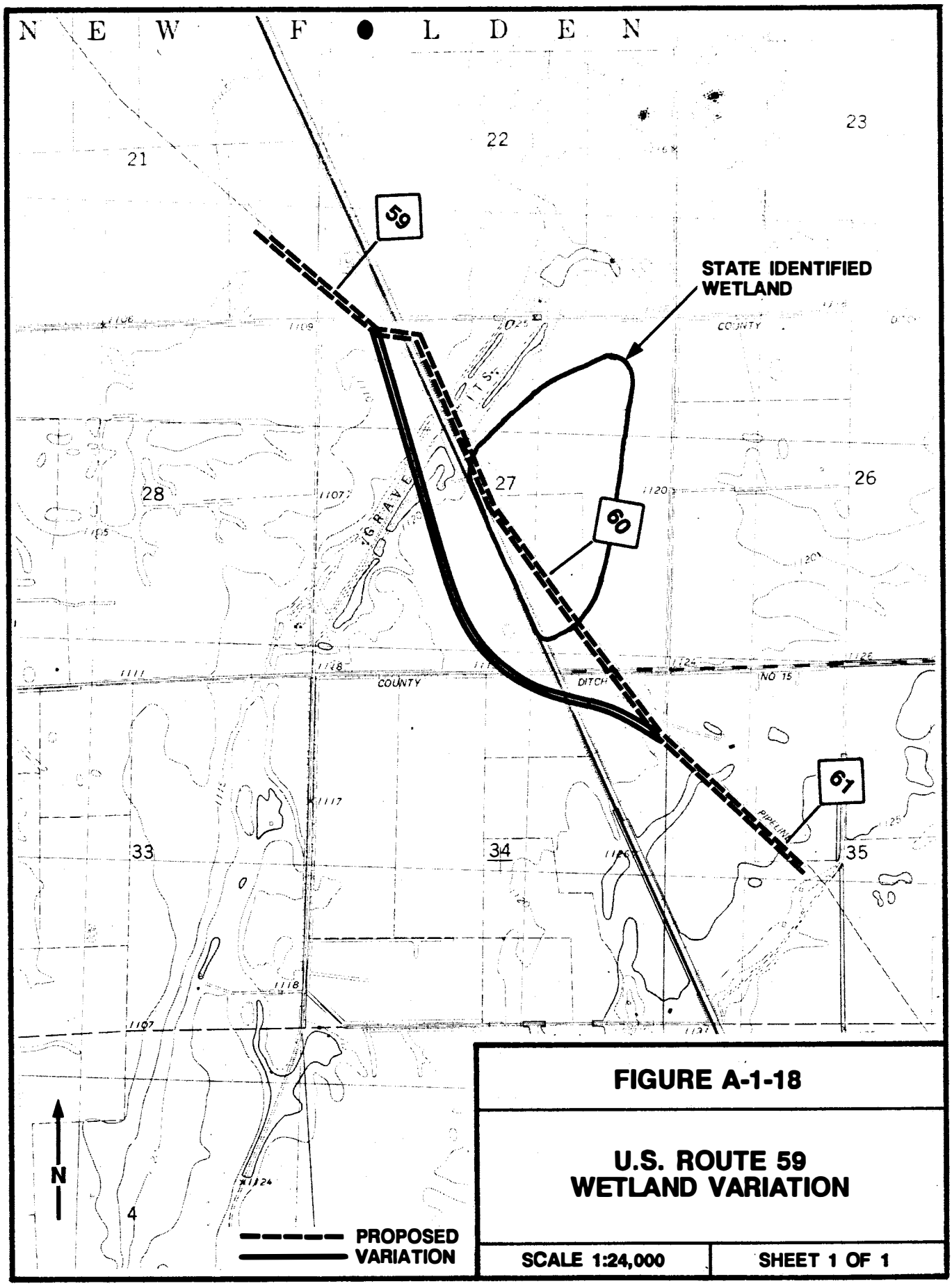
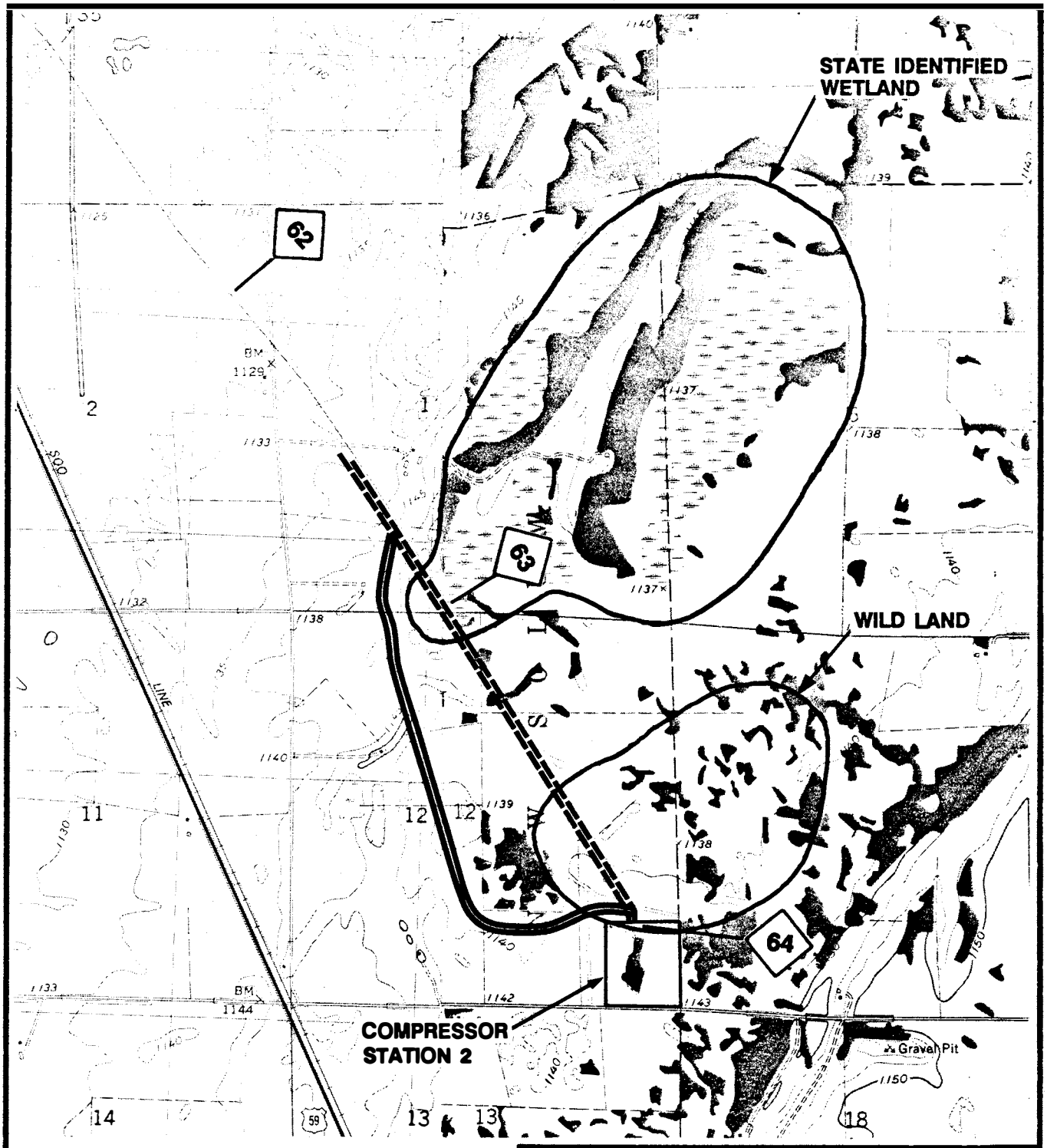


FIGURE A-1-18

U.S. ROUTE 59 WETLAND VARIATION

SCALE 1:24,000	SHEET 1 OF 1



N

PROPOSED VARIATION

FIGURE A-1-19

NEW SOLUM WETLAND VARIATION

SCALE 1:24,000

SHEET 1 OF 1

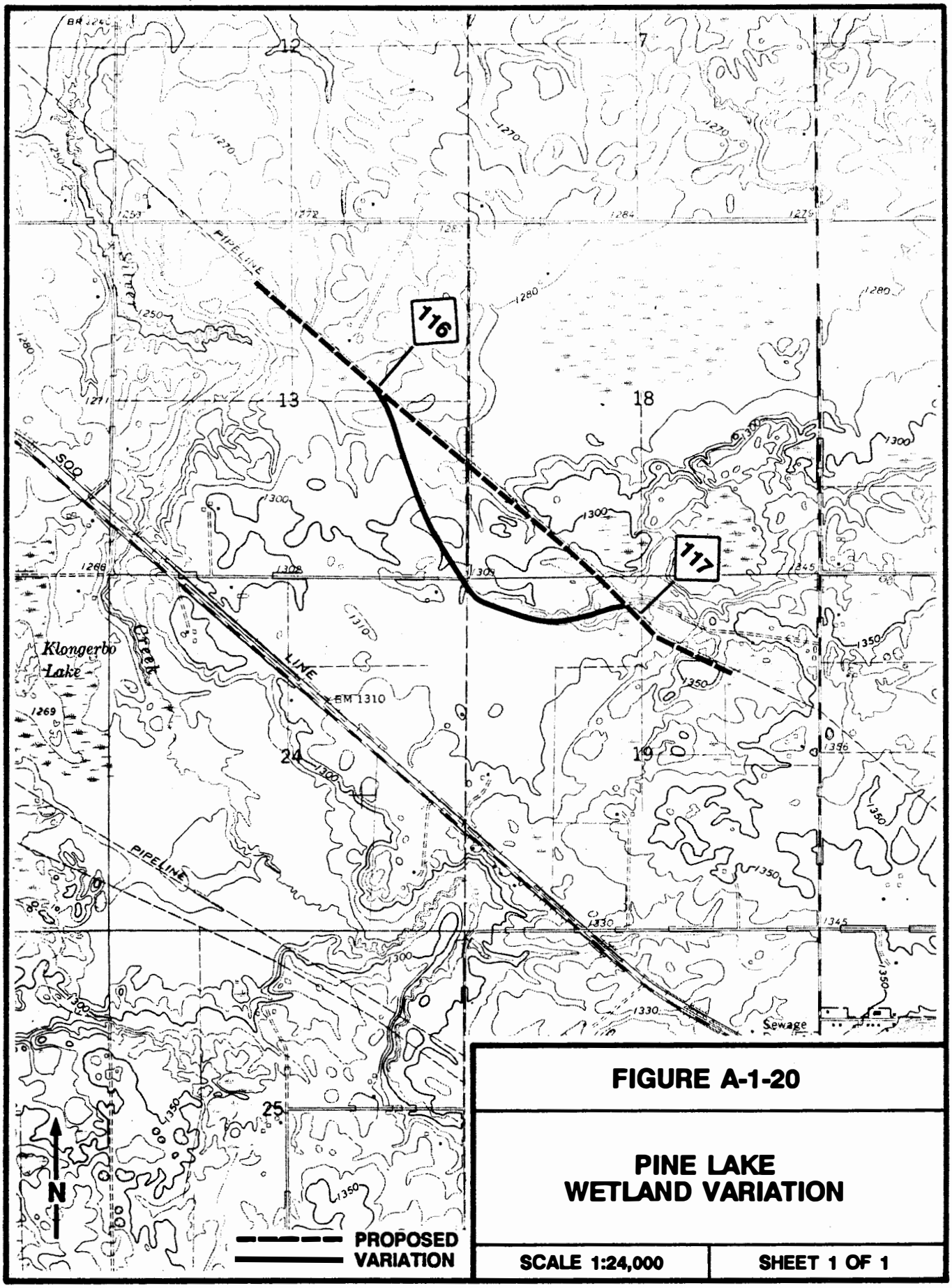


FIGURE A-1-20

PINE LAKE WETLAND VARIATION

SCALE 1:24,000	SHEET 1 OF 1

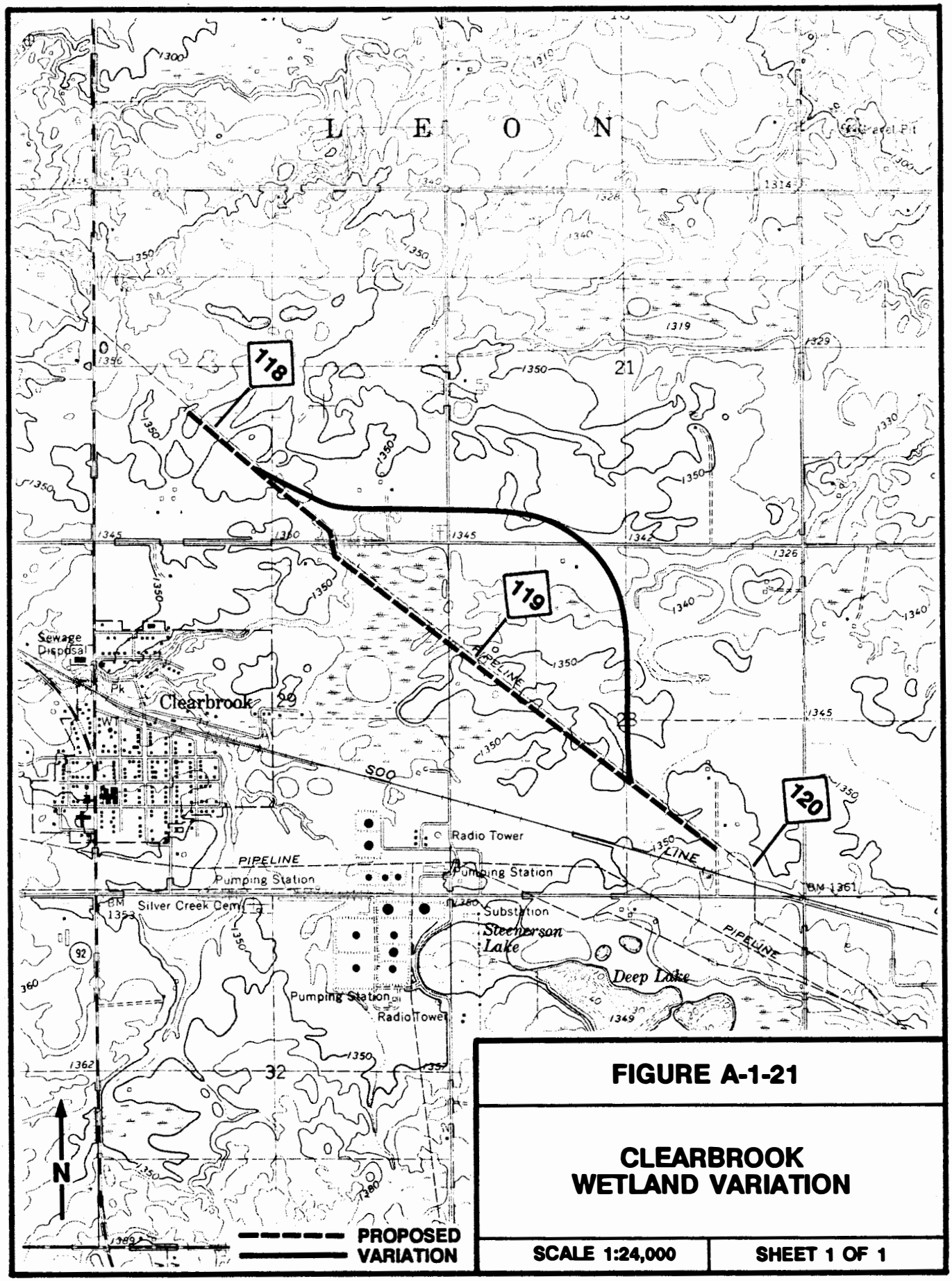


FIGURE A-1-21

CLEARBROOK WETLAND VARIATION

SCALE 1:24,000	SHEET 1 OF 1

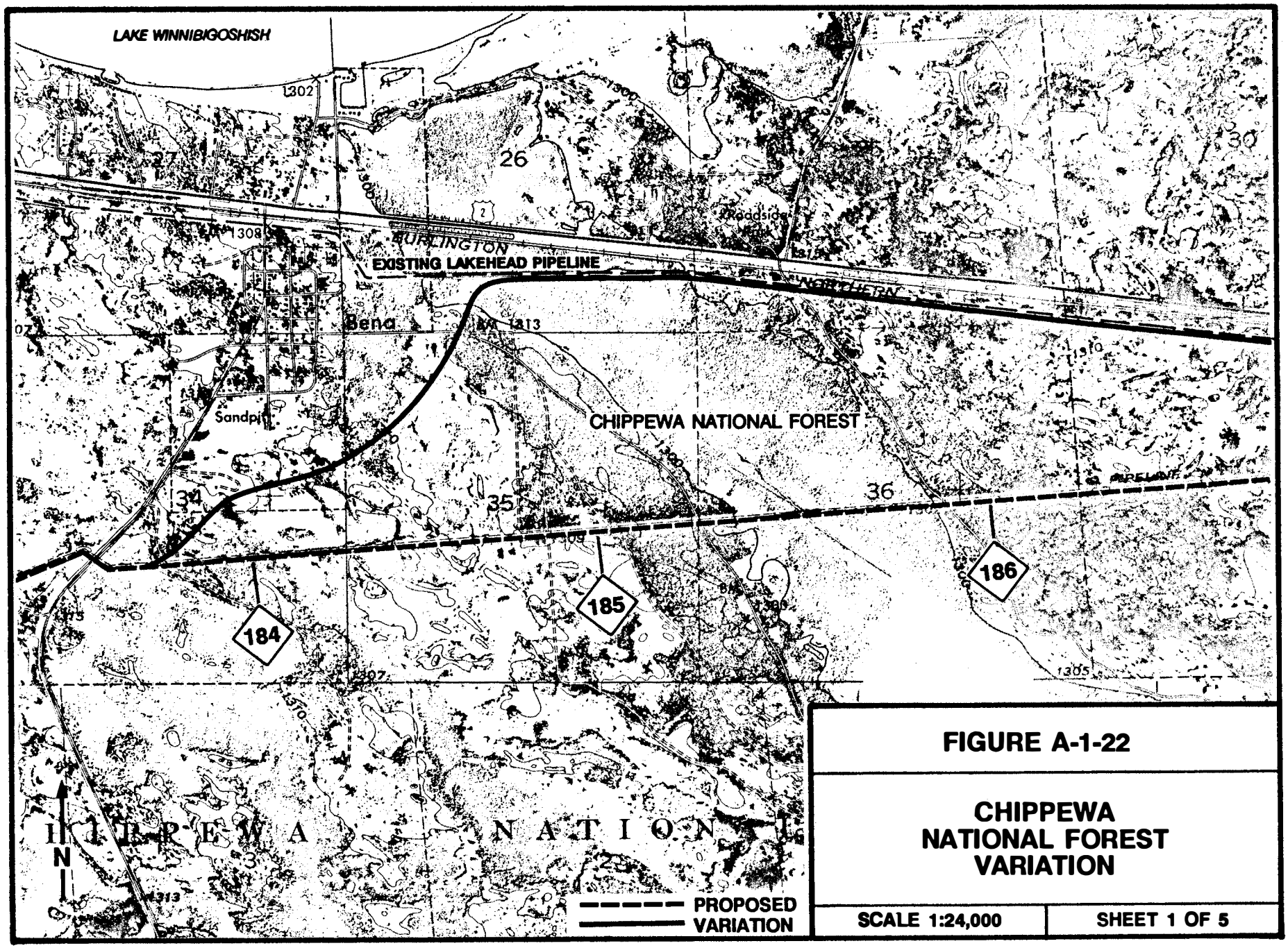


FIGURE A-1-22

CHIPPEWA NATIONAL FOREST VARIATION

SCALE 1:24,000	SHEET 1 OF 5

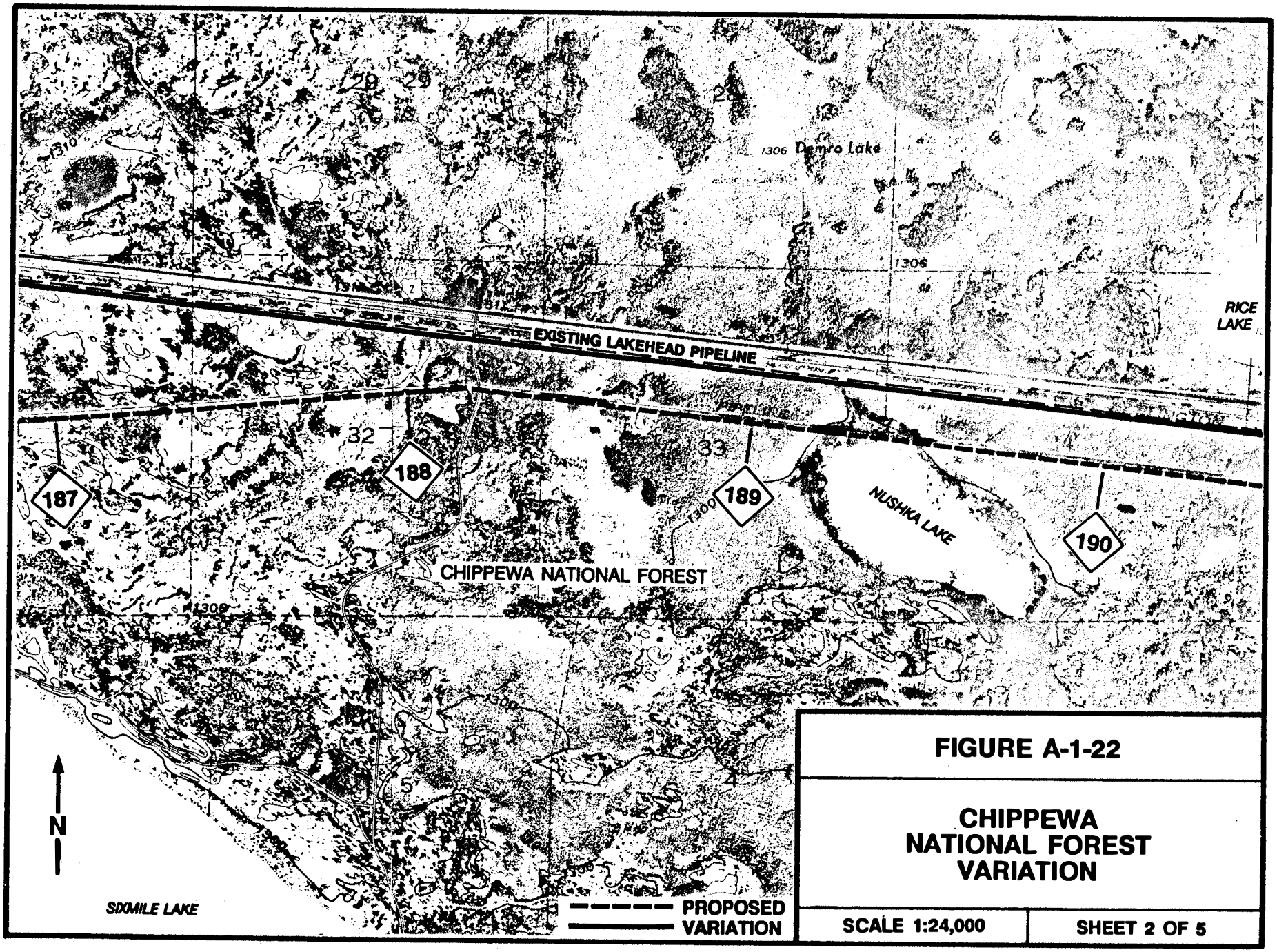


FIGURE A-1-22

CHIPPEWA NATIONAL FOREST VARIATION

SCALE 1:24,000 | SHEET 2 OF 5

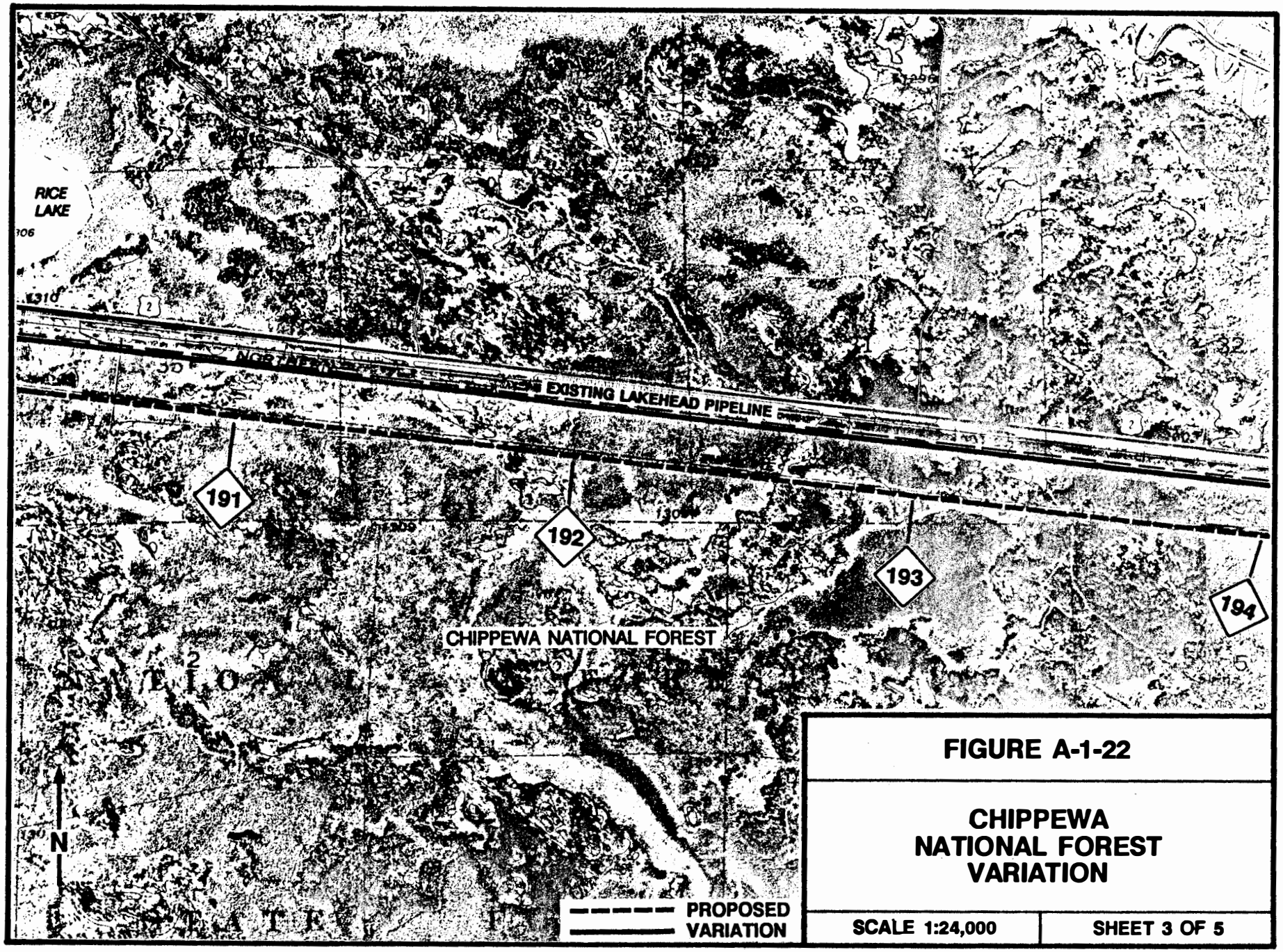


FIGURE A-1-22

CHIPPEWA NATIONAL FOREST VARIATION

SCALE 1:24,000	SHEET 3 OF 5

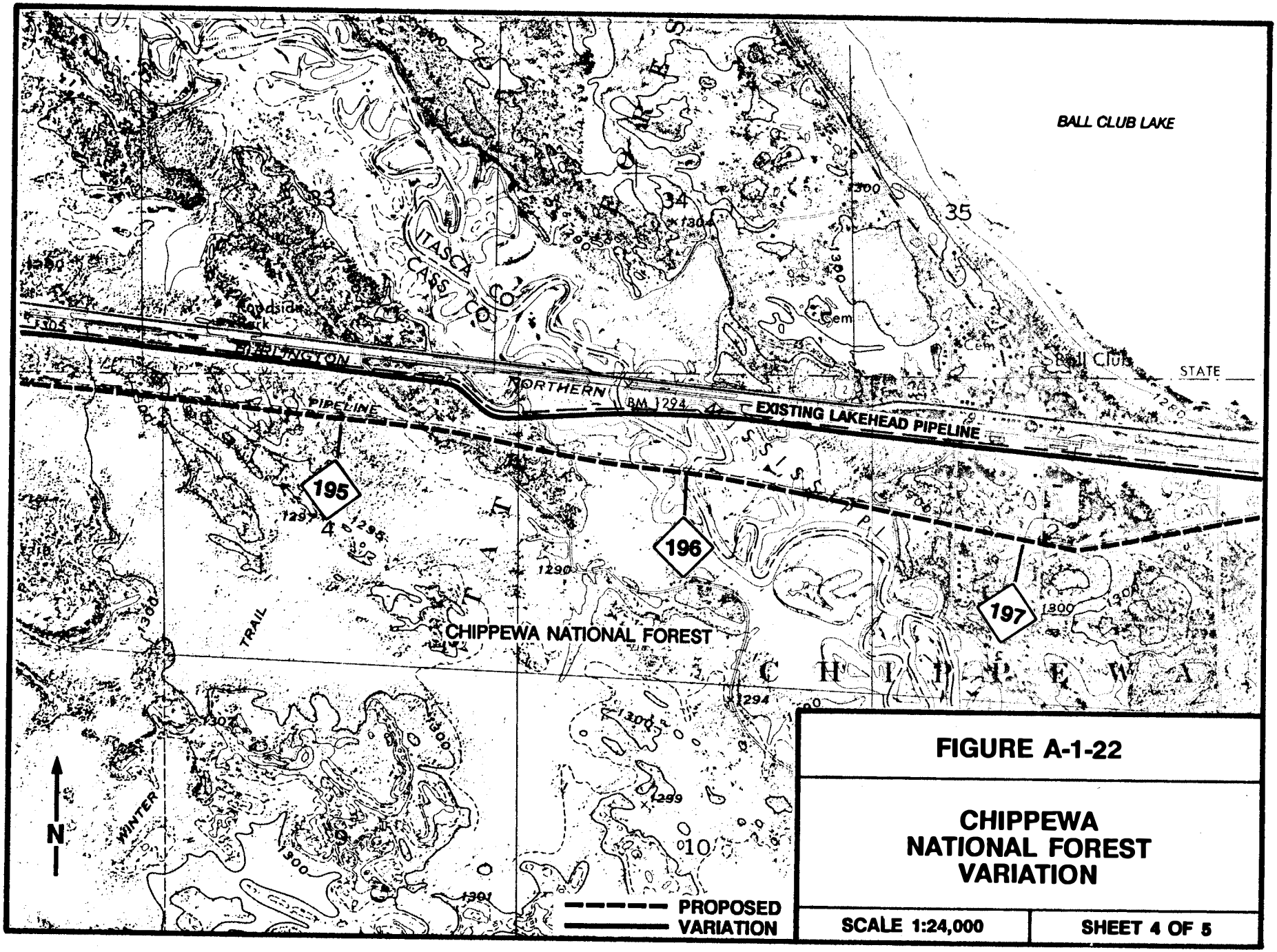


FIGURE A-1-22

CHIPPEWA NATIONAL FOREST VARIATION

SCALE 1:24,000	SHEET 4 OF 5

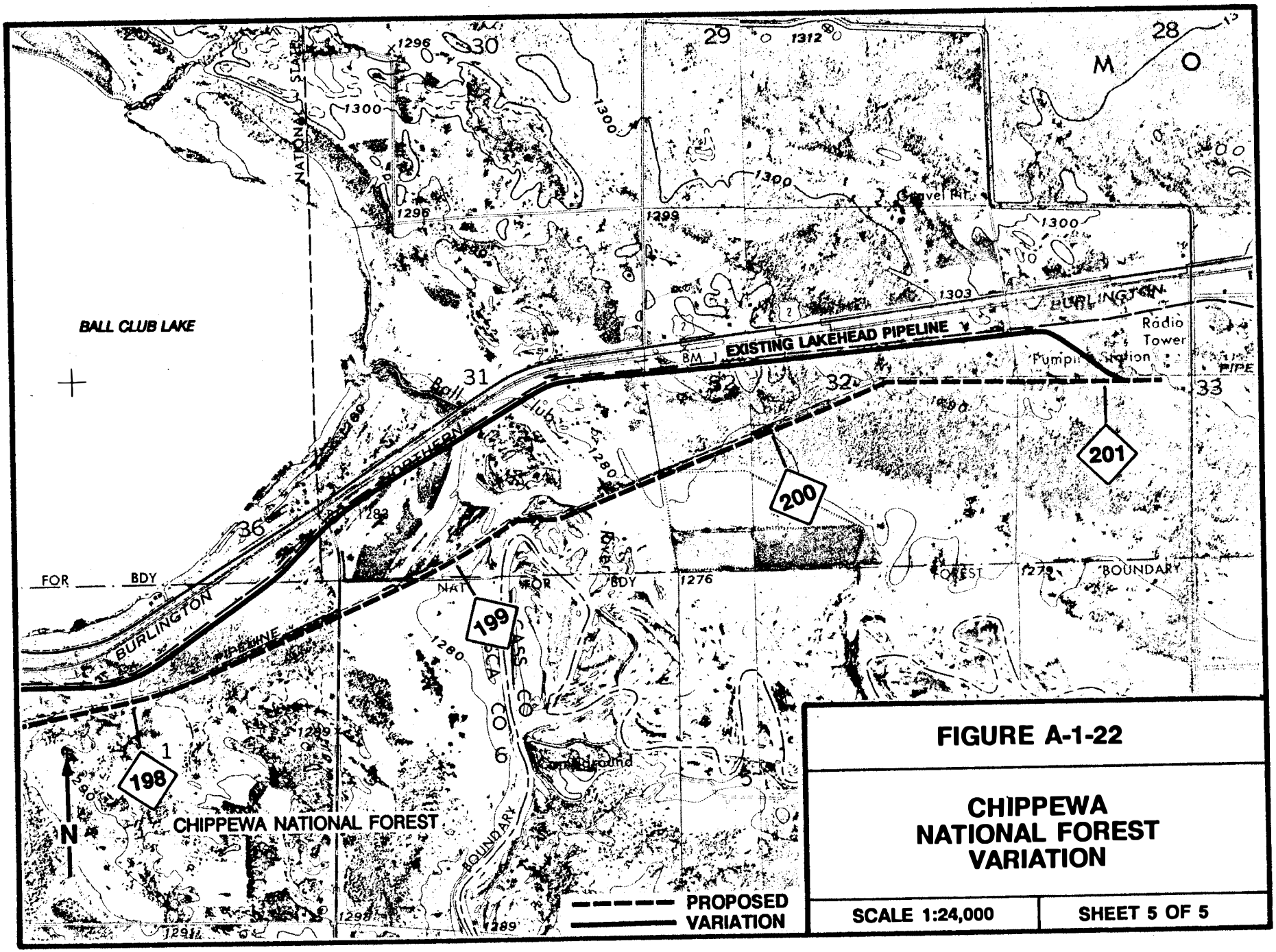


FIGURE A-1-22

CHIPPEWA NATIONAL FOREST VARIATION

SCALE 1:24,000	SHEET 5 OF 5

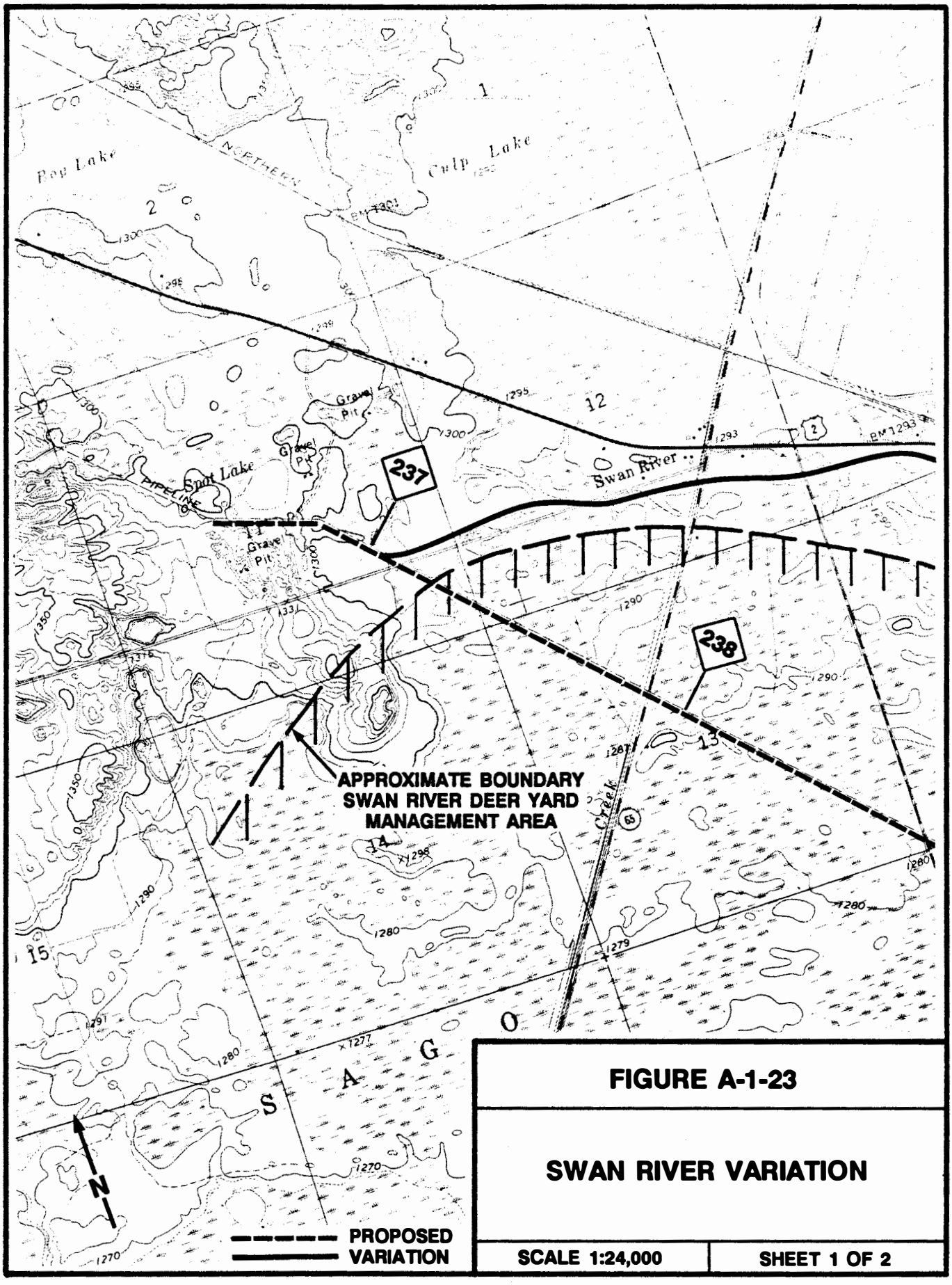


FIGURE A-1-23

SWAN RIVER VARIATION

SCALE 1:24,000	SHEET 1 OF 2

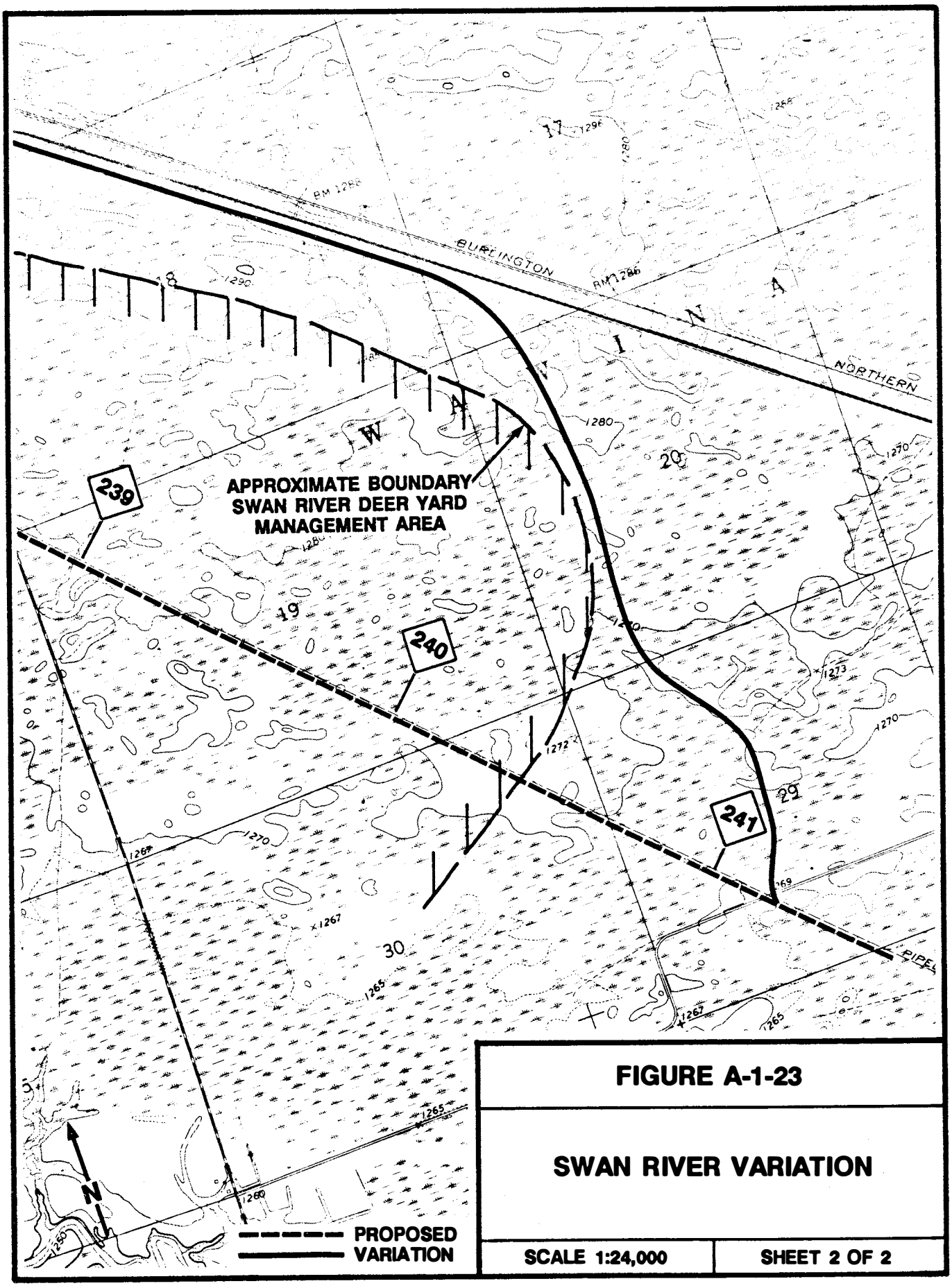


FIGURE A-1-23

SWAN RIVER VARIATION

SCALE 1:24,000 | SHEET 2 OF 2

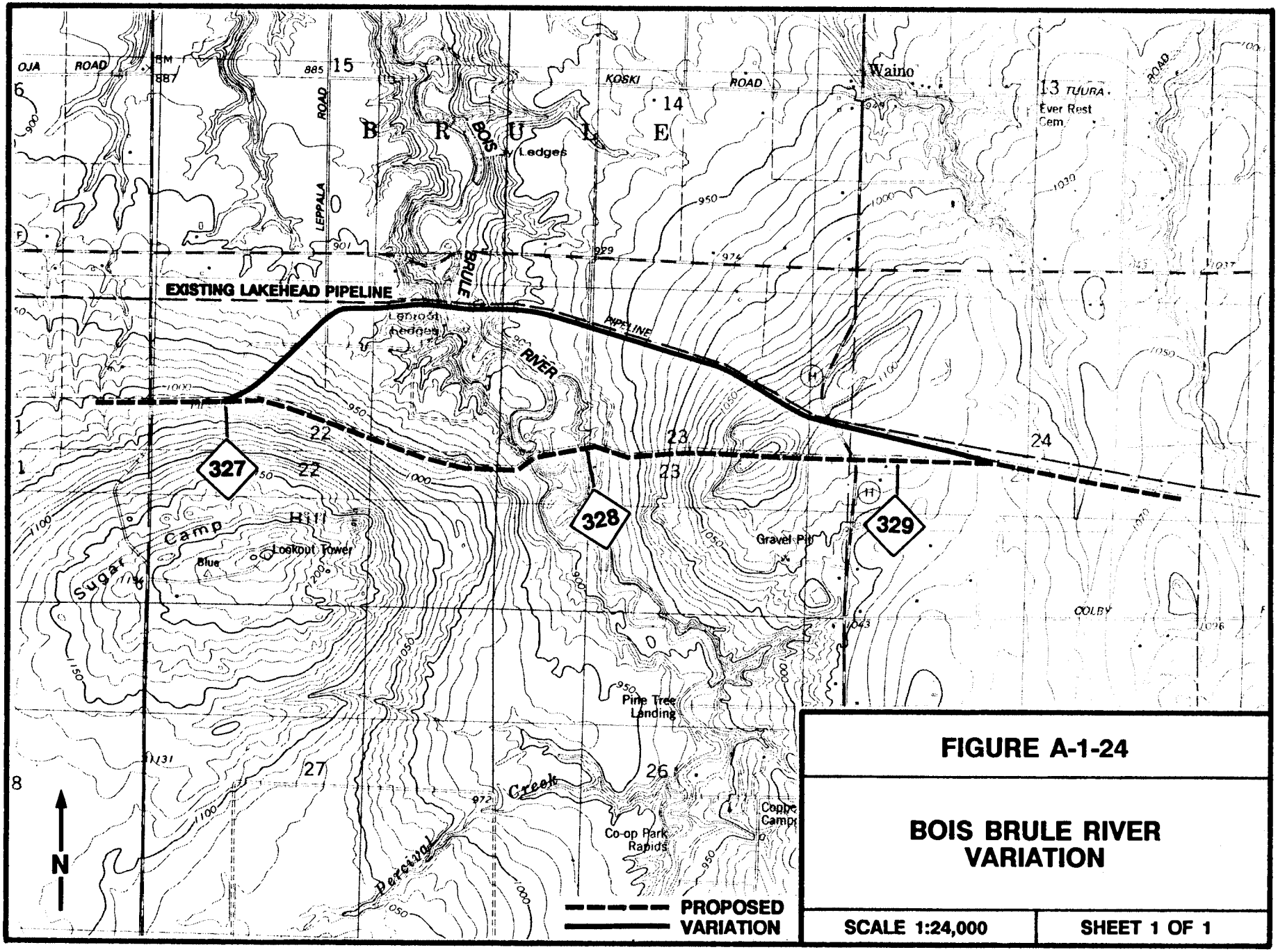


FIGURE A-1-24

BOIS BRULE RIVER VARIATION

SCALE 1:24,000 | SHEET 1 OF 1

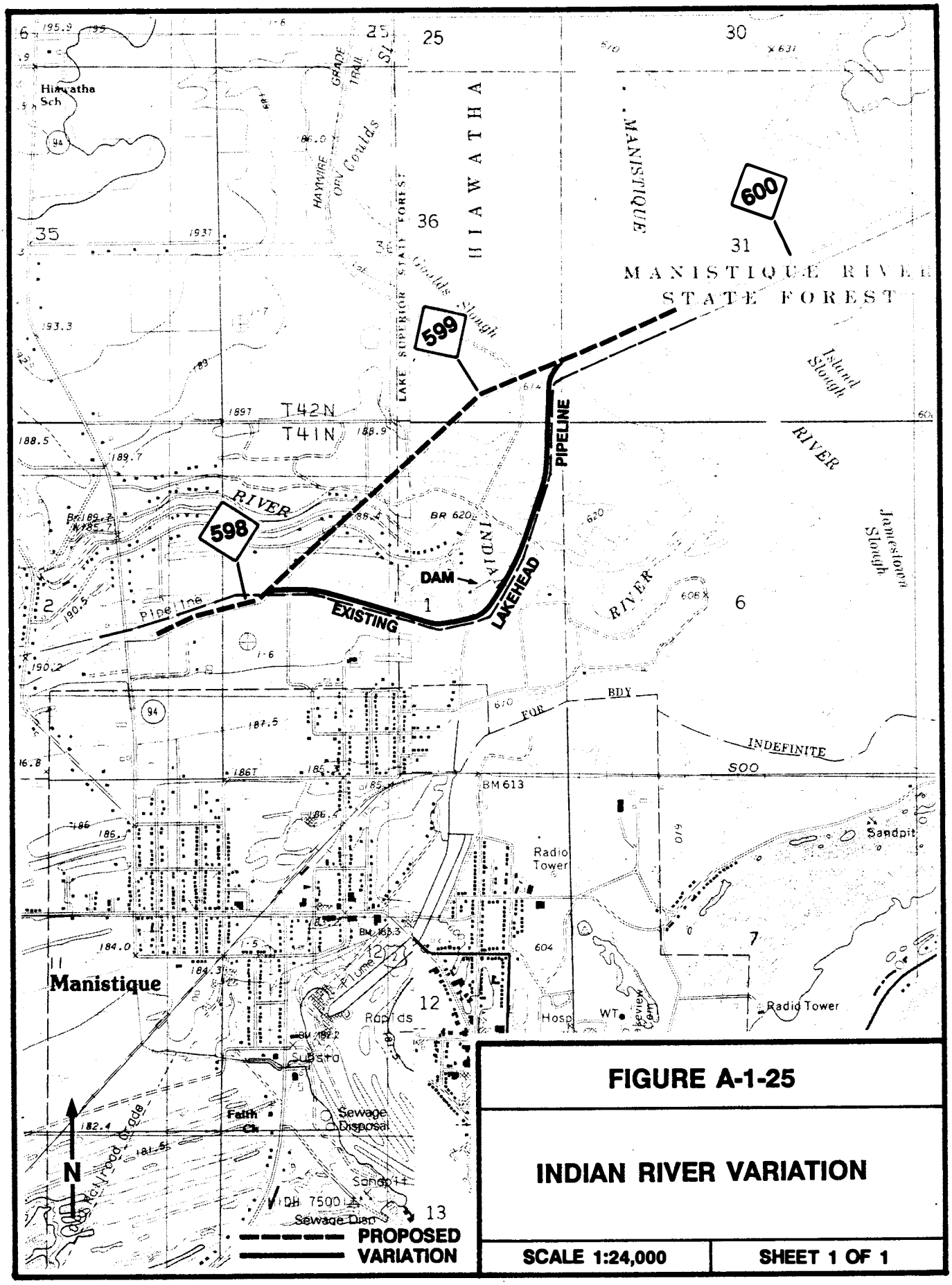


FIGURE A-1-25

INDIAN RIVER VARIATION

SCALE 1:24,000 | SHEET 1 OF 1

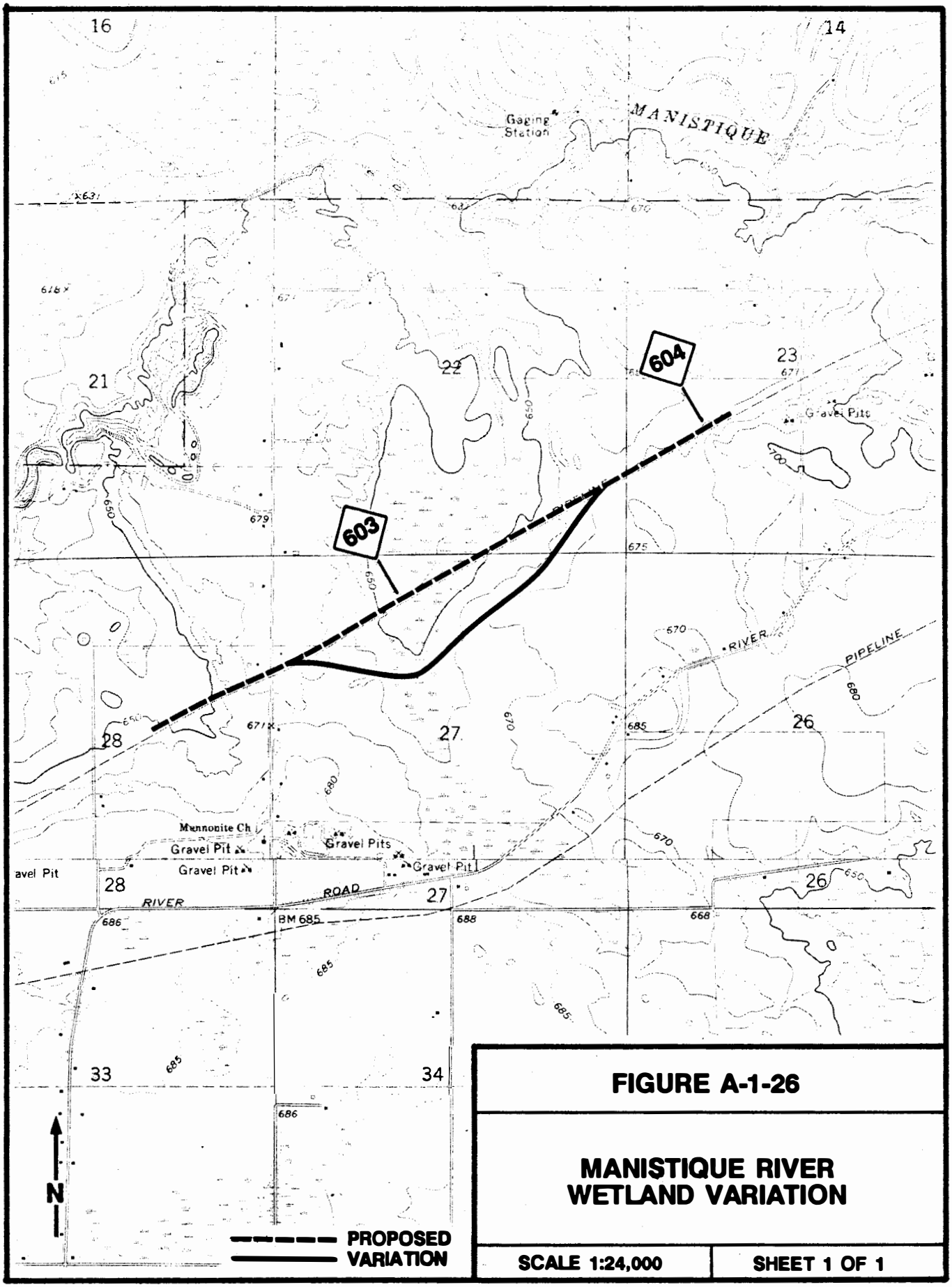


FIGURE A-1-26

MANISTIQUE RIVER WETLAND VARIATION

SCALE 1:24,000 | SHEET 1 OF 1

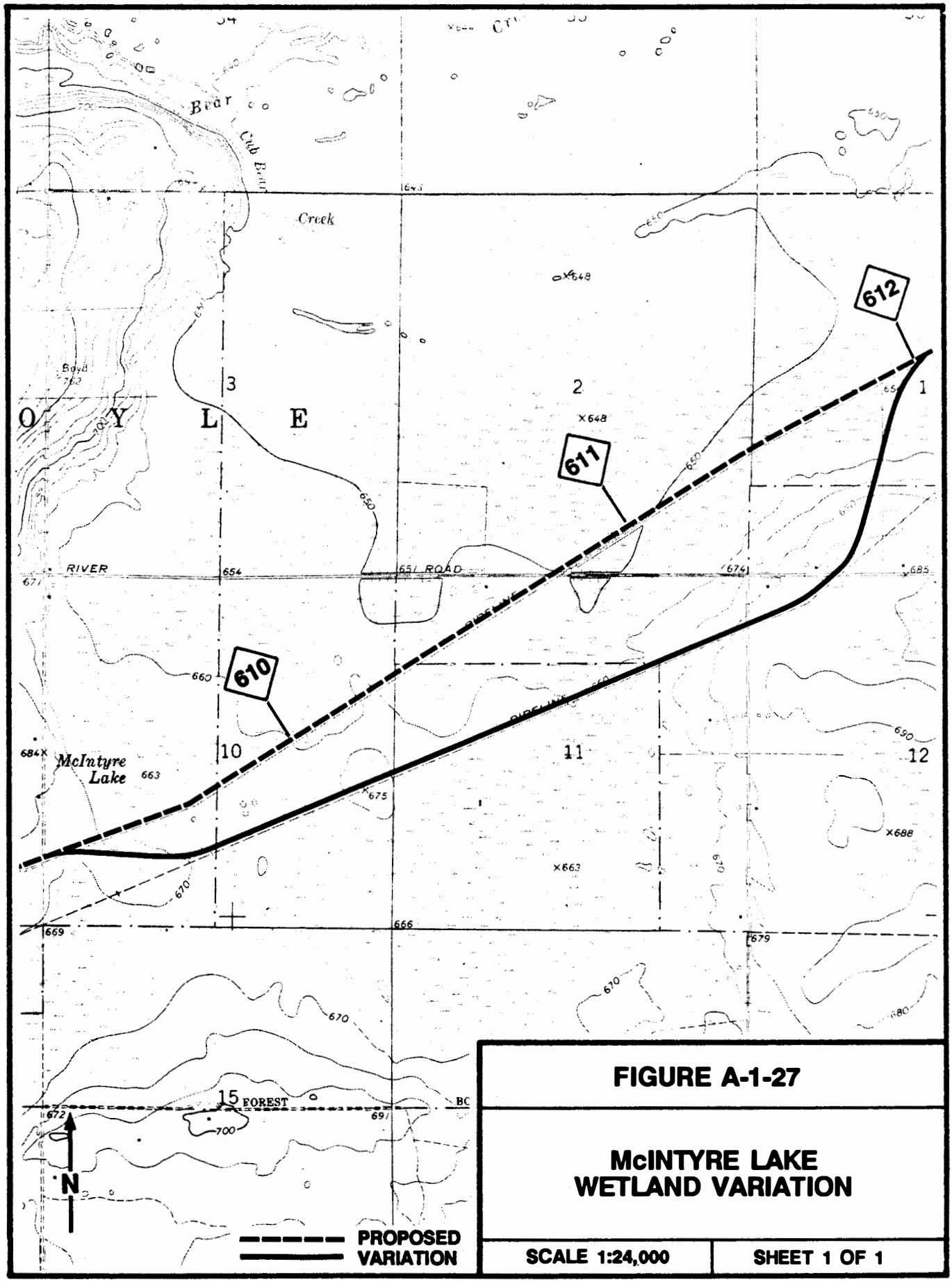


FIGURE A-1-27

McINTYRE LAKE
WETLAND VARIATION

SCALE 1:24,000	SHEET 1 OF 1

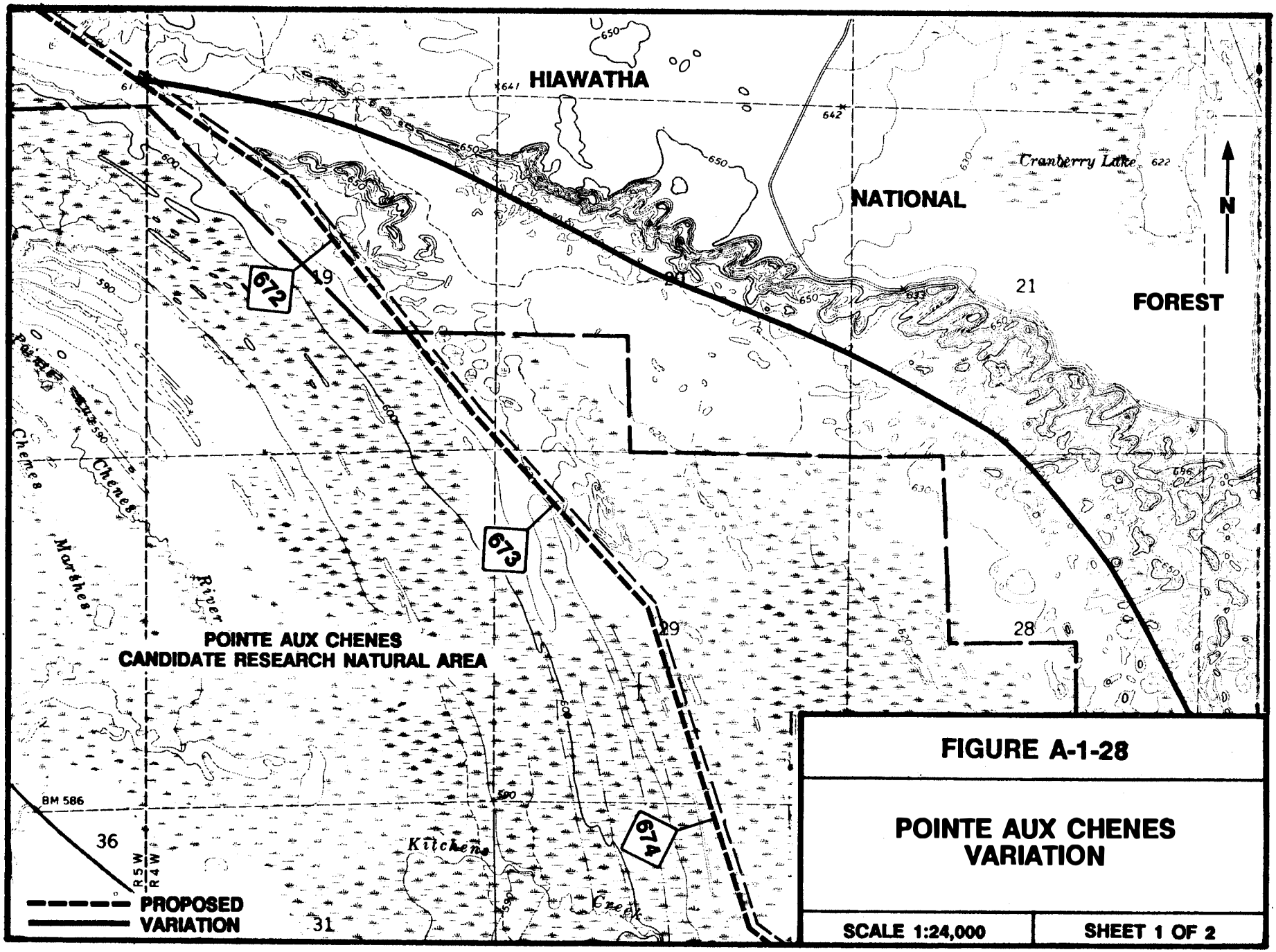


FIGURE A-1-28

POINTE AUX CHENES VARIATION

SCALE 1:24,000 | SHEET 1 OF 2

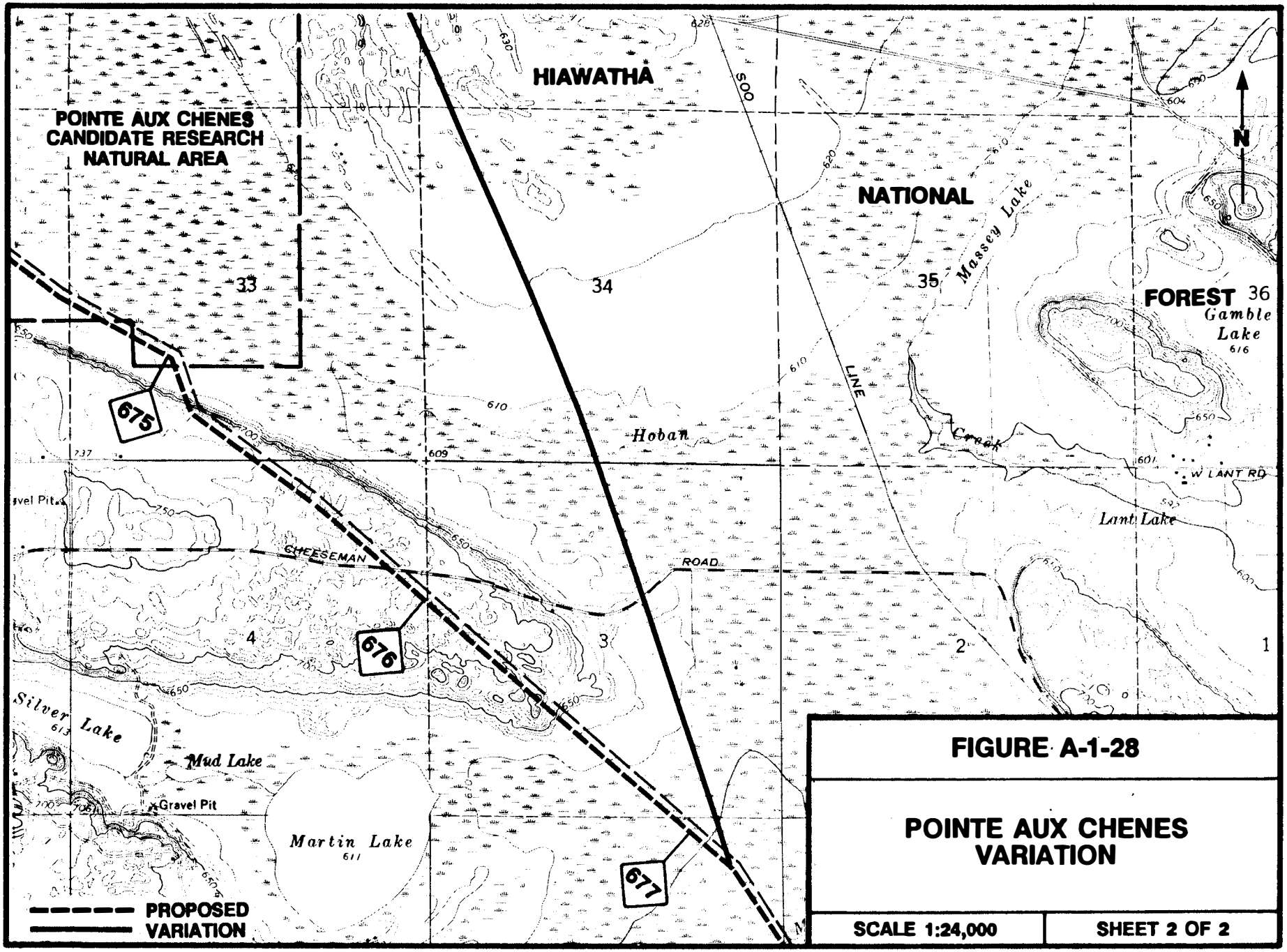


FIGURE A-1-28

POINTE AUX CHENES VARIATION

SCALE 1:24,000	SHEET 2 OF 2

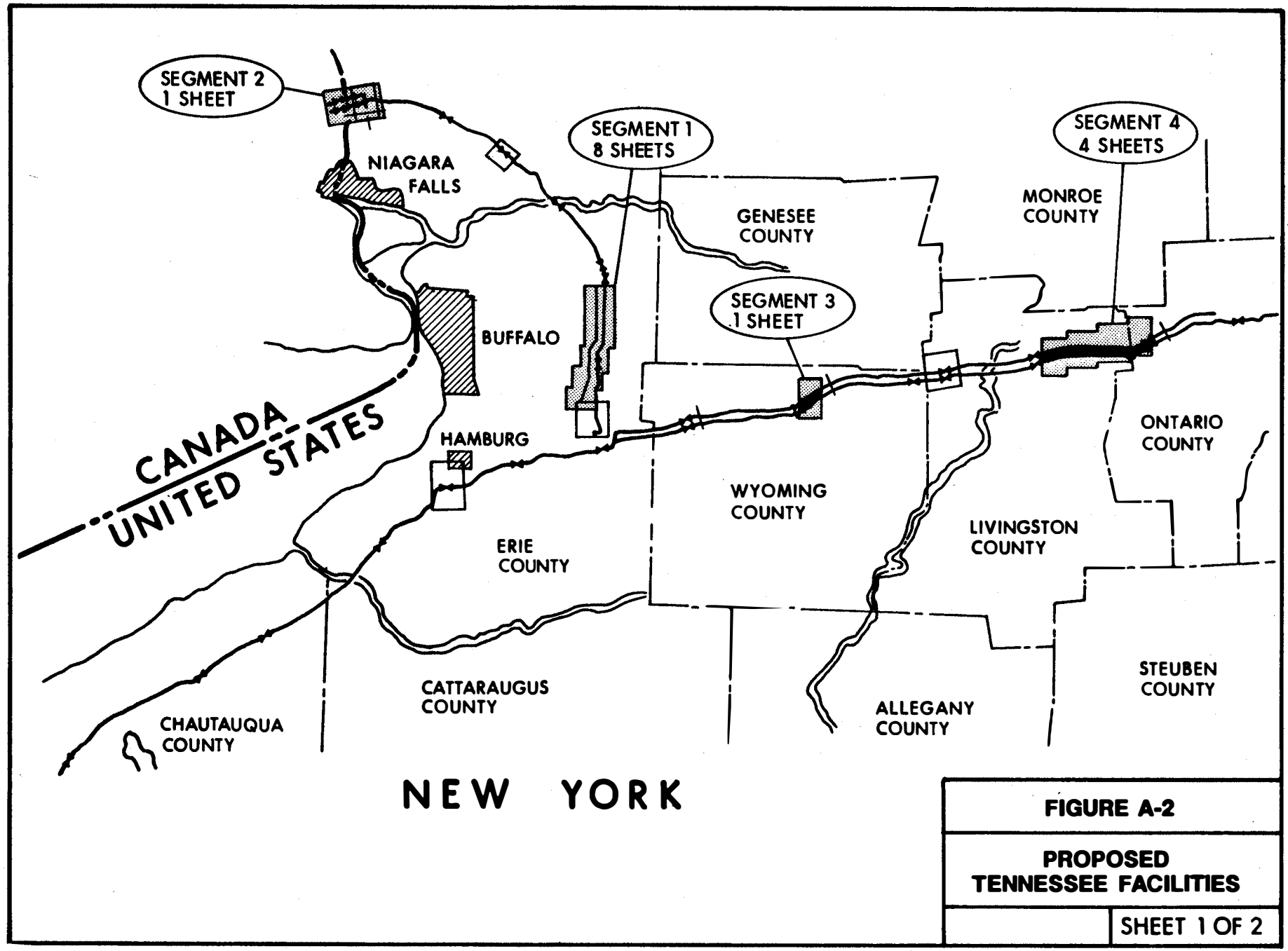


FIGURE A-2

PROPOSED TENNESSEE FACILITIES

SHEET 1 OF 2

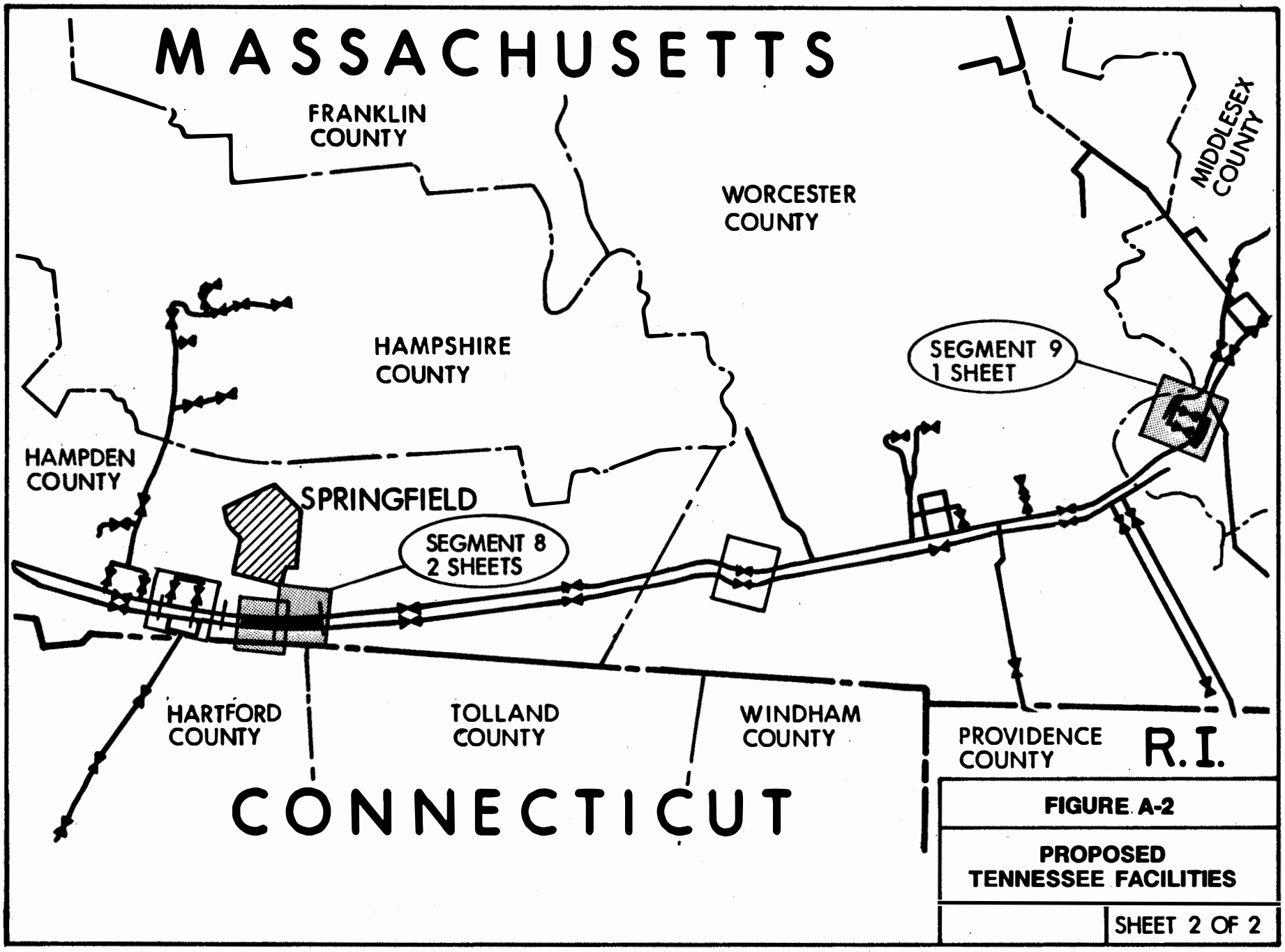


FIGURE A-2

PROPOSED TENNESSEE FACILITIES

SHEET 2 OF 2

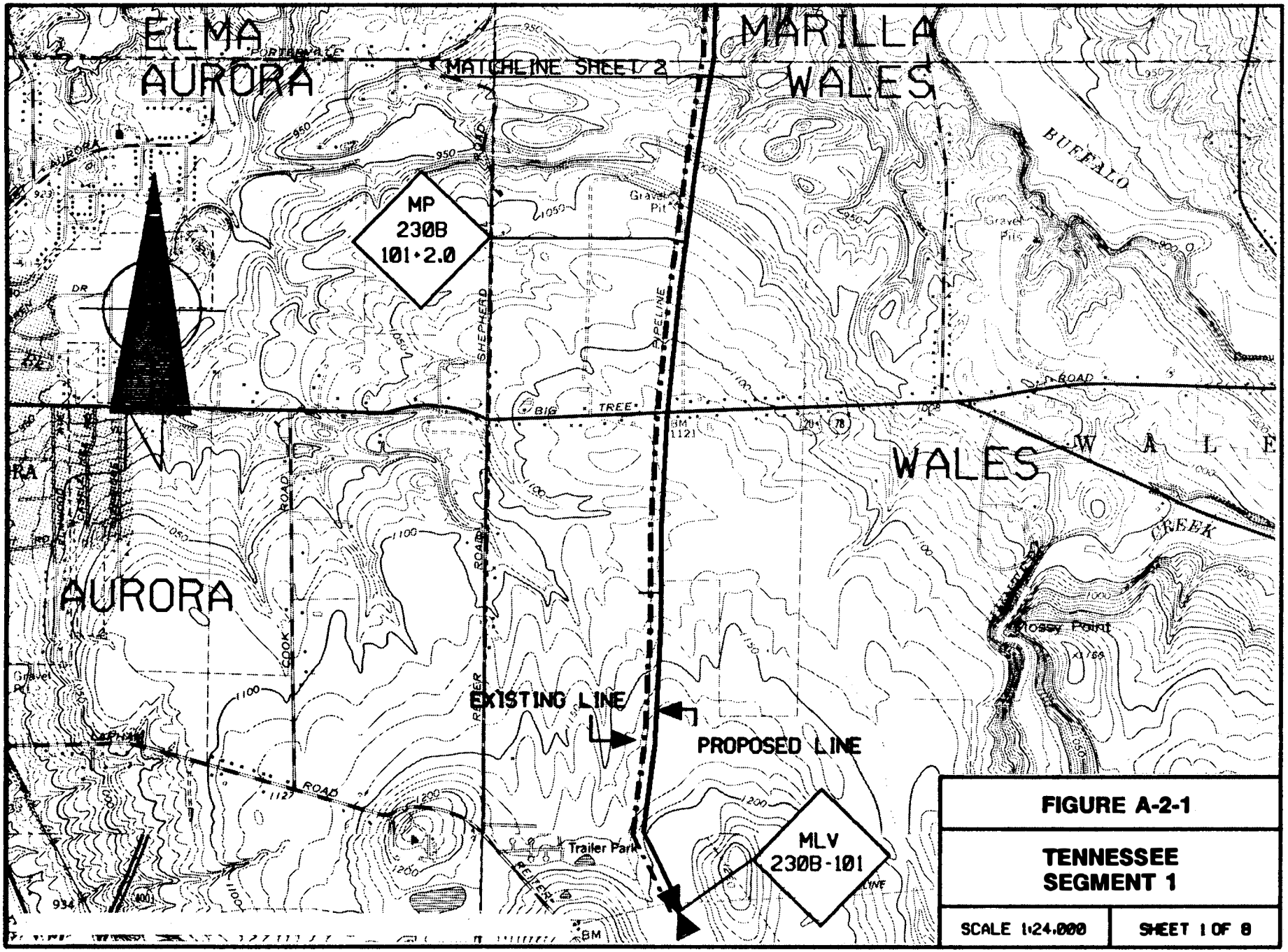


FIGURE A-2-1

TENNESSEE SEGMENT 1

SCALE 1:24,000 | SHEET 1 OF 8

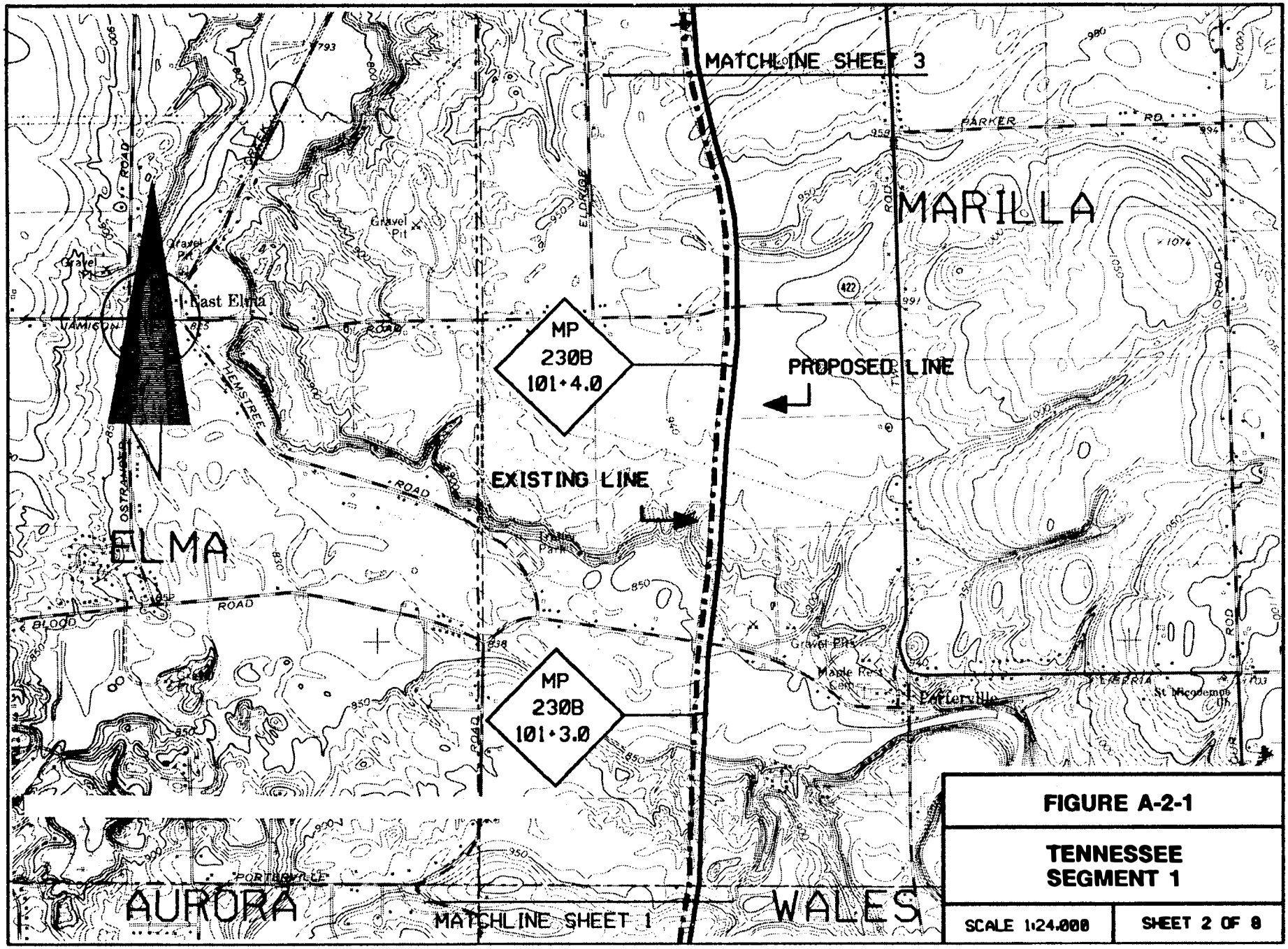


FIGURE A-2-1

TENNESSEE SEGMENT 1

SCALE 1:24,000 | SHEET 2 OF 8

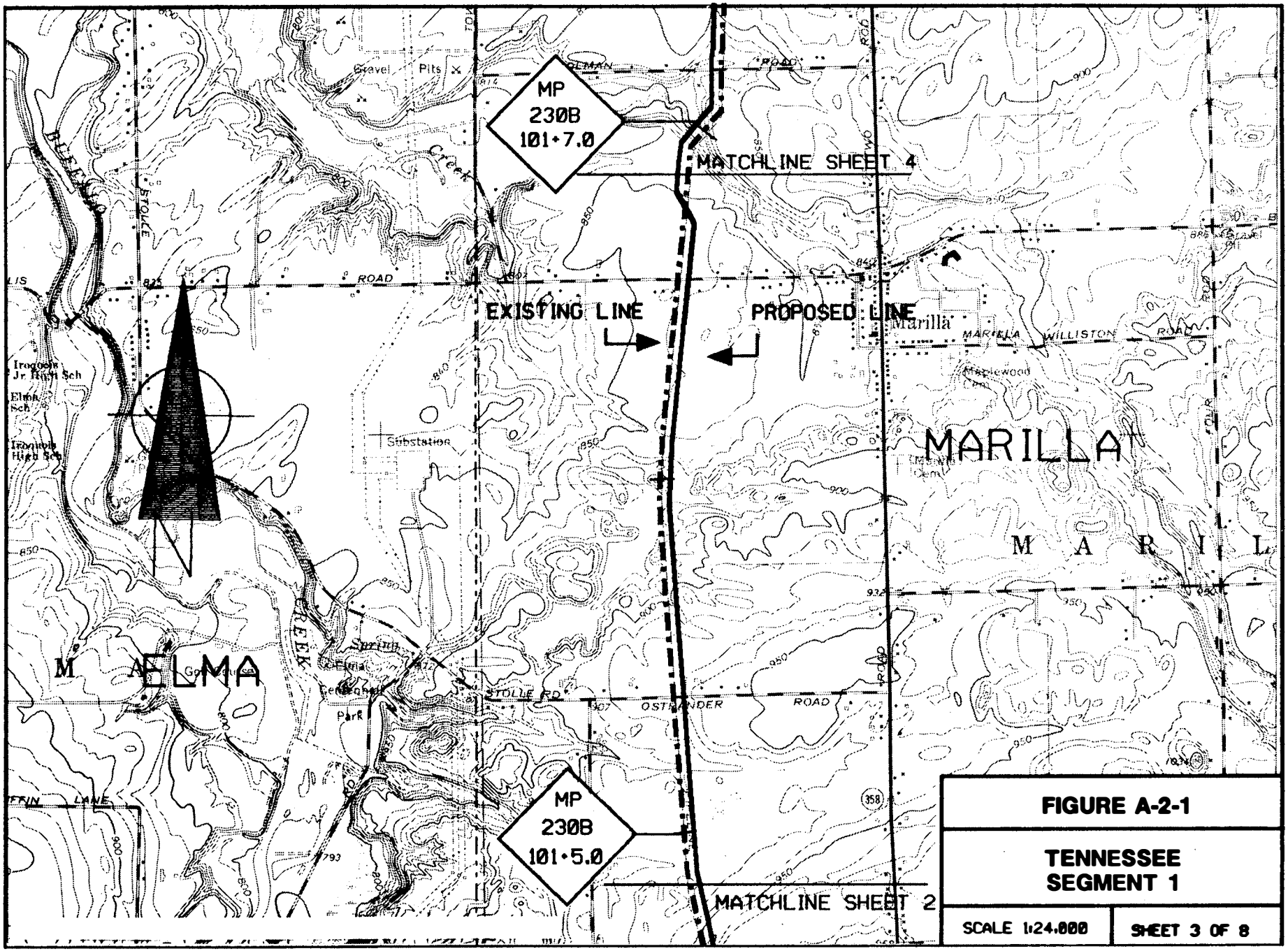


FIGURE A-2-1

TENNESSEE SEGMENT 1

SCALE 1:24,000 | SHEET 3 OF 8

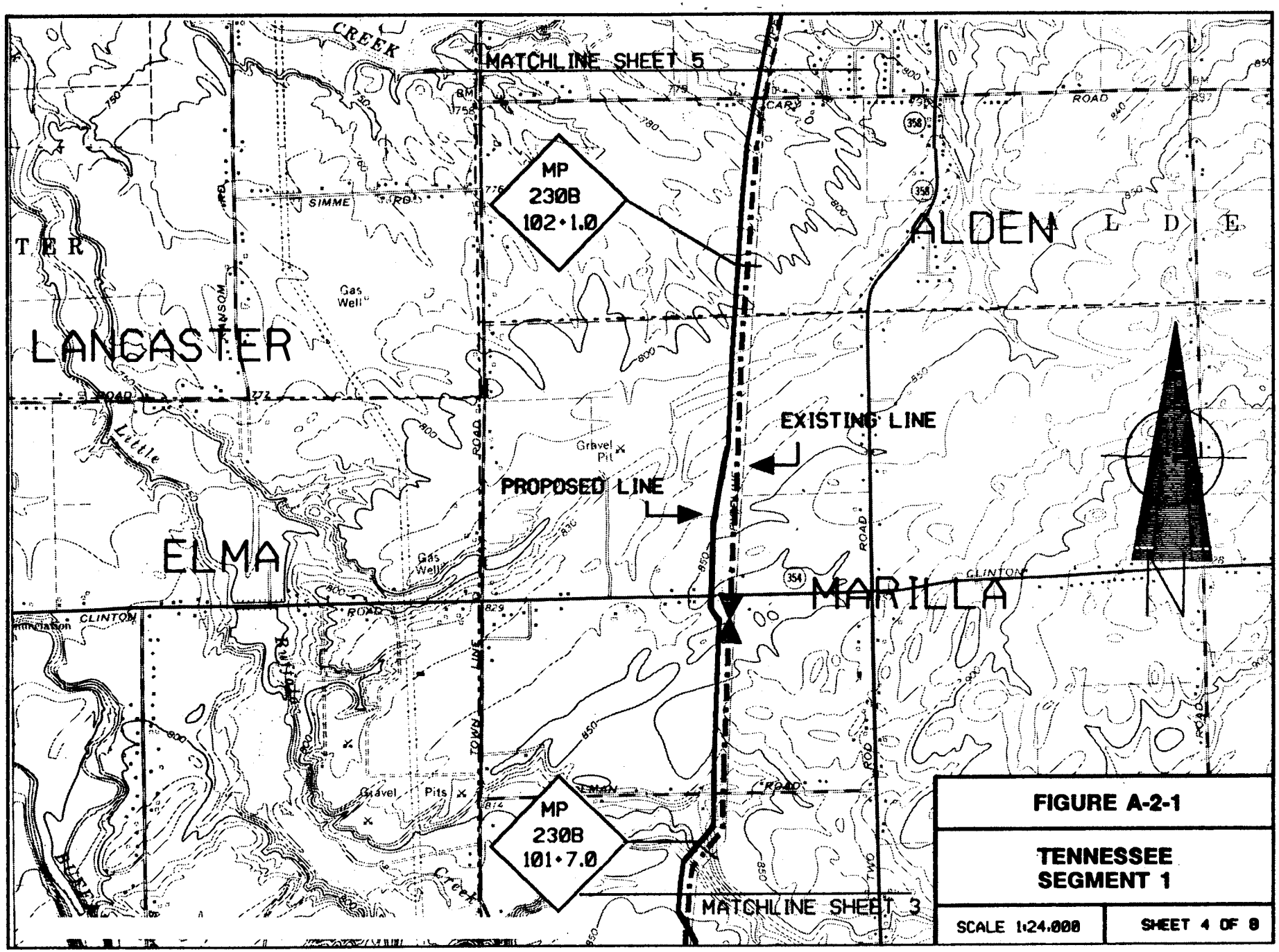


FIGURE A-2-1

TENNESSEE SEGMENT 1

SCALE 1:24,000 | SHEET 4 OF 8

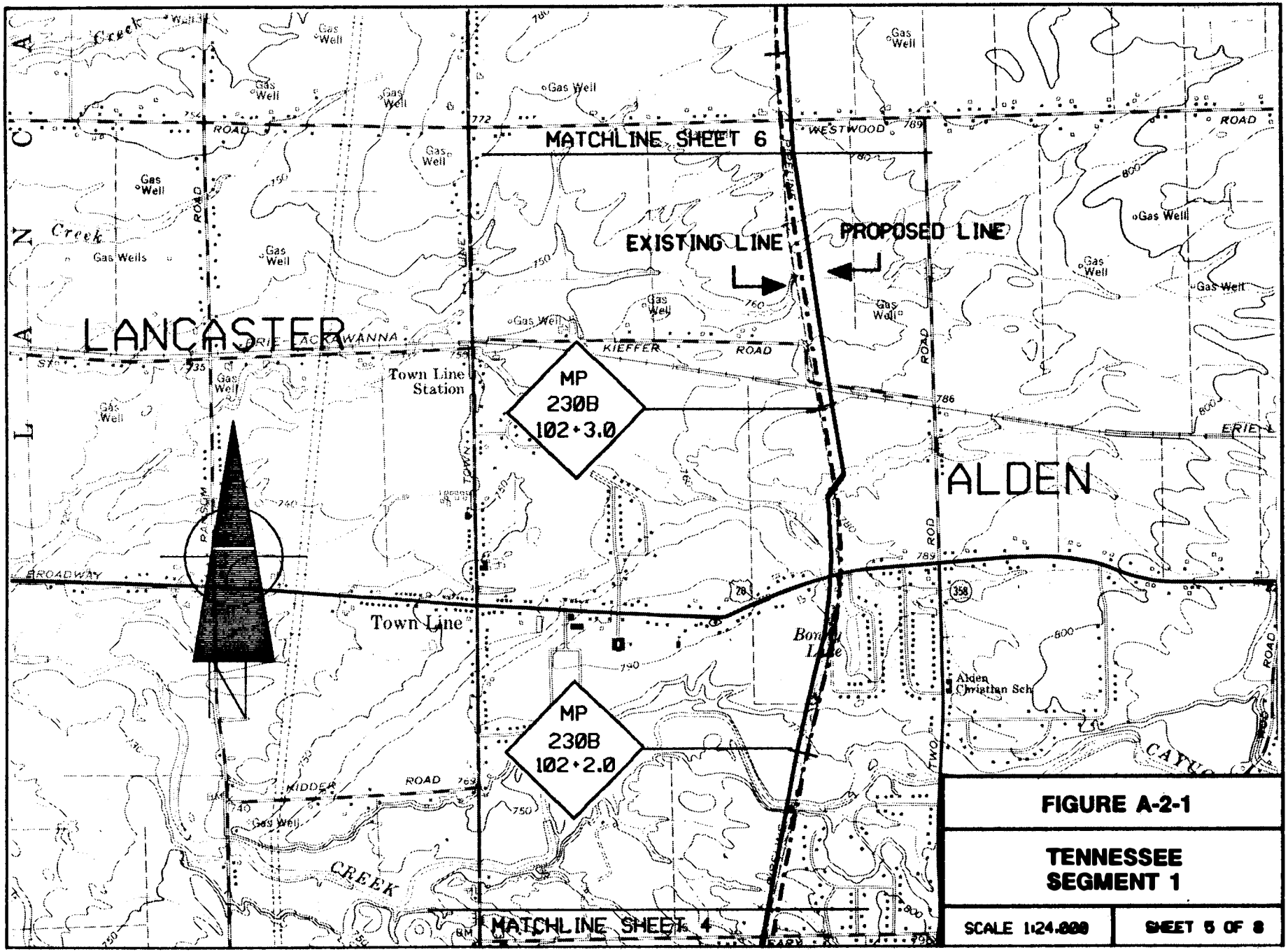


FIGURE A-2-1

TENNESSEE SEGMENT 1

SCALE 1:24,000 | SHEET 5 OF 8

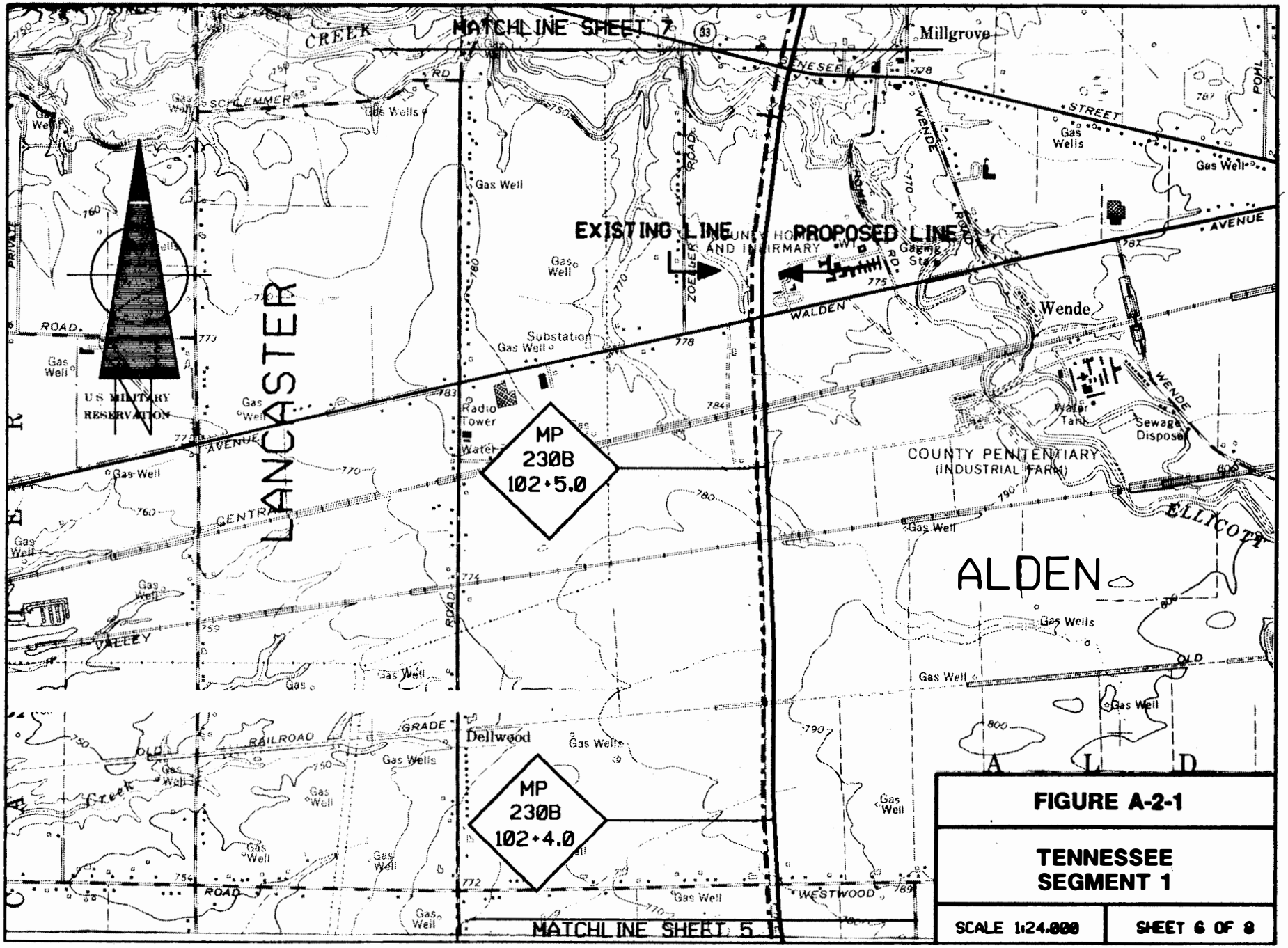


FIGURE A-2-1

TENNESSEE SEGMENT 1

SCALE 1:24,000 | SHEET 6 OF 8

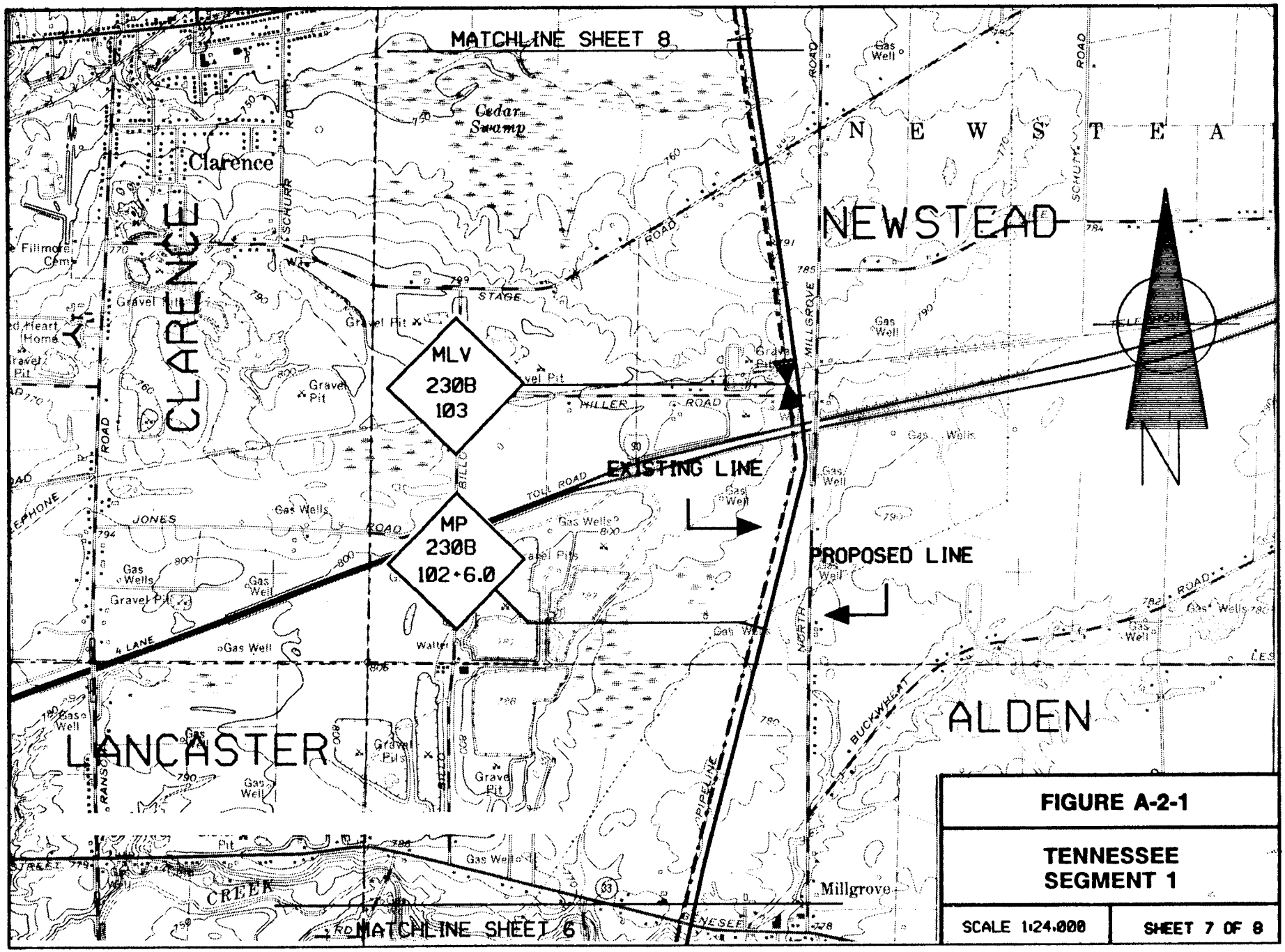


FIGURE A-2-1

TENNESSEE SEGMENT 1

SCALE 1:24,000 | SHEET 7 OF 8

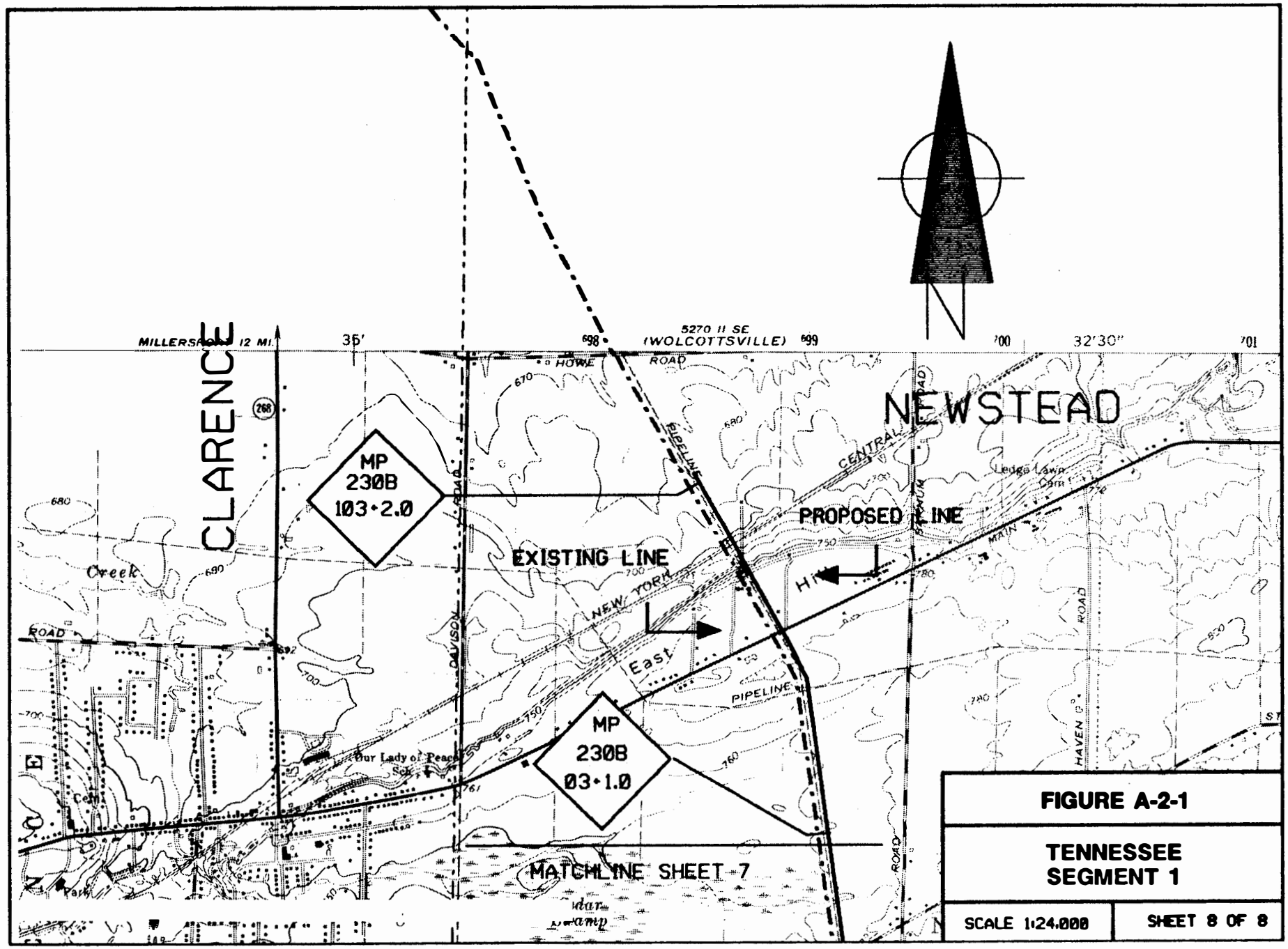


FIGURE A-2-1

TENNESSEE SEGMENT 1

SCALE 1:24,000 | SHEET 8 OF 8

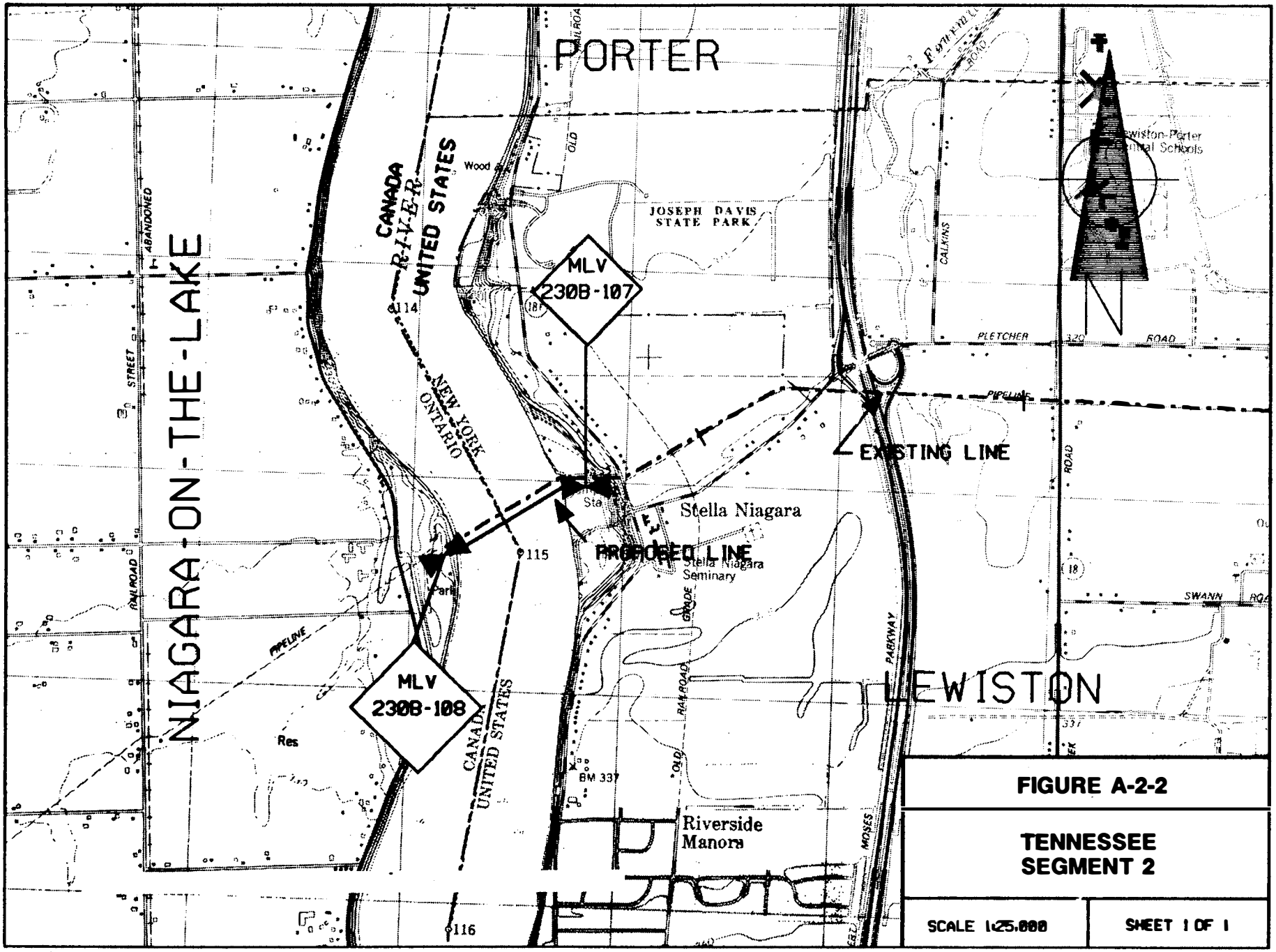


FIGURE A-2-2

TENNESSEE SEGMENT 2

SCALE 1:25,000 | SHEET 1 OF 1

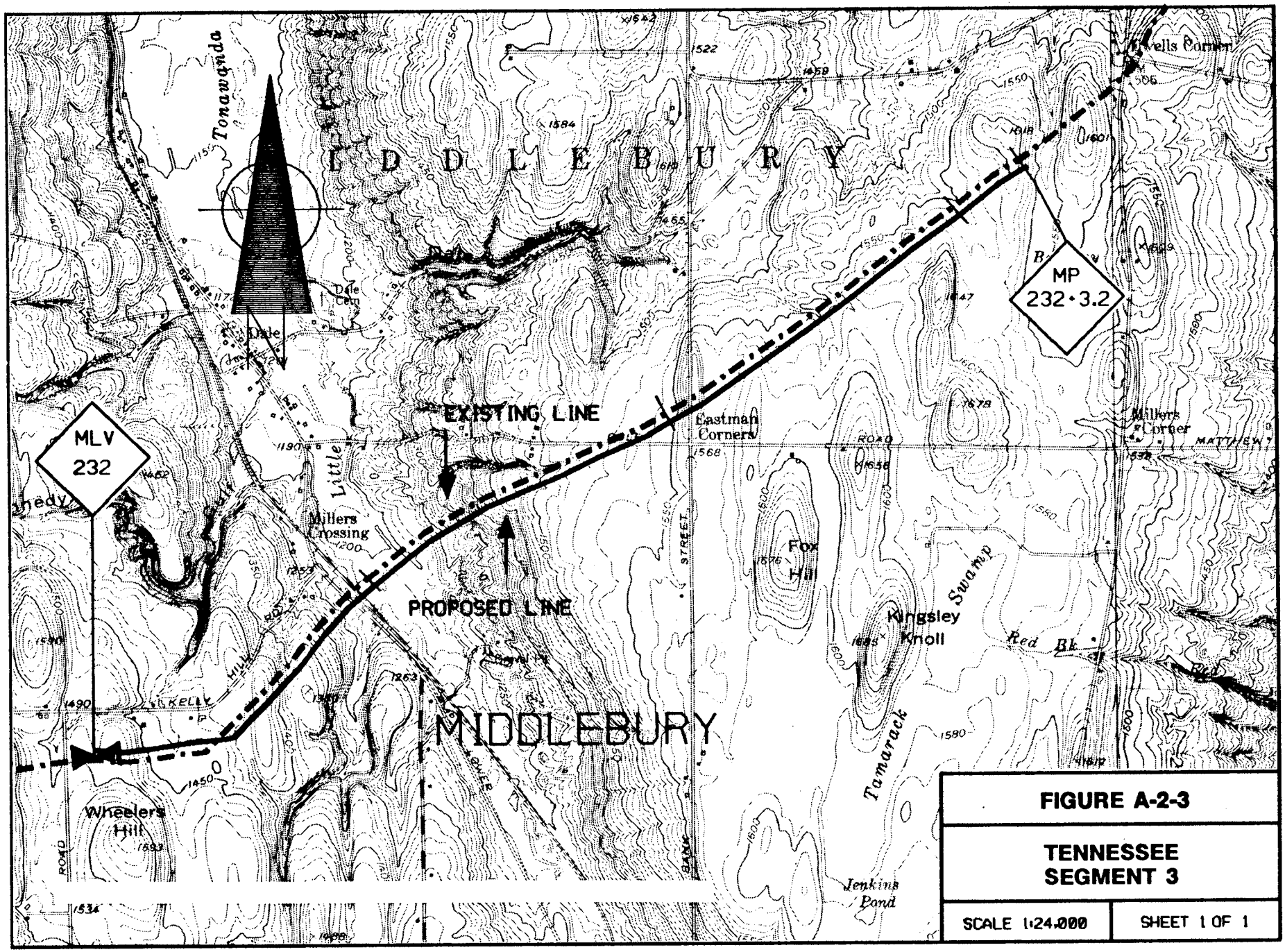


FIGURE A-2-3

TENNESSEE SEGMENT 3

SCALE 1:24,000	SHEET 1 OF 1

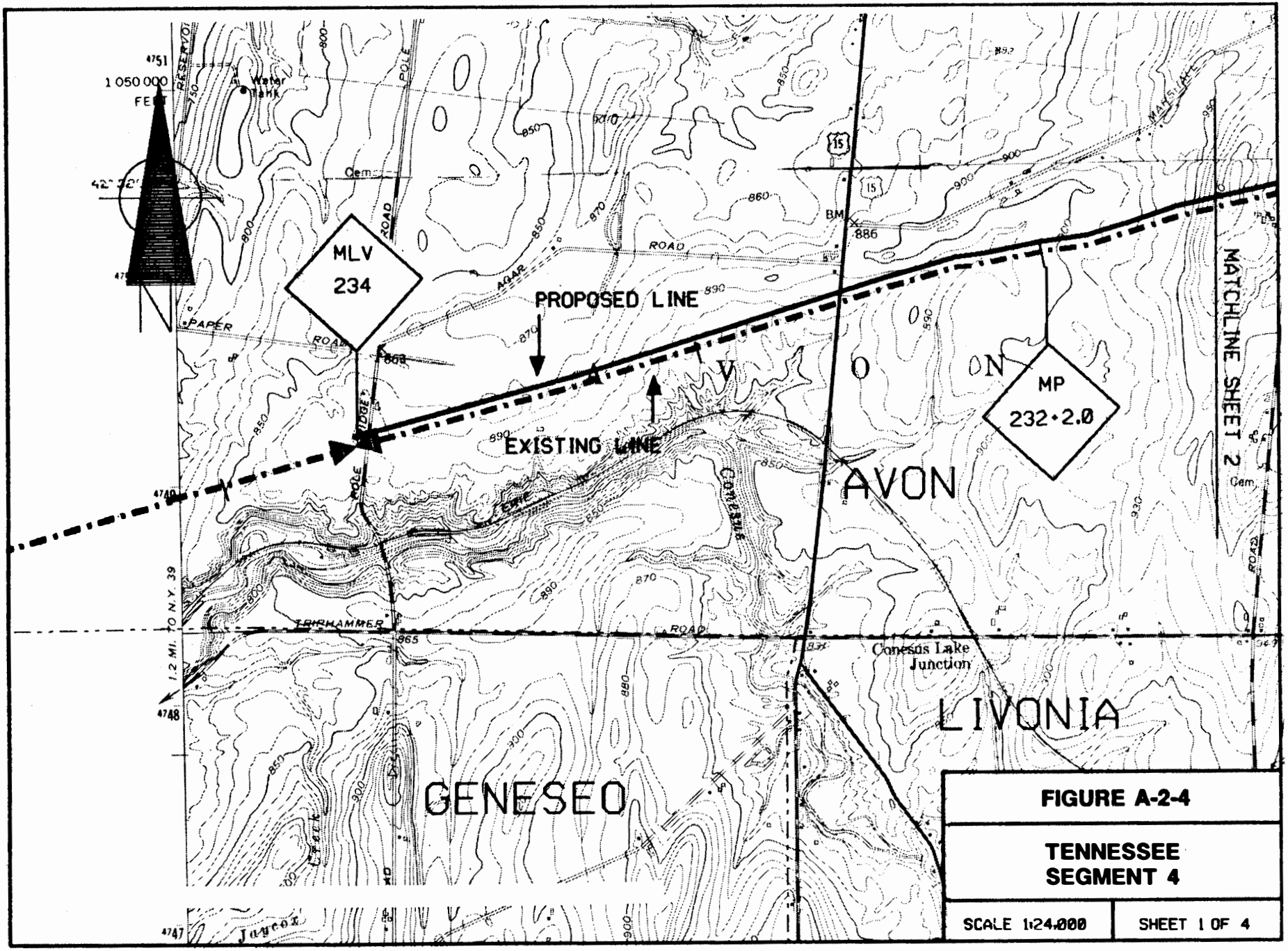


FIGURE A-2-4

TENNESSEE SEGMENT 4

SCALE 1:24,000 | SHEET 1 OF 4

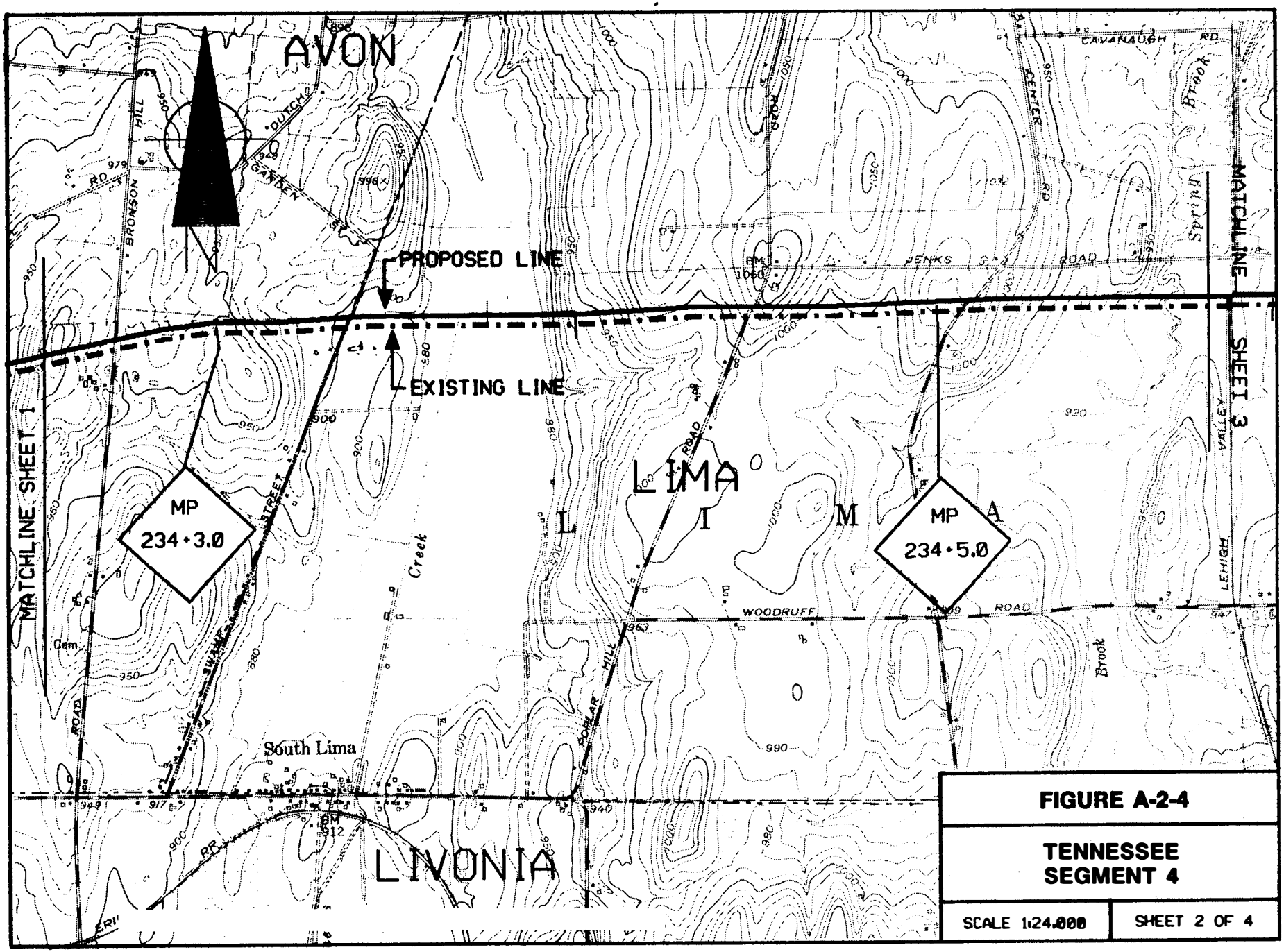


FIGURE A-2-4

TENNESSEE SEGMENT 4

SCALE 1:24,000 | SHEET 2 OF 4

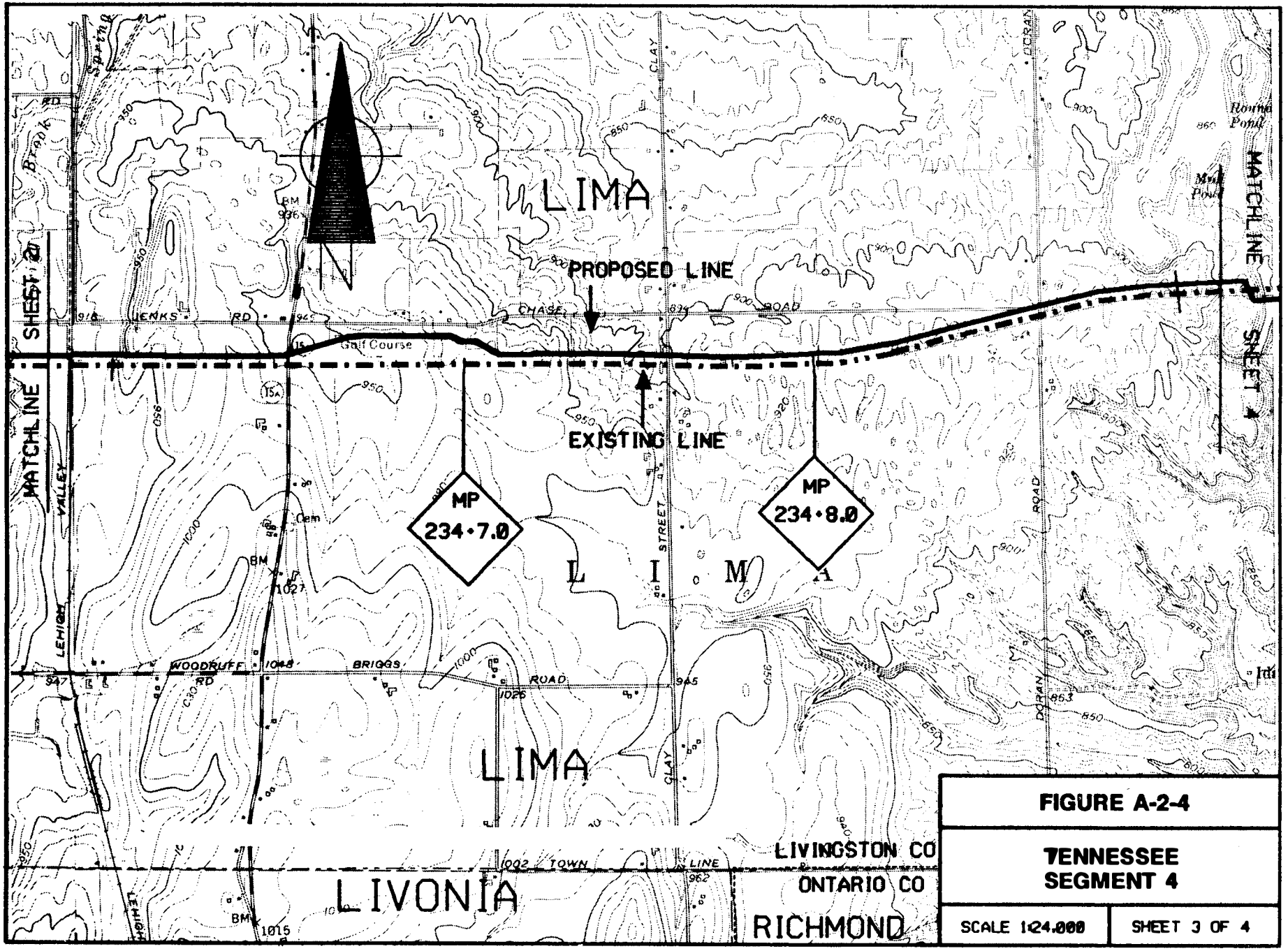


FIGURE A-2-4

TENNESSEE SEGMENT 4

SCALE 1:24,000 | SHEET 3 OF 4

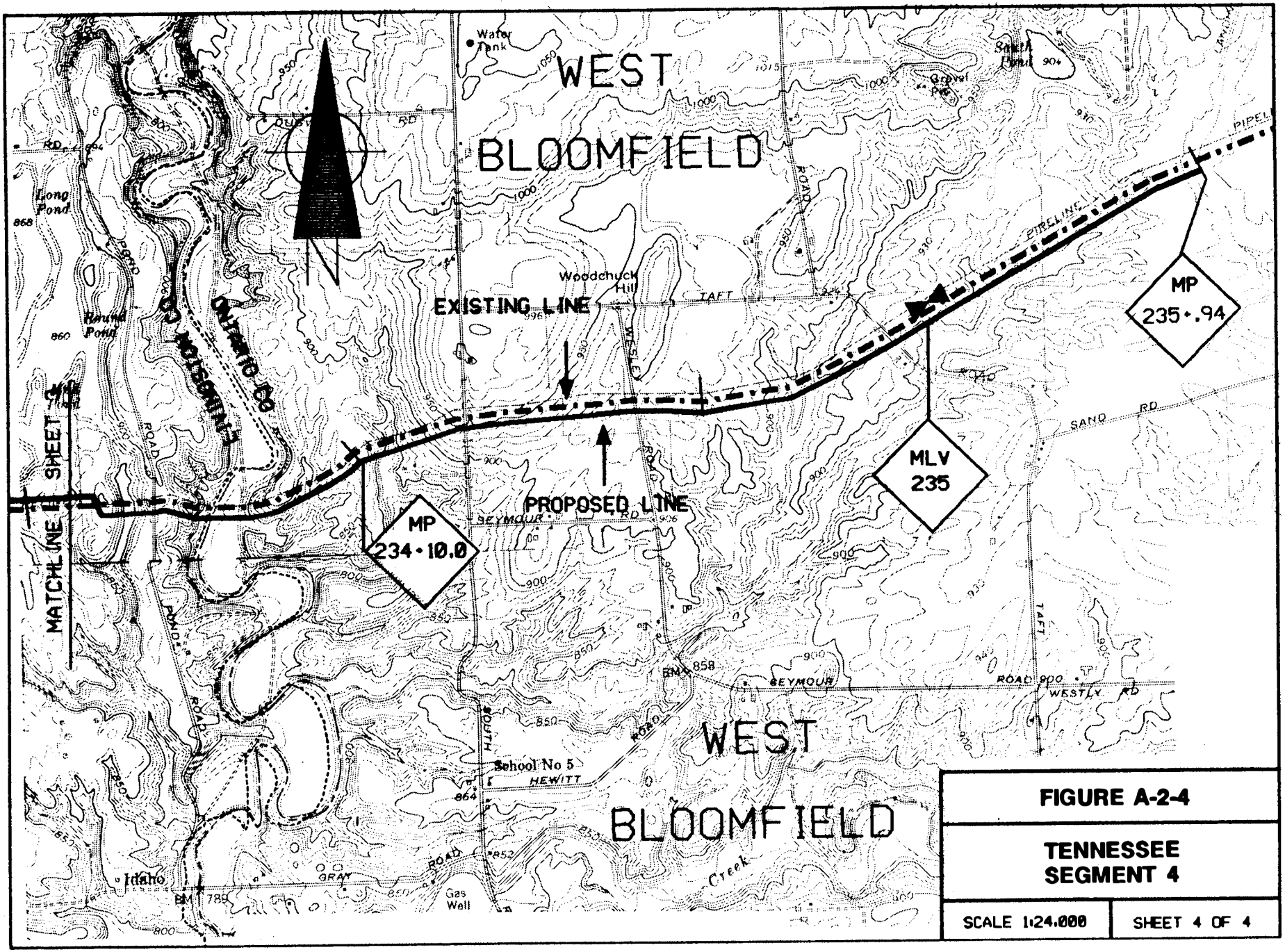


FIGURE A-2-4

TENNESSEE SEGMENT 4

SCALE 1:24,000 | SHEET 4 OF 4

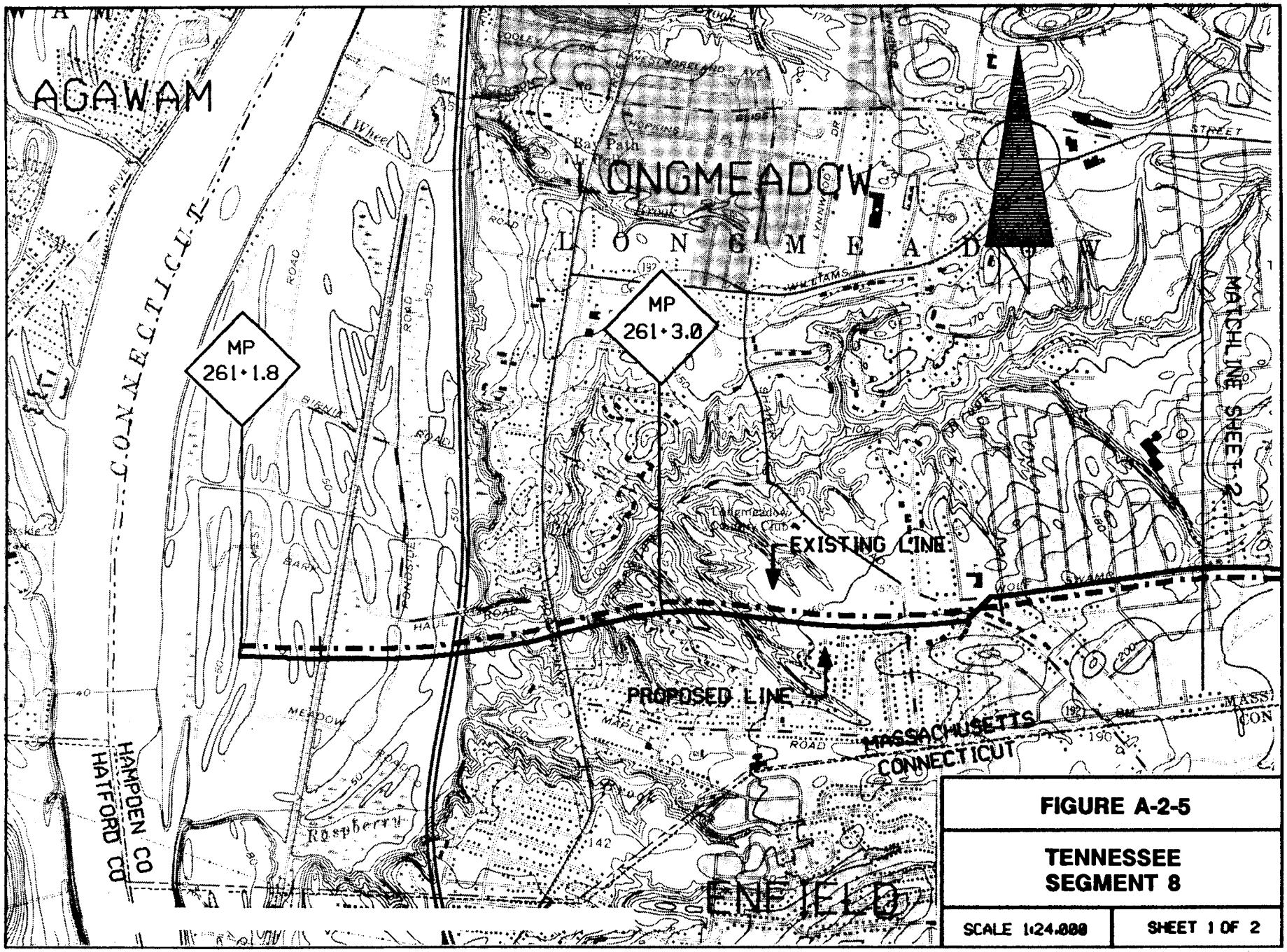
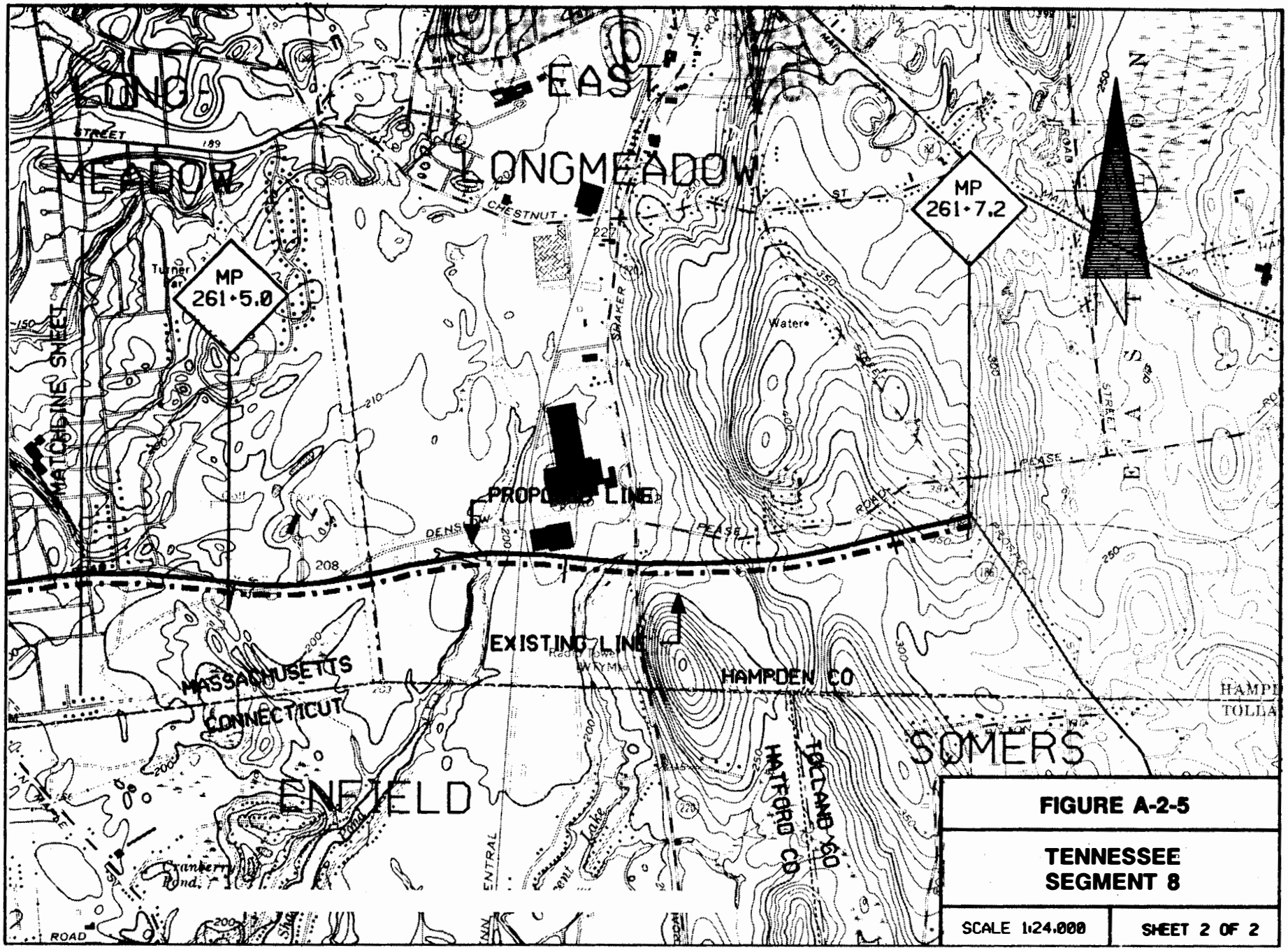


FIGURE A-2-5

TENNESSEE SEGMENT 8

SCALE 1:24,000 | SHEET 1 OF 2


EAST LONGMEADOW
LONGMEADOW
MP 261-5.0
MP 261-7.2
MATCHING SHEET
PROPOSED LINE
EXISTING LINE
MASSACHUSETTS
CONNECTICUT
HAMPDEN CO
HAMPDEN CO
ENFIELD
SOMERS
TOLLAND CO
MAIN STREET
CHESTNUT
DENSLOW
PEASE
SHAKER
Water
Turner
Cranberry Pond
Lake
ROAD
FIGURE A-2-5
TENNESSEE SEGMENT 8
SCALE 1:24,000
SHEET 2 OF 2

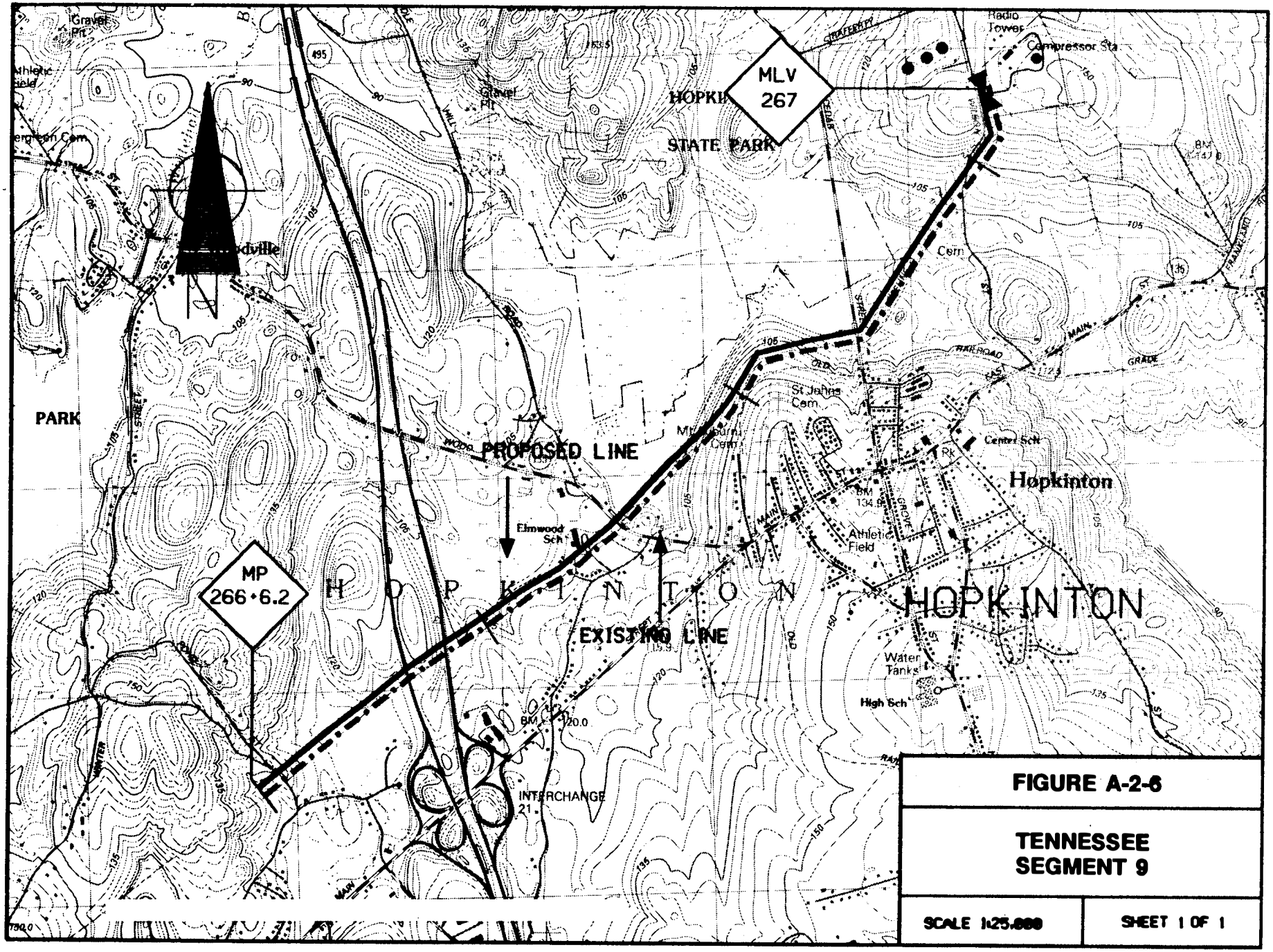


FIGURE A-2-6

TENNESSEE SEGMENT 9

SCALE 1:25,000 | SHEET 1 OF 1

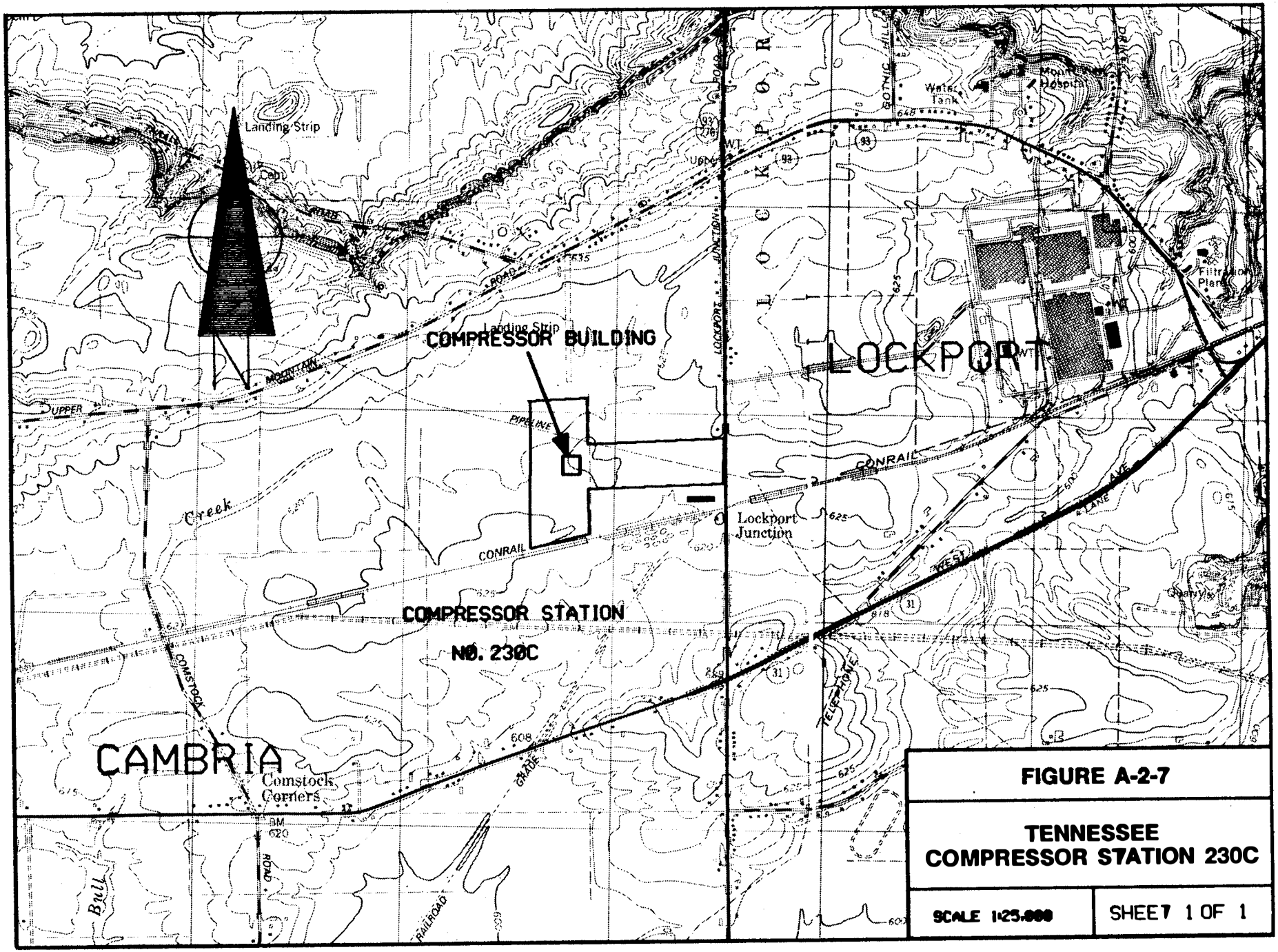


FIGURE A-2-7

TENNESSEE
COMPRESSOR STATION 230C

SCALE 1:25,000 | SHEET 1 OF 1

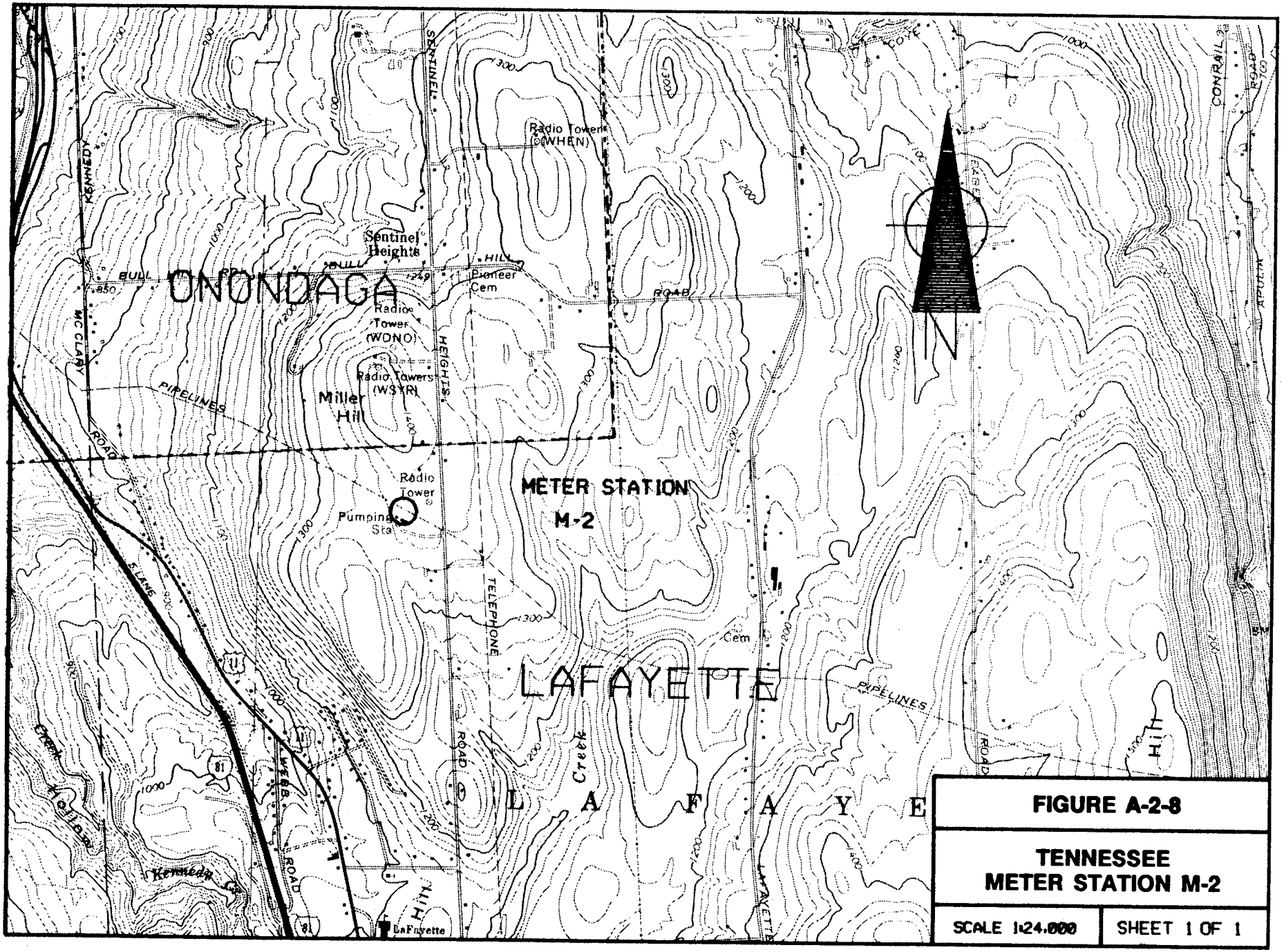


FIGURE A-2-8

TENNESSEE METER STATION M-2

SCALE 1:24,000 | SHEET 1 OF 1

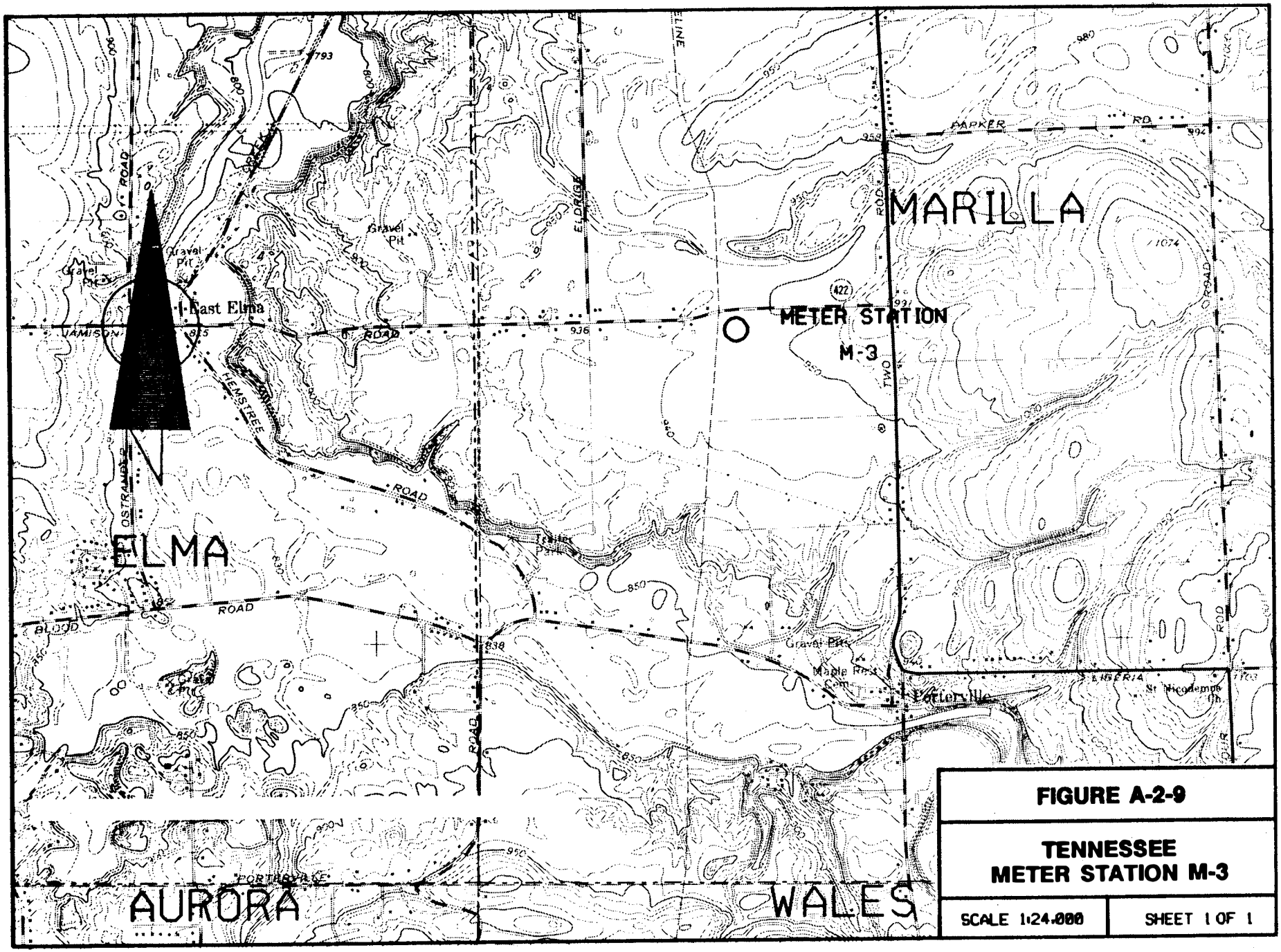


FIGURE A-2-9

TENNESSEE METER STATION M-3

SCALE 1:24,000	SHEET 1 OF 1

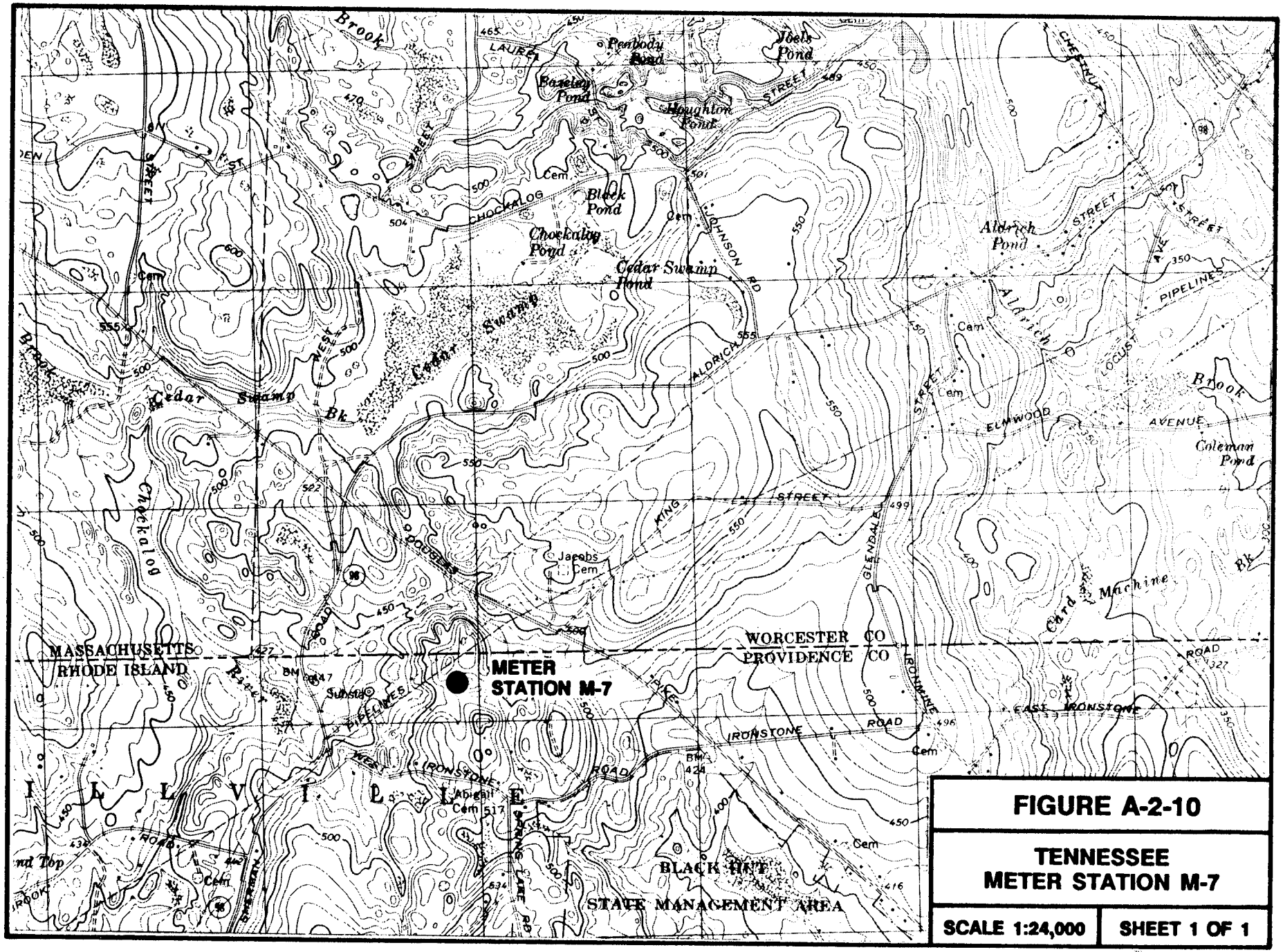


FIGURE A-2-10

TENNESSEE METER STATION M-7

SCALE 1:24,000	SHEET 1 OF 1

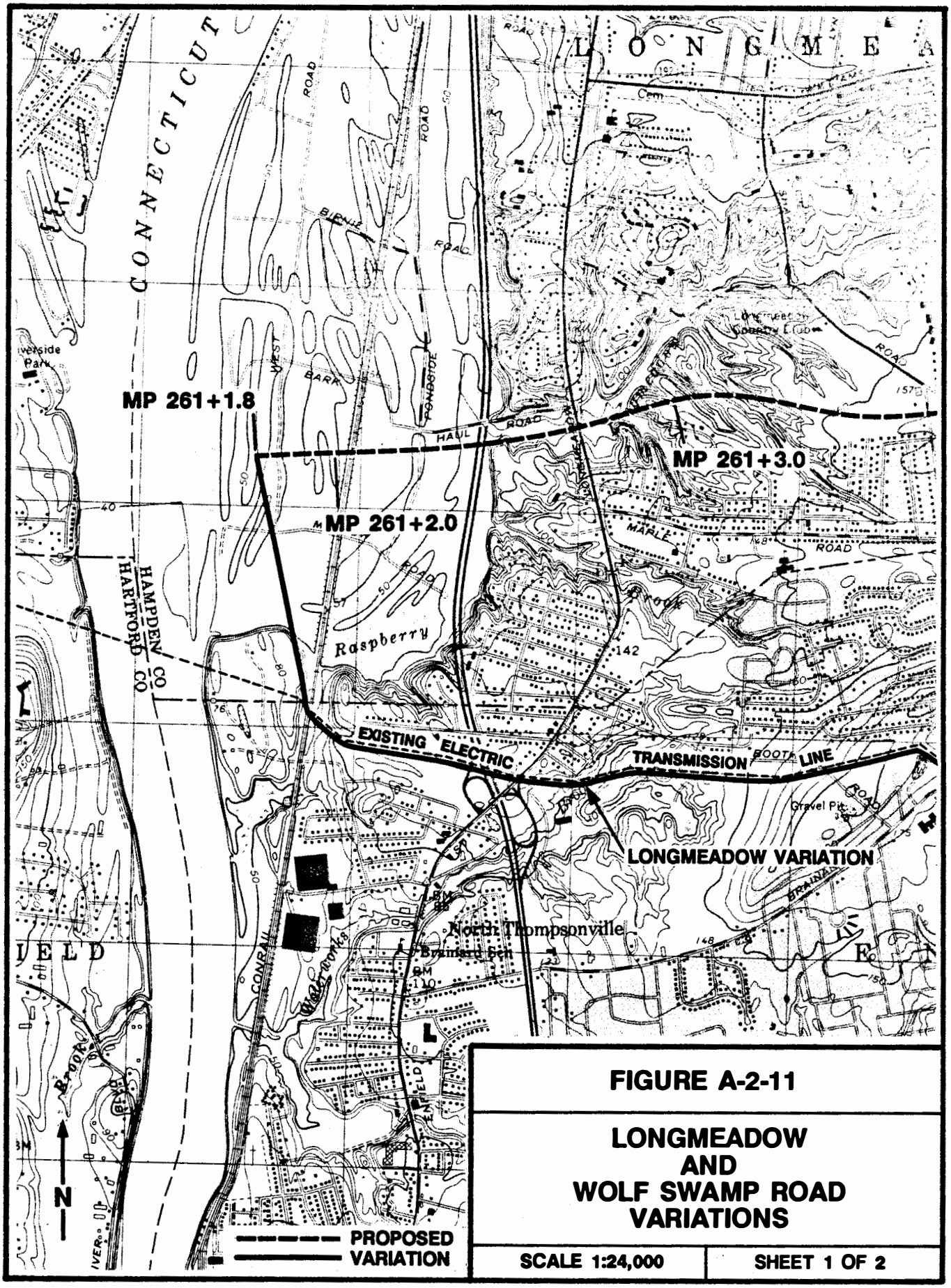


FIGURE A-2-11

LONGMEADOW AND WOLF SWAMP ROAD VARIATIONS

SCALE 1:24,000	SHEET 1 OF 2

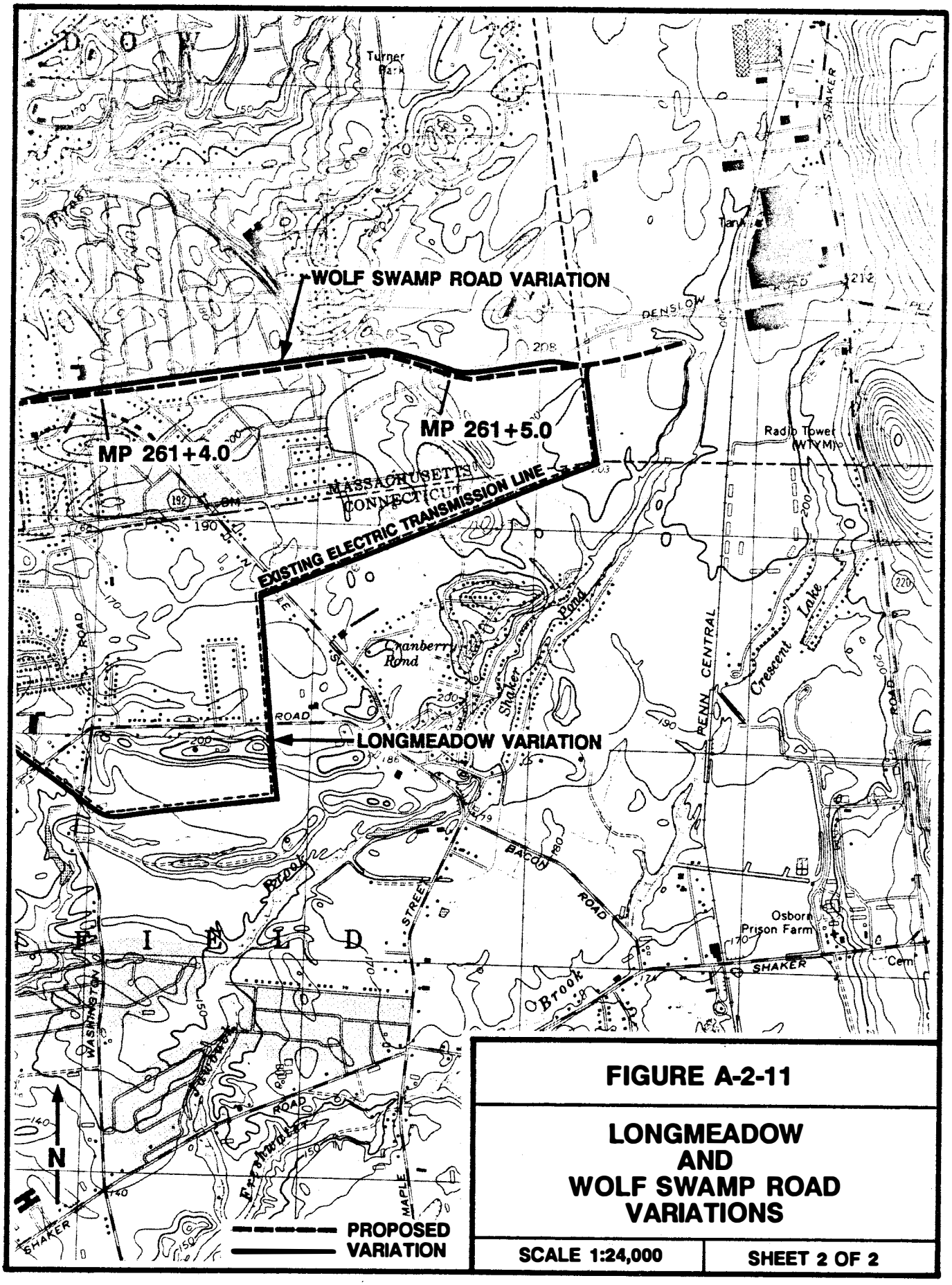


FIGURE A-2-11

LONGMEADOW AND WOLF SWAMP ROAD VARIATIONS

SCALE 1:24,000 | SHEET 2 OF 2

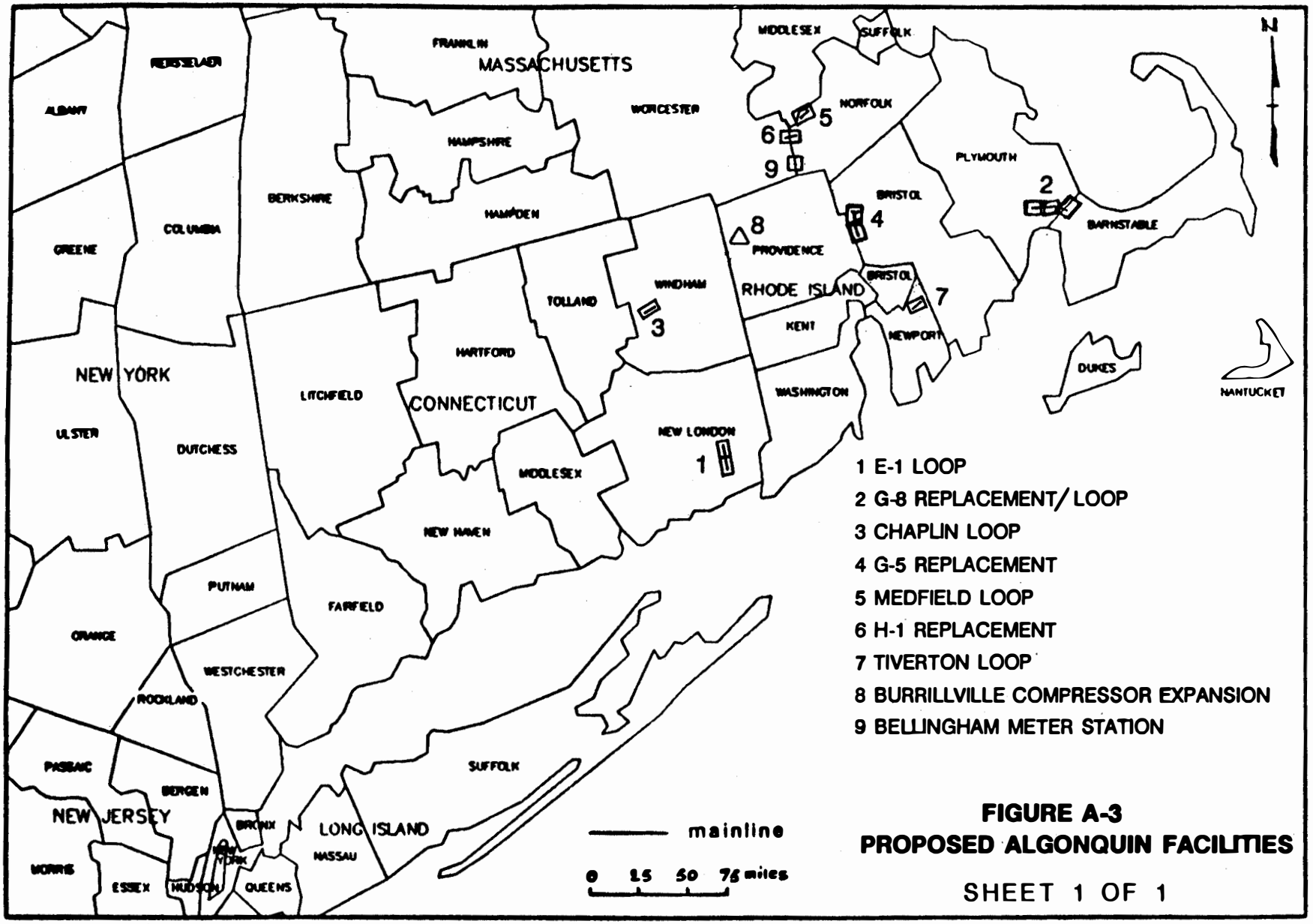


FIGURE A-3
PROPOSED ALGONQUIN FACILITIES

SHEET 1 OF 1

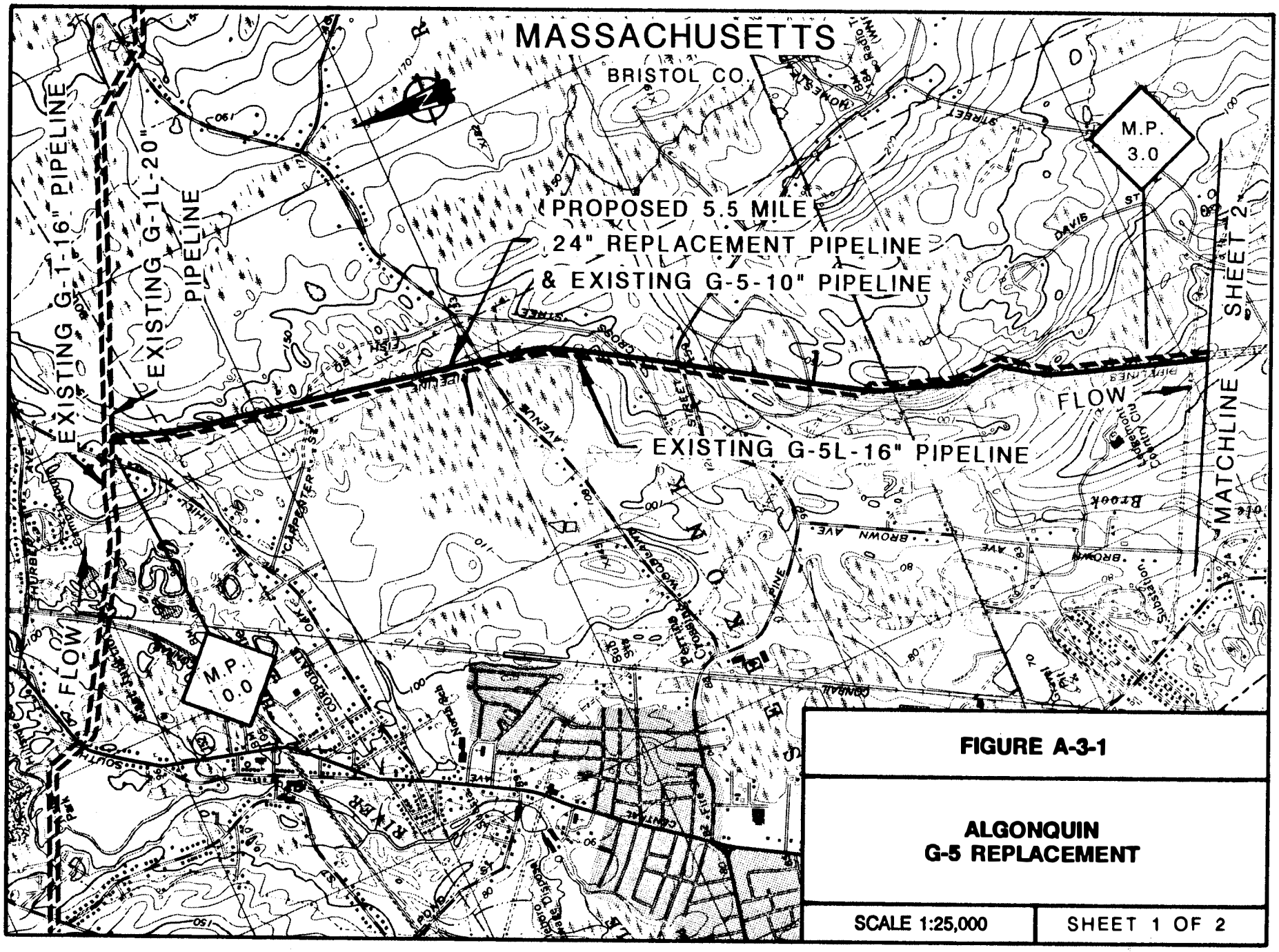


FIGURE A-3-1

ALGONQUIN
G-5 REPLACEMENT

SCALE 1:25,000	SHEET 1 OF 2

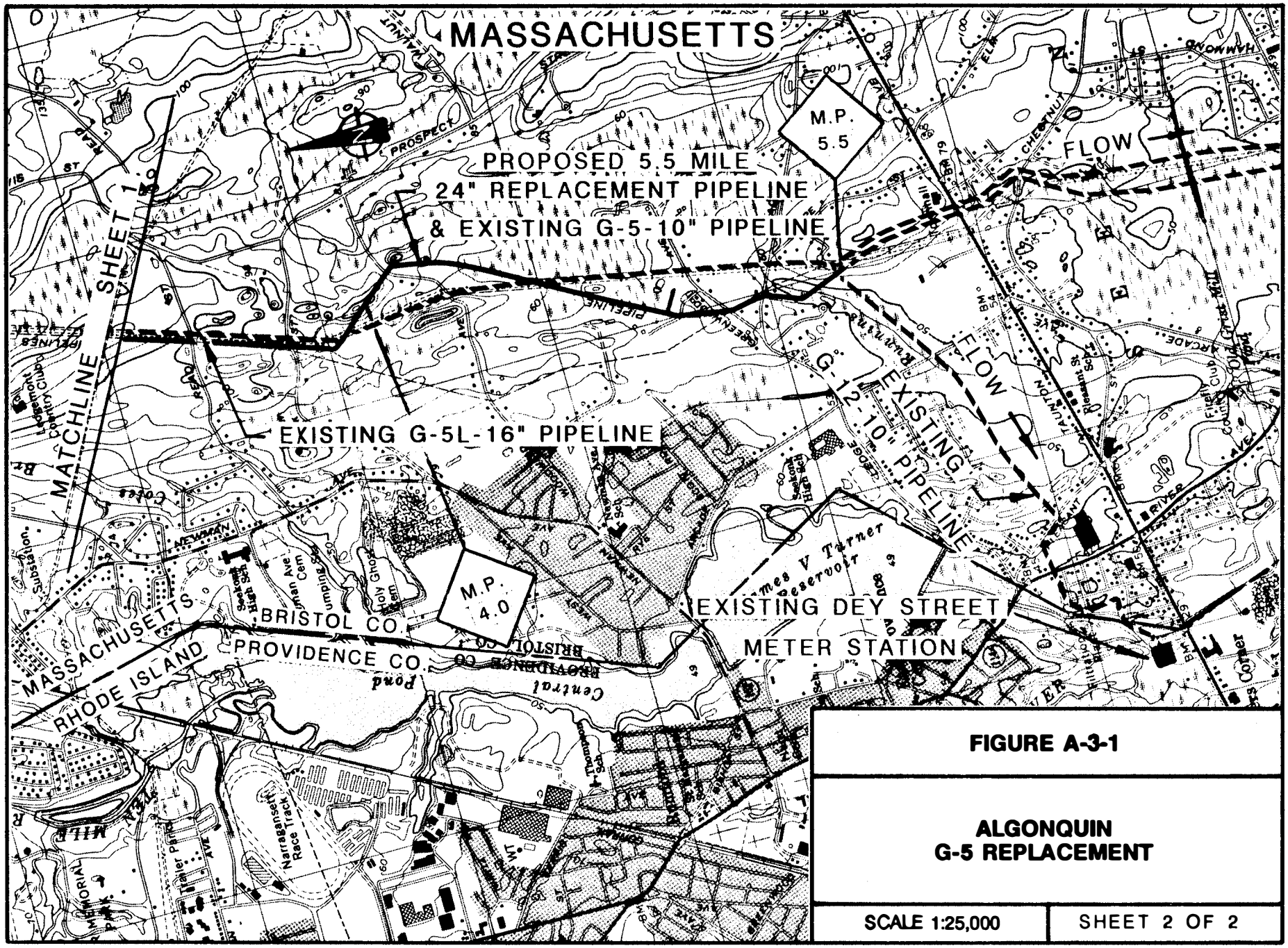


FIGURE A-3-1

ALGONQUIN
G-5 REPLACEMENT

SCALE 1:25,000	SHEET 2 OF 2

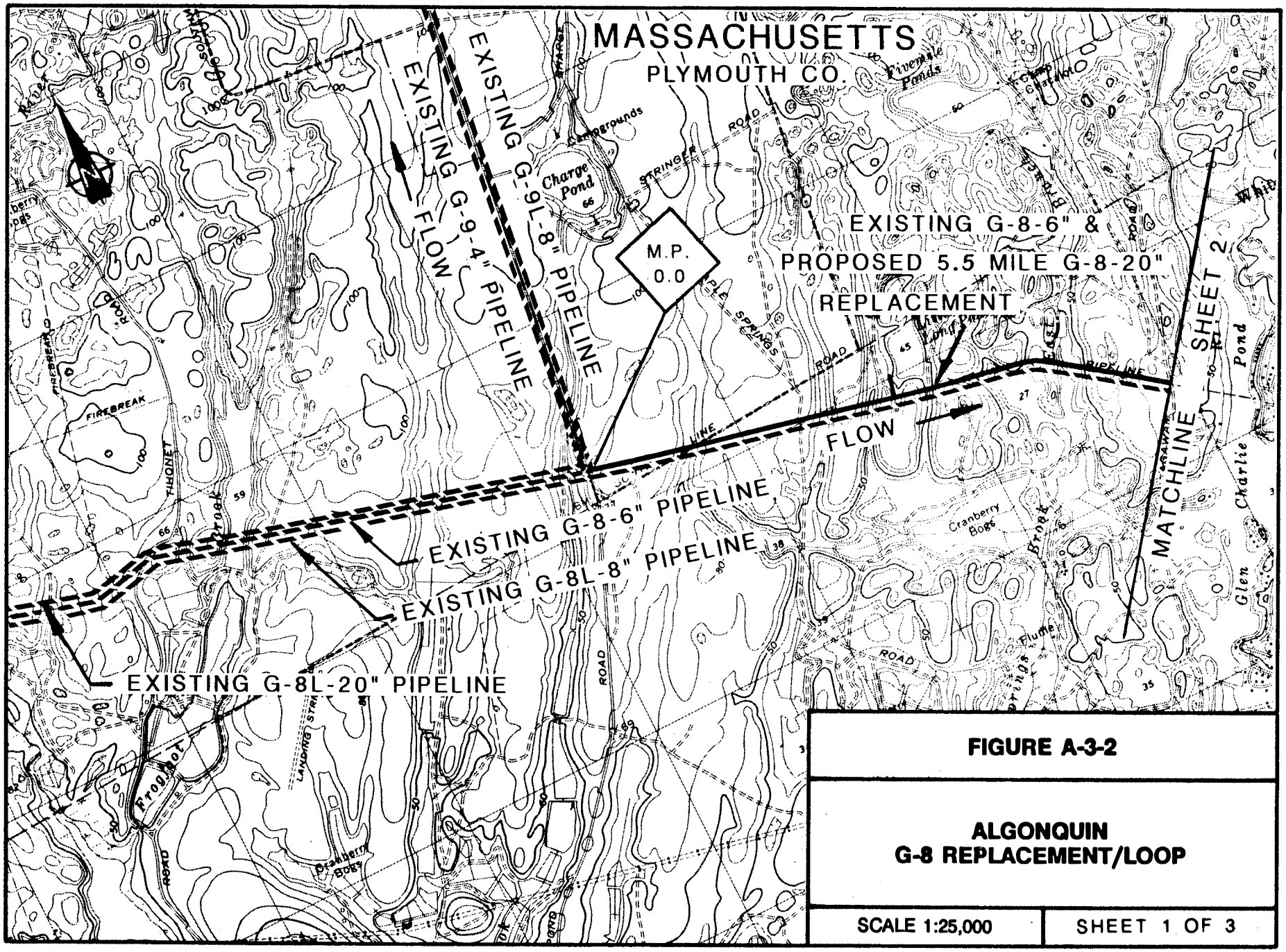


FIGURE A-3-2

ALGONQUIN
G-8 REPLACEMENT/LOOP

SCALE 1:25,000	SHEET 1 OF 3

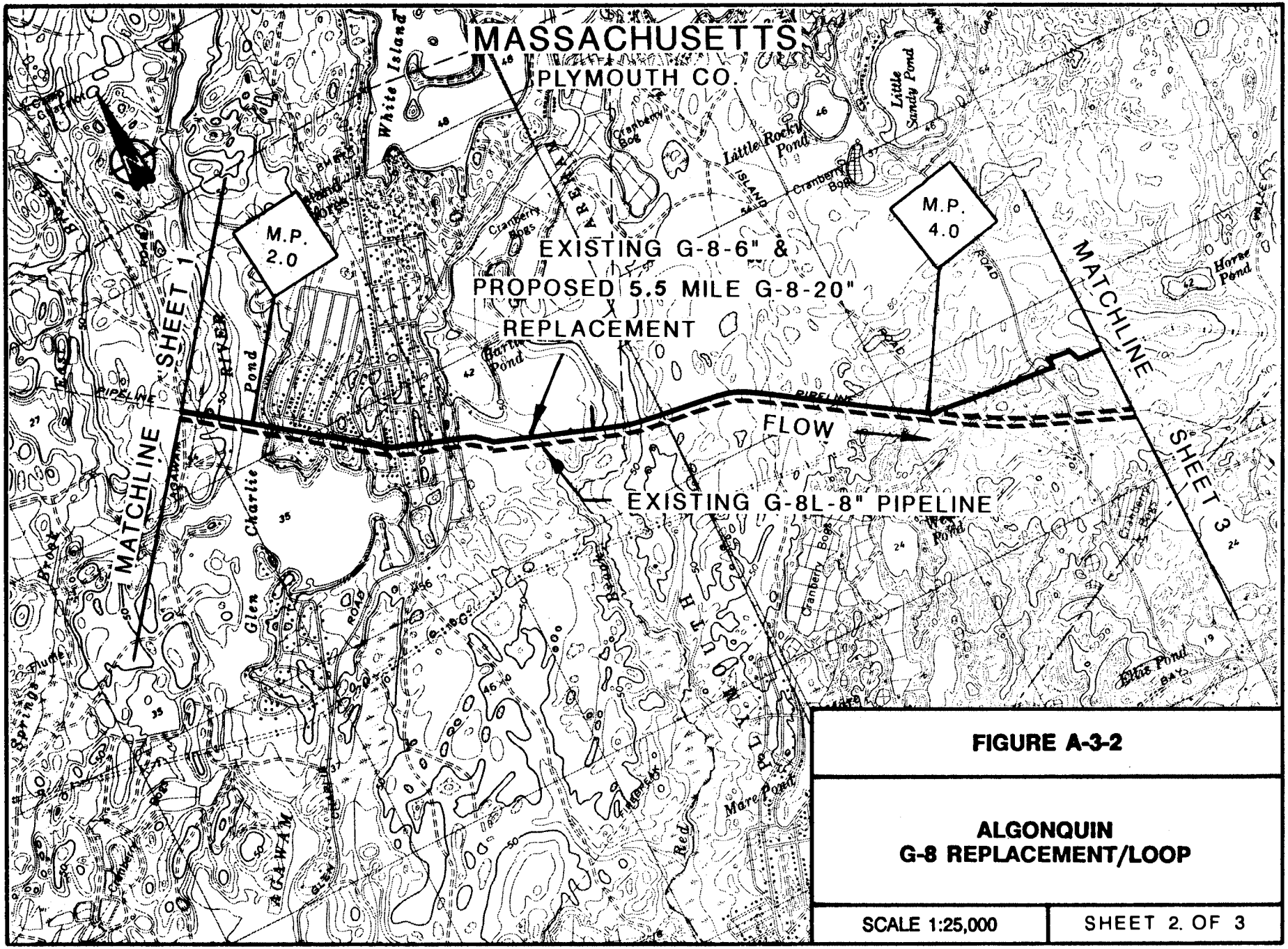


FIGURE A-3-2

ALGONQUIN
G-8 REPLACEMENT/LOOP

SCALE 1:25,000	SHEET 2. OF 3

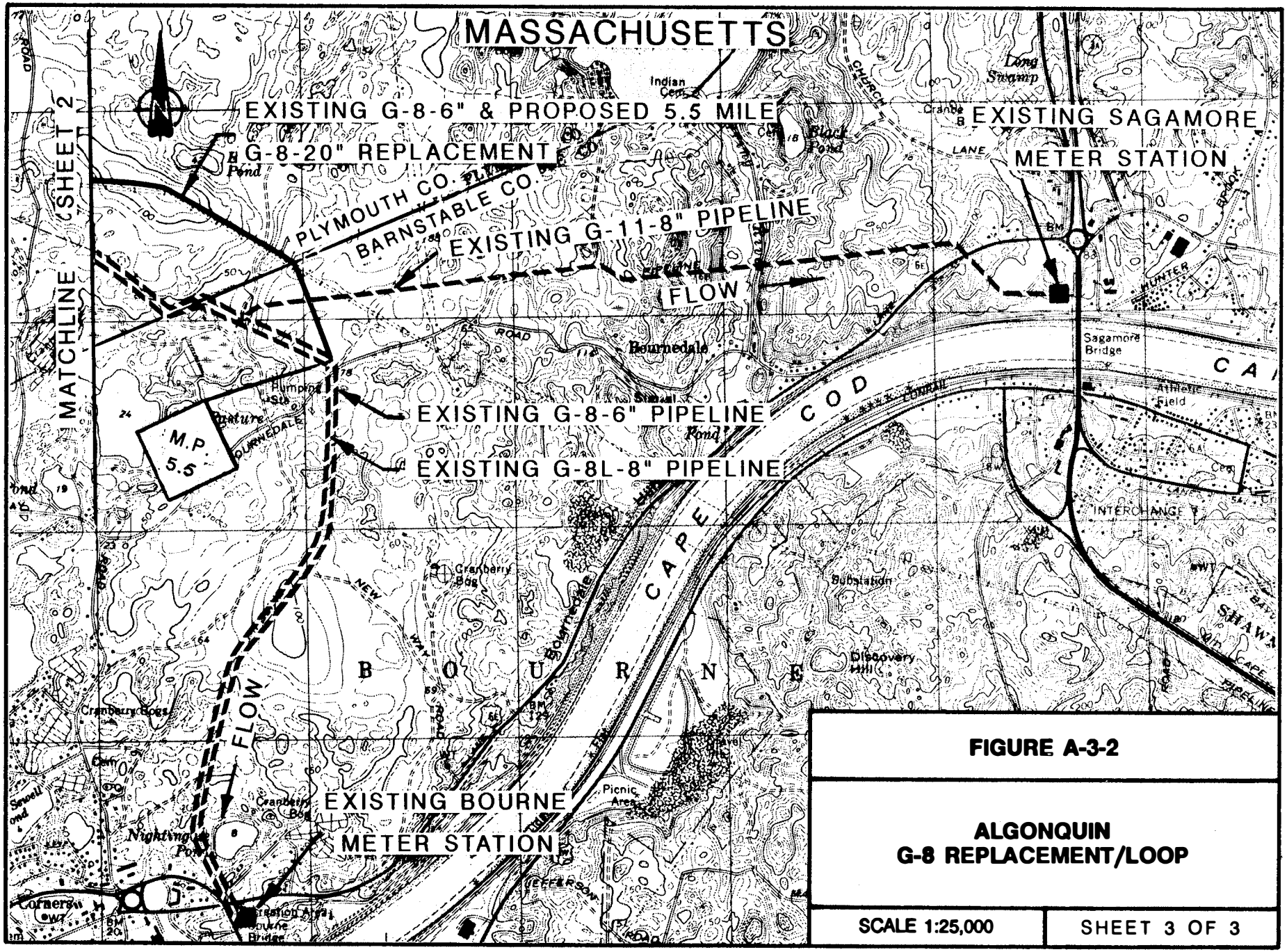


FIGURE A-3-2

ALGONQUIN
G-8 REPLACEMENT/LOOP

SCALE 1:25,000	SHEET 3 OF 3

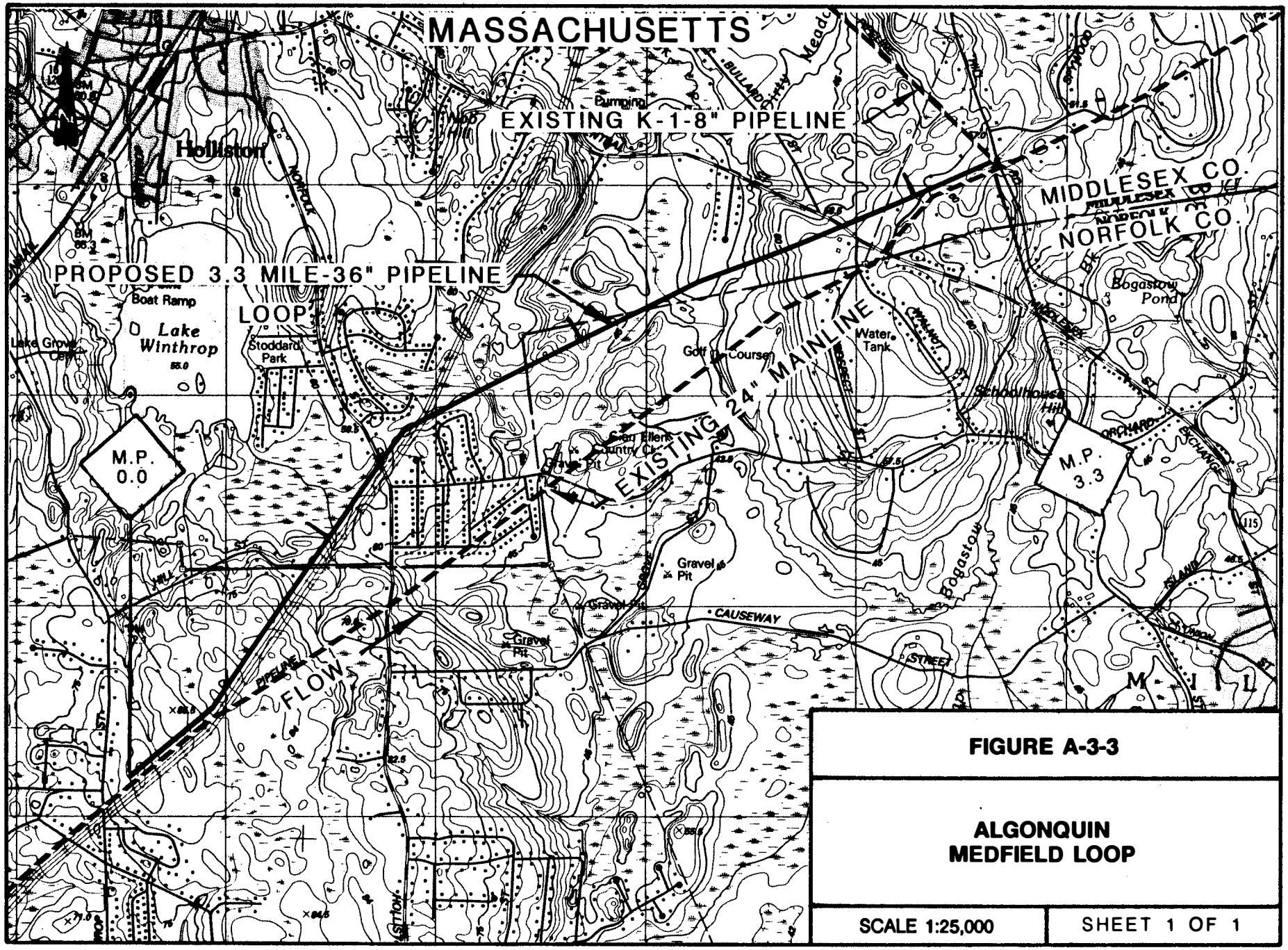


FIGURE A-3-3

ALGONQUIN
MEDFIELD LOOP

SCALE 1:25,000	SHEET 1 OF 1

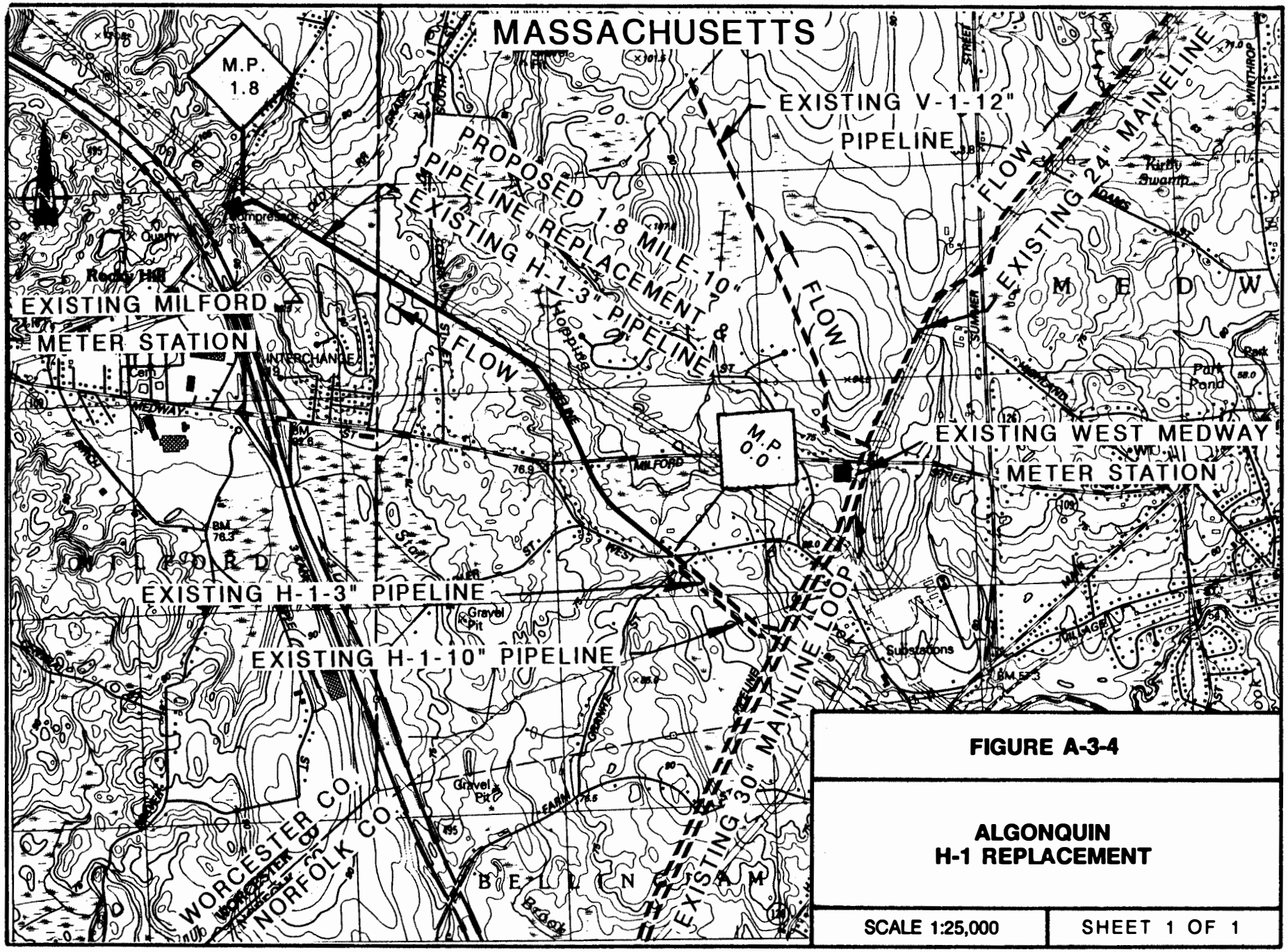


FIGURE A-3-4

ALGONQUIN
H-1 REPLACEMENT

SCALE 1:25,000	SHEET 1 OF 1

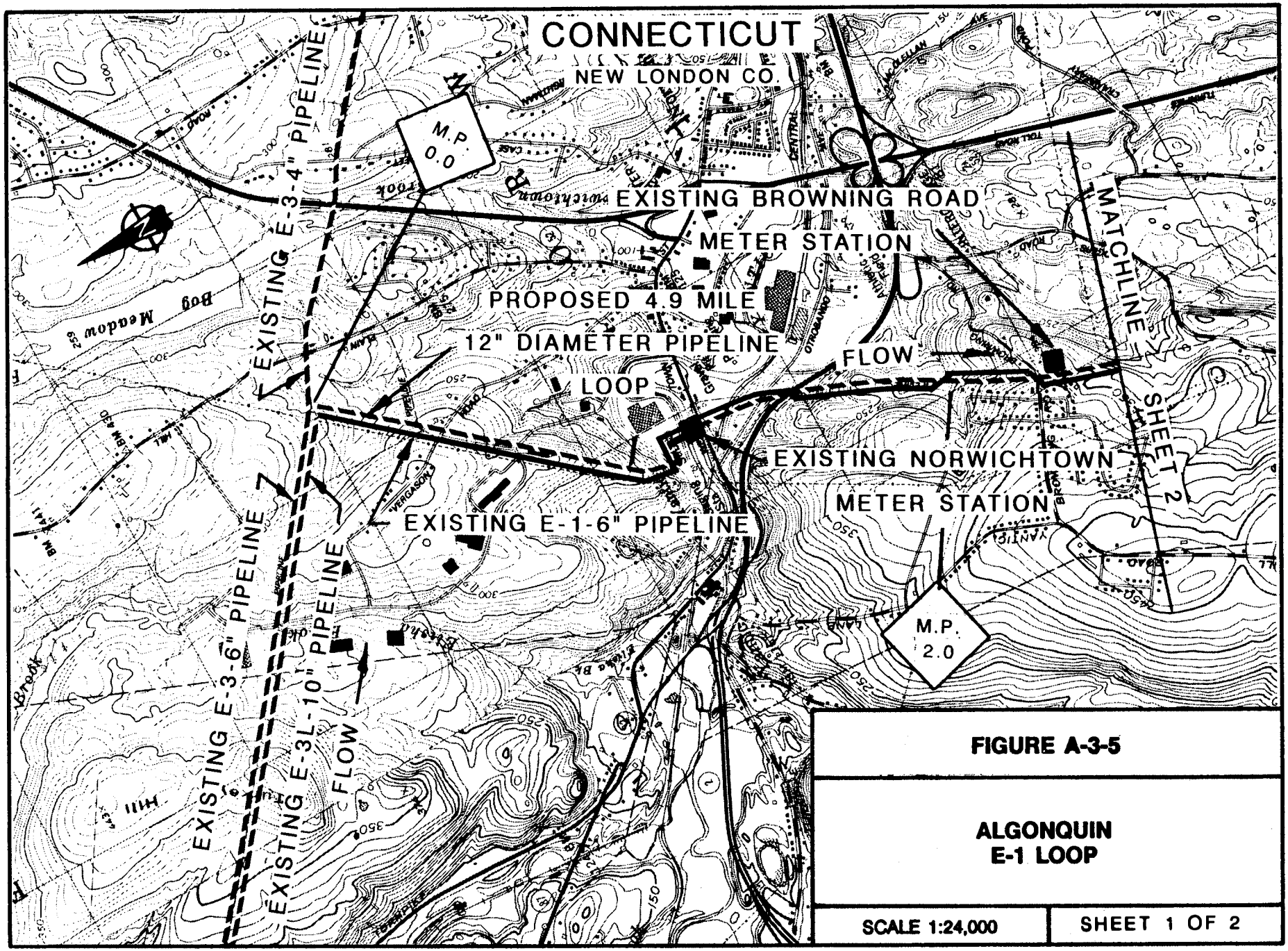


FIGURE A-3-5

ALGONQUIN
E-1 LOOP

SCALE 1:24,000	SHEET 1 OF 2

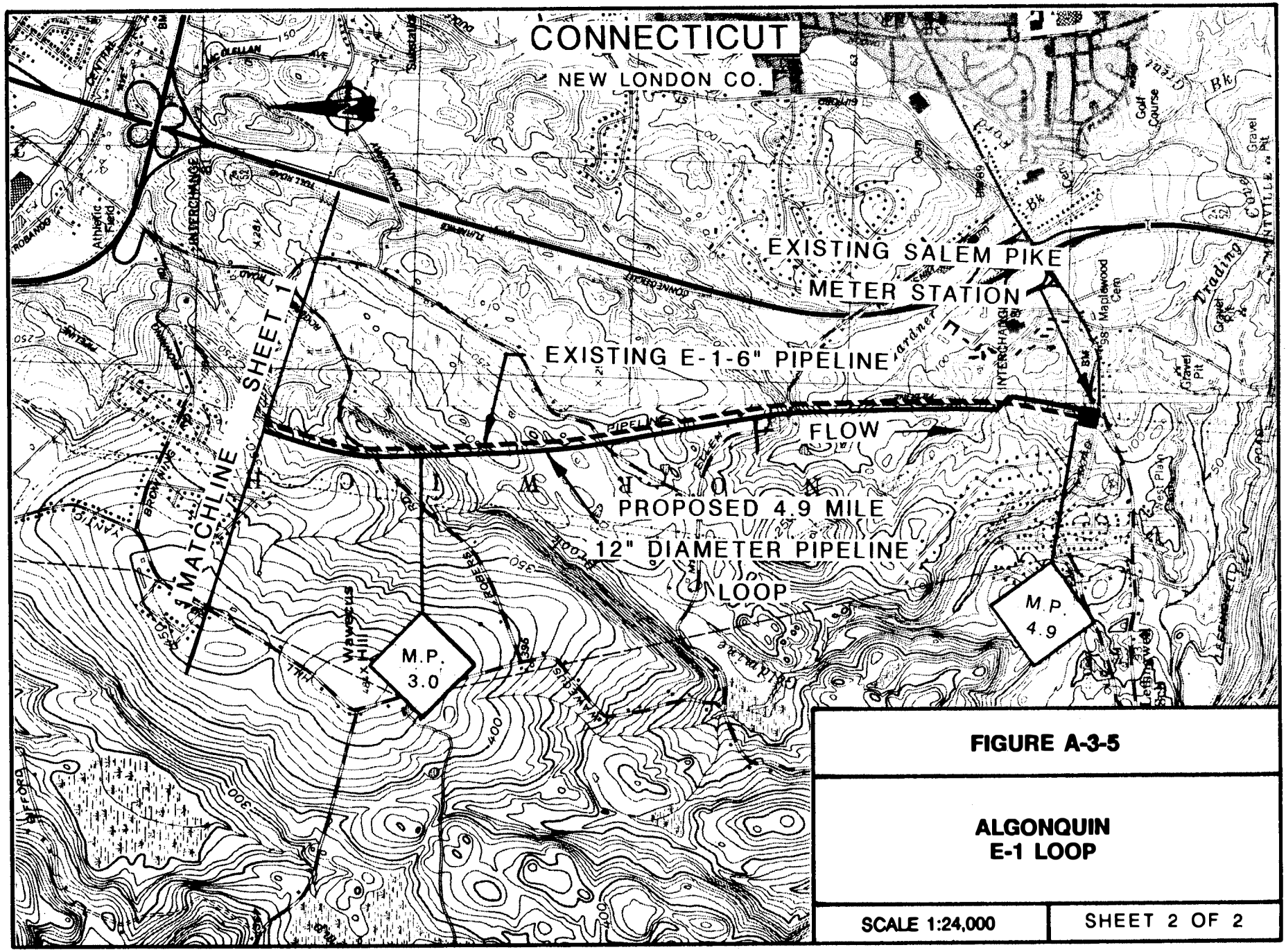


FIGURE A-3-5

ALGONQUIN
E-1 LOOP

SCALE 1:24,000	SHEET 2 OF 2

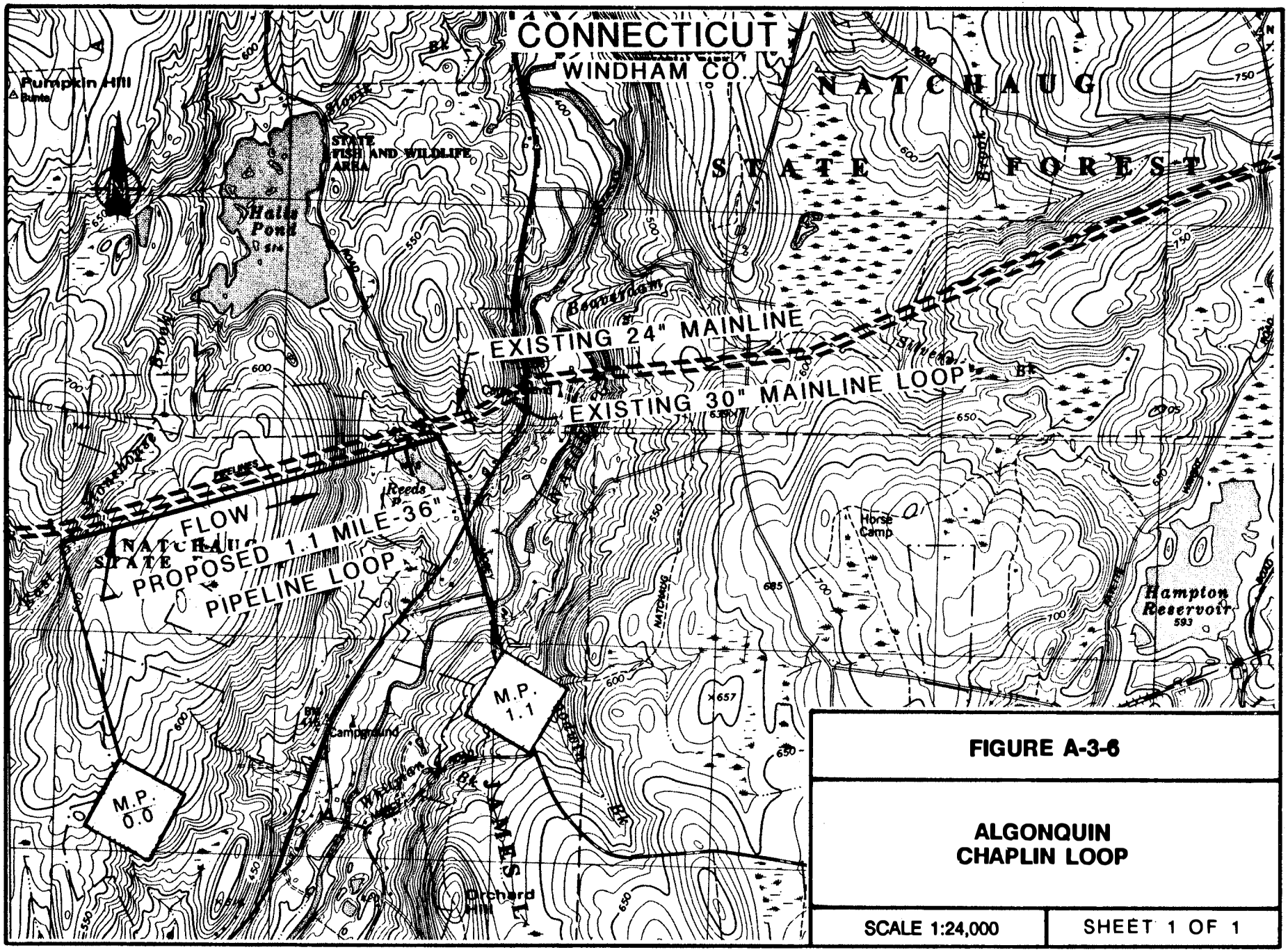


FIGURE A-3-6

ALGONQUIN
CHAPLIN LOOP

SCALE 1:24,000	SHEET 1 OF 1

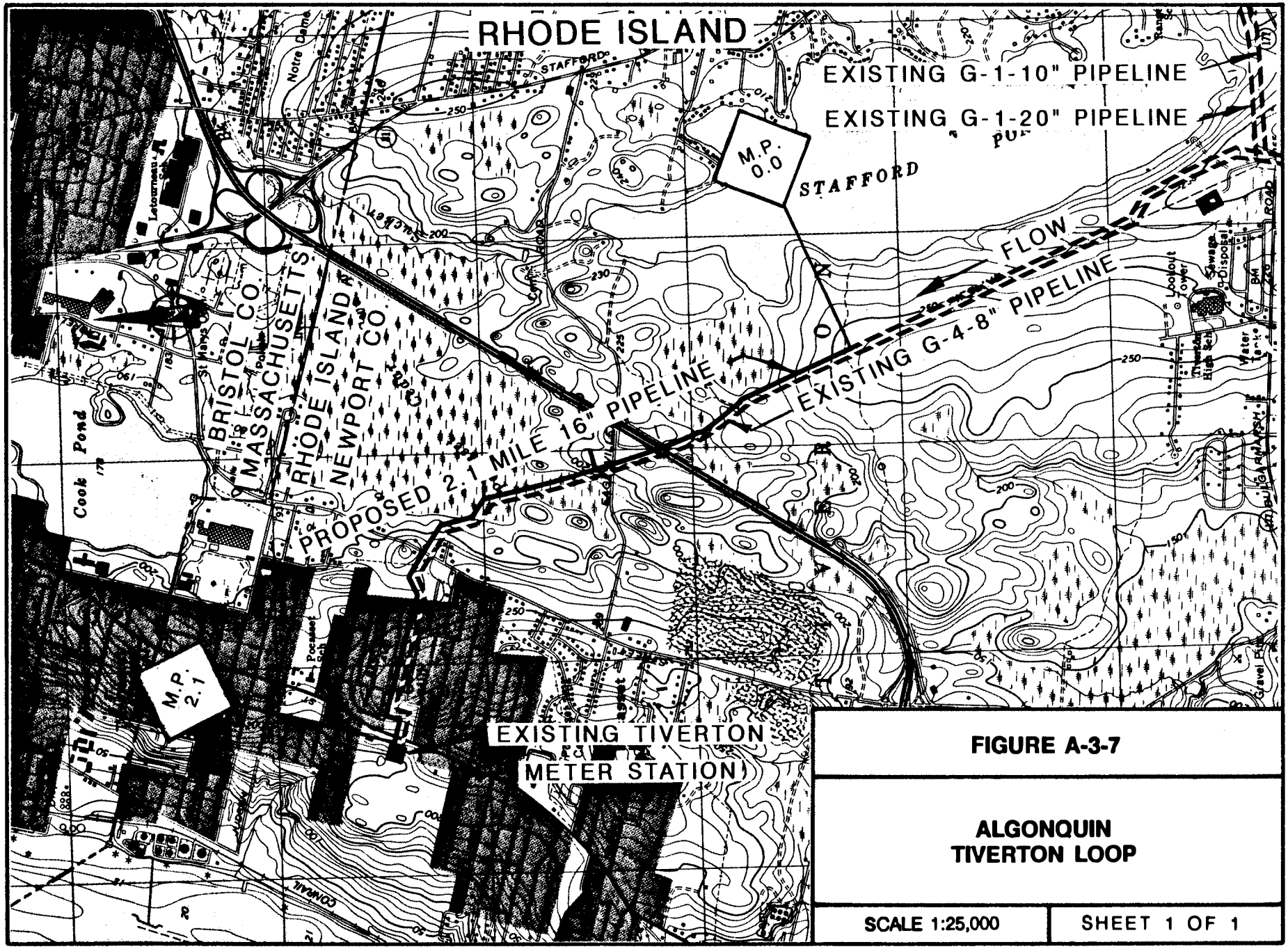


FIGURE A-3-7

ALGONQUIN
TIVERTON LOOP

SCALE 1:25,000	SHEET 1 OF 1

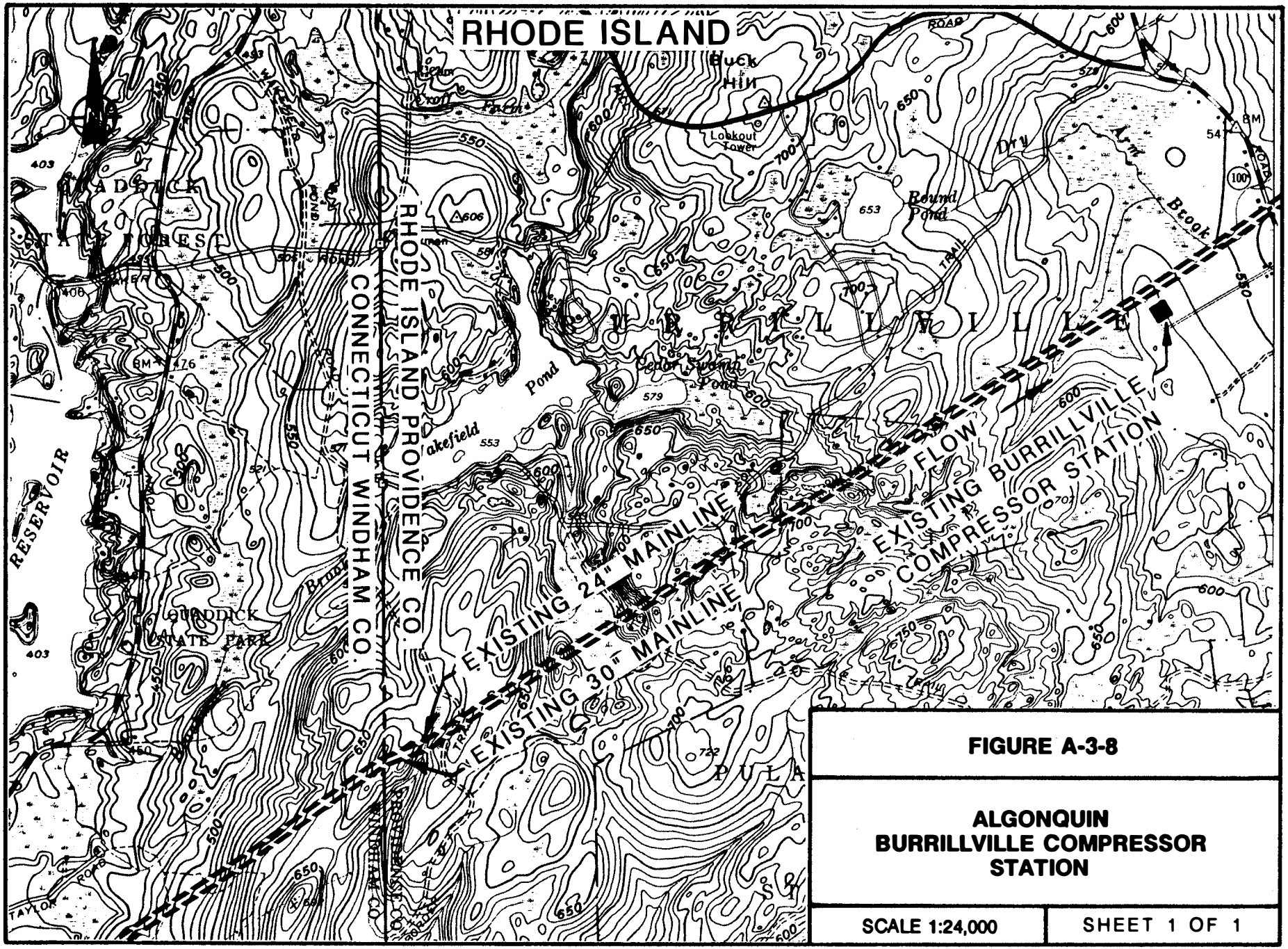


FIGURE A-3-8

ALGONQUIN
BURRILLVILLE COMPRESSOR STATION

SCALE 1:24,000	SHEET 1 OF 1

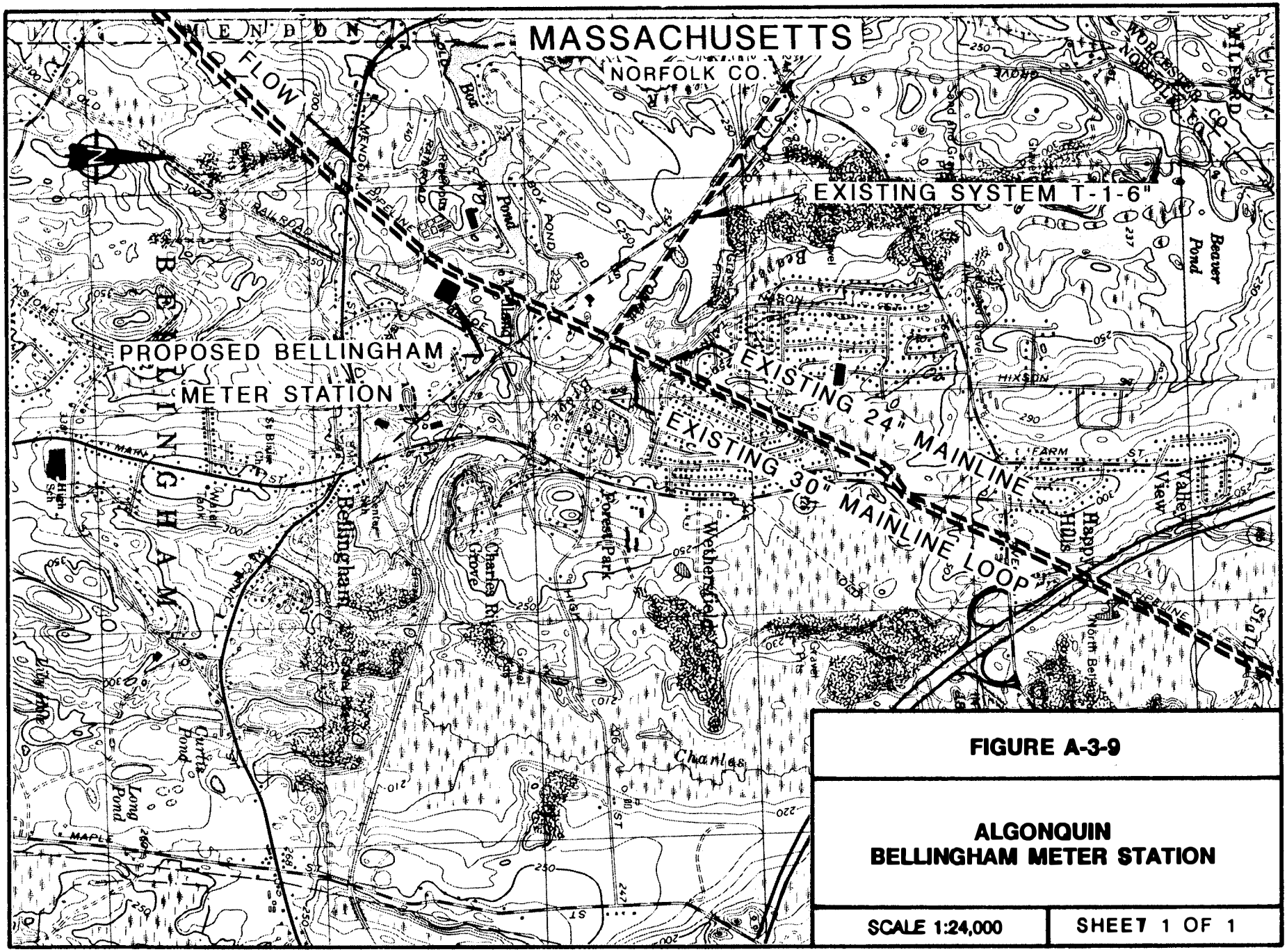


FIGURE A-3-9

ALGONQUIN
BELLINGHAM METER STATION

SCALE 1:24,000	SHEET 1 OF 1

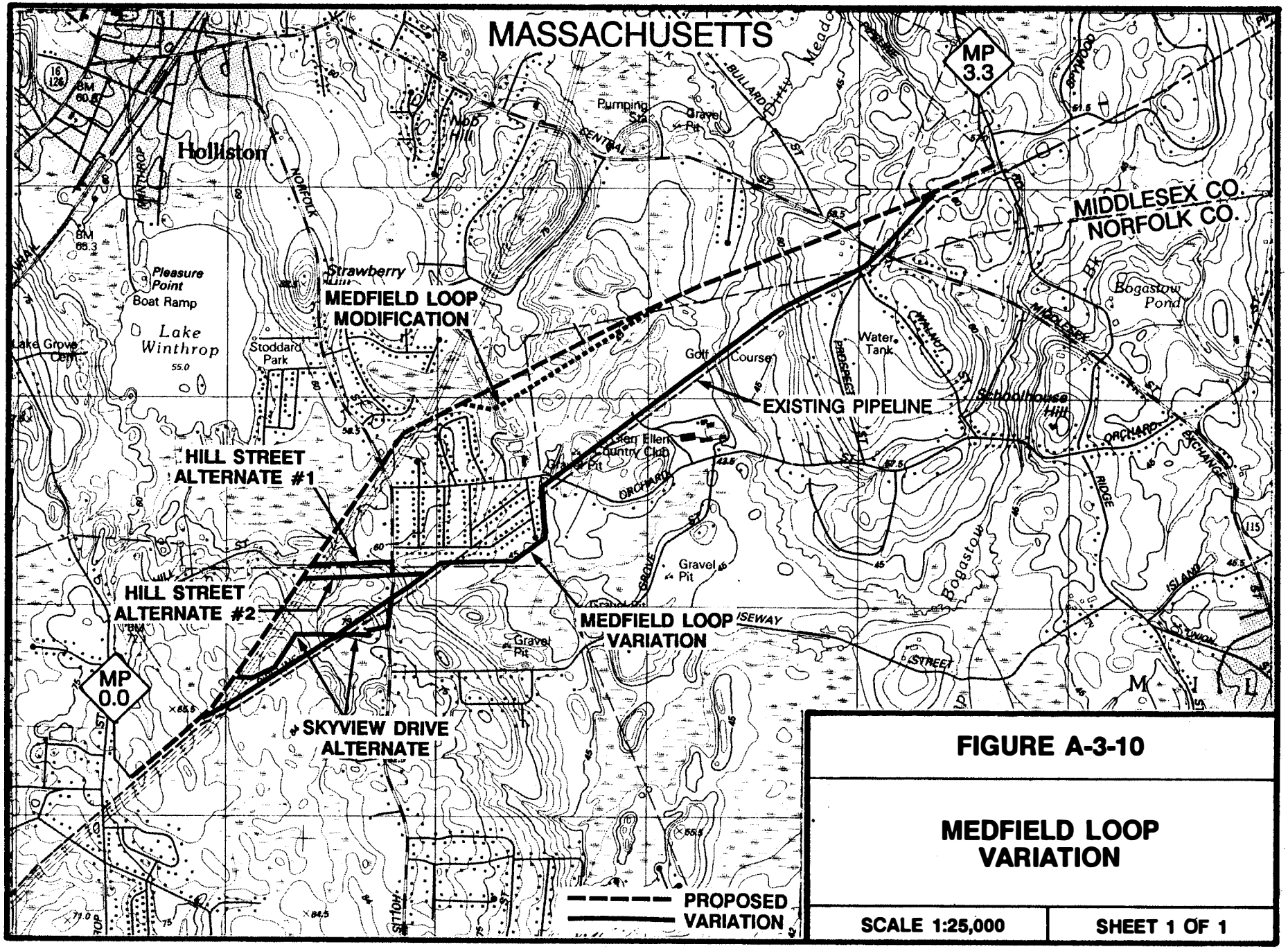
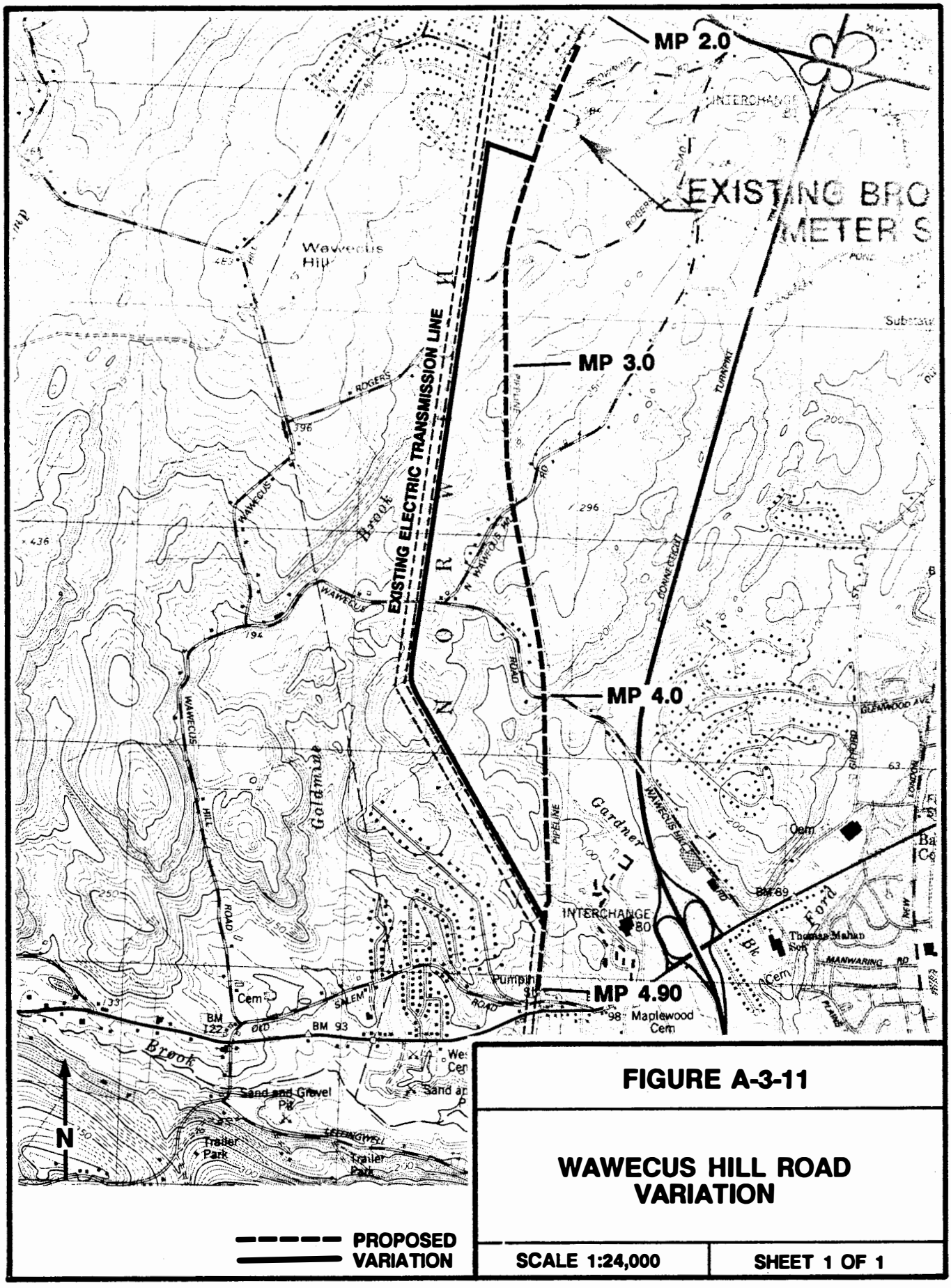


FIGURE A-3-10

MEDFIELD LOOP VARIATION

SCALE 1:25,000	SHEET 1 OF 1



PROPOSED
VARIATION

FIGURE A-3-11

WAWECUS HILL ROAD VARIATION

SCALE 1:24,000 | SHEET 1 OF 1

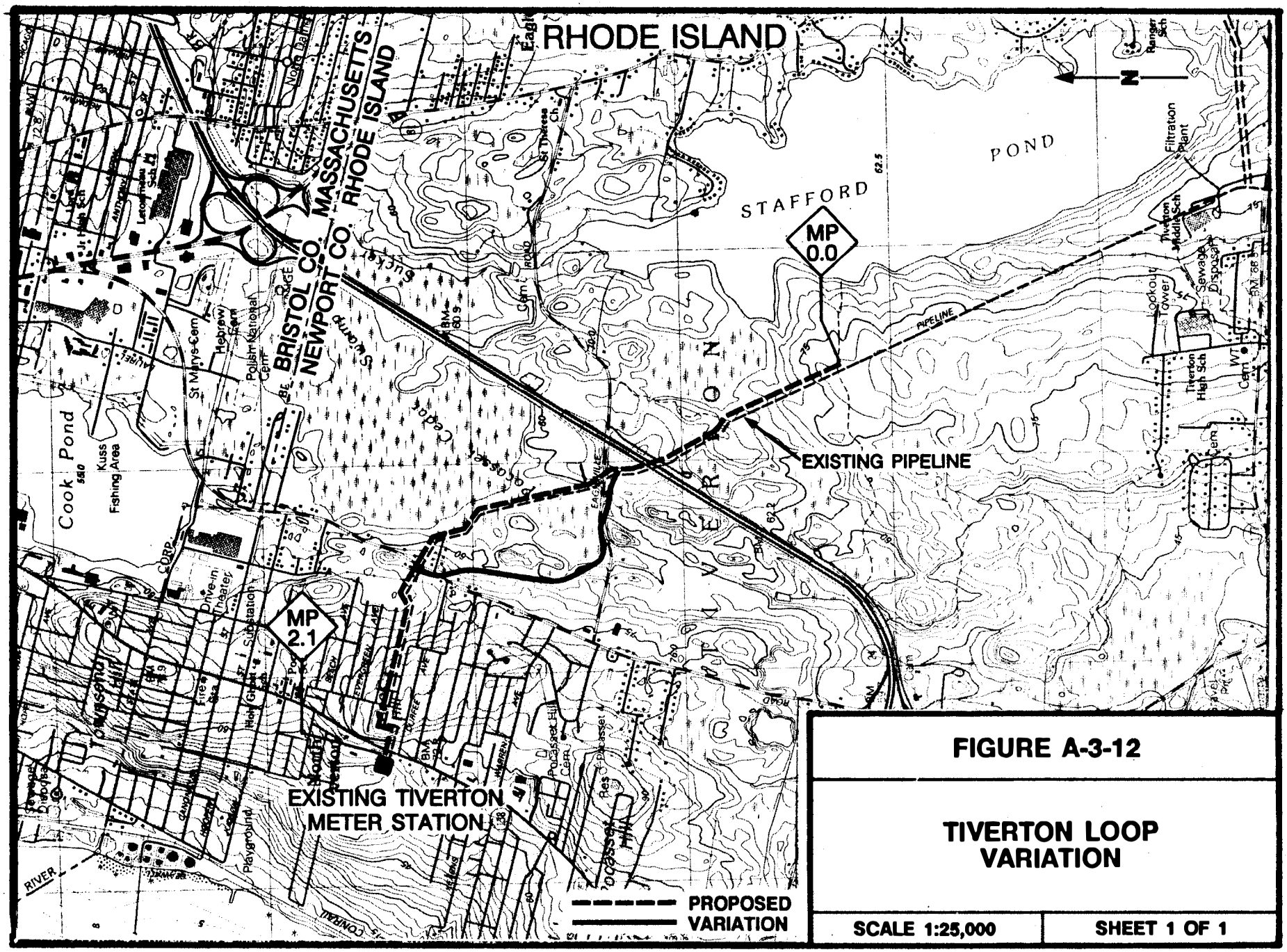


FIGURE A-3-12

TIVERTON LOOP VARIATION

SCALE 1:25,000	SHEET 1 OF 1

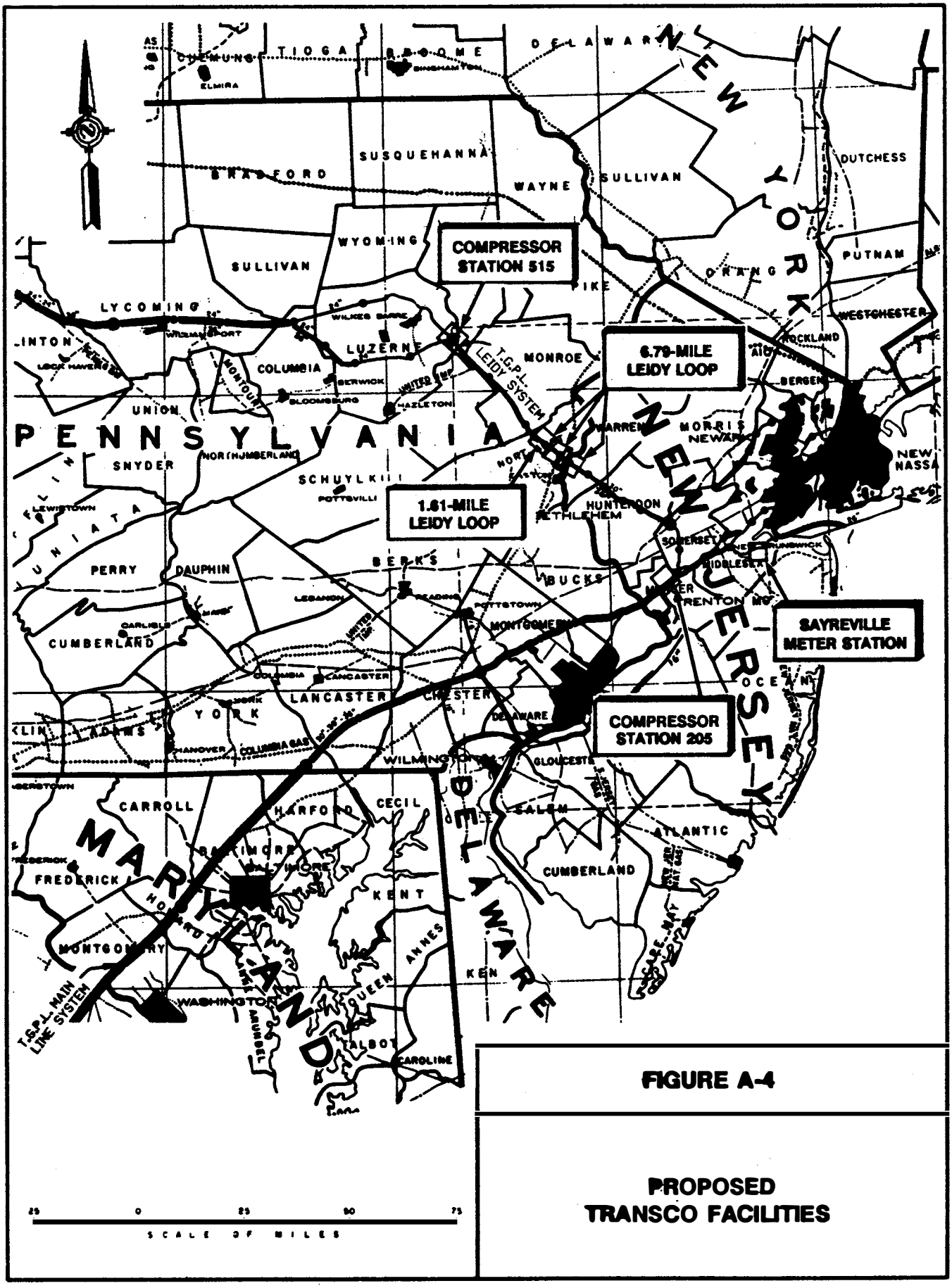


FIGURE A-4

PROPOSED TRANSCO FACILITIES

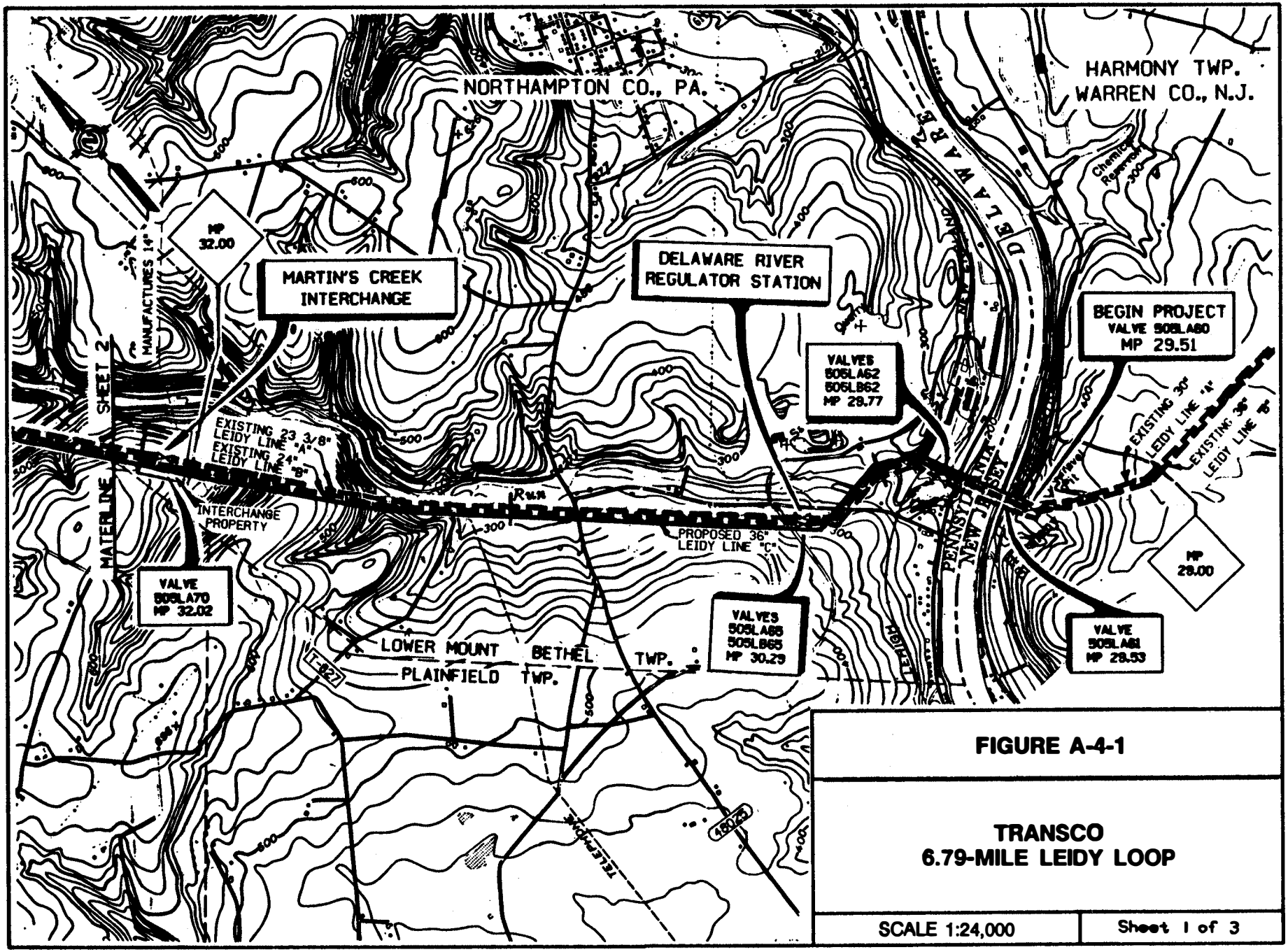


FIGURE A-4-1

TRANSCO
6.79-MILE LEIDY LOOP

SCALE 1:24,000 | Sheet 1 of 3

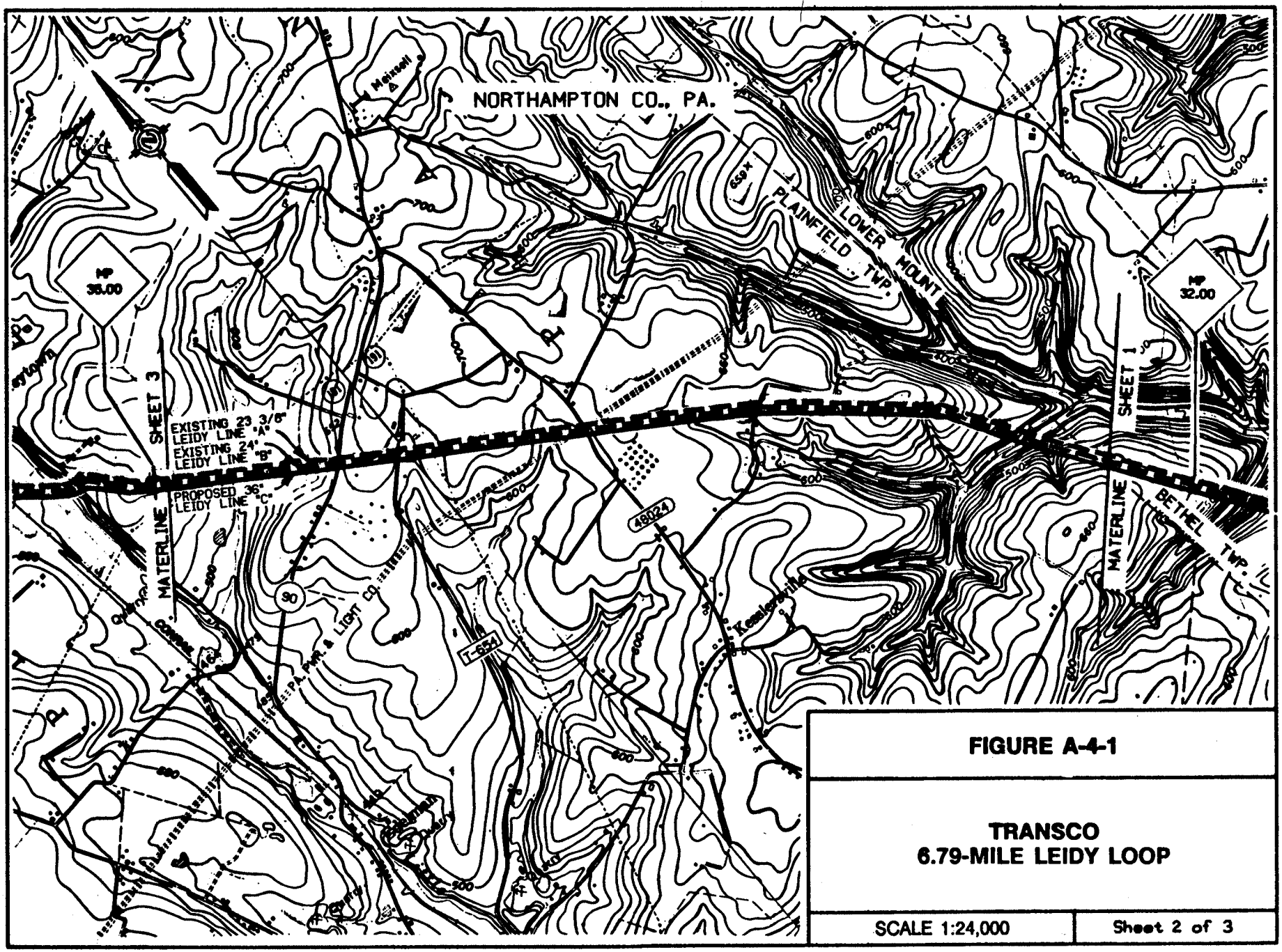


FIGURE A-4-1

TRANSCO
6.79-MILE LEIDY LOOP

SCALE 1:24,000 | Sheet 2 of 3

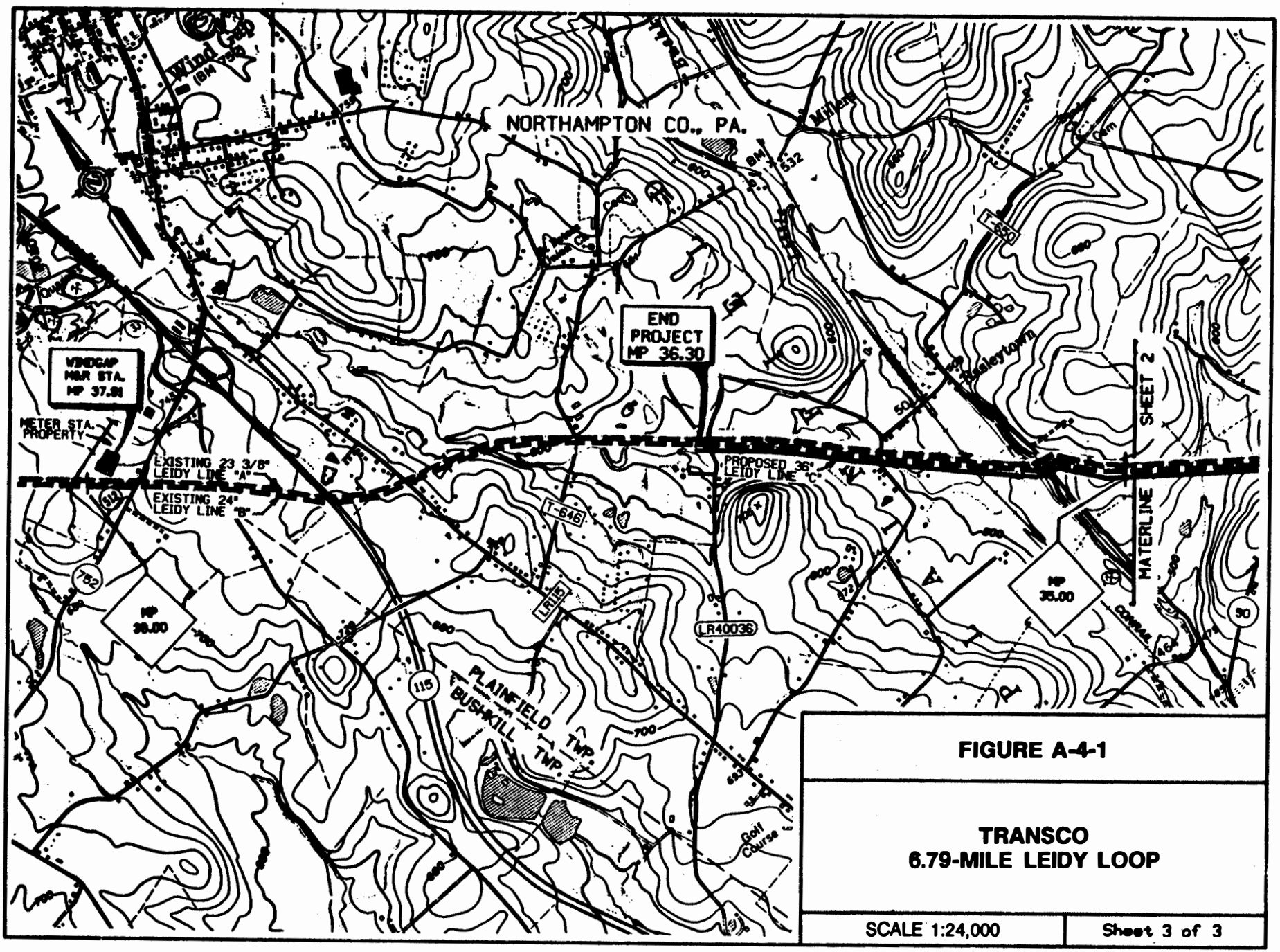


FIGURE A-4-1

TRANSCO
6.79-MILE LEIDY LOOP

SCALE 1:24,000 | Sheet 3 of 3

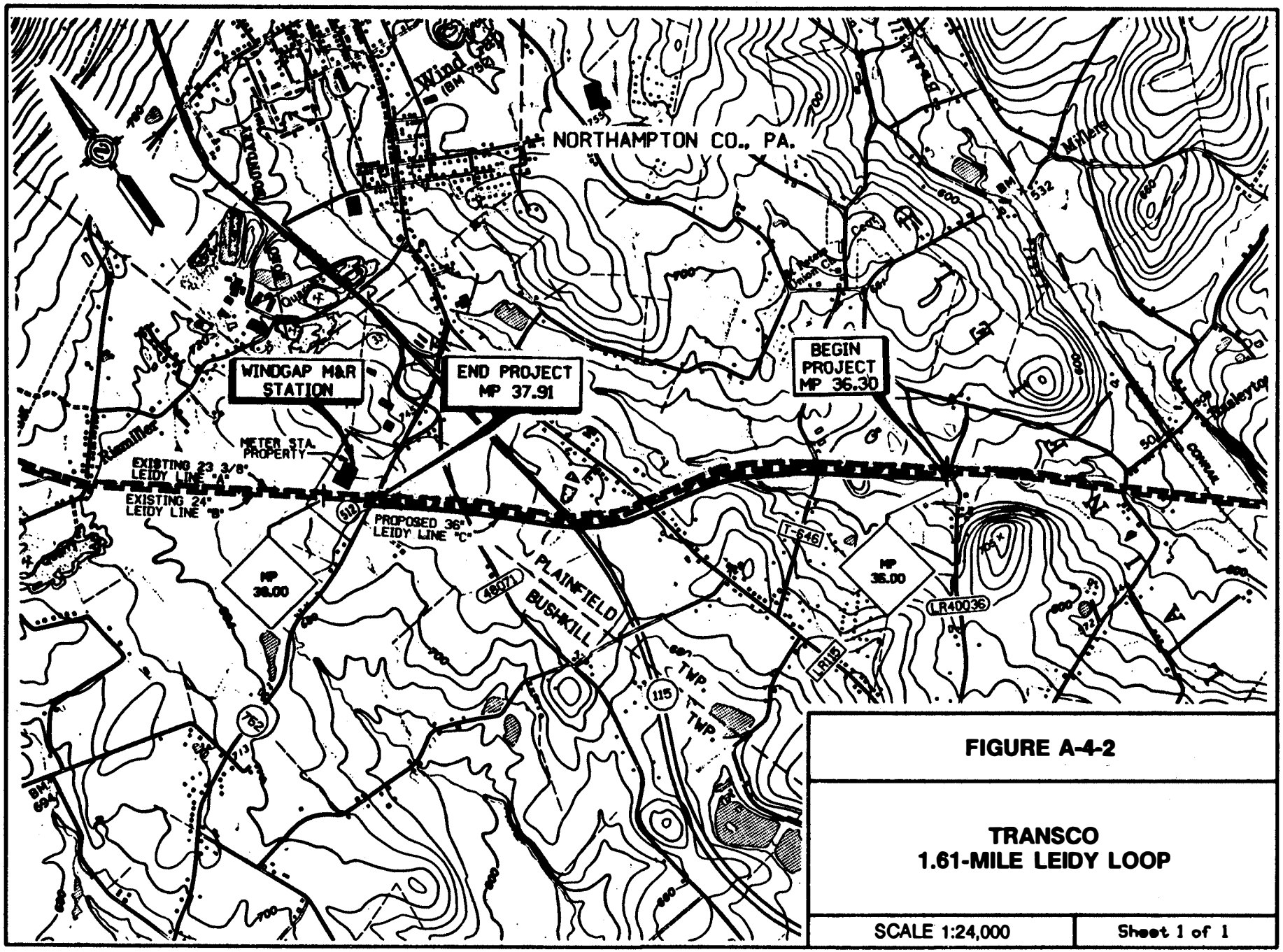


FIGURE A-4-2

TRANSCO
1.61-MILE LEIDY LOOP

SCALE 1:24,000 | Sheet 1 of 1

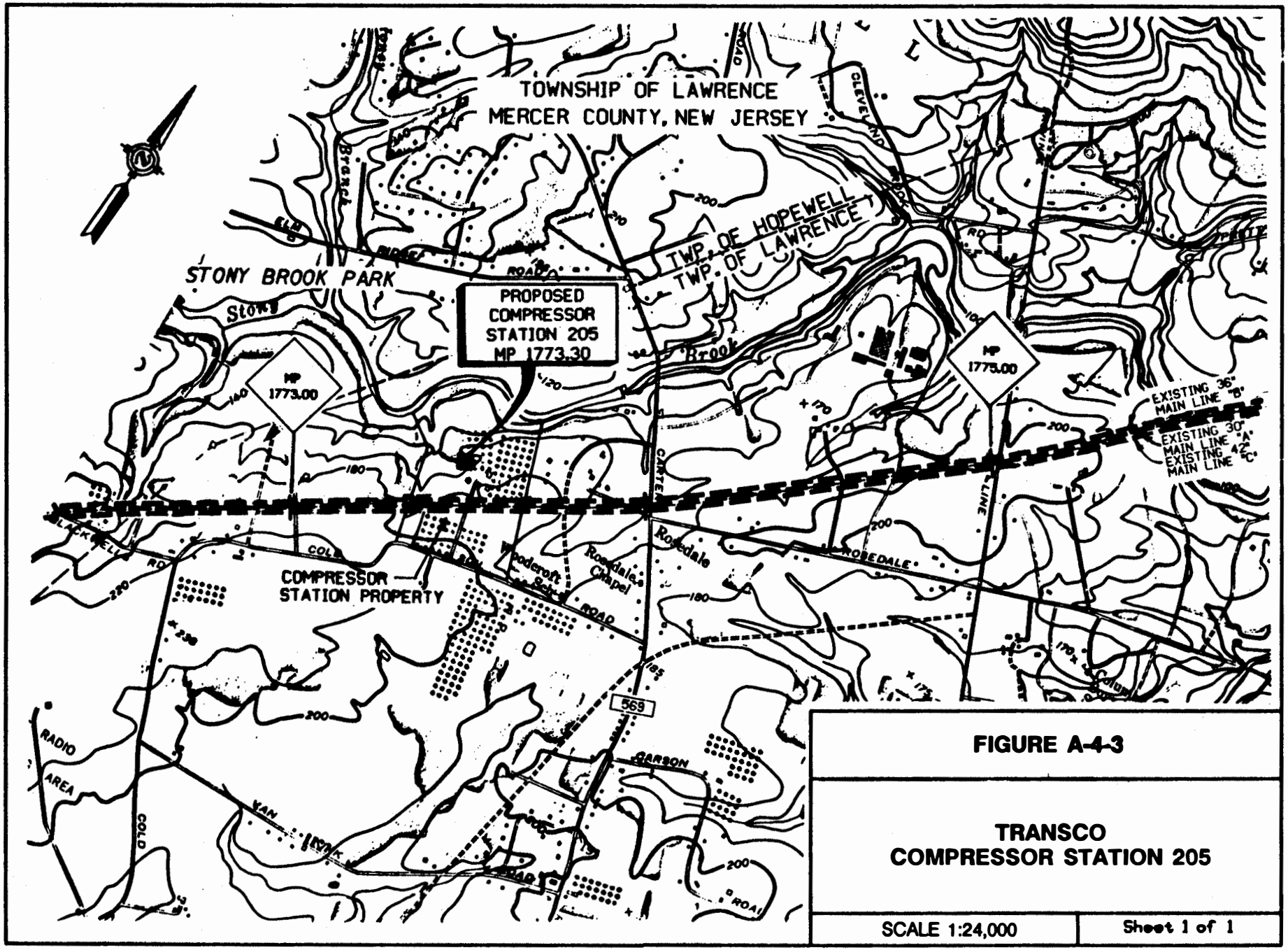


FIGURE A-4-3

TRANSCO
COMPRESSOR STATION 205

SCALE 1:24,000 | Sheet 1 of 1

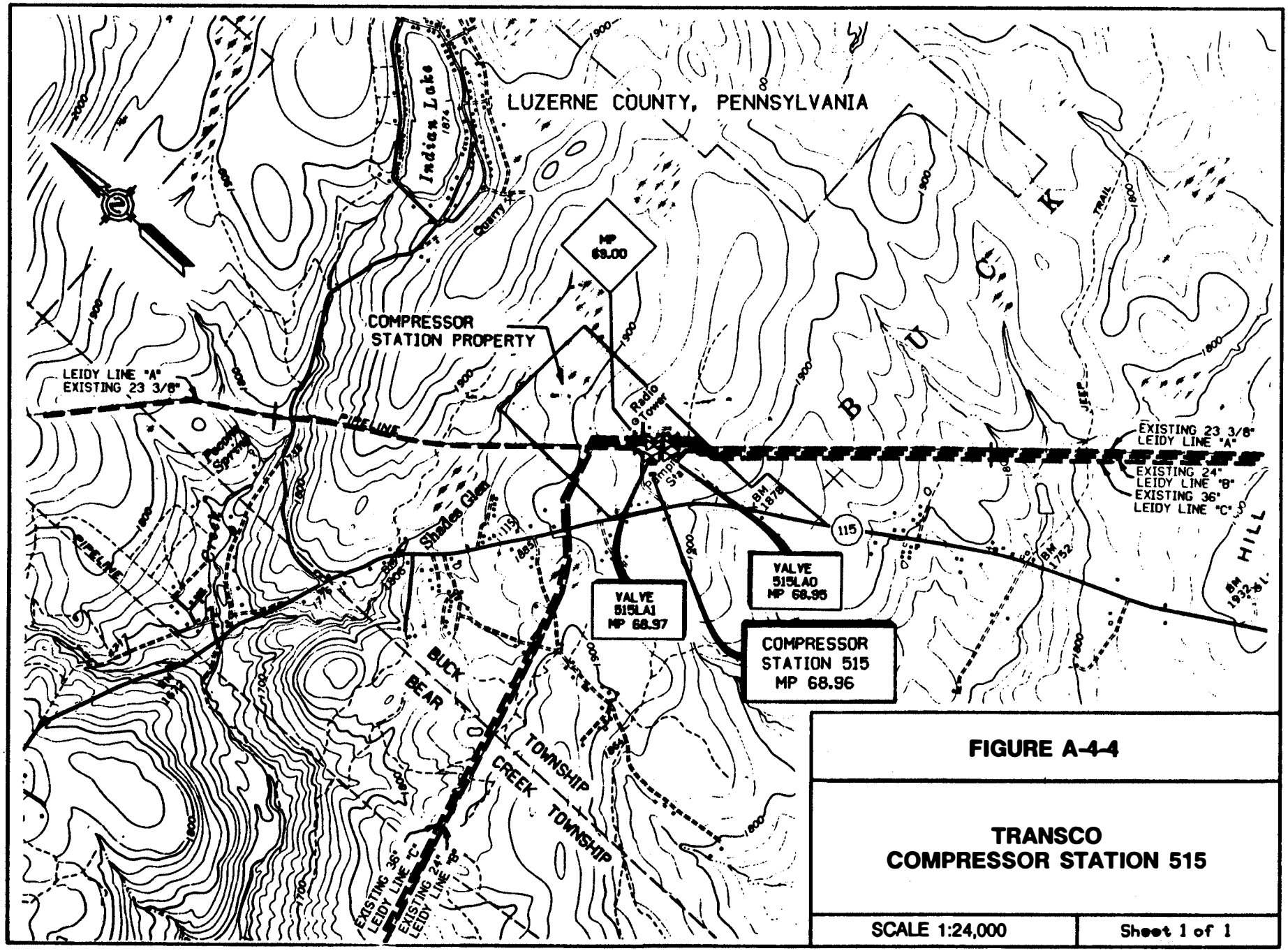


FIGURE A-4-4

TRANSCO
COMPRESSOR STATION 515

SCALE 1:24,000	Sheet 1 of 1

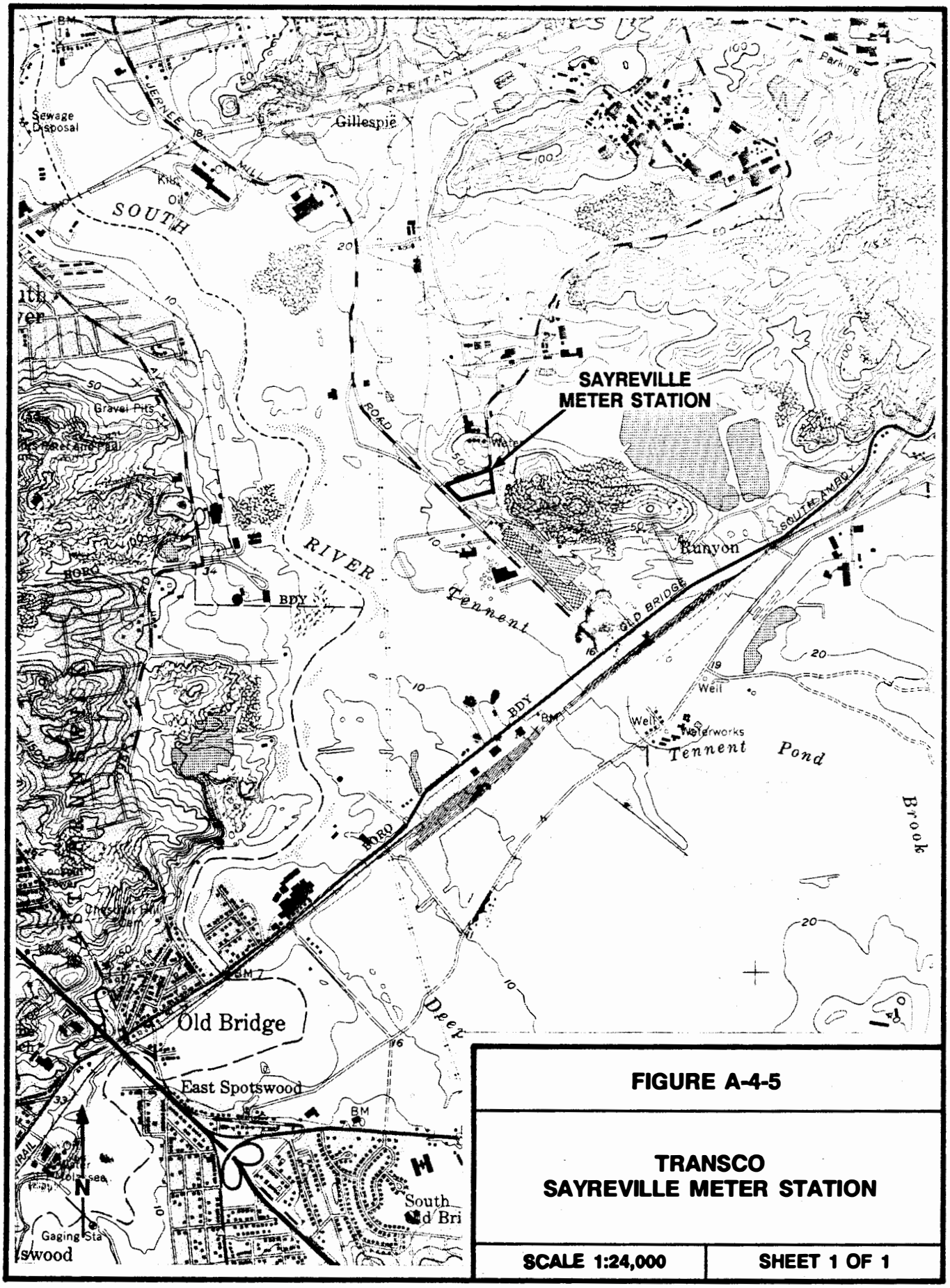


FIGURE A-4-5

TRANSCO
SAYREVILLE METER STATION

SCALE 1:24,000	SHEET 1 OF 1

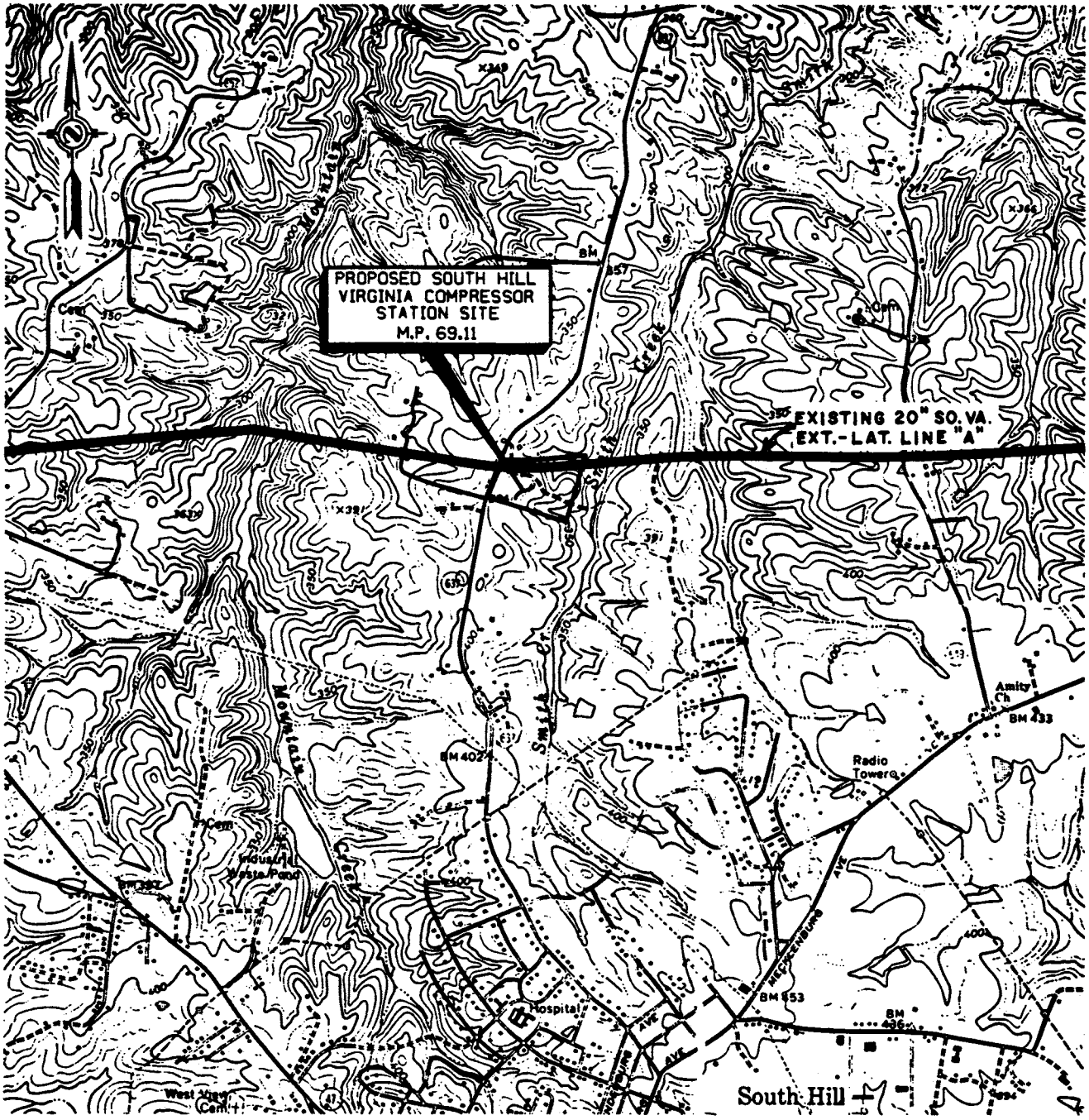


FIGURE A-4-6

TRANSCO
COMPRESSOR STATION 167

SHEET 1 OF 1

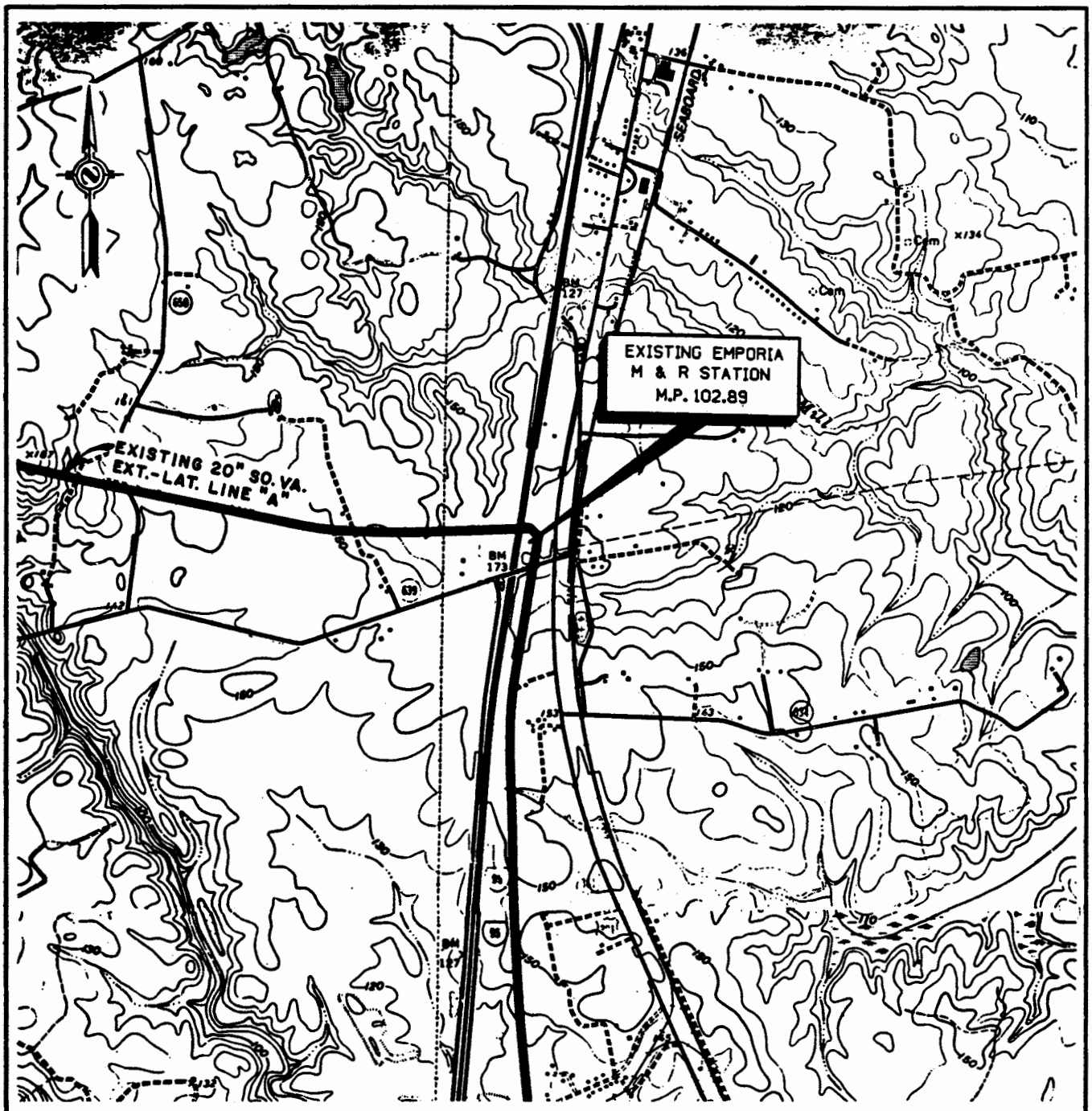


FIGURE A-4-7

TRANSCO
EMPORIA METER STATION

SHEET 1 OF 1

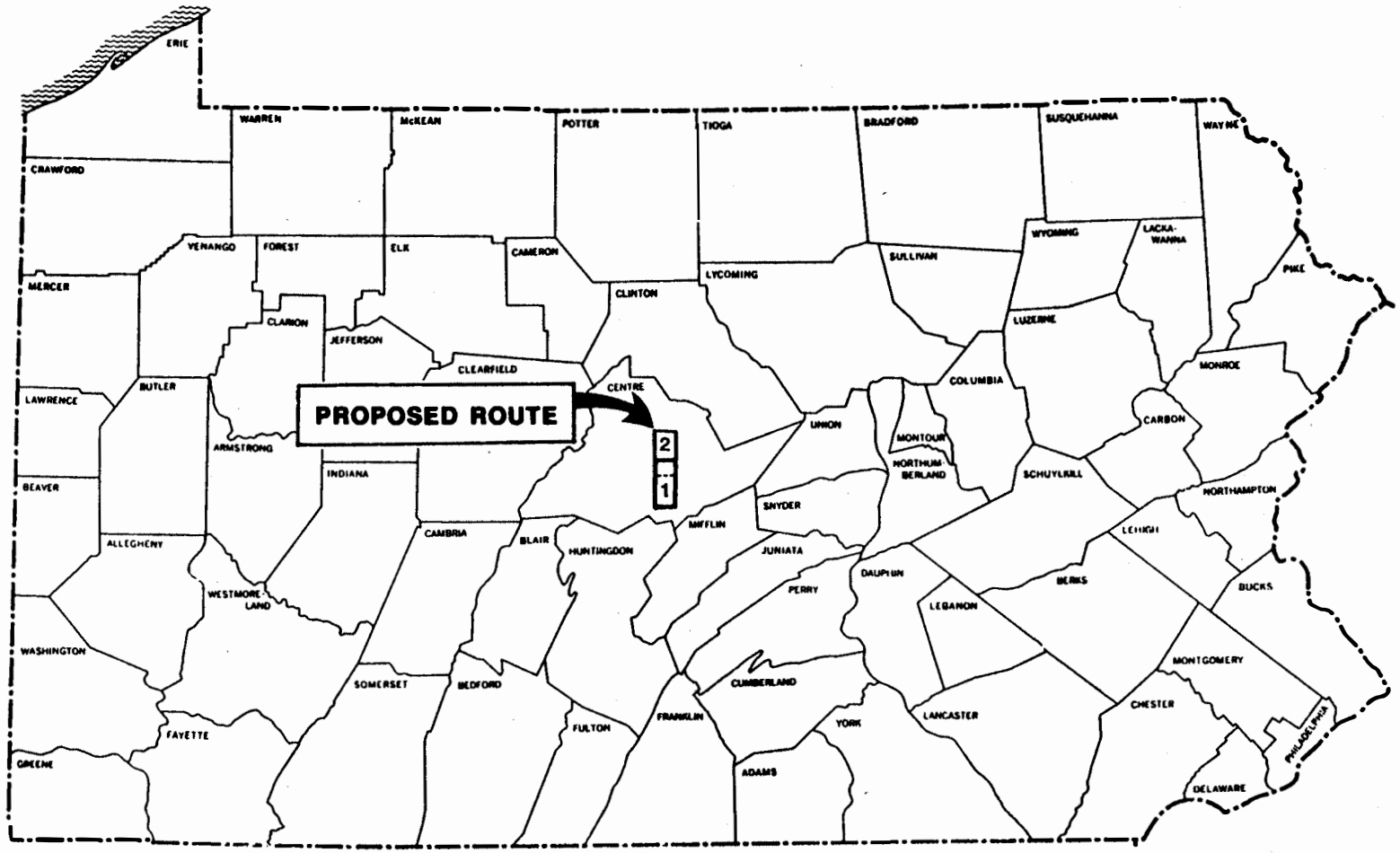


FIGURE A-5

PROPOSED
TEXAS EASTERN FACILITIES

Prepared By : Engineering/Drafting
Pipeline/Mapping Section

SCALE OF MILES
0 10 20 30 40

SHEET 1 OF 1

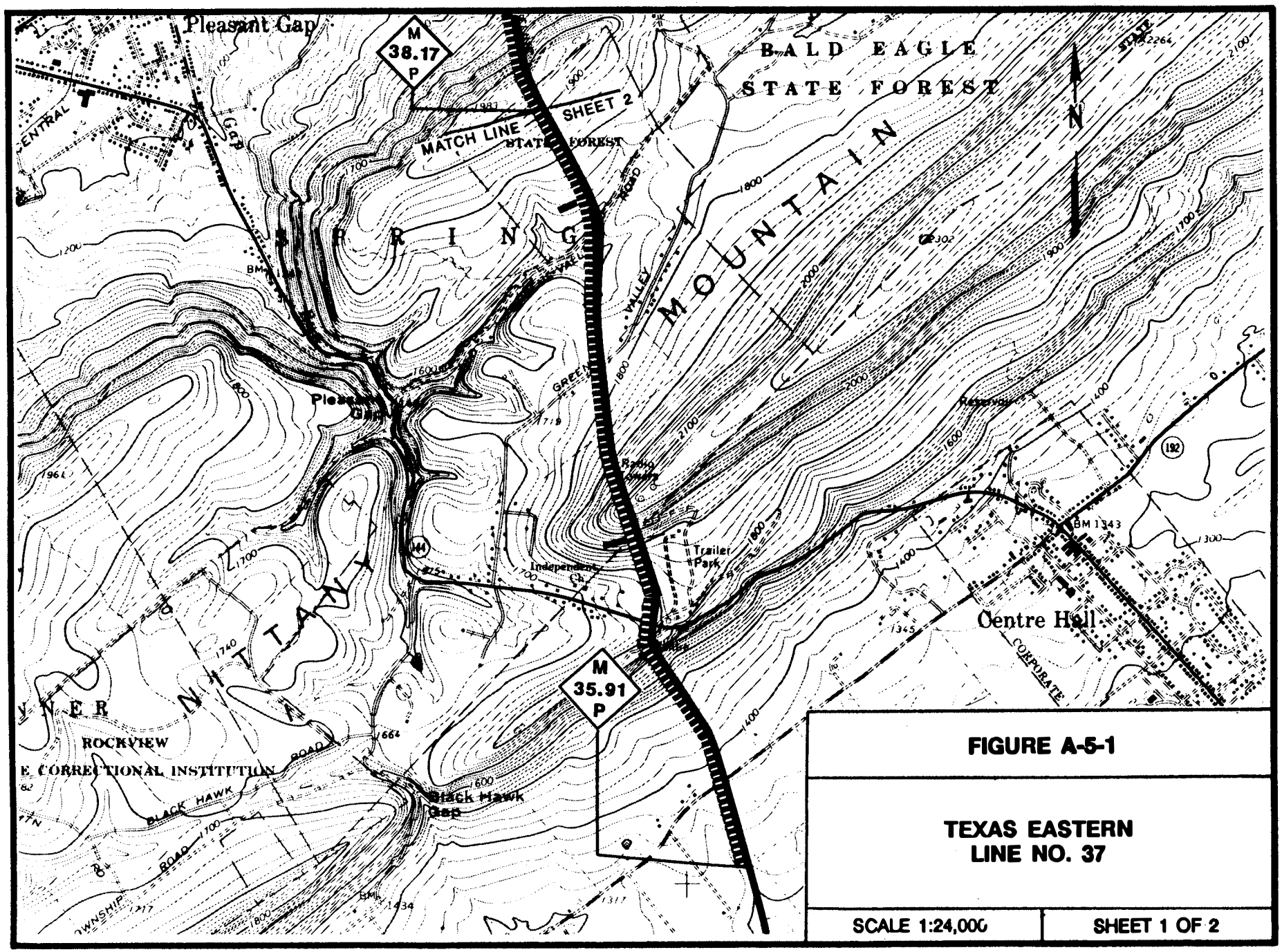


FIGURE A-5-1

TEXAS EASTERN
LINE NO. 37

SCALE 1:24,000	SHEET 1 OF 2

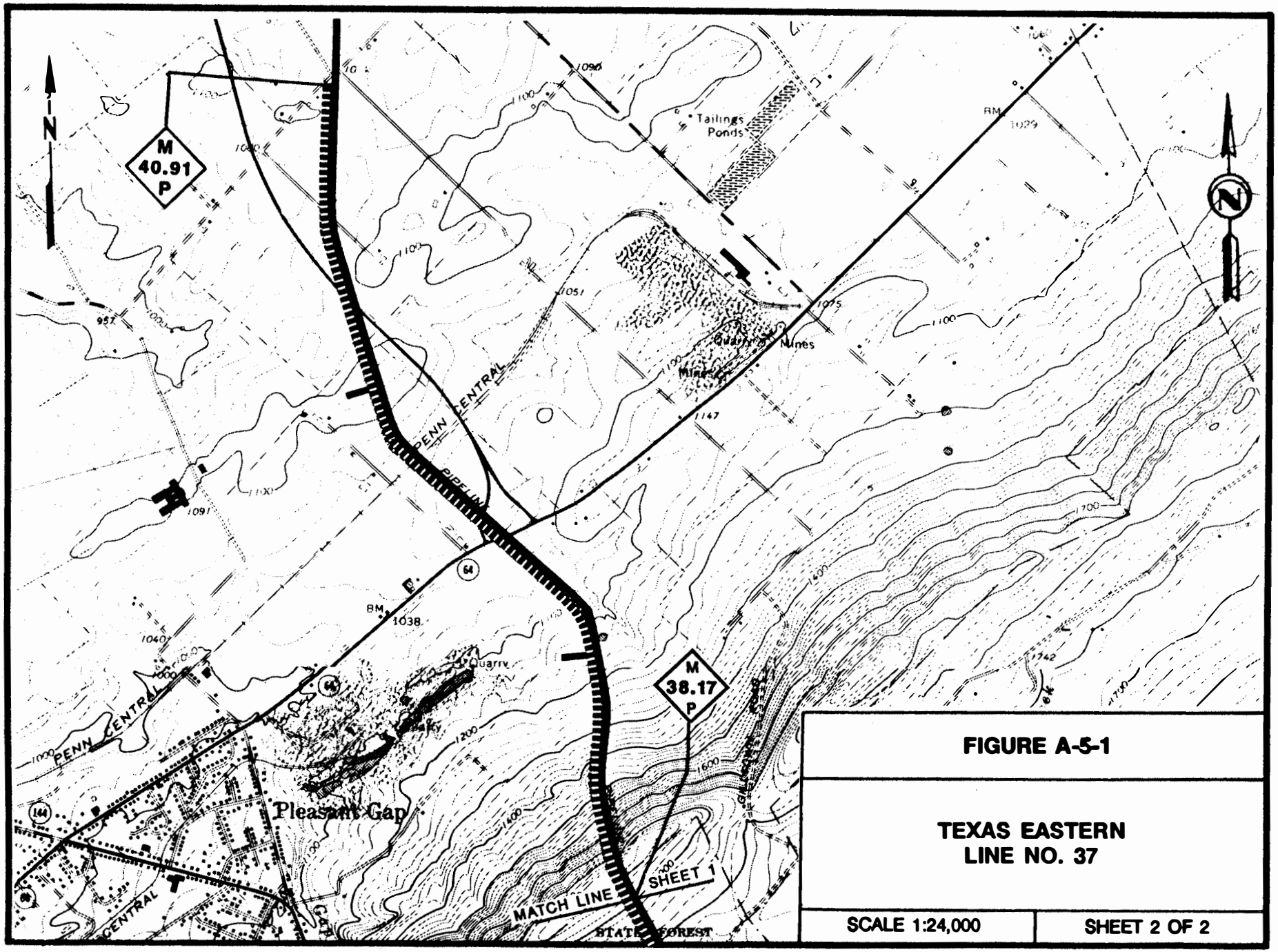


FIGURE A-5-1

TEXAS EASTERN
LINE NO. 37

SCALE 1:24,000	SHEET 2 OF 2

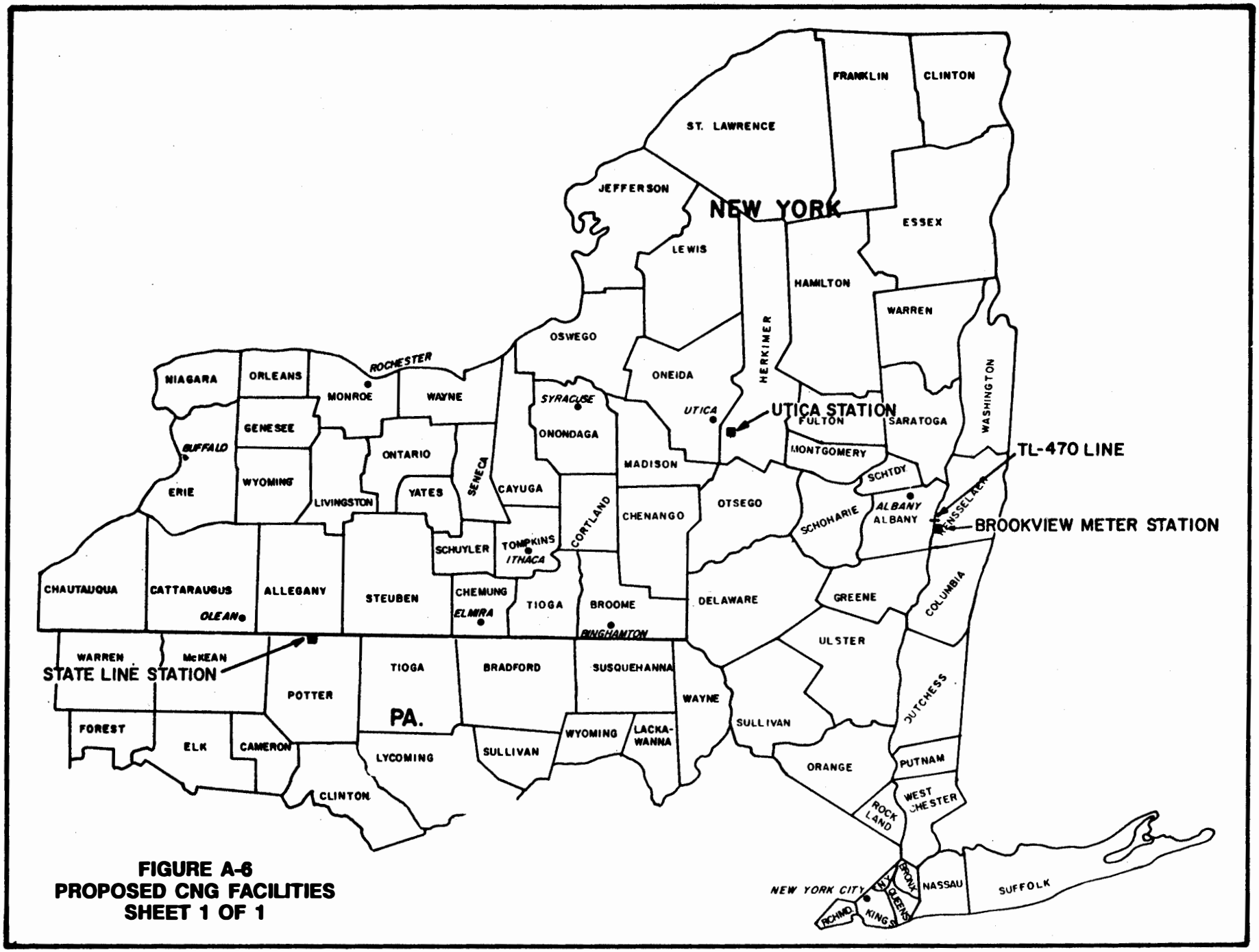
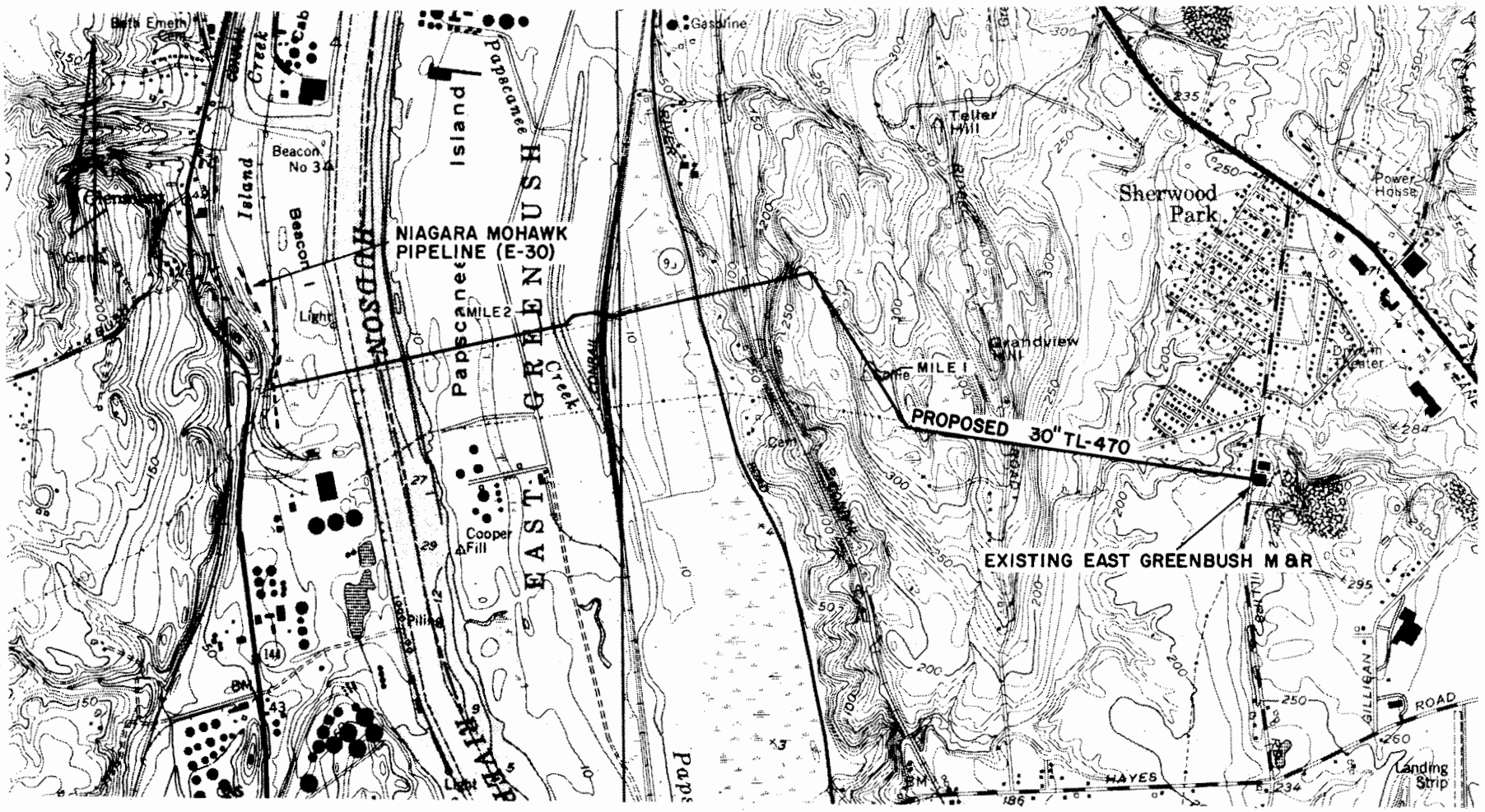


FIGURE A-6
PROPOSED CNG FACILITIES
SHEET 1 OF 1



LOCATION:
RENSSELAER CO. N.Y.
EAST GREENBUSH TOWN

ALBANY CO. N.Y.
BETHLEHEM TOWN

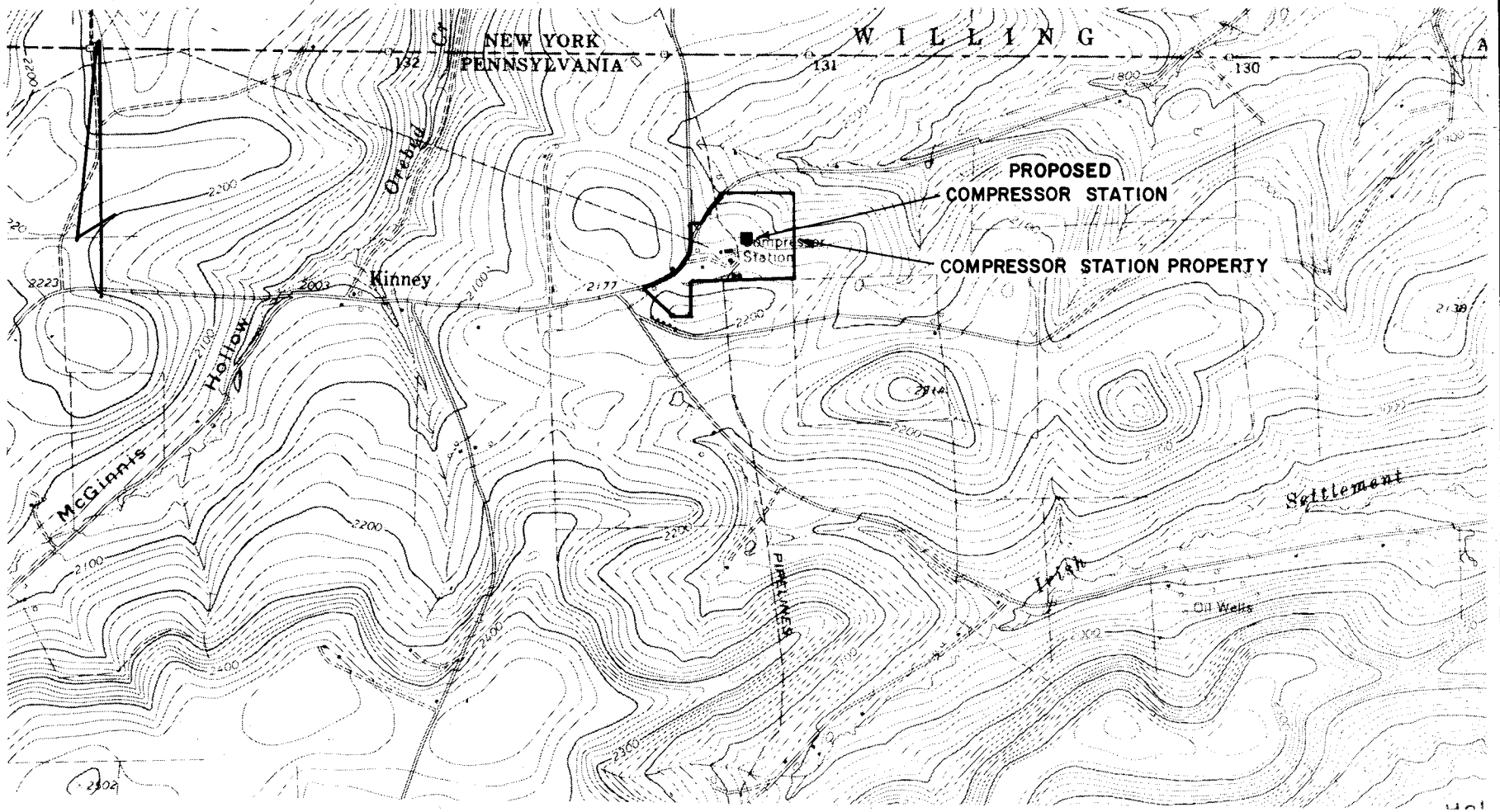
7.5 MINUTE TOPO MAP

DELMAR (N.Y.)
EAST GREENBUSH (N.Y.)

FIGURE A-6-1

CNG
TL-470 LINE

SCALE 1:24,000	SHEET 1 OF 1



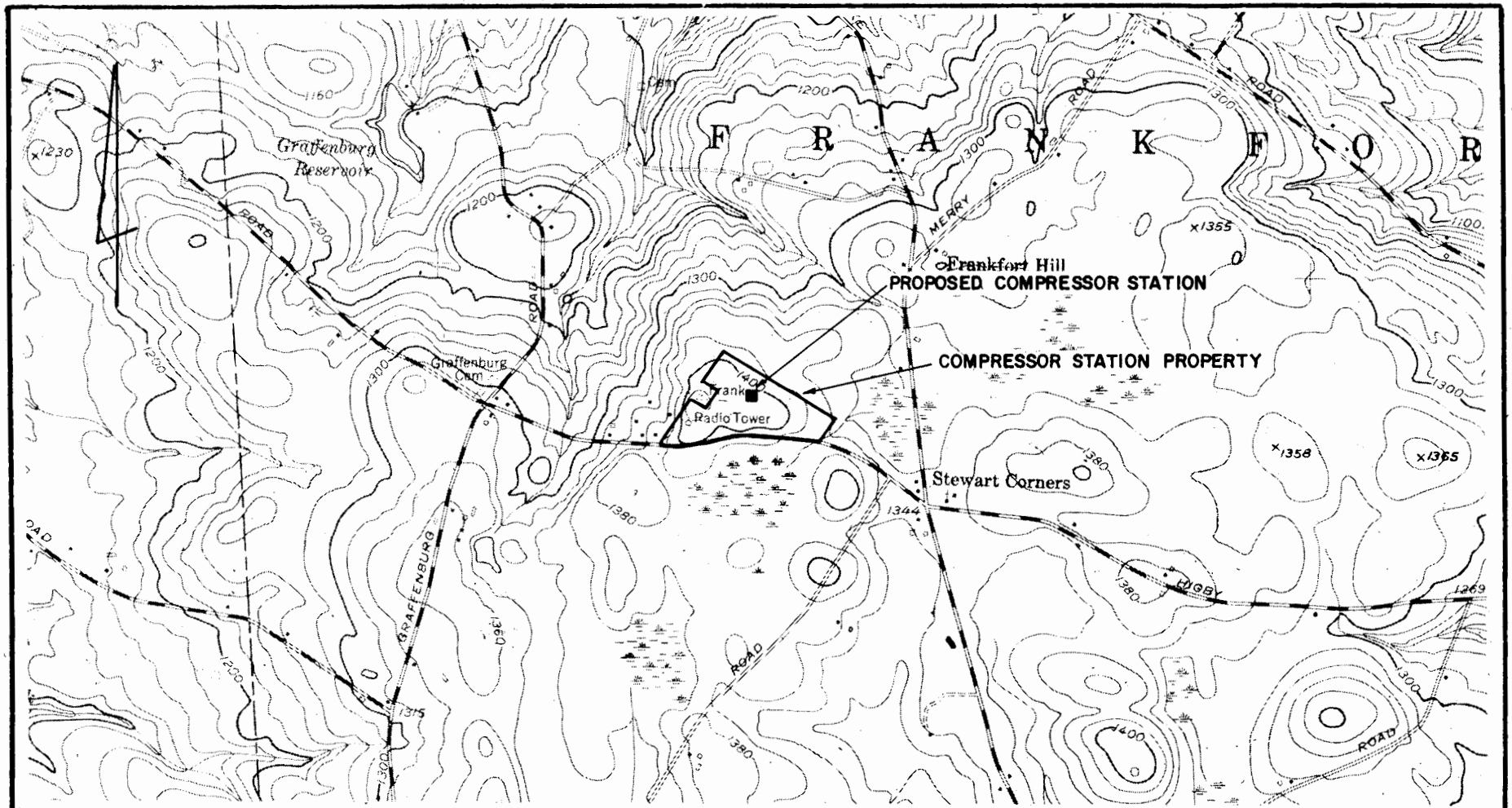
LOCATION:
POTTER CO. PA.
GENESEE TWP.

7.5 MINUTE TOPO MAP
ELLISBURG (PA.)

FIGURE A-6-2

CNG
STATE LINE COMPRESSOR STATION

SCALE 1:24,000	SHEET 1 OF 1



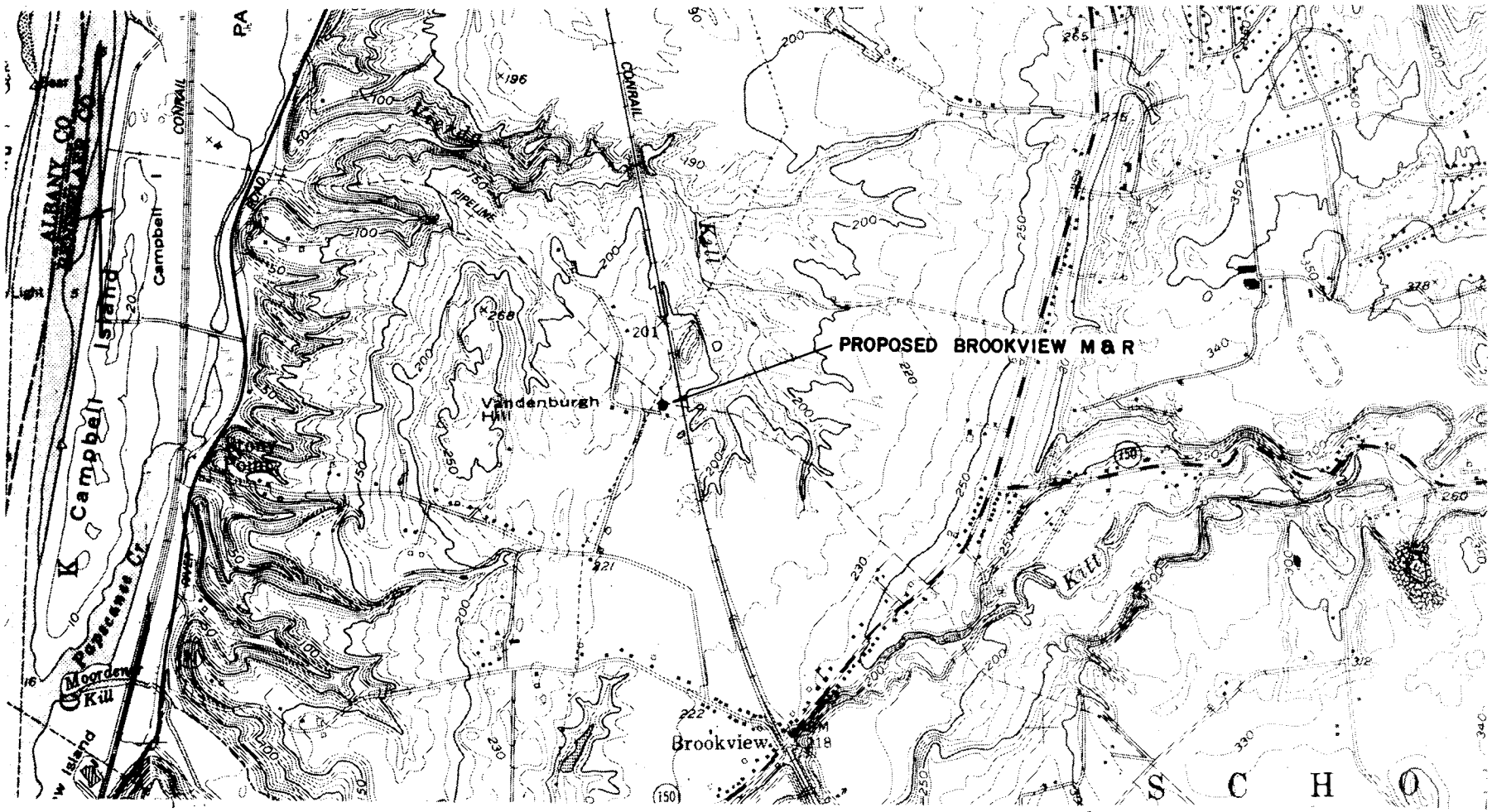
LOCATION:
HERKIMER CO. N.Y.
FRANKFORT TOWN

7.5 MINUTE TOPO MAP
UTICA EAST (N.Y)

FIGURE A-6-3

CNG
UTICA COMPRESSOR STATION

SCALE 1:24,000	SHEET 1 OF 1



LOCATION:
RENSSELAER CO. N.Y
SCHODACK TOWN

7.5 MINUTE TOPO MAP
EAST GREENBUSH (N.Y.)

FIGURE A-6-4

CNG
BROOKVIEW METER STATION

SCALE 1:24,000	SHEET 1 OF 1

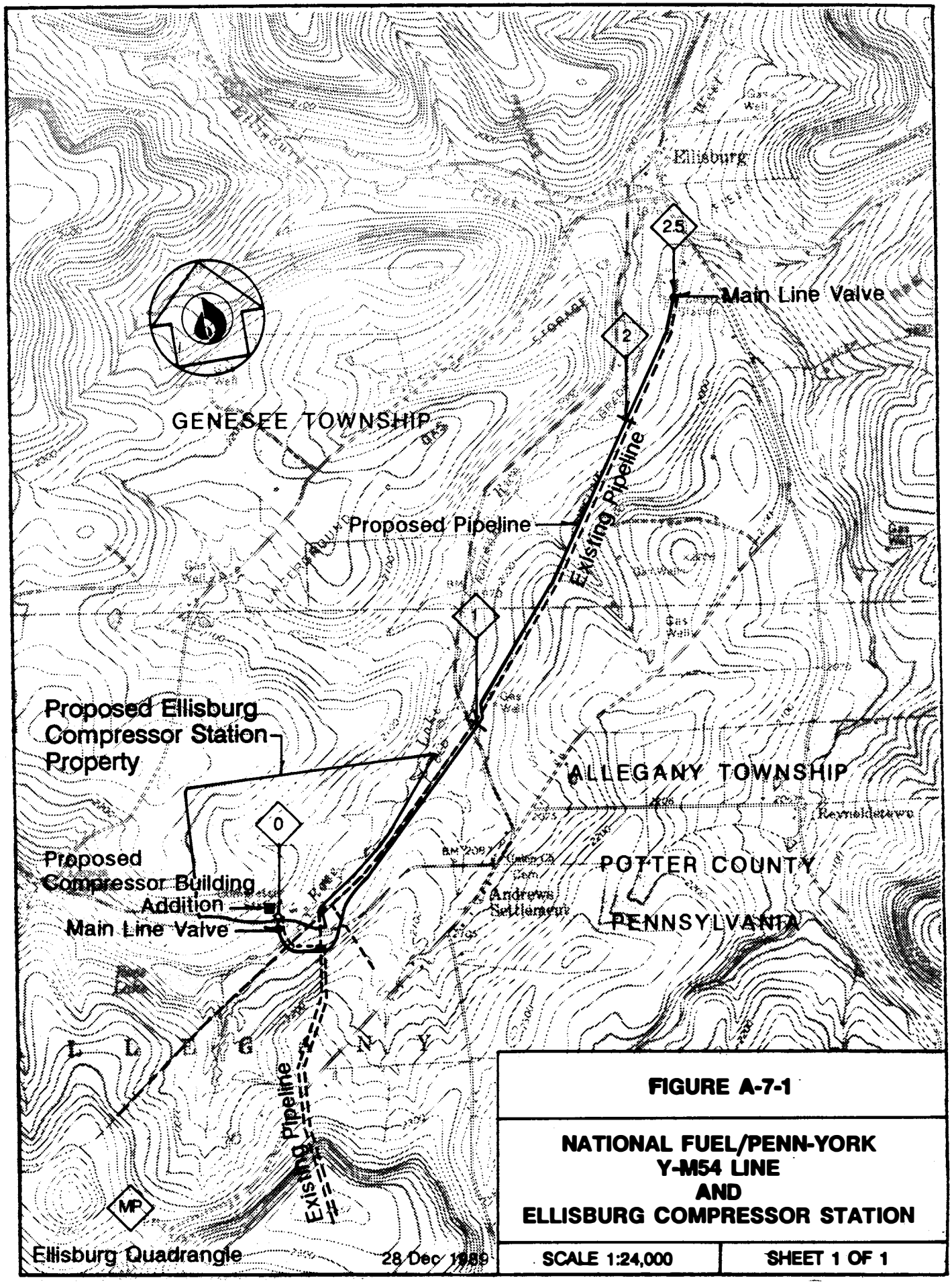


FIGURE A-7-1

NATIONAL FUEL/PENN-YORK
Y-M54 LINE
AND
ELLISBURG COMPRESSOR STATION

SCALE 1:24,000	SHEET 1 OF 1

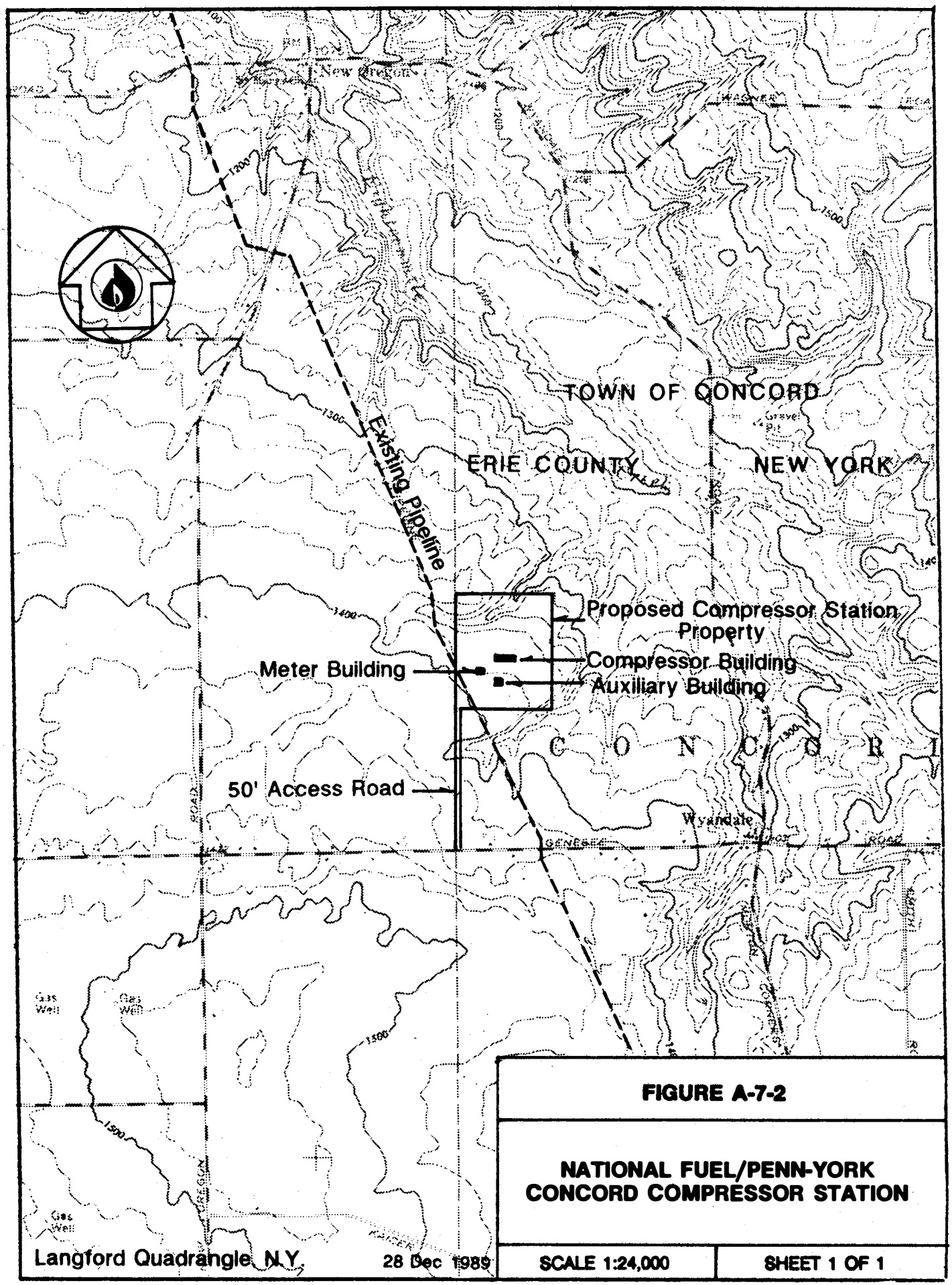


FIGURE A-7-2

NATIONAL FUEL/PENN-YORK CONCORD COMPRESSOR STATION

SCALE 1:24,000 | SHEET 1 OF 1

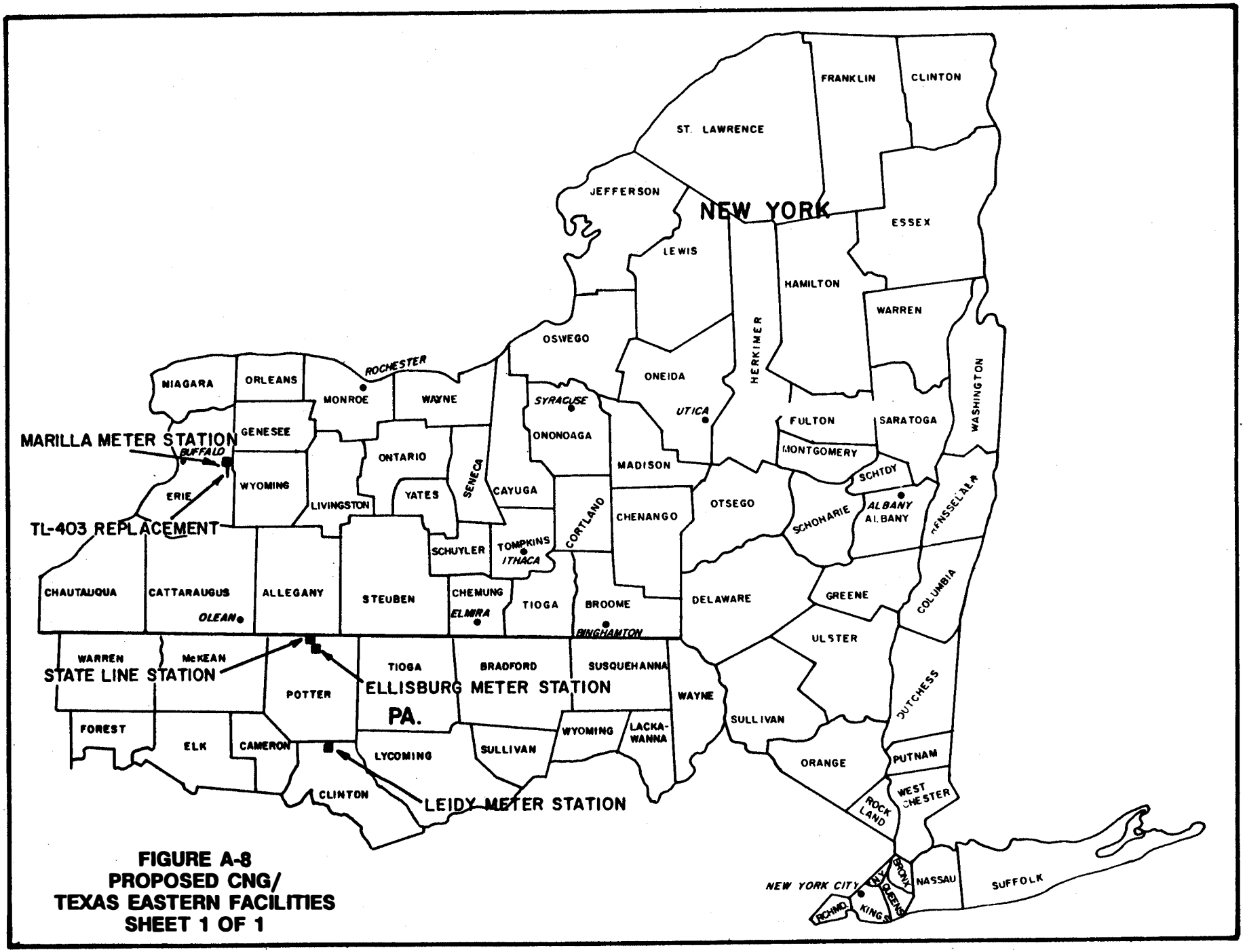
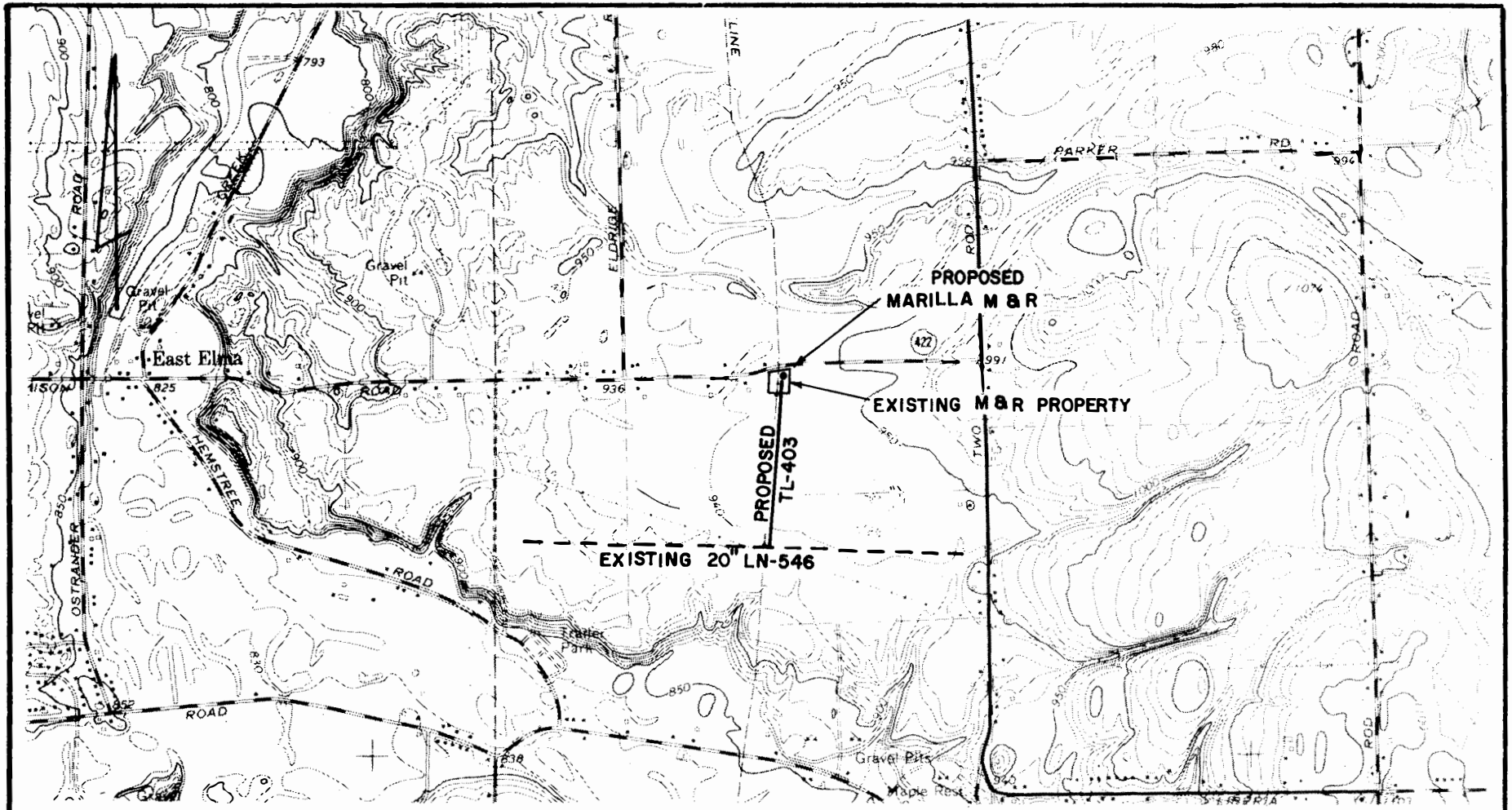


FIGURE A-8
PROPOSED CNG/
TEXAS EASTERN FACILITIES
SHEET 1 OF 1



LOCATION:
ERIE CO. N.Y.
MARILLA TOWN

7.5 MINUTE TOPO MAP
EAST AURORA (N.Y.)

FIGURE A-8-1

**CNG/TEXAS EASTERN
TL-403 REPLACEMENT
AND
MARILLA METER STATION**

SCALE 1:24,000	SHEET 1 OF 1

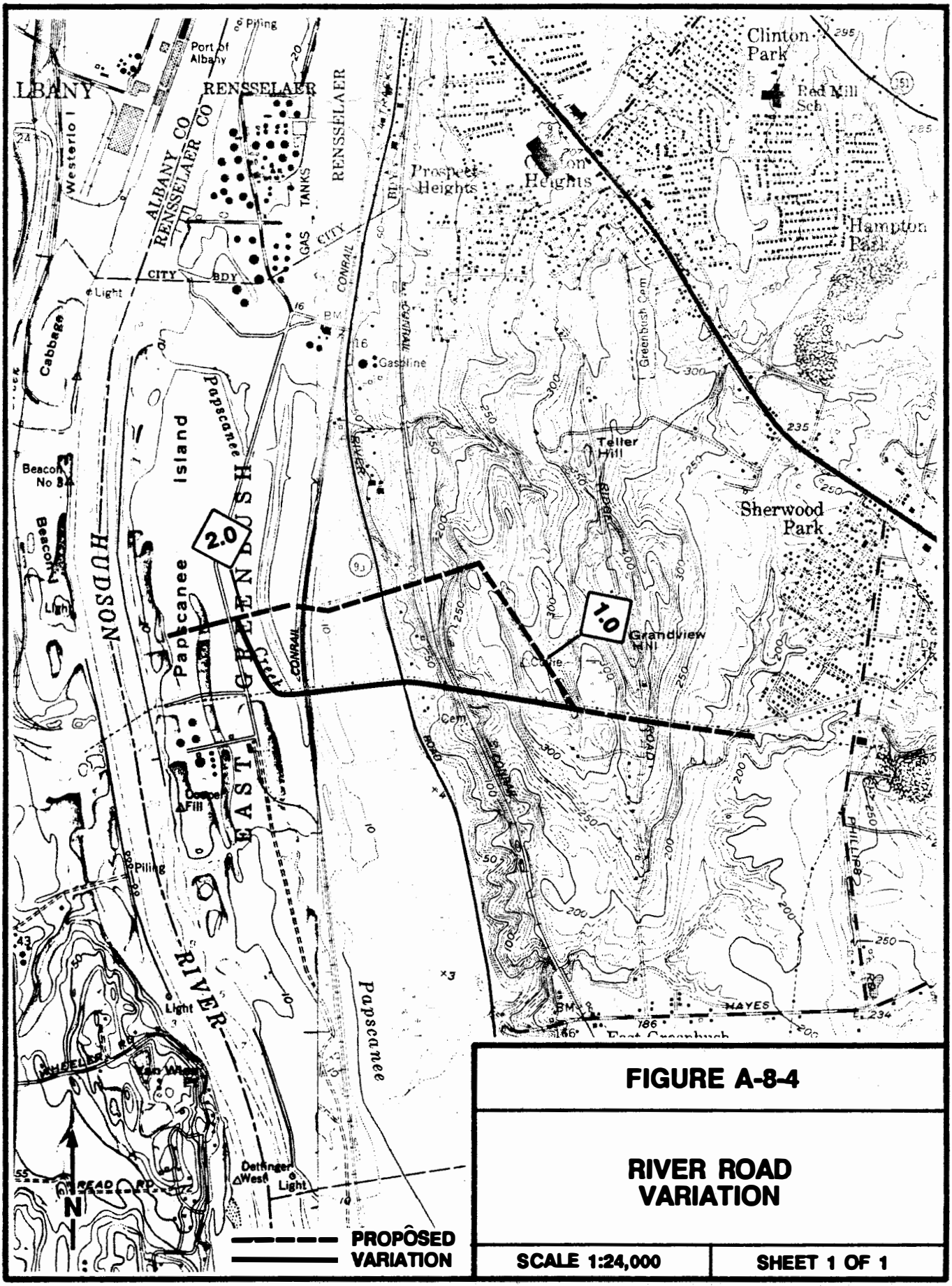
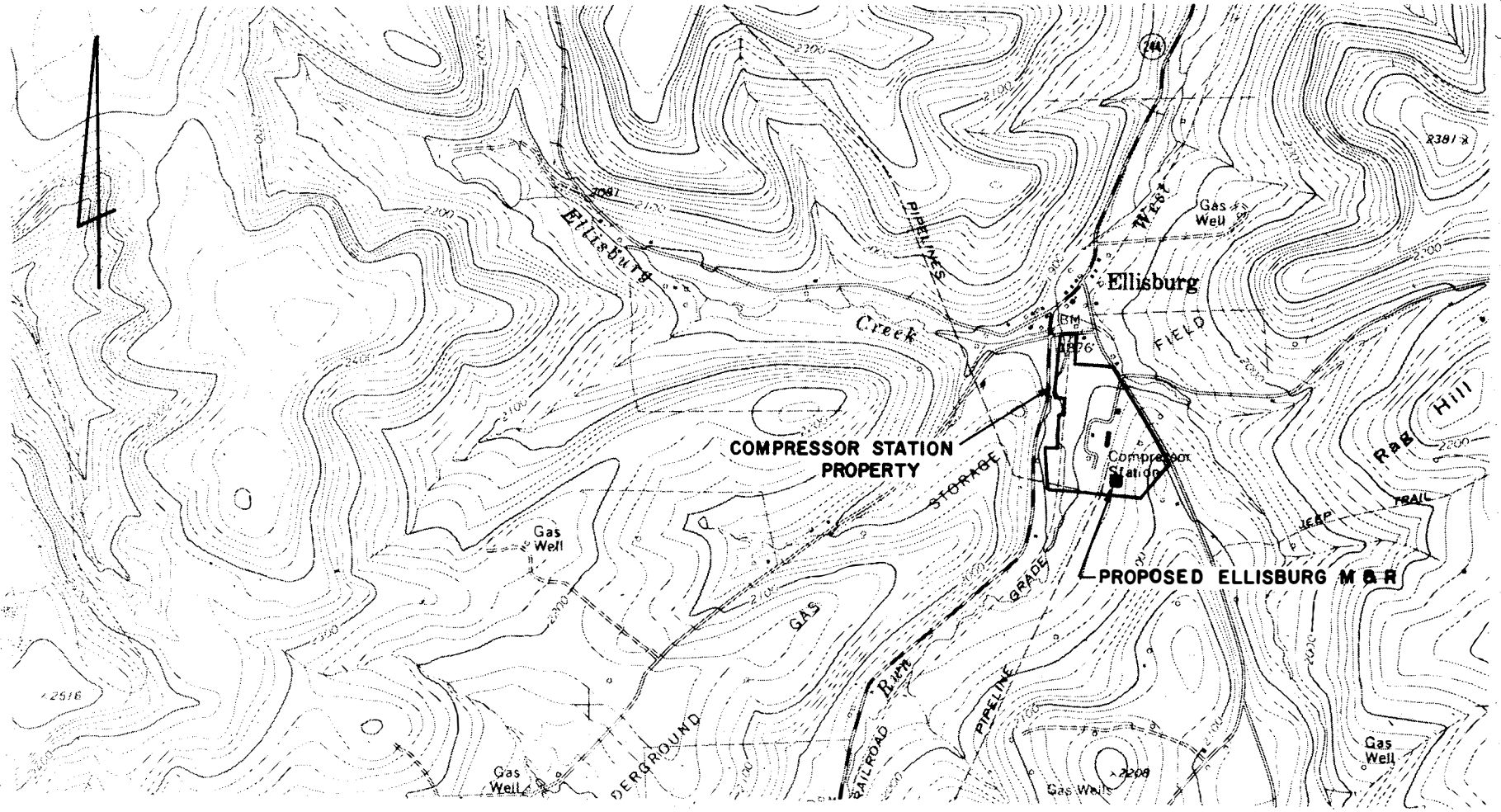


FIGURE A-8-4

RIVER ROAD VARIATION

SCALE 1:24,000

SHEET 1 OF 1



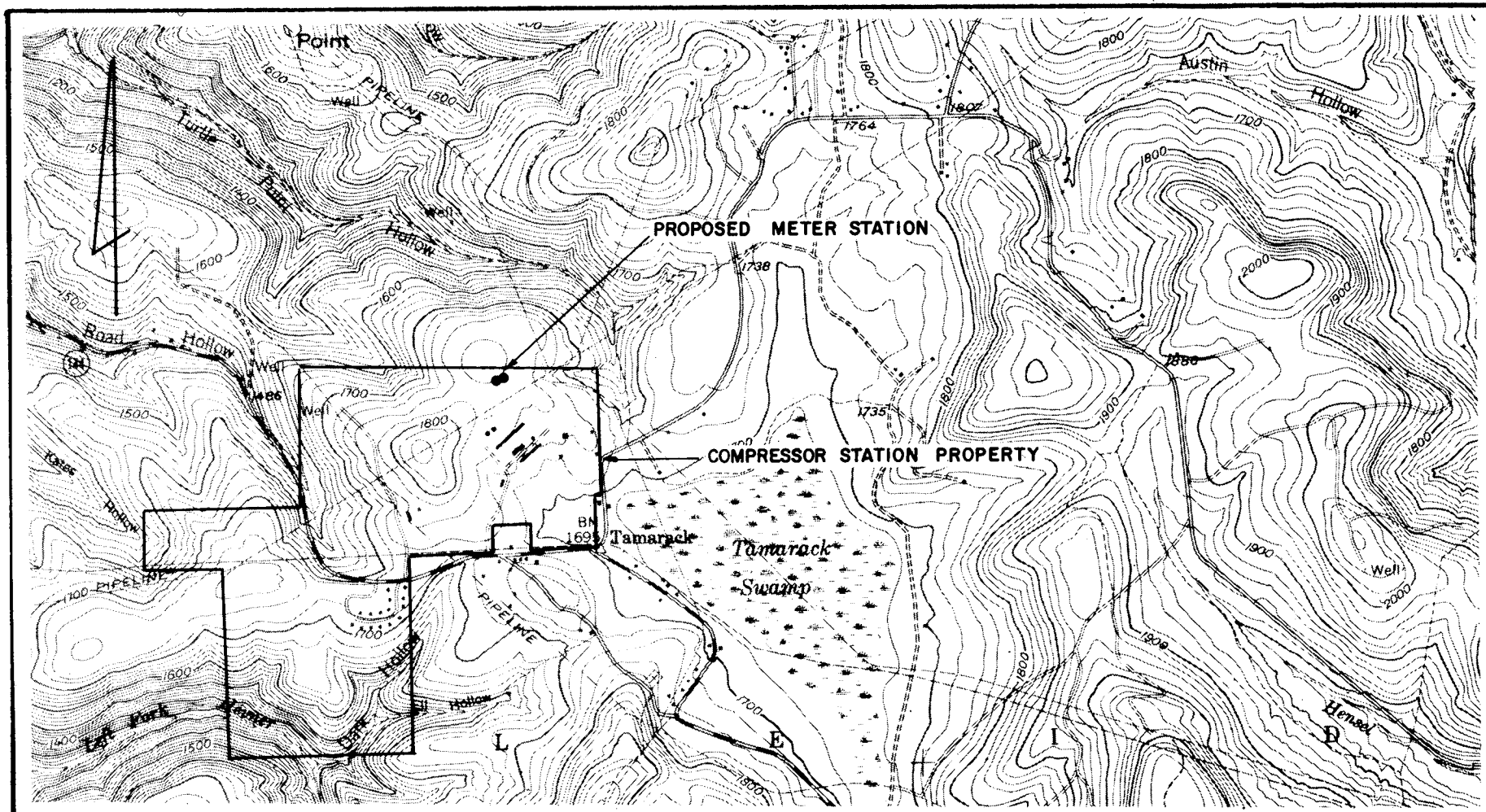
LOCATION:
POTTER CO. PA.
GENESEE TWP.

7.5 MINUTE TOPO MAP
ELLISBURG (PA.)

FIGURE A-8-2

CNG/TEXAS EASTERN
ELLISBURG METER STATION

SCALE 1:24,000	SHEET 1 OF 1



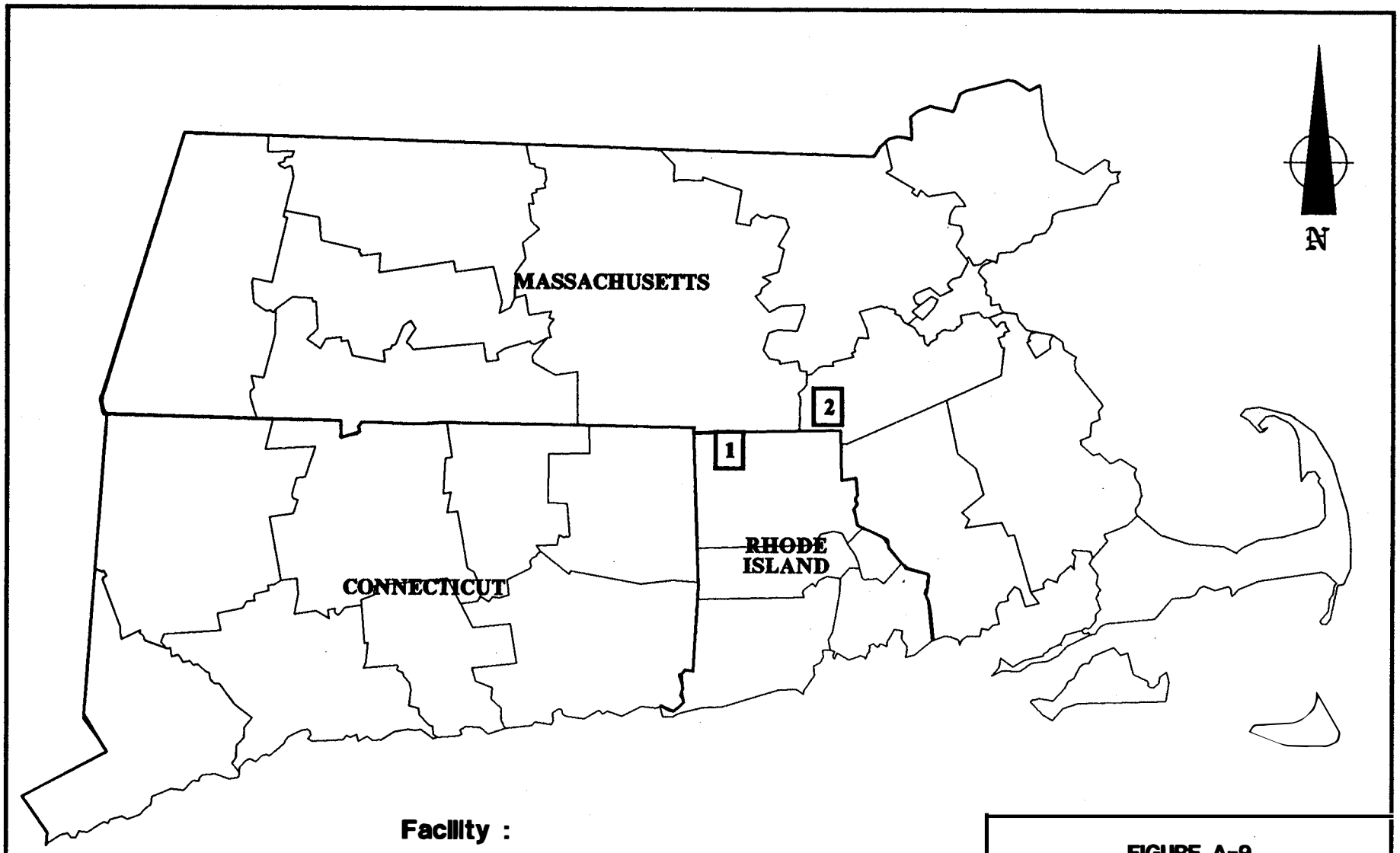
LOCATION:
CLINTON CO. PA.
LEIDY TWP.

7.5 MINUTE TOPO MAP
TAMARACK (PA.)

FIGURE A-8-3

CNG/TEXAS EASTERN
LEIDY METER STATION

SCALE 1:24,000	SHEET 1 OF 1



Facility :

1 OSP II

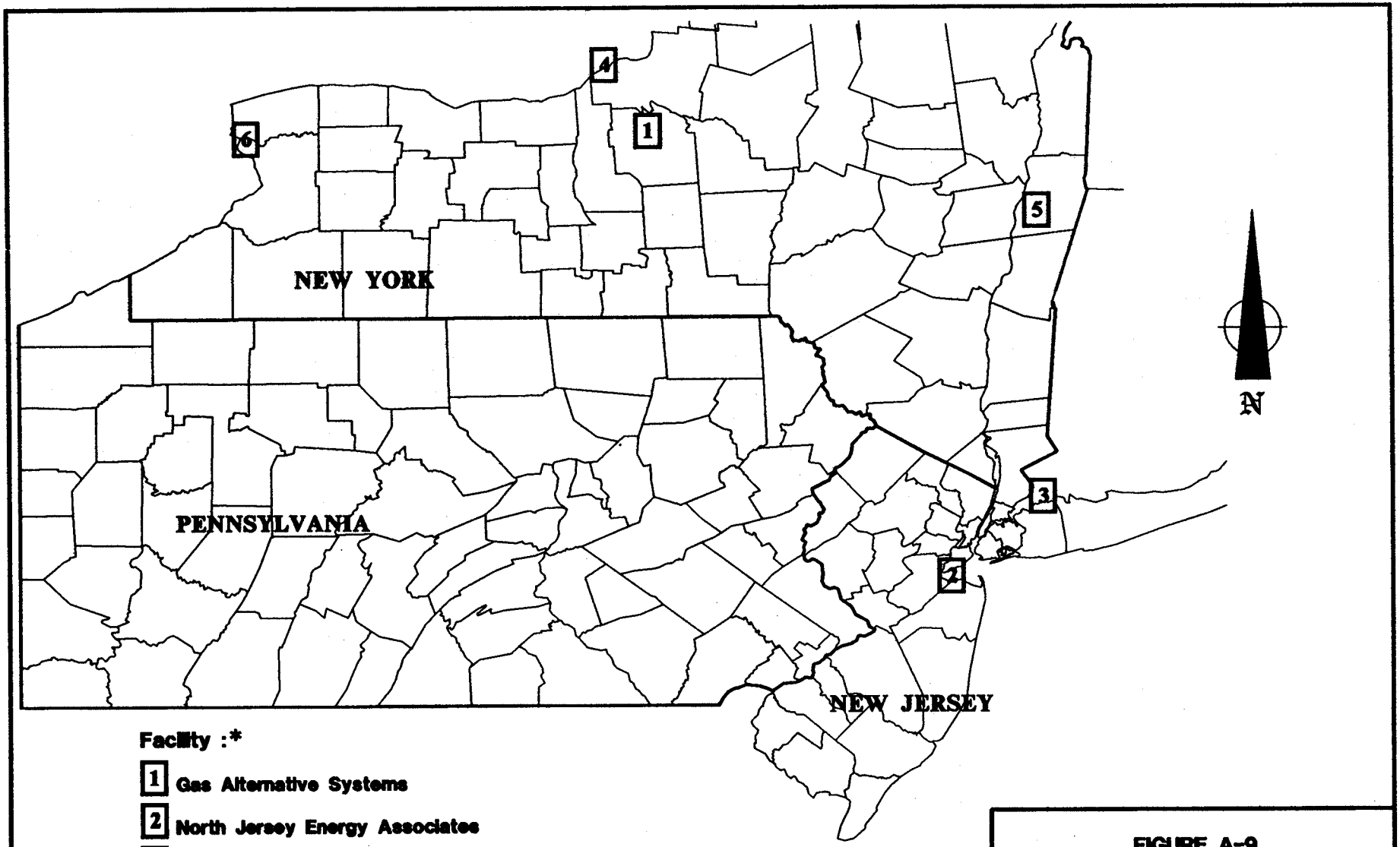
2 NorthEast Energy Associates

FIGURE A-9

NONJURISDICTIONAL FACILITIES KEY MAP

SHEET 1 OF 2

DWG:NOI



Facility :*

1. Gas Alternative Systems
2. North Jersey Energy Associates
3. Long Island Cogeneration LTD. Partnership
4. Index Energy Services of Oswego, Inc.
5. Cogen Energy Technology, Inc.
6. Indeck-Yerkes Services, Inc.

* Hopewell Cogeneration Limited Partnership and Columbia Gas Pipelines facilities are located in Virginia

DWG: N05

FIGURE A-9

NONJURISDICTIONAL FACILITIES KEY MAP

SHEET 2 OF 2

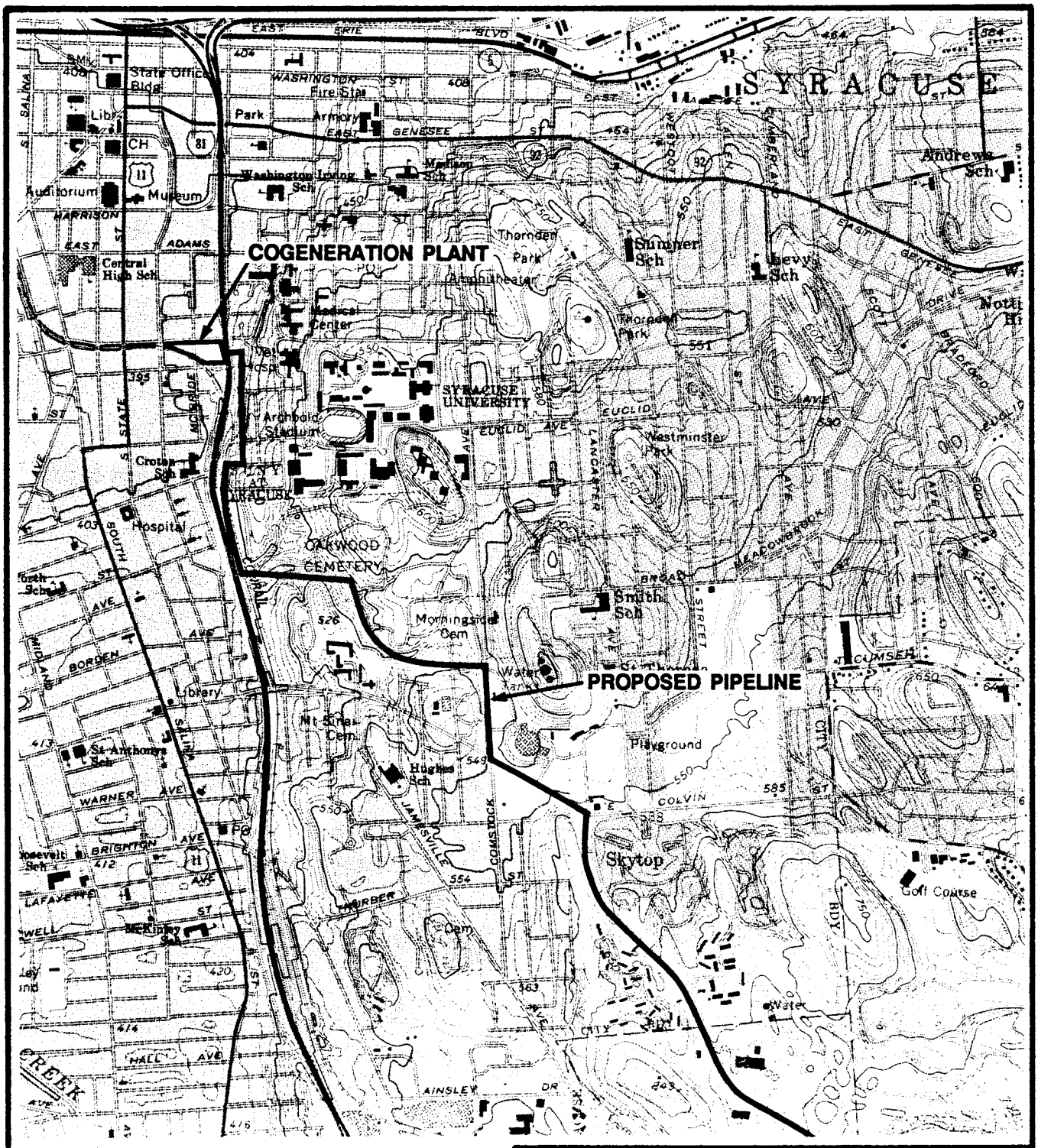


FIGURE A-9-1

GAS ALTERNATIVE SYSTEMS
COGENERATION PLANT AND PIPELINE

SCALE 1:24,000	SHEET 1 OF 3

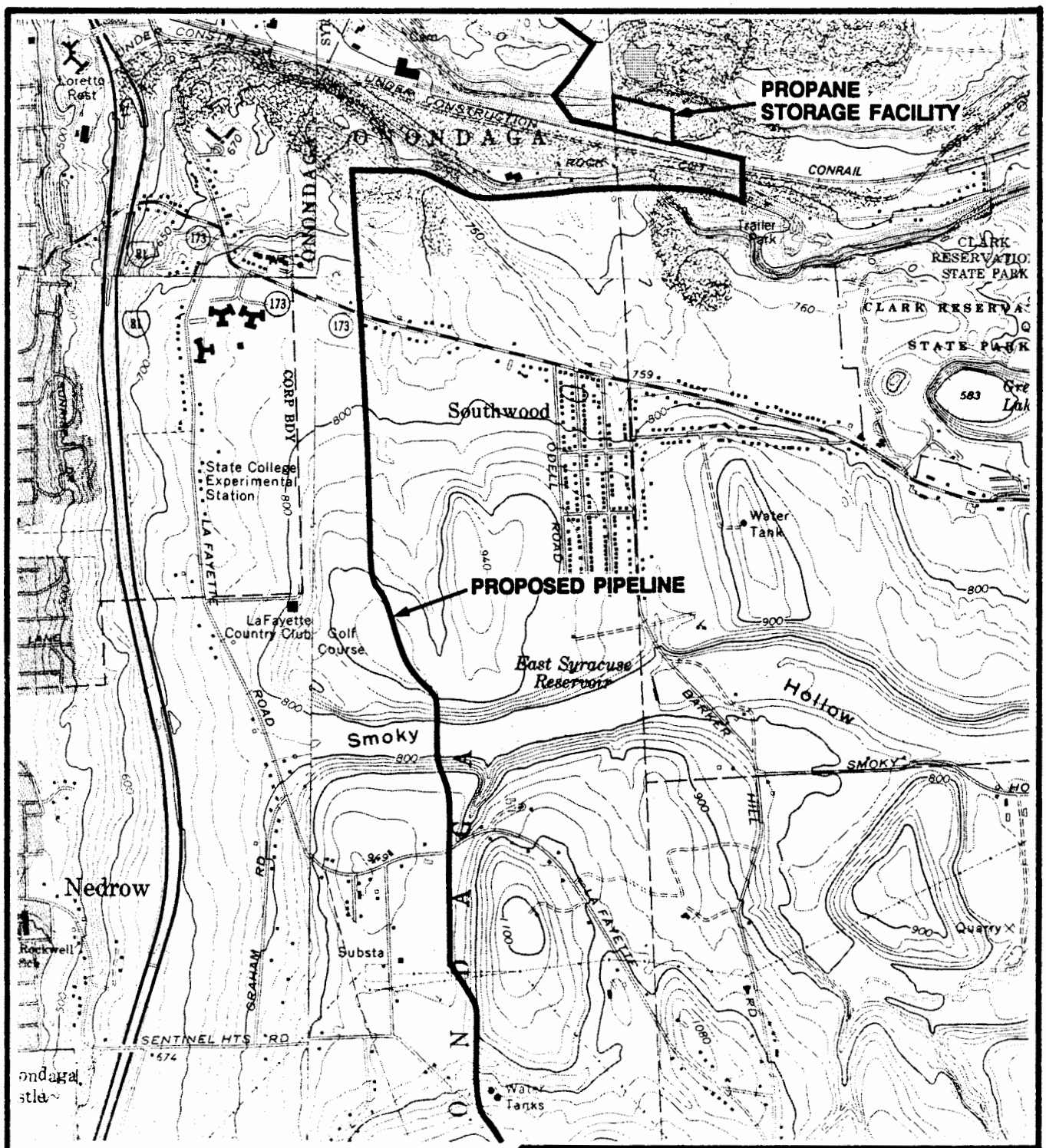


FIGURE A-9-1

GAS ALTERNATIVE SYSTEMS COGENERATION PLANT AND PIPELINE

SCALE 1:24,000	SHEET 2 OF 3

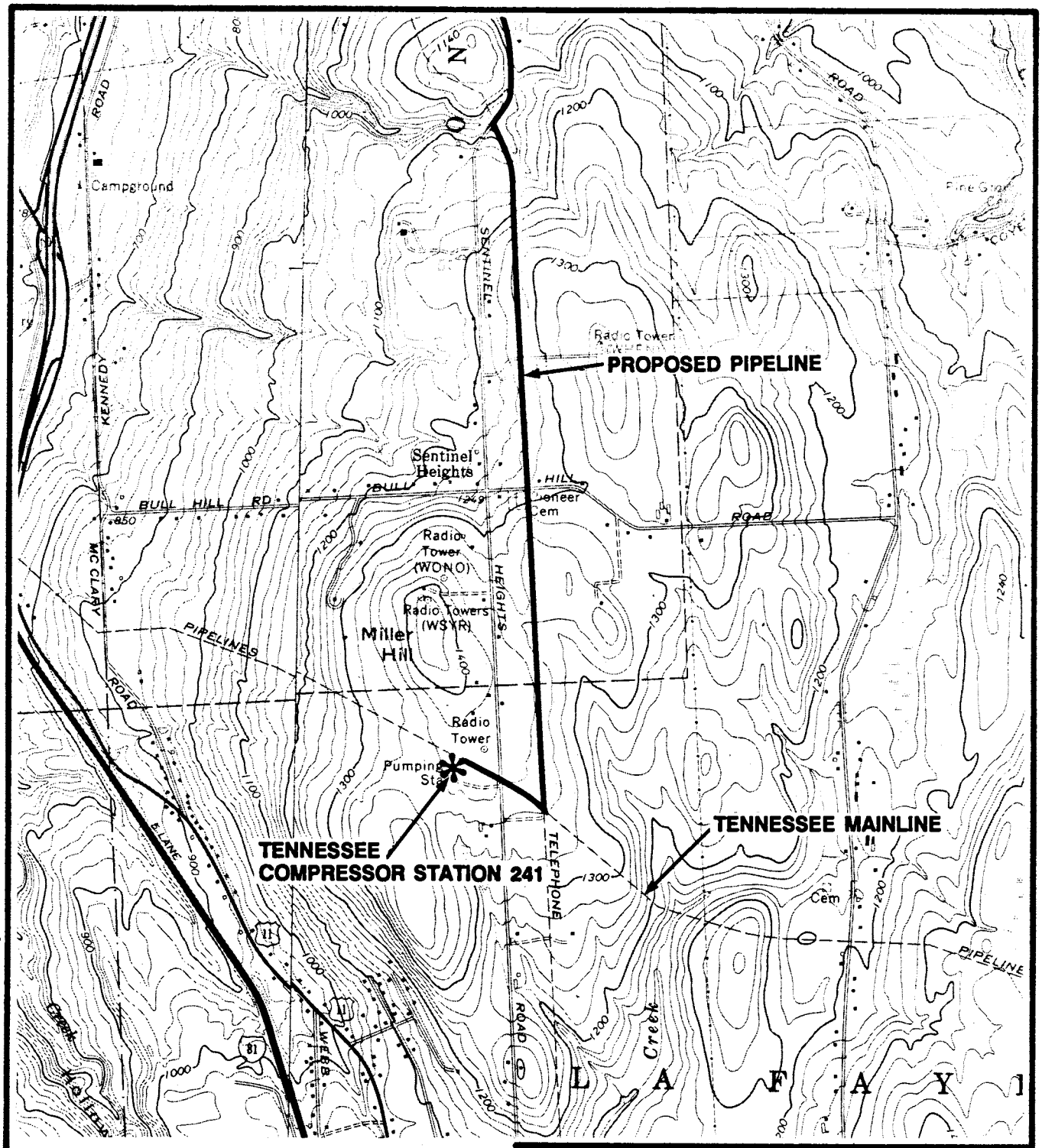


FIGURE A-9-1

GAS ALTERNATIVE SYSTEMS
COGENERATION PLANT AND PIPELINE

SCALE 1:24,000	SHEET 3 OF 3

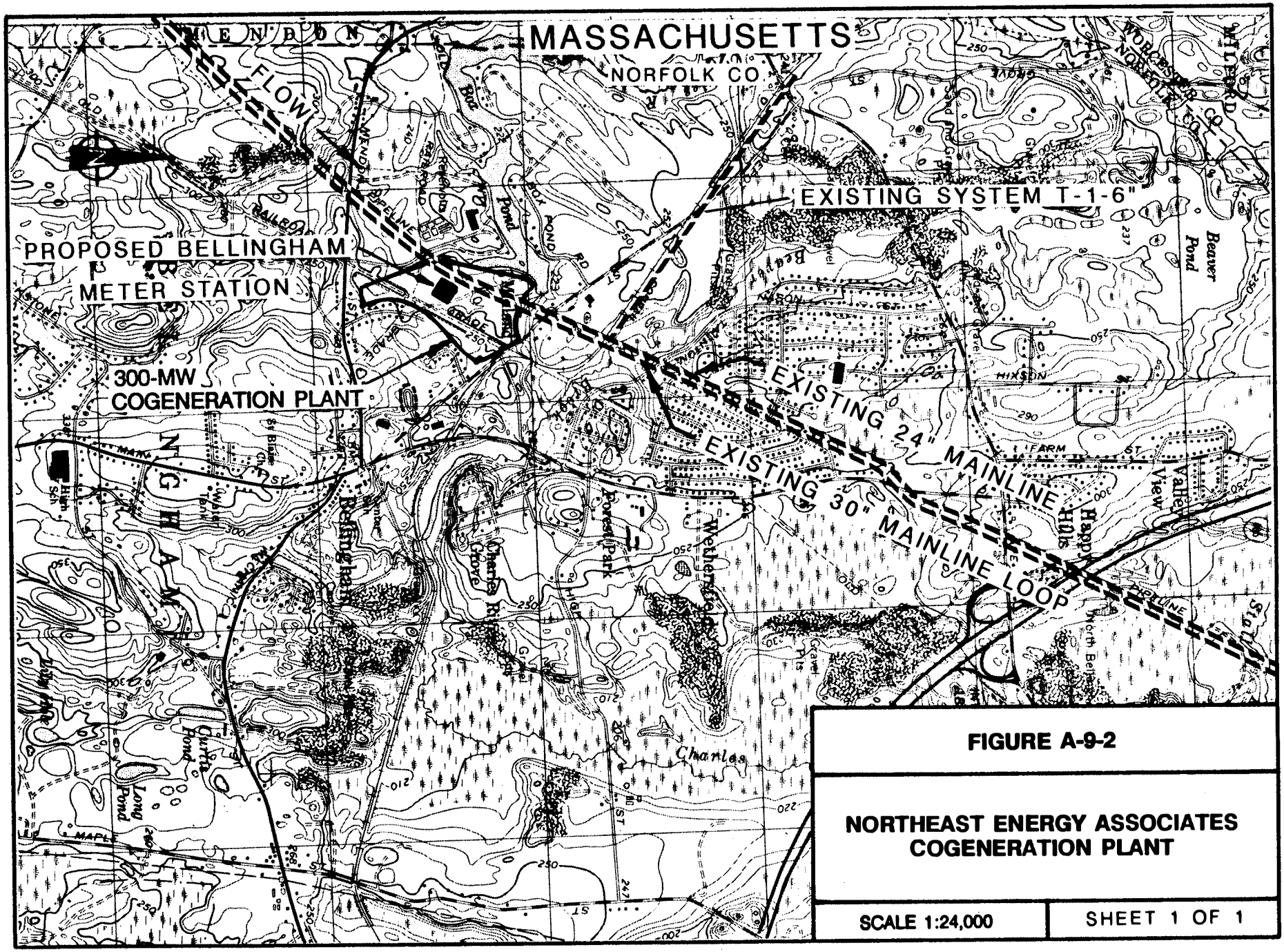


FIGURE A-9-2

NORTHEAST ENERGY ASSOCIATES COGENERATION PLANT

SCALE 1:24,000	SHEET 1 OF 1

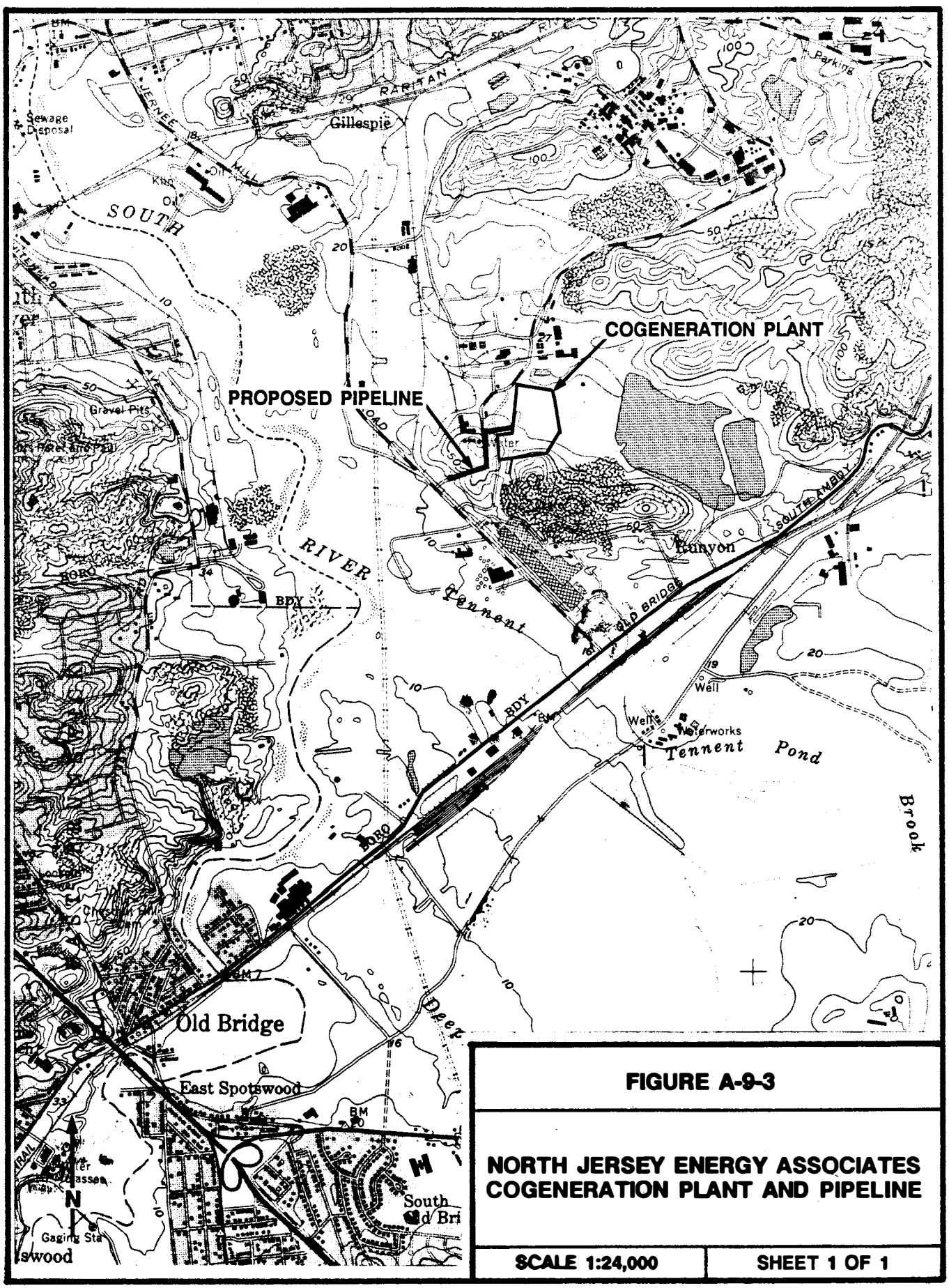
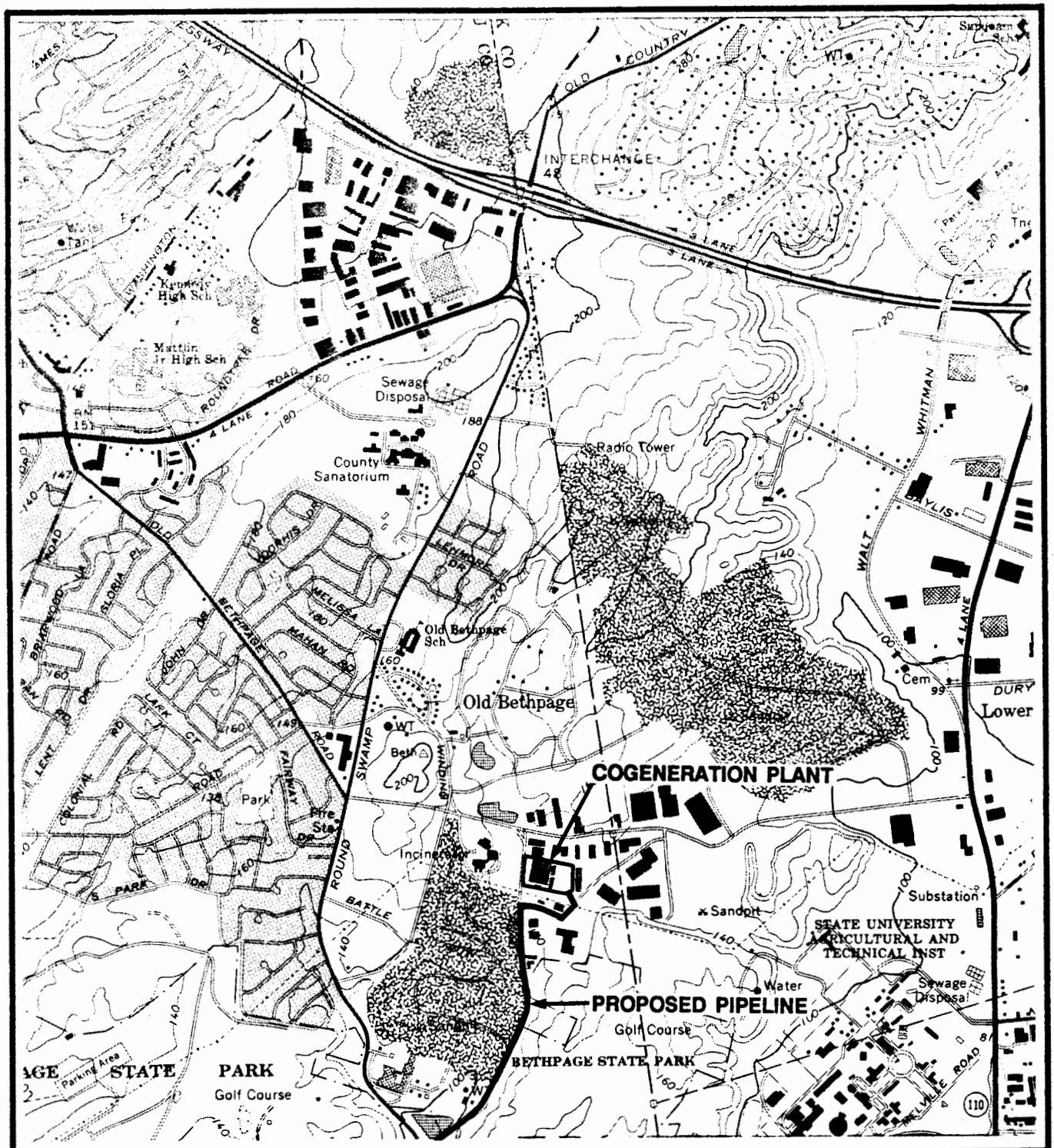


FIGURE A-9-3

NORTH JERSEY ENERGY ASSOCIATES COGENERATION PLANT AND PIPELINE

SCALE 1:24,000	SHEET 1 OF 1



N

FIGURE A-9-4

LONG ISLAND COGENERATION LIMITED PARTNERSHIP COGENERATION PLANT AND PIPELINE

SCALE 1:24,000	SHEET 1 OF 1

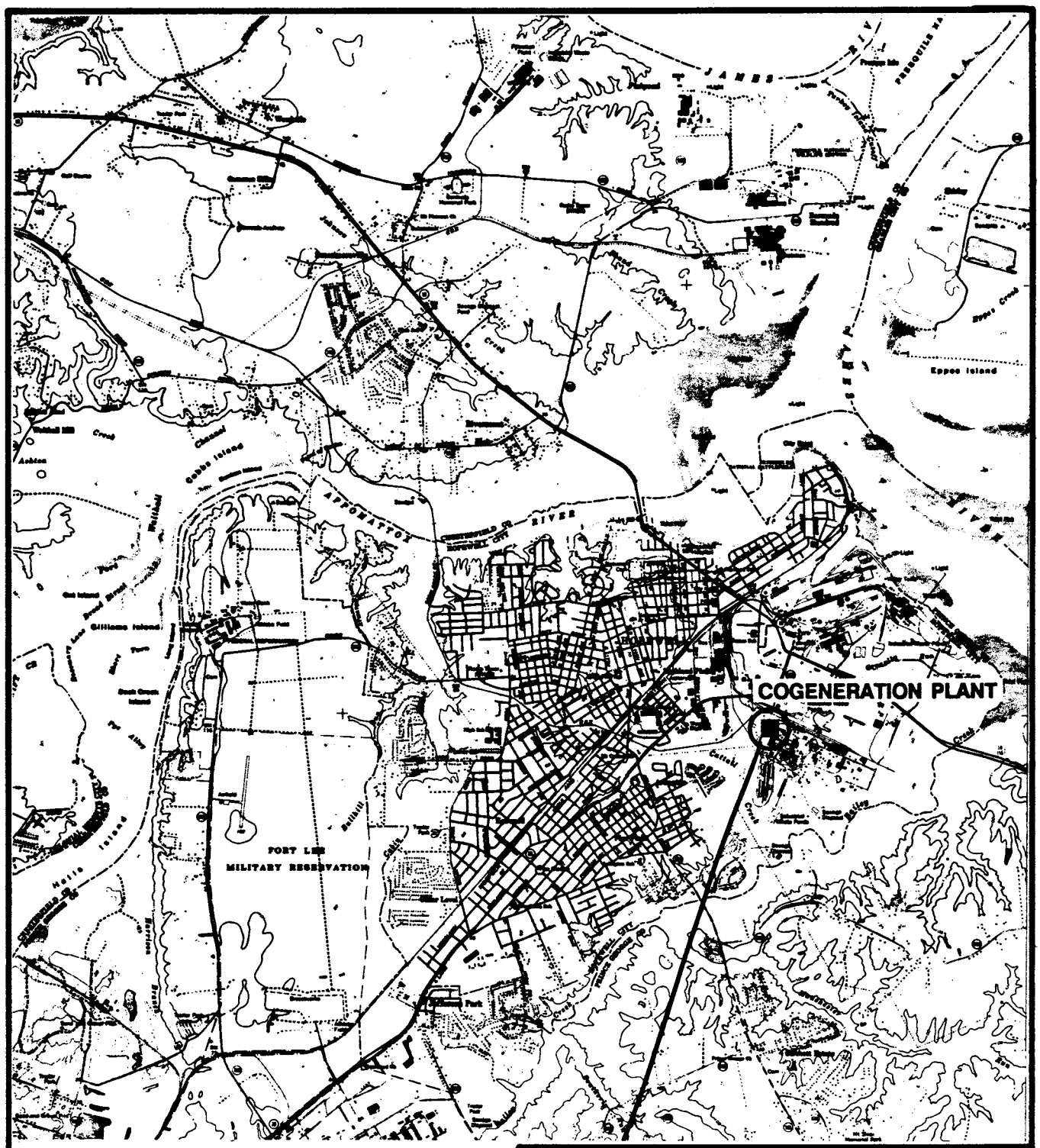


FIGURE A-9-5

HOPEWELL COGENERATION LIMITED PARTNERSHIP COGENERATION PLANT

SCALE 1" = 1 MI.	SHEET 1 OF 1

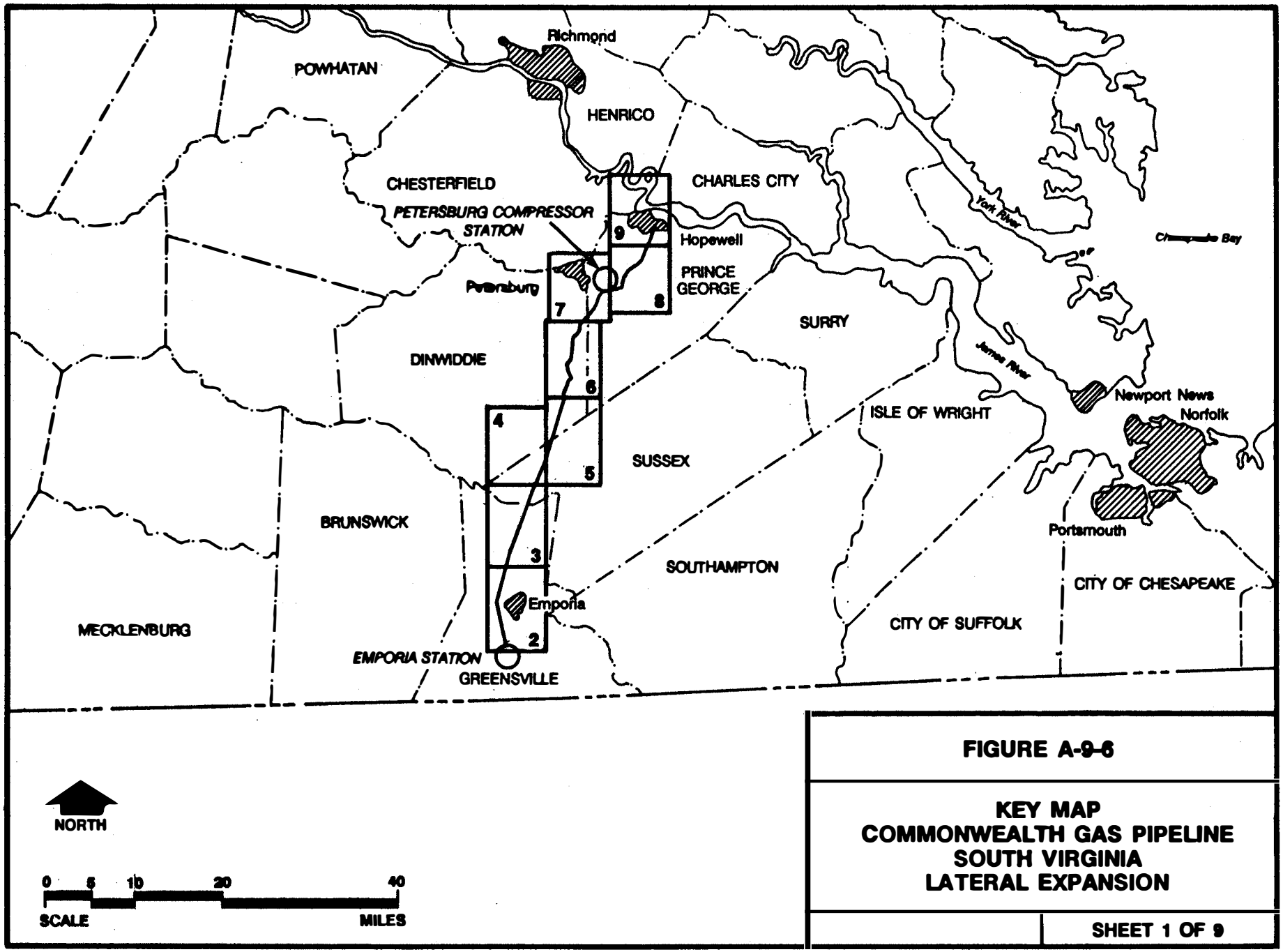


FIGURE A-9-6

KEY MAP
COMMONWEALTH GAS PIPELINE
SOUTH VIRGINIA
LATERAL EXPANSION

SHEET 1 OF 9

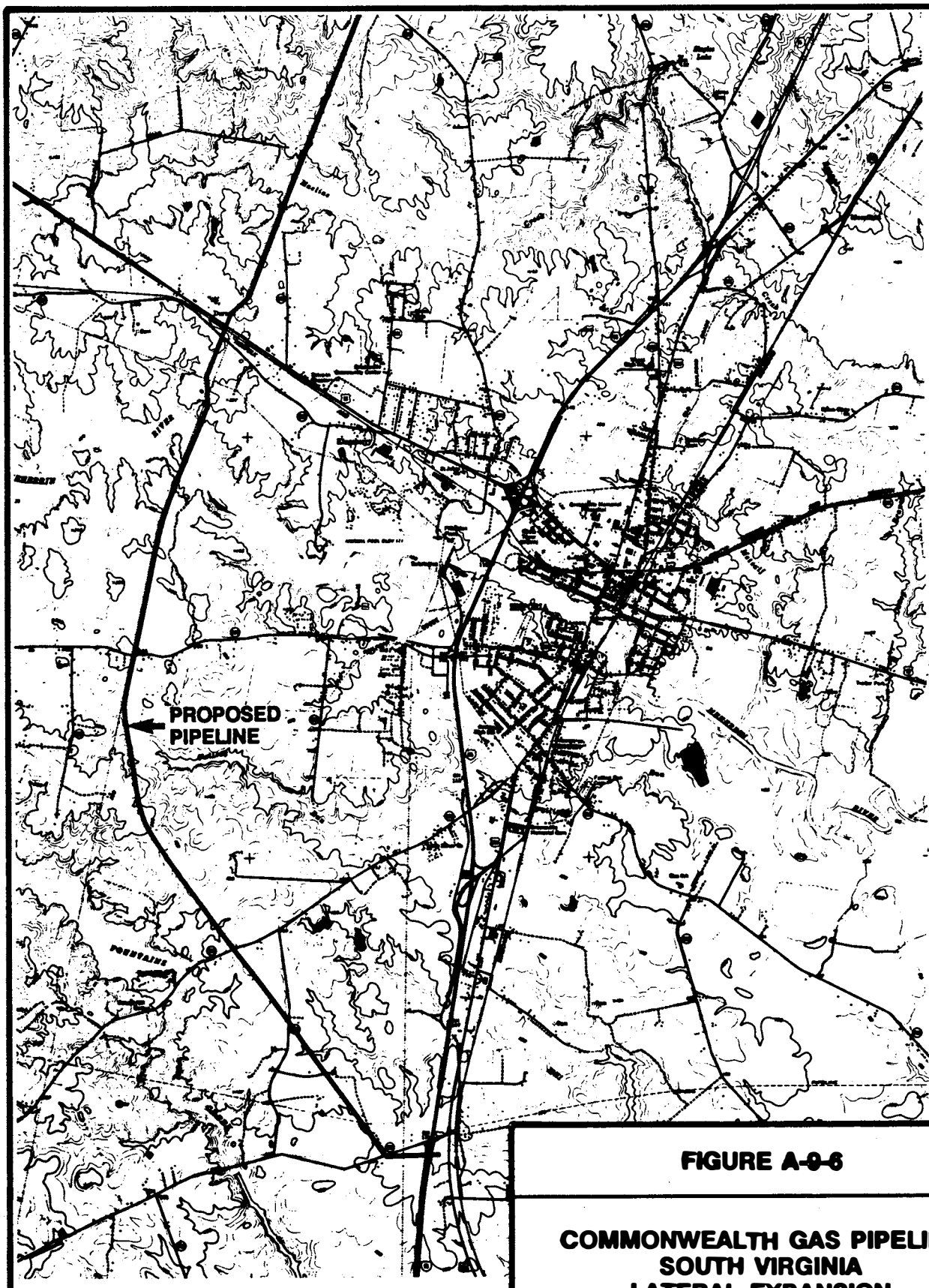


FIGURE A-9-6

COMMONWEALTH GAS PIPELINE
SOUTH VIRGINIA
LATERAL EXPANSION

SCALE 1" = 1 Mi.	SHEET 2 OF 9

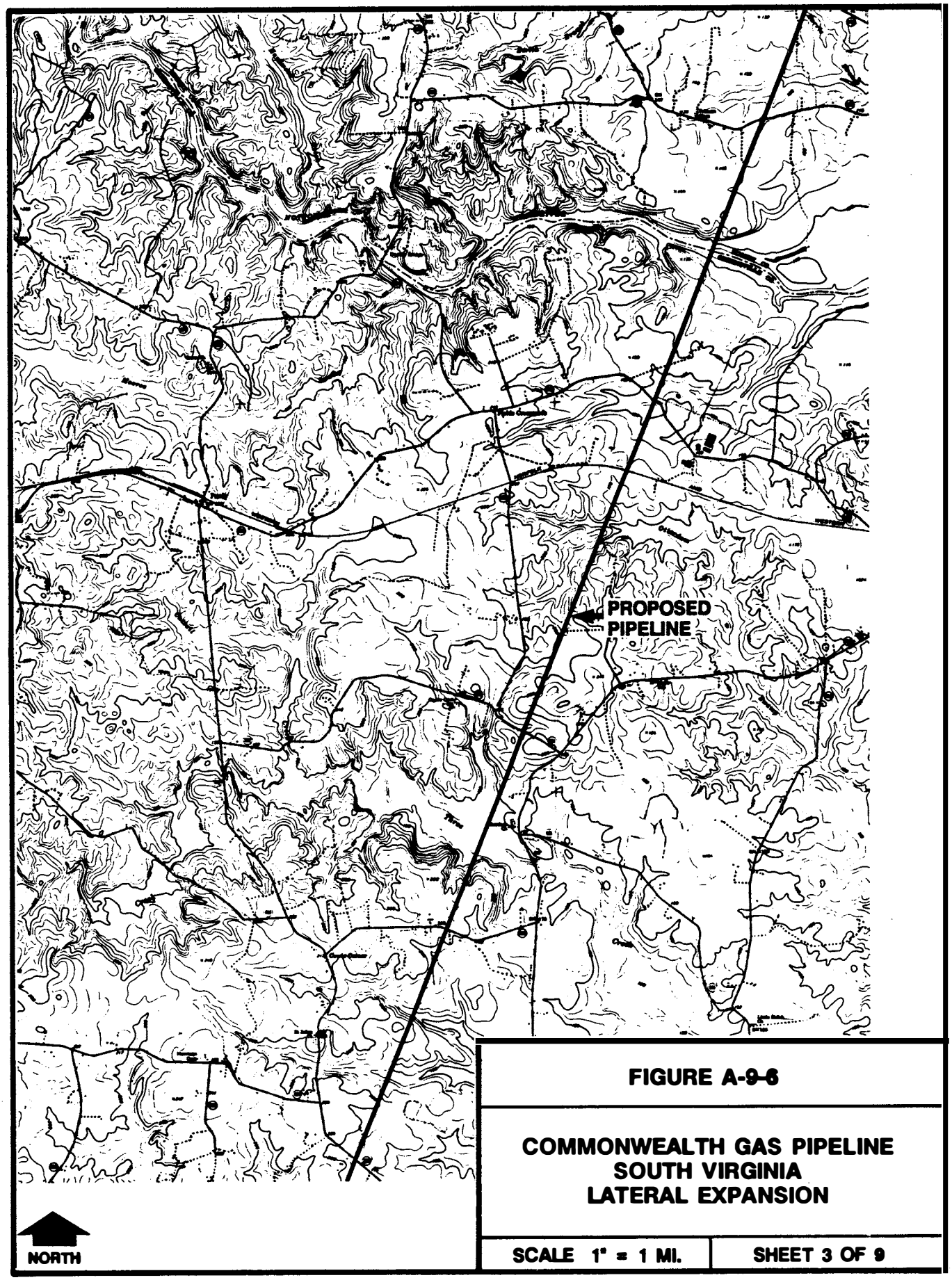
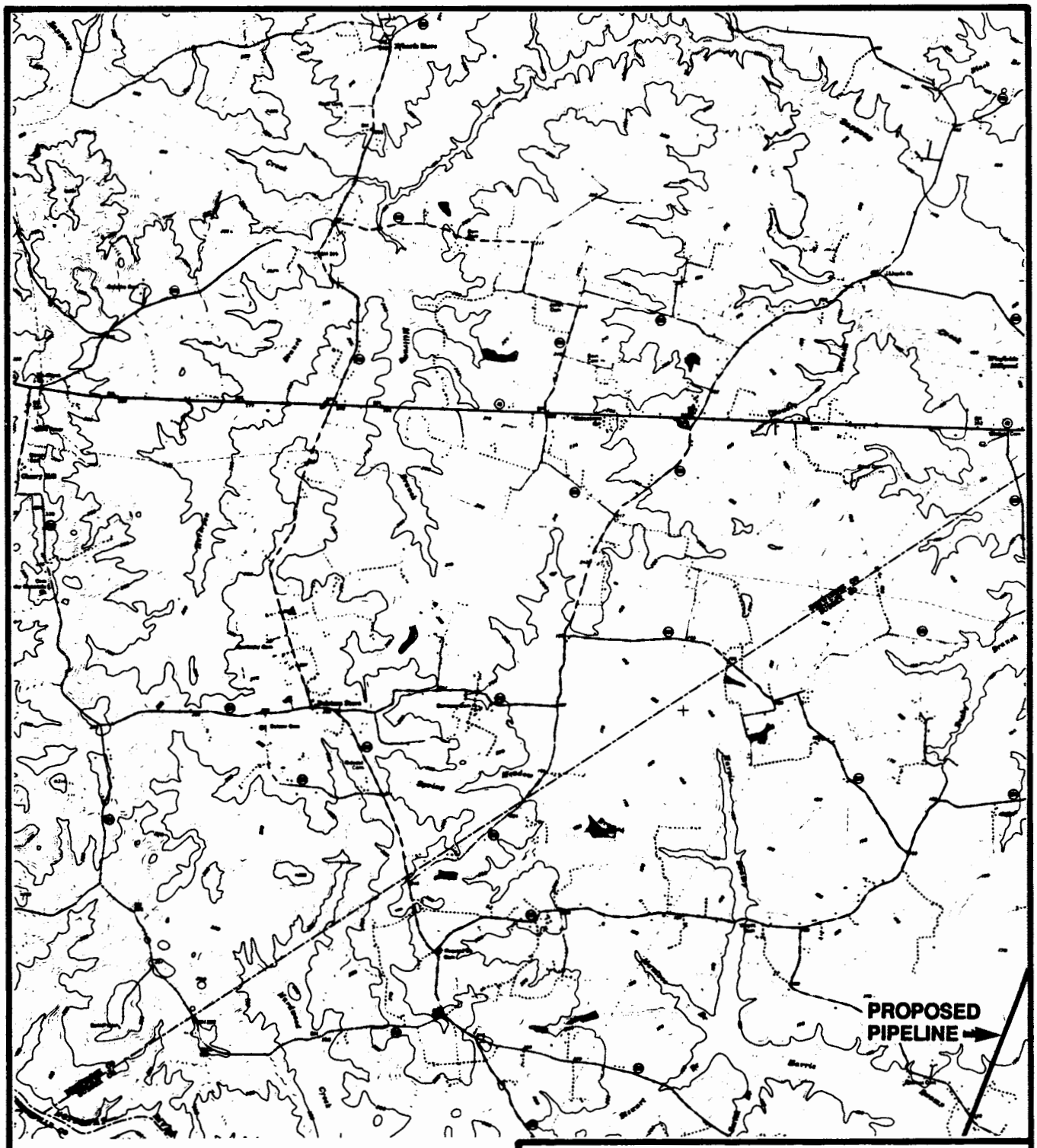


FIGURE A-9-6

COMMONWEALTH GAS PIPELINE
SOUTH VIRGINIA
LATERAL EXPANSION

SCALE 1" = 1 MI.	SHEET 3 OF 9



NORTH

FIGURE A-9-6

COMMONWEALTH GAS PIPELINE
SOUTH VIRGINIA
LATERAL EXPANSION

SCALE 1" = 1 MI.	SHEET 4 OF 9

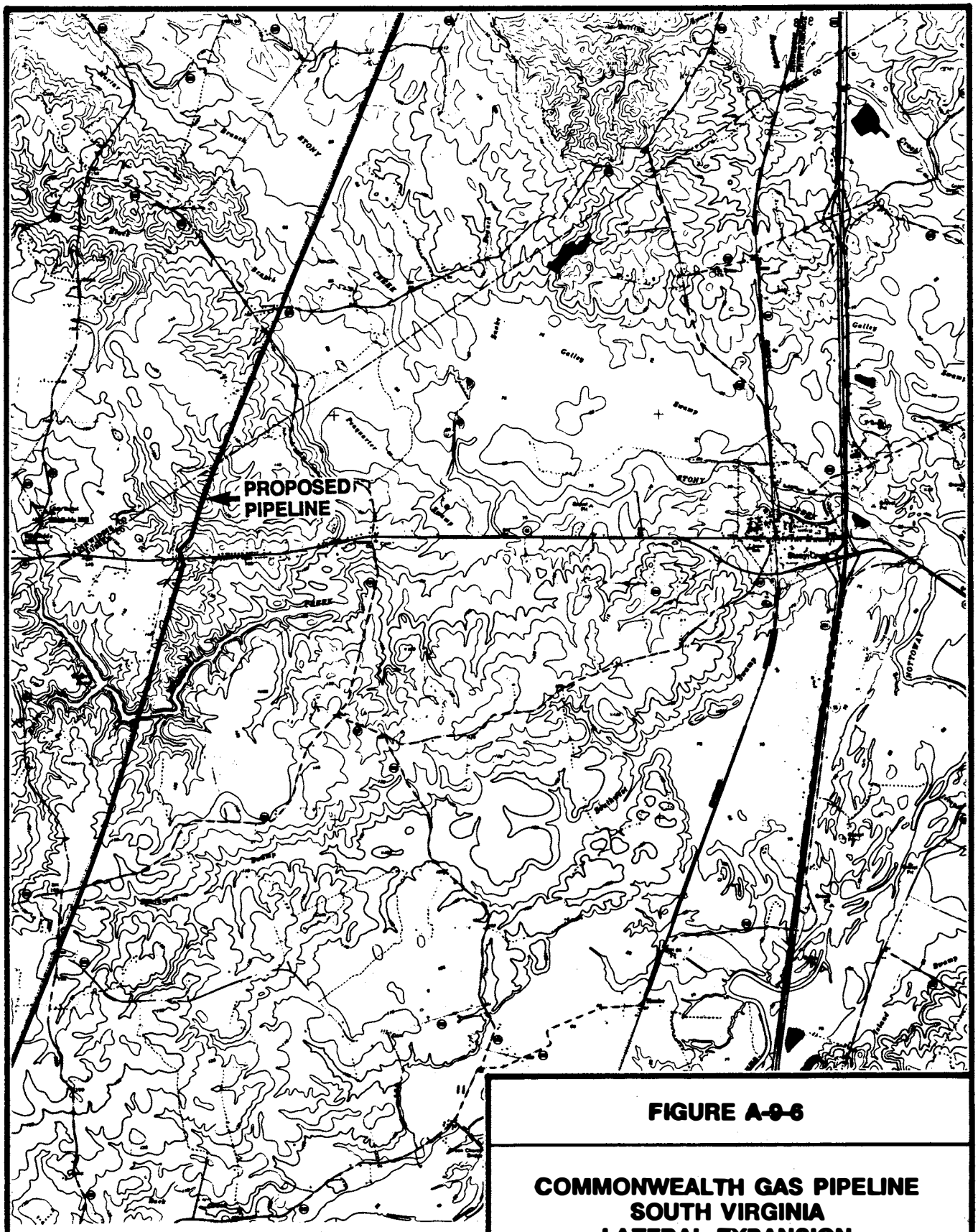


FIGURE A-8-6

COMMONWEALTH GAS PIPELINE
SOUTH VIRGINIA
LATERAL EXPANSION

SCALE 1" = 1 MI.	SHEET 5 OF 9

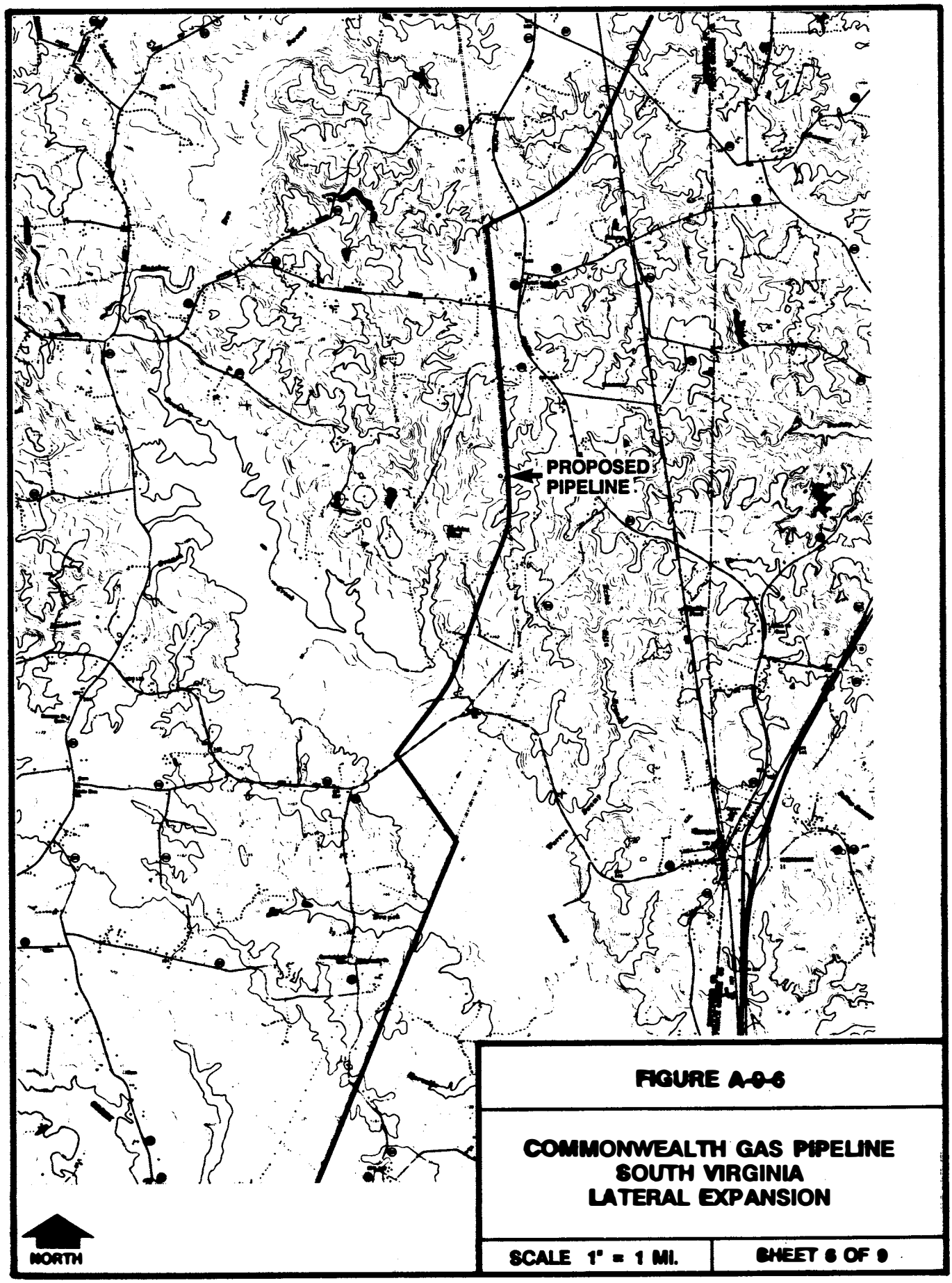


FIGURE A-8-6

COMMONWEALTH GAS PIPELINE
SOUTH VIRGINIA
LATERAL EXPANSION

SCALE 1" = 1 MI.	SHEET 6 OF 9

NORTH

FIGURE A-8-6

COMMONWEALTH GAS PIPELINE
SOUTH VIRGINIA
LATERAL EXPANSION

SCALE 1" = 1 MI.	SHEET 7 OF 9

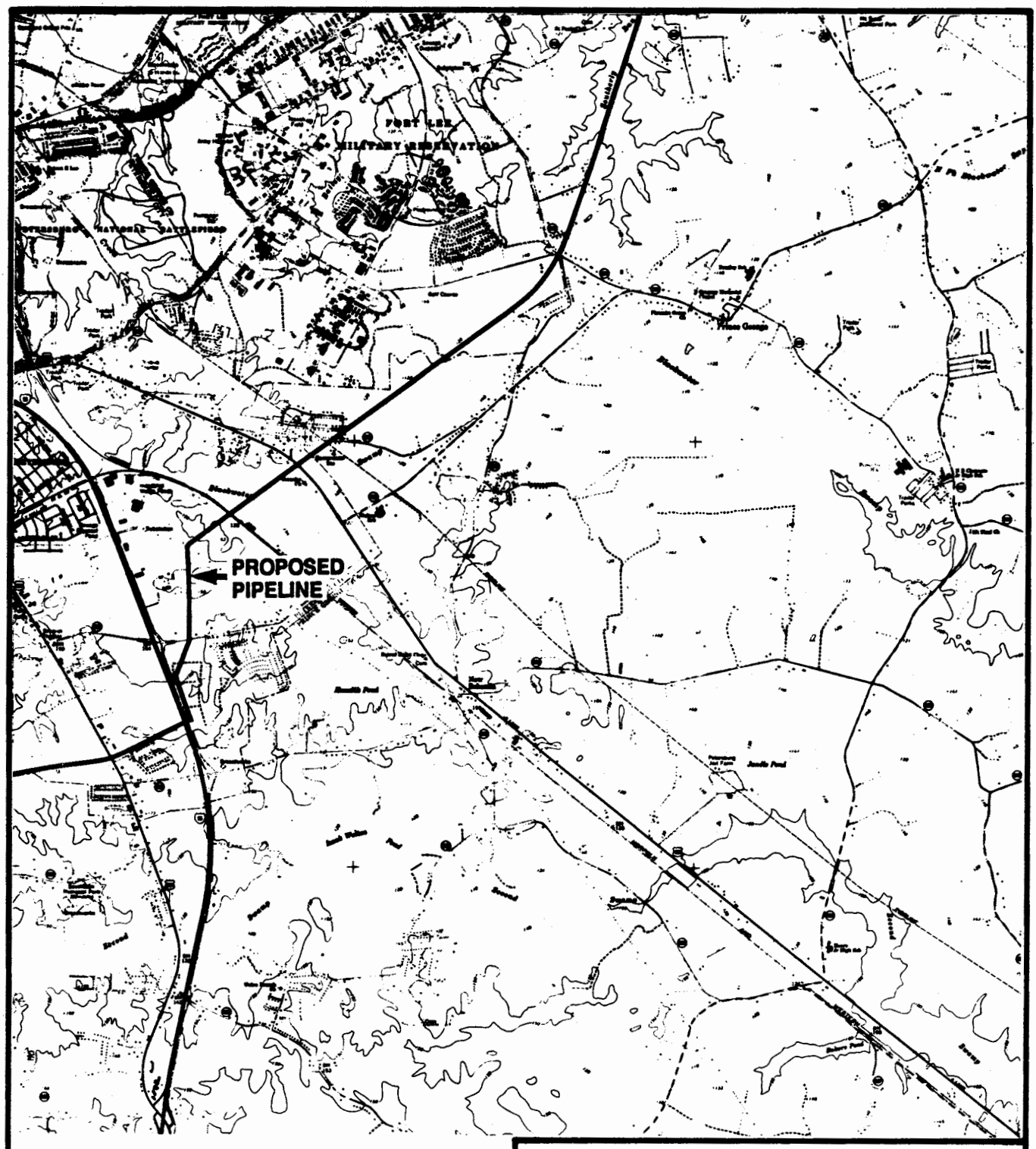


FIGURE A-9-6

COMMONWEALTH GAS PIPELINE
SOUTH VIRGINIA
LATERAL EXPANSION

SCALE 1" = 1 MI.	SHEET 8 OF 9

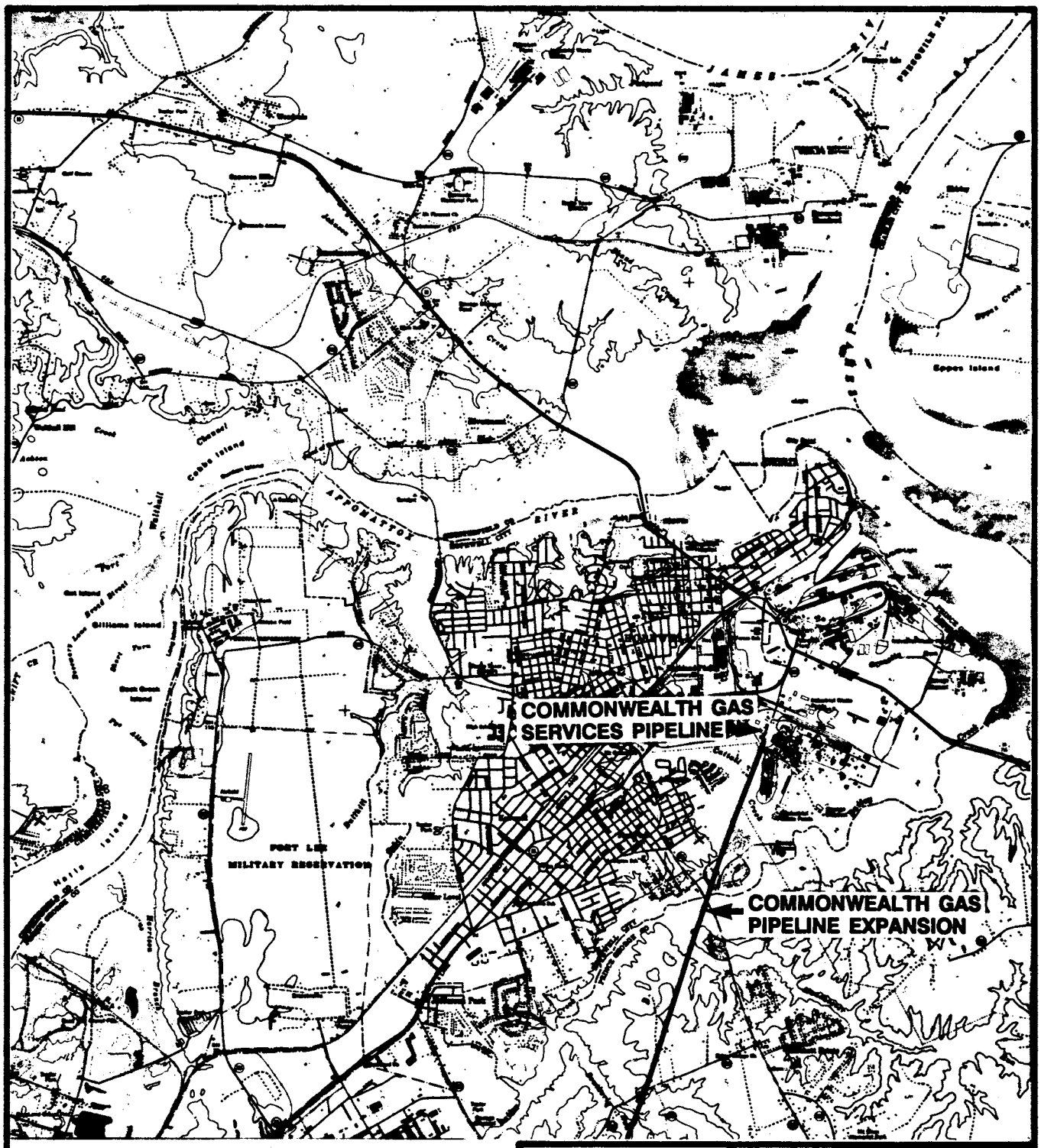


FIGURE A-9-6

**COMMONWEALTH GAS PIPELINE
SOUTH VIRGINIA LATERAL EXPANSION
AND COMMONWEALTH GAS SERVICES
PIPELINE**

SCALE 1" = 1 Mi.	SHEET 9 OF 9

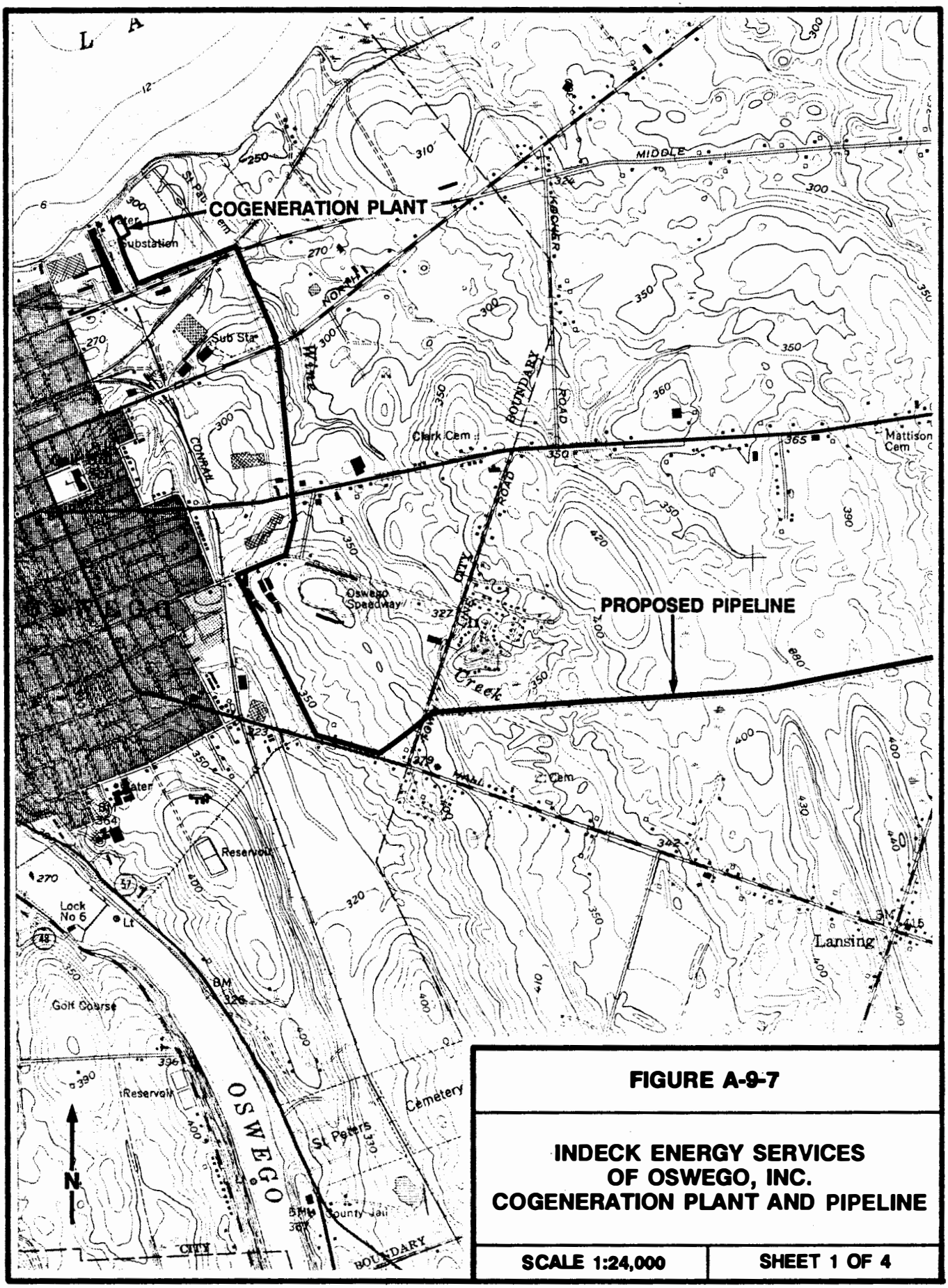


FIGURE A-9-7

INDECK ENERGY SERVICES OF OSWEGO, INC. COGENERATION PLANT AND PIPELINE

SCALE 1:24,000	SHEET 1 OF 4

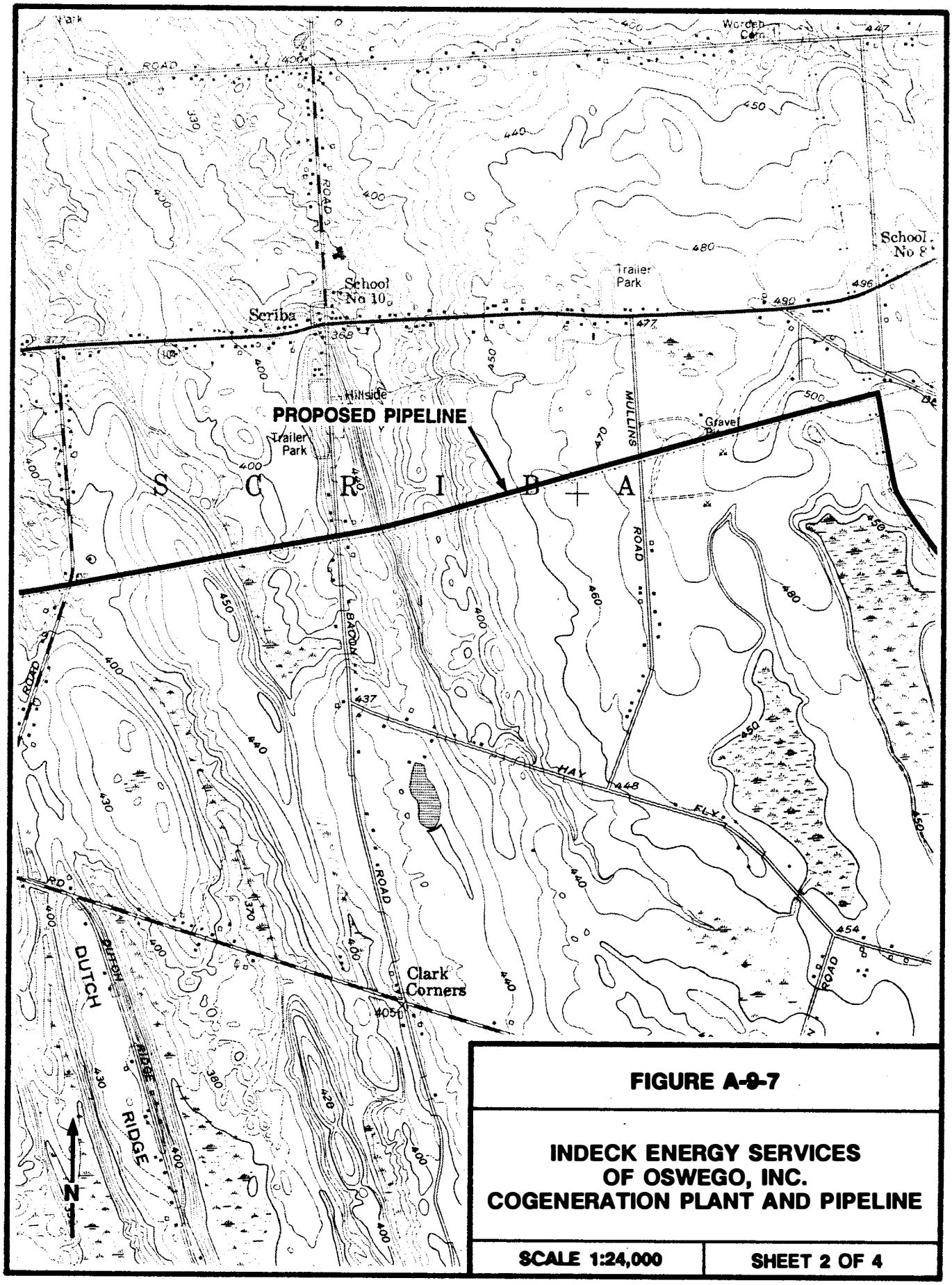


FIGURE A-9-7

INDECK ENERGY SERVICES OF OSWEGO, INC. COGENERATION PLANT AND PIPELINE

SCALE 1:24,000	SHEET 2 OF 4

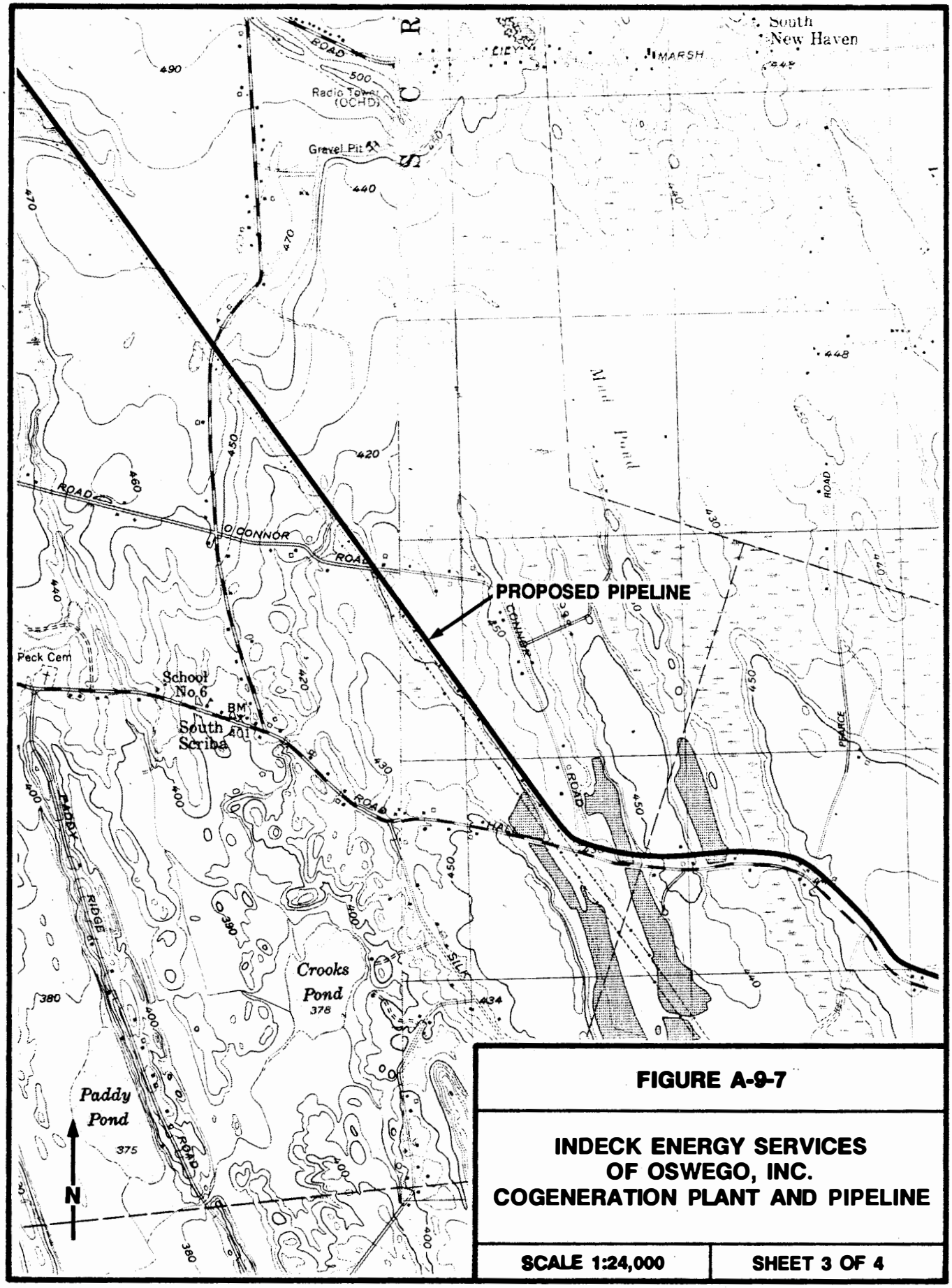


FIGURE A-9-7

INDECK ENERGY SERVICES OF OSWEGO, INC. COGENERATION PLANT AND PIPELINE

SCALE 1:24,000	SHEET 3 OF 4

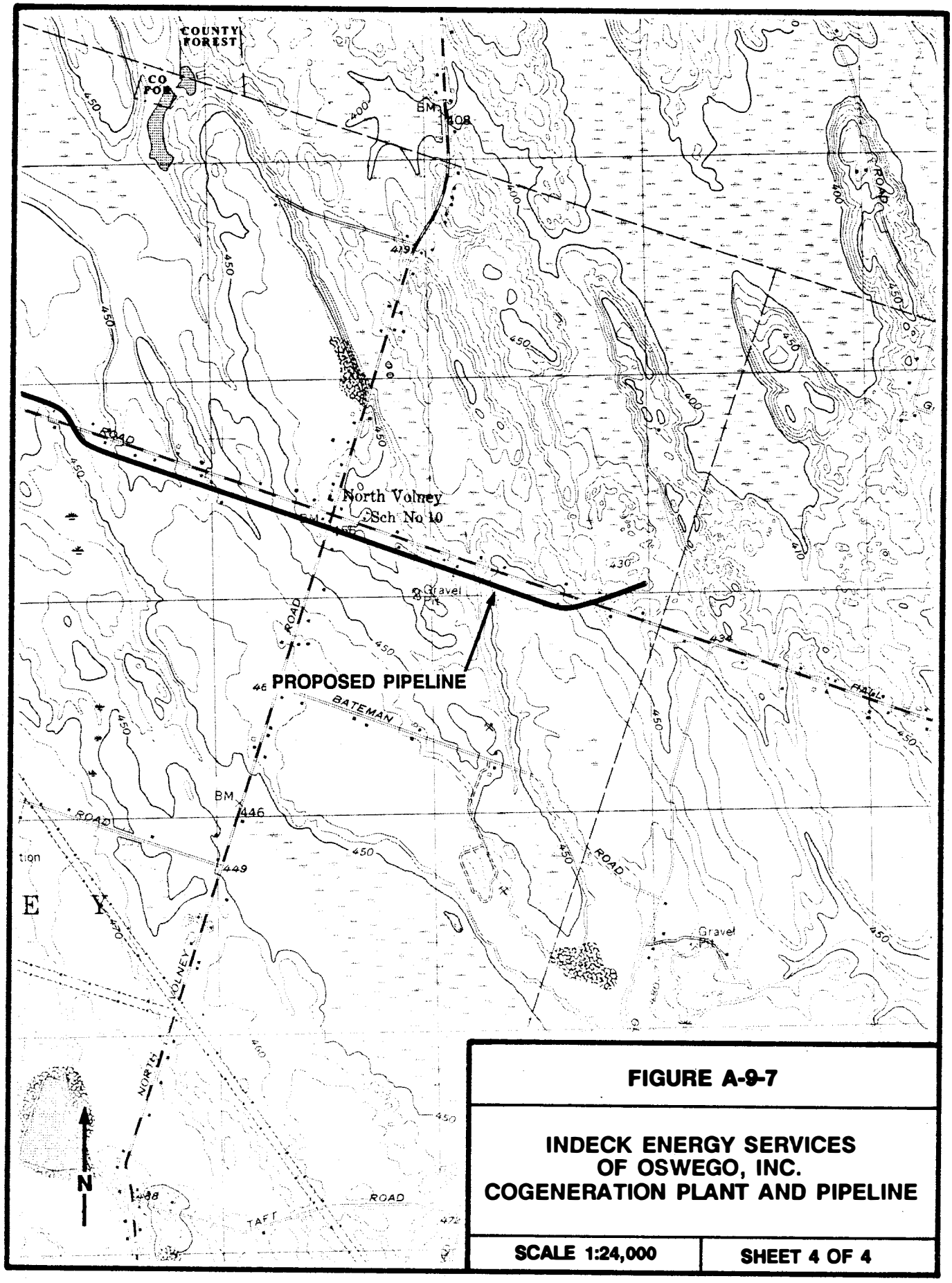


FIGURE A-9-7

INDECK ENERGY SERVICES OF OSWEGO, INC. COGENERATION PLANT AND PIPELINE

SCALE 1:24,000	SHEET 4 OF 4

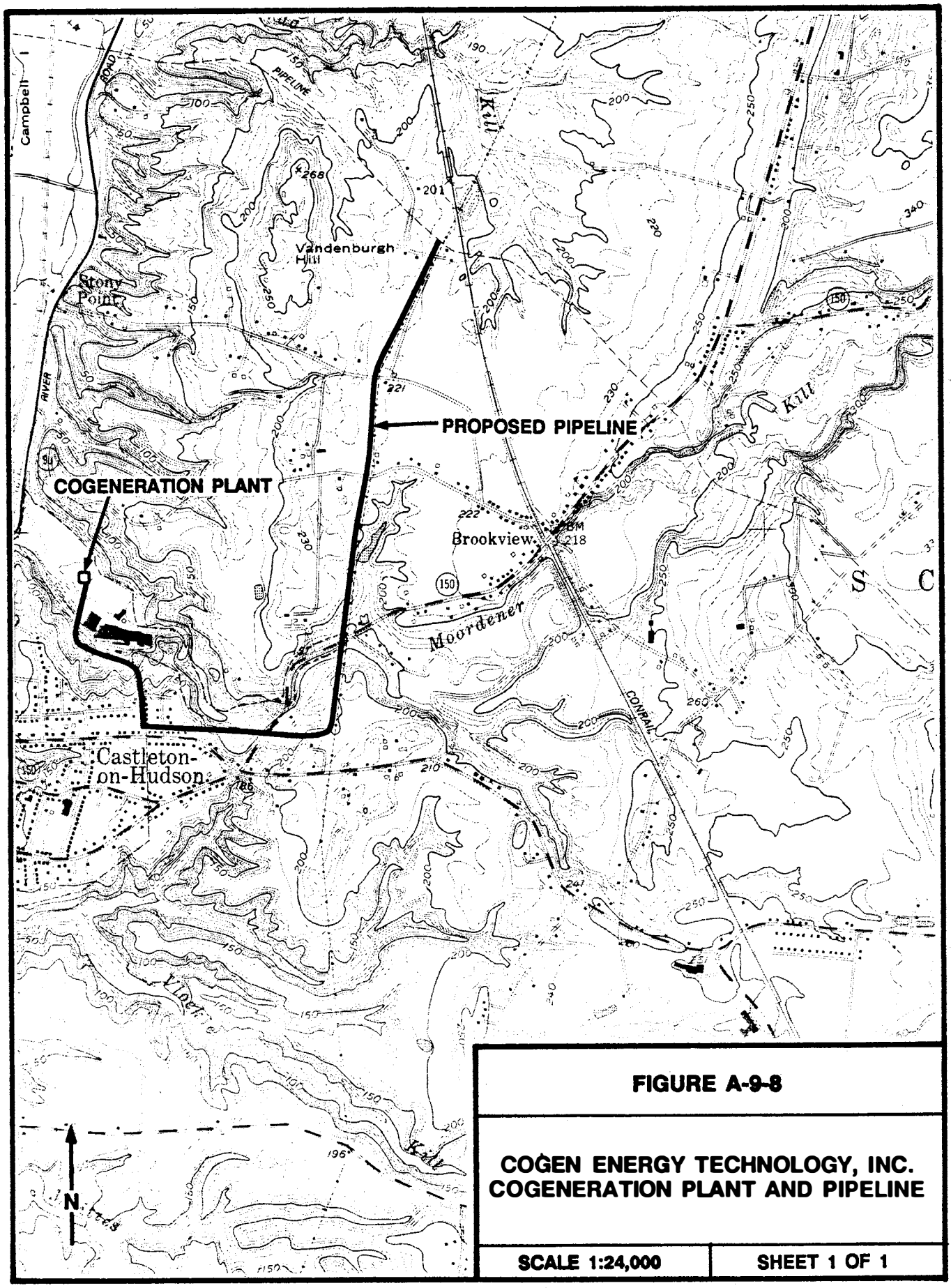


FIGURE A-9-8

COGEN ENERGY TECHNOLOGY, INC.
COGENERATION PLANT AND PIPELINE

SCALE 1:24,000	SHEET 1 OF 1

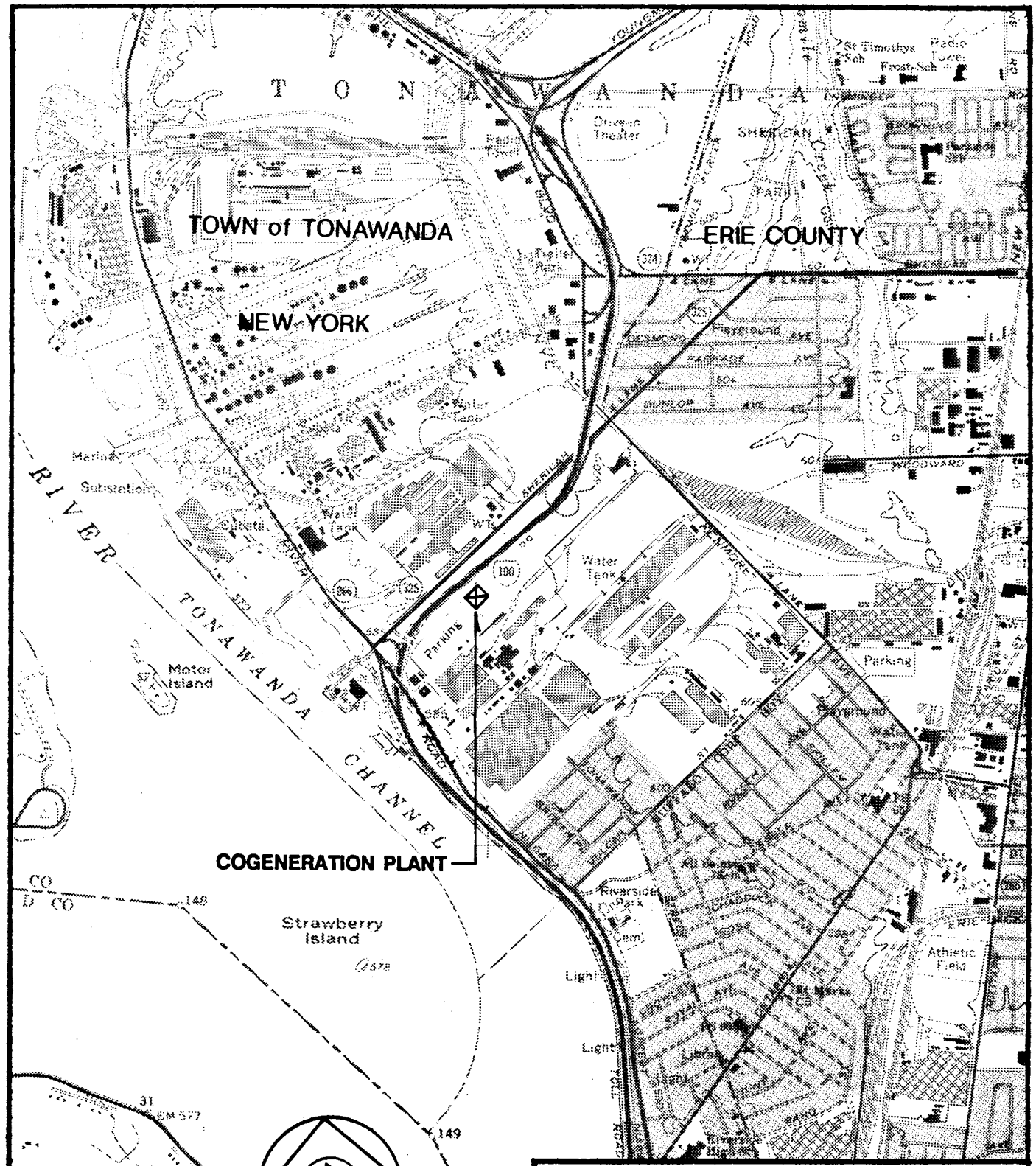


FIGURE A-9-9

INDECK-YERKES SERVICES, INC.
COGENERATION PLANT

SCALE 1:24,000	Sheet 1 of 1

APPENDIX B

ALTERNATIVE FUEL CONSUMPTION AND EMISSION DATA

APPENDIX B-1

APPENDIX B-1

ASSUMPTIONS AND FACTORS USED IN DETERMINING EMISSION CHANGES

This appendix lists the various factors and assumptions used in determining emission changes if the Northeast Settlement Projects are not approved.

One replacement fuel for natural gas in residential, commercial, and industrial sectors is electricity. Consequently, if gas is not available, then electricity consumption would be greater than it would be otherwise. Exhibit B-1 discusses the reasoning and assumptions concerning how such increased electricity consumption would be distributed among generating equipment using various fuels. Exhibit B-2 discusses the split between resistance heating and electric heat pumps in new homes that are assumed to switch to electric heating in the event gas is not available.

Tables 3 through 6 show the details of estimated alternative fuel substitution. Column A shows the projected split among alternative fuels for each sector. Column B apportions the split among different fuel uses. The sums of all values in column B for all type uses equals 1.00. Column C is the efficiency adjustment factor. Column D (the alternate fuel substitution factor) is the multiple of columns B & C. Note that in all cases this adds up to less than 1.00. This is because of the assumption that a portion of the electricity substitution would be supplied by a heat pump, which would yield more energy in the form of heat than the energy it consumes in electricity. Later in the conversion it is necessary to convert the additional amounts of electricity consumed into the primary fuels used to generate the electricity. Close to three Btus of primary fuel will be required for each Btu of electricity generated. When this correction is made, the total Btus of alternate fuels would be greater than the total Btus of the gas they replace. However, that correction does not show in these tables. Note that in the tables in Appendix B-3, the total Btus of alternate fuels always exceed the total Btus of gas replaced.

Tables 7 through 9 list the conversion factors to convert MMBtus of various fuels to emissions pollutants. The factors are based upon maximum allowed limits for each state. To the extent any user installs equipment or uses fuels that emit less pollutants than legally allowed, the computed emissions are over estimated.

EXHIBIT 1

SOURCE OF INCREASED ELECTRICITY IF NORTHEAST PROJECTIONS NOT APPROVED

BASIC ASSUMPTIONS

1. **Nuclear:** Utilities normally run plants with the lowest fuel cost as base load plants. Due to its low fuel cost, any nuclear capacity available in the region would likely be fully utilized whether or not the Northeast pipeline projects are completed. Consequently, the amount of electricity generated by nuclear capacity should not change if the Northeast projects are not approved.

2. **Hydro:** Same as Nuclear. All hydro power available will be utilized in either scenario.

3. **1992:** NERC and EIA both project that the Northeast will still have remaining spare generating capacity in 1992. Consequently, we assumed that the increased generation required to meet demand in the residential, commercial, and industrial sectors that normally would be supplied by gas would be divided among coal, oil, and gas in roughly the same proportion as their relative generation in 1987.

   For the normal projected demand increases in the electric utility sector we assumed that to the extent gas isn't available it would be distributed among other fuels in proportion to their historic relative use. We made an exception in Rhode Island, where planned new generating capacity significantly exceeds existing generating capacity, and where gas is slated to replace #6 fuel oil in an existing facility. In Rhode Island, we assumed that to the extent gas isn't available, #6 fuel oil would continue to be used in that facility as at present and that #2 fuel oil would replace gas for the rest of the increased load. We made the same assumptions in the electric utility sector for 1997 as for 1992.

4. **1997:** Electricity growth in both New England and the Middle Atlantic states will require new generating capacity by 1997. Because short lead times will not allow construction of traditional coal-fired generation, the majority of new units in 1997 will be oil- or gas-fired combined-cycle units. If restrictions on pipeline capacity prevent firm gas sales, necessity will likely require constructing dual-fired plants that can burn gas off-peak and substitute #2 fuel oil during periods that gas isn't available. By 1997 some coal-fired, combined-cycle plants possibly will be competitive. Consequently, we assumed that coal would replace a small portion of the load that can't be met by gas.

   We made an arbitrary assumption concerning cogen fuels, assuming to the extent gas isn't available in 1992 it would be replaced 100% by #2 fuel oil, and in 1997 by 90% #2 fuel oil and 10% coal.

EXHIBIT 2

DISPLACEMENT OF NATURAL GAS FOR SPACE HEATING IN THE NORTHEAST

The Gas Research Institute (GRI) projects the housing stock by system type for the northeast as follows:

	New England		Middle Atlantic	
	1987	Incr. 1995	1987	Incr. 1995
Electric	510	+40	1058	153
Heat Pump	77	+77	191	+259
Resistance	433	-37	867	-106
Gas	1476	+482	6927	+741
Oil	2409	-82	5369	-481
Other	297	+28	590	+47

They also project the efficiency of new electric heat pumps increasing in New England from a COP of 1.66 in 1987 to 2.10 in 1995. If their projections of the increased efficiency of heat pumps is reasonable, then their projection of the growth of heat pumps in the New England region likely is also reasonable.

Energy Information Agency (EIA) data clearly shows that oil has been losing market in the northeast at the expense of the growth of gas heating and electric heating. Gas has not increased annual volumes, but has increased its number of customers. Demand from the new customers has offset the decline in demand from old customers due to conservation and the increased efficiency of new gas furnaces. Electricity has both increased sales and market share.

If gas is unable to supply new customers due to capacity limitations, how will new homes and markets be heated? Also, to the extent that new homes rely on electric heat, to what extent will electric resistance heating be used, and to what extent will heat pumps be used?

For this study it was assumed that if gas isn't available for new connections, that the principal fuels used in place of gas would be #2 fuel oil and electricity. It was assumed they would increase market share in the absence of gas in proportion to their relative growth projected by GRI. It was assumed that 30% of the new electric homes in 1992 would be heating using resistance heaters, and 70% using heat pumps. In 1997 we assumed that only 20% of new homes heated by electricity would use resistance heating and that 80% would use heat pumps.

TABLE 3

ALTERNATE FUEL SUBSTITUTION -- NEW ENGLAND 1992

RESIDENTIAL SECTOR

	Space Heat				Water Heat				Cooking				Drying				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.757				0.17				0.056				0.013			0.996	
Northeast		0.73				0.16				0.1				0.01			1	
Electricity	0.24	0.18	0.58	0.10	0.65	0.10	0.76	0.08	0.95	0.10	0.63	0.06	0.95	0.01	0.833	0.01	0.38	0.248
#2 Fuel Oil	0.60	0.44	1.01	0.44	0.33	0.05	1.07	0.06		0.00		0.00		0.00		0.00	0.49	0.498
LPG	0.02	0.01	1	0.01	0.02	0.00	1	0.00	0.05	0.01	1	0.01	0.05	0.00	1	0.00	0.02	0.023
Coal	0.04	0.03	1.37	0.04		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.040
Wood	0.10	0.07	1.37	0.10		0.00		0.00		0.00		0.00		0.00		0.00	0.07	0.100
Total	1.00	0.73		0.70	1.00	0.16		0.14	1.00	0.10		0.06	1.00	0.01		0.01	1.00	0.910

COMMERCIAL SECTOR

	Space Heat				Water Heat				Other*				Cooling				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.70				0.04				0.25				0.01			1.00	
Northeast		0.71				0.04				0.25				0.00			1.00	
Electricity	0.24	0.17	0.54	0.09	0.75	0.03	0.76	0.02	0.95	0.24	0.73	0.17		0.00		0.00	0.44	0.288
#2 Fuel Oil	0.60	0.43	1.01	0.43	0.25	0.01	1.07	0.01		0.00		0.00		0.00		0.00	0.44	0.440
#6 Fuel Oil	0.08	0.06	1.01	0.06		0.00		0.00		0.00		0.00		0.00		0.00	0.06	0.057
LPG	0.02	0.01	1	0.01		0.00		0.00	0.05	0.01	1	0.01		0.00		0.00	0.03	0.026
Coal	0.04	0.03	1.11	0.03		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.031
Wood	0.02	0.01	1.11	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.71		0.64	1.00	0.04		0.03	1.00	0.25		0.19	0.00	0.00		0.00	1.00	0.860

* Includes cooking (resturants) & drying (laundries).

INDUSTRIAL SECTOR

	Space Heat				Process Steam				Direct Heat				Plant Fuel				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.28				0.41				0.14				0.17			1.00	
Northeast		0.28				0.41				0.14				0.17			1.00	
Electricity	0.20	0.06	0.54	0.03		0.00		0.00	0.20	0.03	0.83	0.02	0.40	0.07	0.36	0.02	0.15	0.077
#2 Fuel Oil	0.45	0.13	1.01	0.13	0.20	0.08	1.03	0.08	0.50	0.07	1.03	0.07	0.50	0.09	1.03	0.09	0.36	0.37
#6 Fuel Oil	0.20	0.06	1.01	0.06	0.40	0.16	1.03	0.17	0.20	0.03	1.11	0.03		0.00		0.00	0.25	0.25
LPG	0.05	0.01	1	0.01		0.00		0.00	0.10	0.01	1	0.01	0.10	0.02	1	0.02	0.05	0.04
Coal	0.05	0.01	1.11	0.02	0.40	0.16	1.11	0.18		0.00		0.00		0.00		0.00	0.18	0.197
Wood	0.05	0.01	1.11	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.28		0.26	1.00	0.41		0.44	1.00	0.14		0.14	1.00	0.17		0.13	1.00	0.96

KEYS:
A -- Allocation Fraction
B -- Use Fraction
C -- Alternate Fuel Adjustment Factor
D -- Alternate Fuel Substitution Fraction

TABLE 4

ALTERNATE FUEL SUBSTITUTION -- NEW ENGLAND 1997

RESIDENTIAL SECTOR

	Space Heat				Water Heat				Cooking				Drying				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.757				0.17				0.056				0.013			0.996	
Northeast		0.73				0.16				0.1				0.01			1	
Electricity	0.24	0.18	0.53	0.09	0.65	0.10	0.76	0.08	0.95	0.10	0.63	0.06	0.95	0.01	0.833	0.01	0.38	0.239
#2 Fuel Oil	0.60	0.44	1.05	0.46	0.33	0.05	1.07	0.06		0.00		0.00		0.00		0.00	0.49	0.516
LPG	0.02	0.01	1	0.01	0.02	0.00	1	0.00	0.05	0.01	1	0.01	0.05	0.00	1	0.00	0.02	0.023
Coal	0.04	0.03	1.42	0.04		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.041
Wood	0.10	0.07	1.42	0.10		0.00		0.00		0.00		0.00		0.00		0.00	0.07	0.103
Total	1.00	0.73		0.71	1.00	0.16		0.14	1.00	0.10		0.06	1.00	0.01		0.01	1.00	0.924

COMMERCIAL SECTOR

	Space Heat				Water Heat				Other*				Cooling				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.70				0.04				0.25				0.01			1.00	
Northeast		0.71				0.04				0.25				0.00			1.00	
Electricity	0.24	0.17	0.48	0.08	0.75	0.03	0.76	0.02	0.95	0.24	0.73	0.17		0.00		0.00	0.44	0.277
#2 Fuel Oil	0.60	0.43	1.01	0.43	0.25	0.01	1.07	0.01		0.00		0.00		0.00		0.00	0.44	0.446
#6 Fuel Oil	0.08	0.06	1.01	0.06		0.00		0.00		0.00		0.00		0.00		0.00	0.06	0.057
LPG	0.02	0.01	1	0.01		0.00		0.00	0.05	0.01	1	0.01		0.00		0.00	0.03	0.026
Coal	0.04	0.03	1.14	0.03		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.032
Wood	0.02	0.01	1.14	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.016
Total	1.00	0.71		0.63	1.00	0.04		0.03	1.00	0.25		0.19	0.00	0.00		0.00	1.00	0.851

* Includes cooking (resturants) & drying (laundries).

INDUSTRIAL SECTOR

	Space Heat				Process Steam				Direct Heat				Plant Fuel				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.28				0.41				0.14				0.17			1.00	
Northeast		0.28				0.41				0.14				0.17			1.00	
Electricity	0.20	0.06	0.48	0.03		0.00		0.00	0.20	0.03	0.83	0.02	0.40	0.07	0.36	0.02	0.15	0.074
#2 Fuel Oil	0.45	0.13	1.01	0.13	0.20	0.08	1.03	0.08	0.50	0.07	1.03	0.07	0.50	0.09	1.03	0.09	0.36	0.371
#6 Fuel Oil	0.20	0.06	1.01	0.06	0.40	0.16	1.03	0.17	0.20	0.03	1.11	0.03		0.00		0.00	0.25	0.256
LPG	0.05	0.01	1	0.01		0.00		0.00	0.10	0.01	1	0.01	0.10	0.02	1	0.02	0.05	0.045
Coal	0.05	0.01	1.14	0.02	0.40	0.16	1.11	0.18		0.00		0.00		0.00		0.00	0.18	0.198
Wood	0.05	0.01	1.14	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.28		0.26	1.00	0.41		0.44	1.00	0.14		0.14	1.00	0.17		0.13	1.00	0.961

KEYS:
A -- Allocation Fraction
B -- Use Fraction
C -- Alternate Fuel Adjustment Factor
D -- Alternate Fuel Substitution Fraction

TABLE 5

ALTERNATE FUEL SUBSTITUTION -- MIDDLE ATLANTIC STATES 1992

RESIDENTIAL SECTOR

	Space Heat				Water Heat				Cooking				Drying				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.757				0.17				0.056				0.013			0.996	
Northeast		0.73				0.16				0.1				0.01			1	
Electricity	0.24	0.18	0.5	0.09	0.65	0.10	0.76	0.08	0.95	0.10	0.63	0.06	0.95	0.01	0.833	0.01	0.38	0.234
#2 Fuel Oil	0.60	0.44	1	0.44	0.33	0.05	1.07	0.06		0.00		0.00		0.00		0.00	0.49	0.494
LPG	0.02	0.01	1	0.01	0.02	0.00	1	0.00	0.05	0.01	1	0.01	0.05	0.00	1	0.00	0.02	0.023
Coal	0.04	0.03	1.33	0.04		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.038
Wood	0.10	0.07	1.33	0.10		0.00		0.00		0.00		0.00		0.00		0.00	0.07	0.097
Total	1.00	0.73		0.68	1.00	0.16		0.14	1.00	0.10		0.06	1.00	0.01		0.01	1.00	0.888

COMMERCIAL SECTOR

	Space Heat				Water Heat				Other*				Cooling				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.70				0.04				0.25				0.01			1.00	
Northeast		0.71				0.04				0.25				0.00			1.00	
Electricity	0.24	0.17	0.51	0.09	0.75	0.03	0.76	0.02	0.95	0.24	0.73	0.17		0.00		0.00	0.44	0.283
#2 Fuel Oil	0.60	0.43	1.01	0.43	0.25	0.01	1.07	0.01		0.00		0.00		0.00		0.00	0.44	0.440
#6 Fuel Oil	0.08	0.06	1.01	0.06		0.00		0.00		0.00		0.00		0.00		0.00	0.06	0.057
LPG	0.02	0.01	1	0.01		0.00		0.00	0.05	0.01	1	0.01		0.00		0.00	0.03	0.026
Coal	0.04	0.03	1.11	0.03		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.031
Wood	0.02	0.01	1.11	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.71		0.64	1.00	0.04		0.03	1.00	0.25		0.19	0.00	0.00		0.00	1.00	0.855

* Includes cooking (resturants) & drying (laundries).

INDUSTRIAL SECTOR

	Space Heat				Process Steam				Direct Heat				Plant Fuel				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.28				0.41				0.14				0.17			1.00	
Northeast		0.28				0.41				0.14				0.17			1.00	
Electricity	0.20	0.06	0.51	0.03		0.00		0.00	0.20	0.03	0.83	0.02	0.40	0.07	0.36	0.02	0.15	0.076
#2 Fuel Oil	0.45	0.13	1.01	0.13	0.20	0.08	1.03	0.08	0.50	0.07	1.03	0.07	0.50	0.09	1.03	0.09	0.36	0.371
#6 Fuel Oil	0.20	0.06	1.01	0.06	0.40	0.16	1.03	0.17	0.20	0.03	1.11	0.03		0.00		0.00	0.25	0.256
LPG	0.05	0.01	1	0.01		0.00		0.00	0.10	0.01	1	0.01	0.10	0.02	1	0.02	0.05	0.045
Coal	0.05	0.01	1.11	0.02	0.40	0.16	1.11	0.18		0.00		0.00		0.00		0.00	0.18	0.197
Wood	0.05	0.01	1.11	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.28		0.26	1.00	0.41		0.44	1.00	0.14		0.14	1.00	0.17		0.13	1.00	0.962

KEYS:
A -- Allocation Fraction
B -- Use Fraction
C -- Alternate Fuel Adjustment Factor
D -- Alternate Fuel Substitution Fraction

TABLE 6

ALTERNATE FUEL SUBSTITUTION -- MIDDLE ATLANTIC STATES 1997

RESIDENTIAL SECTOR

	Space Heat				Water Heat				Cooking				Drying				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.757				0.17				0.056				0.013			0.996	
Northeast		0.73				0.16				0.1				0.01			1	
Electricity	0.24	0.18	0.45	0.08	0.65	0.10	0.76	0.08	0.95	0.10	0.63	0.06	0.95	0.01	0.833	0.01	0.38	0.225
#2 Fuel Oil	0.60	0.44	1.03	0.45	0.33	0.05	1.07	0.06		0.00		0.00		0.00		0.00	0.49	0.507
LPG	0.02	0.01	1	0.01	0.02	0.00	1	0.00	0.05	0.01	1	0.01	0.05	0.00	1	0.00	0.02	0.023
Coal	0.04	0.03	1.37	0.04		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.040
Wood	0.10	0.07	1.37	0.10		0.00		0.00		0.00		0.00		0.00		0.00	0.07	0.100
Total	1.00	0.73		0.68	1.00	0.16		0.14	1.00	0.10		0.06	1.00	0.01		0.01	1.00	0.896

COMMERCIAL SECTOR

	Space Heat				Water Heat				Other*				Cooling				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.70				0.04				0.25				0.01			1.00	
Northeast		0.71				0.04				0.25				0.00			1.00	
Electricity	0.24	0.17	0.48	0.08	0.75	0.03	0.76	0.02	0.95	0.24	0.73	0.17		0.00		0.00	0.44	0.277
#2 Fuel Oil	0.60	0.43	1.01	0.43	0.25	0.01	1.07	0.01		0.00		0.00		0.00		0.00	0.44	0.440
#6 Fuel Oil	0.08	0.06	1.01	0.06		0.00		0.00		0.00		0.00		0.00		0.00	0.06	0.057
LPG	0.02	0.01	1	0.01		0.00		0.00	0.05	0.01	1	0.01		0.00		0.00	0.03	0.026
Coal	0.04	0.03	1.14	0.03		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.032
Wood	0.02	0.01	1.14	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.016
Total	1.00	0.71		0.63	1.00	0.04		0.03	1.00	0.25		0.19	0.00	0.00		0.00	1.00	0.851

* Includes cooking (resturants) & drying (laundries).

INDUSTRIAL SECTOR

	Space Heat				Process Steam				Direct Heat				Plant Fuel				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.28				0.41				0.14				0.17			1.00	
Northeast		0.28				0.41				0.14				0.17			1.00	
Electricity	0.20	0.06	0.48	0.03		0.00		0.00	0.20	0.03	0.83	0.02	0.40	0.07	0.36	0.02	0.15	0.074
#2 Fuel Oil	0.45	0.13	1.01	0.13	0.20	0.08	1.03	0.08	0.50	0.07	1.03	0.07	0.50	0.09	1.03	0.09	0.36	0.371
#6 Fuel Oil	0.20	0.06	1.01	0.06	0.40	0.16	1.03	0.17	0.20	0.03	1.11	0.03		0.00		0.00	0.25	0.256
LPG	0.05	0.01	1	0.01		0.00		0.00	0.10	0.01	1	0.01	0.10	0.02	1	0.02	0.05	0.045
Coal	0.05	0.01	1.14	0.02	0.40	0.16	1.11	0.18		0.00		0.00		0.00		0.00	0.18	0.198
Wood	0.05	0.01	1.14	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.28		0.26	1.00	0.41		0.44	1.00	0.14		0.14	1.00	0.17		0.13	1.00	0.961

KEYS:
A -- Allocation Fraction
B -- Use Fraction
C -- Alternate Fuel Adjustment Factor
D -- Alternate Fuel Substitution Fraction

TABLE 7

NORTHEAST ALTERNATE ENERGY STUDY
STATE NOX EMISSION FACTORS (LB/MMBTU)

MARKET SECTOR & Type Fuel	CN	MA	NH	NJ	NY	PA	RI	VT
RESIDENTIAL								
Natural Gas	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128
Coal	0.353	0.353	0.353	0.353	0.353	0.353	0.353	0.353
Wood	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
LPG	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102
COMMERCIAL								
Natural Gas	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136
#6 Fuel Oil	0.300	0.407	0.407	0.407	0.407	0.407	0.407	0.407
Coal	0.256	0.256	0.256	0.256	0.256	0.256	0.256	0.256
Wood	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
LPG	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092
INDUSTRIAL								
Natural Gas	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
#6 Fuel Oil	0.300	0.400	0.400	0.400	0.400	0.400	0.400	0.400
Coal	0.580	0.580	0.580	0.580	0.580	0.580	0.580	0.580
Wood	0.156	0.156	0.156	0.156	0.156	0.156	0.156	0.156
LPG	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
ELECTRIC UTILITY								
Additional Generating Load from Electricity Replacing Gas								
Natural Gas	0.200	0.200	0.200	0.200	0.200	0.200	0.164	0.200
#2 Fuel Oil	0.300	0.300	0.300	0.300	0.300	0.300	0.180	0.300
#6 Fuel Oil	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Coal	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600
Electrical Imports	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Normal Load								
Natural Gas	0.200	0.200	0.200	0.200	0.200	0.200	0.164	0.200
#2 Fuel Oil	0.300	0.300	0.300	0.300	0.300	0.300	0.180	0.300
#6 Fuel Oil	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Coal	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600
Nuclear	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hydro	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
COGENERATION								
Natural Gas	0.280	0.280	0.280	0.280	0.280	0.280	0.280	0.280
#2 Fuel Oil	0.410	0.410	0.410	0.410	0.410	0.410	0.410	0.410
Residual Fuel Oil	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Coal	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600

TABLE 8

NORTHEAST ALTERNATE ENERGY STUDY
STATE SO2 EMISSION FACTORS (LB/MMBTU)

MARKET SECTOR & Type Fuel	CN	MA	NH	NJ	NY	PA	RI	VT
RESIDENTIAL								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Electricity	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
#2 Fuel Oil	0.5200	0.3400	0.4100	0.2060	0.3800	0.3090	0.5200	0.5200
Coal	1.1900	1.1000	1.5000	0.2380	0.2380	3.0000	0.5500	2.3800
Wood	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
LPG	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
COMMERCIAL								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Electricity	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
#2 Fuel Oil	0.5200	0.3400	0.4100	0.2060	0.3800	0.3090	0.5200	0.5200
#6 Fuel Oil	1.0600	1.1000	2.1200	0.3180	0.3900	2.1200	1.0600	2.1200
Coal	1.5000	1.1000	1.5000	0.3000	0.3000	3.0000	0.5500	3.0000
Wood	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080
LPG	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
INDUSTRIAL								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Electricity	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
#2 Fuel Oil	0.5200	0.3400	0.4100	0.2060	0.3800	0.5200	0.5200	0.5200
#6 Fuel Oil	0.8000	0.8000	0.8000	0.3180	0.3900	0.8000	0.8000	0.8000
Coal	1.1000	1.1000	1.2000	0.3000	0.3000	1.2000	0.5500	1.2000
Wood	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080
LPG	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
ELECTRIC UTILITY								
Additional Generating Load from Electricity Replacing Gas								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.2000	0.0006	0.0006
#2 Fuel Oil	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000
#6 Fuel Oil	0.8000	1.1000	0.8000	0.3180	0.3900	0.8000	1.0600	0.8000
Coal	1.1000	1.1000	1.2000	0.3000	0.3000	1.2000	1.2000	1.2000
Electrical Imports	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Normal Load								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.2000	0.0006	0.0006
#2 Fuel Oil	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000
#6 Fuel Oil	0.8000	1.1000	0.8000	0.3180	0.3900	0.8000	1.0600	0.8000
Coal	1.1000	1.1000	1.2000	0.3000	0.3000	1.2000	1.2000	1.2000
Nuclear	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hydro	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
COGENERATION								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
#2 Fuel Oil	0.5000	0.3400	0.4000	0.2000	0.3700	0.3000	0.5000	0.5000
Residual Fuel Oil	0.8000	0.8000	0.8000	0.3180	0.3900	0.8000	0.8000	0.8000
Coal	1.1000	1.1000	1.2000	0.3000	0.3000	1.2000	1.2000	1.2000

TABLE 9

NORTHEAST ALTERNATE ENERGY STUDY
STATE TSP EMISSION FACTORS (LB/MMBTU)

MARKET SECTOR & Type Fuel	CN	MA	NH	NJ	NY	PA	RI	VT
RESIDENTIAL								
Natural Gas	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
Coal	0.200	0.580	0.300	0.580	0.580	0.580	0.580	0.500
Wood	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130
LPG	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
COMMERCIAL								
Natural Gas	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
#6 Fuel Oil	0.087	0.087	0.154	0.040	0.045	0.154	0.087	0.154
Coal	0.200	0.100	0.300	0.380	0.380	0.380	0.380	0.380
Wood	0.200	0.100	0.300	0.600	0.600	0.400	0.780	0.270
LPG	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
INDUSTRIAL								
Natural Gas	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
#6 Fuel Oil	0.087	0.087	0.100	0.040	0.045	0.100	0.087	0.100
Coal	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Wood	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
LPG	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019
ELECTRIC UTILITY								
Additional Generating Load from Electricity Replacing Gas								
Natural Gas	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
#2 Fuel Oil	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
#6 Fuel Oil	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Coal	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Electrical Imports	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Normal Load								
Natural Gas	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
#2 Fuel Oil	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
#6 Fuel Oil	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Coal	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Nuclear	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hydro	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
COGENERATION								
Natural Gas	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
#2 Fuel Oil	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036
Residual Fuel Oil	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Coal	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030

APPENDIX B-2

APPENDIX B-2

Determination of Northeast Gas Demand

The calculation of gas demand in the Northeast states follows several steps, described in the following discussion.

Step 1

In response to the Commission's March 1988 data request, various operators filed projections of anticipated increased demand contingent upon new pipeline capacity to the Northeast. Both peak-day and annual volumes were projected through the year 1997 for each state in the region for pipeline sales to electric utilities, cogenerators, and local distribution companies (LDCs). LDC demand was projected for the residential, commercial, industrial, electric utility, and cogeneration sectors.

The available data for settlements and for authorized discrete projects included only peak-day increases, with no allocation of LDC sales by market sector or projected annual volumes. The settlement data also differed materially from the filed data in how it was distributed among sales to electric utilities, cogenerators, and LDCs.

Table 10 shows the March 1988 data for the 1997 forecast year along with the settlement data, broken out by market sector (as defined by each set of data) and by state. For each settlement market sector (LDC, cogeneration and electric generation) for each state, a ratio is determined between the settlement volumes (including previously authorized projects) and the March 1988 forecasted volumes.

Step 2

The ratios from Step 1 are multiplied by the March 1988 forecasts for annual flow increases for each market sector (including the LDC breakdown), for each state and for each forecast year to obtain "adjusted growth projections," the results of which are shown in Table 11.

The results in Table 11 are not used further in the calculations, but represent projected annual demand (not peak day demand) as defined by the overall settlement volumes only.

All remaining calculations in this Appendix are performed for each market sector, for each state and for each forecast year as shown on Table 11.

Step 3

The ratios from Step 1 are multiplied by the March 1988 forecasts for peak flow increases, to obtain a forecast for adjusted peak day increases. The results of this calculation are not shown on a table.

Step 4

The volumes for previously approved projects are subtracted from the adjusted peak day increases from Step 3. The amounts to subtract for each LDC category are determined by prorating the volumes according the breakdown within the March 1988 data for each state and forecast year, since these amounts are not explicitly available in the data for approved projects. The result of this calculation is the forecast for net peak day growth, and is not shown in a table.

Step 5

Growth load factors are determined for each market sector, forecast year and state and multiplied by their respective results from Step 4. The growth load factor for a given category is the ratio of the increase in annual volume to the increase in annualized peak day volume for that category. The result of this calculation is the forecast for settlement growth, and is not shown on a table.

Step 6

The company use and unaccounted-for amounts are removed from the results of Step 5 to obtain the 100% replacement projection, which is shown in Table 12.

This result represents gas that would need to be replaced if the settlement projects are not completed and there is 100% replacement of the projected gas volumes.

Step 7

Each amount from Step 6 (Table 12) is multiplied by its appropriate AGA partial replacement factor to obtain the "Partial Replacement Projection," shown in Table 13.

This result represents projected volumes of gas that would need to be replaced by alternate fuels if some of the anticipated increased demand can be met with gas flowing through existing pipelines off-peak when there is spare capacity. It represents demand that would most likely have to be replaced if the settlement projects are not approved.

TABLE 10

FILED PEAK DAY INCREASES -- MARCH 1988 DATA

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST	MAtl.	NE
RESIDENTIAL	119	43	41	505	390	49	25	12	1184	944	240
COMMERCIAL	55	75	12	171	119	36	16	8	492	326	166
INDUSTRIAL	22	12	1	27	21	0	0	20	103	48	55
ELECTRIC UTIL	56	0	0	2	0	0	0	0	58	2	56
COGENERATION	17	12	0	2	0	10	0	12	53	12	41
COMPANY USE	1	2	0	-1	11	1	2	1	17	11	6
TOTAL LDC	270	144	54	706	541	96	43	53	1907	1343	564
DIRECT EU	0	240	0	0	0	0	50	0	290	0	290
DIRECT COGEN	26	217	0	82	73	22	15	0	435	177	258
NON-LDC	26	457	0	82	73	22	65	0	725	177	548
TOTAL	296	601	54	788	614	118	108	53	2632	1520	1112

SETTLEMENT PEAK DAY INCREASES (11/21/88 AND 1/17/89 FILINGS)

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST		MAtl.	NE
SETTLEMENT												
LDC	144	91	4	206	280	28	1		754		514	240
EU		95					145		240		0	240
COGEN		145		102	218		13		478		320	158
SUB-TOTAL	144	331	4	308	498	28	159	0	1471		833	638
UNDESIGNATED					30				30	[1]	30	0
SYSTEM SUPPLY					39				39	[2]	39	0
TOTAL	144	331	4	308	566	28	159	0	1540		902	638
AUTHORIZED OTHER NORTHEAST PROJECTS												
LDC	8	122	11	233	329	29	85		817		592	226
EU		22					50		72		0	72
COGEN				3		15			18		18	0
SUB-TOTAL	8	144	11	236	329	44	135	0	907		610	298
UNDESIGNATED	70	30	40				10		150	[3]	0	150
SYSTEM SUPPLY		3		180	44	2	1		230	[4]	226	4
CAP. RESTORATION					60				60	[4]	60	0
TOTAL	78	177	51	416	433	46	146	0	1347		896	452
TOTAL SETT & AUTH	222	508	55	724	999	74	305	0	2887		1797	1090
ALLOCATION												
LDC	222	246	55	620	782	59	97	0	2080		1460	620
EU	0	117	0	0	0	0	195	0	312		0	312
COGEN	0	145	0	105	218	15	13	0	496		338	158
RELATIVE TO FILING												
LDC	0.822	1.710	1.015	0.877	1.445	0.610	2.253	0.000	1.091		1.087	1.099
EU	0.000	0.486	0.000	0.000	0.000	0.000	3.900	0.000	1.075		1.000	1.075
COGEN	0.000	0.668	0.000	1.279	2.985	0.682	0.853	0.000	1.139		1.908	0.612

ADJUSTED PEAK DAY INCREASES

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST	MAtl.	NE
RESIDENTIAL	98	74	42	443	563	30	56	0	1306	1036	269
COMMERCIAL	45	128	12	150	172	22	36	0	566	344	222
INDUSTRIAL	18	21	1	24	30	0	0	0	94	54	40
ELECTRIC UTIL	46	0	0	2	0	0	0	0	48	2	46
COGENERATION	14	21	0	2	0	6	0	0	42	8	35
COMPANY USE	1	3	0	-1	16	1	5	0	24	16	9
TOTAL LDC	222	246	55	620	782	59	97	0	2080	1460	620
DIRECT EU	0	117	0	0	0	0	195	0	312	0	312
DIRECT COGEN	0	145	0	105	218	15	13	0	496	338	158
NON-LDC	0	262	0	105	218	15	208	0	807	338	470
TOTAL	222	508	55	724	999	74	305	0	2887	1797	1089

NOTES:
[1] 30 MMcfd settlement undesignated allocated to New York.
[2] 39 MMcfd settlement system supply allocated to New York.
[3] 150 MMcfd authorized undesignated allocated to New England states as shown.
[4] 290 MMCF/d authorized system supply and capacity restoration allocated in accordance with Table 1, FERC APEC Project Environmental Assessment (excluding APEC I Capacity Restoration Project).

TABLE 11

ADJUSTED GROWTH PROJECTIONS

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST	MAtl.	NE
RESIDENTIAL											
88-89	632	6937	160	5031	5728	225	890	0	19604	10984	8620
89-90	1634	7406	334	10647	12139	563	1641	0	34364	23349	11014
90-91	2410	7326	647	16197	21381	921	2391	0	51273	38499	12774
91-92	3568	7993	908	21592	28616	1298	3144	0	67119	51506	15613
96-97	8559	9929	2373	45191	58978	3109	6855	0	134995	107278	27716
COMMERCIAL											
88-89	-483	4615	200	2073	3279	162	480	0	10326	5514	4812
89-90	-801	6734	455	3928	6639	438	960	0	18353	11005	7348
90-91	4924	7993	707	5900	10103	715	1440	0	31783	16719	15064
91-92	5972	9500	976	7892	14539	993	1920	0	41792	23425	18368
96-97	8422	16572	2579	18420	33869	2172	4293	0	86327	54461	31866
INDUSTRIAL											
88-89	-544	901	2	793	747	564	0	0	2463	2104	359
89-90	298	1115	6	1228	1296	564	0	0	4506	3087	1419
90-91	3096	1242	11	1638	2831	564	0	0	9383	5034	4349
91-92	3640	1392	15	2254	3357	564	0	0	11223	6175	5047
96-97	3582	1919	45	2260	5384	564	0	0	13754	8208	5545
ELECTRIC UTILITIES											
88-89	572	-18526	0	142	-2210	0	0	0	-20021	-2068	-17953
89-90	265	-18527	0	4287	146	0	4836	0	-8993	4433	-13426
90-91	19609	-18526	0	4494	11116	0	5656	0	22349	15609	6740
91-92	19304	-18526	0	4705	11267	0	5974	0	22725	15973	6753
96-97	14585	-18526	0	5843	28869	0	5974	0	36746	34712	2034
COGENERATION											
88-89	33	765	0	19386	39	191	0	0	20414	19616	797
89-90	2782	2738	0	38074	413	401	2682	0	47090	38888	8202
90-91	5504	3221	0	47347	2339	2560	10231	0	71201	52246	18956
91-92	5815	5285	0	51280	2901	2560	14839	0	82680	56741	25939
96-97	6716	10859	0	61561	3792	2560	50911	0	136399	67913	68486
COMPANY USED AND UNACCOUNTED FOR											
88-89	153	7522	-100	132	1047	-352	419	0	8821	827	7994
89-90	179	7536	-70	1283	1619	-345	7	0	10209	2557	7652
90-91	1273	7563	-51	1318	2379	-323	72	0	12232	3374	8858
91-92	839	7582	-63	1594	2827	-317	142	0	12604	4103	8501
96-97	-40	7818	80	2863	4082	-294	552	0	15062	6652	8410
TOTAL LDCs											
88-89	363	2215	262	27557	8630	790	1789	0	41607	36977	4630
89-90	4356	7002	725	59447	22252	1621	10125	0	105528	83320	22208
90-91	36817	8819	1315	76894	50149	4438	19790	0	198222	131481	66741
91-92	39139	13227	1837	89317	63508	5098	26019	0	238143	157922	80221
96-97	41824	28573	5076	136139	134974	8112	68585	0	423283	279225	144058
DIRECT ELECTRIC UTILITIES											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	71175	0	71175	0	71175
90-91	0	0	0	0	0	0	71175	0	71175	0	71175
91-92	0	16851	0	0	0	0	71175	0	88026	0	88026
96-97	0	33703	0	0	0	0	71175	0	104878	0	104878
DIRECT COGENERATION											
88-89	0	973	0	0	0	5475	90	0	6538	5475	1063
89-90	0	8244	0	12469	22563	5475	550	0	49300	40507	8793
90-91	0	36888	0	38163	28384	5475	3580	0	112490	72022	40468
91-92	0	39276	0	38163	45953	5475	4188	0	133056	89591	43464
96-97	0	39276	0	38163	55956	5475	4188	0	143058	99594	43464
TOTAL - ALL CATEGORIES											
88-89	363	3188	262	27557	8630	6265	1879	0	48144	42452	5692
89-90	4356	15246	725	71916	44815	7096	81849	0	226003	123827	102176
90-91	36817	45707	1315	115057	78533	9913	94545	0	381887	203503	178384
91-92	39139	69354	1837	127480	109461	10573	101382	0	459225	247514	211712
96-97	41824	101552	5076	174302	190930	13587	143948	0	671219	378819	292400

TABLE 12

100% REPLACEMENT PROJECTION

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST	MAtl.	NE
RESIDENTIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	896	0	0	0	0	0	0	0	896	0	896
91-92	1589	0	0	0	0	0	0	0	1589	0	1589
96-97	5552	3672	173	15049	26278	1465	71	0	52260	42791	9468
COMMERCIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	1831	0	0	0	0	0	0	0	1831	0	1831
91-92	2659	0	0	0	0	4	0	0	2663	4	2659
96-97	5463	6130	188	6134	15090	1023	44	0	34072	22247	11825
INDUSTRIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	1151	0	0	0	0	0	0	0	1151	0	1151
91-92	1621	0	0	0	0	0	0	0	1621	0	1621
96-97	2323	710	3	753	2399	0	0	0	6188	3152	3036
ELECTRIC UTILITIES											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	7290	0	0	0	0	0	0	0	7290	0	7290
91-92	8595	0	0	0	0	0	0	0	8595	0	8595
96-97	9461	0	0	1946	0	0	0	0	11407	1946	9461
COGENERATION											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	2046	0	0	0	0	0	0	0	2046	0	2046
91-92	2589	0	0	0	0	11	0	0	2600	11	2589
96-97	4356	4017	0	20501	0	1206	0	0	30079	21706	8373
COMPANY USED AND UNACCOUNTED FOR											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	0	0	0	0	0	0	0	0	0	0	0
91-92	0	0	0	0	0	0	0	0	0	0	0
96-97	0	0	0	0	0	0	0	0	0	0	0
TOTAL LDCs											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	13214	0	0	0	0	0	0	0	13214	0	13214
91-92	17052	0	0	0	0	15	0	0	17067	15	17052
96-97	27155	14529	365	44382	43767	3693	115	0	134006	91842	42163
DIRECT ELECTRIC UTILITIES											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	52925	0	52925	0	52925
90-91	0	0	0	0	0	0	52925	0	52925	0	52925
91-92	0	10585	0	0	0	0	52925	0	63510	0	63510
96-97	0	27436	0	0	0	0	52925	0	80361	0	80361
DIRECT COGENERATION											
88-89	0	973	0	0	0	0	90	0	1063	0	1063
89-90	0	8244	0	11461	22563	0	550	0	42817	34024	8793
90-91	0	36888	0	37072	28384	0	3580	0	105923	65455	40468
91-92	0	39276	0	37072	45953	0	4188	0	126489	83025	43464
96-97	0	39276	0	37072	55956	0	4188	0	136492	93027	43464
TOTAL - ALL CATEGORIES											
88-89	0	973	0	0	0	0	90	0	1063	0	1063
89-90	0	8244	0	11461	22563	0	53475	0	95742	34024	61718
90-91	13214	36888	0	37072	28384	0	56505	0	172062	65455	106606
91-92	17052	49861	0	37072	45953	15	57113	0	207066	83040	124026
96-97	27155	81241	365	81454	99723	3693	57228	0	350859	184870	165989

TABLE 13

PARTIAL REPLACEMENT PROJECTION

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST	MAtl.	NE
RESIDENTIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	806	0	0	0	0	0	0	0	806	0	806
91-92	1430	0	0	0	0	0	0	0	1430	0	1430
96-97	4997	3305	156	13544	23650	1318	64	0	47034	38512	8522
COMMERCIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	1648	0	0	0	0	0	0	0	1648	0	1648
91-92	2393	0	0	0	0	4	0	0	2397	4	2393
96-97	4917	5517	169	5521	13581	921	40	0	30665	20023	10643
INDUSTRIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	576	0	0	0	0	0	0	0	576	0	576
91-92	810	0	0	0	0	0	0	0	810	0	810
96-97	1162	355	2	376	1199	0	0	0	3094	1576	1518
ELECTRIC UTILITIES											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	1822	0	0	0	0	0	0	0	1822	0	1822
91-92	2149	0	0	0	0	0	0	0	2149	0	2149
96-97	2365	0	0	486	0	0	0	0	2852	486	2365
COGENERATION											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	512	0	0	0	0	0	0	0	512	0	512
91-92	647	0	0	0	0	3	0	0	650	3	647
96-97	1089	1004	0	5125	0	301	0	0	7520	5427	2093
COMPANY USED AND UNACCOUNTED FOR											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	0	0	0	0	0	0	0	0	0	0	0
91-92	0	0	0	0	0	0	0	0	0	0	0
96-97	0	0	0	0	0	0	0	0	0	0	0
TOTAL LDCs											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	5363	0	0	0	0	0	0	0	5363	0	5363
91-92	7429	0	0	0	0	6	0	0	7436	6	7429
96-97	14529	10181	327	25053	38431	2540	104	0	91164	66024	25141
DIRECT ELECTRIC UTILITIES											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	13231	0	13231	0	13231
90-91	0	0	0	0	0	0	13231	0	13231	0	13231
91-92	0	2646	0	0	0	0	13231	0	15877	0	15877
96-97	0	6859	0	0	0	0	13231	0	20090	0	20090
DIRECT COGENERATION											
88-89	0	243	0	0	0	0	22	0	266	0	266
89-90	0	2061	0	2865	5641	0	137	0	10704	8506	2198
90-91	0	9222	0	9268	7096	0	895	0	26481	16364	10117
91-92	0	9819	0	9268	11488	0	1047	0	31622	20756	10866
96-97	0	9819	0	9268	13989	0	1047	0	34123	23257	10866
TOTAL - ALL CATEGORIES											
88-89	0	243	0	0	0	0	22	0	266	0	266
89-90	0	2061	0	2865	5641	0	13369	0	23935	8506	15430
90-91	5363	9222	0	9268	7096	0	14126	0	45076	16364	28712
91-92	7429	12465	0	9268	11488	6	14278	0	54935	20763	34173
96-97	14529	26859	327	34321	52420	2540	14382	0	145378	89281	56097

APPENDIX B-3

TABLE 14

NORTHEAST U.S. 100% REPLACEMENT CASE

MARKET SECTOR & Type Fuel	1986 ENERGY DEMAND (MDth)	1992 DEMAND INCR. (MDth) W NEP	1992 DEMAND INCR. (MDth) W/O NEP	1992 EMISSION INCR. (Ton/yr) NOx	1992 EMISSION INCR. (Ton/yr) SO2	1992 EMISSION INCR. (Ton/yr) PM	1997 DEMAND INCR. (MDth) W NEP	1997 DEMAND INCR. (MDth) W/O NEP	1997 EMISSION INCR. (Ton/yr) NOx	1997 EMISSION INCR. (Ton/yr) SO2	1997 EMISSION INCR. (Ton/yr) PM
RESIDENTIAL											
Natural Gas	936800	1589	0	-81	-0	-12	52260	0	-2665	-16	-392
Electricity	394700	0	395 ▒	0	0	0	0	11925 ▒	0	0	0
#2 Fuel Oil	652900	0	793	51	206	7	0	26612	1703	4532	240
Coal	25500	0	64	11	38	6	0	2104	371	512	566
Wood	182700	0	159	1	1	10	0	5261	21	18	342
LPG	37400	0	37	2	0	0	0	1218	62	0	12
Subtotal	2230000	1589	1447	-17	244	12	52260	47120	-508	5047	767
COMMERCIAL											
Natural Gas	462200	2663	0	-122	-1	-20	34072	0	-1567	-10	-256
Electricity	443700	0	767 ▒	0	0	0	0	9471 ▒	0	0	0
#2 Fuel Oil	258500	0	1174	80	305	8	0	15025	1022	2721	105
#6 Fuel Oil	121000	0	153	23	81	7	0	1955	381	659	61
Coal	26100	0	84	11	63	8	0	1103	141	400	166
Wood	3300	0	42	1	0	4	0	552	10	2	121
LPG	6700	0	71	3	0	1	0	910	42	0	9
Subtotal	1321500	2663	2292	-5	449	8	34072	29015	29	3772	206
INDUSTRIAL											
Natural Gas	430700	1621	0	-122	-0	-12	6188	0	-464	-2	-46
Electricity	367700	0	126 ▒	0	0	0	0	462 ▒	0	0	0
#2 Fuel Oil	103400	0	602	45	156	4	0	2298	172	467	16
#6 Fuel Oil	142500	0	416	62	166	18	0	1588	288	462	52
Coal	381400	0	320	93	176	8	0	1225	355	424	31
Wood	161200	0	25	2	0	1	0	99	8	0	5
LPG	46500	0	73	5	0	1	0	278	21	0	3
Subtotal	1633400	1621	1562	86	499	20	6188	5950	380	1353	59
ELECTRIC UTILITY											
Additional Generating Load from Electricity Replacing Gas											
Natural Gas	0	0	0	0	0	0	0	0	0	0	0
#2 Fuel Oil	0	0	20	3	2	0	0	29901	4483	2990	209
#6 Fuel Oil	0	0	3272	491	1309	49	0	0	0	0	0
Coal	0	0	574	172	316	9	0	10819	3246	2908	162
Electrical Imports	0	0	0	0	0	0	0	4590	0	0	0
Normal Load											
Natural Gas	193400	72104	0	-6258	-22	-541	91768	0	0	0	0
#2 Fuel Oil	27800	0	49269	4451	4927	345	0	49727	4519	4973	348
#6 Fuel Oil	817200	0	21183	3178	10403	318	0	35263	5289	17565	529
Coal	1364000	0	5326	1598	2930	80	0	13382	4015	6681	201
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Subtotal	4053300	72104	79645	3634	19864	260	91768	143683	21552	35117	1449
COGENERATION											
Natural Gas	Included	129089	0	-18072	-39	-904	166571	0	-23320	-50	-1166
#2 Fuel Oil	in Ind.	0	132445	27151	21116	2384	0	153812	31531	23811	2769
Residual Fuel Oil	& EU	0	0	0	0	0	0	0	0	0	0
Coal	sectors	0	0	0	0	0	0	18556	5567	5177	278
Subtotal		129089	132445	9079	21078	1480	166571	172368	13778	28938	1881
TOTAL MARKET											
Natural Gas	2023100	207066	0	-24655	-62	-1488	350859	0	-28017	-78	-1860
#2 Fuel Oil	1042600	0	184303	31781	26713	2749	0	277374	43431	39493	3687
Residual Fuel Oil	1080700	0	25023	3754	11959	392	0	38805	5958	18687	641
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Coal	1797000	0	6368	1885	3522	111	0	47190	13695	16101	1403
Wood	347200	0	226	3	1	16	0	5911	39	21	468
LPG	90600	0	181	11	0	2	0	2406	125	1	24
Electrical Imports	0	0	0	0	0	0	0	4590	0	0	0
Subtotal	8032100	207066	216102	12778	42133	1781	350859	376277	35231	74225	4363

▒ Replacement of gas by electricity will increase the primary fuel consumption used to generate electricity. Cells marked with ▒ not included in primary fuel total.

900424

TABLE 15

NORTHEAST U.S. PARTIAL REPLACEMENT CASE

MARKET SECTOR & Type Fuel	1986 ENERGY DEMAND (MDth)	1992 DEMAND INCR. (MDth) W NEP	1992 DEMAND INCR. (MDth) W/O NEP	1992 EMISSION INCR. (Ton/yr) NOx	1992 EMISSION INCR. (Ton/yr) SO2	1992 EMISSION INCR. (Ton/yr) PM	1997 DEMAND INCR. (MDth) W NEP	1997 DEMAND INCR. (MDth) W/O NEP	1997 EMISSION INCR. (Ton/yr) NOx	1997 EMISSION INCR. (Ton/yr) SO2	1997 EMISSION INCR. (Ton/yr) PM
RESIDENTIAL											
Natural Gas	936800	1589	159	-73	-0	-11	52260	5226	-2399	-14	-353
Electricity	394700	0	355 ▒	0	0	0	0	10732 ▒	0	0	0
#2 Fuel Oil	652900	0	713	46	185	6	0	23951	1533	4079	216
Coal	25500	0	57	10	34	6	0	1894	334	460	509
Wood	182700	0	143	1	1	9	0	4735	19	17	308
LPG	37400	0	33	2	0	0	0	1096	56	0	11
Subtotal	2230000	1589	1461	-15	220	11	52260	47634	-457	4542	691
COMMERCIAL											
Natural Gas	462200	2663	266	-110	-1	-18	34072	3407	-1411	-9	-230
Electricity	443700	0	691 ▒	0	0	0	0	8524 ▒	0	0	0
#2 Fuel Oil	258500	0	1057	72	275	7	0	13522	920	2448	95
#6 Fuel Oil	121000	0	137	21	73	6	0	1759	343	593	55
Coal	26100	0	76	10	57	8	0	993	127	360	149
Wood	3300	0	38	1	0	4	0	496	9	2	109
LPG	6700	0	64	3	0	1	0	819	38	0	8
Subtotal	1321500	2663	2329	-4	404	7	34072	29520	26	3394	186
INDUSTRIAL											
Natural Gas	430700	1621	810	-61	-0	-6	6188	3094	-232	-1	-23
Electricity	367700	0	63 ▒	0	0	0	0	231 ▒	0	0	0
#2 Fuel Oil	103400	0	301	23	78	2	0	1149	86	234	8
#6 Fuel Oil	142500	0	208	31	83	9	0	794	144	231	26
Coal	381400	0	160	46	88	4	0	613	178	212	15
Wood	161200	0	13	1	0	1	0	49	4	0	2
LPG	46500	0	36	3	0	0	0	139	10	0	1
Subtotal	1633400	1621	1591	43	249	10	6188	6069	190	676	30
ELECTRIC UTILITY											
Additional Generating Load from Electricity Replacing Gas											
Natural Gas	0	0	15	1	0	0	0	19485	1948	61	146
#2 Fuel Oil	0	0	22	3	2	0	0	6665	999	666	47
#6 Fuel Oil	0	0	2799	420	1120	42	0	0	0	0	0
Coal	0	0	491	147	270	7	0	9646	2894	2585	145
Electrical Imports	0	0	0	0	0	0	0	4092	0	0	0
Normal Load											
Natural Gas	193400	72104	54078	-1564	-5	-135	91768	68826	0	0	0
#2 Fuel Oil	27800	0	7774	704	777	54	0	7877	719	788	55
#6 Fuel Oil	817200	0	9728	1459	4949	146	0	13004	1951	6641	195
Coal	1364000	0	1280	384	704	19	0	3088	926	1579	46
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Subtotal	4053300	72104	76188	1554	7818	134	91768	132683	9437	12321	634
COGENERATION											
Natural Gas	Included	129089	96817	-4518	-10	-226	166571	124928	-5830	-12	-291
#2 Fuel Oil	in Ind.	0	33111	6788	5279	596	0	38453	7883	5953	692
Residual Fuel Oil	& EU	0	0	0	0	0	0	0	0	0	0
Coal	sectors	0	0	0	0	0	0	4639	1392	1294	70
Subtotal		129089	129928	2270	5269	370	166571	168020	3445	7234	470
TOTAL MARKET											
Natural Gas	2023100	207066	152145	-6325	-16	-396	350859	224966	-7923	24	-751
#2 Fuel Oil	1042600	0	42979	7635	6597	667	0	91616	12140	14168	1112
Residual Fuel Oil	1080700	0	12873	1931	6225	203	0	15557	2437	7465	276
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Coal	1797000	0	2064	598	1153	44	0	20872	5851	6491	934
Wood	347200	0	193	2	1	14	0	5281	32	19	419
LPG	90600	0	134	7	0	1	0	2054	104	1	20
Electrical Imports	0	0	0	0	0	0	0	4092	0	0	0
Subtotal	8032100	207066	210388	3848	13960	533	350859	364439	12641	28168	2010

▒ Replacement of gas by electricity will increase the primary fuel consumption used to generate electricity. Cells marked with ▒ not included in primary fuel total.

900424

TABLE 16

NORTHEAST U.S. 100% REPLACEMENT CASE
(NSP ONLY)

MARKET SECTOR & Type Fuel	1986 ENERGY DEMAND (MDth)	1992 DEMAND INCR. (MDth) W NEP	1992 DEMAND INCR. (MDth) W/O NEP	1992 EMISSION INCR. (Ton/yr) NOx	1992 EMISSION INCR. (Ton/yr) SO2	1992 EMISSION INCR. (Ton/yr) PM	1997 DEMAND INCR. (MDth) W NEP	1997 DEMAND INCR. (MDth) W/O NEP	1997 EMISSION INCR. (Ton/yr) NOx	1997 EMISSION INCR. (Ton/yr) SO2	1997 EMISSION INCR. (Ton/yr) PM
RESIDENTIAL											
Natural Gas	936800	0	0	0	0	0	10563	0	-539	-3	-79
Electricity	394700	0	0 ▒	0	0	0	0	2383 ▒	0	0	0
#2 Fuel Oil	652900	0	0	0	0	0	0	5362	343	848	48
Coal	25500	0	0	0	0	0	0	423	75	80	123
Wood	182700	0	0	0	0	0	0	1056	4	4	69
LPG	37400	0	0	0	0	0	0	246	13	0	2
Subtotal	2230000	0	0	0	0	0	10563	9470	-104	928	163
COMMERCIAL											
Natural Gas	462200	0	0	0	0	0	5524	0	-254	-2	-41
Electricity	443700	0	0 ▒	0	0	0	0	1535 ▒	0	0	0
#2 Fuel Oil	258500	0	0	0	0	0	0	2436	166	400	17
#6 Fuel Oil	121000	0	0	0	0	0	0	317	64	77	8
Coal	26100	0	0	0	0	0	0	179	23	43	34
Wood	3300	0	0	0	0	0	0	89	2	0	26
LPG	6700	0	0	0	0	0	0	147	7	0	1
Subtotal	1321500	0	0	0	0	0	5524	4704	7	519	45
INDUSTRIAL											
Natural Gas	430700	0	0	0	0	0	765	0	-57	-0	-6
Electricity	367700	0	0 ▒	0	0	0	0	57 ▒	0	0	0
#2 Fuel Oil	103400	0	0	0	0	0	0	284	21	48	2
#6 Fuel Oil	142500	0	0	0	0	0	0	196	39	37	4
Coal	381400	0	0	0	0	0	0	152	44	23	4
Wood	161200	0	0	0	0	0	0	12	1	0	1
LPG	46500	0	0	0	0	0	0	34	3	0	0
Subtotal	1633400	0	0	0	0	0	765	736	51	107	5
ELECTRIC UTILITY											
Additional Generating Load from Electricity Replacing Gas											
Natural Gas	0	0	0	0	0	0	0	0	0	0	0
#2 Fuel Oil	0	0	0	0	0	0	0	5439	816	544	38
#6 Fuel Oil	0	0	0	0	0	0	0	0	0	0	0
Coal	0	0	0	0	0	0	0	1968	590	345	30
Electrical Imports	0	0	0	0	0	0	0	835	0	0	0
Normal Load											
Natural Gas	193400	18250	0	-1497	-5	-137	18722	0	0	0	0
#2 Fuel Oil	27800	0	398	36	40	3	0	421	39	42	3
#6 Fuel Oil	817200	0	18326	2749	9713	275	0	18616	2792	9759	279
Coal	1364000	0	0	0	0	0	0	412	123	62	6
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Subtotal	4053300	18250	18725	1288	9747	141	18722	27690	4361	10751	356
COGENERATION											
Natural Gas	Included	58502	0	-8190	-18	-410	67253	0	-9415	-20	-471
#2 Fuel Oil	in Ind.	0	60023	12305	9677	1080	0	62102	12731	9801	1118
Residual Fuel Oil	& EU	0	0	0	0	0	0	0	0	0	0
Coal	sectors	0	0	0	0	0	0	7492	2248	2594	112
Subtotal		58502	60023	4114	9660	671	67253	69594	5563	12375	759
TOTAL MARKET											
Natural Gas	2023100	76752	0	-9687	-23	-546	102827	0	-10266	-25	-597
#2 Fuel Oil	1042600	0	60421	12340	9717	1083	0	76043	14116	11683	1226
Residual Fuel Oil	1080700	0	18326	2749	9713	275	0	19129	2896	9873	292
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Coal	1797000	0	0	0	0	0	0	10625	3103	3146	308
Wood	347200	0	0	0	0	0	0	1158	7	4	95
LPG	90600	0	0	0	0	0	0	428	22	0	4
Electrical Imports	0	0	0	0	0	0	0	835	0	0	0
Subtotal	8032100	76752	78747	5403	19407	812	102827	108218	9878	24681	1329

▒ Replacement of gas by electricity will increase the primary fuel consumption used to generate electricity. Cells marked with ▒ not included in primary fuel total.

900516

TABLE 17

NORTHEAST U.S. PARTIAL REPLACEMENT CASE

(NSP ONLY)

MARKET SECTOR & Type Fuel	1986 ENERGY DEMAND (MDth)	1992 DEMAND INCR. (MDth) W NEP	1992 DEMAND INCR. (MDth) W/O NEP	1992 EMISSION INCR. (Ton/yr) NOx	1992 EMISSION INCR. (Ton/yr) SO2	1992 EMISSION INCR. (Ton/yr) PM	1997 DEMAND INCR. (MDth) W NEP	1997 DEMAND INCR. (MDth) W/O NEP	1997 EMISSION INCR. (Ton/yr) NOx	1997 EMISSION INCR. (Ton/yr) SO2	1997 EMISSION INCR. (Ton/yr) PM
RESIDENTIAL											
Natural Gas	936800	0	0	0	0	0	10563	1056	-485	-3	-71
Electricity	394700	0	0 ▒	0	0	0	0	2145 ▒	0	0	0
#2 Fuel Oil	652900	0	0	0	0	0	0	4826	309	763	43
Coal	25500	0	0	0	0	0	0	380	67	72	110
Wood	182700	0	0	0	0	0	0	951	4	3	62
LPG	37400	0	0	0	0	0	0	221	11	0	2
Subtotal	2230000	0	0	0	0	0	10563	9580	-94	835	146
COMMERCIAL											
Natural Gas	462200	0	0	0	0	0	5524	552	-229	-1	-37
Electricity	443700	0	0 ▒	0	0	0	0	1382 ▒	0	0	0
#2 Fuel Oil	258500	0	0	0	0	0	0	2192	149	360	15
#6 Fuel Oil	121000	0	0	0	0	0	0	285	58	69	7
Coal	26100	0	0	0	0	0	0	161	21	39	31
Wood	3300	0	0	0	0	0	0	80	2	0	24
LPG	6700	0	0	0	0	0	0	133	6	0	1
Subtotal	1321500	0	0	0	0	0	5524	4786	7	467	41
INDUSTRIAL											
Natural Gas	430700	0	0	0	0	0	765	383	-29	-0	-3
Electricity	367700	0	0 ▒	0	0	0	0	29 ▒	0	0	0
#2 Fuel Oil	103400	0	0	0	0	0	0	142	11	24	1
#6 Fuel Oil	142500	0	0	0	0	0	0	98	20	18	2
Coal	381400	0	0	0	0	0	0	76	22	11	2
Wood	161200	0	0	0	0	0	0	6	0	0	0
LPG	46500	0	0	0	0	0	0	17	1	0	0
Subtotal	1633400	0	0	0	0	0	765	751	25	54	3
ELECTRIC UTILITY											
Additional Generating Load from Electricity Replacing Gas											
Natural Gas	0	0	0	0	0	0	0	3555	356	21	27
#2 Fuel Oil	0	0	0	0	0	0	0	1216	182	122	9
#6 Fuel Oil	0	0	0	0	0	0	0	0	0	0	0
Coal	0	0	0	0	0	0	0	1760	528	309	26
Electrical Imports	0	0	0	0	0	0	0	747	0	0	0
Normal Load											
Natural Gas	193400	18250	13688	-374	-1	-34	18722	14041	0	0	0
#2 Fuel Oil	27800	0	100	9	10	1	0	103	10	10	1
#6 Fuel Oil	817200	0	4582	687	2428	69	0	4632	695	2436	69
Coal	1364000	0	0	0	0	0	0	72	22	11	1
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Subtotal	4053300	18250	18369	322	2437	35	18722	26127	1792	2909	133
COGENERATION											
Natural Gas	Included	58502	43876	-2048	-4	-102	67253	50440	-2354	-5	-118
#2 Fuel Oil	in Ind.	0	15006	3076	2419	270	0	15525	3183	2450	279
Residual Fuel Oil	& EU	0	0	0	0	0	0	0	0	0	0
Coal	sectors	0	0	0	0	0	0	1873	562	649	28
Subtotal		58502	58882	1029	2415	168	67253	67839	1391	3094	190
TOTAL MARKET											
Natural Gas	2023100	76752	57564	-2422	-6	-137	102827	70028	-2741	12	-202
#2 Fuel Oil	1042600	0	15105	3085	2429	271	0	24005	3843	3729	348
Residual Fuel Oil	1080700	0	4582	687	2428	69	0	5016	773	2524	79
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Coal	1797000	0	0	0	0	0	0	4322	1221	1090	198
Wood	347200	0	0	0	0	0	0	1037	6	4	86
LPG	90600	0	0	0	0	0	0	371	19	0	4
Electrical Imports	0	0	0	0	0	0	0	747	0	0	0
Subtotal	8032100	76752	77250	1351	4852	203	102827	105526	3121	7358	513

▒ Replacement of gas by electricity will increase the primary fuel consumption used to generate electricity. Cells marked with ▒ not included in primary fuel total.

900516

APPENDIX C

EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

APPENDIX C

EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

I. SUPERVISION AND INSPECTION

The following plan requires that some judgment be applied in the field and shall thus be implemented under the supervision of the Environmental Inspector or other qualified professional with knowledge of soil conditions and conservation plantings in the project area. Problems with contractor compliance shall be reported to the Environmental Inspector for remedial action. All uncultivated and non-wetland areas and residential turfs disturbed by construction shall be treated in accordance with this plan except for areas where landowners specify other seeding requirements. Deviations from this plan that involve less protective measures will only be permitted with the written approval of the Director, Office of Pipeline and Producer Regulation.

Inspectors shall have the direct responsibility to represent the applicant and to enforce these requirements. They shall have peer status with all other activity inspectors. A chief inspector shall be responsible for enforcing stop-work authority.

Duties of the environmental inspectors shall include monitoring and/or supervision of the following:

A. compliance with requirements of erosion and sedimentation control plans; Stream and Wetland Construction and Mitigation Procedures (appendix D); conditions of the FERC certificate; and other environmental permits and approvals;

B. marking of surface and subsurface drainage system locations identified by landowners and/or soil conservation authorities;

C. identification of stabilization needs in all areas;

D. performance of appropriate tests of subsoil and topsoil to determine the extent of compaction across the project right-of-way;

E. restoration of soil profile as requested or required;

F. approval of imported soils used as fill and/or additional cover material;

G. documentation of the temporary and permanent revegetation programs;

H. monitoring of crop productivity for not less than 2 years for purposes of additional restoration, in case of inadequate restorative practices, and preparation of weekly activity reports documenting problems and solutions;

I. documentation of all public and private roadway crossings/access points to insure safe and accessible conditions exist relative to pre-construction conditions.

Within 30 days of the in-service date for the facilities, a summary shall be filed with the Commission detailing the quantity and type of fertilizer for each pipeline segment; lime, seed, mulch, and equipment used to implement this plan; the acreage treated, and the dates of backfilling and seeding. The number of landowners specifying other seeding requirements and a description of the requirements shall be reported. In the event that the in-service date precedes the seeding season, the materials, equipment, and dates for future seeding shall be stated as well as the temporary stabilization measures utilized.

II. PRECONSTRUCTION PLANNING

A. Locate all drainage tiles prior to construction by contacting landowners and local soil conservation authorities.

B. Undertake an assessment of vegetation requirements for screening and landscaping of new compression and metering facilities. A report shall be submitted to FERC for review and approval prior to construction.

C. Locate all roadway crossings/access points to document and insure that safe and accessible conditions exist throughout the construction phase. Use of 50-foot-long crushed stone access pads, sweeping, culvert installation, matting and other forms of rutting protection shall be utilized depending on local permit conditions. If crushed stone access pads are used, place stone on a synthetic fabric in active agricultural areas.

III. CLEARING AND INSTALLATION

A. Prevent the mixing of topsoil with subsoil by using topsoil segregation construction methods in annually cultivated or rotated crop lands and in residential areas. In all actively cultivated agricultural lands, which includes permanent or rotated cropland and hayfields, full right-of-way topsoil stripping will be used with the construction right-of-way not to exceed 100 feet. The ditch and spoil side method of topsoil segregation shall be applied in all other improved and residential areas, and in other areas at the landowners request. The construction right-of-way for the ditch plus spoilside method shall be limited to 75-feet. For deep soils (such as floodplains and stream terraces), 12 inches of topsoil shall be segregated. Where soils are shallow to bedrock or have a stony subsoil, 8 inches of topsoil segregation is recommended. Remove stones greater than 4 inches in any shape or dimension from the segregated topsoils.

B. Probe all drainage systems with a sewer rod or pipe snake to determine if damage has occurred. All tiles damaged during construction shall be flagged by the trench inspector, then repaired to their original or better condition. Filter-covered drain tiles should only be used after consultation with the local soil conservation authorities. Qualified specialists shall be used to insure proper repairs and adequate probing/testing of the repaired drainage systems.

Detailed records of drainage system repairs should be kept and given to the landowner for future reference.

C. Contact landowners and local soil conservation authorities to determine future drain tile locations. Increase depth of cover over the pipeline to 4 feet or more, if needed, so the pipeline is below the anticipated depth of drain tile installations.

D. Construct and maintain temporary slope breakers at the following spacing:

Slope (%)	Spacing (ft)
5 - 15	300
16 - 30	200

Temporary slope breakers shall be repaired at the end of each working day.

E. Use temporary silt fences at the base of slopes adjacent to road crossings where vegetation has been disturbed within the following distances from the road:

Slope (%)	Vegetation Strip Required (ft)
< 5	25
5 - 15	50
15 - 30	75
> - 30	100

F. Use silt fences at the base of slopes at all stream crossings, as recommended in the Stream and Wetland Construction and Mitigation Procedures (appendix D).

G. Construct trench breakers so that the bottom of one breaker is at the same elevation as the top of the next breaker down slope. The use of topsoil in trench breakers shall be prohibited.

IV. CLEANUP

A. Final clean-up and permanent erosion control measures, as appropriate, shall be completed within 10 days after the trench is backfilled, weather and soil conditions permitting.

B. Blast rock shall not be used as backfill in rotated or permanent cropland. It may be used to backfill the trench to the top of the existing bedrock profile in hayfields and pastures. Excess loose rock generated by blasting shall be removed from at least the top 12 inches of topsoil in all rotated and permanent cropland and hayfields as well as residential areas, pastures, and other areas at the landowners' request.

C. Test for soil compaction across the project right-of-way in agricultural areas. Tests shall be done on the same soil type under the same moisture conditions and should include the following areas: soil from undisturbed areas, soil stockpile areas, the trenched zone, the work area, and any traffic areas related to the project. Devices such as COE-style cone penetrometers or other appropriate devices may be utilized to test for compaction.

D. Plow severely rutted areas with a paraplow (or similar "winged" plow) or arrange with the landowner to plant and plow under a "green manure" crop, such as alfalfa, to decrease soil bulk density and to improve soil structure. If plowing is employed, the stripped construction right-of-way will be plowed first followed by replacement of the segregated topsoil. Where necessary, additional plowing of the topsoil will be undertaken to prevent subsurface compaction. If subsequent construction and cleanup activities result in further compaction, additional tilling will be undertaken.

E. Remove construction debris from the right-of-way and grade it to leave the soil in the proper condition for planting, taking care to remove all construction debris and woody material. On slopes, divert concentrations of surface flow to a stabilized outlet using runoff diversions that extend beyond the edge of the right-of-way with a 2 percent outslope directed toward appropriate energy-dissipating devices.

F. Permanent slope breakers shall be constructed and maintained at the following spacing:

Slope (%)	Spacing (ft)
5 - 10	150
11 - 20	100
21 - 30	75
> 30	50

G. Restore all turf, ornamental shrubs, and other landscaping in accordance with the landowner's requests or compensate the landowner the amount equal to replacement of said landscaping. Such restoration work shall be performed by a landscaping contractor familiar with local horticultural and turf establishment practices.

H. Insure public and private roadway crossings/access points are restored to safe and acceptable conditions relative to pre-construction status.

V. REVEGETATION

A. GENERAL REQUIREMENTS

1. Apply finely ground agricultural or dolomitic limestone at a rate of 2 tons/acre. Lime temporarily seeded sites to a pH of 6.0 to insure optimum growing conditions with regard to pH.

2. Fertilize permanent grass and/or legume plantings with 300 lbs/acre of 10-20-20 fertilizer mix. If manure is also applied, reduce the addition of nitrogen by half for each 10 tons of manure applied. Where possible, incorporate lime and fertilizer into the top 2 inches of soil.

3. Prepare the seedbed to depth of 3 to 4 inches using appropriate equipment to provide a firm, smooth seedbed, free of debris. If hydroseeding is to be done, scarify the seedbed to ensure sites for seeds to lodge and germinate.

4. The project area should be seeded no earlier than May 1 and no later than October 15. Any soil disturbance that occurs between October 15 and May 1, or any bare soil left unstabilized by vegetation, should be treated as a winter construction problem and mulched. See section V (B) and (D) of this Plan. Except in lawns, all seeding of permanent cover shall be done between the aforementioned dates. If seeding cannot be done within the seeding dates, temporary erosion control shall be used and seeding of permanent cover shall be done at the beginning of the next seeding season.

5. Seed slopes steeper than 3:1 immediately after final grading, weather permitting, subject to the limitations addressed in section V (A.4).

6. Seed rights-of-way within 6 working days of final grading, weather permitting, subject to the limitations addressed in section V (A.4).

B. TEMPORARY EROSION CONTROL

1. In the event that construction is completed more than 30 days before the seeding season for perennial vegetation, all areas adjacent to perennial and intermittent streams shall be mulched with 3 tons/acre of hay or straw, or its equivalent, for a minimum of 100 feet on either side of the waterway. The mulch shall be anchored with a mulch anchoring tool, as discussed in section D.

2. Fertilize temporary plantings with 400 lbs/acre of 10-10-10 fertilizer mix. Where possible, incorporate lime and fertilizer into the top 2 inches of soil.

C. SEED SPECIFICATIONS

1. Purchase seed in accordance with the Pure Live Seed (PLS) specifications for seed mixes.

2. Use seed within 12 months of testing.

3. Treat legume seed with an inoculant specific to the species. For conventional seeding, use four times the manufacturer's recommended rate of inoculant, and 10 times the recommended rate if hydroseeding methods are being used.

4. Uniformly apply the seed over the area and cover it 0.5- to 1-inch deep, depending on seed size. A seed drill equipped with a cultipacker is preferred, but broadcast or hydroseeding can be used at double the seeding rates listed in the table below. Where broadcasted, firm the seedbed with a cultipacker or roller. Other alternative seed mixes specifically requested by the landowner or land-managing agency may be used.

Seeding Specifications and Adaptation

Species Mix	Pounds PLS Per Acre	Use and Adaptation
Midwest		
Kentucky Bluegrass	10	Well to Poorly Drained
Creeping Red Fescue	5	
Birdsfoot Trefoil	4	
Crownvetch	8	
Kentucky Bluegrass	8	Excessively Drained
Creeping Red Fescue	16	
Northeast		
Tall Fescue	20	Well to Poorly Drained
Birdsfoot Trefoil	8	
Redtop	2	
Flat Pea	30	Excessively Drained
Tall Fescue	20	
Redtop	2	

D. MULCH SPECIFICATIONS

1. Mulch all dry sandy sites and all slopes greater than 8 percent with 2 tons/acre of straw or hay or its equivalent. Spread mulch uniformly over the area so that 75 percent of the ground surface is covered. If a mulch blower is used, the strands shall not be shredded less than 8 inches in length to allow anchoring.

2. Anchor mulch immediately after placing to minimize loss by wind and water. Use a mulch anchoring tool, which is a series of straight notched disks specifically designed for the purpose, to crimp the mulch to a depth of 2 to 3 inches. To maintain proper seed depth, a regular farm disc should not be used.

3. Mulch may be anchored using a liquid mulch binder. Cutback asphalt (rapid or medium curing), or emulsified asphalt applied at 200 gallons/acre may be used. A variety of synthetic binders are also available, which should be used at rates recommended by the manufacturer for mulch anchoring. Use caution in residential areas or areas of pedestrian traffic, because asphaltic and some synthetic binders can damage shoes, clothing, automobile paint, etc.

4. Use jute thatching or bonded fiber blankets (instead of straw or hay) on streambanks to stabilize seeded areas. Anchor the thatching with pegs or staples.

5. Up to 1 ton/acre of wood chips may be added as mulch if areas so mulched are top-dressed with 11 lbs/acre available nitrogen or a similar quantity of 50 percent slow-release fertilizer.

VI. OFF-ROAD VEHICLE CONTROL

For each owner and manager of forest lands, offer to install and maintain, based on state and local regulations, the following off-road vehicle control measures and install one or more of them, as requested, at the completion of clean-up and reseeding:

A. Install a locking, heavy steel gate with fencing extending a reasonable distance to prevent bypassing the gate, and post appropriate signs.

B. Plant conifers across the right-of-way. The spacing of trees and length of right-of-way planted should be sufficient to limit access and to screen the right-of-way from view.

C. Install a slash and timber barrier, a pipe barrier, or a line of boulders across the right-of-way to restrict vehicle access.

D. Post signs at all points of access and along the right-of-way at intervals not to exceed 2,000 feet, saying "This Area Seeded for Wildlife Benefits and Erosion Control."

VII. MAINTENANCE

A. Follow-up inspections shall occur after the first and second growing season, normally 3 to 6 months and 12 to 15 months after planting, respectively, to determine the success of revegetation. Revegetation shall be considered successful if perennial vegetation contacts 70 percent or more of each square yard of the right-of-way, based on representative random sampling in the field. If vegetative cover is less, the judgment of a professional agronomist shall be used to determine the need for fertilizing or reseeding based on site conditions, and those actions shall be undertaken at the beginning of the next growing season.

B. Right-of-way vegetation maintenance clearing shall not be done more frequently than every 3 years, and not before August 1 of any year.

C. Efforts to control off-road vehicle use, in cooperation with the landowner, shall continue throughout the life of the project. Signs, gates, and vehicle trails shall be maintained as necessary.

D. Monitor and correct drainage problems in active agricultural areas that have resulted from pipeline construction.

APPENDIX D

STREAM AND WETLAND
CONSTRUCTION AND MITIGATION PROCEDURES

APPENDIX D

STREAM AND WETLAND CONSTRUCTION AND MITIGATION PROCEDURES

I. PERENNIAL STREAM CROSSINGS

A. STAGING AREAS/ADDITIONAL RIGHT-OF-WAY (ROW)

1. Locate at least 50 feet away from streambank, where topographic conditions permit.

2. Limit size to minimum needed for prefabrication of pipe segment for stream crossing.

3. Do not store hazardous materials, chemicals, fuels, and lubricating oils; refuel construction equipment; or perform concrete coating activities, within 100 feet of streambanks or within any municipal watershed area.

B. SPOIL PILE PLACEMENT/CONTROL

1. Trench spoil shall be placed at least 10 feet away from streambanks at all minor and major stream crossings.

2. Spoil piles located above streambanks shall be protected with silt fence and/or haybales.

3. Prevent flow of spoil off of ROW.

C. TIME WINDOW FOR CONSTRUCTION

1. June 1 through September 30 unless expressly permitted or further restricted by appropriate state agency on a site-specific basis.

2. Notify authorities responsible for potable water supplies located within 3 miles downstream prior to FERC certification and at least 72 hours prior to commencement of instream work.

D. CROSSING PROCEDURES

1. Provide notification to the U.S. Army Corps of Engineers (COE) concerning the proposed construction activities, and submit to FERC staff a copy of the COE's determination regarding the need for individual Section 404 and/or Section 10 permits.

2. Comply with nationwide Section 404 permit Nos. 12 and 14 conditions (33 CFR §330) at a minimum.

3. Apply for state-issued stream crossing permits and obtain Section 401 water quality certification or waiver.

4. Crossings shall be constructed as perpendicular to axis of stream channel as engineering and routing conditions permit.

5. Utilize clean gravel for upper 1 foot of fill over backfilled trench in all minor and major streams, which contain coldwater fisheries.

6. Maintain downstream flow rates at all times.

7. Minor Streams ($\leq$ 10 feet wide and $\leq$ 2 feet average depth)

   a. For crossings of all coldwater and warmwater fisheries, construction equipment will cross the stream on a bridge consisting of one of the following:

      - equipment pads and culvert(s)
      - clean rockfill and culvert(s)
      - flexi-float or portable bridge

   b. For crossings of all coldwater fisheries, and warmwater fisheries considered significant by the state fish management agency, route stream across trench using flume pipe, and install pipeline using "dry-ditch" techniques as follows:

      - install flume after blasting, but prior to trenching
      - use sand bag/plastic dam structure
      - properly align flume pipe
      - do not remove flume during trenching or pipe-laying activities
      - dewater trench, as required, to prevent discharge of silt laden water into stream during construction and backfilling operations
      - remove all flumes and dams upon completion of construction

   c. For all other minor perennial stream crossings, complete instream construction within 24 hours.

8. Major Streams (> 10 feet wide or > 2 feet average depth, but $\leq$ 100 feet wide)

   a. Construction equipment crosses on bridge consisting of one of the following:

      - equipment pads and culvert(s)
      - clean rockfill and culvert(s)
      - flexi-float or portable bridge

b. In-stream equipment limited to that needed to construct crossing.

c. Notify state authorities at least 48 hours prior to commencement of in-stream trenching or blasting.

d. Attempt to complete in-stream trenching and backfill work (not including blasting) within 48 hours; maximum of 72 hours allowed.

9. Rivers (> 100 feet wide)

a. Submit site-specific construction procedures to FERC staff for review and approval prior to construction.

E. TEMPORARY EROSION AND SEDIMENT CONTROL

1. Perform daily inspection, and repair as needed.

2. Install and maintain sediment filter devices at all streambanks.

3. Use trench plugs at major stream and river crossings to prevent diversion of streamflow into upland portions of pipeline trench during construction.

F. BANK STABILIZATION AND REVEGETATION

1. All riprap activities must comply with nationwide Section 404 permit No. 13 conditions at a minimum.

2. Limit use of riprap to areas where flow conditions preempt vegetative stabilization, unless otherwise specifically required by state permit.

3. Restore topsoil to original horizon and revegetate with conservation grasses and legumes.

4. Allow 10-foot-wide riparian strip above streambank to permanently revegetate with native woody plant species across the entire ROW.

5. Maintain sediment filter devices at base of all slopes located adjacent to streams until ROW revegetation is complete.

6. Install permanent slope breakers at base of all slopes adjacent to streams.

G. TRENCH DEWATERING

1. Dewater into upland area in such a manner that no silt laden water flows into any perennial stream or river.

II. FEDERALLY DELINEATED WETLAND CROSSINGS a/

A. STAGING AREAS

1. Locate at least 50 feet away from wetland edge, where topographic conditions permit.

2. Limit size to minimum needed for prefabrication of pipe segment for wetland crossing.

3. Do not store hazardous materials, chemicals, fuels, and lubricating oils; refuel construction equipment; or perform concrete coating activities, within 100 feet of wetland boundary.

4. Do not construct aboveground facilities in any federally delineated wetland.

B. SPOIL PILE PLACEMENT/CONTROL

1. Utilize sediment filter devices to prevent flow of spoil off of ROW.

C. CROSSING PROCEDURES

1. Provide notification to the COE concerning the proposed construction activities, and submit to FERC staff a copy of the COE's determination regarding the need for individual Section 404 permits prior to construction.

2. Comply with nationwide Section 404 permit conditions (33 CFR §330) at a minimum.

3. Apply for state-issued wetland crossing permit and obtain Section 401 water quality certification or waiver.

4. Pipeline should be routed to avoid wetland areas to the maximum extent practicable. If wetland cannot be avoided, or crossed by following an existing ROW, route new pipeline in a manner that

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a/ These procedures apply to any wetland which satisfies delineation requirements contained in the Federal Manual for Identifying and Delineating Wetlands Using the Unified Federal Method (Method). Applicant must delineate all wetlands using this Method prior to construction.

minimizes disturbance to wetland. Where looping an existing pipeline, locate loop line no more than 25 feet away from existing pipeline.

5. Minimize width of construction right-of-way to $\leq$ 75 feet.

6. Cut vegetation off only at ground level, leaving existing root systems intact, and remove from wetland for disposal.

7. Limit pulling of tree stumps and grading activities to directly over trench; do not remove stumps or root systems from non-trenched portions of the ROW in wetlands.

8. Segregate and replace the top 1 foot of topsoil from the area disturbed by trenching, except in areas with standing water or saturated soils.

9. Limit construction equipment operating in wetland to that needed to dig trench, install pipe, backfill trench, and restore ROW.

10. Do not use dirt, rockfill, tree stumps, or brush riprap to stabilize ROW.

11. Utilize wide-track or balloon-tire construction equipment, or operate normal equipment off of timber pads, prefabricated equipment pads, or geotextile fabric overlain with gravel fill, if standing water or saturated soils are present.

12. Do not cut trees located outside of ROW to obtain timber for equipment pads, and do not utilize more than two layers of timber or equipment pads to stabilize the ROW.

13. Remove all timber pads, prefabricated equipment pads, and geotextile fabric overlain with gravel fill upon completion of construction.

14. Assemble pipeline in upland area and utilize "push-pull" or "float" technique to place pipe in trench whenever water and other site conditions allow.

D. TEMPORARY EROSION AND SEDIMENT CONTROL

1. Perform daily inspection, and repair as needed.

2. Install and maintain sediment filter devices at edge of all wetlands until ROW revegetation is complete.

3. Install permanent slope breakers at base of all slopes adjacent to wetlands.

E. REVEGETATION TECHNIQUES

1. Do not use fertilizer or lime, unless required by appropriate state permitting agency.

2. Restore topsoil to original horizon and temporarily revegetate disturbed areas with annual ryegrass at a rate of 40 lbs per acre, unless standing water is present.

3. Ensure that all disturbed areas permanently revegetate with native herbaceous and woody plant species.

4. Develop specific procedures, in coordination with the appropriate state agency, to prevent the invasion or spread of undesirable exotic vegetation (e.g., purple loosestrife and phragmites).

F. TRENCH DEWATERING

1. Dewater in such a manner that no silt laden water flows into wetland areas off of construction ROW.

G. ROW MAINTENANCE PRACTICES

1. Mowing (and other vegetation maintenance practices) of the permanent ROW is prohibited, except for the selective cutting of trees that are located within 15 feet of the pipeline and are greater than 15 feet in height.

III. HYDROSTATIC TESTING

A. TIMING

1. Hydrotest pipeline section prior to installation under stream or wetland.

B. INTAKE SOURCE AND RATE

1. Screen intake hose to prevent entrainment of fish.

2. Do not utilize state designated exceptional value waters, or streams designated as public water supplies, unless appropriate state and/or local permitting agencies grant permission.

3. Notify state water quality and fishery management agencies of intent to use specific sources at least 48 hours prior to testing activities.

4. Adequate flow rates shall be maintained to protect aquatic life, provide for all in-stream uses, and provide for downstream withdrawals of water by existing users.

5. Apply for state-issued withdrawal permit, as required.

C. DISCHARGE LOCATION, METHOD, RATE

1. Regulate discharge rate and utilize energy dissipation device(s) in order to prevent erosion of upland areas, streambottom scour, suspension of sediments, or excessive stream flow.

2. Discharge test water from existing pipelines, using velocity dispersion device, into haybale/silt fence containment structure.

3. Obtain NPDES or state-issued discharge permit, as required.

4. Sample test water during discharge in accordance with any NPDES or state-issued discharge permit requirements; provide a copy of the results to FERC.

APPENDIX E

WETLAND CROSSING TABLES

TABLE E-1

Wetlands Crossed by the Proposed NIP Project Facilities

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
GREAT LAKES			
Loop 2/MN	52.0	PEM	100
	52.1	PEM	300
	54.0	PFO1	275
	55.4	PEM	500
	57.1	PEM	100
	58.1	PEM	50
	58.2	PEM	300
Loops 1&2/MN	59.7	PEM	1,550
	60.2	PEM	50
	60.8	PEM	125
	61.3	PEM	100
	62.1	PEM	25
	62.7	PEM	25
	62.8	PSS	150
	62.9	PSS	300
	62.9	PEM	1,525
	63.3	PEM	2,275
Loop 3/MN	110.1	PEM/SS1	1,700
	110.3	PFO1/2	575
	110.6	PEM/SS1	300
	112.6	PEM/UB	200
	112.9	PEM	175
	113.0	PSS1	100
	113.2	PEM	25
	115.0	PEM	25
	115.2	PEM	50
	115.6	PEM	150
	115.8	PEM/SS1	350
	115.9	PEM/SS1	250
	116.2	PFO2/SS1	1,000
	116.6	PFO1	175
	117.0	PEM/SS1	25
	117.1	PSS4	50
	117.2	PEM	250
	117.5	PEM	75
	118.0	PEM/SS1	75
	118.6	PEM	550
	118.7	PFO1/2	1,150
	119.0	PEM	325
	119.3	PEM	250
	119.6	PEM	175
	120.1	PEM	200
	121.0	PEM/SS1	250
	121.2	PSS1	50
	121.3	PSS1	50
	121.4	PEM	275
	122.8	PEM	75
	123.0	PSS1	100
	123.4	PSS	100
	123.8	PEM	100
	123.8	PSS1	225
	124.0	PFO	100
	124.0	PEM	100
	124.1	PEM/SS1	225
	124.2	PEM/SS1	75
	124.3	PEM/SS1	850

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
Loop 3/MN (cont'd)	124.5	PEM	100
	124.6	PSS1	325
	124.9	PF01	150
	125.2	PEM/PSS1	475
	125.3	PEM/SS1	225
	125.4	PEM/SS1	100
	125.4	PEM	100
	125.4	PSS1/EM	1,350
	126.0	PFO1/SS1	250
	126.6	PEM	100
	126.8	PEM/SS1	1,100
	127.4	PEM/SS1	275
	127.5	PEM	125
	127.9	PSS1/EM	100
	128.4	PEM/SS3	875
	131.1	PEM	150
Loop 4/MN	182.2	PEM/SS3	600
	182.2	PSS2/1	400
	182.4	PEM	2,100
	182.9	PEM	600
	183.3	PSS6/EM	1,200
	183.5	PEM	750
	183.9	PFO2/4	550
	183.9	PFO4	100
	184.0	PSS1/3	250
	184.0	PEM/SS1	1,200
	184.2	PSS2/1	875
	184.7	PEM/SS1	100
	185.4	PFO1	250
	185.5	PFO4/1	325
	185.5	PSS2/1	625
	185.7	PFO4/2	900
	185.8	PSS4/EM	125
	185.8	PFO4/2	250
	185.9	PSS4/EM	75
	186.0	PFO4/2	200
	187.3	PEM	200
	187.7	PSS1	725
	187.9	PSS1/EM	725
	188.3	PEM	100
	188.4	PSS1/4	600
	188.5	PSS1/4	350
	188.6	PFO1	425
	188.7	PFO4/2	700
	188.9	PFO2/4	1,500
	189.2	PSS1/3	350
	189.2	PEM	1,225
	189.5	PSS1/EM	850
	189.6	PEM/SS1	3,850
	189.7	PFO4/2	1,600
	190.0	PSS3/4	1,500
	190.3	PFO4	725
	190.6	PSS1/EM	375
	191.0	PFO4/SS3	4,175
	193.9	PFO6/4	475
	194.1	POW	200
	194.3	PEM5	300
	194.5	PSS/EM5	475
	194.6	PEM5	900
	194.8	FSS/EM5	1,150

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
Loop 4/MN (cont'd)	195.7	PEM5	825
	195.8	POW	125
	195.9	PEM5	675
	196.0	PSS1/EM5	1,675
	196.3	POW	75
	198.1	PFO1	500
	198.2	PFO4/1	1,200
	198.4	PFO/SS1	1,175
	198.7	PEM5	2,200
	199.1	PSS1/EM5	450
	199.2	PEM5	350
	199.2	PSS1/EM5	1,100
	199.4	PEM5	1,375
	199.7	PFO4/SS1	1,150
	199.9	PFO4	1,250
	200.2	PFO4/1	250
Loop 5/MN	210.0	PFO1	300
	210.1	PFO1	525
	210.4	PFO/SS1	5,500
	211.4	PSS1/EM5	1,750
	211.8	PFO4	425
	211.9	PSS1/EM5	400
	211.9	PFO1	1,650
	211.9	PFO4/SS	100
	212.3	PFO/SS1	300
	212.8	PEM5	1,150
Loop 6/MN	226.4	PSS	2,350
	227.2	PSS	350
	227.9	PEM5	250
	228.4	PFO/SS	650
	228.5	PFO	4,200
	229.3	PSS/EM5	825
	229.5	PFO/SS	1,200
	229.6	PSS	325
	229.7	PFO	225
	229.7	PSS	875
	230.0	PSS	200
	230.1	PSS	125
	230.4	PFO	1,000
	230.6	PFO	775
	231.4	PEM5	175
	232.2	PSS	925
	232.4	PSS	500
	232.6	PSS	1,400
	233.5	PFO1	1,750
	233.9	PSS1	450
	233.9	PSS/EM5	275
	234.2	PSS1/EM5	975
	234.3	PFO/SS	950
	235.3	PFO4/2	750
	235.5	PFO4/2	1,175
	236.1	PSS/EM5	275
	236.2	PFO2/SS	250
	236.6	PFO2/SS	475
	237.0	PSS/EM5	150
	237.2	PSS/EM5	450
	237.3	PEM5	150
	237.5	PSS	825
	237.8	PFO2/SS	300

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
Loop 6/MN (cont'd)	237.9	PEM5	100
	237.9	PEM5	500
	238.0	PFO2/SS	625
	238.2	PFO2/SS	225
	239.3	PFO2/SS	475
	238.4	PEM5	250
	238.5	PFO2/SS	950
	238.7	PFO2/SS	500
	238.8	PSS/EM5	2,375
	239.3	PFO2/SS	300
	239.5	PFO4/2	550
	239.6	PFO2	425
	239.7	PFO2/SS	275
	239.8	PFO2	425
	239.9	PFO2	2,150
	240.4	PFO2/SS	600
	240.7	PFO2/SS	1,050
	240.9	PSS	825
	241.1	PSS	300
Loop 7/WI	325.3	PFO1/SS1	525
	339.3	PEM5	150
Loop 8/WI/MI	386.0	PSS1/3	425
	386.1	PSS1	1,075
	386.7	PSS/EM	500
	388.1	PFO1/7	475
	388.7	PSS1	375
	389.1	PFO1	1,200
	389.9	PFO1	275
	390.8	PFO1	1,075
	391.7	PFO1	1,550
	392.9	PFO1/3	950
	394.1	PFO1	275
	394.3	PFO1	300
	395.1	PSS1	475
	397.7	PFO/SS	750
	398.0	PSS/EM	1,300
	398.8	PFO1	575
	399.5	PFO/SS	300
	400.3	PFO/SS	200
	401.7	PFO/SS	425
	402.9	PSS1	500
	410.3	PFO	200
	412.3	PSS	250
	412.5	PFO4	2,375
	415.9	PSS	325
Loop 9/MI	434.2	PSS1	600
	435.0	PFO/SS	300
	435.3	PFO/SS	275
	435.5	PFO/SS	625
	435.6	PFO4	1,125
	436.0	PFO	7,925
	438.6	PFO4/1	800
	438.9	PSS	1,175
	439.5	PFO4	1,475
	440.2	PFO4	75
	440.4	PFO4	225
	440.5	PFO/SS	1,100
	441.3	PSS/EM	300

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification g/	Length of Crossing (ft)
Loop 9/MI (cont'd)	441.9	PFO/SS	1,950
	442.6	PFO/SS	500
	443.9	PFO	625
	444.0	PSS	625
	445.8	PFO	200
	446.7	PFO	450
	447.3	PFO/SS	450
	447.8	PFO/SS	575
	447.9	PFO/SS	300
	450.3	PFO4	175
	450.7	PSS1	400
	452.0	PSS	152
	452.6	PFO	175
	453.6	PSS1	950
	453.9	PSS	350
	454.5	PSS/EM	175
	454.6	PSS/EM	850
	455.4	PFO/SS	325
	455.5	PSS/EM	175
	455.8	PSS	925
	456.0	PFO/SS	175
	456.7	PFO4/1	225
	456.9	PFO4/1	500
	457.2	PSS1	625
	457.3	PFO4	250
	457.6	PSS/EM	225
	457.7	PFO	800
	460.2	PFO	450
	460.7	PFO4	450
	460.8	PFO/SS	500
	460.8	PFO4	400
	461.6	PFO4/2	500
	462.1	PFO/SS	175
	462.4	PFO4	75
	463.2	PFO/SS	275
	463.9	PFO4/1	600
	464.2	PFO4/1	250
	464.8	PFO4	200
	465.2	PFO4	575
	466.1	PFO/SS	1,100
	469.3	PFO/SS	350
	470.3	PEM	275
	471.0	PSS/EM	450
	473.5	PFO4	350
	474.5	PFO	450
	474.7	PFO/SS	350
Loop 10/MI	524.3	PFO/SS	1,000
	525.0	PFO4	950
	525.9	PFO	1,350
	526.2	PFO4	1,550
	526.9	PSS1	25
	527.4	PFO4	900
	527.6	PSS	1,700
	527.9	PFO4	500
	528.2	PSS/EM	300
	529.4	PFO4	3,000
	531.5	PFO/SS	600
	531.6	PFO4	500
	531.7	PFO/SS	1,600
	532.2	PFO/SS	2,500

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
Loop 10/MI (cont'd)	532.7	PFO4	4,400
	533.6	PFO4	500
	534.0	PFO4	400
	534.4	PFO4	350
	534.7	PF04	300
	535.4	PFO4	950
	535.6	PFO5/EM	100
	536.2	PFO4	1,650
	536.6	PFO/SS	700
	537.1	PFO4	6,000
	538.5	PFO4	850
	538.7	PFO4	950
	538.9	PFO4	1,500
	539.7	PFO4	150
	540.2	PSS/EM	250
	540.4	PFO/SS	650
	540.8	PFO/SS	150
	540.9	PFO4	550
	541.1	PFO/SS	500
	541.1	PFO4	1,400
	542.2	PFO4	3,050
	543.0	PFO4	500
	543.4	PFO	300
	543.8	PFO	900
	544.0	PSS/EM	550
	544.1	PFO	200
	544.8	PFO/SS	1,000
	545.4	PEM	100
	545.5	PSS	25
	545.9	PFO4	900
	546.3	PFO/SS	100
	547.4	PFO/SS	900
	547.9	PFO/SS	700
	548.7	PSS	300
	549.3	PSS	1,000
	549.5	PFO	100
	549.6	PFO/SS	450
	550.1	PSS	200
	550.6	PFO	300
	551.0	PFO	1,250
	551.5	PFO/SS	300
	551.7	POW	250
	551.9	PSS	150
	552.0	PFO4	1,000
	552.4	PSS	1,300
	552.7	PSS	900
	553.0	PFO	550
	553.1	PFO	400
	553.3	PFO	350
	553.4	PFO	1,300
	553.9	PFO	700
	554.1	PFO	800
	554.6	PSS/EM	100
	554.6	PFO	600
	555.5	PFO	600
	555.9	PFO/SS	2,600
	556.5	PFO	850
	556.6	PSS/EM	250
	556.7	PFO	800
	557.2	PFO/SS	1,500
	557.7	PFO/SS	1,100

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
Loop 10/MI (cont'd)	558.0	PFO	700
	558.4	PFO	1,900
	559.5	PFO/SS	1,500
Loop 11/MI	576.2	PSS	1,400
	576.7	PFO	1,500
	577.1	PFO	950
	578.3	PSS4/PF0	1,600
	578.7	PSS4/PFO	2,400
	580.8	PFO	5,000
	581.7	PFO	1,150
	582.0	PFO/SS	7,900
	583.2	PFO	550
	584.4	PSS4	3,250
	591.6	PSS4/EM	400
	592.0	PFO	275
	592.9	PFO	1,850
	593.4	PSS4	11,400
	595.7	PFO	2,800
	596.4	PSS	3,200
	598.3	PSS4	25
	598.7	PFO4	2,975
	599.3	PFO	575
	599.4	PFO	150
	599.4	PSS/OW	250
	599.5	PSS/OW	200
	599.5	PFO	1,150
	599.7	PFO	675
	600.1	PFO4/1	375
	600.3	PFO4/1	450
	600.4	PFO4/1	875
	601.4	PFO4/1	150
	601.6	PFO4/1	1,450
	602.3	PFO4	675
	602.9	PFO4/1	2,100
	603.2	PSS1/EM	600
	603.3	PFO	600
	604.4	PSS/EM	150
	605.4	PFO	350
	605.6	PFO4	225
	605.8	PFO4/1	300
	606.5	PFO4/1	100
	607.5	PFO4/1	800
	607.7	PFO	100
	608.5	PFO4	200
	609.4	PFO4	125
	609.5	PFO4	175
	609.6	PFO4/SS	3,475
	610.4	PFO/SS	475
	610.9	PFO4	350
	610.9	PFO/SS	525
	611.2	PFO/SS	2,950
	611.8	PFO4	1,200
	612.3	PFO/SS	300
	612.6	PSS	1,050
	612.8	PEM	650
	612.9	PEM	400
	613.5	PSS/EM	775
	613.6	PEM	875
	613.7	PSS/EM	450
	613.8	PEM	975

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
Loop 11/MI (cont'd)	615.9	PFO4/1	325
	616.0	PFO4/1	2,000
	616.4	PSS/EM	125
	616.5	PFO4/1	150
	616.5	PSS/EM	350
	616.7	PEM	150
	616.8	PEM	200
	616.8	PSS	1,075
	617.0	PFO/SS	1,000
	617.3	PFO4/1	1,825
	618.0	PSS4/EM	250
Loop 12/MI	649.7	PFO4/1	1,350
	650.0	PFO4	675
	650.0	PFO	175
	650.0	PEM	350
	650.1	PFO4/1	175
	650.2	PFO4/1	1,250
	650.3	PFO4/1	775
	650.5	PFO	850
	650.6	PFO4/1	275
	650.7	PSS/EM	275
	650.9	PFO4/1	400
	651.0	PFO4/1	625
	655.4	PFO	100
	655.8	PFO	175
	659.5	PEM	1,700
	659.9	PFO4/1	150
	660.3	PEM	100
	661.0	PFO4/1	450
	661.3	PFO4	275
	661.4	PFO4	1,675
	661.7	PSS	875
	662.8	PFO	75
	663.8	PEM	450
	663.9	PEM	250
	664.1	PFO	2,400
	664.9	PEM	25
	665.2	PEM	350
	665.4	PEM	100
	665.4	PEM	175
	667.8	PFO/SS	1,850
	668.2	PFO/SS	3,500
	668.9	PFO/SS	1,375
	669.5	PFO	300
	669.8	PFO	475
	670.1	PFO	300
	670.3	PFO4	200
	670.4	PFO4	400
	670.6	PSS	200
	672.0	POW	250
	672.1	POW	250
	673.5	PF0/SS	100
	673.5	PSS/EM	4,800
	674.3	PFO4/1	875
	674.7	PFO4	1,650
	676.5	PFO4/1	1,325
	676.8	PFO4	2,975
	677.7	PFO4/SS	3,450

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
Loop 13/MI	685.7	PFO	875
	686.6	PSS/EM	2,600
	687.5	PFO4	250
	687.7	PFO4	400
	687.8	PSS4	400
	688.1	PFO4	300
	688.2	PFO4	75
	688.2	PFO4	350
	688.3	PFO4	300
	688.5	PFO4	200
	688.5	PFO4	600
	689.2	PEM	100
	689.3	PEM	300
	689.4	PEM	200
	689.4	PFO4	425
	689.6	PEM	225
	689.8	PFO4	100
	689.9	PFO4	2,300
	690.5	PFO/SS	450
	690.5	PSS/EM	50
	692.3	PSS	750
	693.3	PSS/EM	1,575
	693.7	PSS/EM	1,650
	694.2	PFO	350
	694.7	PSS	300
	695.0	PFO	875
	695.8	PSS	350
	697.4	PFO/SS	425
	697.9	PSS	2,175
	698.3	PFO	200
	698.4	PFO	1,000
	699.0	PFO	350
	699.1	PFO	400
	705.1	PFO	150
	705.4	PFO	375
	705.5	PFO	100
	705.5	PSS	625
	706.6	PFO	250
	706.9	PFO	5,225
	707.9	PSS/EM	200
	708.0	PFO4	350
	708.2	PFO	775
	708.4	PFO/SS	750
	708.9	PFO	1,150
	711.7	PSS/EM	550
	713.3	PFO4	1,850
Loop 14/MI	None		
Loop 15/MI	778.2	PSS1	725
	778.7	PFO4/SS3	150
	778.8	PSS1/EM	150
	778.8	PFO1	250
	779.9	PSS/EM	1,100
	779.3	PSS1/EM	1,000
	779.6	PSS1/EM	225
	779.7	PEM/SS1	150
	779.8	PEM	100
	780.4	POW/FO5	150
	780.4	PSS1	300
	780.5	PFO4	500

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
Loop 15/MI (cont'd)	780.6	PSS3/FO4	750
	780.7	PSS1/3	325
	781.0	PEM	250
	781.3	PSS1/3	200
	781.4	PSS1	200
	781.4	PSS1	350
	781.9	PSS1/EM	100
	783.5	PSS1/EM	1,375
	783.8	PSS1/EM	375
	784.1	PSS1/EM	1,050
	795.5	PSS1/3	475
	795.6	PEM	250
	796.2	PEM	375
	796.3	PEM	350
	796.4	PFO4	125
	797.2	PSS1	200
	797.3	PSS1	175
	797.5	PFO4	100
	800.0	PEM/OW	100
	803.4	PFO	175
	805.9	PFO4	100
	806.0	PFO4	175
	806.7	PSS1	125
	807.1	PSS1	25
	807.2	PSS1/EM	450
	807.4	PSS1/EM	225
	809.6	PSS1	200
	809.7	PEM/SS1	250
	809.9	PSS1	475
	810.1	PSS1/FO	175
	810.2	PSS1	550
	810.3	PFO1/4	600
	810.6	POW	150
	810.9	PFO4	100
	811.7	PSS	750
	813.9	PSS	800
	814.9	PSS	950
Loop 16/MI b/	None		
Loop 17/MI	926.8	PFO4	500
	927.8	PFO/SS	1,650
	928.2	PSS	100
	928.5	PFO1	850
	929.7	PSS1/EM	200
	929.8	PSS1	650
	931.0	PEM	100
	932.6	PSS1	175
	933.4	PSS	175
	933.6	PSS/EM	1,900
	934.1	PSS1/EM	175
	934.3	PEM	250
	935.3	PFO	150
	935.4	PEM	375
	937.7	PFO	750
	935.9	PFO	225
	937.1	PSS/EM	200
	938.1	PSS	250
	938.5	POW	25
	938.7	PSS/EM	325
	938.9	PSS/EM	300

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
Loop 17/MI (cont'd)	939.0	PSS/EM	1,050
	939.8	PSS/EM	700
	940.4	PSS	175
	941.4	PFO	1,300
	943.0	PSS	100
	943.7	PFO	1,550
	945.2	PFO	350
	946.5	PFO1	650
	947.0	PFO1	600
	947.5	PFO/SS	1,300
	947.9	PFO/SS	375
	949.8	PFO1	775
TENNESSEE			
Segment 1/NY	230B-101+2.9	PFO1	100
	230B-101+4.5	PSS1/EM5	300
	230B-101+4.6	PSS1/EM5	200
	230B-101+4.7	PSS1/EM5	400
	230B-101+5.7	PEM5	25
	230B-101+5.7	PEM5	400
	230B-101+5.9	PEM5	400
	230B-101+7.4	PFO1	700
	230B-102+0.0	PEM5	200
	230B-102+7.0	PEM5	350
	230B-102+7.1	PFO	2,600
	230B-103+1.0	PFO1/4	850
Segment 3/NY	232+2.1	PFO1	150
	232+2.3	PFO1	100
	232+3.0	PFO/SS1	275
Segment 4/NY	None		
Segment 8/MA	261+2.3	PFO1	800
	261+2.4	PFO1	700
	261+2.5	PFO/SS1	1,250
	261+2.8	PFO1	550
	261+3.1	PFO1	25
	261+5.8	PFO1	300
	261+6.0	PFO1	300
Segment 9/MA	266+6.5	PSS1/EM	600
	266+7.1	PFO1	25
	266+7.7	PFO1	700
	266+8.8	PFO1	250
Station 230C/NY	None		

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
ALGONQUIN			
G-5 Replacement/MA	0.8	PFO1	1,600
	1.0	PFO1	200
	2.8	PFO1	950
	3.9	PFO1	200
	4.4	PFO1	950
	4.8	PFO	1,175
	4.9	PEM	400
G-8 Replacement/MA	0.3	PSS1	25
	0.7	PSS	25
	1.4	PSS1	175
	1.5	PFO/SS1	100
H-1 Replacement/MA	0.3	PFO1	650
	1.3	PFO1	500
	1.5	PFO1	1,100
Medfield Loop/MA	0.4	PFO1	100
	1.0	PFO1	1,400
	1.5	PSS1	300
	1.6	PFO1	250
	1.9	PFO1	600
	2.2	PFO1	300
	2.5	PSS1	200
	3.1	PFO1	250
E-1 Loop/CT	2.6	POW	150
	2.9	POW	200
	3.2	PFO	25
	3.5	PFO1	200
	3.9	PFO1	200
	4.6	PFO1	100
Chaplin Loop/CT	0.0	PFO1	125
	1.0	PFO1	400
Tiverton Loop/RI	0.5	PFO1	350
	0.8	PFO1	2300
	1.5	PFO1/SS1	300
TRANSCO			
6.79-Mile Leidy Loop/PA,NJ	34.8	PFO1 c/	100
Station 205/NJ	None		
Station 515/PA	None		
TEXAS EASTERN			
Line No. 37/PA	None		

TABLE E-1 (cont'd)

Applicant Loop/State	Beginning Milepost	NWI Classification a/	Length of Crossing (ft)
CNG			
TL-470 Line/NY	1.7	PEM	100
	1.8	PEM	550
	2.2	PEM	100
	2.3	PEM	100
State Line Station/NY	None		
Utica Station/PA	None		
NATIONAL FUEL/PENN-YORK			
Y-M54 Line 2/PA	0.1	PUB d/	75
Concord Station/NY	None		
Ellisburg Station/PA	None		
PENNEAST			
TL-403 Replacement/NY	None		
TOTAL			473,202 (89.6 miles)

a/ NWI Wetland Types:

Palustrine Forested:	PFO1	=	broad-leaved deciduous
	PFO2	=	needle-leaved deciduous
	PFO3	=	broad-leaved evergreen
	PFO4	=	needle-leaved evergreen
	PF05	=	dead
	PF06	=	deciduous
	PF07	=	evergreen
Palustrine Scrub-Shrub:	PSS1	=	broad-leaved deciduous
	PSS2	=	needle-leaved deciduous
	PSS3	=	broad-leaved evergreen
	PSS4	=	needle-leaved evergreen
	PSS6	=	deciduous
Palustrine Emergent:	PEM	=	emergent marsh or wet meadow
	PEM5	=	needle-leaved persistent
Palustrine Openwater:	POW	=	small pond or standing water
	PUB	=	open water with unconsolidated bottom

Wisconsin and New York have their own classification systems. For uniformity, the state codes have been converted to the NWI system.

b/ Wetland maps exist for only 19.1 miles of the proposed 51.4 miles of Loop 16.

c/ Along a tributary to Little Bushkill Creek.

d/ Wetland associated with Rose Lake Run would not require any vegetation removal due to its aquatic nature.

TABLE E-2

Wetland Areas Affected by the Proposed NIP Project Facilities

Applicant Segment/State	NWI Classification a/	Length of Each Wetland Type Crossed (ft)	Wetland Area Affected During Construction of Proposed ROW (ac) b/	Wetland Area Proposed to Be Maintained Clear of Woody Vegetation (ac) b/
GREAT LAKES		443,827	509.0	255.1
Loop 2/MN	PEM	1,350	1.5	0.8
	PFO1	275	0.3	0.2
	subtotal	1,625	1.8	1.0
Loops 1&2/MN	PEM	5,675	6.5	3.3
	PSS	450	0.5	0.3
	subtotal	6,125	7.0	3.6
Loop 3/MN	PFO	100	0.1	0.1
	PFO1	325	0.4	0.2
	PFO1/2	1,725	2.0	1.0
	PFO1/SS1	250	0.3	0.1
	PFO2/SS1	1,000	1.1	0.6
	PSS	100	0.1	0.1
	PSS1	850	1.0	0.5
	PSS4	50	0.1	<0.1
	PSS1/EM	1,450	1.7	0.8
	PEM/SS1	6,275	7.2	3.6
	PEM/SS3	875	1.0	0.5
	PEM	3,375	3.9	1.9
	PEM/UB	200	0.2	0.1
	subtotal	16,575	19.1	9.5
Loop 4/MN	PFO1	1,175	1.3	0.7
	PFO4	2,075	2.4	1.2
	PFO2/4	2,050	2.4	1.2
	PFO4/1	1,775	2.0	1.0
	PFO4/2	3,650	4.2	2.1
	PFO6/4	475	0.5	0.3
	PFO/SS1	1,175	1.3	0.7
	PFO4/SS1	1,150	1.3	0.7
	PFO4/SS3	4,175	4.8	2.4
	PSS1	725	0.8	0.4
	PSS1/3	600	0.7	0.3
	PSS1/4	950	1.1	0.5
	PSS2/1	1,900	2.2	1.1
	PSS3/4	1,500	1.7	0.9
	PSS/EM5	1,625	1.9	0.9
	PSS1/EM	1,950	2.2	1.1
	PSS1/EM5	3,225	3.7	1.9
	PSS4/EM	200	0.2	0.1
	PSS6/EM	1,200	1.4	0.7
	PEM/SS1	5,150	5.9	3.0
	PEM/SS3	600	0.7	0.3
	PEM	4,975	5.7	2.9
	PEM5	6,625	7.6	3.8
	POW	400	0.5	0.2
	subtotal	49,325	56.5	28.4
Loop 5/MN	PFO1	2,475	2.8	1.4
	PFO4	425	0.5	0.2
	PFO/SS1	5,800	6.7	3.3
	PFO4/SS	100	0.1	0.1
	PSS1/EM5	2,150	2.5	1.2
	PEM5	1,150	1.3	0.7
	subtotal	12,100	13.9	6.9

TABLE E-2 (cont'd)

Applicant Segment/State	NWI Classification a/	Length of Each Wetland Type Crossed (ft)	Wetland Area Affected During Construction of Proposed ROW (ac) b/	Wetland Area Proposed to Be Maintained Clear of Woody Vegetation (ac) b/
Loop 6/MN	PFO	6,200	7.1	3.6
	PFO1	1,750	2.0	1.0
	PFO2	3,000	3.4	1.7
	PFO2/SS	6,025	6.9	3.5
	PFO4/2	2,475	2.8	1.4
	PFO/SS	2,800	3.2	1.6
	PSS	9,000	10.3	5.2
	PSS1	450	0.5	0.3
	PSS/EM5	4,350	5.0	2.5
	PSS1/EM5	975	1.1	0.6
	PEM5	1,425	1.6	0.8
	subtotal	38,450	43.9	22.2
Loop 7/WI	PFO1/SS1	525	0.6	0.3
	PEM5	150	0.2	0.1
	subtotal	675	0.8	0.4
Loop 8/WI/MI	PFO	200	0.2	0.1
	PFO1	5,250	6.0	3.0
	PFO1/3	950	1.1	0.5
	PFO1/7	475	0.5	0.3
	PFO4	2,375	2.7	1.4
	PFO/SS	1,675	1.9	1.0
	PSS	575	0.7	0.3
	PSS1	2,425	2.8	1.4
	PSS1/3	425	0.5	0.2
	PSS/EM	1,800	2.1	1.0
	subtotal	16,150	18.5	9.2
Loop 9/MI	PFO	11,075	12.7	6.4
	PFO4	5,375	6.2	3.1
	PFO4/1	2,375	2.7	1.4
	PFO4/2	500	0.6	0.3
	PFO/SS	9,325	10.7	5.4
	PSS	3,227	3.7	1.9
	PSS1	2,575	3.0	1.5
	PSS/EM	2,175	2.5	1.2
	PEM	275	0.3	0.2
	subtotal	36,902	42.4	21.4
Loop 10/MI	PFO	13,950	16.0	8.0
	PFO4	32,800	37.6	18.8
	PFO5/EM	100	0.1	0.1
	PFO/SS	17,850	20.5	10.2
	PSS	5,575	6.4	3.2
	PSS1	25	<0.1	<0.1
	PSS/EM	1,450	1.7	0.8
	PEM	100	0.1	0.1
	POW	250	0.3	0.1
	subtotal	72,100	82.7	41.3
Loop 11/MI	PFO	17,675	20.3	10.1
	PFO4	5,925	6.8	3.4
	PFO4/1	10,900	12.5	6.3
	PFO4/SS	3,475	4.0	2.0
	PFO/SS	13,150	15.1	7.5
	PSS	6,725	7.7	3.9
	PSS1/EM	600	0.7	0.3
	PSS4	14,675	16.8	8.4
	PSS4/EM	650	0.7	0.4
	PSS4/PFO	4,000	4.6	2.3

TABLE E-2 (cont'd)

Applicant Segment/State	NWI Classification a/	Length of Each Wetland Type Crossed (ft)	Wetland Area Affected During Construction of Proposed ROW (ac) b/	Wetland Area Proposed to Be Maintained Clear of Woody Vegetation (ac) b/
Loop 11/MI (cont'd)	PSS/EM	1,850	2.1	1.1
	PSS/OW	450	0.5	0.3
	PEM	3,250	3.7	1.9
	subtotal	83,325	95.5	47.9
Loop 12/MI	PFO	4,850	5.6	2.8
	PFO4	7,850	9.0	4.5
	PFO4/1	7,650	8.8	4.4
	PFO4/SS	3,450	4.0	2.0
	PFO/SS	6,825	7.8	3.9
	PSS	1,075	1.2	0.6
	PSS/EM	5,075	5.8	2.9
	PEM	3,500	4.0	2.0
	POW	500	0.6	0.3
	subtotal	40,775	46.8	23.4
Loop 13/MI	PFO	12,075	13.9	6.9
	PFO4	7,500	8.6	4.3
	PFO/SS	1,625	1.9	0.9
	PSS	4,200	4.8	2.4
	PSS4	400	0.5	0.2
	PSS/EM	6,625	7.6	3.8
	PEM	825	0.9	0.5
	subtotal	33,250	38.2	19.0
Loop 14/MI	None			
Loop 15/MI	PFO	175	0.2	0.1
	PFO1	250	0.3	0.1
	PFO4	1,100	1.3	0.6
	PFO1/4	600	0.7	0.3
	PFO4/SS3	150	0.2	0.1
	PSS1/FO	175	0.2	0.1
	PSS3/FO4	750	0.9	0.4
	POW/FO5	150	0.2	0.1
	PSS	2,500	2.9	1.4
	PSS1	3,325	3.8	1.9
	PSS1/3	1,000	1.1	0.6
	PSS/EM	1,100	1.3	0.6
	PSS1/EM	4,950	5.7	2.8
	PEM/SS1	400	0.5	0.2
	PEM	1,325	1.5	0.8
	PEM/OW	100	0.1	0.1
	POW	150	0.2	0.1
	subtotal	18,200	21.1	10.3
Loop 16/MI c/	None			
Loop 17/MI	PFO	4,325	5.0	2.5
	PFO1	2,875	3.3	1.7
	PFO4	500	0.6	0.3
	PFO/SS	3,325	3.8	1.9
	PSS	800	0.9	0.5
	PSS1	825	0.9	0.5
	PSS/EM	4,475	5.1	2.6
	PSS1/EM	375	0.4	0.2
	PEM	725	0.8	0.4
	POW	25	<0.1	<0.1
	subtotal	18,250	20.8	10.6

TABLE E-2 (cont'd)

Applicant Segment/State	NWI Classification a/	Length of Each Wetland Type Crossed (ft)	Wetland Area Affected During Construction of Proposed ROW (ac) b/	Wetland Area Proposed to Be Maintained Clear of Woody Vegetation (ac) b/
TENNESSEE		12,550	15.6	8.5
Segment 1/NY	PFO	2,600	3.0	1.5
	PFO1	800	0.9	0.5
	PFO1/4	850	1.0	0.5
	PSS1/EM5	900	1.0	0.5
	PEM5	1,375	1.6	0.8
	subtotal	6,525	7.5	3.8
Segment 3/NY	PFO1	250	0.3	0.1
	PFO/SS1	275	0.3	0.2
	subtotal	525	0.6	0.3
Segment 4/NY	None			
Segment 8/MA	PFO1	2,675	3.7	2.1
	PFO/SS1	1,250	1.7	1.0
	subtotal	3,925	5.4	3.1
Segment 9/MA	PFO1	975	1.3	0.8
	PSS1/EM	600	0.8	0.5
	subtotal	1,575	2.1	1.3
Station 230C/NY	None			
ALGONQUIN		15,800	9.3	8.1
G5 Replacement/ MA	PFO1	3,900	1.5	0.9
	PFO	1,175	0.5	0.3
	PEM	400	0.2	0.1
	subtotal	5,475	2.5	1.3
G-8 Replacement/ MA	PFO/SS1	100	<0.1	<0.1
	PSS	25	<0.1	<0.1
	PSS1	200	0.1	<0.1
	subtotal	325	0.1	0.1
H-1 Replacement/ MA	PFO1	2,250	0.8	0.0
Medfield Loop/MA	PFO1	2,900	2.7	2.7
	PSS1	500	0.5	0.5
	subtotal	3,400	3.2	3.2
E-1 Loop/CT	PFO	25	<0.1	<0.1
	PFO1	500	0.2	0.2
	POW	350	0.2	0.2
	subtotal	875	0.4	0.4
Chaplin Loop/CT	PFO1	525	0.4	0.4
Tiverton Loop/RI	PFO1	2,650	2.4	2.4
	PFO1/SS1	300	0.3	0.3
	subtotal	2,950	2.7	2.7

TABLE E-2 (cont'd)

Applicant Segment/State	NWI Classification a/	Length of Each Wetland Type Crossed (ft)	Wetland Area Affected During Construction of Proposed ROW (ac) b/	Wetland Area Proposed to Be Maintained Clear of Woody Vegetation (ac) b/
TRANSCO				
6.79-Mile Leidy Loop/PA,NJ	PFO1	100	0.1	0.1
Station 205/NJ	None			
Station 515/PA	None			
TEXAS EASTERN				
Line No. 37/PA	None			
CNG				
TL-470 Line/NY	PEM	1.5	1.5	
State Line Station/NY	None			
Utica Station/PA	None			
NATIONAL FUEL/PENN-YORK				
Y-M54 Line 2/PA	PUB	75	0.0	0.0
Concord Station/NY	None			
Ellisburg Station/PA	None			
PENNEAST				
TL-403 Replacement/NY	None			
PROJECT TOTAL		473,202 (89.6 miles)	535.5	273.3

a/ NWI Wetland Types:

Palustrine Forested:
- PFO1 = broad-leaved deciduous
- PFO2 = needle-leaved deciduous
- PFO3 = broad-leaved evergreen
- PFO4 = needle-leaved evergreen
- PFO5 = dead
- PFO6 = deciduous
- PFO7 = evergreen

Palustrine Scrub-shrub:
- PSS1 = broad-leaved deciduous
- PSS2 = needle-leaved deciduous
- PSS3 = broad-leaved evergreen
- PSS4 = needle-leaved evergreen
- PSS6 = deciduous

Palustrine Emergent:
- PEM = emergent marsh or wet meadow
- PEM5 = needle-leaved persistent

Palustrine Openwater:
- POW = small pond or standing water
- PUB = open water with unconsolidated bottom

Wisconsin and New York have their own classification system. For uniformity, the state codes have been converted to the NWI system.

b/ These figures represent wetland areas that would be affected by using the proposed right-of-way widths. We have recommended that Great Lakes, Tennessee and Algonquin reduce their proposed right-of-ways widths for all or portions of their projects. This would significantly reduce the area of forested wetlands that would be affected. See sections 5.1.7 and 5.1.9.1 for complete discussion.

c/ Wetland maps exist for only 19.1 miles of the proposed 51.4 miles of Loop 16.

APPENDIX F

LIST OF PREPARERS

APPENDIX F

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Soil Conservation Service
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- Water Resources Unit
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- State Forester
- Bureau of Wildlife
- Air Compliance Division

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Department of Agriculture
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State Office of Comprehensive Planning
Council on Environmental Quality
Division of Planning and Coastal Management
Division of Energy
- Office of Policy and Management

Department of Public Utilities Control
Energy Facility Siting Council

Massachusetts:

Governor Michael S. Dukakis
Massachusetts Historical Commission
Massachusetts Department of Public Utilities
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Division of Wetlands and Waterways
Executive Office of Communities and Development
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Executive Office of Environmental Affairs
- Conservation Services
- Environmental Impact Review
- Water Resources Commission
- Division of Agricultural Development
- Bureau of Land Use
- Division of Regulatory Services

Department of Environmental Management
Department of Environmental Protection

Michigan:

Governor James J. Blanchard
Office of Secretary of State, Archives and Historic Preservation

Michigan Public Service Commission
Department of Agriculture
Department of Natural Resources
  Forest Management Division
Michigan Association of Conservation
  Districts
Wildlife Society - Michigan Chapter

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State Historic Preservation Office
State Public Service Commission
State Planning Agency
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Geological Survey, University of Minnesota
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Minnesota Association of Soil and Water
  Conservation
Minnesota Forestry Association
Minnesota Pollution Control Agency
Minnesota Department of Environmental Resources

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New Jersey Department of Environmental
  Protection
  Division of Fish, Game and Wildlife
  Division of Water Resources
  Regulatory and Governmental Affairs
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  Historic Preservation
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State Fish and Wildlife Management Division
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New York Soil Conservation
New York Division of Budget
New York State Energy Office

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State Water Control Board

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Harrisville, RI
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South Hill, VA

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Tripp, WI

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Otis Library, Norwich, CT
William Ross Library, Chaplin, CT

Carver Public Library, Carver, MA
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Seville Township Public Library, Riverdale, MI
St. Charles District Library, St. Charles, MI
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State Library, Escanaba, MI
Taymouth Township Community Library, Burt, MI
Wickson Memorial Library, Frankenmith, MI

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Lydia Essex Public Library, Tiverton, RI

R.T. Arnold Library, South Hill, VA

Ashland Public Library, Ashland, WI
City Library, Hurley, WI
Superior Public Library, Superior, WI

Media

The Chronicle, Willamantic, CT
The Hartford Courant, Hartford, CT
Norwich Bulletin, Norwich, CT
The Observer Patriot, Putnam, CT

The Boston Globe, Boston, MA
The Boston Herald, Boston, MA
Bourne Courier, Bourne, MA
Bourne Enterprise, Bourne, MA
Cape Cod Times, Hyannis, MA

Hopkinton Crier, Hopkinton, MA
Milford Daily News, Milford, MA
The Taunton Daily Gazette, Taunton, MA
Wareham Courier, Plymouth, MA

Clare County Cleaver, Harrison, MI
Crawford County Avalanche, Grayling, MI
Daily News, Iron Mountain, MI
Diamond Drill, Crystal Falls, MI
Escanaba Daily Press, Escanaba, MI
Herald-Times, Gaylord, MI
Ironwood Daily Globe, Ironwood, MI
Lapeer County Press, Lapeer, MI
Manistique Pioneer Tribune, Manistique, MI
Midland Daily News, Midland, MI
Mining Journal, Marquette, MI
Petosky News Review, Petosky, MI
Saginaw News, Saginaw, MI
St. Ignace News, St. Ignace, MI
The Waterfront, Lake City, MI
The Reporter, Iron River, MI
Times Herald, Port Huron, MI

Cass Lake Times, North Cass Lake, MN
Farmers Independent, Bagley, MN
Grand Rapids Herald Review, Grand Rapids, MN
Thief River Times Newspaper, Thief River Falls, MN

Home News, New Brunswick, NJ
News Tribune, Woodbridge, NJ
The News, Belvidere, NJ
Princeton Packet, Princeton, NJ
The Suburban, East Brunswick, NJ
The Trenton Times, Trenton, NJ
The Trentonian, Trenton, NJ
Town Topics, Princeton, NJ

Buffalo News, Buffalo, NY
Cazenovia Republican, Cazenovia, NY
Daily Messenger, Canandaigua, NY
Greenbush Area News, East Greenbush, NY
Herald Journal, Syracuse, NY
Livingston County News, Geneseo, NY
Niagara Falls Gazette, Niagara Falls, NY
Observer Dispatch, Utica, NY
Post Standard, Syracuse, NY
Register Star, Hudson, NY
Rockland County Times, Haverstraw, NY

Rockland Journal News, West Nyack, NY
The New York Times, New York, NY
Times Record, Troy, NY
Times Union, Albany, NY
Times Journal, Cobleskill, NY
Troy Record, Troy, NY
Union Sun and Journal, Lockport, NY
Western New Yorker, Warsaw, NY

Center Democrat, Bellefonte, PA
Center Daily Times, State College, PA
Citizens Voice, Wilkes-Barre, PA
Leader Publishing, Coudersport, PA
Pike County Dispatch, Milford, PA
Pocono Record, Stroudsburg, PA
Sun Gazette, Williamsport, PA
The Express, Jersey Shore, PA
The Easton Express, Easton, PA
Times Leader, Wilkes-Barre, PA

Providence Journal, Providence, RI
Woonsocket Call, Woonsocket, RI

South Hill Enterprise, South Hill, VA

County Journal, Cable, WI
Evening Telegram, Superior, WI
Iron County Miner, Hurley, WI

Organizations and Individuals

Adirondack Council, Elizabethtown, NY
Adirondack Land Trust, Elizabethtown, NY
Adirondack Mountain Club, Glen Falls, NY
Algonquin Gas Transmission Company, Boston, MA
American Bass Association of Virginia, Charlottesville, VA
Association of New Jersey Environmental Commissions, Mendham, NJ
Attleboro Conservation Commission, Attleboro, MA
Audubon Council of CT, Sharon, CT
Audubon Society of Rhode Island, Smithfield, RI
Berkshire-Litchfield Environmental Council, Inc., Lakeville, CT
Bureau of Environmental Analysis and Review, Madison, WI
Carey, Mary Flagler Arboretum, Millbrook, NY
Catskill Center for Conservation, Arkville, NY
Center County Board of Commissioners, Center County, PA
CNG Transmission Corporation, Clarksburg, WV
Citizens Natural Resources Association of WI, Richland Center, WI

Connecticut Forest and Park Association, Middletown, CT
Connecticut Wildlife Federation, Middletown, CT
Connecticut Wildlife Federation, W. Haven, CT
Conservation Council of Virginia, Richmond, VA
Conservation Law Foundation of Rhode Island, Providence, RI
CT Association of Soil and Water Conservation, East Haddam, CT
CT Audubon Society, Fairfield, CT
CT Bass Chapter, Coventry, CT
CT Fund for the Environment, New Haven, CT
CT Office of Policy and Management, Hartford, CT
DOE - Office of Environment, Safety and Health, Washington, DC
DOE - Office of Fuel Programs, Washington, DC
DOE - Office of NEPA Project Assistance, Washington, DC
Ecology Action for Rhode Island, Providence, RI
Environmental Council of Rhode Island, Cranston, RI
Environmental Lobby of Massachusetts, Boston, MA
Environmental Planning, Albany, NY
Great Lakes Gas Transmission Company, Detroit, MI
Hopkinton Conservation Commission, Hopkinton, MA
Law Offices of Howard L. Newell, Framingham, MA
Leech Lake Reservation Business Committee, Cass Lake, MN
Long Island Sound Task Force, Stamford, CT
Long Island Sound Taskforce of the Oceanic Society, Stamford, CT
Longmeadow Conservation Commission, Longmeadow, MA
Marquette County Planning Commission, Marquette County, MI
Massachusetts Association of Conservation Commissions, Medford, MA
Massachusetts Association of Conservation Districts, Randolph, MA
Massachusetts Audubon Society, Lincoln, MA
Massachusetts Bass Chapter Federation, Bedford, MA
Massachusetts Forestry Association, Princeton, MA
Michigan Association of Conservation Districts, Middleville, MI
Michigan Audubon Society, Kalamazoo, MI
Michigan Bass Chapter Federation, Portage, MI
Michigan United Conservation Clubs, Grand Rapids, MI
Michigan United Conservation Clubs, Lansing, MI
MNDNR - Office of Natural Heritage/Nongame Programs, St. Paul, MN
MNDNR - Planning and Review Services, St. Paul, MN
Natural Lands Trust, Inc., Philadelphia, PA
New York Conservation Council, Teron, NY
NJ Association of Conservation Districts, Cape May Courthouse, NJ
NJ Audubon Society, Franklin Lakes, NJ
NJ Conservation Foundation, Morristown, NJ
NJ Forestry Association, Chatham, NJ
NJDER - Office of Program Coordinator, Trenton, NJ
Northern States Power Company, Ashland, WI
North Michigan University, Department of Geography, Marquette, MI
NY Association of Conservation Commissions, Syracuse, NY
NY Forest Owners Association, Rochester, NY

PADER - Bureau of Waste Management, Harrisburg, PA
PADER - Secretary's Office of Policy, Harrisburg, PA
Palisades Interstate Park Commission, Bear Mountain, NY
Pennsylvania Association of Conservation Districts, Dauphin, PA
Pennsylvania Bass Chapter Federation, Inc., Allentown, PA
Pennsylvania Citizens Advisory Council, Harrisburg, PA
Pennsylvania Cooperative Fish & Wildlife Reservation Unit, University Park, PA
Pennsylvania Environmental Council, Inc., Philadelphia, PA
Pennsylvania Forestry Association, Mechanicsburg, PA
Piedmont Environmental Council, Charlottesville, VA
R & D Engineering and Land Surveying, P.C., Buffalo, NY
Rhode Island State Association of Conservation, Narragansett, RI
Ramapo Commission on Environmental Quality and Recycling, Suffern, NY
Rockland County Conservation Association, Inc., Pomona, NY
Ross, Marsh, Foster, Myers and Quiggle, Washington, DC
Scenic Hudson, Poughkeepsie, NY
Sierra Club - Connecticut Chapter, Hartford, CT
Source Protection, Clinton, CT
The Nature Conservancy, Eastern Regional Office, Boston, MA
The Nature Conservancy, Middletown, CT
Town of Haverstraw, NY - Engineering Department
Trout Unlimited - Mass/RI Council, Boston, MA
Trout Unlimited - Rhode Island Chapter, Upper Providence, RI
Trout Unlimited - New York Council, Syracuse, NY
Trout Unlimited - Pennsylvania Council, Punxsutawney, PA
Trout Unlimited - Watertown, CT
Trout Unlimited - Virginia Council, Lynchburg, VA
Trout Unlimited - Wisconsin Council, Eau Claire, WI
Trustees of Reservations, Beverly, MA
U.S. Dept. of State - Bureau of Oceans and International Environmental and Scientific Affairs, Washington, DC
U.S. Fish and Wildlife Service, New England Branch, Concord, NH
USDA-Forest Service, Chippewa National Forest, Cass Lake, MN
USDA-Forest Service, Ottawa National Forest, Watersmeet, MI
USDA-Forest Service, Ottawa National Forest, Iron River, MI
USDOI-Bureau of Mines, Denver, CO
Virginia Association of Soil and Water Conservation, Rixeyville, VA
Virginia Bass Chapter Federation, Chester, VA
Virginia Native Plant Society, Annandale, VA
Virginia Wildlife Federation, Virginia Beach, VA
Western Michigan Environmental Action Council, Grand Rapids, MI
WI Association of Soil and Water Conservation, Viroqua, WI
WI Bass Chapter Federation, Dresbach, WI
WIDNR - Environmental Impact Coordinator
WI Park and Recreation Association, Greendale, WI
WI Waterfowlers Association, Inc., Waukesha, WI
Wildlife Society - Michigan Chapter, Dewitt, MI
Wildlife Society - Minnesota Chapter, White Bear Lake, MN

Wildlife Society - New York Chapter, Delmar, NY
Wildlife Society - New York Chapter, Rensselaerville, NY
Wildlife Society - Pennsylvania Chapter, Duncannon, PA
Wildlife Society - Pennsylvania Chapter, Harrisburg, PA
Wildlife Society - Wisconsin Chapter, Madison, WI
Wildlife Society - Virginia Chapter, Blacksburg, VA
Willimantic Water Department, Mansfield, CT
Mr. James S. Cummings, Williamsville, NY
Mr. Ladislav R. Hamka, Kalamazoo, MI
Mr. Larry Hartman, St. Paul, MN
Ms. M. Margaret Fabic, Syracuse, NY
Mr. & Mrs. James Kelley, Hopkinton, MA
Mr. J.E. Knight, Hessel, MI
Mr. Thomas E. Knight, Hopkinton, MA
Mr. Douglas Mace, Harmony Township Engineer, Phillipsburg, NJ
Mr. & Mrs. John Douglas McCarthy, Fox Lake, WI
Mr. Jay Newton, Medway, MA
Mr. William T. Seaver, East Douglas, MA

APPENDIX H

REFERENCES AND CONTACTS

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Aaseng, N. 1989. Telephone communications on December 1, between L. Hoehne (CH2M HILL) and N. Aaseng (MNDNR).

Adler, R. 1989. Telephone communication on December 11, between D. Grotzinger (Ebasco) and R. Adler (U.S. Environmental Protection Agency - Groundwater Management).

Advisory Council on Historic Preservation. 1986. Procedures for the Protection of Historic and Cultural Properties. 36 CFR Part 800, Vol. 51, Fed. Reg. 3115. United States Printing Office, Washington, DC.

Aho, G. 1989. Telephone communication on December 14, between D. Hall (CH2M HILL) and G. Aho (Delta County Soil Conservation Service).

Aldrich, R. 1989. Telephone communication on December 14, between D. Hall (CH2M HILL) and R. Aldrich (Midland County Soil Conservation Service).

Alexander, D. 1989. Telephone communication on December 12, between P. Patterson (Ebasco) and D. Alexander (National Park Service, Omaha).

Algermissen, S.T., D.M. Perkins, P.C. Thenhraus, S.L. Hanson, and B.L. Bender. 1982. Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States. U.S. Geological Survey Open-File Report 82-1033.

American Gas Association. 1988. American Gas Association Issue Brief 1988-6.

American Gas Association. 1986. An analysis of Reportable Incidents for Natural Gas Transmission and Gathering Lines: 1970 through June 1984. Jongs, Kramer, and Gideon from OPSR data required on the DOT F7100.2 Form. Columbus, Ohio.

Anderson, S.H., K. Mann, and H.H. Shugart, Jr. 1977. The Effect of Transmission-line Corridors on Bird Populations. The American Naturalist 97(1): 216-221.

Archaeological Research Specialists (ARS). 1990. Phase IA and IB Archaeological Assessment Report for the CNG TL-470 Pipeline Crossing Project, East Greenbush, New York. For ENSR Consulting and Engineering, Somerset, New Jersey. January 1990.

Audubon Society of Rhode Island. 1990. Letter dated January 12 from Eugenia Marks (Audubon Society of Rhode Island, Director for Issues and Publications) to K. Flynn (FERC).

Baldwin, B. 1989. Telephone communication on December 4, between D. Grotzinger (Ebasco) and B. Baldwin (Seekonk Water District, Seekonk, Massachusetts).

Balcom, T. 1989. Letter dated November 20 from T. Balcom (Supervisor, Natural Resources Planning and Review Services, MNDNR) to K. Flynn (FERC).

Banach, F. 1989. Telephone communication on November 11, between E. Fink (CH2M-HILL) and F. Banach (Connecticut Department of Environmental Protection, Water Compliance Unit).

Barbor, E. 1989. Letter dated October 5 from E. Barbor (Bureau of Indian Affairs) to J. Rowe (Project Manager, Braun Environmental Labortories).

Barosh, P.J. 1986. Tectonophysics Vol. 132.

Barosh, P.J. 1981. Seismic source zones of the Eastern United States and Seismic Zoning of the Atlantic Seaboard and Appalachian Regions. State of the Art for Assessing Earthquake Hazards in the United States - Report No. 21 US Army Corps of Engineers, Misc. Paper S-73-1.

Benzie, R. 1989. Telephone communication on October 24, between L. Weyer (CH2M HILL) and R. Benzie (Michigan Department of Public Health - Division of Water Supply).

Bidwell, L.E., T.C. Winter, and R.W. Maclay. 1970. Water Resources of the Red Lake River Watershed, Northwestern Minnesota. U.S. Geological Survey Hydrologic Investigations Atlas HA - 346.

Bloom, A.L. 1978. Geomorphology. Prentice-Hall, Inc., New Jersey.

Bodine, R. 1989. Letter dated November 14 from R. Bodine (District Ranger, Ottawa National Forest) to Secretary (FERC).

Born, S.M., D.A. Yanggen, A.R. Czecholinski, R.J. Tierney, R.G. Hennings. 1988. Wellhead-Protection Districts in Wisconsin: An Analysis and Test Applications. Wisconsin Geological and Natural History Survey Special Report 10.

Brady, N.C. 1974. The Nature and Properties of Soils. MacMillan Publishing, London.

Brash, B. 1989. Telephone communication on December 14, between D. Hall (CH2M HILL) and B. Brash (Mercer County Soil Conservation Service).

Braun, E.L. 1950. Deciduous Forests of Eastern North America. Hafner Press, New York, New York.

Braun Environmental Laboratories. 1988. Letters dated December 5, from David L. Nelson, Environmental Scientist and Roger V. Blomquist, Ph.D. Vice President (Braun Environmental Laboratories), to Richard Dexter (Historical Preservation Division, State Historical Society of Wisconsin), Ted Lofstrom (Minnesota Historical Society); and John Halsey (Michigan Department of State).

Bricker, D.M. 1977. Seismic Disturbances in Michigan. Michigan Department of Natural Resources, Geological Survey Division Circular 14.

Canadian Department of Fisheries and Oceans. 1983. A Rationale for Standards Relating to the Discharge of Sediments into Yukon Streams from Placer Mines. Environmental Protection Service, New Westminster British Columbia, Canada.

Carvell, K.L, and P.A. Johnston. 1978. Environmental Effects of Right-of-Way Management of Forested Ecosystems. Electric Power Research Institute, EA-491.

Castleberry, D.H. 1990. Letter dated February 27, D. Castleberry (Regional Director, National Park Service, Omaha, Nebraska) to G. Willant (EIS Manager, Ebasco).

Chandler, V.W., and G.B. Morey. 1989. Seismic History of Minnesota and Its Geological Significance: An Update. Eastern Seismological Society of America Seismological Research Letters, v. 60, no. 2.

Checho, J. 1989. Telephone communication on October 30, between M. McMullen (Ebasco) and J. Checho (President, Lima Golf Course).

Chessness, R. 1990. Telephone communication on January 16, between L. Hoehne (CH2M HILL) and R. Chesness (MNDNR).

Clayton, L. 1984. Pleistocene Geology of the Superior Region, Wisconsin. Wisconsin Geological Survey Information Circular 46.

Clearwater County Soil Conservation Service. 1989. Telephone communication on December 13, between D. Hall (CH2M HILL) and county soil conservationist.

Connecticut Department of Environmental Protection. 1989. Letter dated December 8 from K. Metzler (CTDEP) to L. Hoehne (CH2M HILL).

Crawford, N. 1989. Telephone communication on December 12, between P. Patterson (Ebasco) and N. Crawford (Hiawatha National Forest).

Culp, R. 1989a. Telephone communications on November 9 and October 31, between L. Hoehne (CH2M HILL) and R. Culp (PGC).

Culp, R. 1989b. Telephone communication on October 31, between L. Hoehne (CH2M HILL) and R. Culp (PGC).

DeCapita, M. 1989. Telephone communication on December 19, between J. Scott (Ebasco) and M. DeCapita (FWS, East Lansing, Michigan).

DeGraaf, R. and Rudis, D. 1986. New England Wildlife: Habitat, Natural History and Distribution. U.S. Department of Agriculture.

Denslow, H. 1989. Telephone communication on December 12, between D. Hall (CH2M HILL) and H. Denslow (Windham and New London County Soil Conservation Services).

Doucet, G.J., R.S. Stewart and K.A. Morrison. 1981. The Effect of the Utility Right-of-Way on White-tailed Deer in a Northern Deer Yard. Proceedings Second Symposium on Environmental Concerns on Rights-of-Way Management. University of Michigan, Ann Arbor. 59:1-9.

Doucet, G.J., D.T. Brown and P. Lamothe. 1987. Deer Behavior in a Powerline Right-of-Way Located in a Northern Deer Yard. Fourth Symposium an Environmental Concerns in Rights-of-way Management.

East Greenbush. 1989. Telephone communication on December 13, between P. Patterson (Ebasco) and Town of East Greenbush, New York Town Planner.

Eliason, B. 1990. Telephone communication on January 18, between L. Hoehne (CH2M HILL) and B. Eliason (MNDNR).

Eliason, B. 1989. Letter dated August 24 from B. Eliason (Natural Heritage/Nongame Programs, MNDNR) to L. Hartman (Great Lakes).

Emanco Inc. August 18, 1989. Response to FERC Data Request for Selected Facilities of Docket No. CP89-007-002.

Emmet County Soil Conservation Service. 1989. Telephone communication on December 11, between D. Hall (CH2M HILL) and county soil conservationist.

Energy Facility Siting Council (Massachusetts, EFSC). 1989. Initial comments of the Massachusetts Energy Facilities Siting Council to Algonquin Gas Transmission Company and Tennessee Gas Pipeline Company.

Englet, R. 1989. Telephone communication on October 31, between S. Bridges (Ebasco) and Robert Englet (Regional Historic Preservation Reviewer, New York State Office of Parks. Recreation, and Historic Preservation, Bureau of Field Services).

Ensor, R, 1989. Telephone communication on April 26, between J. Scott (Ebasco) and R. Ensor (Rhode Island Natural Heritage Program).

Evans, E. 1990. Telephone communication on January 8, between D. Grotzinger (Ebasco) and E. Evans (Surface Water Quality, Michigan Department of Natural Resources).

Federal Energy Regulatory Commission. 1988. Order Establishing Guidelines for the Submission of Required Data. July.

Federal Energy Regulatory Commission. 1989. Midland Cogeneration Ventures Pipeline Project. Washington, D.C. June.

Federal Interagency Committee for Wetland Delineation. 1989. Federal Manual for Identifying and Delineating Jurisdictional Wetlands. U.S. Army Corp. of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service, Washington, D.C. Cooperative technical publication.

Feister, L. 1985. Archaelogy in Rensselaerwyck, Dutch Seventeenth Century Domestic Sites, New Netherland Studies; an Inventory of Current Research and Approaches. Bulletin KNOB jaargang 84, nummer 2 en 3, pp. 80-88.

Fenske, J. 1990. Telephone communication on January 3, between D. Lake (Ebasco) and J. Fenske (Fisheries Biologist, MIDNR).

Fossburg, J. 1989. Telephone communication on December 11, between D. Hall (CH2M HILL) and J. Fossburg (Lapeer County Soil Conservation Service).

Galli, A.E., C.F. Leck, and R.T.T. Forman. 1976. Avian Distribution Patterns in Forest Islands of Different Sizes in Central New Jersey. Auk. 93: 356-364.

Gantz, W. 1990. Telephone communication on May 14, between D. Grotzinger (Ebasco) and W. Gantz (WIDNR).

Gibson, G. 1990. Telephone communication on February 14, between P. Patterson (Ebasco) and G. Gibson (Land Acquisition and Management Division, CTDEP).

Gibson, W. 1989. Telephone communication on December 8, between P. Patterson (Ebasco) and W. Gibson (WIDNR, Northwest District).

Gleason, H. A., and A. Cronquist. 1963. Manual of Vascular Plants of Northeastern United States and Canada. D. Van Nostrand Company.

Gorski, S. 1990. Telephone communication on January 4, between D. Lake (Ebasco) and S. Gorski (Assistant Branch Chief, NMFS)

Great Lakes Gas Transmission Company. 1990. Response to FERC formal data request, Docket No. CP89-892-000.

Halliwell, D. 1990. Telephone communication on January 3, between D. Lake (Ebasco) and D. Halliwell (Fisheries Biologist, MADEP).

Hendrickson, G.E., and C.J. Doonan. 1966. Ground-Water Resources of Dickinson County, Michigan. State of Michigan Department of Conservation, Geological Survey Division Water Investigation 5.

Hill, J. 1990. Telephone communication on January 3, between P. Patterson (Ebasco) and J. Hill (Chairman, Planning Board, Concord, New York).

Hinds, L. 1989. Telephone communication on December 15, between D. Hall (CH2M HILL) and L. Hinds (Barnstable County Soil Conservation Service).

Hole, F.D., M.T. Beatty, C.J. Milfred, G.B. Lee, and A.J. Klingelhoets. 1968. Soils of Wisconsin. Wisconsin Geological and Natural History Survey State Map 20, Scale 1:710.000.

Honig, R. and K. Thibodeaux. 1990. Telephone communication on May 10, 1990 between D. Lake (Ebasco) and R. Honig and K. Thibodeaux (Tennessee Gas Pipeline Co.).

Hrabik, A. 1989. Letter dated August 28 from P. Hrabik (National Resource Coordinator, Lac du Flambeau Band of the Lake Superior Chippewa Indians) to N. Bresette (Executive Director, Great Lakes Inter Tribal Council Inc.).

Huey, P.R. 1984. Dutch Sites of the 17th Century in Rennselaerswyck. In: The Scope of Historical Archaeology, David S. Orr and Daniel G. Crozier, eds. Temple University, Philadelphia, PA.

Huey, P. 1989. Telephone communication on November 29, between S. Bridges (Ebasco) and P. Huey (Senior Scientist, Archeology, New York State Office of Parks, Recreation, and Historic Preservation, Bureau of Historic Sites).

Jackson, H. T. 1972. Mammals of Wisconsin. University of Wisconsin Press.

Jones, D.J., G.S. Kramer, D.N. Gideon, R.J. Eiber. 1986. An Analysis of Reportable Incidents for Natural Gas Transportation and Gathering Lines 1970 through June 1984. NG-18 Report No. 158, Pipeline Research Committee of the American Gas Association.

Jordan, J. 1989. Telephone communication on December 18, between P. Patterson (Ebasco) and J. Jordan (Forest Soil Scientist, Ottawa National Forest).

Juetten, R. 1989. Telephone communication on December 27, between D. Lake (Ebasco) and R. Juetten (Fisheries Biologist, MIDNR).

Kampa, J. 1989. Telephone communication on December 21, between D. Lake (Ebasco) and J. Kampa (Fisheries Biologist, WIDNR).

Kanivetsky, R. 1978. Hydrogeologic Map of Minnesota, Bedrock Hydrogeology. Minnesota Geological Survey Map S-2, Scale 1:5000,000.

Kanivetsky, R. 1979. Hydrogeologic Map of Minnesota, Quaternary Hydrogeology. Minnesota Geological Survey Map S-3, Scale 1:5000,000.

Kelley, T. 1989. Telephone communication on December 13, between P. Patterson (Ebasco) and T. Kelley (Bureau of Forestry, PADER).

Kells, K. 1990. Telephone communication on January 16, between D. Grotzinger (Ebasco) and K. Kells (Vice President, Construction Design, Connecticut Water Company).

Kick, D. 1989. Telephone communication on December 13, between P. Patterson (Ebasco) and D. Kick (District Ranger, Chequamegon National Forest).

Kiel, D. 1989. Telephone communication on October 25, between M. McMullen (Ebasco and D. Kiel (Senior Wildlife Technician, NYDEC).

Koin, J. 1989. Telephone communication on December 13, between D. Hall (CH2M HILL) and J. Koin (Ostego County Soil Conservation Service).

Konieczny, C. 1989. Telephone communication on October 24, between L. Weyer (CH2M HILL) and C. Konieczny (Hampden County Soil Conservation Service).

LaFleur, Todd. 1989. Telephone communication on December 11, between D. Grotzinger and T. LaFleur (Massachusetts Department of Environmental Management - Forest and Parks Region I).

Laubach, R. 1988. Letter dated October 27 from R. Laubach (District Forester, PADER) to K. Denny (Assistant Supervisor, Texas Eastern Transmission Corporation).

Lahti, D. 1989. Telephone communication on December 19, between D. Grotzinger (Ebasco) and D. Lahti (Water Management Specialist, Wisconsin Department of Natural Resources).

LaPoint, M. 1989. Telephone communication on December 11, between D. Hall (CH2M HILL) and M. LaPoint (Schoolcraft, Mackinac, and Marquette County Soil Conservation Services).

Lavin, L. 1989. Telephone communication on September 29, between S. Bridges (Ebasco) and L. Lavin (Archeological Consultant to CNG).

Law, S. 1989. Telephone communication on December 12, between D. Hall (CH2M HILL) and S. Law (Misaukee County Soil Conservation Service).

Lawrence. 1989. Telephone communication on December 7, between P. Patterson (Ebasco) and Town of Lawrence, New Jersey Town Planner.

Lenthall, D. 1989. Telephone communication on December 15, between D. Hall (CH2M HILL) and D. Lenthall (Middlesex County Soil Conservation Service).

Longmeadow Board of Selectmen. 1989. Letter dated November 20 from the Board of Selectmen (Longmeadow, Massachusetts) to K. Flynn (FERC).

Longmeadow. 1990. Telephone communication on January 8, between P. Patterson (Ebasco) and Town of Longmeadow, Massachusetts Town Engineer.

Ludwig, M. 1989a. Telephone communication on September 7, between J. Scott (Ebasco) and M. Ludwig (NMFS).

Ludwig, M. 1989b. Telephone communication on December 15, between D. Lake (Ebasco) and M. Ludwig (NMFS).

Lupine, A. 1990. Telephone communication on January 4, between D. Lake (Ebasco) and A. Lupine (Fisheries Biologist, NJDEP).

Macek, K. J., S.R. Petrocelli and B.H. Sleight. 1977. Consideration in Assessing the Potential for, and Significance of, Biomagnification of Chemical Residue in Aquatic Food Chains. In: ASTM Second Symposium on Aquatic Toxicology/American Society for Testing Materials.

Mackenzie. B. 1989. Telephone communication on November 7, between M. McMullen (Ebasco) and B. Mackenzie (Forest Supervisor, Miles Standish State Forest).

Maclay, R.W., T.C. Winter, and G.M. Pike. 1965. Water Resources of the Middle River Watershed - Northwestern Minnesota. U.S. Geological Survey Hydrologic Investigations Atlas HA-201.

Marshall County Soil Conservation Service. 1989. Telephone communication on December 11, between D. Hall (CH2M HILL) and county soil conservationist.

Massachusetts Department of Environmental Quality Engineering, Division of Water Supply. 1988. DWS Policy 88-03. April.

Massachusetts Natural Heritage and Endangered Species Program. 1989a. Letter dated April 5 from B. Dukeman (MNHESP) to T. J. Horst (Stone & Webster Engineering Corporation).

Massachusetts Natural Heritage and Endangered Species Program. 1989b. Letter dated December 7 from J. Copeland (MNHESP) to J. King (HMM Associates, Inc.)

Massachusetts Natural Heritage and Endangered Species Program. 1988. Letter dated September 9 from K. Pelto (MNHESP) to B. Steigers (Stone and Webster Engineering Corporation).

Massachusetts Natural Heritage and Endangered Species Program. 1987. Letter dated November 8 from J. Michaud (MNHESP) to P. Marajh (ERT, Inc.).

Maurice, K., R. Blye, P. Hamon and D. Lake. 1987. Increased Spawning by American Shad Coincident with Improved Dissolved Oxygen in the Tidal Delaware River. In: Common Strategies of Anadromous and Catadromous Fishes. American Fisheries Society Symposium. pp 79-88.

McCaffery, K.R., J.E. Ashbrenner and J.C. Moulton. 1981. Forest Opening Construction and Impacts in Northern Wisconsin. Tech. Bull. No. 120, Wisconsin Department of Natural Resources, Madison.

McCartney, T. 1989. Telephone communication on November 1, between L. Hoehne (CH2M HILL) and T. McCartney (U.S. Fish and Wildlife Service).

McDowell, D. 1989. Telephone communication, between L. Hoehne (CH2M HILL) and D. McDowell (PGC, Land Management Division, Harrisburg, PA).

McGeshick, C. 1989. Letter dated August 29 from J. Geshick (Tribal Chairman, Lac View Desert Bank of Lake Superior Chippewa Indians) to F. Annette (USDOI, BIA).

McIntire, P. 1989. Telephone communication on December 12, between P. Patterson (Ebasco) and P. McIntire (Chippewa National Forest).

McLellan, C.H., A.P. Dobson, D.S. Wilcove and J.F. Lynch. 1986. Effects of Forest Fragmentation on New- and Old-World Bird Communities: Empirical Observations and Theoretical Implications. In J. Verner, M.L. Morrison, and C.J. Ralph eds. Modeling Habitat Relationships of Terrestrial Vertebrates. University of Wisconsin Press.

Mersmen, J. 1989. Telephone communication on December 11, between D. Hall (CH2M HILL) and J. Mersmen (Saginaw County Soil Conservation Service).

Michigan Department of Natural Resources. 1990. Letter dated April 10 from E. Evans (MIDNR) to J. Downing (Braun Environmental Laboratories).

Michigan Department of Natural Resources. 1990. Letter dated February 20 from G. Martz (MIDNR, Waterfowl Specialist) to S. Lundy (Braun Environmental Laboratories).

Michigan Department of Natural Resources. 1989a. Maps of Kirtland's Warbler Management Units in Crawford and Clare Counties, Michigan. Letter dated October 25 from S. Taylor (MIDNR) to L. Hoehne (CH2M HILL).

Michigan Department of Natural Resources. 1989b. Letter dated October 30 from G. Matthews (MIDNR) to J. Reinemann and S. Elbert (Braun Environmental Laboratories).

Michigan Department of Natural Resources. 1989c. Letter dated February 14 from T. Weise (MIDNR) to D. Nelson and W. Regan (Braun Environmental Laboratories).

Michigan Department of Natural Resources. 1989d. Letter dated November 1 from R. Aartila (MIDNR) to L. Hoehne (CH2M HILL).

Michigan Department of Public Health. 1989. Community Water Supplies Summary Report.

Michon, D. 1989. Telephone communication on December 15, between L. Hoehne (CH2M HILL) and D. Michon (WIDNR, Bureau of Endangered Resources).

Miller, J. 1990. Telephone communication on January 4, between D. Lake (Ebasco) and J. Miller (Fisheries Biologist, FWS).

Minnesota Department of Health, Division of Environmental Health. 1989. Public Water Supply Data, v. 1 and 2.

Minnesota Department of Natural Resources. 1990. Letter dated May 16 from Paul Stolen (Minnesota Department of Natural Resources) to FERC.

Minnesota Department of Natural Resources. 1989a. Letter dated July 19 from L. Johnson (MNDNR) to J. Reinemann (Braun Environmental Laboratories).

Minnesota Department of Natural Resources. 1989b. Letter dated July 28. from G. Forester (MDNNR, Area Wildlife Manager) to J. Reinemann (Braun Environmental Laboratories).

Minnesota Department of Natural Resources. 1988. Letter dated November 23, from B. Eliason (MNDNR, Natural Heritage Program) to D. Nelson (Braun Environmental Laboratories).

Minnesota Department of Natural Resources. 1987. Minnesota's Protected Waters and Wetlands Permit Program.

Minnesota Department of Natural Resources. 1984. Recommendations for the Protection of Ecologically Significant Peatlands in Minnesota. November.

Minnesota Environmental Quality Board. 1989. Environmental Assessment Worksheet for Great Lakes Gas Transmission Company--1990 Pipeline Looping Project (MNEQB Docket No. GLG-1-1990). September.

Minnesota Historic Society. 1989. Letters dated January 13 and January 20, from Dennis A. Gimmestad (Deputy Minnesota State Historic Preservation Officer) to David L. Nelson (Braun Environmental Laboratories, Inc.).

Minnesota National Heritage Program. 1989. Letter dated August 24 from B. Eliason (Minnesota National Heritage Program) to L. Hartman (Minnesota Environmental Quality Board).

Monthey, R.W., and E.C. Southiere. 1985. Response of Small Mammals to Forest Harvesting in Northern Maine. Canadian Field Naturalist. 99 (1):13-18.

Morey, G.B., P.K. Sims, W.F. Cannon, M.G. Mudrey, Jr., and D.L. Southwick. 1982. Geologic Map of the Lake Superior Region -- Minnesota, Wisconsin, and Northern Michigan. Minnesota Geological Survey Map S-13, Scale 1:1,000,000.

Morykin, M. 1989. Letter dated October 3 from M. Morykin (Secretary, Plainfield Township Board of Supervisors) to G. Willant (Ebasco).

Mudrey, Jr., M.G., B.A. Brown, J.K. Greenberg. 1982. Bedrock Geology Map of Wisconsin. Wisconsin Geological and Natural History Survey State Map 18, Scale 1:1,000,000.

National Marine Fisheries Service. 1989. Letter dated September 22 from S. Gorski (NMFS) to J. Nickerson (Ebasco).

National Safety Council. 1985. Accident Facts. Chicago, Illinois.

New England Energy Policy Council. 1987. Power to Spare, A Plan for Increasing New England's Competitiveness Through Energy Efficiency. July.

New Jersey Natural Heritage Program. 1989. Letter dated December 14 from F. Williams (NJ Natural Heritage Program) to L. Hoehne (CH2M HILL).

New York State Department of Environmental Conservation. 1989a. Letter dated June 20 from J. Ozard (NYDEC) to D. Dixon (Wapora Inc.).

New York State Department of Environmental Conservation. 1989b. Letter dated October 25 from R. Sweeney (NYDEC) to L. Hoehne (CH2M HILL).

New York State Department of Environmental Conservation. 1989c. Letter dated January 6 from J. Ozard (NYDEC) to E. Nuss (Stone & Webster Engineering Corporation).

New York State Department of Environmental Conservation. 1988a. Letter dated January 12 from L. Brown (NYDEC) to P. Marajh (ERT).

New York State Department of Environmental Conservation. 1988b. Letter dated August 25 from L. Brown (NYDEC) to D. Sullivan (Stone & Webster Engineering Corporation).

New York State Department of Health, Bureau of Public Water Supply Protection. 1984. Inventory -- Community Water Systems, v. 1 and 2.

New York State Office of Parks, Recreation, and Historic Preservation. 1989. Letter dated October 6 from Julia S. Stokes, Deputy Commissioner for Historic Preservation to Kenneth Plumb (Federal Energy Regulatory Commission).

Niska, C. 1989. Telephone communication on December 13, between D. Hall (CH2M HILL) and C. Niska (Itasca County Soil Conservation Service).

Oakes, E.L., and L.E. Bidwell. 1968. Water Resources of the Mississippi Headwaters Watershed -- North-Central Minnesota. U.S. Geological Survey Hydrologic Investigations Atlas HA-278.

Oliver, E. 1989. Telephone communication on October 10, between L. Weyer (CH2M HILL) and E. Oliver (Niagara County Soil Conservation Service).

Olson, B. 1989. Telephone communication on October 25, between L. Weyer (CH2M HILL) and B. Olson (Minnesota Department of Public Health -- Division of Water Supply).

Ottawa National Forest Service. 1990. Letter dated April 26 from C. Bartlett to FERC.

Pasquale, F. 1989. Telephone communication on October 10, between L. Weyer (CH2M HILL) and F. Pasquale (Livingston County Soil Conservation Service).

Pearson, D. 1989. Telephone communication on December 12, between P. Patterson (Ebasco) and D. Pearson (Natural Rivers Program, MIDNR).

Pennsylvania Department of Health. 1989. Community Public Water Supplies in Pennsylvania. Quick Look Report.

Pennsylvania Fish Commission. 1988. Letter dated August 18 from C. Shiffer (Pennsylvania Fish Commission) to B. Carroll (Texas Eastern).

Pennsylvania Game Commission. 1988. Letter dated March 23 from J. Sitlinger (PGC) to M. Gunter (Emanco, Inc.)

Pennsylvania Natural Diversity Inventory. 1988. Letter dated September 6 from C. Bier (PNDI) to B. Carroll (Texas Eastern).

Pennsylvania Natural Diversity Inventory. 1989. Letter dated December 15, from E. Drayton (Pennsylvania Natural Diversity Inventory) to L. Hoehne (CH2M HILL).

Pennsylvania Natural Diversity Inventory. 1990. Letter dated January 2 from C. Bier (PNDI) to L. Hoehne (CH2M HILL).

Peterson, J. 1989. Telephone communication on December 27, between D. Lake (Ebasco) and J. Peterson (Fisheries Biologist, MIDNR).

Peterson, R.T. 1980. A Field Guide to the Birds. Houghton Mifflin Company.

Poindexter, H. 1989. Telephone communication on December 14, between D. Hall (CH2M HILL) and H. Poindexter (Gratiot County Soil Conservation Service).

Pratt, D. 1989. Telephone communication on December 21, between D. Lake (Ebasco) and D. Pratt (Fisheries Manager, WIDNR).

Purcell, J. 1989. Telephone communication on December 15, between D. Hall (CH2M HILL) and J. Purcell (Tolland County Soil Conservation Service).

Quigley, D. 1989. Telephone communication on December 14, between D. Grotzinger (Ebasco) and D. Quigley (Superintendent, Easton Water Department).

Radbruch-Hall, D., R.B. Colton, W.E. Davies, B.A. Skipp, I. Lucchetta, and D.J. Varnes. 1976. Preliminary Landslide Map of the Conterminous United States. U.S. Geological Survey Miscellaneous Field Studies Map MF-771.

Rhode Island Division of Fish and Wildlife. 1989. Letter dated March 6 from C. Raithel (RIDFW) to L. Sloate (ENSR Consulting and Engineering).

Robbins, C.S., D.K. Dawson and B.A. Dowell. 1989. Habitat Area Requirements of Breeding Forest Birds of the Middle Atlantic States. Wildlife Monographs: 103.

Robbins, C.S. 1979. Effect of Forest Fragmentation on Bird Populations. In: Management of North Central and Northeastern Forests for Nongame Birds, R.M. DeGaaf and K.E. Evans, editors.

Robbins, T.W. 1988. Analysis of the Texas Eastern Gas Pipeline Company Proposed Pipeline Crossing of the Susquehanna River in Reference to Impacts on the American Shad and Resident Fishes of the Susquehanna River, Pennsylvania. National Environmental Services, Inc. Lancaster Pennsylvania.

Robinson, F. 1979. The Effects of Large-Diameter Underground Crude-Oil Pipelines on Aquatic Life and Habitats. Department of Natural Resources and Conservation Energy Division. Helena, Montana. Norther Tier Report No. 3.

Sanna, J. 1989. Telephone communication on December 13, between D. Grotzinger (Ebasco) and J. Sanna (Buzzards Bay Water District, Bourne, MA).

Sawmick, A. Sr. 1989. Letter dated September 7 from A. Sawmick (Tribal Chief Saginaw Chippewa Indian Tribe) to F. Annette (USDOI, BIA).

Schnicke, G. 1989. Telephone communication on December 27, between D. Lake (Ebasco) and G. Schnicke (Fisheries Biologiest, MIDNR).

Scholl, D. 1989. Telephone communications on November 16 and 24, between E. Fink (CH2M-HILL) and D. Scholl (Fish Manager, Iron County, Wisconsin Department of Natural Resources).

Schubert, J.P., W.S. Vinikour, and D.K. Gartman. 1985. Effects of Gas Pipeline Construction on the Little Miami River Aquatic Ecosystem. Gas Research Institute. Chicago, IL GRI-86/0024.

Scott, S. 1990. Telephone communication on January 2, between D. Lake (Ebasco) and S. Scott (Fisheries Biologist, MIDNR).

Sears, R. 1990. Telephone communication on January 16, between D. Grotziner (Ebasco) and R. Sears (Superintendent Willimantic Water Department).

Seecrest, C. 1989. Telephone communication on December 12, between D. Hall and C. Seecrest (Douglas, Bayfield, and Iron County Soil Conservation Services).

Semeyn, B. 1989. Telephone communication on December 14, between D. Hall (CH2M HILL) and B. Semeyn (Clare County Soil Conservation Service).

Simmons, B. 1989. Telephone communication on December 8, between D. Grotzinger (Ebasco) and B. Simmons (Wareham Water Department, Wareham, MA).

Sinclair, W.C. 1959. Reconnaissance of the Ground-Water Resources of Schoolcraft County, Michigan. State of Michigan Department of Conservation Geological Survey Division Progress Report No. 22.

Siskind, D.E., and R.R. Fumanti. 1974. Blast-Produced Fractures in Lithonia Granite. U.S. Department of the Interior, Bureau of Mines.

Smith, C.L. 1985. The Inland Fishes of New York State. New York State Department of Environmental Conservation, Albany, New York.

Smith, R. L. 1977. Elements of Ecology and Field Biology. Harper & Row, New York.

Somerville, J. 1989. Telephone communication on December 11, between P. Patterson (Ebasco) and J. Somerville (Ottawa National Forest).

Spaulding, D. 1989. Telephone communication on December 18, between P. Patterson (Ebasco) and D. Spaulding (Forestry Management, MIDNR).

Spinner, W. 1989. Letter dated November 14 from W. Spinner (Forest Supervisor, Chippewa National Forest) to Secretary (FERC).

St. Pierre. 1989. Telephone communication on October 27, between M. McMullen (Ebasco) and L. St. Pierre (Superintendent, Longmeadow Country Club).

Stokes, J. 1989. Letter dated October 11 from J. Stokes (Deputy Commissioner, Historic Preservation, New York State Office of Parks, Recreation and Historic Preservation) to K. Plum (FERC).

Stone & Webster Engineering Corporation. 1989. Telephone communications on May 25, between J. Copeland (MA Natural Heritage and Endangered Species Program) and D. Lawson (Stone & Webster).

Stover, C.W. 1986. Seismicity Map of the Conterminous United States and Adjacent Areas, 1975-1984. U.S. Geological Survey Geophysical Investigations Map GP-984, Scale 1:5,000,000.

Sumptian, J. 1989. Telephone communication on December 13, between D. Hall (CH2M HILL) and J. Sumptian (Cass County Soil Conservation Service).

Swanson, E. 1989. Telephone communication on October 23, between L. Weyer (CH2M HILL) and E. Swanson (Renssalaer County Soil Conservation Service).

Sweeney R. 1989. Telephone communication on October 25, between L. Hoehne (CH2M HILL) and R. Sweeney (NYDEC, Region 9, Buffalo, NY).

Tabor, B. 1989. Telephone communication on December 12, between D. Hall (CH2M HILL) and B. Tabor (Bristol County Soil Conservation Service).

Teleki, G.C. and A.J. Chamberlain. 1978. Acute Effects of Underwater Blasting on Fishes in Long Point Bay, Lake Erie. J. Fish Res. Bd. Canada. 35:1191-1198.

Temple, S.A. 1986. Predicting Impacts of Habitat Fragmentation on Forest Birds: A Comparison of Two Models. In: Modeling Habitat Relationships of Terrestrial Vertebrates, J. Verner, M.L. Morrison, and C.J. Ralph eds. University of Wisconsin Press.

The State Historical Society of Wisconsin. 1989. Letters dated January 17 and March 22, from Richard W. Dexter (The State Historical Society of Wisconsin, Compliance and Archeology Section) to William J. Regan (Braun Environmental Laboratories Inc.).

Tolbers, D. 1989. Telephone communications on various dates, between L. Hoehne (CH2M HILL) and D. Tolbers (U.S. Fish and Wildlife Service, St. Paul, MN).

Trout. 1989. America's 100 Best Trout Streams. Trout. Spring 1989. Vol. 30:2.

U.S. Department of Commerce, Bureau of Census. 1988. 1986 Population and 1985 Per Capita Income Estimates For Counties and Incorporated Places. Series P-26, No. 86-NE-SC.

U.S. Department of Commerce, Bureau of Census. 1983. 1980 Census of Population, Number of Inhabitants, United States Summary. PC80-1-A1.

U.S. Department of Transportation. 1987. Annual Report on Pipeline Safety -- Calendar Year 1987.

U.S. Environmental Protection Agency. 1988. 1985 National Emissions Report. National Emission Data System.

U.S. Environmental Protection Agency. 1978. Ambient Monitoring Guidelines for Prevention of Significant Deterioration. EPA-450/2-78-019.

U.S. Geological Survey. 1988. Water Resources Data -- Wisconsin. U.S. Geological Survey Water Resources Data Report WI-88-1.

U.S. Geological Survey. 1988. Water Resources Data -- Pennsylvania. U.S. Geological Survey Water Resources Data Report PA-88-1 and PA-88-2.

U.S. Fish and Wildlife Service. 1983. Northern states bald eagle recovery plan.

U.S. Fish and Wildlife Service. 1990. Letter dated January 5 from R. Lambertson (USFWS Regional Director) to FERC.

U.S. FIsh and Wildlife Service. 1990. Letter dated January 3 from S. Gorski (USFWS) to M. Gunter (EMANCO).

U.S. Fish and Wildlife Service. 1990a. Letter dated March 14 from G. Beckett (FWS) to J. Nickerson (Ebasco).

U.S. Fish and Wildlife Service. 1990b. Letter dated March 21 from L. Corin (FWS) to J. Nickerson (Ebasco).

U.S. Fish and Wildlife Service. 1990c. Letter dated April 2 from C. Day (FWS) to J. Nickerson (Ebasco).

U.S. Fish and Wildlife Service. 1988 and 1989. Letters dated October 12, 1988 and January 30, 1989 from G. Lowry (FWS) to D. Nelson and R. Voss (Braun Environmental Laboratories, Inc.)

U.S. Fish and Wildlife Service. 1989. Letter dated November 17 from V. Lang (FWS) to L. Hoehne (CH2M HILL).

U.S. Fish and Wildlife Service. 1989a. Letter dated September 25 from W. Gill (FWS) to D. Kibbe (ENSR).

U.S. Fish and Wildlife Service. 1989b. Letter dated January 30 from G. Lowry (FWS) to D. Nelson, R. Blomquist and W. Regan (Braun Environmental Laboratories).

U.S. Fish and Wildlife Service. 1989d. Letter dated November 27 from C. Kulp (FWS) to L. Hoehne (CH2M HILL).

U.S. Fish and Wildlife Service. 1989e. Letter dated February 22 from G. Beckett (FWS) to T. J. Horst (Stone and Webster Engineering Corporation).

U.S. Fish and Wildlife Service. 1988a. Letter dated September 9 from D. Putnam (FWS) to B. Carroll (Texas Eastern).

U.S. Fish and Wildlife Service. 1988b. Letter dated April 5 from C. Kulp (FWS) to M. Gunter (Emanco, Inc.).

U.S. Fish and Wildlife Service. 1988c. Letter dated September 7 from C. Day (FWS) to P. Marajh (ERT).

U.S. Fish and Wildlife Service. 1987. Letter dated November 12 from W. Gill (FWS) to P. Marajh (ERT).

U.S. Geological Survey. 1986. Water Resources Data - Massachusetts and Rhode Island. U.S. Geological Survey Water Resources Data Report MA-RI-86-1.

U.S. Geological Survey. 1987. Water Resources Data - Michigan. U.S. Geological Survey Water Resources Data Report MI-87-1.

U.S. Geological Survey. 1987. Water Resources Data - Connecticut. U.S. Geological Survey Water Resources Data Report CT-87-1.

U.S. Geological Survey. 1986. Water Resources Data - Minnesota. U.S. Geological Survey Water Resources Data Report MN-86-1.

U.S. Department of Agriculture Soil Conservation Service County Soil Surveys. Various Publication Dates.

Upton, D. 1989. Telephone communication on October 23, between L. Weyer (CH2M HILL) and D. Upton (Wyoming County Soil Conservation Service).

Vinchesi, P. 1989. Telephone communication on November 3 and December 13, between M. McMullen (Ebasco) and P. Vinchesi (Assistant, Board of Selectman, Longmeadow, Massachusetts).

Warrinder, R. 1989. Telephone communication on September 6, between D. Grotziner (Ebasco) and R. Warrinder (NYDEC, Bureau of Water Quality Management).

Weir, Donald J., et al. 1981. A Cultural Resource Inventory St. Vincent to St. Clair Gas and Sault Lateral Pipelines Minnesota, Wisconsin, and Michigan. Commonwealth Associates, Jackson, Michigan.

Weise, T. 1990. Telephone communication on January 9, between L. Hoehne (CH2M HILL) and T. Weise (MIDNR).

Weise, T. and D. Albert. 1990. Telephone communication on January 18, between L. Hoehne (CH2M HILL) and T. Weise and D. Albert (MIDNR).

Wetzel, R.G. 1975. Limnology. W.B. Saunders Company, Philadelphia, Pennsylvania.

Whitson, A.R., W.J. Geob, C.E. Kellogg, K. Ableiter, H.Cook, M Whitson, B. Butman, D.S. Finc, M.H. Gallatin, and H.H. Hull. 1929. Soil Survey of Bayfield County, Wisconsin. Wisconsin Geological and Natural History Survey Bulletin 72A.

Wilson. 1987. Bedrock Geology of Michigan. Michigan Department of Natural Resources Geological Survey Division Map GM-1, Scale 1:5000,000.

Wilson, J. 1989. Telephone communication on December 5, between L. Hoehne (CH2M HILL) and J. Wilson (WIDNR).

Wisconsin Department of Natural Resources. 1979. Wisconsin Natural Resources. October.

Wisconsin Department of Natural Resources. 1989a. Letter dated August 2 from D. Bublitz (WIDNR) to J. Reinemann (Braun Environmental Laboratories).

Wisconsin Department of Natural Resources. 1989b. Letter dated December 8 from R. Nicotera (WIDNR) to L. Hoehne (CH2M HILL).

Wisconsin Department of Natural Resources. 1989c. Letter dated January 31 from R. Nicotera (Bureau of Endangered Resources) to D. Nelson (Braun Environmental Laboratories).

Wisconsin Geological and Natural History Survey. 1989. Telephone communication on October 3, between L. Weyer (CH2M HILL) and survey personnel.

Wopat, B. 1990. Telephone communication on January 16, between D. Grotziner (Ebasco) and B. Wopat (Army Corps. of Engineers - St. Paul, Minnesota).

Wolf, C. and J. Rowe. 1989. Letter dated August 8 from C. Wolf and J. Rowe (Braun Environmental Laboratories to F. Heide (U.S. Department of the Interior, Bureau of Indian Affairs (USDOI, BIA)).

Young, H.L., and E.L. Skinner. 1974. Water Resources of Wisconsin, Lake Superior Basin. U.S. Geological Survey Hydrologic Investigations Atlas HA-524.

Zaporozec, A., and R.D. Cotter. 1985. Major Ground-Water Units of Wisconsin. Wisconsin Geological and Natural History Survey Educational Series ES-28.

Zich, H. 1990. Telephone communication on January 4, between D. Lake (Ebasco) and H. Zich (Fisheries Biologist, FWS).

Zosel, C. 1989. Telephone communication on December 13, between P. Patterson (Ebasco) and C. Zosel (Brule River State Forest, Wisconsin).

APPENDIX I

SUBJECT INDEX

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