Office of Energy Projects

September 2016

FERC/FEIS-000268

FINAL ENVIRONMENTAL IMPACT STATEMENT

FOR

Columbia Gas Transmission, LLC – Leach XPress Project

Columbia Gulf Transmission, LLC – Rayne XPress Expansion Project

Docket Nos. CP15-514-000 and CP15-539-000

VOLUME I

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

Cooperating Agencies:

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:
OEP/DG2E/Gas 2
Columbia Gas Transmission, LLC
Leach XPress Project
Columbia Gulf Transmission, LLC
Rayne XPress Expansion Project
Docket Nos. CP15-514-000
CP15-539-000

TO THE PARTY ADDRESSED:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared a final environmental impact statement (EIS) for the Leach XPress and Rayne XPress Expansion Projects (Projects), proposed by Columbia Gas Transmission, LLC (Columbia Gas) and Columbia Gulf Transmission, LLC (Columbia Gulf), respectively, in the above-referenced dockets. Columbia Gas requests authorization to construct, operate, abandon in-place, replace, and operate certain natural gas pipeline facilities in West Virginia, Pennsylvania, and Ohio to transport about 1.5 million dekatherms of natural gas per day of firm transportation service to natural gas consumers served by the Columbia Gas pipeline systems. Columbia Gulf requests authorization to add new compression in Kentucky to provide about 621,000 dekatherms per day of firm transportation on Columbia Gulf's system.

The final EIS assesses the potential environmental effects of the construction and operation of the Projects in accordance with the requirements of the National Environmental Policy Act (NEPA). The FERC staff concludes that approval of the Projects would have some adverse and significant environmental impacts; however, these impacts would be reduced to less than significant levels with the implementation of Columbia Gas' and Columbia Gulf's proposed mitigation and the additional measures recommended by staff in the final EIS.

The U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, Kentucky Department for Environmental Protection, Ohio Environmental Protection Agency, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Department of Environmental Protection, West Virginia Department of Environmental Protection, and West Virginia Department of Natural Resources participated as cooperating agencies in the preparation of the final EIS. Cooperating agencies have jurisdiction by law or special expertise with respect to resources potentially affected by the proposals and participate in the NEPA analysis. Although the cooperating agencies provided input to the conclusions and

recommendations presented in the final EIS, the agencies will present their own conclusions and recommendations in their respective Records of Decision for the Projects.

The final EIS addresses the potential environmental effects of the construction and operation of the following facilities:

- 132 miles of new 36-inch-diameter natural gas pipeline, 24 miles of 36-inch-diameter looping pipeline[1], 28 miles of 20-inch-diameter pipeline to be abandoned in place, 3 new compressor stations, and appurtenant facilities including 2 existing compressor station modifications, 4 new and 1 modified regulator stations, 13 pig launcher and receiver facilities[2], 9 mainline valves and 5 odorization facilities proposed by Columbia Gas; and
- two new compressor stations, and a modification to an existing measurement and regulation station proposed by Columbia Gulf.

The FERC staff mailed copies of the final EIS to federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Native American tribes; potentially affected landowners and other interested individuals and groups; newspapers and libraries in the project area; and parties to this proceeding. Paper copy versions of this final EIS were mailed to those specifically requesting them; all others received a CD version. In addition, the final EIS is available for public viewing on the FERC's website (www.ferc.gov) using the eLibrary link. A limited number of copies are available for distribution and public inspection at:

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

Questions?

Additional information about the project is available from the Commission's Office of External Affairs, at **(866) 208-FERC**, or on the FERC website (www.ferc.gov) using the eLibrary link. Click on the eLibrary link, click on "General Search," and enter

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[1] A pipeline loop is a segment of pipe constructed parallel to an existing pipeline to increase capacity.

[2] A pig is an internal tool that can be used to clean and dry a pipeline and/or to inspect it for damage or corrosion.

the docket number excluding the last three digits in the Docket Number field (i.e., CP15-514 or CP15-539). Be sure you have selected an appropriate date range. For assistance, please contact FERC Online Support at FercOnlineSupport@ferc.gov or toll free at (866) 208-3676; for TTY, contact (202) 502-8659. The eLibrary link also provides access to the texts of formal documents issued by the Commission, such as orders, notices, and rulemakings.

In addition, the Commission offers a free service called eSubscription that allows you to keep track of all formal issuances and submittals in specific dockets. This can reduce the amount of time you spend researching proceedings by automatically providing you with notification of these filings, document summaries, and direct links to the documents. Go to www.ferc.gov/docs-filing/esubscription.asp.

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TECHNICAL ACRONYMS

$\mu g/m^3$	micrograms per cubic meter
ACHP	Advisory Council of Historic Preservation
AMM	avoidance and minimization measures
API	American Petroleum Institute
AQCR	Air Quality Control Regions
ATWS	additional temporary workspace
BCC	Birds of Conservation Concern
BGEPA	bald and golden eagle protection act
BMP	best management practices
Btu	british thermal unit
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERI	Center for Earthquake Research and Information
Certificate	Certificates of Public Convenience and Necessity
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
COE	U. S. Army Corps of Engineers
Columbia Gas	Columbia Gas Transmission, LLC
Columbia Gulf	Columbia Gulf Transmission, LLC
Commission	Federal Energy Regulatory Commission
CS	Compressor Station
CSR	Code of State Rules
CWA	Clean Water Act
dB	decibels
dBA	A-weighted sound level
DOT	U.S. Department of Transportation
Dth/d	dekatherms per day
DWSPA	Drinking Water Source Protection Areas
ECDs	erosion control devices
ECS	Environmental Construction Standards
EI	environmental inspector
EIA	U. S. Energy Administration
EIS	Environmental Impact Statement
EPA	U. S. Environmental Protection Agency
ESA	Endangered Species Act
ESCP	erosion and sedimentation control plans
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FSA	Farm Services Administration
FWS	U. S. Fish and Wildlife Service
GHG	greenhouse gases
GP	General Permit

TECHNICAL ACRONYMS

GWP	global warming potential
HAP	hazardous air pollutant
HCA	high consequence area
HDD	horizontal directional drill
hp	horsepower
IBA	important bird area
IPCC	Intergovernmental Panel on Climate Change
ISO	Internal Organization for Standardization
KDFWR	Kentucky Department of Fish and Wildlife Resources
KDOW	Kentucky Division of Water
KGS	Kentucky Geological Survey
KPDES	Kentucky Pollutant Discharge System
KSNPC	Kentucky State Nature Preserves Commission
KYDEP	Kentucky Department for Environmental Protection
L_{dn}	day-night sound level
L_{eq}	24-hour equivalent sound level
LX Project	Leach XPress Project
MACT	maximum achievable control technology
M&R	Measuring and Regulator Station
MAOP	Maximum Allowable Operating Pressure
MBTA	Migratory Bird Treaty Act
mg/L	milligram per liter
mgd	million gallons per day
MLV	mainline valve
MOU	Memorandum of Understanding
MP	milepost
MSHCP	Multiple Species Habitat Conservation Plan
MSL	Mean Sea Level
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEC	National Electric Code
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection ACT
NGA	Natural Gas Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NNSR	Non-Attainment New Source Review
NO_2	nitrogen dioxide
NOI	Notice of Intent
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Parks Service

TECHNICAL ACRONYMS

NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NSA	noise sensitive areas
NSPS	new source performance standards
NSR	New Source Review
NWI	national wetlands inventory
NWP	nationwide general permit
O_3	ozone
OAC	Open Air Campaigners
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
OS	odorization station
PADCNR	Pennsylvania Department of Conservation and Natural Resources
PADEP	Pennsylvania Department of Environmental Protection
PASDA	Pennsylvania Spatial Data Clearinghouse
PCB	polychlorinated biphenyl
PCN	pre-construction notification
PEM	palustrine emergent
PFBC	Pennsylvania Fish and Boat Comission
PFO	palustrine forested
PHMSA	Pipeline and Hazardous Materials Safety Administration
Plan	Upland Erosion Control, Revegetation, and Maintenance Plan
PM	particulate matter
PM_{10}	particulate matter with a diameter of 10 microns or less
$PM_{2.5}$	particulate matter with a diameter of 2.5 microns or less
Procedures	Wetland and Waterbody Construction and Mitigation Procedures
PSD	Prevention of Significant Deterioration
psig	pounds per square inch
PSS	palustrine scrub-shrub
PTE	potential to emit
RHA	Rivers and Harbors Act
RS	regulator station
RXE Project	Rayne XPress Expansion Project
SAA	sole source aquifer
SCADA	supervisory control and data acquisition
SCS	Soil Conservation Survey
SHPO	State Historic Preservation Office
SILs	significant impact levels
SO_2	sulfur dioxide
SPCC	Spill Prevention Control and Countermeasures
SWPPP	stormwater pollution prevention plan
TMDL	total maximum daily load
tpy	tons per year

TECHNICAL ACRONYMS

TSCA	Toxic Substances Control Act
TSP	total suspended particulate
USC	United States Code
USDA	United States Department of Agriculture
USGS	U. S. Geological Survey
USGCRP	U. S. Global Change Research Program
VOC	volatile organic compounds
WHPA	Wellhead Protection Areas
WMA	Wildlife Management Area
WVDEP	West Virginia Department of Environmental Protection
WVDHHR	West Virginia Division of Health and Human Resources
WVDNR	West Virginia Department of Natural Resources
WVGES	West Virginia Geological and Economic Survey

EXECUTIVE SUMMARY

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared this final Environmental Impact Statement (EIS) to fulfill requirements of the National Environmental Policy Act of 1969 (NEPA) and the Commission's implementing regulations under Title 18 of the Code of Federal Regulations Part 380 (18 CFR 380). On June 8, 2015, Columbia Gas Transmission, LLC (Columbia Gas), filed an application with the FERC under Section 7(b) and 7(c) of the Natural Gas Act (NGA) and Part 157 of the Commission's regulations to construct, operate, and abandon certain interstate natural gas pipeline facilities in Ohio, Pennsylvania, and West Virginia. On July 29, 2015, Columbia Gulf Transmission, LLC (Columbia Gulf) filed an application with FERC under section 7(c) of the NGA and part 157 of the Commission's regulations to construct, operate, and maintain certain interstate related natural gas pipeline facilities in Kentucky. Columbia Gas and Columbia Gulf are seeking Certificates of Public Convenience and Necessity (Certificate), and were assigned Docket Nos. CP15-514-000 and CP15-539-000 for their applications, respectively.

The FERC is the federal agency responsible for authorizing interstate natural gas transmission facilities under the NGA and is the lead federal agency for preparation of this EIS in compliance with the requirements of NEPA. The U.S. Environmental Protection Agency (EPA), the U.S. Army Corps of Engineers (COE), the U.S. Fish and Wildlife Service (FWS), the Ohio Environmental Protection Agency (OEPA), the Pennsylvania Department of Environmental Protection (PADEP), the Pennsylvania Department of Conservation and Natural Resources (PADCNR), the West Virginia Department of Environmental Protection (WVDEP), the West Virginia Division of Natural Resources (WVDNR), and the Kentucky Department for Environmental Protection (KYDEP) participated as cooperating agencies in preparation of the EIS. A cooperating agency has jurisdiction by law or has special expertise with respect to environmental resource issues associated with a project.

PROPOSED ACTION

Columbia Gas's proposal, referred to as the Leach XPress Project (LX Project), would involve the construction, operation, and abandonment of an existing pipeline. The proposed LX Project's pipeline facilities would total about 160.7 miles of pipe and add approximately 143,000 horsepower (hp) of compression to transport up to 1.5 million dekatherms (Dth/d)[1] per day of natural gas.

Columbia Gas would abandon 28.2 miles of the existing Line R-501 in Fairfield, Hocking, and Vinton Counties, Ohio. By abandoning a segment of Line R-501 and constructing the R-801 Loop[2], Columbia Gas would enhance the overall reliability and flexibility of its existing R-System and increase the existing system capacity. Various replacement and upgrade projects along its existing R-System would allow Columbia Gas to modernize the system facilities, improve system integrity, and enhance service reliability and flexibility. According to Columbia Gas, the proposed pipeline project was developed in response to market demand for the transportation of stranded natural gas supplies from the existing production region to areas of higher demand and premium markets.

Columbia Gas' proposal (LX Project) includes the following:

- two natural gas pipelines in Ohio, West Virginia, and Pennsylvania (LEX Pipeline - 132 miles; LEX1 Pipeline – 1.2 miles);

[1] A dekatherm is a unit of heating value often used by natural gas companies instead of volume for billing purposes. A dekatherm is equivalent to 10 therms, or one million British thermal units, or approximately 1,000 cubic feet.

[2] A pipeline loop is a segment of pipe constructed parallel to an existing pipeline to increase capacity.

- two natural gas pipeline loops in Ohio and West Virginia (R-801 Loop – 24 miles; BM-111 Loop – 2.9 miles);
- abandonment in place of a segment of one existing natural gas pipeline in Ohio (R-501 Abandonment – 28 miles);
- construction of new three compressor stations in Ohio and West Virginia (Lone Oak Compressor Station, Summerfield Compressor Station, Oak Hill Compressor Station);
- modification of two compressor units in Ohio and West Virginia (Benton Compressor Station, Crawford Compressor Station);
- installation of three new electric motor-driven compressor units and the decommissioning of one existing natural gas-driven compressor unit at an existing compressor station (Ceredo Compressor Station);
- construction of four new regulator stations;
- modification at one existing regulator station;
- 13 bi-directional pig[3] launcher and/or receiver facilities;
- nine Main Line Valves (MLVs);
- five odorization sites at facilities located along Columbia Gas' existing pipeline system; and
- various appurtenant and auxiliary facilities.

LX Project facilities to be constructed would be located in Marshall and Wayne Counties, West Virginia; Greene County, Pennsylvania; and Monroe, Noble, Muskingum, Morgan, Perry, Fairfield, Hocking, Jackson, Lawrence, and Vinton Counties, Ohio.

Columbia Gulf's proposal, referred to as the Rayne XPress Expansion Project (RXE Project), would involve the construction and operation of 51,800 hp at two compressor stations in Carter, Menifee, and Montgomery Counties, Kentucky to enable up to 621,000 Dth/d of firm transportation on its system.

Subject to the receipt of FERC authorization and all other applicable permits, authorizations, and approvals, Columbia Gas and Columbia Gulf propose to start construction of both projects in November 2016 and continue through November 2017. Columbia Gas and Columbia Gulf would request to place the natural gas pipeline facilities into service (i.e., operation) following determination that restoration is proceeding satisfactorily, which is expected to follow shortly after construction is completed.

PUBLIC INVOLVEMENT

On September 26, 2014, Columbia Gas filed a request with the FERC to initiate the Commission's pre-filing process for its pipeline project. At that time, Columbia Gas was in the preliminary design stage of the project and no formal application had been filed with FERC. The purpose of the pre-filing process is to involve interested stakeholders early in the project planning process and to identify and resolve issues prior to filing an application with the FERC. On October 9, 2014, FERC granted Columbia Gas's request and assigned the project a pre-filing docket number (PF14-23-000) to

[3] A pig is an internal tool that can be used to clean and dry a pipeline and/or to inspect it for damage or corrosion.

place information related to the pipeline project into the public record. The cooperating agencies agreed to conduct their environmental reviews of the pipeline project in conjunction with the Commission's environmental process.

On January 13, 2015, the Commission issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Leach XPress Project, Request for Comments on Environmental Issues,* and *Notice of Public Scoping Meetings*. The notice was published in the *Federal Register* on January 20, 2015, and mailed to more than 1,300 interested parties including federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Native American Tribes; affected property owners; other interested parties; and local libraries and newspapers. We[4] held five public scoping meetings in the project area to provide an opportunity for agencies, stakeholders, and the general public to learn more about the proposed project and participate in the environmental analysis by commenting on the issues to be addressed in the draft EIS. The notice briefly described the project and the EIS process, provided a preliminary list of issues identified by us, invited written comments on the environmental issues that should be addressed in the draft EIS, listed the date and location of five public scoping meetings to be held in the area of the project. As a result of route modifications, the Commission issued a supplemental letter to parties on April 1, 2015. The notice was mailed to more than 300 interested parties.

On September 4, 2015, the Commission issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Rayne XPress Expansion Project* and *Request for Comments on Environmental Issues*. The notice was published in the *Federal Register* on September 11, 2015 and mailed to more than 230 interested parties, including federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Native American Tribes; affected property owners; other interested parties; and local libraries and newspapers. The notice established a closing date for receipt of comments of October 5, 2015. In this notice, we stated that we would evaluate the environmental impacts of the RXE Project in the EIS being prepared for the LX Project.

In response to our notices and at our public meetings, we received 57 written comments and 58 motions to intervene from landowners, public officials, non-governmental organizations, and government agencies regarding the LX and RXE Projects. These comments primarily expressed concerns with the proposed location of the pipeline route and the effects of the LX and RXE Projects on resources, including, but not limited to waterbodies, wetlands, wildlife, vegetation, threatened and endangered species, project safety, blasting, air quality, and cumulative impacts.

On April 21, 2016, we issued a *Notice of Availability of the Draft Environmental Impact Statement for the Proposed Leach Xpress Project and Rayne Xpress Expansion Project*. This notice, which was published in the Federal Register, listed the dates and locations of public comment meetings and established a closing date of June 13, 2016 for receiving comments on the draft EIS. Copies of the draft EIS were mailed to over 1,670 stakeholders. The public had 45 days after the date of publication of the EPA's notice in the *Federal Register* to comment on the draft EIS either in the form of written comments or at public meetings held in the LX/RXE Project areas. All comments received on the draft EIS are addressed in the final EIS.

We held five public comment meetings in the LX/RXE Project area to solicit and receive comments on the draft EIS. The meetings were held between May 18, 2016 and May 26, 2016 in Caldwell, Ohio; Moundsville, West Virginia; Logan, Ohio; Oak Hill, Ohio; and Huntington, West Virginia. The meetings provided the public an opportunity to present oral comments on the analysis of environmental impacts described in the draft EIS. This final EIS addresses all substantive comments

[4] "We," "us," and "our" refer to the environmental staff of the FERC's Office of Energy Projects.

submitted to the FERC or received at the open houses, scoping meetings, interagency meetings, and comment meetings on the draft EIS.

PROJECT IMPACTS AND MITIGATION

Construction and operation of the Projects could result in numerous impacts on the environment. We evaluated the impacts of the LX and RXE Projects, taking into consideration Columbia Gas' and Columbia Gulf's proposed impact avoidance, minimization, and mitigation measures on geology, soils, groundwater, surface water, wetlands, vegetation, wildlife, fisheries, special status species, land use, visual resources, socioeconomics, cultural resources, air quality, noise, and safety. Where necessary, we are recommending additional mitigation measures to further minimize or avoid impacts. We also assessed cumulative impacts on past, current, and reasonably foreseeable actions in the project areas. In section 3 of this EIS, we summarize the evaluation of alternatives to the LX and RXE Projects including the no-action alternative, system alternatives, major and minor route alternatives, and aboveground facility site alternatives.

Based on scoping comments, agency consultations, and our independent evaluation of resource impacts, the major issues identified in our analysis are associated with the LX Project, including waterbodies, forests, and wildlife habitat. Our analysis of these issues is summarized below and discussed in detail in the appropriate resource sections in sections 3 and 4 of this EIS. Section 5 of this EIS contains our conclusions and a compilation of our recommended mitigation measures.

Geology and Soils

The primary effect of the Projects on geologic resources would be the disturbance to steep topographic features and the excavation of consolidated or shallow bedrock during the construction of the pipeline and aboveground facilities, found along the construction right-of-way. All areas disturbed during pipeline construction would be graded and restored as closely as possible to pre-construction contours during cleanup and restoration.

A number of stone and coal mines were identified within, or within proximity to, the Project areas. Columbia Gas and Columbia Gulf have undertaken geotechnical investigations and have coordinated with the appropriate mining companies regarding the potential for future surface and longwall mining activities. No impacts are expected as a result of longwall mining activity at the Lone Oak Compressor Station site. In addition, a total of 222 oil and gas wells have been identified within, or within proximity to, the LX and RXE Project areas. These sites would be field verified through civil surveys prior to the start of construction. We are recommending that Columbia Gas file the results of these surveys and provide measures to minimize hazards for wells located within 100 feet of the LEX Pipeline.

Based on the avoidance, minimization and mitigation measures developed by Columbia Gas and Columbia Gulf, including measures outlined in their Project-specific Environmental Construction Standards (ECS), Columbia Gas' Longwall Mining Plan, and Columbia Gas' Blasting Plan, we conclude that construction and operation of the Projects would not have any significant adverse effects on geologic resources in the Projects' areas.

Landslide impacts were assessed for the Projects and due to steep slopes and underlying soils and geologic conditions in certain areas, 20 minor route deviations were incorporated into the proposed route of the LX Project to avoid site-specific features (e.g., topography, landowner concerns, sensitive habitat, or structures). Many of these deviations occurred to minimize the risks associated with construction on steep side slopes and to avoid difficult and rugged terrain primarily characterized by severe elevation changes and rocky outcrops.

The Projects would traverse a variety of soil types and conditions. Construction activities associated with the Projects, such as clearing, grading, trenching, and backfilling, could adversely affect soil resources by causing erosion and compaction and by introducing excess rock or fill material to the surface, which could hinder restoration of the disturbed areas. However, Columbia Gas and Columbia Gulf would implement the mitigation measures contained in the ECS, which incorporates the measures in FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan), to control erosion, enhance successful revegetation, and minimize any potential adverse impacts on soil resources. Specifically, these measures include topsoil segregation, temporary and permanent erosion controls, and post-construction restoration and revegetation of construction work areas. Additionally, Columbia Gas and Columbia Gulf would implement its Spill Prevention and Response Procedures (Spill Procedures) during construction and operation to prevent and contain and, if necessary, clean up accidental spills of any material that may contaminate soils.

Most impacts on soil would be temporary and short-term. Permanent impacts on soils would occur at the aboveground facilities, where the sites would be covered with gravel and converted to natural gas facility use. With Columbia Gas' and Columbia Gulf's implementation of their best management practices (BMPs), ECSs, and implementation of the measures contained in FERC's Plan, as well as our additional recommendations for Columbia Gas to conduct civil surveys identifying the location of any conventional or unconventional oil and gas well locations (including permitted, drilled, producing and abandoned oil and gas wells) within the LX Project footprint, we conclude that impacts on geological and soil resources would be adequately minimized.

Groundwater, Waterbody Crossings, Water Use, and Wetlands

Regional aquifers in the LX Project area originate from Pennsylvanian and Mississippian principal aquifers. The project would cross 15 drinking water source protection areas (DWSPAs) for public water supplies associated with groundwater sources in Ohio located within 0.5 mile of the project and five (5) DWSPAs are located in within the project workspace. There are no other DWSPAs or wellhead protection areas (WHPA) located within 0.5 mile of the LX Project. The project, including alternate pipe yard sites, would contain 73 water wells within 150 feet of the project area. There are 24 springs identified along the project area in Ohio, 3 in West Virginia, and 2 in Pennsylvania. Columbia Gas has agreed to test all water wells and springs within 150 feet of the construction workspace, at the landowner's request, for water quality and quantity prior to and after construction, and provide an alternative water source or a mutually agreeable solution in the event of construction related impacts.

Construction activities in the LX and RXE Projects would not significantly impact groundwater resources because the majority of construction would involve shallow, temporary, and localized excavation. These potential impacts would be avoided or further minimized by the use of construction techniques and mitigation described in in Columbia Gas' and Columbia Gulf's Project-specific ECS, which incorporates measures contained in FERC's Procedures. Columbia Gas and Columbia Gulf would prevent or adequately minimize accidental spills and leaks of hazardous materials into groundwater resources during construction and operation by adhering to its Spill Procedures.

The LX Project would cross 1,083 waterbodies (170 perennial, 390 intermittent, and 516 ephemeral, and 7 open water) and the RXE project would cross 5 tributaries. Two of the manmade ponds in Ohio which are classified as open water are located within the project workspace; however, the ponds would be avoided during construction activities. Approximately 63 feet of one minor, intermittent waterbody would be permanently filled as a result of construction and operation of the proposed Lone Oak Compressor Station. In addition, approximately 100 feet of one minor, ephemeral waterbody would be permanently relocated to accommodate a new storm water management pond within the existing Ceredo Compressor Station.

Columbia Gas anticipates using the open-cut or horizontal directional drill (HDD) methods to cross all waterbodies. Twenty-four of these waterbodies would be crossed using the HDD method; however, the Hocking River in Ohio, a major waterbody, would be crossed via the open-cut method. Additional measures outlined in Columbia Gas' ECS would aid in the effective avoidance or minimization of impacts on surface waterbodies.

Construction of the LX Project (including temporary pipeline impacts, aboveground facility impacts, and access road impacts) would affect a total of 16.1 acres of wetlands, including 1.4 acres of forested wetlands, 0.8 acre of scrub-shrub wetlands, and 13.9 acres of emergent wetlands. No wetlands would be disturbed for the RXE project. A majority of project wetlands would return to pre-construction conditions. During the operational life of the project, Columbia Gas would maintain a 30-foot-wide corridor with selective removal of trees that could compromise the integrity of the pipeline coating, impacting 1.0 acre of wetlands. We are recommending that Columbia Gas provide a copy of its final wetland compensation plan being developed with the appropriate agencies.

Based on the avoidance and minimization measures developed by Columbia Gas, including the Project-specific ECS, and pending agency recommendations for wetland mitigation, we conclude that impacts on groundwater, surface water, and wetland resources would be effectively minimized or mitigated, and would be largely temporary in duration. Construction and operation-related impacts on wetlands would be further minimized or mitigated by Columbia Gas's compliance with the pending conditions imposed in the permits issued by the COE, the KYDEP, Ohio Department of Natural Resources (ODNR), the PADEP, and the West Virginia Department of Natural Resources (WVDNR).

Vegetation, Wildlife, Fisheries, and Federally Listed and State-Sensitive Species

The proposed Projects' impacts on vegetation would range from short-term to permanent due to the varied amount of time required to re-establish certain community types, as well as the maintenance of grassy vegetation within the permanent right-of-way and the conversion of aboveground facility locations to non-vegetated areas. The greatest impact on vegetation would be on forested areas because of the time required for tree regrowth to pre-construction condition. Construction in forest lands would remove the tree canopy over the width of the construction right-of-way, which would change the structure and local setting of the forest area. The regrowth of trees would take years and possibly decades. Moreover, the forest land on the permanent right-of-way would be permanently impacted by ongoing vegetation maintenance during operations, which would preclude the re-establishment of trees directly over the centerline of the proposed pipeline. Although Columbia Gas has attempted to route its pipeline adjacent to existing disturbed areas and outside forested areas where possible, impacts on forest habitat represents a significant impact and still account for about 1,380.6 acres of upland forest impacts and 1.1 acres of forested wetland impacts.

Invasive plant species have the potential to out-compete native plants and colonize areas disturbed by construction of the pipeline. Potential impacts resulting from invasive species establishment would be minimized through Columbia Gas' and Columbia Gulf's employment of their proposed invasive species mitigation practices contained within their ECS, such as minimization of sediment transport, topsoil preservation in wetlands, quick revegetation of native species within the right-of-way during restoration, and restoration monitoring of the construction corridor. In addition, we are recommending that Columbia Gas address agency requests for the use of seed mixes that contain native pollinator plant species in order to benefit pollinating species.

The Projects would affect wildlife and wildlife habitats along the pipeline route and at the compressor stations. These impacts would be temporary, short-term, long-term, or permanent, depending on the habitat type impacted, proposed facility type, as well as the location of that habitat within project workspaces. Overall impacts on wildlife from the LX and RXE Projects would be long-term in forested

areas, but minor and temporary in other habitats that are previously disturbed. The proposed LX Project would be located near four Important Bird Areas, but would not cross them. To ensure that the LX Project's proposed crossing of the Sunfish Creek State Forest would result in minimal impacts on habitat, we are recommending that Columbia Gas provide any mitigation measures it has developed with the Ohio Department of Natural Resources aimed at minimizing impacts on habitat within this forest. Columbia Gas has routed the pipeline and associated facilities to minimize impacts on wildlife to the maximum extent possible. Columbia Gas would minimize impacts on wildlife by collocating the proposed workspace with other existing rights-of-way (approximately 40 percent of the proposed alignment). Columbia Gas and Columbia Gulf would follow measures outlined in their ECS to minimize effects on wildlife and their associated habitat.

Construction has the potential to impact migratory birds within the project area. A variety of migratory bird species, including Birds of Conservation Concern, are associated with the habitats that would be affected by the project. The clearing of vegetation during the nesting season could have direct impacts on individual migratory birds. As recommended by the FWS, Columbia Gas and Columbia Gulf would conduct clearing activities between September 1 and March 31 to minimize impacts. The final EIS discusses numerous minimization and mitigation measures that the applicants would implement to protect migratory birds and their habitat. We are recommending that Columbia Gas further mitigate the negative impacts on migratory bird habitat by avoiding or minimizing impacts to the degree practicable through its Final Migratory Bird Conservation Plan developed in consultation with the FWS to further minimize impacts on birds of special concern.

The LX Project pipeline would cross 983 freshwater waterbodies including 6 Ohio state-designated superior high quality waters; 3 waterbodies classified by the COE as Section 10 of the Clean Water Act (navigable waterway); 18 Pennsylvania state-designated Warm Water Fishes Aquatic Life streams; 1 Pennsylvania Fish and Boat Commission approved trout water; and 128 waterbodies listed as 303(d) impaired waters. Additionally, the LX Project aboveground facilities would affect 15 waterbodies, access roads would cross 75 waterbodies, and contractor yards would affect 10 waterbodies. Columbia Gas would use various crossing methods such as wet open-cut, conventional bore, and HDD and follow measures outlined in the ECS and Procedures to minimize impacts on waterbodies. Crossings of waterbodies that support fisheries of special concern would comply with federal and state regulations and conditions. We are recommending that Columbia Gas construct through waterbodies in compliance with timing windows established by our Procedures unless expressly permitted in writing by the appropriate state agency that alternative time windows are granted.

Columbia Gas would use surface water and municipal sources totaling approximately 42 million gallons for hydrostatic testing. The LX Project proposes to use four waterbodies as sources of hydrostatic test water for the pipeline and municipal and various sources of test water for aboveground facilities. WVDEP recommended that water withdrawn from the Ohio River either be discharged back into the Ohio River or be treated with a WVDEP-recommended biocide prior to discharge. The RXE Project proposes to use municipal sources for water hydrostatic testing.

Based on Columbia Gas' and Columbia Gulf's consultations with FWS and our review of existing records, 16 federally listed threatened or endangered species are potentially present in the project areas. We requested that the FWS consider the draft EIS as the Biological Assessment for the Projects. We have determined that construction and operation of the Projects in accordance with Columbia Gas' and Columbia Gulf's proposed measures and our recommendations would not likely adversely affect the Indiana bat, northern long-eared bat, Gray bat, Virginia big-eared bat, fanshell, pink mucket, rabbitsfoot, sheepnose, snuffbox, clubshell, rayed bean, American burying beetle, northern monkshood, running buffalo clover or small whorled pogonia. We have determined that the proposed Projects would have no effect on white-haired goldenrod. In order to assess the LX Project's potential impact on the Indiana bat and the northern long-eared bat, we are recommending that Columbia Gas not

begin construction of the LX Project within lands not covered by the Multiple Species Habitat Conservation Plan (MSHCP) in Ohio until FERC staff completes any necessary ESA Section 7 consultation with the FWS for the Indiana bat and northern long-eared bat.

Through desktop analysis and field habitat assessments, we have determined that 1) after implementation of the MSHCP, and 2) any additional impact minimization measures specified by the FWS and state agencies, the LX and RXE Projects would have no effect or are not likely to adversely affect any species federally listed as proposed threatened or species of management concern. We hold this conclusion for state-listed species as well, with the exception of single-headed pussytoes. Consultation with PADCNR is ongoing for this species pending the completion of field survey reports.

We are recommending Columbia Gas and Columbia Gulf provide results from all outstanding surveys, correspondence, and mitigation measures for state-listed species prior to construction of the Projects.

Land Use and Visual Resources

Construction of the proposed Projects would affect approximately 3,196.0 acres of land, while operations would affect approximately 1,045.0 acres. Right-of-way (including permanent and temporary right-of-way and approved temporary work space (ATWS)) would account for approximately 76.6 percent of all affected land during the construction phase, and approximately 95.0 percent of all affected land during the operations.

Columbia Gas and Columbia Gulf have identified 116 structures within 50 feet of the construction work area, including residences, businesses, and other structures such as barns, sheds, or garages. Of these, 68 are within 25 feet of the construction work area. No planned developments have been identified within 0.5 mile of the project. Columbia Gas has developed site specific residential construction plans for all residences crossed within 50 feet of the LX Project's work limits. We are recommending that Columbia Gas provide evidence prior to construction of landowner concurrence from residences that are within 10 feet of the LX Project construction work area.

The LX Project would have two crossings of the North Country National Scenic Trail; one scenic byway; the Sunfish Creek state forest in Ohio; three recreational trails; one wildlife management area; and one outdoor recreation area. The LEX Pipeline portion of the LX Project would cross 0.4 mile of the Sunfish Creek State Forest. Since consultations with ODNR regarding impacts, permitting, and regulatory requirements are ongoing concerning the impacts on and restoration of wildlife habitat in the Sunfish Creek State Forest, we recommend continued consultations with the ODNR, formal application and independent Environmental Assessment, as well as any avoidance or mitigation measures developed with this agency regarding the Sunfish Creek State Forest crossing.

The LX Project would also be within 0.25 mile of one nature preserve and its two associated components, an additional nature preserve, one public park, one conservation preserve, and two state parks. The LX Project would also cross the Dunkard Fork Wildlife Management in West Virginia. Impacts on recreation in these areas would be temporary and limited to the period of active construction, which typically would last only several days to several weeks in any one area. These impacts would be minimized by implementation of Columbia Gas's ECS.

The LX Project would cross one parcel enrolled in the Conservation Reserve Program and three conservation easements. The LX Project would also occur within 0.3 mile of one state forest and one easement within the Wetland Reserve Program. Columbia Gas has agreed to continue to coordinate with the owners of these easements and refine the pipeline routes regarding BMPs and mitigation measures to be implemented during construction activities in these areas.

Visual resources along the pipeline route are a function of geology, climate, and historical processes, and include topographic relief, vegetation, water, wildlife, land use, and human uses and development. Approximately 40 percent of the pipeline corridors would be installed within or parallel to existing pipeline and/or utility rights-of-way. As a result, the visual resources along collocated portions have been previously affected by other similar activities. Impacts in other areas would be greatest where a conversion from forested land to a grassy, maintained right-of-way would occur, particularly at viewing locations such as roadways or trails. Additionally, we are recommending Columbia Gas and Columbia Gulf provide visual screening plans to benefit nearby noise sensitive receivers located near the proposed Oak Hill and Means Compressor Stations in response to landowner concerns.

Construction and operation of compressor stations and meter stations would result in a greater impact on visual resources. Construction of new aboveground facilities would result in conversion of 133.6 acres of forest, agricultural, and open land into industrial land. Several of the facilities are within the viewshed of residences. Some of these residences have existing visual buffers that would screen their view of the aboveground facilities, while others would experience altered viewsheds. Overall, visual impacts on residences close to the aboveground facilities would be permanent.

We conclude that overall impacts on land use and visual resources would be adequately minimized, with adherence to Columbia Gas' and Columbia Gulf's proposed impact avoidance, minimization, and mitigation plans, and our recommendations.

Socioeconomics

The primary socioeconomic effects of the projects include an increased population associated with the influx of construction workers and the impact of these workers on public services and temporary housing during construction. Secondary socioeconomic effects include increased sales and property tax revenue, job opportunities, income associated with local construction employment, increased vehicle traffic, and impacts on roads.

We received comments regarding potential adverse effects on property values, traffic safety within the project area during construction, and concern about eminent domain. The actual potential for these impacts is highly variable as each individual property that would be crossed by the project is unique. The effect that an easement may have on property values is an issue that Columbia Gas and landowners negotiate during the easement acquisition process. The easement acquisition process focuses on providing fair compensation to landowners for the right to use the property for pipeline construction and operation. To address traffic impacts related to construction across and within roadways and railroads, Columbia Gas has developed an acceptable Traffic Control Plan. During construction of the projects, Columbia Gas and Columbia Gulf would maintain traffic safety through use of appropriate traffic control measures, including the use of flagmen and signs in affected areas. Necessary permits would be obtained for traffic related impacts and contractors would comply with weight limitations and restrictions.

Construction of the projects would result in minor positive impacts from increases in construction jobs, payroll taxes, purchases made by the workforce, and expenses associated with the acquisition of material goods and equipment. Operation of the LX and RXE Projects would have a minor to moderate positive effect on local government tax revenues from an increase in property taxes that would be collected.

Cultural Resources

Columbia Gas and Columbia Gulf conducted archival research and walkover surveys of the area of the proposed Projects to identify historic aboveground resources and locations for additional subsurface testing in areas with potential for prehistoric and historic archaeological sites. Columbia Gas

identified 149 historic aboveground resources in Ohio and 16 historic aboveground resources in West Virginia within the area of direct impact for the proposed LX Project. Additionally 96 historic farms were reported located in various counties in Ohio and 9 historic farms were reported in West Virginia. No historic aboveground resources were identified in Pennsylvania. We have determined that one of these historic aboveground resources is eligible for listing in the National Register of Historic Places (NRHP). Sixty sites have been recommended as ineligible, and 104 sites have not been assessed. Columbia Gas has committed to avoiding and monitoring resources. We are recommending Columbia Gas file avoidance plans prior to construction of facilities.

Phase I archaeological surveys and architectural reconnaissance surveys are ongoing at the time of this final EIS for portions of the pipeline corridor, aboveground facilities, temporary workspaces, contractor yards and access roads. Columbia Gas and Columbia Gulf would complete and submit all survey information in the proposed Area of Potential Effect to FERC prior to construction.

We consulted with federally recognized Native American tribes to provide them an opportunity to comment on the proposed Projects. Several tribes and organizations requested additional consultation or information and the Delaware Tribe of Indians requested they participate as a consulting party. The Catawba Indian Nation and the Delaware Tribe of Indians responded that they have no immediate concerns within the boundaries of the proposed LX Project area, but requested they be notified if any unanticipated discovery is encountered during construction.

To ensure that our responsibilities under Section 106 of the National Historic Preservation Act are met, we are recommending, except in Pennsylvania, that Columbia Gas and Columbia Gulf not begin construction until any additional required surveys are completed, survey reports and treatment plans (if necessary) have been reviewed by the appropriate parties, and we have provided written notification to proceed.

Air Quality and Noise

Air quality impacts associated with construction of the proposed projects would include emissions from fossil-fueled construction equipment and fugitive dust. Such air quality impacts would generally be temporary and localized, and are not expected to cause or contribute to a violation of applicable air quality standards. Similarly, emissions associated with modifications at the existing Columbia Gulf's RXE facilities would be intermittent and short-term. Once construction activities in an area are completed, fugitive dust and construction equipment emissions would subside, and the impact on air quality due to construction would go away completely. Further, construction emissions do not exceed the General Conformity thresholds in areas of degraded air quality. Since there are counties in the project areas that are in nonattainment and maintenance areas, we are recommending that Columbia Gas submit a plan for monitoring in the emissions during construction to ensure emissions meet the General Conformity requirements. Therefore, we conclude that the projects' construction-related impacts would not result in a significant impact on local or regional air quality.

Columbia Gas' LX Project would consist of the construction of three new compressor stations, modifications at two existing stations, decommissioning of one existing natural gas-driven compressor unit among other modifications at an existing compressor station, abandonment of one compressor station, four new regulator stations, modification at one existing regulator station, 13 bi-directional pig launcher and/or receiver facilities, nine mainline valves, and five new odorization stations. Columbia Gulf's RXE Project would consist of the construction of two new compressor stations and modification at a measuring and regulator station. The majority of new emissions from the Columbia Gas' and Columbia Gulf's Projects would result from operation of the five new compressor stations.

Emissions generated during operation of the pipeline portions of the LX Project would be minimal, limited to emissions from maintenance vehicles and equipment and fugitive emissions (considered negligible for the pipeline). Based on potential emission rates, the proposed Lone Oak, Oak Hill, and Grayson Compressor Stations would be subject to Title V permitting for the LX and RXE Projects. Columbia Gas would need to apply for a Title V permit for the Lone Oak and Oak Hill Compressor Stations within twelve months of commencing operation. The Ceredo Compressor Station currently operates under the authority of a Title V permit; therefore, a Title V application would need to be submitted to revise the existing permit to account for the modifications at the Ceredo Compressor Station. The Initial Operating Permit obtained for the construction of the Grayson Compressor Station includes the operating permit requirements for Title V; therefore, a subsequent Title V permit application is not required for the Grayson Compressor Station.

The New Source Performance Standard (40 CFR 60) (NSPS) Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines) sets emission standards for oxides of nitrogen (NOx), carbon monoxide, and volatile organic compounds. Since the Projects' emergency engines would be greater than 130 hp, the emission standards of Subpart JJJJ would apply to the emergency generators at the LX and RXE Projects and Columbia Gas and Columbia Gulf would comply with the emission standards. NSPS Subpart KKKK (Standards of Performance for Stationary Combustion Turbines) sets emission limits for NOx and sulfur dioxide (SO_2). The combustion turbines at the Lone Oak, Summerfield, Oak Hill, Grayson, and Means Compressor Stations would have heat inputs causing them to be subject to Subpart KKKK. Columbia Gas and Columbia Gulf would demonstrate compliance with the NOx emission limits through annual performance tests. We are recommending Columbia Gas file a Construction Emission Plan to ensure construction emissions of NOx remain under the General Conformity applicability threshold. Columbia Gas and Columbia Gulf would demonstrate compliance with the SO_2 limits through the use of pipeline quality natural gas. The LX and RXE Projects would not trigger any additional NSPS at the existing facilities. As discussed in section 4.11.1.2, the potential greenhouse gas (GHG) emission rates associated with the proposed Lone Oak, Summerfield, and Oak Hill Compressor Stations would total approximately 497,021CO_2e. The potential GHG emission rates associated with the proposed Grayson and Means Compressor Stations would total approximately 331,860 CO_2e.

Noise Sensitive Areas (NSAs) near the construction areas may experience an intermittent increase in perceptible noise during construction, but the effect would be temporary and local. Construction of aboveground facilities would be limited to daytime hours. Noise mitigation measures that would be implemented during construction include the use of sound-muffling devices on engines and installation of barriers between construction activity and NSAs. Additional noise mitigation measures could be implemented to further reduce construction noise disturbances at NSAs. Generally, nighttime noise would not increase during construction, with the exception of HDD activity. Proposed mitigation would reduce noise levels from HDD activity to below 55 dBA L_{dn} (decibels on the A-weighted scale and day-night noise level). Based on modeled noise levels, our recommendations that Columbia Gas prepare a revised HDD noise mitigation analysis and weekly construction status reports, and the temporary nature of construction, we conclude that the Projects would not result in significant noise impacts on residents and the surrounding communities during construction.

Columbia Gas proposes seven HDD locations. HDD activities would use a wide variety of equipment with a majority of the noise being generated at the entry points. Columbia Gas would implement general mitigation measures, and we are recommending that Columbia Gas provide noise measurements and site-specific mitigation measures to reduce noise from HDD activities below the required level.

Columbia Gas's project would require blasting in some areas of the proposed route resulting in potential noise and vibration effects. Columbia Gas has developed a Project-specific Blasting Plan. In

comparison with other construction noise, the sound resulting from blasting would be brief and infrequent. Blasting would be conducted in accordance with applicable agency regulations, including pre- and post-blast inspections, advance public notification, and mitigation measures as necessary.

Noise impacts would result from operation of the Project's aboveground pipeline facilities, compressor stations, and meter stations. The new and modified compressor stations would be designed so that the total noise from each of these facilities operating at full capacity would not exceed our requirements, resulting in noise levels at an L_{dn} of 55 dBA or lower, at the nearest NSA. Columbia Gas and Columbia Gulf would implement noise control measures to reduce noise impacts at aboveground facilities. All site noise sources that could cause perceptible vibration would be adequately mitigated at regulator stations and odorization sites. Based on the analyses conducted, mitigation measures proposed, and our recommendations that Columbia Gas prepare noise surveys after placing the compressor stations in service, we conclude that operation of Columbia Gas' and Columbia Gulf's Projects would not result in significant noise impacts on residents and the surrounding communities.

Given adherence to Columbia Gas' and Columbia Gulf's proposed measures as well as our additional recommendations, we conclude that potential air and noise-related impacts associated with the Projects would be adequately minimized or mitigated.

Reliability and Safety

The pipeline and aboveground facilities associated with the proposed Projects would be designed, constructed, operated, and maintained to meet the Department of Transportation's Minimum Federal Safety Standards in 49 CFR 192 and other applicable federal and state regulations. These regulations include specifications for material selection and qualification; minimum design requirements; and protection of the pipeline from internal, external, and atmospheric corrosion.

Columbia Gas would implement its own management plan for its pipeline facilities, which would be clearly marked at line-of-sight intervals and at other key points to indicate the presence of the pipeline. The pipeline system would be inspected to observe right-of-way conditions and identify soil erosion that may expose the pipe, dead vegetation that may indicate a leak in the pipeline, conditions of the vegetative cover and erosion control measures, unauthorized encroachment on the right-of-way such as buildings and other structures, and other conditions that could present a safety hazard or require preventive maintenance or repairs. Columbia Gas and Columbia Gulf would use Supervisory Control and Data Acquisition systems that would allow for continuous monitoring and control of the Project.

Columbia Gas and Columbia Gulf would prepare emergency response plans that would provide procedures to be followed in the event of an emergency that would meet the requirements of 49 CFR 192.615. The plan would include the procedures for communicating with emergency services departments, prompt responses for each type of emergency, logistics, emergency shut down and pressure reduction, emergency service department notification, and service restoration.

We conclude that Columbia Gas' and Columbia Gulf's implementation of the above measures would protect public safety and the integrity of the proposed facilities.

Cumulative Impacts

Three types of projects (past, present, and reasonably foreseeable projects) could potentially contribute to a cumulative impact when considered with the proposed Projects. Cumulative analysis considered projects meeting one or more of the criteria listed below. These criteria define the Projects' regions of influence used in this analysis to describe the general area for which the proposed Projects could potentially contribute to cumulative impacts. The region of influence for the cumulative

analysis included projects within the proposed Projects' boundaries of the eight-digit hydrologic unit code watersheds affecting water resources and aquatic resources; projects located within 0.5 mile of the proposed Projects' areas that may impact wildlife, vegetation, and land use; counties within the proposed Projects' construction areas and where non-local workers are expected to reside during construction and operations personnel are expected to reside permanently and an additional 10 to 15 miles into the adjacent counties for portions of the proposed projects near a county border; geological resources within the proposed Projects' footprint; construction related air emissions within 1.2 miles of the proposed Projects' workspace; and projects occurring 0.5 mile or less from facilities creating operational noise associated with the proposed Projects. We have identified three types of projects that could potentially cause a cumulative impact when considered with the proposed projects. These include: (1) infrastructure; (2) FERC jurisdictional and non-jurisdictional linear pipeline projects; and (3) major residential, commercial, and industrial development projects within counties affected by the Projects. These include ten identified natural gas related projects, one transportation interchange project, and one residential subdivision project.

Impacts associated with the proposed Projects in combination with other projects, such as residential developments, utility lines, and transportation projects, would be relatively minor overall. We have included recommendations in the EIS to further reduce the environmental impacts associated with Columbia Gas's and Columbia Gulf's Projects, as summarized in section 5.2. Additionally, Columbia Gas selected a route that collocates with existing rights-of-way where feasible. Therefore, we conclude that the cumulative impacts associated with the proposed Projects, when combined with other known or reasonably foreseeable projects, would be effectively limited.

ALTERNATIVES CONSIDERED

The no-action alternative was considered for the proposed Projects. While the no-action alternative would eliminate the short- and long-term environmental impacts identified in this EIS, the stated objectives of Columbia Gas' and Columbia Gulf's proposals would not be met. The Projects could also reduce the reliance on alternative energy sources such as coal, oil, nuclear energy, or a combination of these.

Our analysis of system alternatives included an evaluation of whether existing or proposed natural gas pipeline systems could meet the Projects' objectives while offering an environmental advantage. There is no available and suitably located capacity for existing pipeline systems to transport the required volumes of natural gas, nor are they connected to the Columbia Gas's gas supply area in the Marcellus and Utica Shale regions of West Virginia, Pennsylvania, and Ohio. No existing pipeline system with the capacity to transport the contracted load connects the Marcellus and Utica Shale regions to serve the identified Project markets. Therefore, we do not consider the use of existing pipeline systems as feasible alternatives for the proposed Projects.

We evaluated two major route alternatives for the LX Project. Neither of the major route alternatives offered significant environmental advantages over the proposed pipeline routes. Columbia Gas assessed numerous minor route variations over the course of Project development, and incorporated many of these into the proposed route evaluated in the EIS.

Based on consultations with landowners, resource agencies, municipal governments, field review, and impact assessment, Columbia Gas is evaluating landowner requested variations, agency requested variations, and minor route alternatives for the proposed LX Project to avoid site-specific features such as topography, landowner concerns, sensitive habitat, or structures. Since some of the landowner requested variations are still in development, we are recommending that Columbia Gas further assess the minor route evaluations. Columbia Gas should conduct these assessments in coordination with the landowners and either incorporate a route that avoids the resources of concern, or otherwise explain how potential

impacts on resources have been effectively avoided, minimized, or mitigated. We also evaluated one additional minor route alternative through areas in which two other FERC-regulated pipeline projects (the Rover Pipeline Project and the Appalachian Lease Project) have proposed routes similar to that of the LX Project.

A portion of the proposed LX Project route would be adjacent to Texas Eastern Transmission, LP's (Texas Eastern) existing permanent pipeline for about 17 miles between LEX Pipeline mileposts (MP) 34.6 and 52.2. Within this portion, the LEX Pipeline would closely overlap Rover Pipeline LLC's (Rover) Seneca Lateral (part of the Rover Pipeline Project) for about 13 miles in Monroe County, Ohio. In response to a FERC information request, Rover and Columbia reached an agreement in early July of 2016 to design their respective pipeline facilities in a manner such that both pipelines would be constructed and operated safely with minimal environmental and stakeholder impacts. Columbia Gas and Rover Pipeline LLC have tentatively agreed to use a non-exclusive easement for this overlap, which includes a mutual new permanent right-of-way width of 50 feet located on the south side of Texas Eastern's right-of-way. Their tentative design would be to distance their pipelines 20 feet from each other. Whichever pipeline is installed first in time would be located 40 feet from Texas Eastern's closest pipeline (a 30-inch-diameter pipeline), and that pipeline's temporary right-of-way would overlap Texas Eastern's permanent right-of-way overlap by 10 feet.

We also evaluated two locations of the proposed LX Project's Oak Hill Compressor Station to determine whether environmental impacts would be reduced or mitigated by the use of alternative facility sites. We did not identify any alternative sites that would offer a significant environmental advantage to the proposed site.. These alternative sites were excluded from consideration due to landowner preference, increased environmental impacts, accessibility, location constraints, additional construction needs, increased impacts on forested land or sensitive resources, and proximity to residential areas.

MAJOR CONCLUSIONS

We determined that construction and operation of the Projects would result in limited adverse environmental impacts, with the exception of impacts on forested land. This determination is based on a review of the information provided by Columbia Gas and Columbia Gulf and further developed from environmental information requests; field reconnaissance; scoping; literature research; alternatives analyses; and contacts with federal, state, and local agencies, and other stakeholders.

We conclude that approval of the LX Project would result in a significant environmental impact to forests. Forested impacts from the construction of the LX Project would be significant; however, due to the prevalence of forested habitats within the project area and eventual regrowth of prior forested areas outside of the permanent right-of-way, in addition to Columbia Gas' mitigation and routing, we conclude that the permanent conversion of forested lands would be reduced to less than significant levels. Although many factors were considered in this determination, the principal reasons are:

- LX and RXE Projects would minimize impacts on natural and cultural resources during construction and operation of its Project by implementing Columbia Gas and Columbia Gulf's ECS, which incorporates FERC's Plan and Procedures and includes a Spill Prevention, Containment and Control Plan and a Winter Construction Plan; HDD Contingency Plan; Unanticipated Discoveries and Emergency Procedures; Procedure Guiding the Discovery of Unanticipated Cultural Resources and Human Remains; Blasting Plan; Traffic Control Plan; Longwall Mining Plan; Fugitive Dust Control Plan; Polychlorinated Biphenyl Risk Management Plan; and Polychlorinated Biphenyl Soil Management Plan.
- We would complete Endangered Species Act consultations with the FWS prior to allowing any construction to begin.

- We would complete the process of complying with Section 106 of the National Historic Preservation Act and implementing the regulations at 36 CFR 800 prior to allowing any construction to begin.
- Columbia Gas and Columbia Gulf would be required to obtain applicable permits and provide mitigation for unavoidable impacts on waterbodies and wetlands through coordination with the COE and applicable state agencies.
- We are recommending that the applicants further mitigate the negative impacts on migratory bird habitat by avoiding or minimizing impacts to the degree practicable, and file its Final Migratory Bird Conservation Plan developed in consultation with the FWS.
- We would provide oversight of an environmental inspection and mitigation monitoring program that would ensure compliance with all mitigation measures that become conditions of FERC authorizations and other approvals.

In addition, we developed site-specific mitigation measures that Columbia Gas and Columbia Gulf should implement to further reduce the environmental impacts that would otherwise result from construction of its Projects. We determined that these measures are necessary to reduce the significant and adverse impacts associated with the Projects, and in part, are basing our conclusions on implementation of these measures. Therefore, we are recommending that these mitigation measures be attached as conditions to any authorization issued by the Commission. These recommended mitigation measures are presented in section 5.2 of the final EIS.

1.0 INTRODUCTION

On June 8, 2015, Columbia Gas Transmission, LLC (Columbia Gas) filed an application with the Federal Energy Regulatory Commission (FERC or Commission) under section 7(b) and 7(c) of the Natural Gas Act (NGA) and part 157 of the Commission's regulations to construct, operate, and abandon certain interstate natural gas pipeline facilities in Ohio, Pennsylvania, and West Virginia. On July 1, 2015, NiSource, Inc. created a separate legal company, Columbia Pipeline Group which includes Columbia Energy Group and its subsidiaries Columbia Gas, and Columbia Gulf Transmission, LLC (Columbia Gulf). On July 29, 2015, Columbia Gulf filed an application with FERC under section 7(c) of the NGA and part 157 of the Commission's regulations to construct, operate, and maintain certain interstate related natural gas pipeline facilities in Kentucky. Columbia Gas and Columbia Gulf are seeking Certificates of Public Convenience and Necessity (Certificate), and were assigned Docket Nos. CP15-514-000 and CP15-539-000 for their applications, respectively. On October 23, 2015 and March 18, 2016, Columbia Gas filed supplemental information to the June 8, 2015 application.

Columbia Gas' proposed facilities, referred to as the Leach XPress Project (LX Project), total about 160.7 miles of new pipeline and 143,000 horsepower (hp) of compression to transport up to 1,500,000 dekatherms per day (Dth/d)[1] of natural gas. Facilities to be constructed are located in:

- Marshall and Wayne Counties, West Virginia;
- Greene County, Pennsylvania; and
- Monroe, Noble, Muskingum, Morgan, Perry Fairfield, Hocking, Jackson, Lawrence and Vinton Counties, Ohio.

Columbia Gulf's proposal, referred to as the Rayne XPress Expansion Project (RXE Project), would involve the construction and operation of 51,800 hp at two compressor stations (CS) in Carter, Menifee, and Montgomery Counties, Kentucky, to enable up to 621,000 Dth/d of firm transportation on its system. The LX and RXE Projects are collectively referred to as (Projects).

The FERC environmental staff prepared this final Environmental Impact Statement (EIS) to assess the environmental impacts associated with the construction and operation of the LX and RXE Projects in accordance with the requirements of the National Environmental Policy Act (NEPA). The RXE Project facilities are related to the LX Project; therefore, they are being evaluated together in this EIS. The U.S. Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (COE), U.S. Fish and Wildlife Service (FWS), Ohio Environmental Protection Agency (OEPA), Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Department of Conservation and Natural Resources (PADCNR), West Virginia Department of Environmental Protection (WVDEP), West Virginia Department of Natural Resources (WVDNR), and Kentucky Department for Environmental Protection (KYDEP) are participating as cooperating agencies in the preparation of the EIS.[2] The roles of FERC and the cooperating agencies in the review process are described in section 1.2.

The vertical line in the margin identifies text that has been modified in this final EIS and differs materially from the corresponding text in the draft EIS.

[1] A dekatherm is a unit of heating value often used by natural gas companies instead of volume for billing purposes. A dekatherm is equivalent to 10 therms or one million British thermal units.

[2] A cooperating agency has jurisdiction by law or special expertise with respect to environmental impacts involved with the proposed Project and is involved in the NEPA analysis.

1.1 PROJECT PURPOSE AND NEED

While this EIS will briefly describe each of the project's purpose, it will not determine whether the need for the Projects exists, as this will later be determined by the Commission. Based on information provided by Columbia Gas:

- the purpose of the LX Project is to expand the capacity of Columbia Gas' existing pipeline system to transport up to 1,500,000 Dth/d[3] of natural gas to meet the market demand for the transportation of stranded natural gas supplies from the existing production region to areas of higher demand, premium markets.

Based on the information provided by Columbia Gulf:

- the proposed RXE Project is necessary to respond to the specific market need to transport up to 621,000 Dth/d of natural gas in a north-to-south direction.

The LX Project is supported by binding precedent agreements[4] with four anchor shippers collectively representing more than 90 percent of the project's capacity. The RXE Project is fully supported by binding precedent agreements with shippers with contract terms of 15 and 16 years from the in-service date.

Under section 7 of the NGA, the Commission determines whether interstate natural gas transportation facilities are in the public convenience and necessity and, if so, grants a Certificate to construct, operate, and abandon them. If the Commission determines that a project is required by the public convenience and necessity, Certificates would be issued under Section 7(b) and 7(c) of the NGA and Part 157 of the Commission's regulations. Section 7(b) of the NGA specifies that no natural gas company shall abandon any portion of its facilities subject to the Commission's jurisdiction without the Commission first finding that the abandonment will not negatively affect the present or future public convenience and necessity.The Commission bases its decision on technical competence, financing, rates, market demand, gas supply, environmental impact, long-term feasibility, and other issues concerning a proposed project. The scope of this EIS discusses the environmental impacts of constructing and operating Columbia Gas and Columbia Gulf's natural gas facilities.

1.2 PURPOSE AND SCOPE OF THE EIS

Our[5] principal purposes for preparing the EIS are to:

- identify and assess the potential impacts on the natural and human environment that would result from the implementation of the proposed Projects;
- describe and evaluate reasonable alternatives to the proposed projects that would avoid or substantially lessen adverse effects of the Projects on the environment while still meeting the Project objectives;

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3 For conceptualization purposes only, a natural gas capacity of 1,500,000 Dth/d would be sufficient to power roughly 14.3 million homes annually (if it were used solely for residential energy production). This estimate assumes an average household energy consumption of 11,000 kilowatt hours per year. If these Projects are approved, the natural gas could be used in a variety of applications, not solely for residential energy generation.

4 A precedent agreement is a binding contract under which one or both parties has the ability to terminate the agreement if certain conditions, such as receipt of regulatory approvals, are not met.

5 "We," "us," and "our" refer to the environmental staff of FERC's Office of Energy Projects.

- identify and recommend specific mitigation measures, as necessary, to avoid or minimize environmental effects; and
- encourage and facilitate involvement by the public and interested agencies in the environmental review process.

The topics addressed in the EIS include: project alternatives; geology; soils; groundwater; surface waters; wetlands; vegetation; wildlife and aquatic resources; special status species; land use, recreation, special interest areas and visual resources; socioeconomics; cultural resources; air quality and noise; reliability and safety; and cumulative impacts. The EIS describes the affected environment as it currently exists based on available information and the environmental consequences of the proposed Projects, and compares the Projects' potential impact to that of various alternatives. The EIS also presents our conclusions and recommended mitigation measures.

Our description of the affected environment is based on a combination of data sources including desktop resources such as scientific literature and regulatory agency reports as well as field data collected by Columbia Gas and Columbia Gulf. Columbia Gas has field surveyed about 154.7 miles (96.3 percent) of the total pipeline facilities along the LX Project route. Completion of field surveys has been dependent upon winter weather, project design, and acquisition of survey permission from landowners. If the necessary access cannot be obtained through coordination with landowners and the proposed project is certificated by FERC, Columbia Gas may use the right of eminent domain granted to it under section 7(h) of the NGA to obtain a right-of-way. Therefore, if the LX Project is certificated by the Commission, then the outstanding surveys (and associated agency permitting) would have to be completed after issuance of the Certificate. Columbia Gulf has completed all surveys for the proposed and alternative sites.

We received comments regarding the potential impacts associated with natural gas development activities, including production of natural gas from shale formations. Our authority under the NGA relates only to natural gas facilities that are involved in interstate commerce. The permitting of oil and gas production facilities is under the jurisdiction of various state and federal agencies where those facilities are located. Thus, the facilities associated with the production of natural gas are not under FERC jurisdiction. However, to the extent the review of such facilities are relevant, they are included as part of our analysis of cumulative impacts.

1.2.1 Federal Energy Regulatory Commission Purpose and Role

FERC is an independent federal agency responsible for evaluating applications for authorization to construct and operate interstate natural gas pipeline facilities. FERC is the lead federal agency for the preparation of this EIS in compliance with the requirements of NEPA, the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA (Title 40 Code of Federal Regulations [CFR] Parts 1500–1508), and FERC's regulations implementing NEPA (18 CFR 380).

As the lead federal agency for the proposed Projects, FERC is required to comply with section 7 of the Endangered Species Act of 1973 (ESA), the Magnuson-Stevens Fishery Conservation and Management Act, section 106 of the National Historic Preservation Act (NHPA), and section 307 of the Coastal Zone Management Act of 1972. These and other statutes have been taken into account in the preparation of the EIS.

1.2.2 U.S. Environmental Protection Agency Purpose and Role

The EPA is an independent federal agency responsible for protecting human health and safeguarding the natural environment. The EPA has delegated water quality certifications under

section 401 of the Clean Water Act (CWA) to the OEPA, WVDNR, KYDEP, and the Pennsylvania Department of Environmental Protection (PADEP), but the EPA may assume this authority if no state program exists, if the state program is not functioning adequately, or at the request of a state.

The EPA also oversees the issuance of a National Pollutant Discharge Elimination System (NPDES) permit by the state agency, under section 402 of the CWA, for point-source discharge of water used for hydrostatic testing of pipelines into waterbodies. The EPA has the authority to review and veto the decisions on section 404 permits. The EPA also has jurisdictional authority to control air pollution under the Clean Air Act (CAA) (Title 42 United States Code [USC] Chapter 85) by developing and enforcing rules and regulations for all entities that emit toxic substances into the air. Under this authority, the EPA has developed regulations for major sources of air pollution. The EPA has delegated the authority to implement these regulations to state and local agencies, who are also allowed to develop their own regulations for non-major sources. The EPA also establishes general conformity applicability thresholds, with which a federal agency can determine whether a specific action requires a general conformity assessment.

In addition to its permitting responsibilities, the EPA is required under section 309 of the CAA to review and publicly comment on the environmental impacts of major federal actions including actions that are the subject of draft and final EISs, and responsible for implementing certain procedural provisions of NEPA (e.g., publishing the Notices of Availability of the draft and final EISs in the *Federal Register*) to establish statutory timeframes for the environmental review process.

1.2.3 U.S. Army Corps of Engineers Purpose and Role

The COE is a federal agency within the U.S. Department of Defense with jurisdictional authority pursuant to section 404 of the CWA (33 USC 1344), which governs the discharge of dredged or fill material into waters of the United States, and section 10 of the Rivers and Harbors Act (33 USC 403), which regulates any work or structures that potentially affect the navigable capacity of a waterbody. Because the COE would need to evaluate and approve several aspects of the project and must comply with the requirements of NEPA before authorizing fill activities or work under the above statutes, it has elected to participate as a cooperating agency in the preparation of this EIS. The COE would adopt the EIS per 40 CFR 1506.3 if, after an independent review of the document, it concludes that its comments and suggestions have been satisfied. The LX Project occurs within the Huntington and Pittsburgh Districts of the COE.

Columbia Gas states that the proposed LX Project meets the criteria for a nationwide general permit (Nationwide Permit 12) under Section 404 of the CWA. Nationwide permits are a type of general permit designed to authorize certain activities that have minimal individual and cumulative adverse effects on the aquatic environment and generally comply with the related laws cited in 33 CFR 320.3. Activities that result in more than minimal individual and cumulative adverse effects on the aquatic environment cannot be authorized by nationwide permits. Nationwide Permit 12 has preconstruction notification requirements that trigger case-by-case review of certain activities. Two nationwide permit general conditions require case-by-case review of all activities that may adversely affect federally listed endangered or threatened species or historic properties (i.e., general conditions 18 and 20). Accordingly, Columbia Gas submitted a preconstruction notification to the COE on June 12, 2015.

Columbia Gulf states that the proposed RXE Project meets the criteria for a nationwide general permit (Nationwide Permit 12) under Section 404 of the CWA. Accordingly, Columbia Gulf has submitted a preconstruction notification to the Louisville District COE in August 2015.

As an element of its review, the COE must consider whether the proposed Projects represent the least environmentally damaging practicable alternative pursuant to the CWA Section 404(b)(1) guidelines. The term "practicable" means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall purposes of the project. Although this document addresses environmental impacts associated with the proposed project as they relate to Section 404, it does not serve as a public notice for any of the COE's permits. Based on its participation as a cooperating agency and its consideration of the final EIS (including responses to comments), the COE would issue a Record of Decision to formally document its decision on the proposed action, including section 404(b)(1) analysis and required environmental mitigation commitments.

1.2.4 U.S. Fish and Wildlife Service Purpose and Role

The FWS is responsible for ensuring compliance with the ESA. Section 7 of the ESA, as amended, states that any project authorized, funded, or conducted by any federal agencies 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)). The FWS also reviews project plans and provides comments regarding protection of fish and wildlife resources under the provisions of the Fish and Wildlife Coordination Act (16 USC 661 et seq.). The FWS is responsible for the implementation of the provisions of the Migratory Bird Treaty Act (MBTA) (16 USC 703) and the Bald and Golden Eagle Protection Act (BGEPA) (16 USC 688).

Section 7 of the ESA requires identification of and consultation on aspects of any federal action that may have effects on federally listed species, species proposed for federal listing, and their habitat. The ultimate responsibility for compliance with section 7 remains with the lead federal agency (i.e., FERC for these Projects).

As the lead federal agency for the Projects, FERC consulted with the FWS pursuant to section 7 of the ESA to determine whether federally listed endangered or threatened species or designated critical habitat are found in the vicinity of the Projects, and to evaluate the proposed action's potential effects on those species or critical habitats. FERC coordinated with the FWS regarding other federal trust wildlife resources, such as migratory birds. The FWS elected to cooperate in preparing this EIS because it has special expertise with respect to environmental impacts associated with the Projects.

1.2.5 Ohio Environmental Protection Agency Purpose and Role

The OEPA is a state agency whose goal is to protect the environment and public health by ensuring compliance with environmental laws. Those laws and related rules outline OEPA's authority and what must be considered when making decisions about project-regulated activities. Because the OEPA would need to evaluate and approve several aspects of the project, it has elected to participate as a cooperating agency in the preparation of this EIS.

1.2.6 West Virginia Department of Environmental Protection

The WVDEP is a state agency responsible for implementing and enforcing West Virginia's environmental regulations with respect to managing the state's air, land, and water resources. The WVDEP has authority (through delegation from the EPA) for Section 401 of the CWA Water Quality Certification. Additionally, the WVDEP reviews and approves all applications for NPDES permits. The WVDEP has requested to be a cooperating agency in order to lend their experiences and insight with environmental impacts relative to this type of activity and provide recommendations on assessment, minimization, and mitigation of potential environmental impacts. Therefore, the WVDEP has elected to be a cooperating agency.

1.2.7 West Virginia Department of Natural Resources Purpose and Role

The WVDNR is a state agency charged with enforcing regulations enacted to protect fish, wildlife, and critical habitat resources. Because the WVDNR would need to evaluate and approve several aspects of the LX Project, it has elected to participate as a cooperating agency in the preparation of this EIS.

1.2.8 Kentucky Department for Environmental Protection Purpose and Role

The KYDEP is a state agency whose mission is to protect and enhance Kentucky's public health, our citizens' safety and the quality of Kentucky's natural resources. Because the KYDEP would need to evaluate and approve several aspects of the RXE Project, it has elected to participate as a cooperating agency in the preparation of this EIS.

1.3 PUBLIC REVIEW AND COMMENT

On September 26, 2014, Columbia Gas filed a request with FERC to implement the Commission's pre-filing process for the LX Project. At that time, Columbia Gas was in the preliminary design stage of the project and no formal application had been filed with FERC. The purpose of the pre-filing process is to encourage the early involvement of interested stakeholders, facilitate interagency cooperation, and identify and resolve issues before an application is filed. On October 9, 2014, FERC granted Columbia Gas' request and established pre-filing Docket No. PF14-23-000 to place information related to the pipeline project into the public record. The cooperating agencies agreed to conduct their environmental reviews of the pipeline project in conjunction with the Commission's environmental review process.

During the pre-filing process, Columbia Gas held seven informational open houses in November 2014. The purpose of the open houses was to provide affected landowners, elected and agency officials, and the general public with information about the pipeline project and to give them an opportunity to ask questions and express their concerns. We participated in the open houses and provided information regarding the Commission's environmental review process to interested stakeholders and to take comments about the proposed pipeline project and the alternatives. An additional open house was held in on April 8, 2015 to account for a major reroute of the LX Project. The substantive questions and concerns raised by the public at the open houses are addressed in this EIS.

In addition, Columbia Gas established a single point of contact to answer questions and provide information, established a website with information about the pipeline project (https://www.cpg.com/current-projects/leach-xpress-project), and sent periodic update newsletters. Columbia Gas also communicated directly with certain landowners where specific issues were raised regarding individual properties.

On January 13, 2015, the Commission issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Leach XPress Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meetings*. The notice was published in the *Federal Register* on January 20, 2015 and mailed to more than 1,500 interested parties, including federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Native American Tribes; affected property owners; other interested parties; and local libraries and newspapers. The notice briefly described the project and the EIS process, provided a preliminary list of issues identified by us, invited written comments on the environmental issues that should be addressed in the draft and final EIS, listed the date and location of three public scoping meetings to be held in the area of the project, and established a closing date for receipt of comments of February 12, 2015.

We held five public scoping meetings to provide an opportunity for agencies, stakeholders, and the general public to learn more about the proposed pipeline project and participate in the environmental analysis by commenting on the issues to be addressed in the draft and final EIS. The first meeting was in Moundsville, West Virginia on January 27, 2015, followed by meetings on January 28, 2015 in Caldwell, Ohio; January 29, 2015 in Oak Hill, Ohio; February 3, 2015 in Logan, Ohio; and February 4, 2015 in Huntington, West Virginia. Three people commented at the meeting in Moundsville, four people commented at the meeting in Caldwell, four people commented at the meeting in Oak Hill, eight people commented at the meeting in Logan, and four people commented at the meeting in Huntington. Each meeting was documented by a court reporter, and the transcripts were placed into the public record for Columbia Gas' LX Project.

In addition, during the pre-filing process, we conducted conference calls on an approximately biweekly basis with representatives from Columbia Gas and interested agencies to discuss the pipeline project's progress and issues. Summaries of the calls were placed in the public record and are available for viewing on the FERC internet website (http://www.ferc.gov).[6]

On July 29, 2015, Columbia Gulf filed an application for its proposed RXE Project. On September 4, 2015, the Commission issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Rayne XPress Expansion Project and Request for Comments on Environmental Issues*. The notice was published in the *Federal Register* on September 11, 2015 and mailed to more than 230 interested parties, including federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Native American Tribes; affected property owners; other interested parties; and local libraries and newspapers. The notice briefly described the project and the EIS process, provided a preliminary list of issues identified by us, invited written comments on the environmental issues that should be addressed in the draft EIS and established a closing date for receipt of comments of October 5, 2015. In this notice, we stated that we would evaluate the environmental impacts of the RXE Project in the EIS being prepared for the related LX Project.

On April 21, 2016, we issued a *Notice of Availability of the Draft Environmental Impact Statement for the Proposed Leach XPress Project and Rayne XPress Expansion Project*. This notice, which was published in the Federal Register, listed the dates and locations of public comment meetings and established a closing date of June 13, 2016 for receiving comments on the draft EIS. Copies of the draft EIS were mailed to over 1,650 stakeholders. The EPA noticed receipt of the draft EIS in the Federal Register on April 27, 2016.

We held five public comment meetings in the Leach XPress Project area to solicit and receive comments on the draft EIS. Due to the scope and potential environmental effects from the Rayne XPress Project, we determined that it was not necessary to hold separate public comment meetings in the Rayne XPress Project area. The meetings were held between May 18, 2016 and May 26, 2016 in Caldwell, Ohio; Moundsville, West Virginia; Logan, Ohio; Oak Hill, Ohio; and Huntington, West Virginia. The meetings provided the public an opportunity to present oral comments on the analysis of environmental impacts described in the draft EIS. A combined total of approximately 80 individuals attended these comment meetings, including 10 who provided oral comments. We also received nine individual comment letters from federal and state agencies; companies/organizations; and individuals in response to the draft EIS prior to the close of the comment period on June 13, 2016. No form letters or petitions were submitted. We also continued to accept comment letters past the close of the comment period through July 8, 2016. Those letters received through July 8, 2016 included one comment letter from the

[6] Using the "eLibrary" link, select "General Search" from the eLibrary menu and enter the docket number excluding the last three digits in the "Docket Number" field (i.e., PF14-23). Be sure to select an appropriate date range.

Huntington District COE and are included in our comment responses contained in Volume II.[7] Letters received after July 8, 2016 continued to be posted to the eLibrary site and were reviewed by staff for additional new substantive concerns, but are not included in Volume I because no new issues were raised that were not already addressed in previous comment letters. Transcripts from the public comment meetings, as well as written comment letters, were entered into the public record and are available for viewing on the FERC's eLibrary website (www.ferc.gov).

This EIS addresses all substantive comments submitted to the FERC or made at the open house, scoping meetings, interagency meetings, and comment meetings on the draft EIS. Table 1.3-2 lists the environmental issues and concerns identified by commenters during the scoping and comment process and identifies the section of the EIS where the issue is addressed. Fifty-eight motions to intervene were filed with FERC and placed in the public record for the Projects. Table 1.3-1 also lists comments that were received after the formal scoping period closed, including the relevant environmental comments raised by individuals requesting to be intervenors in the Commission's proceeding.[8] Additional issues we independently identified are also addressed in the EIS.

Numerous commenters expressed support for the Leach XPress Project, noting the potential local employment opportunities that would be generated by the LX Project. However, many commenters expressed opposition to the LX Project. The LX Project's purpose and need, property values, impacts on sensitive resources, and routing were common objections. Other concerns included drinking water impacts, safety concerns, wildlife impacts, and economic impacts.

Copies of this final EIS have been mailed to the agencies, individuals, organizations, and other parties identified in the distribution list provided as appendix A. Additionally, the final EIS has been filed with the EPA for issuance of a formal Notice of Availability in the Federal Register. In accordance with the CEQ's regulations implementing NEPA, no agency decision on the proposed actions may be made until 30 days after the EPA publishes the Notice of Availability in the Federal Register. However, the CEQ regulations provide an exception to this rule when an agency decision is subject to a formal internal appeal process that allows other agencies or the public to make their views known. This is the case at the FERC, where any Commission decision on the proposed action would be subject to a 30-day rehearing period. Therefore, the FERC decision may be made and recorded concurrently with the publication of the final EIS or any time thereafter.

Several of the issues identified during our environmental review process involved alternative pipeline route variations to avoid or minimize impacts on resources such as mining areas, water wells or wetlands, and larger resource areas such as aquifers, watersheds, and state parks. These concerns were identified by property owners, stakeholders, FERC staff, and other agency staff. Many of these alternative routes that avoided sensitive resources were developed early in the process and voluntarily incorporated by Columbia Gas into its proposed route of the LX Project. Given this process, subsequent

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7 Each comment letter received through July 8, 2016 has been scanned and sorted by commentary type (i.e. federal agencies, Native American tribes, state agencies, companies and organizations, individuals, public meetings, and applicant). The comments within each letter or transcript have been coded and a response to each comment provided side-by-side with the scanned letter. These letters and responses are included in Volume II of the EIS.

8 FERC's Notices of Application for the LX and RXE Projects, issued in the Federal Register on June 22, 2015 and August 11, 2015, respectively, opened the 21-day period for intervention. A total of 38 groups and individuals for the LX Project and 20 groups and individuals for the RXE Project requested intervenor status. Interveners are official parties to the proceeding and have the right to receive copies of case-related Commission documents and filings by other intervenors. Likewise, each intervenor must provide a copy of its filings to the Secretary of the Commission and must send a copy of its filings to all other intervenors. Only intervenors have the right to seek rehearing of the Commission's decision.

alternative route comparisons often were not necessary if the resource was avoided or the stakeholder's concerns were otherwise resolved. Other alternative routes, however, both small and large, remained viable throughout the course of the LX Project. Route adjustments were made throughout the pre-filing and post-filing process. These route adjustments are presented in table 1.3-1 below. Section 3.0 presents our analysis of the alternatives that were identified since the beginning of our review of these Projects in October 2014.

TABLE 1.3-1
Minor Route Alternatives Adopted into the Proposed Pipeline Route for the LX Project

Alternative	Start Milepost	End Milepost	County, State	Description
Deviation A	0.0 (LEX)	7.7 RR-1 (LEX)	Marshall, WV; Greene, PA	Deviation A was adopted to mitigate the risks of crossing multiple ongoing construction sites and existing underground facilities by avoiding the congested area. Incorporation of this deviation minimizes risks associated with construction on vertical side slopes. This deviation would not require the additional discharge line associated with the original route to cross multiple pipelines resulting in safer and more efficient construction in this area.
Deviation A-1[a]	0.0 (LEX)	1.3 (LEX)	Marshall, WV; Greene, PA	Deviation A-1 was adopted due to the MarkWest Processing Plant's future plans for facility expansion.
Deviation A-2[c]	N/A	N/A	Marshall, WV	Deviation A-2 was presented in Columbia Gas' October 2015 filing to accommodate the location of the Lone Oak CS. Columbia Gas has shifted the Lone Oak CS site which resulted in the removal of Deviation A-2.
Deviation B	16.6 (LEX)	18.6 (LEX)	Marshall, WV	Deviation B was adopted to minimize engineering complexity associated with steep slopes and rocky outcrops. This deviation also reduced aesthetic disturbances on residential properties by reducing the number of residences located 100 feet from the pipeline from six to three.
Deviation B-1[b]	16.7 (LEX)	17.2 (LEX)	Marshall, WV	Deviation B-1 was adopted to avoid a planned oil well pad and associated tank site crossed by the previously proposed route. Incorporation of this deviation eliminates impacts on wetlands and waterbodies crossed by the previously proposed route.
Deviation B-2[b]	18.4 (LEX)	18.6 (LEX)	Marshall, WV	Deviation B-2 was adopted to accommodate a new location for MLV #2 at the request of a landowner.
Deviation C	23.6 (LEX)	27.7 (LEX)	Marshall, WV; Monroe, OH	Deviation C was adopted to avoid difficult and rugged terrain primarily characterized by severe elevation changes and rocky outcrops, thereby minimizing engineering complexity.
Deviation C-1[c]	N/A	N/A	Marshall, WV; Monroe, OH	Deviation C-1 was adopted to minimize workspace necessary to safely conduct drilling operations on vertical side slopes and rocky outcrops. However, further studies have indicated a more suitable route and are incorporated as Deviation C-2. Deviation C-1 has been removed.
Deviation C-2[b]	25.2 (LEX)	26.9 (LEX)	Marshall, WV; Monroe, OH	Deviation C-2 was adopted to reduce constructability issues associated with the location and configuration of the previously proposed HDD pullback workspace located on the west side of the Ohio River crossing. Deviation C-2 minimizes potential risks associated with construction across steep slopes. Additionally, Deviation C-2 reduces the number of wetland and waterbody crossings and reduces the length of pipeline proposed through the Sunfish Creek State Forest.
Deviation D	51.8 (LEX)	59.6 (LEX)	Monroe, OH; Noble, OH	Deviation D was developed and adopted to accommodate the proposed Summerfield CS site located at the LEX Pipeline MP 58.00 along the proposed route. The original Summerfield CS site was removed from consideration due to increased environmental impact.
Deviation D-1[a]	57.8 (LEX)	58.3 (LEX)	Noble, OH	Deviation D-1 was developed and adopted to reduce stream impacts and limit the number of crossings.

TABLE 1.3-1 (cont'd)
Minor Route Alternatives Adopted into the Proposed Pipeline Route for the LX Project

Alternative	Start Milepost	End Milepost	County, State	Description
Deviation D-2 [b]	54.5 (LEX)	55.8 (LEX)	Noble, OH	Deviation D-2 was adopted to avoid construction of the pipeline under an existing corrugated metal culvert located at the previous crossing of Highway 78 as per a request from the Ohio Department of Transportation.
Deviation E	122.2 (LEX)	0.4 (LEX1)	Hocking, OH; Fairfield, OH	Deviation E was adopted and would avoid potential impacts on several prehistoric and historic archaeological sites identified on field surveys along the previous route.
Deviation F	68.6 (LEX)	88.7 (LEX)	Noble, OH; Muskingum, OH; Morgan, OH	Deviation F was adopted and would reduce construction through areas designated as ReCreation Land. This deviation would minimize potential constructability constraints associated with inundated areas and difficult terrain, thus reducing additional environmental impacts requiring increased costs and potential schedule delays associated with additional erosion controls and mitigation.
Deviation F-1 [b]	69.8 (LEX)	70.0 (LEX)	Noble, OH	Deviation F-1 was adopted to avoid a natural spring.
Deviation G [c]	0.2 (LEX1)	0.4 (LEX1)	Fairfield, OH	Deviation G was developed to accommodate the future expansion of facilities associated with a nearby school and would result in similar environmental impacts as the previous route. Since Columbia Gas' initial application, Deviation G has been replaced with Deviation L.
Deviation I [a]	19.4 (LEX)	22.3 (LEX)	Marshall, WV	Deviation I was developed and adopted, in part, to allow Noble Energy to construct a well pad in the vicinity of the previously proposed route. Deviation I also accommodates the Blue Racer Pipeline.
Deviation J [b]	100.0 (LEX)	100.2 (LEX)	Perry, OH	Deviation J was adopted to reduce impacts on waterbodies and the number of stream crossings required.
Deviation K [a]	114.0 (LEX)	114.3 (LEX)	Perry, OH	Deviation K was adopted to reroute around a Wetland Reserve Program easement.
Deviation L [a]	127.2 (LEX); K-260 RS	R-System RS Site; Line K-260	Hocking, OH; Fairfield, OH	Deviation L was adopted to avoid cultural resources identified during field surveys.
Deviation M [a]	8.9 (R-801 Loop)	9.4 (R-801 Loop)	Hocking, OH	Although Deviation M increases forest impacts, it was adopted in response to landowner requests.
Deviation N [b]	14.1 (LEX)	15.1 (LEX)	Marshall, WV	Deviation N was adopted to avoid the future construction of newly identified foreign pipelines. Additionally, this would avoid several oil and gas well pads that were recently constructed or currently undergoing construction.
Deviation O [b]	50.7 (LEX)	51.0 (LEX)	Monroe, OH	Deviation O was adopted to avoid potential impacts on a planned oil well pumpjack.
Deviation P [b]	7.4 (LEX)	9.5 (LEX)	Marshall, WV	Deviation P was adopted in response from the West Virginia Department of Transportation to avoid a soil nail reinforcement project. The new route would also accommodate a shift in the Lone Oak CS site.

[a] Deviations adopted into the LX Project Route after the June 8, 2015 Filing.
[b] Deviations adopted into the LX Project Route after the March 18, 2016 Filing.
[c] Deviations removed from the LX Project Route after the March 18, 2016 Filing.

TABLE1.3-2 Environmental Issues Identified and Comments Received for the LX and RXE Projects	
Issue/Specific Comment	**EIS Section Addressing Comment**
Alternatives	
Consideration of alternative routes to avoid populated areas, planned development, and critical infrastructure	3.0
Consideration of alternative routes and construction practices to avoid sensitive resources	3.0
Geology	
Impacts related to future mining operations	4.1.2.1
Impacts from blasting	4.1.2.2
Soils	
Erosion and sediment control	4.2.2
Contaminated soils	4.2.1.7
Water Quality and Aquatic Resources	
Storage of hazardous materials and fuel oil, and spill reporting procedures	4.3.2.6
Impacts on groundwater, existing hydrology, and drinking water supply (including public and private wells)	4.3.1
Impacts on septic systems	4.3.1.7
Waterbody crossing time windows, methods, mitigation, and restoration measures	4.3.2.5
Impacts of horizontal directional drill crossings, including inadvertent releases of drilling mud, drilling spoil management and disposal	4.3.2.5
Impacts on fishery resources	4.3.2
Wetlands	
Impacts on wetlands	4.4.3
Vegetation	
Impacts on mature trees and plants	4.5.5
Revegetation of areas cleared during construction	4.5.5
Plans for invasive species control	4.5.4
Wildlife	
Impacts of wildlife and wildlife habitat	4.6.1.4
Impacts on wildlife from forest fragmentation	4.6.1.4
Timing restrictions and impacts on birds and bats	4.6.1.4
Special Status Species	
Agency coordination and requirements	4.7.1
Evaluation of potential impacts on threatened or endangered species and their habitat	4.7.4
Land Use	
Impacts on future development plans	4.8.3.2
Eminent domain and compensation process	4.8.2
Impacts on existing residences and structures during construction and operation	4.8.3
Impacts on recreational and special interest areas (including agricultural lands)	4.8.4
Visual impacts of aboveground facilities	4.8.6
Impacts on transportation infrastructure (roads, highways, railroads)	4.9.4
Impacts on businesses which rely on the land	4.9.5
Socioeconomics	
Employment opportunities for local contractors and laborers and increased tax revenues	4.9.1
Traffic impacts and maintaining safety during construction	4.9.4
Impacts on homes, businesses, and land values, potential for increased taxes and lowered property values	4.9.6
Potential health impacts associated with proximity to pipeline and compressor stations.	4.12

TABLE 1.3-2 (cont'd) Environmental Issues Identified and Comments Received During the Scoping Process for the LX and RXE Projects	
Issue/Specific Comment	**EIS Section Addressing Comment**
Cultural Resources	
Tribal consultation and impacts on tribal lands and areas of cultural importance to Native American tribes	4.10.4
Impacts on culturally and historically significant properties	4.10.3.2
Air Quality	
Consistency with the emissions limits and standards	4.11.1
Impacts on air quality from construction equipment	4.11.1
Noise	
Noise impacts resulting from construction activities and proposed mitigation measures to reduce impacts	4.11.2.3
Noise impacts from compressor equipment on nearby residents and proposed mitigation measures to reduce impacts	4.11.2.3
Reliability and Safety	
Safety and reliability of constructing and maintaining the pipeline	4.12
Potential for explosion and loss of life	4.12
Cumulative Impacts	
Analysis of cumulative impacts	4.13

1.4 NON-JURISDICTIONAL FACILITIES

Under section 7 of the NGA, FERC is required to consider, as part of its decision to authorize interstate natural gas facilities, all factors bearing on the public convenience and necessity. Occasionally, proposed Projects have associated facilities that do not come under the jurisdiction of the Commission. These "non-jurisdictional" facilities may be integral to the need for the proposed facilities (e.g., a power plant at the end of a FERC-jurisdictional pipeline), or they may be merely associated as minor, non-integral components of the jurisdictional facilities that would be constructed and operated as a result of certification of the proposed facilities.

Non-jurisdictional facilities necessary to operate the LX Project are anticipated to include two new Point of Receipt (POR) facilities located near Majorsville, West Virginia and Clarington, Ohio, as well as the addition of new power supplies and other utilities at the new compressor stations and new regulator stations (RS). Non-jurisdictional facilities for the LX Project are detailed in table 1.4-1.

Non-jurisdictional facilities necessary to operate the RXE Project are limited to the addition of new power and water supply at the Grayson CS and Means CS. Discussions with the local energy providers indicate that no new substations or power-generating facilities would be required to meet the demands of the compressor stations. Additionally, there are existing power lines adjacent to the compressor station sites; therefore, no new power lines would be necessary. Power is anticipated to be provided by Grayson Rural Electric Cooperative Cooperation (Grayson CS) and the Rural Electric Association (Means CS). Water supply is anticipated to come from the Grayson Utilities Commission (Grayson CS) and the Jefferson Water System (Means CS).

TABLE 1.4-1 Non-Jurisdictional Project Facilities for the LX Project		
Facility Name	**Non-Jurisdictional Service**	**Summary of Non-Jurisdictional Service**
Existing Columbia Gas pipeline system	POR. Connect existing pipeline to third-party systems	Constructed by outside parties near the existing MarkWest Plant in Marshall County, West Virginia and in the Clarington, Monroe County, Ohio area. Columbia Gas would use these POR facilities to connect its existing pipeline system to third-party systems in the Majorsville, West Virginia and Clarington, Ohio areas in order to obtain the new firm transportation service for the proposed project. In general, each of these POR facilities would consist of an approximately 200- by 200-foot fenced facility; however, the scope of these POR facilities is still being developed by the responsible outside parties, and the necessary facilities have not been determined. The POR facilities would be constructed, owned, and operated by currently unidentified outside parties in accordance with all applicable state and local permits.
Lone Oak Compressor Station	New electrical power line, which would interconnect to American Electric Power (AEP), West Virginia's existing 138-kilovolt (kV) overhead poles located 0.7 mile southwest from the proposed facility.	The incoming power would be connected to a new pad mounted service transformer at the station. In addition, a communication system, water well, and sanitary sewer would be installed within the proposed facility fence line.
Summerfield Compressor Station	New electrical power line, which would interconnect to Washington Electric, Ohio's existing 69-kV overhead poles located approximately 3.5 miles southwest from the proposed facility.	The incoming power would be connected to a new pad mounted service transformer at the station. In addition, a communication system, water well, and sanitary sewer would be installed within the proposed facility fence line.
Crawford Compressor Station	None required.	Columbia Gas anticipates that the existing power service to the Crawford Compressor Station would be sufficient for the proposed modifications.
Oak Hill Compressor Station	New electrical power line, which would interconnect to AEP, Ohio's existing 69-kV overhead poles located approximately 3.2 miles west of the proposed facility.	The incoming power would be connected to a new pad mounted service transformer at the station. In addition, a communication system, water well, and sanitary sewer would be installed within the proposed facility fence line.
Ceredo Compressor Station	New substation that would receive 138 kV of incoming power from the adjacent AEP, West Virginia power station.	The incoming power would be connected to a new pad-mounted service transformer located on AEP, West Virginia's property to meet station requirements and distribute 12.5 kV to the new compressor units.
K-260 Regulator Station (the LEX1 Pipeline milepost 0.0)	New electrical power line, which would interconnect to AEP, Ohio's existing overhead distribution poles located 1.3 miles west of the proposed regulator station.	The incoming power from the extension would be connected to a new distribution panel with a main breaker at the station. Columbia Gas anticipates that the extension of the existing power service to the proposed facility would be sufficient for this project.
Receiver facility located at the terminus of the LEX1 Pipeline	New electrical power line, which would interconnect to AEP, Ohio's existing 120/240 volt (V) overhead poles located 0.1 mile west of the receiver facility.	The incoming power would be connected to a new distribution panel with a main breaker at the facility.
R-System Regulator Station	New electrical power line from AEP, Ohio. The new power line would interconnect to AEP, Ohio's existing overhead distribution poles located approximately 0.5 mile west of the proposed regulator station.	The incoming power would be connected to a new distribution panel with a main breaker at the station.
Benton Regulatory Station	New electrical power line, which would interconnect with South Central Electric, Ohio's existing 120/240 V overhead poles located approximately 0.1 mile west of the proposed regulator station.	The incoming power would be connected to a new distribution panel with a main breaker at the facility.
Regulator Station 1286	Extension of existing power service from AEP, Ohio's existing 120/240 V overhead poles located 0.05 mile southwest of the regulator station.	Columbia Gas anticipates that the extension of the existing power service to the proposed facility would be sufficient for this project.

TABLE 1.4-1 (cont'd) Non-Jurisdictional Project Facilities for the LX Project		
Facility Name	**Additional Service**	**Summary of Non-Jurisdictional Service**
McArthur Regulator Station	New electrical power line, which would interconnect with Buckeye Rural Electrical Cooperative's existing 120/240 V overhead poles located 0.3 mile south of the proposed regulator station.	The incoming power would be connected to a new distribution panel with a main breaker at the facility.
R-486 Odorization Station	New electrical power line, which would interconnect with Buckeye Rural Electrical Cooperative's existing 120/240 V overhead poles located 0.1 mile north of the odorization site.	The incoming power would be connected to a new distribution panel with a main breaker at the facility.
R-130 Odorization Station	Extension of existing power service from AEP, Ohio's existing 120/240 V overhead poles located less than 0.1mile west of the odorization site.	The incoming power would be connected to a new distribution panel with a main breaker at the facility. Columbia Gas anticipates that the extension of the existing power service to the proposed facility would be sufficient for this project.
R543 Odorization Station	Extension of existing power service from AEP, Ohio's existing 120/240 V overhead poles located 0.01mile southwest of the odorization site.	The incoming power would be connected to a new distribution panel with a main breaker at the facility. Columbia Gas anticipates that the extension of the existing power service to the proposed facility would be sufficient for this project.

The non-jurisdictional electrical facilities are part of private construction Projects under state and local jurisdiction. The federal government has no financial involvement, no permitting authority, and no federal lands are involved; therefore, there is no cumulative federal control or responsibility associated with these electrical facilities. Additionally, FERC has no authority over the permitting, licensing, funding, construction, or operation of local electric lines. Though construction of the non-jurisdictional electrical facilities may overlap with the construction of the Projects, construction of these facilities would result in negligible environmental impacts due to sufficient extension of the existing power service to the proposed facilities. A discussion of these non-jurisdictional facilities is provided in section 4.13.3.

1.5 PERMITS, APPROVALS, CONSULTATIONS, AND REGULATORY REVIEW

Tables 1.5-1 and 1.5-2 list the major federal, state, and local permits, approvals, and consultations identified for the construction and operation of the LX and RXE Projects. Tables 1.5-1 and 1.5-2 also provide the dates or anticipated dates when Columbia Gas and Columbia Gulf commenced or anticipates commencing formal permit and consultation procedures. Columbia Gas and Columbia Gulf are responsible for obtaining all necessary permits and approvals required to implement the proposed Projects prior to construction.

TABLE 1.5-1 Applicable Major Permits, Licenses, Authorizations, and Clearances for the LX Project		
Permit/Clearance/Approval	**Agency**	**Status**
Federal		
Certificate of Public Convenience and Necessity	FERC	Application submitted June 8, 2015; supplemental application submitted October 23, 2015; supplement submitted March 18, 2016
Section 10 Navigable Waters Permit and Section 404 Permit: Nationwide Permit 12	COE – Huntington and Pittsburgh Districts	Applications submitted June 12, 2015; supplemental filing anticipated November 6, 2015, modifications submitted April 1, 2016
ESA, Section 7 Consultation	FWS – West Virginia Field Office and Ohio Ecological Services Field Office	Consultations ongoing; mussel survey reports submitted October 15, 2015; notification letter documenting compliance with MSHCP and requesting concurrence for Project activities outside MSHCP covered lands submitted June 3, 2016; supplemental species-specific plant survey reports for OH submitted June 14, 2016
Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act	FWS – Region 5 Migratory Bird Permit Office	Consultations ongoing
West Virginia		
CWA Section 401 Individual Water Quality Certification	WVDEP	Application submitted June 12, 2015; supplemental filing November 2, 2015, modifications submitted April 1, 2016; Notice of application completeness issued April 19, 2016
National Pollutant Discharge Elimination System Construction General Permit – General Water Pollution Control Permit	WVDEP	Application submitted May 12, 2016
CAA Permit: Minor New Source Review Permit and Title V Source Operating Permit (Lone Oak Compressor Station) Modification of existing Title V Source Operating Permit (Ceredo Compressor Station)	WVDEP	Minor New Source Review Permit application (Lone Oak Compressor Station) permitted December 7, 2015, Title V Source Operating Permit application anticipated to be submitted within 12 months of facility in-service date
Surface Water Withdrawal Permit (Water Management Plan)	WVDEP	Water Management Plan anticipated to be submitted June 2016
NPDES General Permit for Discharges of Hydrostatic Test Water	WVDEP	Applications anticipated to be submitted November 2016
West Virginia Threatened and Endangered Species Consultation/Clearance	WVDNR	Sensitive freshwater mussel species survey reports submitted October 19, 2015; Concurrence received July 6, 2016
Surface Water Withdrawal Permit	WVDNR	Actual water use data anticipated to be submitted subsequent to withdrawal activities in first Quarter 2018
Office of Land and Streams Stream Activity Application	WVDNR	Applications submitted June 12, 2015; supplemental filing submitted November 6, 2015, modifications submitted April 1, 2016 and application for new impacts submitted April 15, 2016
National Historic Preservation Act Section 106 Consultation	West Virginia State Historic Preservation Office	Draft Phase I Reports submitted February 18, 2015; concurrence issued for Draft Initial Phase I Reports on March 20, 2015. Draft Supplemental Phase I Reports submitted October 16, 2015, concurrence issued for Draft Supplemental Phase I reports on November 30, 2015. Second Draft Supplemental Phase I reports submitted March 16, 2016; Concurrence issued for Second Draft Supplemental Phase I Reports on April 11, 2016

TABLE 1.5-1 (cont'd) Applicable Major Permits, Licenses, Authorizations, and Clearances for the LX Project		
Permit/Clearance/Approval	**Agency**	**Status**
Pennsylvania		
Chapter 105 Water Obstruction and Encroachment General Permit 5 for Utility Line Crossings (GP-5)	PADEP – Southwest Regional Office, Bureau of Waterways and Engineering and Wetlands	Application submitted December 28, 2015.
CWA Section 401 Water Quality Certification	PADEP – Southwest Regional Office, Bureau of Waterways and Engineering and Wetlands	Application and Environmental Assessment submitted March 23, 2016
PAG-10 NPDES Hydrostatic Testing of Tanks and Pipelines	PADEP– Bureau of Point and Non-Point Source Management	Applications anticipated to be submitted November 2016
Pennsylvania Threatened and Endangered Botanical Species Consultation/Clearance	Pennsylvania Department of Conservation and Natural Resources	Consultations ongoing; Plant survey reports and request for concurrence submitted December 2, 2015. Letter of concurrence issued for plant surveys completed to date on January 6, 2016. Supplemental plant survey reports submitted June 7, 2016; Letter of concurrence issued for all plant surveys on June 10, 2016
Pennsylvania Threatened and Endangered Bird and Mammal Species Consultation/Clearance	Pennsylvania Game Commission	Letter received March 27, 2015, deferring to FWS
National Historic Preservation Act Section 106 Consultation	Pennsylvania Historical and Museum Commission, Bureau for Historic Preservation	Letter received September 9, 2015 indicating the project would not affect architectural resources, and no survey is required; Draft Phase I Archeological Survey Report submitted October 16, 2015. Concurrence issued for Draft Phase I Report on November 20, 2015
Ohio		
CWA Section 401 Individual Water Quality Certification	OEPA	Applications submitted June 12, 2015; supplemental filing anticipated November 6, 2015, modifications submitted April 1, 2016
NPDES General Permit for Discharges of Hydrostatic Test Water	OEPA	Application anticipated to be submitted November 2016
CAA Permits: Permit-to-Install and Operate Permit (Summerfield Compressor Station) Title V Source Operating Permit (Oak Hill Compressor Station)	OEPA	Permit-to-Install and Operate permit application (Summerfield Compressor Station) submitted June 18, 2015, Permit-to-Install and Operate for the Summerfield CS issued on September 25, 2015 Permit-to-Install permit application (Oak Hill Compressor Station) submitted June 25, 2015, Permit-to-Install for the Oak Hill CS issued on November 20, 2015 Title V Source Operating Permit application (Oak Hill Compressor Station) anticipated to be submitted within 12 months of facility in-service date
Surface Water Withdrawal Permit	Ohio Department of Natural Resources	Application anticipated to be submitted November 2016
Ohio Threatened and Endangered Species Consultation/Clearance	Ohio Department of Natural Resources	Consultations ongoing; mussel survey reports submitted August 26, 2015; Outstanding mussel survey reports anticipated to be submitted upon completion in July/August 2016. Concurrence anticipated to be received September 2016; Informal concurrence request for all other listed species submitted on June 3, 2016. Concurrence anticipated to be received July/August 2016.

TABLE 1.5-1 Applicable Major Permits, Licenses, Authorizations, and Clearances for the LX Project		
Permit/Clearance/Approval	**Agency**	**Status**
Sunfish Creek State Forest Right-of-Way Lease Agreement	Ohio Department of Natural Resources	Right-of-Way Lease Agreement Application and Environmental Assessment submitted September 2015. Modifications to Environmental Assessment submitted March 18, 2016
National Historic Preservation Act Section 106 Consultation	Ohio State Historic Preservation Office	Draft Initial Phase I Reports submitted February 18, 2015; Concurrence issued for Draft Initial Archeological Survey Report on February 28, 2015; Comments issued for Draft Initial Architectural Survey Report March 25, 2015 – Architectural evaluations requested
		Draft Supplemental Phase I Reports submitted October 16, 2015; comments on Draft Supplemental Phase I Archeological Survey Report received January 7, 2016; Revised Draft Supplemental Phase I archeological Survey Report submitted February 16, 2016; Concurrence issued for Revised Draft Supplemental Phase I Archeological Report April 15, 2016
		Comments on Draft Supplemental Phase I Architectural Report received December 11 and 16, 2015 (Summary of 2014 and 2015 Architectural Survey requested). Requested summary of 2014 and 2015 Architectural Survey submitted January 21, 2016. Comments on Summary of 2014 and 2015 Architectural Survey received February 23, 2016. Revised Architectural Survey summary table submitted July 8, 2016
		Second Draft Supplemental Phase I Reports submitted March 16, 2016 Concurrence issued for Second Draft Supplemental Phase I Archeological Report on April 26, 2016
Local		
NPDES Erosion and Sediment Control General Permit -2 (Ch. 102)	Greene County Conservation District	Application submitted December 28, 2015

TABLE 1.5-2 Applicable Major Permits, Licenses, Authorizations, and Clearances for the RXE Project		
Permit/Clearance/Approval	**Agency**	**Status**
Federal		
Certificate of Public Convenience and Necessity	FERC	Application Submitted July 29, 2015
Section 404 Permit: Nationwide Permit 12	COE – Louisville Districts	Applications submitted August 2015
Endangered Species Act, Section 7 Consultation	FWS – Kentucky Ecological Services Field Office	Consultations ongoing; request for concurrence submitted March 5, 2015
Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act	FWS – Region 4 Migratory Bird Permit Office	Consultations ongoing; request for concurrence submitted July 2015
Tribal		
National Historic Preservation Act Section 106 Consultation	Tribal consultations	Request for concurrence submitted June 30, 2015
Kentucky		
Kentucky Heritage Council – State Historic Preservation Office	Section 106 of the National Historic Preservation Act	Request for concurrence submitted July 15, 2015
CWA Section 401 Water Quality Certification; Permit to Construct Across or Along a Stream/ Floodplain Construction Permit	KYDEP	WQC April 13, 2016 Received Floodplain Permit for Grayson CS May 9, 2016 Received Floodplain Permit for Means CS May 11, 2016
Kentucky Pollutant Discharge System General Permit (KYR100000) for Storm Water Discharges Associated with Construction Activities	KYDEP	Anticipated submitted June 20, 2016
Division of Air Quality State – Origin Operating Permit	KYDEP	Application submitted March 20, 2015 Means CS Received Permit for Grayson CS on April 11, 2016
Water Withdrawal Permit	KYDEP	Anticipated submittal date September 2015
Kentucky Pollutant Discharge System Hydrostatic Test Water One Time Discharge Authorization	KYDEP	Anticipated submittal date September 2015
Groundwater Protection Plan	KYDEP	Received approval March 30, 2016
State Threatened and Endangered Species Consultations and Clearances	Kentucky State Nature Preserve Commission	Receive approval June 22, 2015
State Threatened and Endangered Species Consultations and Clearances	Kentucky Department of Fish and Wildlife Resources	Receive approval July 31, 2015
State Threatened and Endangered Species Consultations and Clearances	Kentucky Division of Forestry	Request for concurrence submitted June 15, 2015; No response anticipated

2.0 PROJECT DESCRIPTION

2.1 PROPOSED FACILITIES

2.1.1 Pipeline Facilities

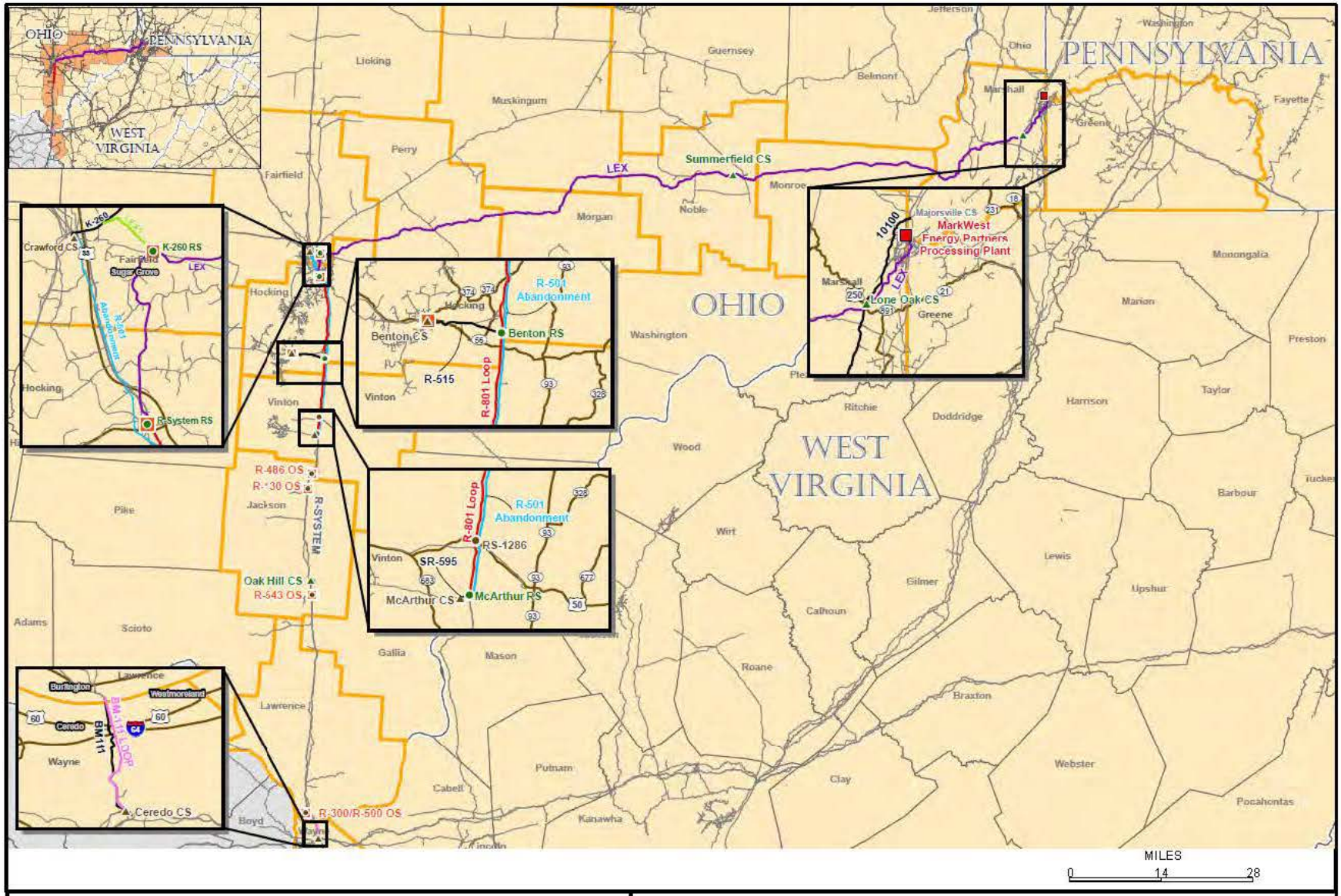
The LX Project consists of four new natural gas pipelines, LEX Pipeline, LEX1 Pipeline, the R-801 Loop, and the BM-111 Loop, totaling 160.7 miles; the abandonment in-place of 28.2 miles of the existing Line R-501; and associated auxiliary and appurtenant facilities, as discussed in the aboveground facilities section below. An overview map of the LX Project location is provided in figure 2.1-1.

The proposed pipeline facilities consist of the following components:

- LEX Pipeline – Installation of 132.4 miles of new 36-inch-diameter natural gas pipeline, which would begin near the existing MarkWest Energy Partners, LP Processing Plant (MarkWest Plant) located in Marshall County, West Virginia and traverse Greene County, Pennsylvania, and Monroe, Noble, Muskingum, Morgan, Perry, Hocking, and Fairfield Counties, Ohio before terminating at the proposed R-System RS in Hocking County, Ohio.
- LEX1 Pipeline – Installation of 1.2 miles of new 30-inch-diameter natural gas pipeline, which would begin near milepost (MP) 127.4 of the proposed LEX Pipeline and terminate at an intersection with the existing Line K-260 in Fairfield County, Ohio.
- R-801 Loop – Installation of 24.2 miles of new 36-inch-diameter natural gas pipeline loop, which would begin at the proposed R-System RS located in Hocking County, Ohio and extend south before terminating at the proposed McArthur RS in Vinton County, Ohio.
- BM-111 Loop – Installation of about 2.9 miles of new 36-inch-diameter natural gas pipeline loop, beginning in Lawrence County, Ohio and terminating at the existing Ceredo CS in Wayne County, West Virginia.
- R-501 Abandonment – Abandonment in-place of 28.2 miles of the existing 20-inch-diameter natural gas Line R-501, which begins at the existing Crawford CS in Fairfield County, Ohio and traverses Hocking County, Ohio before terminating at the proposed McArthur RS in Vinton County, Ohio.

About 40 percent (64.6 miles) of the new pipelines would be co-located with existing Columbia Gas rights-of-way (43.1 miles) or paralleling existing utility corridors (21.5 miles). Table 2.1.1-1 provides a summary of existing corridors with which the LX Project is paralleling or co-located. Areas where Columbia Gas was unable to co-locate the pipelines with existing rights-of-way or parallel existing corridors were primarily due to constructability issues (e.g., crossings of streams, wetlands, congested areas, or side-slope terrain) or efforts to minimize impacts on residential and commercial developments.

A portion of the proposed LX Project route would be adjacent to Texas Eastern Transmission, LP's (Texas Eastern) existing permanent pipeline for about 17 miles between LEX Pipeline mileposts (MP) 34.6 and 52.2. Within this portion, the LEX Pipeline would closely overlap Rover Pipeline LLC's (Rover) Seneca Lateral (part of the Rover Pipeline Project) for about 13 miles in Monroe County, Ohio. In response to a FERC information request, Rover and Columbia Gas reached an agreement in early July of 2016 to design their respective pipeline facilities in a manner such that both pipelines would be constructed and operated safely with minimal environmental and stakeholder impacts. Columbia Gas and Rover Pipeline LLC have tentatively agreed to use a non-exclusive easement for this overlap, which includes a mutual new permanent right-of-way width of 50 feet located on the south side of Texas



- LEX
- LEX1
- R-801 Loop
- BM-111 Loop
- R-501 Abandonment
- Existing Columbia Pipeline
- Existing Columbia Pipeline Associated With Project
- Existing Regulator Station (RS)
- Existing Compressor Station (CS)
- Odorization Site (OS)
- New Regulator Station (RS)
- New Compressor Station (CS)

Figure 2.1-1
Leach XPress Project
Project Overview Map

TABLE 2.1.1-1 Locations of Adjacent Corridors for the LX Project					
Pipeline/Company	**Corridor Type**	**Beginning Milepost**	**Ending Milepost**	**Length (miles)**	**Corresponding Construction Typical [a]**
LEX					
Columbia	Pipeline	1.1	1.2	0.1	17
Columbia	Pipeline	1.4	1.6	0.2	17
Columbia	Pipeline	2.7	2.9	0.2	17
MarkWest	Pipeline	3.7	3.7	0.1	16
MarkWest	Pipeline	4.1	4.2	0.0	16
MarkWest	Pipeline	8.3 RR-1	8.3 RR-1	0.0	16
Texas Eastern	Pipeline	8.3 RR-1.	9.6 RR-1	1.2	16
Texas Eastern	Pipeline	11.3	14.1 RR-2	2.8	16
AEP	Powerline	14.1 RR-2	14.2 RR-2	0.1	18
Williams	Pipeline	14.3 RR-2	14.8 RR-2	0.5	16
Williams	Pipeline	15.0 RR-2	15.0 RR-2	0.0	16
AEP	Powerline	15.6 RR-2	15.6 RR-2	0.0	18
Spectra	Pipeline	16.2	16.7 RR-3	0.5	16
AEP	Powerline	17.1 RR-3	17.3	.1	18
Blue Racer	Pipeline	18.3	18.6 RR-4	0.3	16
Blue Racer	Pipeline	19.7	20.5	0.9	16
AEP	Power line	29.4	30.3	1.0	18
Spectra	Pipeline	30.4	30.8	0.5	16
AEP	Power line	30.8	31.2	0.4	18
Spectra	Pipeline	31.3	31.4	0.1	16
AEP	Power line	31.4	31.5	0.1	18
Spectra	Pipeline	32.5	35.7	3.2	16
Spectra	Pipeline	36.7	41.8	5.1	16/7
Spectra	Pipeline	42.3	45.0	2.7	7
Spectra	Pipeline	46.2	550.7	4.5	7
Spectra	Pipeline	51.1	51.3	0.3	7
Spectra	Pipeline	51.6	51.8	0.1	7
Spectra	Pipeline	59.6	60.9	1.3	7
W.E.C.	Power line	60.9	61.4	0.5	1
Spectra	Pipeline	62.2	63.1	0.9	7
AEP	Power line	68.7	68.8	0.1	1
AEP	Power line	69.6	70.5	0.9	1
AEP	Power line	71.4	72.0	0.6	1
Spectra	Pipeline	72.3	73.4	1.2	7
W.E.C.	Power line	73.5	74.2	0.7	1

TABLE 2.1.1-1 (cont'd) Locations of Adjacent Corridors for the LX Project					
Pipeline/Company	**Corridor Type**	**Beginning Milepost**	**Ending Milepost**	**Length (miles)**	**Corresponding Construction Typical [a]**
Spectra	Pipeline	74.2	75.4	1.2	7
East Ohio Gas Company	Pipeline	75.4	78.4	2.9	7
Spectra	Pipeline	78.4	81.0	2.5	7
Texas Eastern	Pipeline	80.9	82.6	1.7	7
Kinder Morgan	Pipeline	82.6	84.4	1.8	7
Kinder Morgan	Pipeline	85.3	85.7	0.4	7
Kinder Morgan	Pipeline	85.7	85.8	0.1	7
Kinder Morgan	Pipeline	87.3	87.5	0.2	7
Kinder Morgan	Pipeline	87.7	87.8	0.1	7
Kinder Morgan	Pipeline	88.3	88.4	0.1	7
Unknown	Power line	112.4	112.7	0.3	1
Columbia	Pipeline	127.2	127.4	0.2	8B
Columbia	Pipeline	128.1	128.1	0.1	8B
Columbia	Pipeline	127.7	128.8	0.1	8B
Columbia	Pipeline	130.9	131.1	0.1	8B
			Subtotal	42.9	
LEX1					
AEP	Power line	0.00	1.0	1.0	1
			Subtotal	1.0	-
R-801 Loop					
Columbia	Pipeline	0.0	0.5	0.5	8A
Columbia	Pipeline	0.6	6.4	5.8	8A
Unknown	Power line	7.2	7.5	0.3	1
Columbia	Pipeline	7.7	8.6	0.1	8A
Columbia	Pipeline	9.4	11.5	2.1	8A
Columbia	Pipeline	12.2	16.8	4.6	8A
Columbia	Pipeline	17.1	19.6	2.5	8A
Columbia	Pipeline	19.8	22.1	2.2	8A
Columbia	Pipeline	22.2	22.7	0.5	8A
Columbia	Pipeline	23.4	24.2	0.8	8A
			Subtotal	20.1	8A
BM-111 Loop					
Columbia	Pipeline	1.8	2.5	0.7	8B
			Subtotal	0.7	-
Total				**64.6**	**-**

[a] Typical construction work area configurations are contained in appendix C.

Eastern's right-of-way. Their tentative design would be to distance their pipelines 20 feet from each other. Whichever pipeline is installed first in time would be located 40 feet from Texas Eastern's closest pipeline (a 30-inch-diameter pipeline), and that pipeline's temporary right-of-way would overlap Texas Eastern's permanent right-of-way overlap by 10 feet (Appendix C). Columbia Gas has determined that it would have to deviate from the tentative mutual route agreed with by Rover Pipeline LLC, should the LEX Pipeline be the outside (southernmost) installed pipeline, for five minor route deviations. These deviations would allow the outside pipeline's route to accommodate construction constraints caused by steep terrain, geologic features, residences and waterbodies. Given that these deviations have not been identified, **we recommend that:**

- **As part of its Implementation Plan, Columbia Gas should confirm the location of the LEX Pipeline between MPs 34.6 to 52.2 within its non-exclusive easement and identify any locations where the LEX Pipeline along this segment would deviate from the non-exclusive easement in accordance with recommendation 5 (see section 5.2).**

2.1.2 Route and Workspace Modifications

Table 2.1.2-1 lists the minor route deviations Columbia Gas incorporated into the proposed route, since the issuance of the draft EIS. The route deviations presented as (Deviation P, Deviation B-2 and Deviation D-2) have been incorporated into the proposed route, and as such are no longer alternatives. This final EIS includes the impacts of these deviations as part of the proposed action.

TABLE 2.1.2-1
Minor Route Deviations Incorporated into the Proposed Project

Project Segment	Parcel Number or Reroute ID	MP	Requested Minor Route Variation	Columbia Gas' Analysis / Response
LEX	N/A	Launcher Facility	Landowner requested proposed structure relocation	Residential structure is located on an industrial property and is unoccupied. The landowner plans to remove the unoccupied residence.
LEX	WV-MA-194.000 WV-MA-196.000	Not specified	Landowner requested pipeline be moved to avoid forest and property impacts	Columbia Gas evaluated information and supporting data to identify the safest route through this area. The route evaluation modifies the pipeline route on two or more of the landowner's properties.
LEX	WV-MA-095A.000	7.4	WVDOT recommended avoiding a soil nail reinforcement project	Columbia Gas routed the LEX Pipeline west and north of previously proposed route between MP 7.4 and MP 9.6. Reroute would impact residence that has been agreed upon with the landowner for demolition of the structure and has been incorporated into the proposed route as Reroute 1.
LEX	18.64 RR-4	18.4	Landowner requested relocation of MLV on property	Columbia Gas routed the LEX Pipeline southeast and south of originally proposed route to accommodate new location of MLV. The reroute has been incorporated into the proposed route as Reroute 4.
LEX	56.02 RR-7	54.5	Ohio DOT recommended avoiding corrugated metal culvert on Highway 78	Columbia Gas routed the pipeline southwest for 0.6 mile and northwest for 0.9 mile to avoid this area. The reroute has been incorporated into the proposed route as Reroute 7.
LEX	OH-MO-208.000	51.5	Consider adjusting route across property	Columbia Gas has addressed the landowner's concerns. The right-of-way on the affected property was acquired on April 26, 2016.
LEX	OH-MU-071.000	82.9	Consider adjusting route across property	Landowner concerns were addressed and the right-of-way on the affected property was acquired on March 16, 2016.
LEX	OH-MN-120.001	N/A	Landowner requested route adjustment across property	Unrelated route alternative incorporated into the proposed route prior to issuance of DEIS has eliminated impacts on this property

2.1.3 Aboveground Facilities

Aboveground facilities associated with the LX Project include:

- Three new compressor stations (Lone Oak CS, Summerfield CS, and Oak Hill CS);
- modifications at two existing compressor stations (Crawford CS and Ceredo CS);
- four- new regulator stations (K-260 RS, R-System RS, Benton RS, and McArthur RS);
- modifications at 1 existing regulator station (RS-1286);
- thirteen bi-directional launcher and/or receiver facilities;
- nine mainline valves (MLV); and
- five new odorization stations along the existing R-System.

These facilities are summarized in table 2.1.2-2 and locations shown in appendix B maps.

Aboveground facilities associated with the RXE Project include two new compressor stations (Grayson CS and Means CS) and modifications at the Means Measuring and Regulator Station (Means M&R). These facilities are summarized in table 2.1.2-3 and the locations are shown in appendix B. An overview map of the RXE Project location is provided in figure 2.1.2-1.

Further, detailed descriptions of the proposed aboveground facilities and modifications to existing aboveground facilities are provided in sections 2.1.2.1 and 2.1.2.2, respectively.

2.1.3.1 New Aboveground Facilities

LX Project

Lone Oak Compressor Station – Columbia Gas proposes to construct the Lone Oak CS, Marshall County, West Virginia to provide pressure management for deliveries from Columbia Gas' existing Line 10100 and the existing MarkWest Plant. The compressor station would include three natural gas-driven compressor units housed in two compressor buildings, metering, filter separators, gas coolers, valves, and associated piping. Columbia Gas would also install vent silencers, controls to allow for remote start/stop/by-pass of the compressor units, and security fencing around the facility. Outside of the compressor station facility fence lines, Columbia Gas would install a 24-inch-diameter suction line that would extend about 400 feet northwest of the Lone Oak CS to tie-in to the existing Line 10100. Additionally, a tie-in facility would be constructed at the end of the suction line to accommodate the proposed connection with the existing Line 10100. The location of the Lone Oak CS is provided in appendix B.

Summerfield Compressor Station – Columbia Gas proposes to construct the Summerfield CS in Noble County, Ohio to provide pressure management for deliveries to the existing Crawford CS. The Summerfield CS would include two natural gas-driven compressor units housed in a compressor building, metering, filter separators, valves, and associated piping. Columbia Gas would also install vent silencers, controls to allow for remote start/stop/by-pass of the compressor units, and security fencing around the facility. The compressor station facility would be fenced, and land within the permanent footprint not covered by rock or facility foundations would be maintained in an herbaceous state.

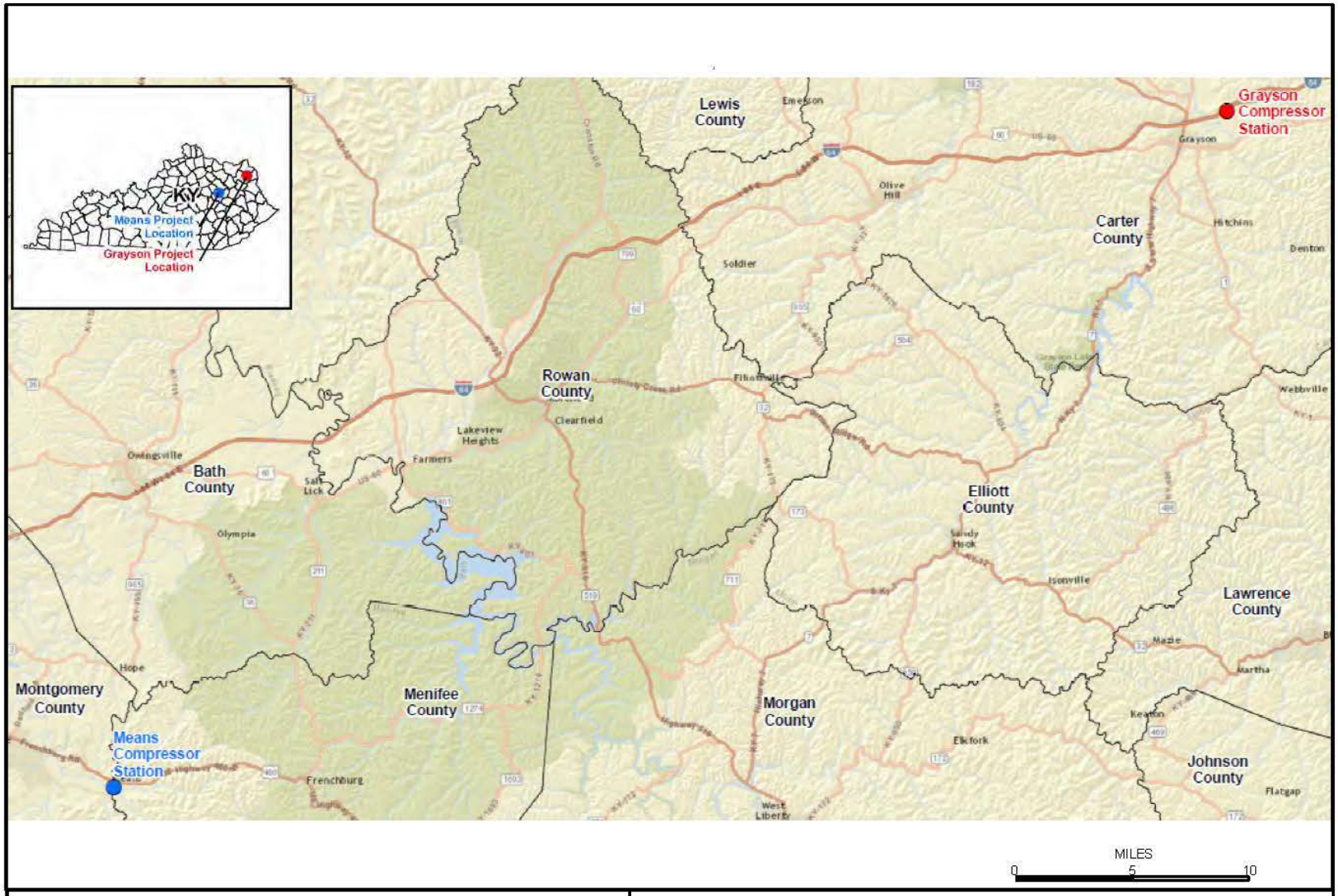
Oak Hill Compressor Station – Columbia Gas proposes to construct the Oak Hill CS, about 1,500 feet east of MP 51.5 on the existing Line R-501 in Jackson County, Ohio to provide pressure management for deliveries from Columbia Gas' existing R-501, R-601, and R-701S lines to the existing Ceredo CS. The compressor station would include three natural gas-driven compressor units housed in two compressor buildings, metering, filter separators, gas coolers, valves, associated piping, vent silencers, controls to allow for remote start/stop/by-pass of the compressor units, and security fencing around the facility. Outside of the proposed compressor station facility fence lines, Columbia Gas would install 36-inch-diameter suction/discharge lines that would extend about 2000 feet west-northwest of the Oak Hill CS to connect to the existing R-System. Additionally, a tie-in facility would be constructed at the end of the suction/discharge lines to accommodate the proposed connection with the existing R-System.

Regulator Stations – Columbia Gas proposes to construct four new regulator stations to allow for natural gas flow between the proposed pipelines and Columbia Gas' existing pipeline system. In addition, Columbia Gas would install pressure regulation and overpressure protection at these facilities as well as an odorization system at the K-260 RS and the R-System RS. Columbia Gas would install a 30-inch-diameter incoming line that would extend about 210 feet south of the K-260 RS fence lines to connect to the proposed LEX Pipeline. The R-System RS would require a 24-inch-diameter incoming line that would extend about 360 feet west of the facility fence lines to connect to the existing Line R-701N.

Launcher and Receiver Facilities – The proposed LX Project would require the construction of a total of 13 bi-directional launcher and/or receiver facilities, as shown in table 2.1.2-2. A launcher for Line R-501 would be installed within the McArthur RS to replace the existing launcher located at the Crawford CS that would be abandoned as part of the proposed R-501 Abandonment. The launcher facility at the BM-111 Loop would require the installation of a new 36-inch-diameter connecting line extending about 424 feet south from the launcher facility to tie in to the existing R-System within Columbia's existing Burlington Meter Station.

Mainline Valves – Columbia Gas proposes to install a total of nine new MLVs, including eight on the LEX Pipeline and one on the R-801 Loop.

Odorization Stations – To maintain compliance with the U.S. Department of Transportation (DOT) Minimum Federal Safety Standards (49 CFR Part 192), Columbia Gas proposes to construct four new odorization stations along the R-System in Jackson and Lawrence Counties, Ohio to odorize its existing R-486, R-130, R-543, and R-300/R-500 lines. In addition, Columbia Gas would install odorant systems at the existing Benton CS in Hocking County, Ohio and within the proposed K-260 RS and R-System RS.



Proposed Grayson Compressor Station

Proposed Means Compressor Station

Figure 2.1.2-1

Rayne XPress Expansion Project

Project Overview Map

TABLE 2.1.2-2
Aboveground Facilities for the LX Project

Facility	Milepost Location	County, State	Description
LEX			
Lone Oak Compressor Station	7.4	Marshall, WV	Construct a new compressor station facility for a combined 47,700 hp.
Summerfield Compressor Station	57.1	Noble, OH	Construct a new compressor station facility for a combined 15,400 hp.
Launcher and Receiver Facilities	0.0; 7.4; 57.1; 131.3	Marshall, WV; Noble and Hocking, OH	Install six bi-directional launcher and/or receiver facilities, including one at the start of the LEX Pipeline at the MarkWest Plan, two at the new Lone Oak CS, two at the new Summerfield CS, and one at the new R-System RS.
MLVs	3.1, 18.6 RR-4, 31.7, 49.3, 65.6, 84.3, 104.2, 122.0	Marshall, WV; Monroe, Noble, Morgan, Perry, and Hocking, OH	Install eight new MLV assemblies along the LEX Pipeline.
LEX1			
K-260 Regulator Station	0.0	Fairfield, OH	Construct a new RS and tie-in facility at the intersection of the LEX Pipeline and LEX1. Install a new odorization system to odorize from the LEX Pipeline to the existing Line K-260 and Crawford CS.
Launcher and Receiver Facilities	0.0, 1.2	Fairfield, OH	Install two bi-directional launcher and/or receiver facilities, including one at the new K-260 RS and one at the terminus of the pipeline.
R-801 Loop			
R-System Regulator Station	0.0	Hocking, OH	Construct a new RS and tie-in facility to the R-801 Loop and existing R-601 and R-701 Lines.
Benton Regulator Station	12.8	Hocking, OH	Construct a new RS and tie-in facility to the R-801 Loop and existing R-515, R-601, and R-701N lines at the terminus of the existing Line R-515 to allow flow from the existing Benton CS.
RS-1286 Regulator Station [b]	21.6	Vinton, OH	Modify the existing regulator and replace the associated building to tie-in to the R-801 Loop and existing Line R-443 at the existing RS-1286 RS.
McArthur Regulator Station	24.2	Vinton, OH	Construct a new RS and tie-in facility to the R-801 Loop and existing SR-595, R-501, R-601, and R-701S lines at the terminus of the R-801 Loop.
Launcher and Receiver Facilities	0.0; 24.2	Hocking and Vinton, OH	Install three bi-directional launcher and/or receiver facilities, including one at the new R-System RS and two at the new McArthur RS.
MLVs	9.7	Hocking, OH	Install one new MLV assembly along the R-801 Loop.

TABLE 2.1.2-2 (cont'd)
Aboveground Facilities for the LX Project

Facility	Milepost Location	County, State	Description
BM-111 Loop			
Ceredo Compressor Station [b]	2.9	Wayne, WV	Install three new electric motor-driven compressor units for a combined 33,000 hp (ISO), decommission one existing natural gas compressor unit replacing with one of the three new electric units, resulting in a total certificated capacity of 65,000 hp, and modify piping at the existing compressor station to increase operations flexibility.
Launcher and Receiver Facilities [b]	0.0; 2.9	Lawrence, OH and Wayne, WV	Install two bi-directional launcher and/or receiver facilities, including one at the start of the BM-111 Loop and one at the existing Ceredo CS at the terminus of the loop.
Existing Columbia Pipeline System			
Crawford Compressor Station [b]	0.0 [a]	Fairfield, OH	Modify piping, valves and regulators and construct new regulator buildings within and outside of the existing compressor station to allow for the flow of the proposed quantities of natural gas.
Oak Hill Compressor Station	51.5 [a]	Jackson, OH	Construct a new compressor station facility, which would include three new natural gas compressor units for a combined 47,700 hp.
Benton Compressor Station [b]	5.2 [c]	Hocking, OH	Install a new odorization system at the existing compressor station facility to odorize gas from the existing Line R-515 to the existing Line C-18. Replace about 700 feet of an existing 4-inch bypass line with a new 12-inch bypass line.
R-486 Odorization Station	34.7 [a]	Jackson, OH	Construct a new odorization system facility to odorize gas from the existing R-501 and R-601 Lines to the existing R-486 Line towards Hamden, OH.
R-130 Odorization Station	37.1 [a]	Jackson, OH	Install a new odorization system facility at the existing Wellston RS to odorize gas from the existing R-501 and R-601 lines to the existing Line R-130 towards Coalton and Altoona, OH.
R-543 Odorization Station	53.7 [a]	Jackson, OH	Install a new odorization system facility at the existing Oak Hill RS to odorize gas from the existing R-501, R-601, and R-701S lines to the existing Line R-543 toward Oak Hill and Cedar Heights Clay, OH.
R-300 / R-500 Odorization Station	88.0 [a]	Lawrence, OH	Install a new odorization system facility at the existing South Point RS to odorize gas from the existing Line R-501 to the existing Line R-300 towards South Point, OH.

[a] Milepost is associated with Columbia Gas' existing R-501 Line.
[b] Project activities would occur at existing aboveground facilities.
[c] Milepost is associated with Columbia Gas' existing Line R-515

TABLE 2.1.2-3 Aboveground Facilities for the RXE Project			
Facility	**Milepost Location**	**County, State**	**Description**
Means Measurement and Regulation Station	6.0 [a]	Montgomery, KY	Modifications to station piping and SCADA[b] systems.
Grayson Compressor Station	68.0 [a]	Carter, KY	Construct a new compressor station facility consisting of two new natural gas compressor units for a combined 36,400 hp.
Means Compressor Station	6.5 [a]	Montgomery and Menifree, KY	Construct a new compressor station facility consisting of two new natural gas compressor units for a combined 15,400 hp.

[a] Approximate milepost associated with Columbia Gulf's existing Mainline 100, 200, and 300.
[b] Supervisory Control and Data Acquisition (SCADA).

RXE Project

Grayson Compressor Station – Columbia Gulf proposes to construct the Grayson CS about 2.5 miles northeast of Grayson, Kentucky. The Grayson CS would be surrounded by a 7.5-foot-tall security fence and accessed from the south via Beckwith Branch Road, an existing access road. Columbia Gulf proposes to install one 15,900 hp ISO rated Solar Mars 100 gas turbine/ compressor unit and one 20,500 hp ISO rated Solar Titan 130 gas turbine/compressor unit at the Grayson CS. The turbines/ compressor units would be housed in two new compressor buildings. The compressor buildings would be acoustically insulated to reduce the sound transmission. Additional buildings and major auxiliary equipment to be installed include an auxiliary building, control/ warehouse building, filter separators, and associated equipment piping. The Grayson CS would be designed in a manner which allows compression to be utilized to flow gas North to South or South to North in any of the Mainlines 100, 200, and 300. The station piping would be designed for a Maximum Allowable Operating Pressure (MAOP) of 1,200 pounds per square inch gauge (psig).

Means Compressor Station – Columbia Gulf proposes to construct the Means CS about 25 miles southeast of Mt. Sterling, Kentucky. The Means CS would be surrounded by a 7.5-foot-tall security fence and accessed from the east via Hawkins Branch Road, an existing access road. A new 30-foot-wide asphalt access driveway would be constructed within the site and maintained as part of the permanent station operations; within the fence line a 30-foot-wide paved road would provide access to the compressor building, control building, filter/separator area. With the exception of the access roads, the equipment area within the site shall be gravel covered as practical. In addition to periodic site visits by Columbia Gulf personnel, necessary automation and controls would be installed to allow for remote station operation from Columbia Gulf's Monitoring Center located in Charleston, West Virginia. Columbia Gulf proposes to install two 7,700 hp ISO rated Solar Taurus 60 gas turbine/ compressor units. The turbines/ compressor units would be housed in one new compressor Building, which would be acoustically insulated to reduce the sound transmission. Additional buildings and major auxiliary equipment to be installed include an Auxiliary Building, Control/ Warehouse Building, Filter Separators, station valves, and associated equipment piping. The station piping would be designed for a MAOP of 1,200 psig.

2.1.3.2 Existing Aboveground Facilities

LX Project

Crawford Compressor Station – Modifications at the Crawford CS would accommodate the capacity increase resulting from the proposed LX Project as well as the proposed R-501 Abandonment.

The majority of the activities at the Crawford CS would be conducted entirely within the existing facility fence lines or existing facility access roads. However, a new regulator valve facility is proposed east of the existing Crawford CS outside of the facility fence.

Ceredo Compressor Station – Modifications at the Ceredo CS would accommodate the capacity increase resulting from the proposed LX Project. The proposed modifications would require a permanent expansion of the northern facility fence line to accommodate the proposed compressor units and equipment required for station blowdowns. In addition, the eastern fence line would be permanently expanded to accommodate gas coolers, piping a new office/warehouse building, permanent access road and parking area., .

RS-1286 Regulator Station – Modifications at the R-1286 RS would allow for interconnection on the proposed R-801 Loop would replace the current connection of RS-1286 Regulator Station at the existing Line R-501 that is proposed to be abandoned as part of the LX Project. Construction of the new interconnect would require a minor expansion of the existing RS-1286 facility to accommodate the new regulator building.

Odorization Stations – Columbia Gas' existing pipeline system currently transports odorized natural gas from the existing Ceredo CS north along the existing Line BM-111 and into the R-System for deliveries throughout Ohio. However, following completion of the proposed LX Project, the flow of natural gas along the existing R-System would be reversed to accommodate the new capacity that would be provided by the LEX Pipeline and transport it south to various markets and delivery points located within and outside of Ohio. Therefore, to maintain compliance with the DOT Minimum Federal Safety Standards (49 CFR 192), Columbia Gas proposes to construct five new odorization stations at existing facilities to odorize natural gas along its existing pipeline system following the flow reversal that would be created by the proposed project.

RXE Project

Means Measuring and Regulation Station – The Means M&R Station is an existing facility located in Menifee County, Kentucky. Columbia Gulf owns the property on which Means M&R is located. Columbia Gulf proposes to modify the Supervisory Control and Data Acquisition (SCADA) system within an existing building as well as install ancillary below ground piping and minor aboveground appurtenance facilities. All work would be conducted within the existing fenced boundary.

2.2 LAND REQUIREMENTS

The LX Project would disturb a total of about 3,161.6 acres of land during construction. Of this, operations would require use of 987.7 acres (consisting of 926.3 acres for the permanent pipeline facilities and 61.4 acres for aboveground facilities) and the remaining 2,173.9 acres of disturbed land would be restored and allowed to revert to its pre-construction use. Tables 2.2-1 and 2.2-2 summarize the land requirements of the LX Project pipeline and aboveground facilities, respectively, and sections 2.2.1 through 2.2.4 describe the LX Project land requirements in further detail.

The RXE Project would disturb a total of about 32.2 acres of land during construction. Permanent operations would require 19.0 acres. Table 2.2-3 summarizes the land requirements of the RXE Project aboveground facilities and sections 2.2.5 and 2.2.6 describe the RXE Project land requirements in further detail.

TABLE 2.2-1
Summary of Land Requirements Associated with the LX Project Pipeline Facilities

Facility	Land Affected During Construction (acres) [a]	Land Affected During Operation (acres) [b]
LEX		
Pipeline	1796.2	800.1
Additional Temporary Workspace	202.2	0.0
Access Roads	49.4	1.7
Contractor Yards	397.1	0.0
Cathodic Protection	1.9	1.9
LEX1		
Pipeline	15.7	7.3
Additional Temporary Workspace	1.1	0.0
Contractor Yards	9.3	0.0
R-801 Loop		
Pipeline	318.4	98.4
Additional Temporary Workspace	29.3	0.0
Access Roads	17.3	0.0
Contractor Yards	110.7	0.0
Cathodic Protection	0.5	0.5
BM-111 Loop		
Pipeline	29.8	16.4
Additional Temporary Workspace	6.4	0.0
Access Roads	0.5	0.0
Existing Columbia Pipeline System		
R-501 Abandonment	12.9	0.0
Access Roads	16.4	0.0
LX Project Pipeline Facilities Total	**3,015.2**	**926.3**

[a] Land affected during construction includes land proposed for use under operations (permanent).
[b] Land affected during operation consists only of new permanent impacts.

TABLE 2.2-2
Summary of Land Requirements Associated with LX Project Aboveground Facilities

Facility	Land Affected During Construction (acres) [a]	Land Affected During Operation (acres) [b]
LEX		
Lone Oak Compressor Station	36.7	23.2
Summerfield Compressor Station	6.8	4.6
Access Roads	2.5	2.5
Launcher	0.8	0.6
MLVs	0.5	0.5
LEX1		
K-260 Regulator Station	9.4	1.2
Incoming Line	0.2	0.2
Tie in Valve	0.0	0.0
Receiver	2.1	1.0
Access Roads	4.0	4.0
R-801 Loop		
R-System Regulator Station	5.2	2.3
Outgoing Line	0.4	0.4
Tie- in Facility	0.2	0.2
Benton Regulator Station	2.4	1.1
RS-1286 Regulator Station [c]	0.2	0.1
McArthur Regulator Station	2.8	1.9
MLVs	0.1	0.1
Access Roads	1.4	1.4
BM-111 Loop		
Launcher	0.8	0.8
Ceredo Compressor Station [c]	16.4	2.9
Access Road	0.0	0.0
Existing Columbia Pipeline System		
Crawford Compressor Station [c]	22.0	0.4
Oak Hill Compressor Station	18.7	6.4
Suction/Discharge Lines	3.7	3.7
Tie-in Facility	0.4	0.4
Benton Compressor Station [c]	3.8	0.3
R-486 Odorization Station [c]	0.1	0.0
R-130 Odorization Station [c]	0.1	0.0
R-543 Odorization Station [c]	0.1	0.1
R-300 / R-500 Odorization Station [c]	1.3	0.0
Access Roads	3.4	1.3
Aboveground LX Facilities Total	**146.6**	**61.4**

[a] Land affected during construction includes land proposed for use under operations (permanent).
[b] Land affected during operation consists only of new permanent impacts.
[c] Project activities would occur at existing aboveground facilities

TABLE 2.2-3 Summary of Land Requirements Associated with RXE Project		
Facility	**Land Affected During Construction (acres)** [a]	**Land Affected During Operation (acres)** [b]
Existing Facilities		
Means Measuring and Regulation Station	1.0 [c]	3.2 [c]
New Facilities		
Grayson Compressor Station	11.8	8.6
Means Compressor Station	19.4	7.2
RXE Project Total	***32.2***	***19.0***

[a] Land affected during construction includes land proposed for use under operations (permanent).

[b] Land affected during operation consists only of new permanent impacts.

[c] Construction and operation activities within the Means Measuring and Regulation Station would take place within the existing fence line which includes previously disturbed land within an industrial facility.

2.2.1 LX Project New Pipeline Facilities

It is anticipated that new pipeline construction would typically require a construction work area width of 110 feet in upland areas to accommodate the proposed 30- and 36-inch-diameter pipelines. However, a width of 125 feet (in uplands) would be required for construction of the LEX Pipeline from MPs 0.0 to 39 in order to provide, sufficient working width for safe and efficient construction of 36-inch-diameter pipeline through hilly terrain and steep slope conditions. As shown in the typical construction standards in Appendix C, the permanent right-of-way would be 25 feet on either side of the pipeline plus 60 feet of ATWS (five feet on the soil spoil side and 55 feet on the working side). Where 125 feet of construction work area would be required, the additional 15 feet of ATWS would be located on the working side. Where the pipeline would cross wetlands, the construction work area would be a total of 75 feet, including the 50 foot permanent right-of-way.

About 26 percent of the LEX Pipeline is characterized by slopes greater than 30 percent, requiring large construction equipment to be adequately stabilized to ensure safe working conditions during construction. In addition, if rock is encountered during construction, additional space would be needed to separate excavated rock from topsoil and to store rock separately from topsoil. Following construction, a 50-foot-wide permanent easement centered on the installed pipeline would be retained. See appendix C for typical construction work area cross-section diagrams of various configurations for this proposal.

A 75-foot-wide construction work area would be used in all wetland areas except where alternate measures are requested as discussed in section 4.3. In areas where the construction work area is proposed to be co-located with existing Columbia Gas and non- Columbia Gas pipeline rights-of-way, Columbia Gas would overlap its temporary workspace to the extent feasible, while providing a safe distance of separation between the proposed and existing pipelines. Overlap areas often require less newly-disturbed construction work area widths. In some areas of the proposed R-801 Loop, new permanent easement would overlap up to 20 feet with existing permanent easement, resulting in only 30 feet of additional new permanent easement.

In total, construction of the four new pipelines (excluding use of additional temporary workspace [ATWS], contractor yards, cathodic protection installations, and access roads) would affect 2,160.1 acres.

In addition to the four new pipelines, the R-501 Abandonment would require work at about 97 areas, primarily within the previously disturbed permanent right-of-way, but including several temporary

access roads, temporary workspaces, and pipe yards outside the permanent right-of-way. These areas are depicted on the alignment sheets provided in appendix B, resulting in a total of 29.3 acres of temporary impacts. The majority of activities associated with the R-501 Abandonment (which involves leaving the existing pipeline in place) would occur within the existing, previously disturbed right-of-way

As presented in table 2.2-1, approximately 922.2 acres of the total land that would be affected by pipeline construction would be maintained as new permanent easement. Areas disturbed by construction that are not part of the new permanent easement would be allowed to revegetate to previous conditions and contours would be restored to pre-construction conditions following the completion of construction activities. New permanent easement areas would be revegetated, with restrictions, and contoured to pre-construction conditions except for the addition of permanent slope breakers for erosion control.

Additional Temporary Workspace – In addition to the previously described typical pipeline construction work areas, ATWS may be required where site-specific conditions warrant the use of specialized construction procedures to reduce environmental impacts and to maintain safe working conditions. Columbia Gas would require ATWS for road, wetland, waterbody, and foreign utility line crossings; steep and side slope terrain; horizontal directional drills (HDD); and areas using topsoil segregation. Additionally, ATWS would be required at the beginning and/or terminus of the pipelines to allow for mobilization of construction equipment. ATWS needed for the LX Project would total 239.0 acres. Descriptions of the specialized construction techniques typically requiring ATWS are provided in section 2.3.2. See appendix N for a listing of ATWS.

Contractor Yards – During construction of the pipelines, Columbia Gas would require work areas outside of the construction work area for contractor parking and storage of pipe and equipment. These contractor yards would be located near the project at locations with convenient and safe access to the LX Project areas. All areas used for staging throughout the project would be allowed to revegetate and contours would be restored to pre-construction conditions upon Project completion unless otherwise agreed upon with the landowner and submitted to FERC for review and approval. Columbia Gas is in the process of evaluating the preferred and alternate sites for the contractor yards and has identified 39 potential sites. Columbia Gas estimates it would need approximately half of these potential sites for construction of the LX Project. To provide the most conservative assessment of potential impacts, we have included all of Columbia Gas' identified contractor yards in our calculation of the LX Project's land requirement/land use impacts. Using this assumption, a total of 517.1 acres of land would be temporarily affected during construction (see table 2.2.1-1). Although several wetlands occur within contractor yards, all wetlands would be avoided during construction, and no impacts are anticipated. Columbia Gas would file its final list of preferred contractor yards prior to construction.

Cathodic Protection – The LX Project would require the installation of 14 buried cathodic protection units. The proposed cathodic protection units would consist of typical remote-impressed current groundbeds that include rectifiers with a remote monitoring unit. The pipeline integrity and safety benefits of cathodic protection units are discussed in section 4.12. Nine of the cathodic protection units would be installed within the fence lines of other aboveground facilities; therefore, impacts associated with the installation of these cathodic protection units are included with the impacts reported for the aboveground facilities within which they are located. The five remaining cathodic protection units proposed for installation along the LEX Pipeline and the R-801 Loop would require 2.4 acres of new permanent right-of-way. Following installation, the areas above these cathodic protection units would be maintained in a manner consistent with that for the permanent pipeline right-of-way. Columbia Gas would conduct routine inspections of the functional capability of cathodic protection systems to ensure proper operating conditions.

TABLE 2.2.1-1
Pipe Yards Along the LX Project Route

Milepost	Name	Land Use	Size (acres)
LEX			
7.5 RR-1	Pipe Yard 37	Forest, Open land	2.0
16.0	Pipe Yard 26 [a]	Industrial	2.5
16.0	Pipe Yard 25 [a]	Agricultural, Forest	7.5
16.7 RR-3	Pipe Yard 46 [a]	Agricultural	23.0
16.9 RR-3	Pipe Yard 29 [a]	Industrial	2.6
23.6	Pipe Yard 02 [a]	Industrial, Forest, Open land	15.1
25.4 RR-5	Pipe Yard 01 [a]	Industrial	4.0
25.8 RR-5	Pipe Yard 35 [a]	Industrial	11.7
27.7	Pipe Yard 30 (Alternate) [a]	Industrial	3.3
37.6	Pipe Yard 47 [a]	Open land	42.6
42.0	Pipe Yard 49 [a]	Industrial, Forest	4.8
42.3	Pipe Yard 04 (Alternate)	Agricultural	15.7
42.8	Pipe Yard 34 (Alternate) [a]	Agricultural, Industrial, Forest	10.0
47.9	Pipe Yard 05 [a]	Agricultural, Industrial, Wetland (PEM)	16.0
57.1	Pipe Yard 38	Agricultural, Industrial, Forest	25.6
63.1	Pipe Yard 14 [a]	Agricultural, Wetland (PEM)	55.6
66.8	Pipe Yard 15 [a]	Agricultural, Wetland (PEM)	3.8
67.3	Pipe Yard 32 (Alternate) [a]	Industrial	3.0
67.5	Pipe Yard 33 [a]	Industrial	9.5
71.6	Pipe Yard 44	Industrial, Open land	2.3
77.3	Pipe Yard 45 [a]	Industrial, Open land	3.7
89.2	Pipe Yard 28 [a]	Agricultural, Industrial, Forest, Open land	17.9
89.3	Pipe Yard 16 (Alternate) [a]	Agricultural, Industrial, Forest	11.5
100.0	Pipe Yard 48 [a]	Industrial, Open land	11.1
100.0	Pipe Yard 36 [a]	Industrial, Open land, Open water, Wetland (PEM)	78.1
102.6	Pipe Yard 18 (Alternate) [a]	Industrial, Forest, Open land, Wetland (PEM)	8.2
120.2	Pipe Yard 11 (Alternate) [a]	Agricultural, Industrial	5.9
LEX1			
1.2	Pipe Yard 27 [a]	Agricultural, Industrial, Open land, Wetland (PEM)	9.3
R-801 Loop			
0.0	Pipe Yard 41	Industrial, Forest, Open land	16.6
3.8	Pipe Yard 09 [a]	Agricultural, Industrial, Wetland (PEM)	6.1
9.7	Pipe Yard 13 (Alternate)	Agricultural, Industrial	6.8
13.5	Pipe Yard 19 [a]	Agricultural, Open land	53.2
14.4	Pipe Yard 20 [a]	Agricultural, Industrial, Open land	7.5
19.3	Pipe Yard 43 [a]	Agricultural, Industrial	0.9
21.6	Pipe Yard 42 [a]	Industrial, Open land	1.2
22.1	Pipe Yard 24 [a]	Industrial, Open land	7.3
22.8	Pipe Yard 21 (Alternate) [a]	Agricultural	4.2
24.2	Pipe Yard 22 (Alternate) [a]	Forest, Open land	0.7
24.2	Pipe Yard 23 [a]	Agricultural, Wetland (PEM)	6.2
		Total	**517.1**

[a] Yard is located offline; therefore, the milepost provided is associated with the nearest temporary workspace, ATWS, access road, or aboveground facility boundary.

Pipeline Facility Access Roads – To access LX Project workspaces and facilities, Columbia Gas would use existing public and private roads to the extent practicable. A total of 130 temporary access

roads (including temporary walking paths to accommodate minor abandonment activities using handheld equipment along Line R-501), requiring 81.9 acres, are proposed for use to construct the proposed pipelines and R-501 Abandonment for the LX Project. Temporary access roads would be used during the construction phase of the LX Project but would be allowed to revegetate and contours would be restored to pre-construction conditions following completion. Columbia Gas is proposing to maintain six additional access roads as permanent (1.7 acre) to accommodate access to the rectifiers associated with each of the cathodic protection units proposed for installation along the LEX Pipeline and the R-801 Loop. Columbia Gas' proposed pipeline access road land requirements are summarized in table 2.2-1 and further detailed in appendix D.

Aboveground Facility Access Roads - A total of 31 private access roads (includes temporary and permanent access roads), requiring 11.3 acres, are proposed for use during construction of the aboveground facilities. When possible, existing public or private roads would be used to access work areas. Two of these roads would be used for temporary access to the aboveground facilities during construction and would require a total of 2.1 acres. Columbia Gas is proposing to maintain a total of 29 permanent access roads, comprising 9.2 acres of the LX Project area, to provide access to the remaining aboveground facilities. Details regarding the access roads that would be used for the aboveground facilities are provided in appendix D.

2.2.2 LX Project Aboveground New Facilities

In total, construction of the LX Project aboveground facilities would temporarily affect 111.6 acres of land. The LX Project would affect 48.7 acres of land during operation. Land requirements for the aboveground facilities associated with the LX Project are summarized in table 2.2-2.

Lone Oak Compressor Station – Columbia Gas has acquired and owns the parcels of land used for the Lone Oak CS construction and operation as well as additional portions of the surrounding parcels (total of 43.8 acres). Upon completion of construction, temporary workspaces would be graded, stabilized, and allowed to revegetate to pre-construction conditions. The compressor station facility would be fenced, and land within the permanent footprint not covered by rock or facility foundations would be maintained in an herbaceous state.

Summerfield Compressor Station –Columbia Gas has acquired and owns the parcels of land used for the Summerfield CS construction and operation as well as additional portions of the surrounding parcels (total of 41.6 acres). Upon completion of construction, temporary workspaces would be graded, stabilized, and allowed to revegetate to preconstruction conditions. The compressor station facility would be fenced, and land within the permanent footprint not covered by rock or facility foundations would be maintained in an herbaceous state.

Oak Hill Compressor Station –Columbia Gas has acquired and owns the parcels of land used for the Oak Hill CS construction and operation as well as additional portions of the surrounding parcels (total of 57.5 acres, of which 36.7 acres were previously acquired by Columbia Gas). Upon completion of construction, temporary workspaces would be graded, stabilized, and allowed to revegetate to preconstruction conditions.

Regulator Stations – Four new regulator stations, including the K-260 RS, R-System RS, Benton RS, and McArthur RS, would require a total of 19.9 acres for construction. A total of 6.4 acres would be used for operation of the four new regulator stations (land requirements associated with the facility access roads are discussed independently below). In addition to the new regulator station facilities, a total of 0.6 acre of land would be affected and maintained as new permanent easement for the suction lines associated with the K-260 RS and R-System RS. A fenced tie-in valve and new pipeline tie-in facility

requiring 0.2 acres will be constructed at the terminus of the R-System outgoing line. Upon completion of construction, temporary workspaces would be graded, stabilized, and allowed to revegetate to pre-construction conditions. The regulator station facilities would be fenced, and land within the permanent footprint not covered by rock or facility foundations would be maintained in an herbaceous state.

Launcher and Receiver Facilities – A total of 13 new bi-directional launcher and/or receiver facilities would be constructed for the project Ten of the 13 facilities would be installed within other proposed aboveground facilities; therefore, impacts associated with the installation of these launcher and/or receiver facilities are included with the impacts reported for the other aboveground facilities within which they are located. Construction of the remaining three new stand-alone launcher and/or receiver facilities located at MP 0.0 of the LEX Pipeline, MP 1.2 of LEX1, and MP 0.0 of the BM-111 Loop would require a total of 3.6 acres, of which a total of 2.4 acres would be used for operation (land requirements associated with the facility access roads are discussed independently below).

Mainline Valves – Construction of the MLV facilities would require a total of 0.5 acre, all of which would be located within the construction work area. Following completion of construction, an approximate 50- by 50-foot fenced gravel area would be retained for operation of each MLV facility.

2.2.3 LX Project Aboveground Existing Facilities

Crawford Compressor Station – The proposed piping and valve modifications at the existing Crawford CS would require 22.0 acres for construction. The majority of Project activities will occur within the limits of the existing facility fence lines or existing facility access roads. However, a new regulator and valve facility will be constructed outside of the existing facility fence lines resulting in 0.4 acres of permanent impacts.

Ceredo Compressor Station – The proposed electric compression installations and decommissioning of an existing natural gas compressor unit at the existing Ceredo CS would require 16.4 acres for construction. In addition, Columbia Gas proposes to expand the existing facility fence lines to accommodate the proposed new compressor units and equipment required for station blowdowns as well as a new office building, resulting in 2.9 acres of new permanent impacts (land requirements associated with the facility access road are discussed independently below). Although temporary workspace and new permanent facilities would be required outside of the existing compressor station facility, all impacts would occur within previously cleared areas located adjacent to the Ceredo CS.

2.2.4 RXE Project Aboveground New Facilities

Grayson Compressor Station – Construction of the Grayson CS would require a total of 11.8 acres of workspace for construction, with about 8.6 acres used for operation of the facility. Columbia Gulf would use an existing access road (Beckwith Branch Road). Road improvements to Beckwith Branch Road are being evaluated and Columbia Gulf would notify FERC if additional temporary or permanent improvements were needed. Upon completion of construction, temporary workspace (about 3.3 acres) would be graded, stabilized, and revegetated and maintained in an herbaceous state. The compressor station facility would be fenced, and land within the permanent footprint not covered by rock or facility foundations would be maintained in an herbaceous state.

Means Compressor Station –Construction of the Means CS would require a total of 19.4 acres of workspace for construction, with about 7.2 acres used for operation of the facility. Columbia Gulf would use an existing access road (Hawkins Branch Road) to access the site for construction and operation. Upon completion of construction, temporary workspace (about 12 acres) would be graded, stabilized, and allowed to revegetate and maintained in an herbaceous state. The compressor station facility would be

fenced, and land within the permanent footprint not covered by rock or facility foundations would be maintained in an herbaceous state.

2.2.5 RXE Project Aboveground Existing Facilities

Means Measurement and Regulation Station – Construction activities within the existing Means M&R Station would require a total of about 3.2 acres of workspace. Upon completion of construction, temporary workspace would be graded, stabilized, and allowed to revegetate to preconstruction conditions where gravel was not previously located. A depiction of the Means M&R Station is included on Means CS drawings provided in appendix B.

2.3 CONSTRUCTION PROCEDURES

Where possible, conventional pipeline construction techniques would be used to construct the LX and RXE Projects. These techniques are described in the following sections.

2.3.1 General Pipeline Construction Procedures

The LX and RXE Projects would be constructed in compliance with applicable federal regulations and guidelines, and the specific requirements of the necessary permits (section 1.5). The projects would be designed, constructed, tested, and operated in accordance with all applicable requirements included in the U.S. Department of Transportation (DOT) regulations in 49 CFR 192[8], *Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards*, and other applicable federal and state regulations, including the U.S. Department of Labor, Occupational Safety and Health Administration requirements. These regulations are intended to ensure adequate protection for the public. Among other design standards, Part 192 specifies pipeline material and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion.

To reduce construction impacts, Columbia Gas and Columbia Gulf would each implement project-specific Environmental Construction Standards (ECS)[9], which incorporate requirements and recommendations from the FERC *Upland Erosion Control, Revegetation, and Maintenance Plan* (FERC Plan) and the FERC *Wetland and Waterbody Construction and Mitigation Procedures* (FERC Procedures), as well as from applicable state regulations and requirements. Columbia Gas and Columbia Gulf indicated that they are continuing to refine their ECSs and would provide revised drafts as agency consultations and recommendations are received throughout the permitting process. A copy of the final ECSs would be submitted to FERC prior to construction. Columbia Gas' and Columbia Gulf's ECSs adhere to the FERC Plan and Procedures to the greatest extent possible. Where alternate measures to the FERC Plan and Procedures are requested because they are necessary for site-specific reasons, they have been identified in appendix E and further discussed in section 2.3, section 4.3 and section 4.6. Columbia Gas' and Columbia Gulf's ECSs each also incorporate a project specific Spill Prevention, Control, and Countermeasures Plan.

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8 Pipe design regulations for steel pipe are contained in subpart C, Part 192. Section 192.105 contains a design formula for the pipeline's design pressure. Sections 192.107 through 192.115 contain the components of the design formula, including yield strength, wall thickness, design factor, longitudinal joint factor, and temperature derating factor, which are adjusted according to the project design conditions, such as pipe manufacturing specifications, steel specifications, class location, and operating conditions. Pipeline operating regulations are contained in subpart L, Part 192.

9 Columbia Gas' ECSs for the LX and RXE Projects are available on the FERC's eLibrary website at, respectively, http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514, Accession No. 20151023-5090, titled "20151023_CP15-514-000-27_Vol_I_RR01_App1C.PDF", and by searching Docket No. CP15-539, Accession No. 20150729-5074, titled "ECS 20150729_CP15-000-05_Vol I_RR_01_App_1C".

Columbia Gas and Columbia Gulf would adhere to permit conditions outlined by various agencies in regard to environmentally sensitive areas, which are further discussed in section 4.7. In addition, Columbia Gas and Columbia Gulf would prepare and implement project-specific Erosion and Sedimentation Control Plans (ESCP) following guidance from the FERC Plan and Procedures, the OEPA, the WVDEP, the PADEP, the KYDEP, and the Greene County Conservation District (Pennsylvania). Columbia Gas would submit its ESCP to the Greene County (Pennsylvania) Conservation District for review and approval as identified in table 1.5-1, and copies of the ESCPs would be provided to FERC prior to construction.

2.3.1.1 Surveying and Staking

Along the pipeline route affected landowners would be notified no later than two weeks prior to pre-construction staking, unless the landowner has previously requested otherwise. Following notification, a crew would stake along the outside limits of the proposed construction work area and ATWS, along the centerline of the pipeline, and along drainages, highway and railroad crossings and access roads. Existing utility lines (e.g., cables, conduits, and pipelines) would be located and marked with flags, stakes, or other devices to prevent accidental damage during pipeline construction.

At the compressor station sites, affected landowners would be notified at least three to five days prior to pre-construction activities. Adjacent landowners surrounding the station sites would also be notified prior to construction activities. Following these notifications, a crew would mark and fence the outside limits of the proposed construction workspace and access roads. Columbia would contact the national 811 “one-call” system and the applicable “Dig-Safe” call system to accurately and safely identify and flag buried utility lines by their respective owners.

Previously identified sensitive resources, such as wetland boundaries, cultural resources sites, and sensitive species habitats, would also be located and marked to minimize or avoid adverse impacts during pipeline construction.

2.3.1.2 Clearing and Grading

Following the establishment of workspace boundaries, the construction work area, ATWS and cathodic protection areas would be cleared and graded. The construction work area would be graded, where necessary, to create a level workspace to allow safe passage of equipment. Grading would be limited in wetland areas. Large obstacles, such as trees, rocks, brush, and logs would be moved, and the natural drainage would be preserved to the extent practicable. Columbia would implement soil mitigation procedures as outlined in the ECS, including the permit requirements in its ECPs, immediately following clearing and throughout grading activities. Cleared vegetation and debris along the construction work area would be disposed of in accordance with federal and state regulations either by chipping and spreading or transportation to a commercial disposal facility.

Fences would be cut and braced along the construction work area and temporary gates would be installed as necessary to control livestock and limit public access. In wetlands, agricultural, and residential areas, conserved topsoil would be stockpiled, usually along one side of the construction work area (spoil side), allowing the other side to be used for access, material transport, and pipe assembly. Where topsoil is stripped from the entire construction work area, ATWS may be used for topsoil storage with permission from the landowner and appropriate environmental approvals. A maximum of 12 inches of topsoil would typically be removed or stripped and segregated in these areas. If the topsoil is less than 12 inches in depth, the actual depth of the topsoil would be removed and segregated.

Temporary security fencing would be installed as necessary around the construction workspace to limit public access.

2.3.1.3 Trenching

Trenching involves excavation of a ditch for pipeline placement, and is accomplished through the use of a rotary trenching machine, track-mounted backhoe, or similar equipment. Trench spoil would be deposited adjacent to the trench within the construction work areas. In agricultural, residential, and wetland areas, topsoil would be stockpiled separately per the ECS. Typically, the bottom of the trench would be cut at least 12 inches wider than the width of the pipe. The width at the top of the trench would vary to allow the side slopes to be adapted to local conditions at the time of construction. The trench would be excavated to a sufficient depth to allow for a minimum 3 feet of cover between the top of the pipe and the final land surface after backfilling and contour restoration, as required by 49 CFR 192, with the exception of agricultural land, which would be excavated to a depth to allow for a minimum of 4 feet of cover. If the pipeline is being buried in an area containing rock, the pipeline may be placed in a ditch with a minimum 18 inches of cover for Class I areas and 24 inches of cover for Class II and Class III areas (refer to section 4.2.1 for class locations crossed by the project). Additional cover may be required at foreign utility line crossings to allow at least 18 inches of clearance between the proposed pipeline and the foreign line.

Columbia Gas and Columbia Gulf would employ best-management practices outlined in their ECSs to minimize erosion during trenching operations and construction activities. Where necessary, temporary and permanent erosion control devices (ECD) would be installed and maintained to contain disturbed soils during trenching in uplands and to minimize potential erosion and sedimentation of wetlands and waterbodies. Additionally, permanent sediment filter devices would be installed in non-agricultural and residential areas with slope.

2.3.1.4 Stringing, Bending, Welding, and Coating

Steel pipe would be procured in nominal 40-foot lengths or joints, protected with an epoxy coating applied at the factory (the beveled ends would be left uncoated for welding), and shipped to the staging areas or strung directly onto the construction work area. The individual joints would be transported to the construction work area and placed along the excavated trench in a single line to allow welding operations to proceed efficiently.

Once placed on the construction work area, some bending of the pipe would be required to allow the pipeline to follow natural grade changes and direction changes. Typically, joints would be bent in the field by track-mounted hydraulic bending machines, as necessary, prior to line-up and welding. For larger horizontal changes of direction, manufactured induction bends would be used.

Following stringing and bending, the joints of the pipe would be placed on temporary supports adjacent to the trench. The ends would be carefully aligned and welded together using multiple passes for a full penetration weld. Gaps in the pipe welding process are often left by the welding crews at wetland and waterbody crossings, road crossings, and other locations where access across the work area is required or when the pipe would be installed later in the construction process. Only welders qualified according to applicable American National Standards Institute, American Society of Mechanical Engineers, and American Petroleum Institute (API) Standards would be permitted to perform the welding.

To ensure that the assembled pipe would meet or exceed the design strength requirements, the welds would be visually inspected and non-destructively tested using radiographic (x-ray) or other

approved test method, in accordance with API Standards. Welds displaying inclusions (void spaces) or other defects would be repaired or cut out (removed) and a new weld would be installed and retested.

Following welding, the previously uncoated ends of the pipe at the joints would be epoxy coated. Prior to lowering the pipe into the trench, the coating on the entire pipe section would be inspected and any damaged areas would be repaired.

2.3.1.5 Pipe Lowering

The completed section of the pipe would be lifted off the temporary supports and lowered into the trench by side-boom tractors, or other equipment. Before lowering the pipe, the trench would be inspected to ensure that it is free of rock and other debris that could damage the pipe or the coating. In addition, the pipe and trench would be visually inspected to ensure that the pipe and trench configurations are compatible. Tie-in welding and pipeline coating would occur within the trench to join the newly lowered-in section with the previously installed sections of pipe.

2.3.1.6 Padding and Backfilling

After the pipe is lowered into the trench, the trench would be backfilled. Previously excavated materials would be pushed back into the trench using bladed equipment or back hoes. Where the previously excavated material contains large rocks or other materials that could damage the pipe or coating, clean fill would be placed around the pipe prior to backfilling. Any excess excavated materials or materials unsuitable for backfill would be spread evenly over the construction work area or transported off-site for proper disposal. The trench would be backfilled to grade or above its original elevation (i.e., slightly crowned) to accommodate any subsequent settling.

Segregated topsoil would not be used for padding the pipe. In areas where topsoil has been segregated, the subsoil would be replaced and segregated topsoil would be returned to its original horizon as practicable. Subsoil and/or topsoil compaction would be conducted, as necessary, depending on the land use and landowner agreements. To minimize the possibility of subsurface water flow on slopes along the pipeline, sand bags or foam-type trench breakers would be placed across the trench prior to backfilling.

2.3.1.7 Hydrostatic Testing

Following backfilling of the trench, the pipeline would be cleaned and hydrostatically tested to ensure it is capable of operating at the design pressure. Following backfilling of the trench, the pipeline would be cleaned and hydrostatically tested to ensure it is capable of operating at the intended design pressure. Pneumatic pressure testing is an alternative option; however, the amount of energy stored in compressed gas is greater than energy stored in a compressed liquid. Therefore, pneumatic pressure testing at the pressures required for testing the project pipeline poses an increased safety risk should a failure of the pipe occur and is not a preferred method of testing.

Once the pipeline tie-ins are completed, it is internally cleaned with pipeline “pigs.” A manifold is installed on one end of the long pipeline section and a pig is propelled by compressed air through the pipeline into an open pig catcher to remove any dirt, water, or debris that was inadvertently collected within the pipeline during installation. After cleaning, the pipeline segments would be pressure tested. Hydrostatic test pressure is obtained by adding water to the test section of the pipeline with a high-pressure pump. The water in the pipe would be held for a minimum of eight hours, and any loss of pressure that cannot be attributed to other factors, such as temperature changes, would be investigated. Any leaks detected would be repaired and the segments that are repaired would be

retested. At the completion of the hydrostatic test, the pressure is removed and the water is released from the test section. Additional "drying" pig runs are made, if necessary, to remove any residual water from the pipeline. Hydrostatic test water would only be in contact with new steel pipe that would be free of chemicals or lubricants. Following testing and after depressurization, water would pass through an energy-dissipating device prior to release into a well-vegetated, upland area or discharged into a truck and hauled to a separate disposal location consistent with the FERC Procedures. In accordance with Columbia Gas' ECS, methanol may be injected, after discharging the water, to dry the pipe. Excess methanol would be retrieved from the facility and used during subsequent operation of Columbia Gas' facilities. Once a segment of pipe has been successfully tested and dried, the test cap and manifold would be removed, and the pipe would be connected to the remainder of the pipeline. Hydrostatic testing is further discussed in section 4.3.

Water used in hydrostatic testing is normally obtained from water sources in the vicinity of the pipeline, including available municipal supply lines. Hydrostatic testing would be conducted in accordance with applicable permits, and no chemicals would be used for hydrostatic testing, with the possible exception of water withdrawn from the Ohio River. Due to concerns related to the spread of invasive species, WVDEP recommended that water withdrawn from the Ohio River either discharge back into the Ohio River (original source) or undergo treatment with a WVDEP-recommended biocide prior to discharge to control the spread of invasive species. Section 4.3.2.6 includes a discussion of water source(s) and quantities that would be required to hydrostatically test each of the LX and RXE Project facilities.

2.3.1.8 Foundations, Equipment, and Building Installations

Construction of the compressor stations would begin with grading, leveling, and compacting the soils for the construction of building foundations.

Excavation would be performed as necessary to accommodate the reinforced concrete foundation that is required for the new compressor units and buildings. Forms would be set, rebar would be installed, and concrete would be poured into the foundation settings. Concrete pours would be randomly sampled to verify compliance with minimum strength requirements. Backfill would be compacted in place, and excess soil would be used elsewhere or distributed around the site. Once the concrete foundations have been completed and determined to meet the design requirements, installation of the machinery and buildings for each compressor station would commence. Various piping and electrical conduit systems would be connected once the machinery is in place. Electrical wiring would be installed for power and instrumentation. Compression equipment is typically shipped to the site by truck after construction commences. The compressors would be offloaded, positioned on the foundation, leveled, grouted, and secured. Compressor station utilities supporting the operation of the gas compressor and cooling equipment would be housed in modularized, skid mounted buildings.

Aboveground and belowground piping would be installed at the stations and would be hydrostatically tested prior to operation. Columbia Gas and Columbia Gulf would develop and implement measures outlined in project-specific station commissioning plans to ensure the proper function of controls and safety features prior to placing the new compressor units into service. Roads and parking areas would be constructed using gravel, asphalt, or concrete, as appropriate. Fencing would be constructed around the facility sites. Once construction is complete, all disturbed areas not covered with gravel or asphalt would be graded, restored, and reseeded.

Construction of the new regulator stations, launcher and receiver facilities, MLVs, and odorization stations as well as activities at the existing facilities would be conducted using the same

general procedures as those described above for the compressor stations and in accordance with the applicable federal and state regulations.

2.3.1.9 Piping Connections

Pipe connections associated with the new compressors and pumps would be flanged, screwed, or welded. All welders and welding procedures would be qualified in accordance with the USDOT requirements (49 CFR 192). All piping system welds would be verified by a non-destructive testing method to ensure compliance with code requirements.

2.3.1.10 Clean-up and Restoration

Following pipeline installation and backfilling, disturbed areas would be restored and graded to pre-construction contours as closely as practicable. Construction debris and organic refuse unsuitable for distribution over the construction work area would be disposed of at appropriate facilities in accordance with applicable regulations. Permanent ECDs would be installed as appropriate, and revegetation measures would be applied in accordance with the ECS.

Restoration activities would be conducted in accordance with state and municipal permit requirements. Soils that supported vegetation prior to construction would be revegetated using seed mixes, application rates, and timing windows recommended by local soil conservation authorities or other duly authorized agencies, landowner requests, and in accordance with the ESC. The construction work area, ATWS and cathodic protection areas would be seeded within 6 working days following final grading, weather and soil conditions permitting, unless otherwise directed by local soil conservation authorities. Additionally, monitoring of revegetation after construction would be conducted to evaluate and correct areas requiring remediation.

2.3.2 Special Construction Techniques

In addition to conventional pipeline construction techniques, specialized construction techniques would be used in sensitive resource areas including waterbody crossings, wetland crossings, residential areas, agricultural areas, road crossings, areas with side slopes, and rocky areas as well as areas requiring reduced workspace. Specialized construction procedures are described in the following sections.

2.3.2.1 Wetland Crossings

In accordance with the ECS, the width of the pipeline construction work area would be limited to 75 feet in wetlands. Areas where Columbia Gas requested additional workspace in wetlands is discussed in section 4.4.4. Prior to the start of construction activities, buffers would be clearly marked with signs and/or highly visible flagging. Columbia Gas would install BMPs as required by the ECS, at edges of the construction work area in wetlands where there is a possibility for spoil to flow into undisturbed areas of the wetlands. Wetland crossing methods would be determined based on site-specific conditions. Wetlands with soils that can support construction equipment may be crossed using the conventional open-cut method, as described in section 2.3.2.2, with the use of timber mats to prevent soil rutting.

Vegetation would be cut to ground level, and grading and stump removal would be performed only over the trench, except where safety conditions dictate additional removal on the working side of the construction work area. Topsoil segregation techniques would be utilized along the trench in unsaturated wetlands to preserve the seed bank and allow for successful restoration of the disturbed area. Trench plugs may be used in wetlands to minimize the flow of water and sediment discharges into the wetland from the open trench. Wetland entry and exit points would be sealed with trench sack breakers or foam

breakers to maintain the hydrologic integrity of the wetland, as appropriate. Following pipeline installation, the trench would be backfilled and excess backfill would be spread over adjacent upland areas and stabilized during clean-up. Columbia Gas would restore wetland contours to pre-construction conditions to the extent practicable upon construction completion. A depiction of typical wetland construction techniques is provided in appendix C.

Push/Float Crossing Method

The push/float method of construction may be used in inundated lowland or saturated wetland areas where conventional pipe laying equipment cannot be supported and in areas that have a significant amount of water that would allow for pipe to be floated through the open trench. Implementation of this method requires excavation of the trench using low-ground weight equipment, limiting the need for grubbing and grading activities over the trench line or working side of the construction work area. Topsoil segregation would not be implemented in areas where there is standing water or inundation at the time of construction.

Coated and weighted pipe would be welded at a staging area where floats are attached to the pipe. The welded pipe would be pushed along the water-filled trench until it is in place. Once in place over the trench, the floats would be cut and the pipe would be allowed to sink into place. The trench would then be backfilled using previously excavated material. Use of this method reduces wetland impacts and soil compaction by minimizing the number of construction passes necessary to install the pipe. Any required staging would be conducted within the construction work area to the extent practicable. If ATWS is required, approval would be requested from FERC prior to use. A depiction of typical push/float construction techniques is provided in appendix C.

2.3.2.2 Waterbody Crossings

Construction methods used at waterbody crossings are highly dependent on the characteristics of the waterbody encountered at the time of construction. Waterbody crossing methods anticipated to be used during construction include conventional open-cut, dam-and-pump, flume, and HDD as described below. The proposed construction method for each waterbody crossed by the projects is identified in section 4.3.2.5.

Conventional Open-Cut Crossing Method

The conventional open-cut method employs the same general construction procedures as described in section 2.3.1.3 for upland construction. The open-cut construction method involves the excavation of the pipeline trench across the waterbody, installation of a prefabricated segment of pipeline, and backfilling of the trench with native material.

Depending upon the width of the crossing and the reach of the excavating equipment, excavation and backfilling of the trench would generally be accomplished using backhoes or other excavation equipment operating from one or both banks of the waterbody. As required by the ECS, flow would be maintained at all times. The pipe segment would be weighted, as necessary, to provide negative buoyancy and placed below scour depth. Typical backfill cover requirements would be met, contours would be restored within the waterbody, and the banks would be stabilized via seeding and/or the installation of erosion control matting.

Impacts on water quality would be minimized through the implementation of measures outlined in the ECS. The pipeline trench would be excavated immediately prior to pipe installation to limit the duration of construction within the waterbody. Waterbody crossings 10 feet or less would be completed

within 24 hours and crossings greater than 10 feet would be crossed within 48 hours. Excavated materials would be stored no less than 10 feet from the edge of the waterbody and temporary sediment barriers, such as silt fences, would be used to prevent the sediment from reentering the waterbody. A depiction of typical conventional open-cut waterbody crossing construction techniques is provided in appendix C.

Dam-and-Pump Crossing Method

The dam-and-pump crossing method is a modification of the conventional open-cut crossing method (section 2.3.1. that allows the trench to remain dry during pipe installation. Temporary dams, typically consisting of sandbags or plastic sheeting are installed upstream and downstream of the proposed waterbody crossing. Following dam installation, using the dam-and-pump method, appropriately sized pumps would be used to dewater and transport the stream flow around the construction work area and trench. Intake screens would be installed at the pump inlets to prevent entrainment of aquatic life, and energy-dissipating devices would be installed at the pump discharge points to minimize erosion and stream bed scour.

Trench excavation and pipeline installation would then commence through the dewatered portion of the waterbody channel. Following completion of pipeline installation, backfill of the trench, and restoration of stream banks, the temporary dams would be removed and flow through the construction work area would be restored. This method is generally only appropriate for those waterbodies where pumps can adequately transfer the stream flow volume around the work area and there are no concerns about the passage of sensitive aquatic species. A depiction of typical dam-and-pump construction techniques is provided in appendix C.

Flume Crossing Method

The flume crossing method is another dry alternative to the conventional open-cut method in which water flow is temporarily directed through one or more flume pipes placed over the excavation area. The use of the flume(s) allows trenching and pipeline installation primarily under dry conditions without significant disruption of water flow and minimized downstream turbidity. A depiction of typical flume construction techniques is provided in appendix C.

2.3.2.3 Horizontal Directional Drill Crossings

The HDD crossing method is typically used at large or sensitive waterbody crossings, major roadways, significant cultural resources, or other sensitive areas. The HDD method allows for construction without the excavation of a trench, by drilling a hole significantly below conventional pipeline depth, and pulling the pipeline through the pre-drilled hole. Columbia Gas would use HDDs to avoid direct impacts on sensitive resources and/or to avoid areas in which constructability by conventional means is not feasible.

Columbia Gas anticipates using the HDD method at seven entry/exit locations to facilitate construction across some highways and waterbodies. Some of these HDD locations include crossings of multiple waterbodies between each entry and exit point to avoid sensitive resources, as discussed further in section 4.3.2.4. Proposed HDD locations and crossing lengths are reflected in table 2.3.2-1. A depiction of typical HDD techniques, including site-specific plan and profile drawings, is provided in appendix C.

TABLE 2.3.2-1 Proposed Horizontal Directional Drill Crossings Associated with the LX Project			
	Approximate Milepost		
Name of HDD Crossing	Entry	Exit	Length (feet)
LEX			
Fish Creek	21.4	21.2	1,380
Ohio River (north)	25.2 RR-5	25.9 RR-5	3,371
Highway I-77	67.0	67.3	1,738
Muskingum River	89.3	89.7	2,529
Rush Creek	120.1	119.7	2,319
Hocking River[a]	130.5	130.4	120
Highway I-33	130.9	130.3	3,220
BM-111 Loop			
Ohio River (south)	0.0	1.1	5,555

[a] HDD crossing of the Hocking River is included in the HDD crossing of Highway I-33 and is not a separate entry/exit location.

To facilitate proposed HDD installations, Columbia Gas is planning to place an electric guide wire coil (closed loop system) along the ground surface between each HDD entry point and exit point, where possible. This coil is used to facilitate tracking of the location of down hole drilling equipment and to determine steering inputs during advancement of the pilot bore. Wireline guidance systems typically require two guide wires for HDD crossings that parallel the centerline of an installation with a variable spacing or offset on each side of the centerline depending on the depth of the particular HDD installation. The wires would be put in place by hand, which would require only hand cutting of side limbs to facilitate a walking path, as needed. Guide wires would stop at the water's edge, with no guide wire coil placed within the waterbody.

Following the completion of the pilot hole, reaming tools would be used to enlarge the hole to accommodate the pipeline diameter. The reaming tools would be attached to the drill string at the exit point and would then be rotated and drawn back to incrementally enlarge the pilot hole. During this process, drilling mud consisting of bentonite clay and water would be continuously pumped into the pilot hole to remove cuttings and maintain the integrity of the hole (sources and volumes of water for drilling mud are presented and further discussed in section 4.3.2.6). When the hole has been sufficiently enlarged, a prefabricated segment of pipe would be attached behind the reaming tool on the exit side of the crossing and pulled back through the drill hole towards the drill rig. In the event that a particular drill is unsuccessful, Columbia Gas would implement its Horizontal Directional Drill Contingency Plan (HDD Plan).[10]

2.3.2.4 Residential Areas

Where residences are located within 50 feet of the construction work area, ATWS or cathodic protection areas, Columbia Gas would reduce the work area as much as practicable to minimize inconvenience to property owners. Following completion of major construction activities, the property would be restored in compliance with Columbia Gas's ECS unless otherwise requested by the landowner. Columbia Gas has prepared site-specific Residential Construction Plans, included as appendix O, for

[10] Columbia Gas' HDD Plan is available on the FERC's eLibrary website at http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514 and Accession No. 20151023-5090, titled "20151023_CP15-514-000-29_VolI_RR01_App1E-1F.PDF" (Appendix 1F).

residences located within 50 feet of the project workspace. Residential areas crossed by the LX Project are identified and discussed further in section 4.8.3.

In general, when working near or adjacent to residential areas, Columbia Gas would:

- notify landowners no later than two weeks before the start of construction;
- maintain a minimum of 25 feet between the residence and construction workspace for a distance of 100 feet on either side of the residence;
- perform construction activities during daytime hours whenever feasible;
- install safety fencing 100 feet on either side of the residence to contain construction equipment in the workspace;
- obtain written approval from landowners within 10 feet of the project area, as indicated in the Residential Construction Plans;
- preserve trees and landscaping, when possible;
- restore lawns and landscaping to final restoration immediately after backfilling of the trench, weather depending;
- use specialized construction techniques, such as stovepipe or drag section techniques, where necessary to minimize disturbances to residences;
- backfill the trench within 30 days, unless otherwise authorized, and fence off open trenches at the end of the workday;
- avoid disruption to utilities, when possible, and notify landowner as soon as possible prior to utility disruption; and
- inspect road surfaces near residences and clean soil and debris from roads, if necessary.

Columbia Gulf would implement the following mitigation measures to limit impacts on nearby residences:

- conduct construction activities during daytime hours, whenever feasible;
- limit disruptions on utilities;
- provide notification to landowner should there be a need to disrupt utilities;
- notify adjacent landowners of construction at least two weeks prior; and
- inspect and clean road surfaces of nearby residences.

Stove Pipe Construction

The stove pipe construction method would be used in areas with limited workspace, and requires installation of a single length, or joint, of pipe (typically 40 feet) at a time. Following clearing and grading of the construction work area, the trench would be excavated to accommodate the installation of only one joint of pipe. A bell hole would be excavated at each end of the joint, to allow for safe entry and exit of the workspace while the newly installed joint of pipe is attached to the adjacent pipe segment. From this point, the general construction procedures above would be followed. Following construction completion, the trench would be backfilled to level ground within 15 or 20 feet of the working end of the joint. In areas where the soils contain large rocks or other materials that could damage the pipe or coating, the pipe may be wrapped with a protective wrap prior to padding and backfill. This process

would then be repeated. At the end of each work day, the working end of the ditch would be backfilled and temporarily stabilized or covered with a steel plate or mats and protected with safety fence.

The construction crew using the stove pipe construction method would be about one-third to one-fourth the size of a typical construction crew. Additionally, the amount of equipment used would be limited to that which is required at that point in construction. When a different piece of equipment or additional materials is required, it would be mobilized to the construction site from an off-site location.

Drag Section

The drag section construction method would be used in areas where there is insufficient space to assemble the pipe in place. This technique involves the trenching, installation, and backfill for a prefabricated section of pipe (i.e., drag section), typically containing several pipe segments. The trench is then backfilled and/or covered with steel plates or timber mats at the end of each work day. Adequate staging areas outside of residential congestion are required for assembly of the drag section. However, this construction method reduces the necessary timeframe for work to occur in a given location because the joint sections of the pipe are pre-assembled (bent, welded, x-rayed, and coated) in a nearby staging area.

2.3.2.5 Agricultural Areas

The trench would be excavated to a sufficient depth to allow for a minimum 4 feet of cover between the top of the pipe and the final land surface after backfilling and contour restoration. Columbia would conserve topsoil in all actively cultivated and rotated cropland and improved pasture. At least 12 inches of topsoil would be segregated in these areas. Topsoil would also be segregated in other areas at the specific request of the landowner. The topsoil and subsoil would be stored in separate spoil piles on the construction work area and would not be allowed to mix. Where topsoil is less than 12 inches deep, the actual depth of the topsoil would be segregated. Upon completing construction, Columbia Gas would coordinate with landowners to ensure that agricultural use of property minimizes impacts on pipeline operations. Agricultural areas crossed by the LX and RXE Projects are identified and discussed further in section 4.8.1.

2.3.2.6 Road Crossings

Paved roads encountered along the LX and RXE Project routes may be crossed via the use of open-cut or subsurface bores. Safe and accessible conditions would be maintained during construction at road crossings per the ECS. The open-cut method would typically be used for crossings of driveways, local roads, and small state roads with low traffic densities where pipeline installation activities would not adversely affect the general public.

The HDD or conventional bore methods would be used for crossings beneath the majority of public roads and all federal and major state highways. To complete a horizontal bore, a pit on either side of the road would be excavated to provide a working area for the equipment. A boring machine would be lowered into one pit, and a horizontal hole would be bored to a diameter slightly larger than the diameter of the pipe (or casing, if required) at the depth of pipeline installation. The pipeline section and/or casing would then be pushed through the bore to the opposite pit. If additional pipeline sections are required to span the length of the bore, they would be welded to the first section of the pipeline in the bore pit prior to being pushed through. ATWS would be required on both sides of the road crossing in order to complete the bore.

Where the construction work area or access roads intersect public paved roads, a construction entrance would be installed for access at construction work area entrances and as needed at additional access road locations. Trenches would be fenced or covered with steel plates during all non-working hours to control livestock and limit public access. To prevent work area sediment from being washed onto roads during a rain event, temporary and permanent ECDs would be installed adjacent to paved roads as needed. Additional information regarding public roads crossed by the project is provided in section 4.9.4. A depiction of typical road crossing techniques is provided in appendix C.

2.3.2.7 Rugged Terrain

Additional surface grading may be required in areas where the project crosses rugged topography. It may be necessary to grade steep slopes to a gentler slope to accommodate pipe bending limitations and safe working conditions. In these areas, the slopes would be cut down and, after the pipeline is installed, returned to original contours. In rugged terrain, temporary erosion control measures would require closer spacing and more frequent maintenance until permanent post- construction erosion control measures are established.

Although side slope terrain has been reduced to the maximum extent practicable during routing, severe side slopes may still be encountered. Side slope areas are where the project route crosses laterally across the face of a slope. Temporary cut-and-fill grading may be required to establish a safe, flat work terrace on side slopes. The upslope side of the construction corridor would be cut during grading. The material removed from the cut would be used to fill the downslope edge of the construction work area to provide a safe and level surface from which to operate the heavy equipment. As such, additional ATWS may be required downslope of side slope terrain to accommodate the fill material (see appendix E for a list of site-specific deviations from the FERC Plan and Procedures). During grade restoration, the spoil would be placed back in the cut and compacted to restore original contours. If necessary, springs or seeps found in the cut can be diverted off of the construction workspace to stable areas or carried downslope through drain pipes and/or gravel French drains that may be required as part of the cut restoration.

2.3.2.8 Blasting

Blasting may be required to excavate the trench in areas where bedrock is encountered at depths that interfere with conventional excavation or rock-trenching methods. If blasting is deemed necessary, a licensed subcontractor would be hired to conduct the blasting operations. Columbia Gas has developed a Blasting Plan[11] that establishes implementation procedures and safety measures that Columbia Gas would adhere to during construction. As part of the Blasting Plan, the Columbia Gas would:

- comply with pre-blasting requirements prior to the initiation of blasting operations;
- outline site-specific areas designated for blasting;
- comply with state-special conditions;
- monitor operations for ground vibration and airblast;
- consult with local water authorities that may be affected during blasting;

[11] Columbia Gas' Blasting Plan is available on the FERC's eLibrary website at http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514 and Accession No. 20151023-5090, titled "20151023_CP15-514-000-43_VolI_RR06_App6A-6F.PDF" (Appendix 6D).

- conduct a three axis seismic survey for each blast event within 300 feet of a Columbia Gas pipeline, unless otherwise permitted; and
- adhere to all federal, state, and local laws and regulations.

The subcontractor also would adhere to BMPs outlined in the ECS based on location, terrain, soil and rock types, and would use seismically monitored blasting techniques in compliance with federal and state regulations and include applicable mitigation measures such as the placement of blasting mats as appropriate.

Prior to blasting, the most up-to-date Blasting Plan and schedule would be submitted to FERC for notification should blasting occur within any designated coldwater fishery, and within any waterbody identified as habitat for federally listed threatened or endangered species. Blasting is further discussed in section 4.1.

2.3.2.9 Winter Construction

Winter construction techniques are required in some parts of the United States that experience extended periods of freezing conditions or heavy snowfall events. Winter construction techniques typically include snow management, working with frozen soils, and managing hydrostatic discharge water under freezing conditions. These techniques also include the application of temporary erosion and sediment control measures to protect against accelerated erosion during spring melt and heavy spring rains. These temporary controls are maintained during project construction and reinstalled as necessary until permanent ECDs are constructed and/or permanent stabilization has occurred. When winter construction conditions are encountered, Columbia Gas would implement its Winter Construction Plan, included in the ECS.

Pipeline Abandonment Procedures

Landowner notification, surveying, and staking of the temporary workspace and access roads associated with the proposed R-501 Abandonment would be conducted using the same general procedures described in section 2.3.1.1 for the new pipeline facilities. Prior to abandonment, the R-501 Line would be cleaned with water to remove any residual materials. Upon completion, the water would be transported off-site for proper disposal, in accordance with applicable federal and state regulations. Specific construction procedures would vary by site; however, activities would generally include abandoning the pipeline in place by cutting the pipe and capping with weld caps or a steel plate as well as relocating or removing all aboveground appurtenances. All removed piping and other materials would be disposed of by the contractor in accordance with all federal, state, and local regulations, with the exception of various appurtenant facilities that would be reinstalled along the proposed R-801 Loop.

2.4 CONSTRUCTION SCHEDULE

Pending all necessary authorizations and permits, Columbia Gas anticipates mobilization and construction of the LX Project to begin in November 2016 in order to meet its in-service date of November 1, 2017. Pending all necessary authorizations and permits, Columbia Gulf anticipates mobilization and construction of the RXE Project to begin in the 4th quarter of 2016 in order to meet its in-service date of November 1, 2017.

2.5 ENVIRONMENTAL COMPLIANCE INSPECTION AND MITIGATION MONITORING

2.5.1 Information Flow and Training

Columbia Gas and Columbia Gulf would include, whenever possible, implementation details in its construction drawings and specifications to ensure that the construction of the proposed facilities would comply with the FERC Certificate conditions, the mitigation measures identified in this report, and the requirements of other federal and state permitting agencies. Selected contractors would receive copies of design specifications, the ECS, the Stormwater Pollution Prevention Plan (SWPPP), and other environmental documents.

For mitigation measures that address pre-construction surveys and clearances, Columbia Gas and Columbia Gulf would provide pertinent correspondence and documentation to the pipeline contractor(s). For those mitigation measures that address permit conditions from federal and state agencies, Columbia Gas and Columbia Gulf would provide copies of permits and related drawings. For those mitigation measures that, in part, address post-construction requirements, Columbia Gas and Columbia Gulf engineers would provide instructions and documentation to operating personnel following the completion of the construction. Columbia Gas and Columbia Gulf would require selected contractors to install facilities according to Columbia Gas, Columbia Gulf, and DOT specifications, specific permit conditions, and the terms of the negotiated contract.

To specifically support the application of proper field construction methods, Columbia Gas and Columbia Gulf would adhere to the ECS, and the SWPPP, except where requested otherwise (see appendix E).

Columbia Gas and Columbia Gulf would conduct environmental training for its field personnel and the contractor's personnel regarding proper field implementation of the ECS, other site-specific environmental documents, regulatory conditions, and other mitigation measures. Columbia Gas and Columbia Gulf would provide copies of permits and related drawings to all personnel prior to the start of construction and ensure that all entities understand the proper procedures for construction, stabilization, and restoration.

2.5.2 Environmental Inspection

For purposes of quality assurance and compliance with mitigation measures, applicable regulatory requirements, and Columbia Gas and Columbia Gulf specifications, Columbia Gas and Columbia Gulf would be represented by at least one environmental inspector (EI) per construction spread. If necessary, additional EIs may be assigned to each spread. Columbia Gas and Columbia Gulf would also require the contractor to provide at least one environmental foreman (i.e., compliance specialist), and a crew for each construction spread. The environmental foreman would be responsible for the successful installation and maintenance of ECDs by the contractor and for construction in environmentally sensitive areas.

The EI position is a full-time position. The EIs would report directly to the Natural Resource Permitting Manager and coordinate with the Chief Inspector for Columbia Gas and Columbia Gulf, and would have stop-work authority. The EIs' duties would be consistent with those contained in paragraph II.B (Responsibilities of Environmental Inspectors) of the FERC Plan and would include ensuring compliance with environmental conditions from FERC's Certificate, Columbia Gas' and Columbia Gulf's environmental designs and specifications, and other permits or authorizations. An adequate number of copies of the construction drawing package would be distributed to Columbia Gas' and Columbia Gulf's inspectors and to the contractors' supervisory personnel. If the contractor's performance is

unsatisfactory, the terms of the contract would allow Columbia Gas and Columbia Gulf to stop work in progress and cause a contractor to begin remedial work. At a minimum, the EI would be responsible for:

- inspecting construction activities for compliance, ensuring compliance with the requirements of the Environmental Management and Construction Plan, ECS, and any permits, landowner agreements, or FERC certificates obtained for the project, and identifying, documenting, and overseeing corrective actions, as necessary for compliance;
- verifying that the limits of authorized construction workspaces and locations of access roads are properly marked before clearing, and maintained throughout construction;
- verifying the location of drainage and irrigation systems;
- identifying, installing, maintaining, and inspecting erosion/sediment control and stabilization areas;
- ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification, or as soon as conditions allow;
- ensuring that the design of slope breakers would not cause erosion or direct water into sensitive environmental resource areas, including cultural resource sites, wetland, waterbodies, and sensitive species habitat;
- verifying that trench dewatering activities are properly monitored, discharged, and maintained;
- verifying the testing of subsoil and topsoil in agricultural and residential areas to measure compaction and determine the need for corrective action;
- advising the Chief Inspector when conditions make it advisable to restrict construction activities in agricultural areas;
- verifying that the soils imported for agricultural or residential use are noxious weed and soil pest free, unless otherwise approved by the landowner;
- keeping records of compliance and mitigation measures during active construction and restoration;
- identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase, including ensuring restoration of contours and topsoil;
- establishing a program to monitor the success of restoration. Implementation of this program may be transferred to (Field Services) upon completion of construction and restoration activities;
- identifying areas of contamination and following proper procedures for contaminated areas, including hazardous waste cleanup;
- verifying the location of signs and visible flagging marking the boundaries of wetlands, waterbodies other sensitive resource areas, or areas with special requirements along the construction workspace; and
- ensuring proper disposal of excess construction material.

Columbia Gas' and Columbia Gulf's engineering and construction departments are responsible for designing and constructing certificated facilities in compliance with regulatory and non-regulatory requirements and agreements. Any issues of non-compliance with mitigation measures or other

regulatory requirements that cannot be solved in the field would be addressed by the Project Manager and the Natural Resource Permitting Manager for Columbia Gas and Columbia Gulf. Routine reporting or specific communication with the FERC staff regarding design, installation, and maintenance of the facilities described in this Application would be the responsibility of Columbia Gas' and Columbia Gulf's Natural Resource Permitting Department. FERC staff inquiries regarding these proposed facilities should be addressed to Columbia Gas' and Columbia Gulf's Natural Resource Permitting Department accordingly.

2.5.3 FERC Third-Party Compliance Monitoring

Columbia Gas and Columbia Gulf have committed to funding a separate FERC third-party compliance monitoring program during the construction phase of each project. Under this program, a contractor, is selected by, managed by, and reports solely to the FERC staff to provide environmental compliance monitoring services. The FERC Third-party Compliance Monitor would provide daily reports to FERC on compliance issues and make recommendations to the FERC Project Manager on how to deal with compliance issues and construction changes, should they arise. In addition to this program, FERC staff would also conduct periodic compliance inspections during all phases of construction.

2.5.4 Post-Approval Variance Process

The pipeline alignment and work areas identified in this final EIS should be sufficient for construction and operation (including maintenance) of the projects. However, minor route realignments and other workspace refinements sometimes continue past the project planning phase and into the construction phase. These changes could involve minor route realignments, shifting or adding new extra workspaces or staging areas, adding additional access roads, or modifications to construction methods. We have developed a procedure for assessing impacts on those areas that have not been evaluated in this final EIS and for approving or denying their use following any Certificate issuance. In general, biological and cultural resources surveys were conducted using a survey corridor larger than that necessary to construct the facilities. Where survey approvals were denied, Columbia Gas and Columbia Gulf would complete the required surveys following a Certificate issuance. If Columbia Gas and Columbia Gulf requests to shift an existing workspace or require a new extra workspace subsequent to issuance of a Certificate, these areas would typically be within the previously surveyed area. Such requests would be reviewed using a variance request process.

2.5.5 Post-Construction Monitoring

After construction, Columbia Gas and Columbia Gulf would conduct follow-up inspections of all disturbed upland areas after the first and second growing seasons to determine the success of restoration. Restoration of upland areas would be considered successful if the right-of-way vegetation is visually successful in density and cover, surface conditions are similar to adjacent undisturbed lands, construction debris is removed, and proper drainage has been restored. For at least 2 years following construction, Columbia Gas and Columbia Gulf would submit quarterly reports to FERC that document any problems identified by Columbia Gas and Columbia Gulf or landowners and describe the corrective actions taken to remedy those problems. Columbia Gas and Columbia Gulf would follow measures outlined in their ECSs, as well as additional management and control measures to minimize the spread of invasive species. However, we are recommending in section 5.2 that Columbia Gas and Columbia Gulf prepare and submit an invasive species management plan that addresses post-construction monitoring requirements for invasive species. In accordance with their ECPs, Columbia Gas and Columbia Gulf would monitor the success of wetland revegetation annually for the first 3 years (or as required by permit) after construction or until wetland revegetation is successful. Wetland revegetation would be considered successful when the cover of herbaceous and/or woody species is at least 80 percent of the type, density, and distribution

of the vegetation in adjacent undisturbed wetland areas or as compared to documented, pre-project conditions. In accordance with their ECSs, if revegetation is not successful at the end of 3 years, Columbia Gas and Columbia Gulf would develop and implement (in consultation with a professional wetland ecologist) a plan to actively revegetate the wetland with native wetland herbaceous and woody plant species.

After construction, the FERC, cooperating agencies, and/or other agencies would continue to conduct oversight inspection and monitoring to assess the success of restoration. If it is determined that the success of any of the restoration activities is not adequate at the end of the respective timeframes, Columbia Gas and Columbia Gulf would be required to extend its post-construction monitoring programs.

2.6 OPERATION, MAINTENANCE, AND SAFETY CONTROLS

Columbia Gas and Columbia Gulf would operate and maintain the newly constructed project facilities in the same manner as it currently operates and maintains its existing system and in accordance with any restrictions or conditions specifically applied to the projects. It is anticipated that the projects would result in the need for 15 to 20 operations personnel. The proposed pipelines and aboveground facilities would be patrolled on a routine basis and personnel well-qualified to perform both routine and extraordinary maintenance on interstate pipeline facilities would handle all maintenance.

The following sections provide specific details on standard operating and maintenance procedures for permanent easement areas, including erosion control procedures and periodic pipeline right-of-way patrols.

2.6.1 Permanent Erosion Controls

If necessary, permanent structural controls would be installed and maintained to accomplish maximum stabilization, prevent erosion, and control sedimentation. Permanent erosion controls would be installed at the base of sloped approaches to streams, wetlands, and roads and at the edge of the construction areas as needed to prevent siltation into waterbodies and wetlands downslope of the construction area (e.g., swales and side slopes). These measures would also be installed in non-agricultural and residential areas with slopes.

In accordance with the ECS, restoration activities would begin within six days of final grading, weather and soil conditions permitting. Revegetation in non-agricultural areas shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. In agricultural areas, revegetation should be considered successful if crop yields are similar to adjacent undisturbed portions of the same field, unless the easement agreement specifies otherwise. To facilitate revegetation and soil stabilization, permanent seeding, liming, and fertilizing may be performed by the landowner. The Environmental Inspector will ensure that the restoration is satisfactory and consistent with the regulatory requirements.

2.6.2 Pipeline Facilities

During periodic pipeline right-of-way patrols, permanent ECDs installed during construction would be inspected to verify that they are functioning properly. If necessary, additional permanent or temporary ECDs may be installed and maintained to accomplish maximum stabilization, prevent erosion, and control sedimentation. In addition, attention would be given to:

- erosion and wash-outs along the right-of-way;

- performance of water control devices such as diversions;
- condition of banks at stream and river crossings;
- fallen timber or other threats to the pipeline;
- general health of vegetation planted during construction; and
- other conditions that could damage the pipeline or create unsafe operating conditions.

The local operations supervisor would be notified of any conditions requiring attention, and corrective measures would be performed, as needed.

Vegetation on the permanent easement would be maintained by mowing, cutting, and trimming to prevent the establishment of trees or deep-rooted shrubs that could damage the protective coating on the pipeline, obscure periodic surveillance, or interfere with potential repairs. In accordance with the ECS, Columbia Gas may maintain a cleared path within the permanent easement not exceeding 10 feet in width in upland areas, as necessary, and may maintain the entire 50-foot-wide permanent easement no more frequently than every three years. Columbia Gas would not conduct vegetation clearing for maintenance of the full 50-foot-wide permanent easement between April 15 and August 1. Vegetation maintenance would normally not be required in agricultural or pasture areas.

Columbia Gas may also maintain a 10-foot-wide cleared permanent easement through wetlands in accordance with the ECS. In addition, in forested wetlands, trees within 15 feet of the pipeline with roots that could compromise the integrity of pipeline coating would be selectively cut and removed from the permanent easement to maintain pipeline integrity. The pipeline facilities would be clearly marked at line-of-sight intervals and at crossings of roads and other key points or resources. The markers would clearly indicate the presence of a pipeline and provide a telephone number and address where a company representative may be reached in the event of an emergency or before a third party commences any excavation in the area of the pipeline. Columbia Gas and Columbia Gulf participate in all One-Call systems and would clear all excavations with the state-specific One-Call service prior to work.

2.6.3 Aboveground Facilities

Columbia Gas and Columbia Gulf would operate and maintain the proposed aboveground facilities. Personnel would perform routine checks of these facilities, including calibration of equipment and instrumentation, inspection of critical components, and scheduled and routine maintenance of equipment and grounds. Vegetation within the fenced portion of the aboveground facilities would be maintained as needed. Operational testing would be performed on safety equipment to ensure proper function. Corrective actions would be taken as necessary if issues are identified.

3.0 ALTERNATIVES

As required by NEPA, FERC policy, and CWA 404(b)(1) guidelines, we evaluated alternatives to the proposed LX and RXE Projects to determine whether an alternative would be environmentally preferable and/or technically and economically feasible to the proposed actions. We evaluated the no-action alternative, energy alternatives, system alternatives, route alternatives and variations, and aboveground facility alternatives. We compared each alternative to the corresponding segment of the proposed LX and RXE Projects using the following three key criteria:

1. Does the alternative have the ability to meet the objectives of the proposed action?

2. Is the alternative technically and economically feasible and practical?

3. Does the alternative offer a significant environmental advantage over the Projects?

With regard to the first criterion, Columbia Gas' and Columbia Gulf's stated objectives of the LX and RXE Projects are to:

- deliver up to a total of 2,121,000 Dth/d of natural gas supply from the existing production region to areas of higher demand, premium markets;
- provide additional pipeline capacity, as needed, to connect these existing gas-producing regions with market areas within and outside of Ohio;
- abandon in-place and replace the capacity thereby increasing the integrity to both the Columbia Gas system and its storage customers (LX Project); and
- increase the capacity of Columbia Gulf's existing pipeline system by adding compression to provide natural gas transportation and compression services (RXE Project).

It is important to note that not all conceivable alternatives are technically feasible or practical. Some alternatives may be incapable of being implemented due to limits on existing technologies, constraints of system capacities, or logistical considerations, while others may be impractical because sites are unavailable or cannot be developed for the proposed use. Additionally, it is necessary to recognize the environmental advantages and disadvantages of the proposed action in order to focus the analysis on reasonable alternatives with the potential to provide a significant environmental advantage over the LX and RXE Projects. Some alternatives may reduce impacts on resources that are not relevant to the analysis or do not provide a significant environmental advantage over the proposed action. Other alternatives may reduce impacts on one resource but increase impacts on others.

Our analysis of each alternative as described in the subsections below is based on information provided by Columbia Gas and Columbia Gulf and reviewed by FERC staff; our review of aerial photographs, U.S. Geological Survey(USGS) topographic maps, National Wetlands Inventory (NWI) maps, data from the National Land Cover Database, and other publicly available information.

For the proposed LX Project, Columbia Gas participated in our pre-filing process (see section 1.3) during the preliminary design stage. This process emphasizes identification of potential stakeholder issues early in the development of a project, as well as identification and evaluation of alternatives that may avoid or minimize these issues. During this process, Columbia Gas made multiple modifications to its proposed pipeline route and other LX Project components to address stakeholder or landowner concerns that would be directly affected by the proposed Project facilities. The majority of route changes were made to avoid conflicts with existing or planned land uses or to increase the distance of the pipeline route from residences and commercial businesses, recreation areas, or other infrastructure. These changes

were subsequently made part of Columbia Gas' proposed route when it filed its FERC application and supplements, and are presented in this EIS.

3.1 NO-ACTION ALTERNATIVE

When processing applications under section 7 of the NGA, the Commission has two courses of action: 1) deny the requested action (the no-action alternative), or 2) grant the Certificate, with or without conditions. If the no-action alternative is selected by the Commission, the proposed facilities would not be constructed, the impacts identified as a result of the proposed project would not occur, and the objectives of the project would not be met. This alternative would eliminate additional pipeline capacity to allow the transportation of natural gas production out of the pipeline capacity-constrained basin to areas of higher market demand, causing existing and potential users of natural gas to either pursue other means of natural gas supply, to rely on other fuels (such as heating oil), or to seek other means to meet or curtail their energy needs.

If Columbia Gas' proposed LX facilities are not constructed, the Project shippers may need to obtain an equivalent supply of natural gas from new or existing pipeline systems. In response, Columbia Gas or another natural gas transmission company would likely develop a new project or projects to provide the volume of natural gas contracted through the project's binding precedent agreements with the project shippers. If the RXE Project is not constructed, Columbia Gulf would not have the ability to meet its obligations to its customers to increase the capacity of its existing pipeline system by adding compression at an existing station to provide natural gas transportation and compression services. Alternatively, customers of the project shippers could seek to use alternative fuel or renewable energy sources, which could require new facilities. While these projects could potentially deliver equivalent amounts of energy, they would not fulfill the purpose and need of the LX and/or RXE Projects, which as stated in section 2.0, which is to provide additional pipeline capacity, as needed, to connect existing gas-producing regions with market areas within and outside of Ohio for both Projects' shippers. Additionally, construction of new pipelines or other non-natural gas energy infrastructure would result in environmental impacts that could be equal to or greater than those of the Projects.

For these reasons, the no action alternative for either project would not be preferable to or provide a significant environmental advantage over the LX and RXE Projects.

3.2 SYSTEM ALTERNATIVES

3.2.1 Leach XPress

3.2.1.1 Existing Transportation System Alternatives

System alternatives would make use of other existing, modified, or proposed pipeline systems (or other transportation systems) to meet the stated objectives of the LX Project. A system alternative would make it unnecessary to construct all or part of the proposed LX Project, although some modifications and/or additions to other existing pipeline systems may be required to increase its capacity, or another entirely new system may need to be constructed to meet the Project's purpose and need. Such modifications or additions would result in environmental impact that could be less than, similar to, or greater than those associated with construction of the proposed Project. The purpose of identifying and evaluating system alternatives is to determine whether potential environmental impacts associated with the construction and operation of the proposed facilities could be avoided or reduced while still meeting the basic objectives of the Project.

To be a practicable system alternative to the LX Project, other systems or modified systems would need to meet Columbia Gas' stated objectives (section 3.0) and be both technically feasible and practicable. The objectives crucial to the evaluation of system alternatives would be their ability to:

- deliver up to 1,500,000 Dth/d of natural gas supplies from connections to Columbia Gas' existing pipeline system and third-party systems in the Majorsville, West Virginia, and Clarington, Ohio areas to the existing R-System located near the Crawford CS in Fairfield County, Ohio;
- transport additional portions of the new capacity from central Ohio to the existing Ceredo CS in Wayne County, West Virginia for further transport southwest to various markets and interconnect points on Columbia Gas' system;
- abandon 28.2-miles of Line R-501 to improve operational reliability of the R-System;
- be constructed and placed into service within a timeframe reasonably similar to the LX Project; and
- meet the criteria above with reduced environmental impacts when compared with the LX Project.

Figure 3.2.1-1 provides a geographic overview of the proposed project area for the LX Project. Figure 3.2.1-1 also illustrates the relative locations of other existing interstate natural gas pipelines in the vicinity of the LX Project. The status of existing systems is described below in section 3.2.2.

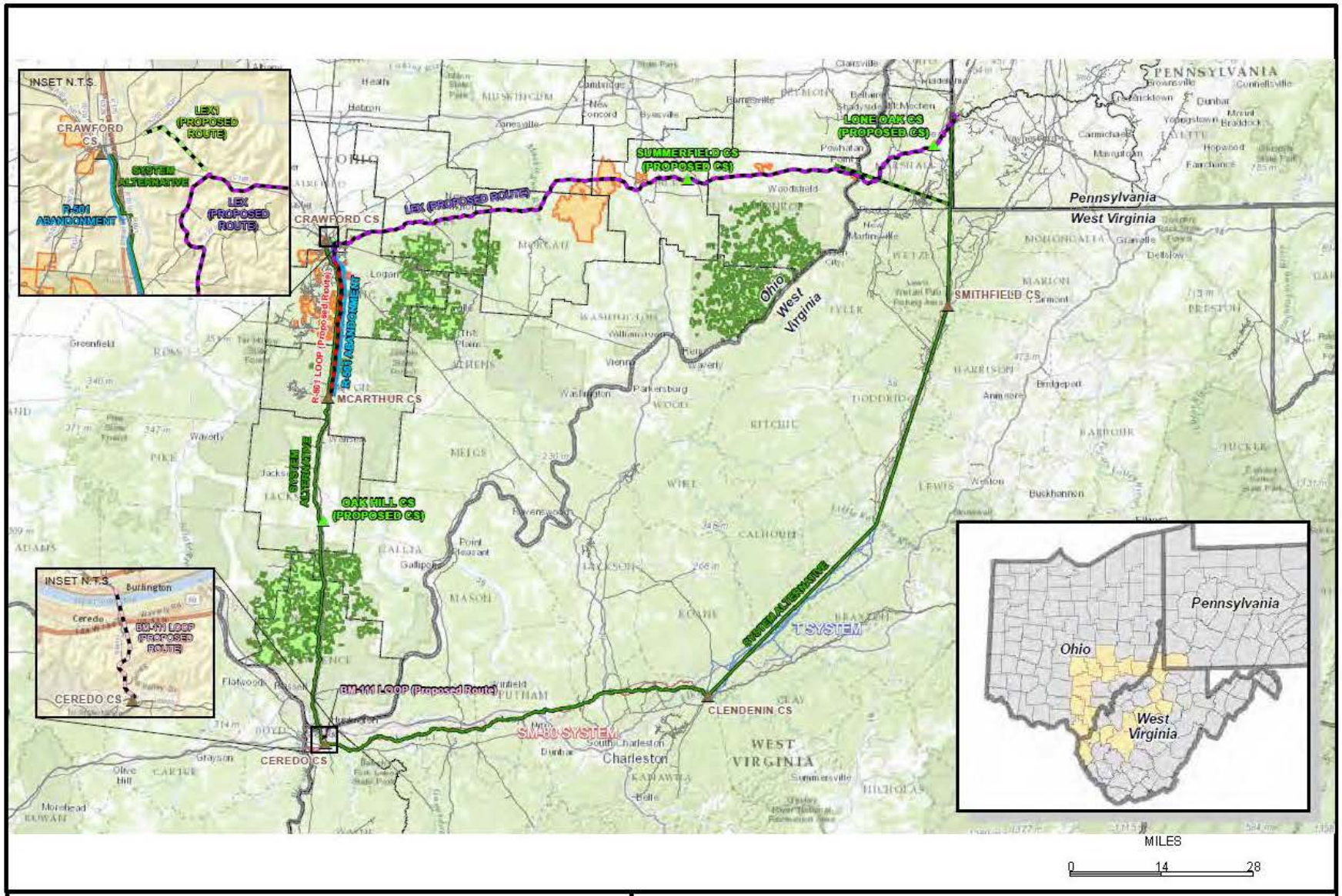
3.2.1.2 Expansion of Existing Pipeline Systems

We reviewed an alternative to the proposed LX Project facilities involving expansion of Columbia Gas' existing T- and SM-80 systems, as depicted in figure 3.2.1-1. This would allow shippers participating in the proposed LX Project area to obtain transportation for natural gas via Columbia Gas' existing pipeline systems located near the Crawford CS in Fairfield County, Ohio and the Ceredo CS in Wayne County, West Virginia.

Providing new capacity from Columbia Gas' system in Majorsville, West Virginia, and Clarington, Ohio to the existing T- and SM-80 systems would likely require construction of two new pipelines. Transporting the proposed volumes at the operating pressures needed at the Ceredo CS for markets outside of Ohio would require looping of the entire T- and SM-80 systems. Looping would also occur along the Line BM-111 in addition to the entirety of the existing R-System from the Ceredo CS north to the point of connection near the Crawford CS to supply the Ohio customers.

Two of Columbia Gas' existing compressor stations would require installation of additional compression, including about 12,600 hp of new compression at the Smithfield CS in Wetzel County, West Virginia and about 20,200 hp at the Clendenin CS in Kanawha County, West Virginia. To support supply pressure for further transportation through central Ohio, Columbia Gas would have to install additional compression at the existing Crawford CS in Fairfield County, Ohio. Additionally, this alternative would require the construction of a new 14,100 hp compression station along Columbia Gas' existing R-System in Jackson County, Ohio.

This system alternative would be 148.5 miles longer than the proposed route and would affect 20 percent more forested land. Looping of the systems would increase land disturbance and would delay the in-service schedule. Additionally, this alternative would cross the Wayne National Forest multiple times, including two scenic byways that transect the park. This alternative would also affect more populated areas than the proposed LX Project.



NEW COMPRESSOR STATION (CS)
EXISTING COMPRESSOR STATION (CS)
LEX (131.32 miles)
R-801 LOOP (24.16 miles)
LEX1 (1.22 miles)
BM-111 LOOP (2.85 miles)
SYSTEM ALTERNATIVE (GREENFIELD)
SYSTEM ALTERNATIVE (CO-LOCATED)
R-501 ABANDONMENT (28.21 miles)
EXISTING COLUMBIA PIPELINE
ODNR MANAGED AREAS
WAYNE NATIONAL FOREST

Figure 3.2.1-1
Leach XPress Project
Systems Alternatives Map

Due to increased land disturbance, construction duration as a result of the increase in pipeline length, and overall costs as well as the potential for increased impacts on residential properties and sensitive resources, we do not consider the expansion of Columbia Gas' existing T- and SM-80 systems to be preferable to the proposed route.

3.2.1.3 Modification of Existing Pipeline Systems

We evaluated the feasibility of using Columbia Gas' existing R-System pipelines, in addition to construction of new 20-inch-diameter pipeline looping, to increase capacity of natural gas from the connection with the proposed LX pipeline in Fairfield County, Ohio south to markets outside of Ohio. However, this alternative would not address the proposal to abandon in-place a 28.2-mile segment of Line R-501, which is one of the goals of the proposed LX Project to improve the overall operational reliability of the R-System. Additionally, increasing the pipeline diameter from 20 to 36 inches, as proposed, would increase the overall capacity of the R-System via construction of a single new relay compressor station near Oak Hill, Ohio. Via Columbia Gas' Modernization Program,[12] Columbia Gas' existing customers have agreed to share in the cost of the abandonment of this segment of the Line R-501, thereby generating benefits to both existing customers and customers associated with the proposed LX Project. Therefore, because this alternative would not meet the LX Project or system objectives, it was dismissed from further consideration.

3.2.2 Rayne XPress Expansion

To be a viable system alternative to the RXE Project, potential system alternatives must meet the following criteria:

- capable of transporting up to 621,000 Dth/d of natural gas to the Gulf Mainline Pool;
- capable of being constructed and placed into service within a timeframe reasonably similar to the RXE Project; and
- able to meet the criteria above with reduced environmental impacts when compared to the RXE Project.

Shippers participating in the proposed RXE Project are primarily seeking transportation for natural gas to the southern region via the existing Columbia Gulf Main Line pipeline system. Existing facilities along the Columbia Gulf's pipeline system would not be capable of delivering 621,000 Dth/d without new pipeline, compression, or looping in some combination. We evaluated varying numbers of compressor stations that would need to be modified to meet the purpose and need of the RXE Project, but none offered any significant environmental advantage over the proposal, so none were considered further in this analysis.

3.3 MAJOR ROUTE ALTERNATIVES AND MINOR ROUTE ALTERNATIVES

Major route alternatives include those that deviate from the LX Project's proposed LEX Pipeline route for a significant distance, often a majority or more of the proposed route's length, and which provide a substantially different pathway from the source area to the delivery area. Minor route alternatives deviate from the proposed route less substantially than major route alternatives, are often designed to avoid large environmental resources or engineering constraints, and typically remain within the same general area as the proposed route. Minor route alternatives are typically site-specific and may allow for avoidance of certain localized features such as a home or wetland.

[12] Columbia Gas Transmission, LLC, Order Approving Contested Settlement, 142 FERC § 61,062 (2013).

This assessment includes route alternatives identified by FERC staff, landowners, municipalities, and other stakeholders. Our assessment of the environmental consequences of the route changes already incorporated by Columbia Gas into its proposed route is included as part of our environmental analysis of the proposed LX Project in section 4.0.

3.3.1 Major Route Alternatives

We evaluated two major route alternatives to the proposed LEX Pipeline route to identify the most environmentally sound and technically feasible route for the transportation of natural gas from the proposed connections in the Majorsville, West Virginia and Clarington, Ohio areas to the proposed connection with Columbia Gas' existing R-System located near the Crawford CS in Fairfield County, Ohio. These route alternatives are shown in figure 3.3.1-1, and discussed in section 3.3.1.1 below.

We also considered the need for route alternatives to the R-801 Loop or BM-111 Loop, as discussed here. However, construction of the proposed R-801 Loop would provide optimal discharge pressure required for a system design to accommodate additional capacity created by the proposed LX Project through construction of one new relay compressor station near Oak Hill in Jackson County, Ohio. Construction of the BM-111 Loop would expand the capacity of the existing Line BM-111 near the existing Burlington Meter Station in Lawrence County, Ohio, which serves as a point of connection for lines R-500, R-601, and R-70, as required to accommodate the new capacity associated with the proposed LX Project. Additionally, the use of co-location with the R-801 Loop and the BM-111 Loop further minimizes environmental impacts. Therefore, in our review, we did not identify any preferable route alternatives that had an environmental advantage to constructing the R-801 Loop and the BM-111 Loop.

3.3.1.1 Alternative 1

Alternative 1 was evaluated to assess the potential environmental impacts associated with routing the proposed LEX Pipeline through flatter terrain to arrive at a comparable endpoint near the existing Crawford CS. Alternative 1 consists of 138.9 miles of new 36-inch-diameter natural gas pipeline from the proposed launcher facility located at the existing MarkWest Plant, extending to the existing Crawford CS. Alternative 1 deviates from the proposed route at MP 28.3 where it turns northwest and extends through Belmont and Guernsey Counties, Ohio and around the city of Cambridge. Alternative 1 turns southwest across Muskingum, Perry, and Fairfield Counties, Ohio, before terminating at the existing CS. Constructed aboveground facilities for this alternative would be comparable to those of the proposed route. Alternative 1 would disturb about 123.0 more acres of land than the current proposed route. A comparative analysis of environmental impacts of the proposed route and Alternative 1 is presented in table 3.3.1-1.

Alternative 1 would be 6.5 miles longer than the corresponding segment of the proposed route. Additionally, Alternative 1 would affect a greater amount of forested land than the proposed route. Alternative 1 would cross the Blue Rock State Forest twice, affecting 1.2 miles of the area, whereas the proposed route would not affect the Blue Rock State Forest. The Blue Rock State Forest consists of about 4,500 acres of land and contains sensitive forest ecosystems and recreational areas managed by the Ohio Department of Natural Resources (ODNR) Division of Forestry (ODNR, 2011). Alternative 1 would affect 103 residences within 100 feet, as opposed to the 6 residences that occur within 100 feet of the proposed route. As a result of increased impacts on environmental resources and residential areas, we have removed Alternative 1 from further consideration, as this alternative does not offer a significant environmental advantage.

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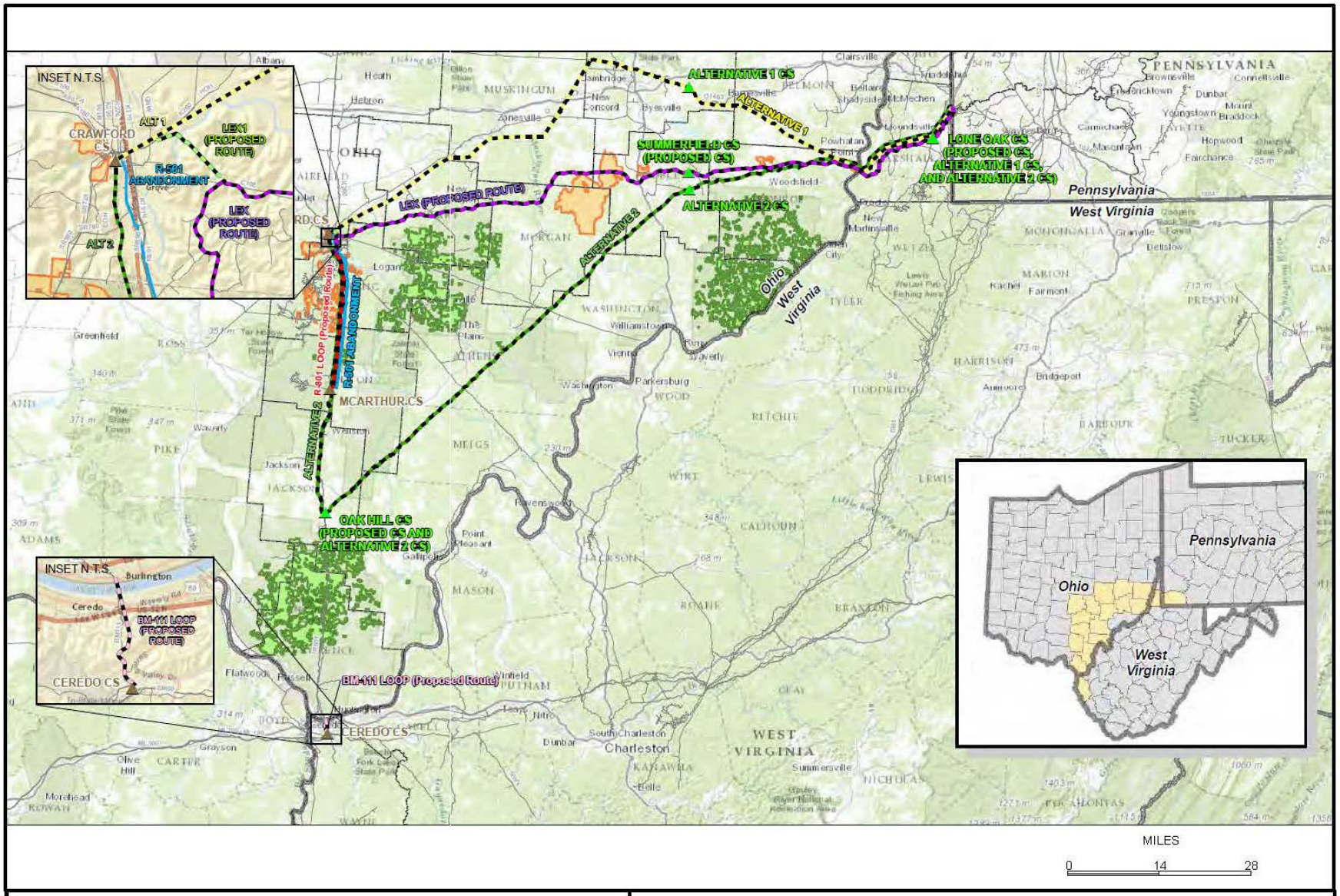


NEW COMPRESSOR STATION (CS)
EXISTING COMPRESSOR STATION (CS)
LEX (131.32 miles)
R-801 LOOP (24.16 miles)
LEX1 (1.22 miles)
BM-111 LOOP (2.85 miles)
ALTERNATIVE 1
ALTERNATIVE 2
R-501 ABANDONMENT (28.21 miles)
EXISTING COLUMBIA PIPELINE
ODNR MANAGED AREAS
WAYNE NATIONAL FOREST

Figure 3.3.1-1
Leach XPress Project
Pipeline Alternatives Map

TABLE 3.3.1-1
Pipeline Route Alternative 1 Comparison for the LX Project

Category	Proposed Route	Alternative 1
Route Length (miles)	132.4	138.9
Total Land Disturbance (acres) [a]	1,796.2	1,919.3
Percent Adjacent to Existing Right-of-Way	32	32
Roads Crossed		
Minor Roads Crossed	109	181
Major Roads Crossed	40	36
Total Road Crossings	149	218
Residences within 100 feet [b]	6	103
Federal Lands Crossed [c]	0	0
Federal Lands within 0.25 mile [b]	0	0
State Lands Crossed [c]	1	2
State Lands within 0.25 mile [b]	1	1
Land Use (percent)		
Agriculture	31	27
Forest	55	60
Wetland	1	<1
Open Water	<1	<1
Open	12	7
Developed	1	6
Waterbodies Crossed [d]		
Minor Waterbody Crossings	460	367
Intermediate Waterbody Crossings	55	31
Major Waterbody Crossings	5	5
Total Waterbody Crossings	*520*	*403*
Wetland Impact (percent)		
Non-forested (PEM) Wetland	1	<1
Forested (PFO) Wetland	<1	<1
Total Wetland Impact	*1*	<1

[a] Impacts for the proposed and alternative routes are based on a 125-foot construction corridor for the first 40 miles and a 110-foot construction corridor for the remaining pipeline length. Impacts for the alternative routes do not account for reduction of workspace in wetland areas or workspace associated with aboveground facilities.

[b] Distance is measured from the pipeline centerline.

[c] Includes only lands crossed by the pipeline centerline.

[d] Includes only waterbodies crossed by the pipeline centerline.

3.3.1.2 Alternative 2

We evaluated Alternative 2 to assess the potential environmental impacts associated with routing the proposed LEX Pipeline parallel to an existing Texas Eastern Transmission, LP pipeline. Alternative 2 follows the proposed route until MP 28.2, where it continues slightly northwest then southwest for 117.6 miles across Monroe, Noble, Morgan, Washington, Athens, Meigs, Vinton, and Gallia Counties. It then intersects with the proposed Oak Hill CS in Jackson County, Ohio. To connect to the existing Crawford CS in Fairfield County Ohio, an additional 51.4 miles of pipeline loop north along the R-System would have to be installed. Alternative 2 would still require the construction of the Lone Oak CS and a new compressor station with comparable specifications to the Summerfield CS. Additional compression would be needed at the existing Crawford CS but would not require a new compressor station near Oak Hill, Ohio. A comparative analysis of environmental impacts of the proposed route and Alternative 2 is presented in table 3.3.1-2.

While a majority of Alternative 2 is adjacent to existing pipeline easements, an additional 67.9 miles of construction corridor, compared to the proposed route, would be required. Due to the extended length of pipeline needed, this alternative would have a greater land impact. Additionally, Alternative 2 would cross 0.9 mile of the Cooper Hollow Wildlife Area in Jackson County, Ohio. The Cooper Hollow Wildlife Area contains more than 5,420 acres of land, with over 50 percent composition of forested areas and is managed by the ODNR for wildlife species associated with these forested habitats as well as for recreational purposes. Construction within the wildlife area would require tree clearing in addition to potentially affecting recreational areas supported by area (ODNR, 2012).

We have removed Alternative 2 from consideration due to the potential for greater impacts on forested areas, other wildlife habitat, and protected public resources associated with crossing the Cooper Hollow Wildlife Area, as this alternative does not offer a significant environmental advantage.

3.3.2 Minor Route Alternatives

Although they can extend for several miles, minor route alternatives deviate from the proposed route less substantially than major route alternatives. Minor route alternatives are often designed to avoid large environmental resources or engineering constraints, and typically remain within the same general area as the proposed route.

In the draft EIS, we evaluated one minor route alternative, known as Deviation H, which was developed to evaluate areas in which two other FERC-regulated pipeline projects (the Energy Transfer Rover Pipeline Project (Rover) and the Texas Eastern Transmission, LP's Appalachian Lease Project) have proposed routes similar to that of the LEX Pipeline segment in Monroe County, Ohio. In response to a FERC information request, Rover and Columbia Gas reached an agreement in early July of 2016 to design their respective pipeline facilities in a manner such that both pipelines would be constructed and operated within a mutual new permanent 50 foot right-of-way located on the south side of Texas Eastern's right-of-way as described in section 2.1.1. This new agreement between Rover and Columbia Gas addresses the purpose of the previously considered Deviation H. Therefore, we are no longer considering Deviation H.

TABLE 3.3.1-2 Pipeline Route Alternative 2 Comparison for the LX Project		
Category	**Proposed Route [e]**	**Alternative 2**
Route Length (miles)	132.4	199.2
Total Land Disturbance (acres) [a]	1,796.2	2,703.4
Percent Adjacent to Existing Right-of-Way	32	59
Roads Crossed		
Minor Roads Crossed	109	243
Major Roads Crossed	40	41
Total Road Crossings	149	284
Residences within 100 feet [b]	6	2
Federal Lands Crossed [c]	0	0
Federal Lands within 0.25 mile [b]	0	0
State Lands Crossed [c]	1	2
State Lands within 0.25 mile [b]	1	3
Land Use (percent)		
Agriculture	31	24
Forest	55	56
Wetland	1	<1
Open Water	<1	<1
Open	12	12
Developed	1	6
Waterbodies Crossed [d]		
Minor Waterbody Crossings	460	460
Intermediate Waterbody Crossings	55	52
Major Waterbody Crossings	5	2
Total Waterbody Crossings	*520*	*514*
Wetland Impact (percent)		
Non-forested (PEM) Wetland	1	<1
Forested (PFO) Wetland	<1	<1
Total Wetland Impact	*1*	<1

[a] Impacts for the proposed and alternative routes are based on a 125-foot-wide construction corridor for the first 40 miles and a 110-foot-wide construction corridor for the remaining pipeline length. Impacts for the alternative routes do not account for reduction of workspace in wetland areas or workspace associated with aboveground facilities.

[b] Distance is measured from the pipeline centerline.

[c] Includes only lands crossed by the pipeline centerline.

[d] Includes only waterbodies crossed by the pipeline centerline.

[e] Includes the impacts of the area that closely overlaps the Rover Pipeline which also shares a common workspace.

3.3.3 Minor Route Variations

In addition to the route alternatives described above, minor route variations that are much smaller in scale, are typically shorter in length and involve minor shifts in the pipeline alignment to avoid a site-specific resource issue or concern. These site-specific issues included proximity to homes and property boundaries, avoidance of forested land, waterbodies, wetlands, side slopes, special agricultural areas, and addressing impacts on other construction-related, environmental, or landowner concerns.

Since issuance of the draft EIS, Columbia Gas has coordinated with several landowners who have requested minor route variations across their own properties that do not affect other landowners. Instances where Columbia Gas was able to accommodate a minor route variation, as identified in table 2.1.2-1 of section 2.1, are now considered part of the proposed pipeline routing. Columbia Gas evaluated other landowner request for minor route variations, but could not accommodate these requests because of additional environmental and safety concerns during construction (see table 3.3.3-1). We agree that these route variations are not preferable to the proposed pipeline alignment.

TABLE 3.3.3-1
Minor Route Variations Not Incorporated into the Proposed Project

Project Segment	Parcel Number or Reroute ID	MP	Requested Minor Route Variation	Columbia Gas' Analysis / Response
LEX	WV-MA-169.000	1.0	Landowners proposed route alternatives to avoid potential impacts to spring and potential future building site.	Columbia Gas incorporated a portion of landowners suggested alternative, however additional constraints including topography, safety concerns, and wetlands and waterbodies prevent reroutes in this area.
LEX	OH-MO-207.000	51.5	Landowner requested deviation to avoid residences, utilities, and farming operations	Columbia Gas has evaluated the potential reroutes requested by the landowner. Constraints involving topography, proximity of the existing Spectra pipeline, soil management, and a required increase of ATWS prevent reroutes in this area.
LEX	OH-NO-001.003; OH-NO-001.004; OH-NO-001.005	53.5	Landowner requested pipeline be moved to avoid forested and wildlife habitats	Columbia Gas evaluated the landowners requested reroutes, however due to construction safety and environmental concerns, the landowner's requested reroutes could not be implemented.
LEX	OH-NO-097.000	60.7	Landowner requested alternative route across property	Alternative routes have been evaluated but not incorporated into the pipeline route due to safety and environmental concerns. However, Columbia Gas modified the workspace configuration to reduce impacts on the property and is continuing landowner coordination.
R-801 Loop	OH-HO-239.000	8.9	Consider adjusting route across property	Columbia Gas has presented various reroute across this property and reroutes have been found unacceptable to the landowner. Overall construction safety concerns do not allow Columbia Gas to accommodate the landowner's exact reroute request.

Additionally, Columbia Gas is continuing negotiations with affected property owners to address outstanding landowner requests that have been filed to the docket. Columbia Gas is investigating six potential route variations and/or modification of construction methods to address specific landowner concerns that do not affect other landowners. Landowners at LEX Pipeline MPs 15.4, 31.0, 35.8, 62.8, 86.6, and 109.7, requested minor route variations across their properties. Columbia Gas is currently negotiating with these landowners to determine the feasibility of the requested variations. Therefore, **we recommend that:**

- **<u>Prior to construction</u>, Columbia Gas should further assess any outstanding minor route variations in coordination with the landowners, including those at LEX Pipeline MPs 15.4, 31.0, 35.8, 62.8, 86.6, and 109.7 and Columbia Gas should either incorporate a route within the same landowner's property that addresses or avoids the resources or issue of concern, or otherwise explain how potential impacts on**

resources have been effectively avoided, minimized, or mitigated to the extent practical.

Columbia Gas should file with the Secretary of the Commission (Secretary), for the review and written approval by the Director of OEP, revised alignment sheets, documentation of its landowner consultations, and a summary of the resources (e.g. forests, wetlands, sensitive species, and cultural resources) affected by the revised routes.

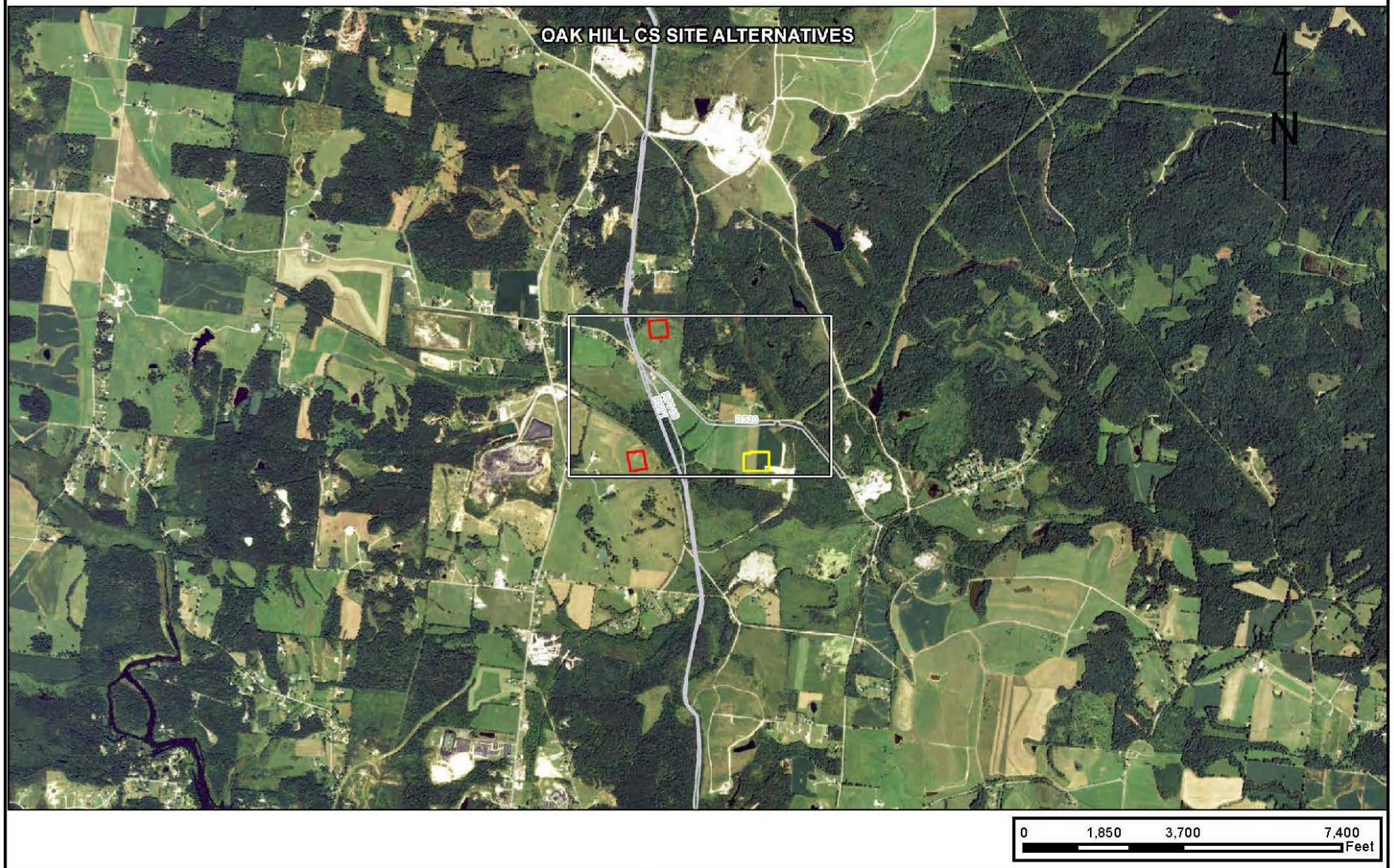
3.4 ABOVEGROUND FACILITY SITE ALTERNATIVES

3.4.1 Leach XPress Project

As is discussed throughout section 4 of this final EIS, the proposed Lone Oak and Summerfield CSs, regulator stations, and odorization stations would not result in any significant environmental impacts. Also, no comments or concerns were received about impacts from these facilities or requests to relocate them. Therefore, we find that the proposed locations for these facilities are environmentally acceptable. We did not identify any other locations that reduce the impacts associated with these proposed facility sites.

Further, the proposed modifications at the Crawford CS and Ceredo CS would occur at existing facility sites and on property owned by Columbia Gas. Alternative sites for this additional compression would result in greater environmental impact associated with the development of entire compressor stations (e.g. compression, control buildings, suction and discharge piping, etc.). Therefore, expanding the existing facilities is preferable.

In response to comments received concerning noise, visual impacts, and safety for the Oak Hill CS, we evaluated two site alternatives (see figure 3.4.1-1). Alternative Site 1 would be located about 0.6 mile northwest of the proposed Oak Hill CS site and Alternative Site 2 would be located about 0.5 mile west of the proposed Oak Hill CS site. While both alternative sites would affect less prime farmland and reduce the length of the suction/discharge lines, these alternative locations would be closer to a substantially greater number of noise sensitive areas (NSA). Therefore, the alternative sites do not address commenters concerns about noise. Given that the proposed site lies within a 0.5-mile sight distance of eight identified NSAs; however, we are requiring Columbia Gas to provide a visual screening plan emphasizing shielding of residences located north and west of the proposed compressor station site, as discussed in section 4.8.6. We find that the alternative sites do not offer a significant environmental advantage, and have been eliminated from further consideration.



LEX (131.32 miles)
LEX1 (1.22 miles)
R-801 LOOP (24.16 miles)
BM-111 LOOP (2.85 miles)
R-501 ABANDONMENT (28.21 miles)
EXISTING COLUMBIA PIPELINE
PROPOSED SITE
ALTERNATIVE SITE

SHEET TILE
STATE BOUNDARY
COUNTY BOUNDARY

Figure 3.4.1-1
Columbia Gas Transmission Leach XPress
Alternatives Oak Hill CS Site Alternatives
Jackson County, OH

3.4.2 Rayne XPress Expansion Project

As discussed throughout section 4 of this final EIS, the proposed Grayson CS and Means CS, would not result in any significant environmental impacts. However, we evaluated the location of the Grayson CS and Means CS to evaluate the potential for environmental impacts and to determine whether the environmental impacts could be mitigated. Therefore, we evaluated three alternative sites for the Grayson CS, but discarded them because of the substantially larger space required for construction. We evaluated two alternative sites for the Means CS, but discarded them because of greater impacts on agricultural land, forest and wetlands. Columbia Gas designed the proposed Means CS to coincide with the existing Means Measurement and Regulation Station site. No comments or concerns were received about impacts from these facilities or requests to relocate them. We did not consider other potential alternatives in which either compressor station would be located farther from the proposed site as Columbia Gulf would not be able to achieve optimal discharge pressures without construction of additional facilities. Therefore, we find that the proposed locations for these facilities are environmentally acceptable.

4.0 ENVIRONMENTAL IMPACT ANALYSIS

4.1 GEOLOGY

4.1.1 Existing Resources

4.1.1.1 Geologic Setting

The proposed LX Project is located entirely in the Kanawha Section of the Appalachian Plateaus physiographic province. The Appalachian Plateaus consist primarily of Pennsylvanian and Permian layered deposits, with Quaternary Alluvium overlying most geologic formations (USGS, 2015a). Elevations along the project range from 455 feet to 1,500 feet above mean sea level (USGS, 2015b). Topography in the project area ranges from relatively flat-lying rocks and rolling hills to steep slopes, with a local relief of up to several hundred feet (West Virginia Geological and Economic Survey [WVGES], 2004a; Greene County Government, 2013; ODNR, 2014a).

The proposed RXE Project Grayson CS is located in the region known as the Eastern Kentucky Coal Field (Kentucky Geological Survey [KGS], 2012a), in an area of Quaternary alluvium composed of sand, silt, clay, and gravel created by floodplain deposits of present day streams. The thickness of the alluvium ranges from 0 to 60 feet (Whittington and Ferm, 1967). The proposed RXE Project Means CS is located within the Lexington Plains Section of the Interior Low Plateaus physiographic province (USGS, 2015a), in a region known as The Knobs, that consists of hundreds of isolated, steep-sloping, cone-shaped hills (KGS, 2012b). The nearest knob, Kash's Knob, is approximately one-quarter mile north of the proposed compressor station site (USGS, 1975). The USDA Soil Conservation Survey (SCS) County soil survey information indicates there are restrictive layers (potentially shallow bedrock) within the upper five feet of the ground surface at both CS locations (USDA SCS, 1974 and 1983). A more detailed discussion of shallow bedrock is included in section 4.2.2.2.

Table 4.1.1-1 provides a summary of the geologic formations crossed by the LX Project facilities, and the location by MP of each geologic formation crossed is presented in appendix F. A summary of shallow bedrock areas crossed by the LX Project is provided in appendix G.

TABLE 4.1.1-1
Geologic Formations in the LX and RXE Project Areas

Geologic Formation/Unit	Facility	Period/Era	Primary Lithology	Secondary Lithology	Description
Monongahela Group	LEX (23.9 miles) Mainline Valve 6 Summerfield Compressor Station LEX launcher	Pennsylvanian	Sandstone	Siltstone	Black, red, gray, and green shale, siltstone, and mudstone.
Dunkard Group	LEX (47.8 miles) Mainline Valves 1, 2, 3 and 4 Lone Oak Compressor Station	Permian, Pennsylvanian	Sandstone	Siltstone	Non-marine cyclic sequences of sandstone, siltstone, shale, limestone, and coal.
Greene Formation	LEX (0.3 mile)	Permian	Sandstone	Shale	Cyclic sequences of sandstone, shale, red beds, thin limestone, and thin, impure coal.
Washington Formation	LEX (0.1 mile)	Permian	Sandstone	Shale	Sequences of sandstone, red shale, limestone, and coal.

TABLE 4.1.1-1 (cont'd)
Geologic Formations in the LX and RXE Project Areas

Geologic Formation/Unit	Facility	Period/Era	Primary Lithology	Secondary Lithology	Description
Waynesburg Formation	LEX (0.4 mile)	Permian and Pennsylvanian	Sandstone	Shale	Sequences of sandstone, shale, limestone, and coal.
Conemaugh Group	LEX (35.5miles) BM-111 Loop (1.8 miles) Mainline Valves 5 and 7	Pennsylvanian	Siltstone	Shale	Black, red, gray, and green shale, siltstone, and mudstone.
Allegheny and Pottsville Groups, Undivided	LEX (11.5 miles) R-801 Loop (14.4 miles) BM-111 Loop (0.1 mile) RS-1286 McArthur Regulator Station Mainline Valves 9 Benton Regulator Station BM-111 Loop launcher Oak Hill Compressor Station R-486 Odorization Station R-130 Odorization Station R-543 Odorization Station R-300 / R-500 Odorization Station	Pennsylvanian	Shale	Siltstone	Gray, olive, and greenish shale, siltstone, and underclay. Locally contains marine fossils.
Maxville Limestone: Rushville, Logan, and Cuyahoga Formations, Undivided	LEX (7.1 miles) LEX1 (0.6 mile) R-801 Loop (6.8 miles) K-260 Regulator Station Mainline Valve 8	Mississippian	Shale	Siltstone	Gray, yellow, brown shale, siltstone, and sandstone.
Black Hand Sandstone Member of Cuyahoga Formation	LEX (4.9 miles) R-801 Loop (3.0 miles) LEX1 (0.6 mile) R-System Regulator Station Crawford Compressor Station Benton Compressor Station	Mississippian	Sandstone	Conglo-merate	Yellow-gray to white sandstone and conglomerate that grade laterally into shale and siltstone.
Quaternary Alluvium	LEX (<0.1 mile) BM-111 Loop (0.9 mile) Ceredo Compressor Station Grayson Compressor Station	Quaternary	Alluvium	N/A	Alluvial deposits of sand, gravel, silt, and clay.
Nancy and Farmers Member of Lower Mississippian Borden Formation	Means Compressor Station	Mississippian	Shale	Siltstone	Olive and gray shales and siltstone, including discontinuous iron-impregnated beds of siltstone. Dark-reddish- and yellowish-brown, iron-rich, siliceous, and calcareous concretions, occur sporadically in both shale and siltstone.

Source: USGS, 2005a-g.

4.1.1.2 Mineral Resources

The primary nonfuel mineral resource in Kentucky, Ohio, Pennsylvania, and West Virginia is crushed stone. Other prevalent mineral resources include Portland cement, lime, construction and sand (USGS, 2011) and clay, specifically in Carter County, Kentucky (USGS, 2015b). No active quarries are located within 0.2 mile of the LX and RXE Project areas (PADEP, 2015; Pennsylvania Department of Conservation and Natural Resources [PADCNR], 2015a; KGS, 2001; USGS, 2003 and 2015b). The Ohio Emergency Management Agency (OEMA) estimates that there are over 7,000 underground mines across Ohio, with approximately 50 percent recorded in the ODNR database and no mapping completed for approximately 2,700 underground mines (OEMA, 2011). Therefore, it is anticipated that there are additional older unidentified and unmapped underground coal mines in the eastern portion of the NGT Project area and the entire TEAL Project area where no accurate or official records exist. The older abandoned coal mines are expected to be small room-and-pillar mines, based on the mining methods used at the time.

No mine spoil areas are located within 0.5 mile of the project areas (West Virginia GIS Technical Center, 1996; Freidhof; 2015; Pennsylvania Spatial Data Clearinghouse [PASDA], 2015c). However, based on data provided by local mining companies and review of publicly available online resources, 41 mines are identified within 0.25 mile of the LX Project area in Ohio and West Virginia (KGS, 2001; ODNR, 2014c; PASDA, 2015d; West Virginia Office of Miners' Health Safety and Training, 2011; WVDEP, 2014). Of the 41 mines, 17 are identified as underground coal mines, 3 as longwall coal mines, 19 as surface coal mines, 1 as a surface gravel mine and 1 as a surface limestone mine. Seven of the 41 mines identified are being actively mined or are planned for future mining, including three longwall mines and four surface mines. Additionally, Columbia Gas is currently negotiating with two mining companies regarding the purchase of material rights for a surface gravel mine and surface coal mine along the proposed LEX Pipeline crossing.

Coal is a major resource for Kentucky, which has two separate major coalfields: the western Kentucky coalfield and the eastern Kentucky coalfield. Although, the RXE Project's Grayson CS is located in the eastern Kentucky coalfield, there are no mines within five miles of the proposed site (Kentucky Mine Mapping Information System, 2015).

Appendix I presents the location (by MP) of each future, active, and abandoned mine crossed or located within 0.2 mile of the LX and RXE Project areas.

Columbia Gas conducted geotechnical investigations at the proposed Lone Oak, Summerfield, and Oak Hill CS sites as well as at the existing Ceredo CS to characterize subsurface conditions for use in the development of facility foundation design and construction considerations. The proposed Summerfield CS occurs over land characterized by reclaimed abandoned coal mines of past and potential future mining activities. However, based on analysis of the results of the geotechnical investigation performed for the Summerfield CS, undisturbed stable soils occur beyond the expected depth of foundations.

Based on a review of publicly available resources and discussions with mining companies, Columbia Gas has identified a potential area near the proposed Lone Oak CS in which future longwall mining activities may occur. Longwall mining is a mining method that involves the subsurface removal of a resource, usually coal, through underground tunnels. Underground mines can cause surface subsidence, however longwall mining subsidence is generally predictable, occurs almost immediately, and the event is largely complete within one to three months. Residual subsidence can occur over a longer period, but it is generally small in nature. Columbia Gas coordinated with the associated mining company to determine when future mining activities would occur at the Lone Oak CS. Longwall mining activities are tentatively scheduled to occur in the area between 2023 and 2025, and therefore, impacts at

the Lone Oak CS as a result of mining activity are not anticipated. Columbia Gas and the associated mining company are developing a commercial solution in the event that any real impacts occur associated with construction or operation of the Lone Oak CS.

A total of 64 oil and gas wells were identified within the LX Project area in Ohio, Pennsylvania, and West Virginia, including 11 active wells and 51 inactive wells and 2 historic wells (appendix H) (WVDEP, 2014; 2011; PASDA 2015a, 2015b; ODNR, 2014b). The data provided in appendix H was obtained through publicly available state records, and the location and distances from the proposed construction workspace limits presented in the appendix may not be exact. Once Columbia Gas is able to conduct its final engineering and civil surveys, these locations would be marked, mitigated and/or avoided. Given the uncertainty of the locations of oil and gas wells within the LX Project workspace at this time, **we recommend that:**

- **<u>Prior to construction</u>, Columbia Gas should file with the Secretary the results of civil surveys identifying the location of any conventional or unconventional oil and gas well locations (including permitted, drilled, producing and abandoned oil and gas wells) within the LX Project footprint, as well as identify measures to minimize hazards for any wells located within 100 feet of the proposed LX Project pipelines.**

In the RXE Project area in Kentucky, 158 oil and gas wells were identified within 5 miles of the Means CS, but none within 1 mile. The majority of the wells (124 of the 158 wells) within 5 miles of the Means CS are gas wells. Of the remaining wells, 29 are dry and/or abandoned wells, 4 are newly permitted wells, and one is a water supply well (KGS, 2015a). Similarly, 102 wells within 5 miles of the Grayson CS, but none within 1 mile. Within 5 miles of the Grayson CS there are 38 gas wells, 34 dry and/or abandoned wells, 5 newly permitted wells, 2 combined oil and gas producing wells, 12 oil wells, and 11 terminated wells, for which the permit has been cancelled or has expired (KGS, 2015a).

In addition to aboveground storage tanks, natural gas may be stored in deep underground reservoirs. There are three primary types of underground reservoirs that may be used for the storage of natural gas, including depleted reservoirs in oil/gas fields, converted aquifers, and converted salt cavern formations (U.S. Energy Information Administration [EIA], 2004). No underground natural gas storage reservoirs are located within 0.5 mile of the proposed Project areas; the closest underground gas storage reservoir is located 0.9 mile northwest of LEX Pipeline MP 107.9 (U.S. EIA, 2014).

4.1.1.3 Geologic Hazards

Geologic hazards are natural physical conditions that can, when active, result in damage to land or structures, or injuries to people. The following potential geologic or other natural hazards are discussed below in relation to the proposed LX and RXE Projects: seismic hazards, landslides, and subsidence.

Seismicity

Seismic hazards include earthquakes, surface faulting, and soil liquefaction. According to the USGS Seismic Hazards maps for the U.S., the LX Project is situated in an area of very low seismic probability.

Seismicity refers to the frequency, intensity, and distribution of earthquakes within a given area. Earthquakes generally occur when the two sides of a fault suddenly slip past each other. The movement creates ground motion, which can damage property and structures if the motion is sufficiently intense. The majority of earthquakes occur along boundaries of tectonic plates. The east coast of the United States

is considered a passive tectonic plate boundary located on the trailing edge of the North American continental plate, which is relatively seismically quiet. The plate boundary nearest the project area, the Mid-Atlantic Ridge, is about 2,000 miles east of eastern North America (Scharnberger, 2003). Damaging earthquakes east of the Rocky Mountains are rare. Of those that do damage to buildings or other man-made structures, most cause only slight, localized damage with few injuries (USGS, 2014). Nevertheless, the eastern United States does experience some earthquake activity (Scharnberger, 2003). The measurement of ground motion is peak ground acceleration (PGA), generally expressed as a percentage of gravitational acceleration (g) for a generic bedrock condition. Typical bedrock PGA values with a 2 percent probability of being exceeded during a 50-year period are between 1 and 10 percent g for areas that are not seismically active. Seismically active areas such as the West Coast typically have corresponding bedrock PGA values of between 40 and 100 percent g. Damage to buildings and other structures is not likely to occur at ground accelerations of less than 10 percent g (USGS, 2007).

Based on historical seismic activity in the area, the USGS (2014a) estimates that a 500-year earthquake, an earthquake with a 10 percent probability of occurring within any 50-year interval, would result in peak ground accelerations of 0 to 1 percent gravity (g) in Marshall County, West Virginia, Greene County, Pennsylvania, and Monroe County, Ohio. A 500-year earthquake is estimated to result in peak ground accelerations of 1 to 2 percent g in Wayne County, West Virginia, as well as in Noble, Muskingum, Morgan, Perry, Fairfield, Hocking, Vinton, Jackson, and Lawrence Counties in Ohio (USGS, 2014a). As noted above, damage to buildings and other structures is not likely to occur at ground accelerations of less than 10 percent gravity (Petersen et al., 2014).

A significant earthquake is defined by the USGS as an earthquake that causes death, property damage, or geological effects, or that was experienced by populations near the epicenter (USGS, 2010). A total of six earthquakes have had epicenters within counties crossed by the LX Project in Ohio: two earthquakes had epicenters originating in Perry County; three earthquakes originated in Fairfield County; and one earthquake originated in Lawrence County, approximately 20 miles from the project area (ODNR, 2014d; USGS, 2014b). However, only one of these earthquakes, a June 1952 event in Perry County, was significant. All other earthquakes that have originated within counties crossed by the LX Project in Ohio were minor and did not result in any significant damage (ODNR, 2012). No recorded earthquakes have originated in the counties crossed by the LX Project within West Virginia and Pennsylvania (USGS, 2014c; PADCNR, 2015b). There are no known active faults in West Virginia, Pennsylvania, or Ohio, and no earthquakes recorded in the states have ever been linked to a fault (USGS, 2014d).

The pipeline and associated facilities would be designed and constructed in accordance with applicable DOT regulations (49 CFR 192) and applicable federal and state standards and design requirements, which would allow the project facilities to withstand probable seismic risks based on the risk zones crossed by the Project. Even under much higher ground vibrations, the main risk to pipelines would be where the pipeline is buried along a hillside coupled with unstable soils that could become displaced laterally during an earthquake.

O'Rourke and Palmer (1996) performed a review of the seismic performance of gas transmission lines in southern California and concluded that modern electric arc-welded gas pipelines perform well in seismically active areas of the United States. Based on the low seismic risk and occurrence assigned to the project area, we find the risk of damage to pipeline facilities by earthquakes to be low.

The proposed RXE Project sites in Kentucky are located near two Special Zones, as designated by the USGS. Special Zones are used to account for local variability in seismicity characteristics within a zone (Petersen et al., 2008). The USGS (2014) estimates that the 500-year earthquake would result in peak ground accelerations of 3 to 5 percent gravity based on historical seismic activity in the area. However, as previously mentioned, damage to buildings and other structures is not likely to occur at

ground accelerations of less than 10 percent gravity (Petersen et al., 2014). The USGS also provides mapping that displays the probability of an earthquake of a specific magnitude over a specified timeframe. The probability of an earthquake of magnitude greater than 5.0 occurring in the next 50 years within approximately 30 miles of either of the proposed Grayson and Means CSs is between 1 and 2 percent. This mapping does not consider potentially induced seismicity or earthquakes occurring after 2006 (USGS, 2009).

In 1980, a magnitude 5.1 earthquake occurring in Bath County, the strongest in the history of Kentucky, was felt over all or parts of 15 States and in Ontario, Canada. Damage occurred in Indiana, Kentucky, and Ohio. Property damage was estimated at $1 million at Maysville, about 50 kilometers north of the epicenter, in Mason County, resulting in damage to 37 commercial structures and 269 private residences. Cracks formed in the ground about 12 kilometers from the epicenter (USGS). Earthquakes occurring in Greenup, Carter, and Mason counties, Kentucky within the last 100 years have included a magnitude 3.6 in 1979, 3.5 in 1983, 2.2 in 2013, and 2.1 in 2014 (Greenup County); magnitude 1.6 in 2015 (Carter County); magnitude 2.1 in 2013, and 2.5 in 2015 (Mason County) (USGS, Search Earthquake Archives). In the last six months, three earthquakes with magnitudes less than 2.5 have occurred in Carter, Greenup, and Mason Counties, Kentucky (i.e. within 30 miles of the Grayson CS and Means CS sites). These earthquakes had magnitudes of 1.6, 2.1, and 2.5 and occurred in January 2015, December 2014, and May 2015, respectively (The Center for Earthquake Research and Information (CERI) at the University of Memphis, 2015). However, no adverse impacts are anticipated on either compressor station site from seismic activity, due to the nature of the underlying, generally competent bedrock, low probability of significant earthquake activity, and low seismic risk at these sites.

Soil liquefaction is a condition that typically occurs when loose, saturated soil is subjected to vibration or shockwaves, typically from a seismic event. During liquefaction, pore water inhibits grain-to-grain contact, and reduces the strength of the soil such that soil may act like a viscous liquid with the ability to move and flow. Soil liquefaction can lead to landslides of slopes and extreme deformation of building foundations and buried pipelines. The low probability of a significant seismic event occurring within the LX or RXE Project areas makes the occurrence of soil liquefaction unlikely.

Landslides

Landslides occur when loose soils and sediments located on steep slopes become saturated, usually from a flood event. Several factors contribute to triggering landslides, including human induced and natural vibrations, but the most significant triggers are heavy rains, clay soil, and steep slopes (USGS, 1982). The bedrock of Mississippian, Pennsylvanian, and Permian ages located in the LX Project area is prone to slope failure. The most slide-prone rocks are red mudstones, also called “red beds”, of Pennsylvanian and Permian age. These rocks tend to lose strength when they become wet, forming rotational slumps or earthflows (USGS, 2013; Ohio Emergency Management Agency, 2011).

The USGS Landslide Overview Map of the Conterminous United States generally identifies the extent of areas characterized by low, medium, and high susceptibility to landslides based on several criteria, including but not limited to past landslide events, geologic conditions, and slopes. These characterizations generally represent the most detailed information available. However, given the lack of precise or insufficient information and the wide array of factors which contribute to landslide events, these susceptibility characterizations and identified extents are approximate (USGS, 2013).

According to the USGS Landslide Overview Map of the Conterminous United States, LX Project facilities within the following counties are located in areas of high landslide susceptibility and/or incidence:

- Greene County, Pennsylvania, Monroe County, Ohio, and Marshall and Wayne Counties, West Virginia (high incidence of landslides);
- Muskingum, Morgan, Perry, a small portion of Hocking, and Vinton Counties, Ohio (high susceptibility); and
- Noble, Jackson, and Lawrence Counties, Ohio (combined high landslide susceptibility and incidence).

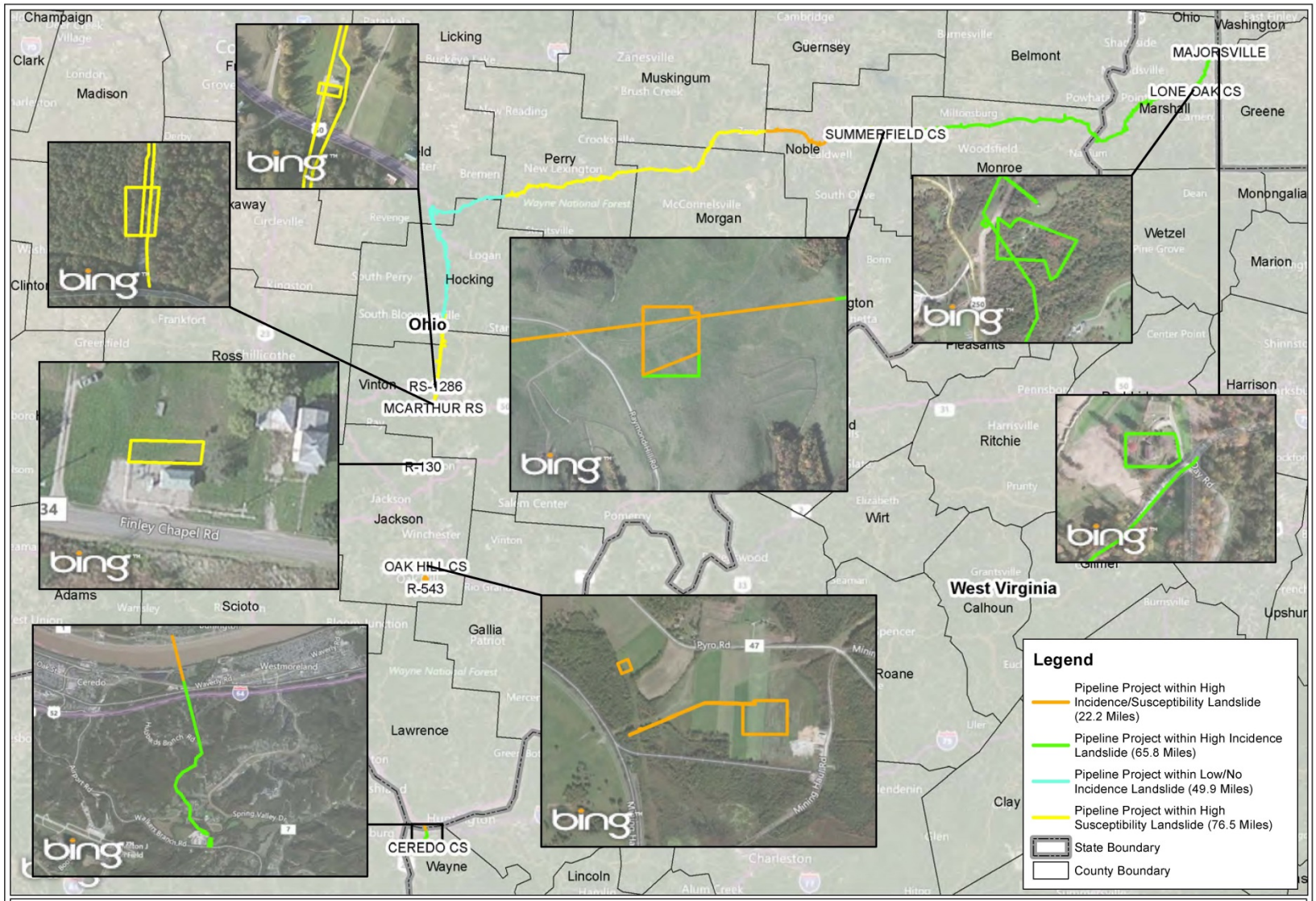
Based on USGS Landslide overview mapping, the LX Project pipeline facilities would cross 65.8 miles of high landslide incidence, 76.5 miles of high landslide susceptibility, and 22.2 miles of combined high landslide susceptibility/incidence. In addition, 30 acres of land for LX aboveground facilities would be located in acres of high landslide incidence, high landslide susceptibility and/or combined high landslide susceptibility/incidence. Figure 4.1.1-1 depicts the location of LX Project facilities in relation to areas of high landslide susceptibility and incidence.

Columbia Gas used the Federal Emergency Management Agency's (FEMA) *Multi-Hazard Identification and Risk Assessment* document reports to determine the probability of future landslide incidences for counties located in southeastern Ohio. Hocking, Monroe, Morgan, Noble, and Vinton Counties average 180 to 200 landslides annually, whereas Jackson and Lawrence Counties have an annual average of 12 landslides (Ohio Emergency Management Agency, 2011). The remaining counties affected by the LX Project within Ohio have a low incidence of landslides and were not included in the probability report. Rock fall is an additional hazard in eastern Ohio due to the presence of massive cliff-forming sandstones, steep slopes, and to the rapidity with which such failures occur (ODNR, 1986).

In Kentucky, the majority of landslides occur in colluvial soils or along soils that meet underlying bedrock (Crawford, 2014). The RXE Project sites are located in topography that is nearly level to gently undulating and is not susceptible to debris flows or landslides (KGS, 2015a).

Columbia Gas and Columbia Gulf assessed the geological landscape for potential landslide areas during its route selection process for the LX and RXE Projects. Seventeen minor route deviations were incorporated into the proposed route to avoid site-specific features (e.g., topography, landowner concerns, sensitive habitat, or structures). Columbia Gas incorporated the deviations to minimize the risks associated with construction on steep side slopes and to avoid difficult and rugged terrain primarily characterized by severe elevation changes and rocky outcrops.

To minimize the risk of landslides during construction in areas with steep slopes, Columbia Gas would install temporary ECDs to control erosion and sedimentation, such as slope breakers and sediment filter devices (filter socks and silt fences) following the initial ground disturbance. Some areas may require ECDs be installed prior to or directly after vegetation clearance. Where required, Columbia Gas would also install sediment barriers (e.g., silt fence or filter socks) at the base of slopes adjacent to road crossings, waterbody crossings, wetlands, and other areas, to prevent siltation into waterbodies and wetlands downslope of the construction area. Temporary ECDs would be maintained until the LX Project areas have been successfully revegetated.



N
W E
S

Scale

0 6.5 13 26 Miles

Notes:
1. USGS 1997; Landslide Overview
2. Calculated NAD83 UTM Zone 17N

July 12, 2016

FIGURE 4.1.1-1
USGS Landslide Overview Map
Leach Express Pipeline
West Virginia, Ohio, Pennyslvania

J:\GIS\Projects\LeachXPress FERC-Pipeline_MXD\Landslide_Mapping_8.5x11.mxd - INITIALS

The risk of slips or landslide events is further exaggerated by the presence of water, which promotes erosion and increases the weight of soils. Columbia Gas would therefore implement typical mitigation procedures and control measures to prevent water from accumulating in areas with steep slopes, including:

- shoring;
- benching;
- installation of jute netting or erosion control blankets;
- slope and trench breakers;
- subsurface gravel or cobble drains;
- French drains; and
- installation of culverts and drainage ditches to divert water away from the construction right-of-way.

During construction, the EI and construction crews would be responsible for identifying potential landslide conditions.

In order to minimize the potential for future slip or landslide events during operation of the LX Project facilities, Columbia Gas may install permanent ECDs in addition to performing regular restoration and revegetation activities. Permanent ECDs would be installed in accordance with revegetation measures outlined in the ECSs and specific landowner requests. Columbia Gas and Columbia Gulf would monitor the effectiveness of revegetation and permanent ECDs during the long-term operation and maintenance of the LX and RXE Project facilities.

Subsidence

Land subsidence is the sinking of the Earth's surface, either gradually or suddenly, due to the subsurface movements of materials such as water or soil. Karst terrain results from the dissolution of highly soluble bedrock such as limestone and dolomite, creating features such as subsurface channels, caves and sinkholes. Areas with karst terrain and/or subsurface mining activities are more susceptible to subsidence events.

Based on a review of publicly available resources, no historic subsidence events have occurred within 1 mile of the LX Project area in West Virginia and Pennsylvania (USGS, 2014e). Seven subsidence events have been documented within 1 mile of the LX Project area in Ohio, as presented in table 4.1.1-2 (Riley, 2015). Further, the LX Project is not located in areas of karst terrain.

Both karst subsidence and mining subsidence hazards exist in Kentucky. It has been estimated that about 55 percent of Kentucky is underlain by rocks with potential to develop karst terrain and about 38 percent of the state has at least some karst development (KGS, 2013). However, neither the Grayson CS nor Means CS sites are located where karst terrain is present, or where significant subsidence events are likely to occur (KGS, 2015a; Paylor and Currens, 2002).

Subsidence may occur as a result of longwall mining operations, which could result in stress and associated damages to buried pipelines. As previously mentioned, Columbia Gas would continue to coordinate with the mining companies to identify additional measures that would maintain the pipeline integrity and ensure safe operation of the LX Project facilities while not interfering with mining activities.

Columbia Gas has developed a Longwall Mining Plan for construction and operation of the LX Project facilities in areas of inactive, active, or future longwall mining to avoid, minimize, and/or mitigate for potential impacts associated with subsidence (appendix J). We reviewed this plan and find it is acceptable. This plan outlines measures to avoid, monitor, and/or reduce pipeline stress caused by subsidence, such as:

- excavating the pipeline trench prior to or following mining activities to remove pressures on the mine being transferred from overlying soil;
- delaying backfilling of the trench and restoration of disturbed areas to accommodate mining schedules until after mining and subsidence has occurred;
- using thicker-walled pipe; and
- installing strain gauges on the pipeline.

TABLE 4.1.1-2
Subsidence Events Recorded Within 1 mile of the LX Project

Milepost/Facility	County, State	Year of Occurrence	Distance and Direction from Project Area (miles)
Pipeline Facilities			
LEX			
107.7	Perry, OH	2004	1.0 NW
R-801 Loop			
15.7	Vinton, OH	2001	1.0 W
Existing Columbia Pipeline System			
R-130 Odorization Site	Jackson, OH	1988	0.8 N
	Jackson, OH	2000	1.0 E
	Jackson, OH	2002	0.9 E
	Jackson, OH	2002	1.0 E
	Jackson, OH	2008	0.9 E
Pipe Yard 36	Muskingum, OH	1997	0.4 E

4.1.1.4 Paleontological Resources

Paleontological resources, including plant, invertebrates, and vertebrate fossils, may be found in a variety of geologic formations. Potential impacts on paleontological resources associated with the projects may occur as a result of construction activities such as trenching the pipeline ditch, excavation, use of heavy equipment, and addition of foundations.

The LX Project area is comprised of primarily Pennsylvanian and Mississippian aged rocks where ferns and marine fossils are common. Fossil deposits in rocks of Pennsylvanian and Permian age would consist of plant species such as lycopod trees, sphenopsid vines, ferns, and horsetails. Thin layers of limestone may contain marine fossils (Ashton, 2015; The Paleontology Portal, 2003). West Virginia does not have any documented, sensitive fossil resources, and there is no state protection for fossils (Ashton, 2015). Pennsylvania's exposed metamorphic and igneous rocks of Precambrian age, which stratigraphically underlie the younger Mississippian-Pennsylvanian age sedimentary rocks, lack fossil resources (The Paleontology Portal, 2003). Ohio has no state protected or sensitive fossils, and no fossil collection sites (Angle, 2015). Therefore, we do not anticipate that construction of the LX Project would uncover significant paleontological resources.

In Kentucky, the Grayson CS site is located on Quaternary alluvium, and as such, its construction is unlikely to encounter fossils. However, the Means CS site is located on Mississippian strata, which is likely to contain marine invertebrate fossils. The Borden Formation at the Means CS location is listed by the KGS as having important fossil-bearing strata (KGS, 2015b), however the only fossil recognized in the Nancy Member of the Borden Formation is sparse zoophycos (Weir, 1976). Therefore, we do not anticipate any significant discoveries of paleontological resources during construction of either compressor station in Kentucky. While we do not anticipate that construction of the RXE Project would uncover significant paleontological resources, there is the potential for unanticipated discovery of fossils during project construction activities especially in areas of shallow bedrock or where bedrock removal is necessary. Columbia Gulf would contact the KGS in the event of an unanticipated discovery of a significant paleontological resource at the Means CS site.

4.1.2 General Impacts and Mitigation

4.1.2.1 General Construction Activities

The primary effect of project construction on geologic resources would be disturbance to steep topographic features found along the pipeline right-of-way. The likelihood of slips or landslide events increases as a result of vegetation clearance and contour grading in areas with steep slopes. In addition, areas requiring side slope construction may be more susceptible to slips or landslide events, as extra space would be needed to provide for safe and efficient construction of the pipeline, resulting in further vegetation clearance and contour grading. A total of 18.4 miles of the proposed LX pipeline routes (approximately 11 percent) is characterized by slopes greater than 30 percent. Several minor route deviations were incorporated to minimize the risks associated with construction on steep side slopes and to avoid difficult and rugged terrain primarily characterized by severe elevation changes and rocky outcrops. Although side slope terrain was avoided to the maximum extent practicable, severe side slopes may still be encountered. While eight subsidence events have been documented within 1 mile of the LX Project area in Ohio, no historic subsidence events have occurred within 1 mile of the LX Project area in West Virginia and Pennsylvania. Neither the RXE Project Grayson CS nor Means CS sites are located where karst terrain is present, or where significant subsidence events are likely to occur.

In addition to the avoidance measures discussed above, Columbia Gas and Columbia Gulf would use both temporary and permanent erosion and sediment control devices to minimize or avoid the risk of landslides during construction in areas with steep slopes, in accordance with their ECSs. In consideration of the proposed mitigation and monitoring measures, construction and operation of the LX and RXE Project facilities are not anticipated to affect or be affected by significant landslide or slip events.

Seven of the coal mines identified within 0.2 mile of the LX Project area are being actively mined or are planned for future mining, including three longwall mines and four surface mines. In these areas, Columbia Gas would coordinate with the appropriate mining companies regarding the construction schedule across active surface mines and longwall mines to allow the completion of mining activities prior to construction (to the extent practicable).

By implementing the measures outlined in the Longwall Mining Plan, Columbia Gas would ensure the safety and stability of the proposed pipeline and greatly minimize or avoid potential landslide and subsidence hazards due to future longwall mining operations. Therefore, significant adverse impacts on the proposed LX Project facilities or on the future planned longwall mining activities are not anticipated.

Columbia Gas identified a potential area in the vicinity of the proposed Lone Oak CS in which future longwall mining activities may occur. Columbia Gas coordinated with the associated mining company and initially shifted the Lone Oak CS to avoid the coal seam boundary and future areas of

potential subsidence. However, coordination efforts confirmed that longwall mining activities are tentatively scheduled to occur in the area between 2023 and 2025 and are not expected to result in impacts in the vicinity of the Lone Oak CS. Therefore, Columbia Gas moved the proposed Lone Oak CS facility site back to the northern portion of the property. This area is characterized by terrain that is more suitable for construction and operation of the facility. Columbia Gas and the associated mining company are developing a commercial solution for impacts associated with construction or operation of the Lone Oak CS and mining.

The proposed Summerfield CS occurs on land characterized by reclaimed abandoned coal mines of past and potential future mining activities. However, based on the analysis of the geotechnical investigation performed for the Summerfield CS, undisturbed stable soils occur beyond the expected depth of foundations. Therefore, the Summerfield CS facility would not be expected to be adversely affected by effects associated with past mining activities.

Columbia Gas conducted geotechnical studies at strategic locations along the proposed LX Project, including within proposed HDD areas. Based on analysis of the results of the geotechnical studies, the HDDs are not anticipated to fail. In the event that a particular drill is unsuccessful, Columbia Gas would implement its Horizontal Directional Drill Contingency Plan.

No underground natural gas storage reservoirs are located within 0.5 mile of the LX or RXE Project areas therefore impacts on underground gas storage reservoirs are not anticipated to occur as a result of construction or operation of the project facilities.

Although fossils are relatively common in the project areas, and the Borden Formation at the Means CS location is listed by the KGS as having important fossil-bearing strata, no significant impacts on paleontological resources are anticipated during construction in any of the project areas.

4.1.2.2 Blasting and Rock Removal

Blasting may be required in the LX and RXE Projects to excavate in areas where bedrock is encountered at depths that interfere with conventional excavation or rock trenching methods. Potential blasting areas are those that have shallow depth to bedrock (less than 5 feet). Approximately 45 percent of the LX Project area is characterized by shallow bedrock (a total of 95.0 miles crossed by the proposed pipelines and a total of 41.6 acres associated with construction of the aboveground facilities). Potential blasting locations were identified using available mapping and soils data. In the event that bedrock is encountered during construction, the technique used for bedrock removal would depend on factors such as strength and hardness of the rock. Appendix G provides a summary of areas characterized by shallow bedrock crossed by the LX Project pipeline.

If consolidated rock is encountered during construction, Columbia Gas' preferred procedure would be to fracture and excavate the bedrock using standard construction equipment. Columbia Gas would use blasting of bedrock only as a last resort if hard bedrock is encountered that is not easily removed by conventional excavation methods. If blasting is necessary, Columbia Gas' blasting contractors would adhere to the procedures and safety measures outlined in their Blasting Plan. This plan contains measures such as the following:

- contractor submission of site-specific blasting plans for Columbia Gas' approval 10 working days prior to execution of blasting activity that include dates and hours of blasting, and distance and orientation to nearest aboveground and underground structures, as well as a schedule identifying when blasting would occur within each waterbody greater than 10 feet wide, or within any designated coldwater fishery;

- use of blasting mats or padding to prevent scattering of loose or fly rock onto adjacent property and to prevent damage to nearby structures and overhead utilities;

- notification of all occupants of nearby buildings, stores, residences, places of business, places of public gathering, and farmers at least 48 hours in advance of blasting;

- an independent contractor employed to perform pre- and post-blast structural inspections and, if necessary, seismographic monitoring if blasting is necessary within 150 feet of residential or commercial buildings;

- pre- and post-blast inspections performed at locations where blasting is proposed within 150 feet of water wells to ensure that the volume/quality of potable water wells is maintained, in accordance with landowner negotiations. In the unlikely event that blasting activities temporarily impair potable well water, Columbia Gas would provide alternative sources of water or otherwise mitigate the impairment through discussions and agreements with the well owner;

- no blast firing without a positive signal from the person in charge who would have made certain that all surplus explosives are in a safe place, all persons, vehicles, and /or boats are at a safe distance (and vehicular and/or pedestrian traffic is stopped near the blast site), and adequate warning has been given to nearby homeowners and local agencies.

In-stream blasting could injure or kill aquatic organisms close to blasting activities. Temporary and minor impacts on aquatic resources from blasting activities are discussed in section 4.6.2.8. While in-stream blasting is not anticipated for the LX Project, in the unlikely event that Columbia Gas encounters bedrock that cannot be excavated using conventional methods, in-stream blasting may be required. If it becomes necessary to blast in waterbodies, Columbia Gas would consult with federal and state conservation authorities to determine what protective measures should be taken to minimize damage to fish and other aquatic life. As outlined in the Blasting Plan and ECS, Columbia Gas would provide notification to FERC no later than 14 days prior to any in-stream blasting activities and would notify FERC of any changes to the schedule no more than 48 hours prior to blasting. Additionally, Columbia Gas would adhere to all applicable federal, state, and local blasting notification requirements. Fly-rock leaving the construction corridor would be collected immediately and disposed of at disposal sites approved by Columbia Gas.

If shallow bedrock is encountered during the construction of the RXE Project, Columbia Gulf would preferentially use hydraulic hammers in an attempt to break up the shallow bedrock. If dense, consolidated bedrock without fractures is encountered, and the use of hydraulic hammers is not effective, blasting may be required. If blasting is necessary, Columbia Gulf would implement appropriate pre- and post-blasting surveys, coordinate with the appropriate local authorities, and develop a project-specific blasting program for the RXE Project. Appropriate notifications would be made and required permits obtained prior to conducting blasting operations. Blasting activities would be performed by local contractors in accordance with all applicable federal, state, and local requirements related to controlled blasting and would adhere to blast vibration limits protective of structures and underground or aboveground utilities.

4.1.2.3 Encountered Oil and Gas Wells

If an oil or gas well is encountered, Columbia Gas would determine an appropriate buffer and construction procedure around the well based on site-specific conditions and coordination with the owner of the well. Additionally, Columbia Gas would implement other measures during construction of the LX Project to reduce likelihood of impacts, such as:

- flagging wells within the construction right-of-way;
- reducing the construction workspace, if necessary, to keep a safe buffer between stockpiled spoil and equipment and the well; and
- attempting to adjust the pipeline centerline to prevent excavation of the pipeline trench from interfering with the integrity of the well.

If an oil or gas well is unexpectedly impacted during construction, Columbia Gas would stop work immediately, contain any spilled product (see the Spill Prevention, Control, and Countermeasures Plan contained within the ECS), secure the area, and notify FERC as well as the appropriate state and/or local agency. Although not anticipated, should an oil or gas well be damaged by construction of the LX Project, Columbia Gas would compensate the owner for the repair or replacement of the well. If an oil well is encountered during construction, and it is determined to have the potential to reach any waters of the U.S., Columbia Gas would immediately notify the appropriate regional office of the EPA through the National Response Center.

4.1.3 Conclusion

The primary effect of the proposed LX and RXE Projects on geologic resources would be the disturbance to steep topographic features, the excavation of shallow bedrock during the construction of the pipeline and aboveground facilities, and the establishment of temporary contractor yards and access roads, affecting the local geologic resource within discrete areas of the project footprints.

A number of mines were identified within or near the LX Project areas. Columbia Gas would coordinate with the appropriate mining companies regarding the construction schedule across active surface mines and longwall mines to allow the completion of mining activities prior to construction (to the extent practicable). In addition, oil and gas wells have been identified within or near the LX Project areas. These sites would be field verified through civil surveys prior to the start of construction.

Based on the avoidance, minimization and mitigation measures developed by Columbia Gas and Columbia Gulf, including measures outlined in the project-specific ECS, Longwall Mining Plan and Blasting Plan, we conclude that construction and operation of the Projects would not have any significant adverse effects on geologic resources.

4.2 SOILS

4.2.1 Existing Resources

The scope of the proposed LX and RXE Projects span 15 counties, including three in Kentucky, nine in Ohio, one in Pennsylvania, and two in West Virginia. The LX and RXE Projects involve soil series and detail soil units within the Central Allegheny Plateau, Western Allegheny Plateau and Kentucky Bluegrass major land resource areas (NRCS, 2006, 2015b).

Columbia Gas further evaluated the soils within the footprints of the proposed LX and RXE Projects to identify major soil characteristics that could affect construction or increase the potential for construction-related soil effects. The soil characteristics evaluated were hydric properties, compaction-potential, erosion potential, depth to shallow bedrock, and revegetation potential. Appendix R lists the characteristics of each detail soil unit within the LX Project areas, as well as the total miles of each soil unit that the pipelines cross and the acres impacted by construction of the aboveground facilities.

4.2.1.1 Erosion

Erosion is a continuing process that can be accelerated by human disturbances. Factors that can influence the degree of erosion include soil texture, structure, length and percent slope, vegetative cover, as well as rainfall or wind intensity. Soils most susceptible to erosion by water are typified by bare or sparse vegetative cover, non-cohesive soil particles with low infiltration rates, and moderate to steep slopes. Wind erosion processes are less affected by slope angles. Highly erodible land, as designated by the NRCS, includes both water and wind as agents of erosion (NRCS, 2014a).

Erosion potential of soils within the LX and RXE Project areas was identified based on NRCS designations of land capability class and subclass. The majority of lands within each project areas has low or moderate erosion potential.[14]

4.2.1.2 Hydric Soils and Compaction Potential

Hydric soils are defined as soils that are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (COE, 1987). Soils that are artificially drained or protected from flooding (e.g., by levees) are still considered hydric if the soil, in its undisturbed state, would meet the definition of hydric. Generally, hydric soils are those that are poorly or very poorly drained. Due to extended periods of saturation, hydric soils can be prone to compaction and rutting. Approximately 14 percent of soils within the LX Project area are classified as hydric . No soils within the RXE Project area are classified as hydric.

4.2.1.3 Stony-Rocky Soils and Shallow Bedrock

Soils with textural classifications including stony, cobbly, gravelly, shale, slate, and droughty in any layer, or with surface layer stones larger than 3 inches found in more than 15 percent of an area, may be characterized as stony or rocky soil. Shallow bedrock is considered prevalent where the depth to bedrock is less than 5 feet below the ground surface.

About 45 percent of the soils within the footprint of the LX Project pipelines have shallow bedrock. However, only one of these soil types, the Homewood-Westmoreland silt loam (15 to 25 percent slopes), contains rock fragments greater than 3 inches. This soil is crossed by the LEX Pipeline for less than 0.2 mile in Perry County, Ohio. In addition, three soil series within the Grayson CS site (Carter County, Kentucky) and the Means CS site (Menifee and Montgomery Counties, Kentucky) potentially have shallow bedrock.

The introduction of stones or rocks to surface soil layers through project construction activities may reduce soil moisture-holding capacity, resulting in a reduction of soil productivity. Additionally, some construction equipment may be damaged by contact with large rocks and stones or shallow bedrock.

4.2.1.4 Poor Revegetation Potential

Approximately 45 percent of the soils within the LX Project area have low revegetation potential. Soils with low revegetation potential typically have the following characteristics:

- high compaction and/or erosion potential;

[14] Columbia Gas' RR7 and RR7 Appendices for the LX Project are available on the FERC's eLibrary website at, respectively, http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514, Accession No. 20160318-5002, titled "16_Att_6_RR_07_Mar_2016.PDF", and by searching Docket No. CP15-514, Accession No. 20160318-5002, titled "17_Att_6_RR_07_Mar_2016_App_7A-7B.PDF".

- slopes greater than 8 percent;
- generally not classified as prime farmland; and/or
- usually hydric in nature.

Successful restoration and revegetation of project workspaces are important for protecting the underlying soil from potential damage and minimizing erosion during operation.

4.2.1.5 Prime Farmland

The USDA defines prime farmland as land that is best suited to food, feed, fiber, and oilseed crops (NRCS, 2014c). This designation includes cultivated land, pasture, woodland, or other lands that are either used for food or fiber crops, or are available for these uses. Urbanized land and open water are excluded from prime farmland designation. Prime farmland typically has the following characteristics:

- contains few or no rocks;
- permeable to water and air;
- not excessively erodible or saturated with water for long periods; and
- not subject to frequent, prolonged flooding during the growing season.

Farmland is designated as prime where 50 percent or more of the components in the map unit composition are prime; of statewide importance where less than 50 percent of the components in the map unit are prime but a combination of lands of prime or statewide importance is 50 percent or more of the map unit composition. Prime farmland is designated as of local importance where less than 50 percent of the components in the map unit are of prime or statewide importance but the total of land of prime, statewide, and/or local importance is 50 percent or more of the map unit composition. All other soil map units are shown as not prime farmland unless they are designated as unique (NRCS, 2015a).

Unique farmland is identified as land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. It has the unique combination of soil quality, growing season, moisture supply, temperature, humidity, air drainage, elevation, and aspect needed for the soil to economically produce sustainable high yields of these crops when properly managed (NRCS, 2014c). The criteria for defining and delineating farmland of statewide importance are determined by the appropriate state agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland, and that economically produce high yields of crops when treated and managed according to acceptable farming methods (NRCS, 2014c).

Soils that do not meet the above criteria may be considered prime farmland if the limiting factor is mitigated (e.g., artificial drainage). Farmland that does not meet the criteria for prime or unique farmland may still be considered farmland of statewide importance, local importance, or prime farmland if special procedures are implemented to protect crops during the growing season, for the production of food, feed, fiber, forage, and oilseed crops.

Prime farmland soil units were identified and assessed using the Soil Survey Geographic Database (SSURGO) developed by the Natural Resources Conservation Service (NCRS, 2014). A summary of prime farmland crossed by the proposed pipelines or being used by new aboveground facilities is presented in table 4.2.1-1. Additionally, section 4.8 discusses agricultural and residential land in more detail, and historic farms are discussed further in section 4.10.1.1 and 4.10.2.1.

TABLE 4.2.1-1 Farmland Crossed by the LX and RXE Projects			
Project Component	**Type of farmland**	**Coverage**	**Notes**
LX Pipelines	Prime [a]	16.4 miles (10% of total soils crossed)	Temporary change of use during pipeline installation
	Statewide or local importance	42.1miles (26% of total soils crossed)	
LX and RXE Aboveground facilities	Prime [a]	39.1 acres [b]	Permanent change of use to industrial after construction
	Statewide or local importance	16.5 acres	

[a] Including those that require draining or protection during flooding for classification

[b] The soils associated with the existing Means Measurement and Regulation Station are not included as prime farmland because the land already has an industrial use.

4.2.1.6 Contaminated Soils

Columbia Gas entered into an Administrative Order on Consent with the EPA in 1995 to evaluate the potential presence of contamination at approximately 250 major facilities and initiated response actions to address PCB contamination at 58 of these facilities, including the Crawford CS, Ceredo CS, and Benton CS between 2000 and 2004. Following remediation activities at the Crawford, Ceredo, and Benton compressor stations, the EPA issued letters of approval in 2002, 2003 and 2005 for the Benton CS, Ceredo CS, and Crawford CS, respectively, indicating all requirements for cleanup of PCBs had been met and no further action was necessary. In 2008, Columbia identified PCB contamination from a new source and that potential PCB impacts had occurred at 36 AOC, including the Crawford CS and the Ceredo CS. Response actions to remove and encapsulate PCB contamination at the Crawford CS and the Ceredo CS were performed in 2012 and are awaiting approval by the EPA. Some sources of PCBs at these sites have been encapsulated and left in-situ in accordance with the Toxic Substances Control Act (TSCA) of 1976.[15]

Based on a review of publicly available resources, a total of 18 previously leaking underground storage tanks are located within 0.5 mile of the LX Project area. These storage tanks are discussed further in section 4.3.1.5. In addition to the leaking underground storage tanks, an existing source of contamination was identified as the Rahall Transportation site. This source is located 0.8 mile west from MP 0.8 on the BM-111 Loop. This property is currently owned by the Rahall Transportation Institute Foundation. Previous owners of the property include SSI Mobley and Techsol. On October 28, 2004, a release of approximately 22,000 gallons of Coal Tar Light Oil occurred from a railroad tanker car at the site. Much of the release made its way to a ditch and then to a storm water system and ultimately discharged into Krouts Creek approximately 2 blocks from the site. Benzene was considered the most prevalent constituent in the release based upon the reported composition of the Coal Tar Light Oil. Remedial actions at the site included the excavation, characterization, and disposal of soil from the site in the area of the release. Clean uncontaminated soil was backfilled into the excavation area (USEPA, 2016). The LX Project does not cross this site, the area of the release or Krouts Creek. Therefore, based on the information publicly available from EPA's website, we do not expect the LX Project to be impacted by contamination associated with the Rahall Transporation site.

[15] Columbia Gas' RR12 for the LX Project is available on the FERC's eLibrary website at, respectively, http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514, Accession No. 20151023-5090, titled "20151023_CP15-514-000-55_VolI_RR12.PDF".

No other contamination issues have been identified within 1 mile of the LX Project.

4.2.2 General Impacts and Mitigation

4.2.2.1 Construction Activities

Construction activities, such as clearing and grading, trenching, backfilling, and grading during restoration, have the potential to adversely affect soils and revegetation potential within the LX and RXE Project areas. Potential impacts from these activities include:

- soil loss due to water or wind erosion, especially on steep slopes or areas with fine sandy soils;
- reduction of soil quality by mixing topsoil with subsoil from lack of topsoil conservation or from rutting by equipment;
- reduction of soil quality by bringing excess rock to the surface;
- soil compaction due to traffic by heavy equipment;
- poor revegetation due to steep slopes, low fertility, or other soil conditions;
- trench settling;
- disruption of surface and subsurface drainage systems; and
- remobilization of existing soil contamination.

To minimize or avoid impacts on soils during construction and operation of the LX and RXE Projects, Columbia Gas and Columbia Gulf would follow construction methods and mitigation measures outlined in their ECSs. The ECS incorporates measures from FERC's Plan and Procedures as well as from federal, state, and local requirements, including:

- West Virginia Erosion and Sediment Control Best Management Practice Manual (WVDEP, 2006);
- PADEP's Erosion and Sediment Pollution Control Program Manual (PADEP, 2012); and
- ODNR's Pipeline Standard and Construction Specifications (ODNR, 2013).

4.2.2.2 Winter Construction

Winter construction techniques are required in some parts of the U.S. that experience extended periods of freezing conditions or heavy snowfall events. Winter construction techniques typically include snow management, working with frozen soils, and managing hydrostatic discharge water under freezing conditions. These techniques also include the application of temporary erosion and sediment control measures to protect against accelerated erosion during spring melt and heavy spring rains. These temporary controls would be maintained during project construction and reinstalled as necessary until permanent ECDs are constructed and/or permanent stabilization has occurred. In the event that winter construction conditions are encountered, Columbia Gas and Columbia Gulf would follow measures in its Winter Construction Plan, within the ECSs. Key components of the plan include:

- snow management and storage to improve driving conditions and allow safe access to the construction right-of-way;
- removing snow in a manner to minimize damage to vegetation or soils, as much as possible;
- restoring damage resulting from snow removal in a timely manner;
- installation of temporary erosion and sediment control measures; and
- clearing trenches of snow, to the greatest extent practical.

Approximately 16 percent of the soils within the LX Project area are classified as hydric. Soil compaction and rutting could occur if construction activities, particularly the operation of heavy equipment, take place when soils are saturated. Columbia Gas would minimize rutting and compaction of hydric soils during construction through the implementation of the proposed upland and wetland construction crossing techniques described in section 4.4, such as the use of timber mats, and the approved BMPs provided in the ECS. Other methods may also be used as necessary depending on conditions. High groundwater levels that accompany hydric soils could also create a buoyancy hazard for the pipeline. Columbia Gas would use special construction techniques, such as concrete coating and other weighting methods, along these sections of the LX pipelines.

4.2.2.3 Soil Handling

During construction activities, the topsoil from all actively cultivated and rotated cropland and improved pasture associated with the LX Project pipelines would be stripped from the entire construction right-of-way, or from directly over the trench, and segregated from the subsoil in accordance with the FERC Plan. In addition, topsoil would be stripped from over the pipeline trench and the adjacent subsoil storage area in residential and wetland areas, unless the landowner or land management agency requests otherwise.

In accordance with its ECS, Columbia Gas would remove the topsoil layer down to a minimum depth of 12 inches in cultivated or rotated agricultural lands and pastures, residential areas, hayfields, and other areas at the landowner's or land mapping agency's request. Segregated topsoil would be returned following backfilling of the subsoil, ensuring preservation of topsoil within the construction area. Following the completion of construction, agricultural areas disturbed by the installation of the LX pipelines would be allowed to return to pre-construction uses; therefore, construction activities in these areas would not adversely affect prime farmland (see 4.2.1.5). Land, including prime farmland, used for the construction of the project aboveground facilities would be permanently converted to industrial use.

The introduction of stones or rocks to surface soil layers may reduce soil moisture-holding capacity and overall soil fertility, resulting in a reduction of soil productivity. Additionally, some agricultural equipment may be damaged by contact with large rocks and stones or shallow bedrock. Shallow bedrock is defined as bedrock within 60 inches of the ground surface. Approximately 45 percent of the soils within the LX Project area have shallow bedrock.

There would be a potential to introduce subsurface stone and rock into surface soils during construction in this area, but due to the short distance of the project within this soil, and given that stones and rock fragments would be likely already present at the surface, it would not be anticipated that construction would change the soil composition. In accordance with its ECS, Columbia Gas would remove any large excess stone and rock from surface soils within the project areas so that rock contents within the soils would be no higher than similar soils in adjacent locations, unless otherwise requested by a landowner. In order to prevent damage to the pipeline protective coating, all excavated materials would

be thoroughly examined, and rocks greater than 4 inches in diameter would be removed prior to backfilling of the trench. In areas where stony/rocky soils or shallow bedrock interfere with conventional excavation or rock trenching methods, blasting may be required to excavate the trench. Blasting details are provided in section 4.1.2.2. Excess rock that cannot be appropriately reclaimed onto the construction right-of-way would be disposed of offsite in approved waste disposal areas. In addition, excess rock not used for backfill or that cleaned off the right-of-way surface would be properly disposed of in approved off right-of-way sites.

Within agricultural lands crossed by the LX and RXE Projects, Columbia Gas and Columbia Gulf would negotiate with and reimburse landowners for any damages to their product or loss of yields as a result of the project construction activities. Columbia Gas and Columbia Gulf would continue to monitor and correct problems with topsoil replacement, soil compaction, rocks, drainage, and irrigation systems resulting from construction until restoration is determined successful. Restoration would be considered successful if the surface condition of the areas disturbed during construction, including the topsoil and the horizon of the upper subsoil, is similar to adjacent undisturbed lands, construction debris is removed, revegetation is successful, and proper drainage has been restored.

4.2.2.4 Soil Restoration and Revegetation

Successful restoration and revegetation of the LX and RXE Project workspaces are important for maintaining productivity and protecting the underlying soil from potential damage. Soil fertility and erosion are generally the two main factors that would limit the regrowth of vegetation, but these can be mitigated through the application of fertilizers and/or seeding nets. Restoration and revegetation growth specifications would follow measures outlined in the ECSs. Columbia Gas and Columbia Gulf would apply soil amendments as needed in areas with low to moderate revegetation potential in order to create a favorable environment for the re-establishment of vegetation.

Documents and guidance specific to Kentucky, Ohio, Pennsylvania and West Virginia to obtain recommendations for seed mixtures and soil amendments for restoration of disturbed areas following construction activities. The ECSs contain seed mixtures and application rates for reseeding disturbed areas, which were established in accordance with requirements and recommendations from the ODNR's Rainwater and Land Development (ODNR, 2006), PADCNR's Seeding Mixtures For Areas Disturbed by Natural Gas Activities (PADCNR, 2015), and the WVDEP's West Virginia Erosion and Sediment Control Field Manual (WVDEP, 2012).

Revegetation of residential and agricultural lands would be conducted in accordance with landowner requests as well as state and local recommendations. In agricultural areas, revegetation would be considered successful if crop yields are similar to adjacent undisturbed portions of the same field. In all other areas, revegetation would be considered successful if, upon visual survey, the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. Columbia Gas would develop grazing deferment plants with willing landowners, grazing permittees, and land management agencies as appropriate to minimize grazing disturbance of revegetation efforts.

4.2.2.5 Installation of Erosion Controls and Stabilization

Clearing, grading, and equipment movement has the potential to accelerate the erosion process and, without adequate protection, result in discharge of sediment to waterbodies and wetlands. Soil loss due to erosion could also reduce soil fertility and impair revegetation. To minimize or avoid potential soil erosion and sedimentation impacts, Columbia Gas and Columbia Gulf would use construction procedures and mitigation measures contained within their ECSs, such as:

- installing temporary ECDs including slope breakers and sediment filter devices (e.g., filter socks and silt fence) following initial ground disturbance;
- installing temporary trench breakers immediately following trench excavation;
- using jute netting or erosion control blankets on steep slopes to help prevent erosion;
- segregating and protecting topsoil from subsoils during trenching;
- postponing work in excessively wet conditions in upland soils;
- using low ground-weight equipment or soil stabilization materials such as timber mats when soils are saturated or standing water is present;
- completing final grading, topsoil replacement and installation of permanent erosion control structures within 20 days after backfilling the trench; and
- inspecting the right-of-way and maintaining erosion and sediment controls as necessary until final stabilization is achieved.

Temporary ECDs would be maintained until the project areas have been successfully revegetated, in accordance with restoration procedures from Columbia Gas' and Columbia Gulf's ECSs, including:

- restoring pre-construction contours;
- installing permanent ECDs such as permanent slope breakers, riprap, rock outlet protection, trench breakers, or French drains;
- removing excess rocks from the right-of-way surface; and
- revegetating the right-of-way as soon as possible following final grading.

Columbia Gas and Columbia Gulf would install permanent ECDs in accordance with revegetation measures outlined in the ECS specific landowner requests. Columbia Gas would monitor the project right-of-way to assess the effectiveness of revegetation and permanent ECDs during the long-term operation and maintenance of the project facilities.

Columbia Gas would continue to coordinate with applicable state agencies to develop mitigation measures for construction activities along steep slopes characterized by soils with increased erosion potential, including Erosion Sediment Control Plans for construction and restoration in Greene County Conservation District.

4.2.2.6 Remobilization of Existing Contamination

Some discrete sites of existing soil contamination have been identified in the LX Project area (section 4.2.1.6). Although Columbia Gas has performed comprehensive assessments and soil remediation at the key sites, some sources of PCBs have been encapsulated and left in place in accordance with the TSCA. Therefore, Columbia Gas previously developed Soil Management Plans for the existing Crawford CS, Ceredo CS, and the Benton CS where residual PCBs were left in place. In addition, Columbia Gas developed Risk Management Plans for the Crawford CS and Ceredo CS following the most recent response actions to maintain compliance with TSCA requirements.

Based on a review of publicly available resources, one additional existing sources of contamination are located within 1 mile of the LX Project area in Wayne County, West Virginia. In addition to reviewing publicly available information, Columbia Gas would attempt to identify areas of historic and existing contamination through discussions with landowners and visual inspection of project workspaces prior to the start of construction to the extent practicable. Therefore, the LX Project is not expected to affect or be affected by any existing contaminated soils. In the event that contaminated media is discovered during construction, Columbia Gas would adhere to their Plan for the Unanticipated Discovery of Contaminated Environmental Media (as part of its ECS) that outlines the steps to be followed in the event that contaminated sediments or soils, as identified by evidence of subsoil discoloration, odor, sheen, or other such indicators, are encountered during construction.

No PCB contamination issues have been identified within the RXE Project area. The RXE Project is not expected to impact or be impacted by PCB contamination. Columbia Gulf would follow all applicable federal, state, and local regulations and measures identified in its ECS in the event that contaminated media is discovered during construction.

4.2.2.7 Fuel Handling and Storage

During construction, contamination from accidental spills or leaks of fuels, lubricants, or coolant from construction equipment could adversely affect soils. Columbia Gas and Columbia Gulf has developed SPCC Plans (as part of their ECSs) that specifies cleanup procedures in the event of soil contamination from spills or leaks. Columbia Gas and Columbia Gulf and their contractors would implement the ECSs to prevent accidental spills of any material that may contaminate soils. If necessary, additional measures would be implemented to ensure that inadvertent spills are contained, cleaned up, and disposed of in an appropriate manner.

4.2.3 Conclusion

Construction activities such as clearing, grading, trench excavation, backfilling, and the movement of construction equipment would affect soil resources during the construction of the pipeline and aboveground facilities, and the establishment of temporary contractor yards and access roads. Clearing removes protective cover and exposes the soil to the effects of wind and rain, which increases the potential for erosion and sedimentation of sensitive areas. Grading, spoil storage, and equipment traffic can compact soil, reducing porosity and increasing runoff potential. Excess rock or fill material brought to the surface during trenching activities could hinder restoration of the right-of-way.

To minimize or avoid impacts on soils during construction and operation of the LX Project, Columbia Gas would implement soil mitigation procedures outlined in their ECS and guidance provided by WVDEP, PADEP, PADCNR, and ODNR.

Columbia Gas and Columbia Gulf would minimize adverse impacts on land, including agricultural, prime farmland and residential areas, by implementing the BMPs identified in their ECSs. Columbia Gas and Columbia Gulf would coordinate with the applicable agencies and landowners in these areas to ensure the proper restoration of any impacted agricultural or residential areas, including replacement of segregated topsoil, stone removal, and to ensure compliance with reseeding recommendations. Columbia Gas and Columbia Gulf would protect active pastureland during construction through the installation of temporary fencing, the use of alternative locations for livestock to cross the construction right-of-way, and/or developing grazing deferment plans, as negotiated with the landowner.

In consideration of the above, we conclude that construction and operation of the project facilities would not have significant adverse effects on soil resources.

4.3 WATER RESOURCES

4.3.1 Groundwater Resources

4.3.1.1 Existing Groundwater Resources

Regional aquifers in the LX Project area in Ohio, Pennsylvania, and West Virginia originate from Pennsylvanian and Mississippian principal aquifers (USGS, 1995, 1997). Groundwater resources in Pennsylvanian aquifers within the vicinity of the project area range from approximately 40 to 260 feet below mean sea level (msl) (USGS, 1995, 1997, 2014b, 2014c; ODNR, 2015). The water quality of Pennsylvanian aquifers generally decreases with depth. Total dissolved solid concentrations range from approximately 322 to 500 milligrams per liter (mg/l) (USGS, 1995). Primary uses of groundwater withdrawn from Pennsylvanian aquifers within the project area include industrial and public supply. In Greene County, Pennsylvania, primary uses include thermoelectric uses and public supply (USGS, 2005).

Groundwater resources in Mississippian aquifers within the vicinity of the LX Project area range from approximately 180 to 290 feet below msl (USGS, 1995; ODNR, 2015). The water quality of Mississippian aquifers generally contains hard water. Total dissolved solid concentrations average approximately 500 mg/l (Ohio State University, 2015). The primary source of potable water in Fairfield and Hocking Counties, Ohio comes from Mississippian aquifers with public supply as the primary use (ODNR, 2005; USGS, 2005).

In the LX Project area, surficial aquifers contain groundwater within unconsolidated sand and gravel deposits. Groundwater ranges from 25 to 200 feet below msl (USGS, 1997). Within the project area, average groundwater depths are approximately 105 feet below msl (USGS, 2014c). Surficial aquifers typically consist of hard water, with dissolved solids averaging approximately 300 mg/l. Iron concentrations increase with depth (West Virginia Department of Health and Human Resources [WVDHHR], 2014). Primary uses for groundwater withdrawn from surficial aquifers include domestic and mining uses (USGS, 2005).

Pennsylvanian principal aquifers are characterized by sandstone and located along the majority of the proposed LEX pipeline segment in addition to portions of the R-801 Loop and BM-111 Loop. Sandstone and carbonate rock characterize Mississippian principal aquifers and found along portions of the LEX1 Pipeline segment, the LEX Pipeline segment, and the R-801 Loop. The surficial aquifer system, made up of unconsolidated sand and gravel deposits, underlays areas along the BM-111 Loop. Table 4.3.1-1 contains a summary of principal aquifers, in addition to location along the pipeline, found in the LX Project area.

Regional aquifers in the RXE Project area consist of sedimentary rocks also ranging in age from Mississippian to Pennsylvanian and from unconsolidated sediments of the Quaternary Age (Kentucky Geological Survey [KGS], 2014a and USGS, 1995).

TABLE 4.3.1-1 Principal Aquifers Crossed by the Leach XPress Project					
		Approximate Milepost		Approximate Depth Below Grade in the Vicinity of the Project Area (feet)[a]	Average Yield (gallons per minute)
Principal Aquifer	**State Designation**	**Begin MP**	**End MP**		
LEX					
Pennsylvanian Aquifers	None	0.0	118.0	45 - 380	1 - 20
Mississippian Aquifers	None	118.0	131.3	109 - 304	5 - 25
LEX1					
Mississippian Aquifers	None	0.0	1.2	25 - 300	5 - 25
R-801 Loop					
Mississippian Aquifers	None	0.0	8.6	35- 315	5 - 25
Pennsylvanian Aquifers	None	8.6	24.2	69 - 315	1 - 20
BM-111 Loop					
Pennsylvanian Aquifers	None	0.0	2.9	25 - 100	1 - 20

Source: USGS 1995, 1997

[a] The approximate depth below grade was determined through review of publicly available data for groundwater wells located within the vicinity of the Project area (USGS, 2015).

4.3.1.2 Sole Source Aquifers

The EPA defines a sole source aquifer (SSA) as the sole or principal source of drinking water for a given service area and supplies 50 percent or more of the drinking water for an area and for which there are no reasonably available alternative sources should the aquifer become contaminated (EPA, 2012). Based on a review of available sources, the LX and RXE Project areas do not include any SSAs (EPA, 2014a, 2014b). The nearest SSA is the Pleasant City SSA in Guernsey County, Ohio, located approximately 8 miles north of the LEX Pipeline segment. Due to the distance of this SSA from project activities, construction and operation of the Project would not directly affect the Pleasant City SSA (EPA, 2013a). There are no state designated aquifers in the LX or RXE Project areas.

4.3.1.3 Wellhead and Aquifer Protection Areas

Under the Safe Drinking Water Act, each state is required to develop and implement a Wellhead Protection Program in order to identify the land and recharge areas contributing to public supply wells, and prevent the contamination of drinking water supplies. The Act also requires the development of a broader-based Source Water Assessment Program, which includes the assessment of potential contamination to both groundwater and surface water through a watershed approach. Wellhead protection areas (WHPA) are defined as designated surface and subsurface zones surrounding public water supply wells or wellfields.

Ohio

In Ohio, OEPA manages the wellhead protection program, part of the Source Water Protection program. OEPA designates areas surrounding public water systems, including groundwater and surface water sources, as Drinking Water Source Protection Areas (DWSPA). Identifying WHPAs and DWSPAs helps prevent contaminants from entering the groundwater table and compromising the quality of public drinking water (EPA, 1994). For each public water system, Drinking Water Source Protection involves two phases; assessment and protection. Assessment determines the area around the public water systems wells or intakes that would be the focus of protection and then all facilities or activities within that area that could potentially release contaminants are listed. The likelihood of water becoming contaminated is determined based upon location of intakes, inventory of potential contaminants, and geologic features.

Protection refers to the activities undertaken by the public water supplier to protect the areas. OEPA encourages municipal public water suppliers to develop Drinking water Source Protection Plans. Columbia Gas reviewed data provided by the OEPA and identified 15 DWSPAs for public water systems associated with groundwater sources located within 0.5 mile of the LX Project (OEPA, 2014a). Five DWSPAs occur within the project workspace including Sugar Grove Village, Wellston, Bremen Village, Lancaster City, and McArthur Village.

In addition to groundwater DWSPAs, the OEPA also establishes DWSPAs for public water systems with surface water sources. LX crosses the Upper Ohio River DWSPA from MP 42.5 to MP 47.8 and MP 62.9 to MP 65.9, and the R-801 Loop crosses the Upper Ohio River DWSPA from MP 23.3 to MP 24.2. LX also crosses the Muskingum River DWSPA from MP 47.8 to MP 54.5 and from MP 59.4 to MP 62.9 (OEPA, 2014a). We further discuss public watersheds in section 4.3.2.2.

Kentucky

A public review of the Kentucky Division of Water (KDOW) Watersheds Viewer indicated that no WHPAs are located within the vicinity of the RXE facilities (KDOW, 2011a).

Pennsylvania

A public review of Pennsylvania's E-mapper indicated that no WHPAs are within 0.5 mile of the project in Pennsylvania (Snider, 2015; PADEP, 2009).

West Virginia

A public review of WVDHHR indicated that no WHPAs are within 0.5 mile of the project in West Virginia (Shaver, 2014; Mitchell, 2014).

4.3.1.4 Water Supply Wells and Springs

Columbia Gas and Columbia Gulf consulted with agencies, performed desktop evaluations, and conducted field surveys to identify groundwater wells within the project areas. The LX Project pipeline facilities, access roads, and pipe yards would be within 150 feet of 73 water wells, including alternate sites for pipe yards. No private or public water supply wells were identified within 150 feet of the RXE facilities (KGS, 2015). Table 4.3.1-2 identifies water supply wells located within 150 feet of the LX Project area.

TABLE 4.3.1-2
Water Wells Within 150 Feet of the LX Project

Approximate Milepost/Facility	County	Type	Status	Use	Distance from Proposed Pipeline (feet)	Distance from Edge of Construction Workspace (feet)[a]
LEX						
West Virginia						
17.9	Marshall	Private	Active	Domestic	111	81
24.6	Marshall	Private	Inactive	Domestic	85	0 [b]
Ohio						
28.0	Monroe	Private	Active	Domestic	33	0 [b]
36.1	Monroe	Private	IU	Domestic	160	131
42.4	Monroe	Private	IU	Domestic	70	41
43.3	Monroe	Private	Active	IU	202	122
48.9	Monroe	Private	Active	Domestic	16	0 [b]
29.6	Noble	Private	Active	Domestic	151	121
60.7	Noble	Private	Inactive	Domestic	25	0 [b]
64.4	Noble	Private	Active	Domestic	16	0 [b]
64.5	Noble	Private	Active	Domestic	108	78
66.3	Noble	Private	Active	IU	155	75
67.3	Noble	Private	Active	Domestic	49	20
70.7	Noble	Private	Active	Domestic	159	78
82.0	Muskingum	IU	Unknown	IU	134	38
85.6	Morgan	Private	Inactive	IU	173	93
88.8	Morgan	Private	Active	Domestic	60	30
88.8	Morgan	Private	Active	Domestic	114	34
91.7	Morgan	Private	Active	IU	247	118
113.3	Perry	Private	Active	Domestic	259	137
117.9	Perry	Private	Active	Domestic	134	51
121.4	Hocking	Private	Inactive	IU	38	9
121.9	Hocking	Private	Active	Domestic	56	0 [b]
123.0	Hocking	Private	Active	Domestic	168	73
123.7	Hocking	Private	Active	Domestic	178	48
123.7	Hocking	Private	Inactive	Domestic	178	48
125.6	Fairfield	Private	Active	Domestic	237	107
129.2	Fairfield	Private	Active	Domestic	38	8
R-801 Loop						
Ohio						
0.2	Hocking	Private	Inactive	IU	138	108
0.3	Hocking	Private	Inactive	IU	103	0 [b]
3.4	Hocking	Private	Inactive	Domestic	145	63
5.0	Hocking	Private	Active	Domestic	3	0 [b]
5.2	Hocking	Private	Active	Domestic	133	104
5.5	Hocking	Private	Inactive	IU	68	0 [b]

TABLE 4.3.1-2 (cont'd)
Water Wells Within 150 Feet of the LX Project

Approximate Milepost/Facility	County	Type	Status	Use	Distance from Proposed Pipeline (feet)	Distance from Edge of Construction Workspace (feet)[a]
6.4	Hocking	Private	Inactive	Domestic	49	0 [b]
7.4	Hocking	Private	Active	Domestic	224	144
9.5	Hocking	Private	Active	Public Water Supply	74	0 [b]
16.6	Vinton	Private	Inactive	Domestic	108	0 [b]
16.9	Vinton	Private	Active	Domestic	34	5
17.0	Vinton	Private	Inactive	IU	183	104
R-501 Abandonment						
4.4	Hocking	Private	Active	IU	87	59
4.4	Hocking	Private	Unknown	Domestic	116	123
5.4	Hocking	Private	Active	Domestic	83	63
5.4	Hocking	Private	Unknown	IU	96	110
Lone Oak Compressor Station, West Virginia						
N/A	Marshall	Private [d]	IU	IU	N/A	0 [b]
Crawford Compressor Station, Ohio						
N/A	Fairfield	Private	Active	Domestic	N/A	0 [b]
N/A	Fairfield	Columbia owned	Active	Industrial	N/A	0 [b]
N/A	Fairfield	Columbia owned	Active	Industrial	N/A	0 [b]
N/A	Fairfield	Columbia owned	Active	Industrial	N/A	0 [b]
N/A	Fairfield	Columbia owned	Active	Industrial	N/A	0 [b]
N/A	Fairfield	Columbia owned	Active	Industrial	N/A	0 [b]
N/A	Fairfield	Columbia owned	Active	Industrial	N/A	0 [b]
N/A	Fairfield	Columbia owned	Active	Industrial	N/A	0 [b]
N/A	Fairfield	Columbia owned	Active	Industrial	N/A	124
Benton Compressor Station, Ohio						
N/A	Hocking	Private (owned by Columbia)	Active	Industrial	N/A [c]	0 [b]
Access Roads and Contractor/Staging/Pipe Yards						
LEX						
Ohio						
Pipe Yard 35 (MP 25.8[c])	Monroe	Private	Inactive	IU	N/A	0 [c]
TAR-40 (MP 48.9)	Monroe	Private	Active	IU	N/A	97
TAR-60 (MP 66.1[c])	Noble	Private	Active	IU	N/A	145
TAR-65 (MP 127.9)	Noble	Private	Active	IU	N/A	142
Pipe Yard 16 (MP 89.3)	Morgan	Private	Active	IU	N/A [c]	0 [b]
Pipe Yard 28 (MP 89.2)	Morgan	Private	Active	IU	N/A [c]	43
Pipe Yard 11 (alt) (MP 120.2 [c])	Fairfield	Private	Active	Domestic	N/A [c]	0 [b]
R-801 Loop						
TAR-52 (MP 2.4)	Hocking	Private	Active	Public	N/A	2
TAR-52 (MP 2.4)	Hocking	Private	Active	IU	N/A	122
TAR-134 (MP 9.4)	Hocking	Private	Inactive	Domestic	N/A	31
PAR-179 (MP 14.2)	Hocking	Private	Inactive	IU	N/A	132

TABLE 4.3.1-2 (cont'd)
Water Wells Within 150 Feet of the LX Project

Approximate Milepost/Facility	County	Type	Status	Use	Distance from Proposed Pipeline (feet)	Distance from Edge of Construction Workspace (feet)[a]
6.4	Hocking	Private	Inactive	Domestic	49	0 [b]
7.4	Hocking	Private	Active	Domestic	224	144
9.5	Hocking	Private	Active	Public Water Supply	74	0 [b]
Pipe Yard 41 (MP 0.1)	Hocking	Private	Active	IU	N/A	99
Pipe Yard 41 (MP 0.1)	Hocking	Private	Active	IU	N/A	88
TAR-137 (MP 24.1)	Vinton	Private	Active	Domestic	N/A	20
Pipe Yard 21 (alternate) (MP 22.8[c])	Vinton	Private	Active	Domestic	N/A	0 [b]
Pipe Yard 21 (alternate) (MP 22.8)	Vinton	Private	Active	Domestic	N/A	51
R-501 Abandonment						
TAR-98 (MP 8.9)	Hocking	Private	Active	IU	N/A	129
TAR-98 (MP 8.9)	Hocking	Private	Active	Domestic	N/A	125
TAR-113 (MP 23.8)	Hocking	Private	Active	Domestic	N/A	104

IU –Information Unavailable
N/A –Not Applicable
[a] Distance from the project to the water well is measured from the center point of the well to the edge of the nearest temporary workspace, additional temporary workspace, contractor/staging/pipe yards, access roads, or aboveground facility boundary.
[b] Private water well occurs within the proposed project workspace.
[c] Facility or contractor/staging/pipe yard located offline; milepost provided is associated with nearest workspace boundary.
[d] Water well and associated property on which it occurs were acquired by Columbia Gas for the operation of the proposed compressor station

Springs are water resources that are formed when flowing groundwater is intersected by a surface feature, such as a valley, at or below the water table. A full aquifer allows water to flow onto the land surface creating a spring (USGS, 2005). Columbia Gas and Columbia Gulf reviewed publically available resources and data obtained during civil surveys, in addition to landowner interviews, to identify the springs located in the LX and RXE Project area (Beck, 2015). Springs identified in the LX Project area are listed in table 4.3.1-3. No springs were identified in the RXE Project area.

Based on the information in the table below, we have identified the milepost locations where the springs are in the vicinity of the proposed project locations. However, the distances of the spring locations relative to the delineated construction areas in certain areas were unavailable. Distances between the edge of the construction workspace and the identified spring were maximized to the extent possible to prevent impacts on spring hydrology.

TABLE 4.3.1-3 Springs Along the LX Project Area				
Approximate Milepost				
Begin MP	End MP	Tract ID	County, State	Distance from Edge of Construction Workspace
LEX				
0.2	0.7	PA-GR-002.000	Greene County, PA	563
IU	IU	PA-GR-005.000	Greene County, PA	IU
4.2	4.3	WV-MA-019A.000	Marshall County, WV	IU
4.7	4.7	WV-MA-023B.000	Marshall County, WV	IU
7.3	7.4	WV-MA-038A.000	Marshall County, WV	IU
31.5	32.0	OH-MO-043.000	Monroe County, OH	30
35.8	36.0	OH-MO-073.00	Monroe County, OH	IU
53.3	53.4	OH-NO-001.003	Noble County, OH	IU
53.4	53.4	OH-NO-001.004	Noble County, OH	IU
53.4	53.6	OH-NO-001.005	Noble County, OH	IU
63.8	64.3	OH-NO-158.000	Noble County, OH	1,451
69.6	69.6	OH-NO-255.000	Noble County, OH	IU
69.6	70.1	OH-NO-256.000	Noble County, OH	IU
79.5	80.3	OH-MU-023.000	Muskingum County, OH	IU
81.1	81.3	OH-MU-041.000	Muskingum County, OH	0
86.2	86.7	OH-MN-017.000	Morgan County, OH	IU
88.7	89.0	OH-MN-035.000	Monroe County, OH	IU
89.0	89.0	OH-MN-037.000	Morgan County, OH	IU
90.6	91.2	OH-MN-085.000	Morgan County, OH	IU
91.2	91.2	OH-MN-092.000	Morgan County, OH	IU
91.2	91.4	OH-MN-091.000	Morgan County, OH	IU
93.4	93.8	OH-MN-118.001	Morgan County, OH	IU
114.3	114.3	OH-PE-163.000	Perry County, OH	IU
114.4	114.5	OH-PE-161.000	Perry County, OH	IU
124.5	124.6	OH-HO-053A.000	Hocking County, OH	IU
124.6	124.7	OH-HO-054A.000	Hocking County, OH	IU
R-801 Loop				
4.7	4.8	OH-165-000.000	Hocking County, OH	IU
5.0	5.0	OH-HO-175.000	Hocking County, OH	IU
6.3	6.6	OH-HO-197.000	Hocking County, OH	IU

IU – Information unavailable

4.3.1.5 Contaminated Groundwater

The LX and RXE Projects and associated facilities would not disturb any sites of known groundwater contamination (Dasher, 2014; PADEP, 2015a, 2015b; Ohio Department of Commerce, 2014; EPA 2015). However, 18 previously leaking underground storage tanks have been identified within 0.5 mile of the project facilities, 12 of which have been successfully remediated and listed as approved (WVDEP, 2016; PADEP, 2015a; Ohio Department of Commerce, 2016). The sources of contamination associated with five of the remaining storage tanks have been cleaned up, but official approval of these remediation activities has not been granted. Clean-up activities for the remaining storage tank has not been initiated; however, no ground disturbance is anticipated, as it is located 0.2 mile south of Pipe Yard 26. One of the 18 identified sites occurs within the workspace of Pipe Yard 36, but this area would be used for staging/storing equipment and no ground disturbance in this area is

anticipated. Pipe Yard 36 is an aboveground pipeline facility located in Muskingum County, Ohio. This facility is located offline, and the nearest milepost is 100.3.

Columbia Gas has not identified any potential issues relative to contaminated groundwater during construction and operation of the LX and Project facilities. Stop work would occur if Columbia Gas encounters any groundwater with a distinct odor or unusual visual appearance during construction. Appropriate state and federal agencies would be contacted and Columbia Gas would proceed in accordance with federal, state, and local regulations and guidance.

4.3.1.6 Groundwater General Impact and Mitigation

Construction of the pipeline facilities, including aboveground facilities, temporary workspace, access roads, and contractor yards, could potentially affect the overland water flow and recharge of shallow aquifers. The majority of construction activities would involve shallow, temporary, and localized excavation. However, impacts on shallow aquifers could result from construction activities such as vegetative clearing, soil compaction, trench excavation, blasting, and dewatering. These activities would have temporary, minor effects on local vegetation and wetland hydrology.

Clearing

To establish the construction workspace, Columbia Gas would implement clearing and grading techniques. These techniques involve removal of vegetation which would filter water during infiltration and recharge of shallow aquifers. Vegetative clearing would only occur where necessary, and vegetation would be allowed to reestablish after construction in accordance with the FERC Plan and described in Columbia Gas' ECSs.

Columbia Gas would mark and locate groundwater wells and springs within the project workspace prior to initiating clearing and grading activities. Coordination with the spring or well owner would take place prior to construction to determine appropriate construction measures. An appropriate buffer and construction procedure would be determined around any well or spring encountered during clearing activities. Columbia Gas would provide a temporary source of water to affected individuals and/or compensate for damages or restore the water supply should adverse impacts on a groundwater well or spring result from construction activities.

Trench Excavation and Dewatering

Under standard conditions, Columbia Gas would trench to a depth of approximately 6.5 to 7.0 feet. Trench excavation could temporarily affect perched groundwater from shallow aquifers or confining units near the surface. During excavation, presence of a high water table could require dewatering of the trench. Disturbances to groundwater from trench excavation would likely be negligible since minor disturbances would be highly localized and temporary.

Trenches would not remain open for more than 30 days in any areas unless authorized by the on-site inspector. Trench breakers would reduce water velocity and erosion of the trench bottom. Water pumped from trench or bore pits would be pumped into a heavily vegetated upland area to allow the water to filter back into the ground.

Soil Mixing and Compaction

Improper soil segregation techniques can affect subsurface hydrology and water table elevations during excavation. Soil compaction, due to the passage of heavy machinery, has the potential to alter water tables. Soil mixing and soil compaction typically reduce the absorptive or retentive abilities of soils

in aquifer recharge areas, adversely affecting shallow aquifers that rely on precipitation seeping into the ground. Section 4.2.2.3 through section 4.2.2.7 provides additional information related to soil handling.

Columbia Gas would return soil horizons to near their original state in wetland and agricultural areas by using topsoil and subsoil segregation techniques. This would limit soil compaction to localized areas. Topsoil and subsoils would be tested for compaction at regular intervals in agricultural and residential areas disturbed by construction activities. Decompaction of soils within the project areas, excluding permanent aboveground facility foundations, would take place prior to project completion. Surrounding groundwater resources or groundwater quality would not be significantly affected by soil mixing and compaction.

Fuel Handling and Storage

Spills or leaks of hazardous liquids could potentially result in long-term impacts on groundwater resources, specifically in areas highly susceptible to surface contamination. The type of underlying bedrock, depth to bedrock, depth to the water table, and characteristics of soils and surficial deposits determine groundwater susceptibility to surface contamination.

Fuel storage, equipment refueling, and equipment maintenance have the potential to cause spill-related impacts from the construction of the LX and RXE Projects. Columbia Gas would regulate fuel storage and refueling activities and require immediate cleanup should a spill or leak occur consistent with the SPCC Plan. These measures would avoid or greatly reduce potential impacts resulting from spills and leaks of hazardous liquids. To minimize the potential impacts on groundwater and water wells due to spills or leaks, measures outlined in Columbia Gas' ECSs in addition to the Plan and Procedures would be implemented such as:

- properly training of all project inspectors and contractor personnel;
- assigning at least one EI to each of the various project components;
- locating fuel storage areas at least 200 feet from active private water wells and at least 400 feet from municipal water wells unless using an operational fuel storage area established on Columbia property;
- cleaning-up all spills immediately after a release is contained and ensure immediate action is taken to minimize the impact of the spill, including proper notification to the EI; and
- performing regular inspection of all construction equipment to ensure equipment is in good operating order and would travel only on approved access roads.

Blasting

Construction of the LX Project may require blasting in certain designated areas. Section 4.1.2.2 provides specific information regarding blasting and locations of areas designated for blasting. Blasting could affect groundwater quality by temporarily changing groundwater levels and increasing groundwater turbidity near the construction right-of-way. Rock particles and sedimentation would most likely settle out quickly. Alternative construction may be used; however, blasting may achieve the necessary trench depth in areas where alternative techniques are ineffective or inefficient. Columbia Gas has developed an acceptable Blasting Plan to minimize impacts on the surrounding environment resulting from blasting. Columbia Gas would adhere to all applicable federal, state, and local blasting notification requirements. Additional details regarding blasting are outlined in section 4.1.2.2.

Water Supply Well and Spring Testing

Columbia Gas would conduct pre-and post-construction testing of water wells and springs found within 150 feet of the LX Project construction workspace, at the landowner's request. Columbia Gas would obtain pre-and post-construction samples from each water well and would test for both water quality and quantity parameters. These samples would be tested for concentration of constituents, volatile organic compounds, total petroleum hydrocarbons, and compounds used in blasting charges. After sampling events, Columbia Gas would contact the landowner with results. Columbia Gas would compensate the landowner for the repair of the well, installation of a new well, or otherwise arrange for provision of suitable water supplies should significant differences arise in the results of sampling events that cannot be attributed to naturally occurring events.

4.3.1.7 Groundwater Conclusion

Permanent impacts on groundwater are not expected as a result of LX Project construction and operation. Disturbances resulting from construction or operation of the Project would be shallow, temporary and localized excavation. Columbia Gas would employ erosion controls, restore the natural ground contours, and revegetate the right-of-way. Implementation of the Projects' ECS, SPCC Plan, and the appropriate protective measures of the FERC Plan and Procedures would further reduce impacts on groundwater resources. Temporary, minor, and localized impacts could result during trenching activities in areas of shallow groundwater (less than 10 feet below the ground surface) crossed by the pipeline. The potential for hazardous waste spills poses the greatest impact on groundwater resources in the project area. Columbia Gas' measures to prevent spills are summarized in the SPCC Plan included in their ECSs. With the implementation of the measures discussed above, the depth of the aquifers, and the relatively shallow nature of construction, we have concluded that construction and operation of the Project would not significantly affect aquifers and groundwater resources.

4.3.2 Surface Water Resources

4.3.2.1 Existing Surface Water Resources

Columbia Gas identified surface water resources in the LX project area during field surveys conducted in the summer and fall of 2014, and spring of 2015. The LX Project would be located within nine watersheds, and the RXE Project would be located in three watersheds. Watershed descriptions and approximate locations near the LX and RXE Projects are provided in table 4.3.2-1.

Appendix K-1 lists the 1,083 waterbodies that would be crossed by the LX Project and includes the MP location, feature name, waterbody name, state water quality classification, fisheries classification, FERC classification, flow regime, approximate waterbody width, pipeline crossing length, and proposed method of crossing. Table 4.3.2-2 lists the five waterbodies affected by the RXE Project and includes the identification number, waterbody name/description, length, width, flow regime, designated uses, and fishery type. Approximately 63 feet of one minor, intermittent waterbody would be permanently filled as a result of construction and operation of the proposed Lone Oak CS. In addition, approximately 100 feet of one minor, ephemeral waterbody would be permanently relocated to accommodate a new storm water management pond within the existing Ceredo CS.

TABLE 4.3.2-1 Watersheds Crossed by the LX and RXE Projects			
Facility	**Milepost/Location**	**County, State**	**Watershed**
Pipeline Facilities			
LEX	0.0- 24.4	Marshall, WV; Greene, PA	Upper Ohio-Wheeling HUC 05030106
	24.4 –47.8 54.5 RR-7 –59.4 62.9 –72.6	Monroe and Noble, OH	Little Muskingum-Middle Island HUC 05030201
	47.8 – 54.5 RR-7 59.4 – 62.9	Monroe and Noble, OH	Wills HUC 05040005
	72.6 – 107.8 108.0 – 108.1 108.8 – 108.9	Noble, Muskingum, Morgan, and Perry, OH	Muskingum HUC 05040004
	107.8 – 108.0 108.1 – 108.8 108.9 – 131.3	Perry, Fairfield, and Hocking, OH	Hocking HUC 05030204
LEX1	0.0 – 1.2	Hocking, OH	Hocking HUC 05030204
R-801 Loop	0.0 – 6.3	Hocking and Fairfield, OH	Hocking HUC 05030204
	6.3 – 14.3	Fairfield and Vinton, OH	Lower Scioto HUC 05060002
	14.2 – 24.2	Vinton, OH	Raccoon-Symmes HUC 05090101
BM-111 Loop	0.0 - 0.4	Lawrence, OH	Raccoon-Symmes HUC 05090101
	0.4 - 2.9	Wayne, OH	Twelvepole HUC 05090102
R-501 Abandonment	0.0 - 10.5	Fairfield and Hocking, OH	Hocking HUC 05030204
	10.5 – 18.3	Hocking and Vinton, OH	Lower Scioto HUC 05060002
	18.28 - 28.23	Vinton, OH	Raccoon-Symmes HUC 05090101
LX Aboveground Facilities			
LEX launcher facility	0.0	Marshall, WV	Upper Ohio-Wheeling HUC 05030106
Lone Oak Compressor Station	7.4	Marshall, WV	Upper Ohio-Wheeling HUC 05030106
Summerfield Compressor Station	57.1	Noble, OH	Little Muskingum Middle-Island HUC 05030201
Mainline Valves	3.1; 18.6 RR-4	Marshall, WV	Upper Ohio-Wheeling HUC 05030106
	31.7; 65.6	Monroe and Noble, OH	Little Muskingum Middle-Island HUC 05030201
	49.3	Monroe, OH	Wills HUC 05040005
	84.26; 104.2	Muskingum, and Perry, OH	Muskingum HUC 05040004
	122.0	Hocking, OH	Hocking HUC 05030204

TABLE 4.3.2-1 (cont'd)
Watersheds Crossed by the LX Project

Facility	Milepost/Location	County, State	Watershed
LEX1			
LEX1 receiver facility	1.2	Fairfield, OH	Hocking HUC 0503020
K-260 Regulator Station	0.0	Fairfield, OH	Hocking HUC 05030204
R-801 Loop			
R-System Regulator Station	0.0	Fairfield, OH	Hocking HUC 05030204
Benton Regulator Station	12.8	Hocking, OH	Raccoon-Symmes HUC 05090101
RS-1286 Regulator Station	21.6	Vinton, OH	Raccoon-Symmes HUC 05090101
McArthur Regulator Station	24.2	Vinton, OH	Raccoon-Symmes HUC 05090101
Mainline Valves	9.7	Hocking, OH	Lower Scioto HUC 05060002
BM-111 Loop			
BM-111 Loop launcher facility	0.0	Lawrence, OH	Raccoon Symmes HUC 05090101
Ceredo Compressor Station	2.9	Wayne, WV	Twelvepole HUC 05090102
Existing Columbia Pipeline System			
Crawford Compressor Station	0.0 [a]	Fairfield, OH	Hocking HUC 05030204
Oak Hill Compressor Station	51.5 [a]	Jackson, OH	Raccoon-Symmes HUC 05090101
Benton Compressor Station	5.2 [b]	Hocking, OH	Lower Scioto HUC 05060002
R-486 Odorization Station	34.7 [a]	Jackson, OH	Raccoon-Symmes HUC 05090101
R-130 Odorization Station	37.1 [a]	Jackson, OH	Raccoon-Symmes HUC 05090101
R-543 Odorization Station	53.7 [a]	Jackson, OH	Raccoon-Symmes HUC 05090101
R-300 / R-500 Odorization Station	88.0 [a]	Lawrence, OH	Little Scioto-Tygarts HUC 05090103
RXE Facilities			
Grayson Compressor Station	68 [c]	Carter, KY	Lower Stinson Creek – Little Sandy River HUC 050901040305
Means Compressor Station	6.0-6.5 [c]	Montgomery and Menifee, KY	Headwaters Slate Creek HUC 051001010701 Spruce Creek – Slate Creek HUC 051001010702

[a] Milepost is associated with Columbia Gas' existing Line R-501
[b] Milepost is associated with Columbia Gas' existing Line R-515
[c] Milepost is associated with Columbia Gulf's existing Mainline 100, 200, and 300

TABLE 4.3.2-2
Waterbodies Affected by the RXE Project

Waterbody ID[a]	Description	Length (ft)	Width (ft)[b]	Flow Regime	State Designated Uses[c]	Fishery Type
Grayson Compressor Station - Carter County						
S039	Unnamed tributary to Beckwith Branch	603	5	Intermittent	PCR, SCR, DWS	WAH[d]
S040	Unnamed tributary to Beckwith Branch	41	2	Ephemeral	PCR, SCR, DWS	WAH[d]
S041	Unnamed tributary to Beckwith Branch	448	3	Ephemeral	PCR, SCR, DWS	WAH[d]
Means Compressor Station – Menifee County						
NA[e]	NA[e]	NA[e]	NA[e]	NA[e]	NA[e]	NA[e]
Means Compressor Station – Montgomery County						
S013	Unnamed tributary to the Licking River	816	3	Ephemeral	PCR, SCR, DWS	WAH[d]
S014	Unnamed tributary to the Licking River	528	1	Ephemeral	PCR, SCR, DWS	WAH[d]

[a] Waterbody ID is based on field designations for identified resources as described in *the Wetland and Waterbody Delineation Report* submitted for the RXE Project and available in the Project Docket (CP15-539).
[b] Crossing width equal to OHWM
[c] Kentucky State Designation of Uses as defined by KAR 10:026.
PCR – Primary Contact Recreation
SCR – Secondary Contact Recreation
DWS – Domestic Water Supply (applicable at existing points of public water supply intake)
[d] Warm Water Aquatic Habitat
[e] NA – Not applicable; no waterbodies located within project boundaries

Pipeline Facilities

Ohio

Pipeline facilities in Ohio would cross 716 minor waterbodies, 65 intermediate waterbodies, and 5 major waterbodies, for a total of 786 crossings. Of these, 388 waterbodies are classified as ephemeral, 279 as intermittent, 112 as perennial, and 7 as open water.

West Virginia

Pipeline facilities in West Virginia would cross 161 minor waterbodies, 14 intermediate waterbodies, and 5 major waterbodies, for a total of 180 crossings. Of these, 78 waterbodies are classified as ephemeral, 67 as intermittent, and 35 as perennial.

Pennsylvania

Pipeline facilities in Pennsylvania would cross 14 minor waterbodies, 3 intermediate waterbodies, and no major waterbodies. Of these, 8 are classified as ephemeral, 5 as intermittent, and 4 waterbodies are classified as perennial.

Aboveground Facilities

Aboveground facilities would affect seven minor waterbodies in Ohio (five ephemeral and two intermittent) and eight minor waterbodies in West Virginia (five ephemeral and three intermittent) associated with the LX Project. There would be no aboveground facility impacts on waterbodies in Pennsylvania associated with the LX Project. In Kentucky, 5 tributaries could be affected by the RXE Project.

Access Roads

Proposed access roads would cause impacts on 57 minor waterbodies and 9 intermediate waterbodies in Ohio (21 ephemeral, 28 intermittent, and 17 perennial). In West Virginia, proposed access roads would affect seven minor waterbodies (four ephemeral, two intermittent, and one perennial), and one major waterbody (perennial). Access roads would affect one minor/intermittent waterbody in Pennsylvania.

Contractor Yards and Anode Beds

Contractor yards would temporarily affect eight minor waterbodies (five ephemeral and three intermittent) in Ohio. Two manmade ponds (open water) in Ohio are located within the project workspace and are classified as major waterbodies; however, the ponds would be avoided during construction activities. Two minor/ephemeral waterbodies would also be temporarily affected in West Virginia as a result of contractor yards. Contractor yards would not impact waterbodies in Pennsylvania. In addition, one minor/ephemeral waterbody in Ohio and another minor/intermittent waterbody in West Virginia could be affected by anode beds.

4.3.2.2 Public Water Supplies

Landowners in Marshall County, West Virginia and Greene County, Pennsylvania rely on groundwater as the primary source of drinking water in the immediate project area. Wayne County, West Virginia uses surface water as the primary source of drinking water. Columbia Gas used publicly available data to identify surface intakes for public water supplies. No surface intakes for public water supplies are located within 3 miles of the project area in Marshall and Wayne Counties, West Virginia, and Greene County, Pennsylvania (Foster, 2015; Seifert, 2015; Lagos, 2015; Farris, 2015; Farley, 2015; Flint, 2015; Williams, 2015; West, 2015; Public Service Commission of West Virginia, 2014; Department of Economic Development for Greene County, 2008).

The WVDHHR established source water protection areas and zones of critical concern surrounding surface water intakes for public water supplies on surface waterbodies that are considered highly susceptible to potential contamination. Zones of critical concern boundaries are drawn according to an estimated 5-hour time of travel of water in streams to the public water supply intake location. WVDEP has further established zones of peripheral concern, which extend beyond the zones of critical concern and are based on an additional 5-hour surface water travel time for a total zone of 10 hours from the public water supply intake location.

The LEX Pipeline crosses the zones of concern and zones of peripheral concern associated with two public water supplies (Covestro public water supply and the Sistersville Municipal Water public water supply). Associated surface water intakes for these two public water supplies are located 5.6 and 18.7 miles, respectively, from the LX Project area (McGee, 2016; Surface, 2016).

Two public water supplies with four individual surface water intakes are located 3 miles downstream of the LX Project area, as shown in table 4.3.2-3 (OEPA, 2014a). Water intakes associated

with the Woodsfield Village public water supply are located downstream of 12 tributaries crossed by the project in Monroe County, Ohio. In addition, a surface water intake associated with the Caldwell Village public water supply is located downstream of six tributaries crossed by the project. Columbia Gas has agreed to notify the operator of each public waters supply prior to initiating construction activities for the Caldwell Village public water supply and the Woodsfield Village public waters supply (Smith, 2015; Weber, 2015; Robinson, 2015).

The nearest intake for surface water withdrawal associated with the RXE Project in Kentucky would be located on the Little Sandy River. However, this intake would be 4 miles away and is upstream of the proposed Grayson CS. No public water supply intakes were identified within 3 miles of the proposed Means CS.

TABLE 4.3.2-3
Surface Water Intakes for Public Water Supplies Within 3 Miles Downstream of the LX Project

Public Water System Name (Location)	Surface Water Intake Source	Milepost of Tributary Crossed by the Project	Approximate Distance from Project (miles)
LEX			
Woodsfield Village (Monroe County, OH)	Woodsfield Reservoir 2	42.7	0.8
	Woodsfield Reservoir 1	42.7	1.4
	Sunfish Creek	43.5	2.0
		43.6	2.0
		43.7	2.1
		43.8	2.1
		44.0	2.2
		44.2	2.3
		44.4	2.5
		44.6	2.6
		44.7	2.7
		45.2	3.0
Caldwell Village (Noble County, OH)	Caldwell Lake	65.1	0.2
		65.2	0.2
		65.4	0.2
		65.5	0.2
		65.7	0.2
		65.8	0.3

4.3.2.3 Water Classifications

Section 303(d) of the CWA requires states to identify waters that do not attain their designated use(s) or meet the state water quality standards. Waters that fail to meet their designated beneficial use are considered as impaired and listed under a state's 303(d) list of impaired waters. According to the EPA, the LX Project would cross a total of 128 waterbodies classified as 303(d) listed impaired waters in West Virginia and Ohio (appendix K-2) (EPA, 2013b). No 303(d) listed impaired waters were identified as being impacted by the RXE Project.

The EPA Water Quality Planning and Management Regulation also requires states to develop a total maximum daily load (TMDL) for those waters (40 CFR 30). TMDLs represent the maximum amount of a given pollutant that a waterbody may contain while still retaining its designated use. The following state-listed regulations are outlined below.

Ohio

OEPA characterizes waterbodies according to designated use. The Ohio Administrative Code 3745-1 classifies waterbodies as: aquatic life habitat (warmwater, limited warmwater, exceptional warmwater, modified warmwater, seasonal salmonid, coldwater [coldwater habitat, inland trout streams and coldwater habitat, native fauna], and limited resource water [acid mine drainage, small drainage way maintenance, and other specified conditions]), nuisance prevention, water supply (public, agricultural, and industrial), and recreational (bathing waters, primary contact [Class A, Class B, and Class C], and secondary contact).

Kentucky

Kentucky defines six surface water designated uses including warm water aquatic habitat, cold water aquatic habitat, primary contact recreation, secondary contact recreation, domestic water supply, and outstanding source resource waters (Kentucky Administrative Regulations [KAR], 2014a). Title 401 of the KAR provides a list of surface water use designations for waterbodies in Kentucky. Surface waters not identified on the list are designated for the uses of warm water aquatic habitat, primary contact recreation, secondary contact recreation, and domestic water supply.

Pennsylvania

PADEP characterizes surface waters by protected uses according to the Pennsylvania Water Quality Standards (25 Pa. Code §93.4). Aquatic life use includes coldwater fishes, warmwater fishes, migratory fishes, and trout stocking. Water supply use consists of potable water supply, industrial water supply, livestock water supply, wildlife water supply, and irrigation. Recreation and fish consumption use includes boating, fishing, water contact sports, and esthetics. Special protection use characterizes high quality waters and exceptional value waters. Navigation is categorized as other use (PADEP, 2015c).

West Virginia

WVDEP characterizes surface waters by designated use. Under the 47 Code of State Rules 2, surface waters are characterized by designated use:

- Category A includes public water supply;
- Category B characterizes aquatic life including warmwater fisheries (B1), trout waters (B2), and wetlands (B4);
- Category C is water contact recreation;
- Category D characterizes agriculture and wildlife uses including irrigation (D1), livestock watering (D2), and wildlife (D3); and
- Category E characterizes water supply industrial, water transport, cooling, and power, including water transport (E1), cooling water (E2), power production (E3), and industrial uses (E4) (WVDEP, 2015b).

Waterbodies in West Virginia are further classified according to level of protection required to maintain the water's designated and/or high quality use (47 CSR 2). Tier 1 surface waters maintain and protect existing uses of a waterbody and the water quality conditions necessary to support such uses. Tier 1 waterbodies include those listed as impaired on the state's 303(d) list as it pertains to the specific pollutant listed. Surface waters listed as Tier 2 maintain and protect "high quality" waters or waterbodies

where the level of water exceeds levels necessary to support recreation and wildlife and the propagation and maintenance of fish and other aquatic life. Waterbodies not listed as impaired on the state's 303(d) list are considered Tier 2 waterbodies. A Tier 3 classification maintains and protects water quality in outstanding national resource waters (WVDEP, 2015b).

4.3.2.4 Sensitive Waterbodies

Sensitive waterbodies include, but are not limited to:

- National Wild and Scenic Rivers;
- Section 10 Navigable waters;
- those listed on the National Park Service's (NPS) Nationwide Rivers Inventory; and
- waterbodies on a state river inventory.

Table 4.3.2-4 lists sensitive surface waters crossed by the LX Project based on water quality parameters. The LX and RXE Projects would not cross any federally listed Wild and Scenic Rivers, West Virginia designated Outstanding National Resource Waters, Ohio designated Scenic Rivers and outstanding state waters, or Pennsylvania-designated Scenic Rivers and special protection waters. We have not identified any sensitive waterbodies in the RXE Project area. The LX Project crosses three high quality streams in Marshall County that have significant importance to WVDEP, as monitoring sites on them have been identified as Reference Sites for use in assessing Aquatic Life Designated use attainment. These sites are used to establish expectations for healthy benthic macroinvertebrate communities in the Western Allegheny Plateau Ecoregion and are French Run (of Grave Creek); Long Run (of Fish Creek); and Henderson Hollow (of Long Run)[16].

The LX Project would cross six Ohio-designated superior high quality waters: Piney Fork, Muskingum River, Turkey Run, Hocking River, Queer Creek, and the Ohio River. The LX Project would also cross three Ohio state-designated state resource waters: Little Blackjack Branch, Blackjack Branch, and Elk Fork. Superior high quality waters and state resource waters in Ohio are waterbodies that possess exceptional ecological value. Exceptional ecological value is determined based on the presence of threatened or endangered species or suitable habitat and/or a high level of biological integrity (OEPA, 2014b). Crossings of these waterbodies would comply with requirements under the OEPA's Section 401 Water Quality Certification.

In West Virginia, the LX Project would cross four West Virginia state-designated high quality waters: Fish Creek, Grave Creek, Ohio River, and Twelvepole Creek (Brooks, 2015). WVDNR recommends trenchless crossing methods during fish spawning season (April 1 to June 30) and dry open-cut crossing methods outside of fish spawning season. Columbia Gas would use dry open-cut construction methods for one of the two crossings of Twelvepole Creek and at the Grave Creek crossing. Additionally, Columbia Gas would use the HDD construction method for both Ohio River pipeline crossings, the remaining Twelvepole Creek Crossing, and the pipeline crossing of Fish Creek. Activities associated with crossing West Virginia state-designated high quality waters would be covered under the WVDNR Stream Activity Permit for Marshall and Wayne Counties, West Virginia. Columbia Gas intends to request a waiver from the fish spawning season timing restriction prior to construction.

[16] http://www.dep.wv.gov/WWE/watershed/wqmonitoring/Documents/SOP%20Doc/WABSOP/WABRerence.pdf

TABLE 4.3.2-4
Sensitive Surface Waters Crossed by the LX Project

Waterbody Name	Approximate Milepost of Crossing	Feature ID	County, State	Basis for Sensitivity	Waterbody Width at Crossing (ft)	Proposed Crossing Method
LEX						
Dunkard Fork	1.8	SA6MR001	Greene, PA / Marshall, WV	Approved Trout Water [a]	73	Dry open-cut
Grave Creek	16.1	SA2MR580	Marshall, WV	High quality water [d]	51	Dry open-cut
Fish Creek	21.3	SA6MR328	Marshall, WV	High quality water [d]	104	HDD
Fish Creek	TAR -14 (MP 21.4)	SA7MR019	Marshall, WV	High quality water [d]	75	Existing bridge
Ohio River	25.4 RR-5	SA7MN027	Marshall, WV / Monroe, OH	High quality water [d]; Section 10 [b]; Superior high quality [c]	1,366	HDD
French Run	11.1	SA6MR048	Marshall, WV	WVDEP Reference Site	1	Workspace only
Long Run	23.3	SA8MR104	Marshall, WV	WVDEP Reference Site	32	Dry open-cut
Henderson Hollow	23.3	SA8MR103	Marshall, WV	WVDEP Reference Site	3	Wet open-cut
Piney Fork	38.7	SA3MN107	Monroe, OH	Superior high quality [c]	29	Dry open-cut
Muskingum River	89.4	SA6MO298	Morgan, OH	Section 10 [b]; Superior high quality [c]	300	HDD
Turkey Run	110.1	SA8PE174	Perry, OH	Superior high quality [c]	8	Dry open-cut
Turkey Run	118.2	SA6PE236	Perry, OH	Superior high quality [c]	10	Dry open-cut
Hocking River	130.4	SA1HO291	Hocking, OH	Section 10 [b]; Superior high quality [c]	120	HDD
R-801 Loop						
Blackjack Branch	7.6	SA2HO368	Hocking, OH	State resource water [c]	25	Dry open-cut
Little Blackjack Branch	8.9	SA1HO313	Hocking, OH	State resource water [c]	7	Dry open-cut
Queer Creek	11.8	SA1HO324	Hocking, OH	Superior high quality [c]	12	Dry open-cut
Elk Fork	19.1	SA1VN351	Vinton, OH	State resource water [c]	5	Dry open-cut
BM-111 Loop						
Ohio River	0.1	SA1WA368	Lawrence, OH / Wayne, WV	Section 10 [b]; Superior high quality [c]; High quality water [d]	1,666	HDD
Twelvepole Creek	0.5	SA1WA370	Wayne, WV	High quality water [d]	144	HDD
Twelvepole Creek	2.6	SA2WA450	Wayne, WV	High quality water [d]	80	Dry open-cut

[a] As designated by the Pennsylvania Fish and Boat Commission
[b] As designated by the US Army Corps of Engineers.
[c] As designated by the Ohio Environmental Protection Agency
[d] As designated by the West Virginia Division of Natural Resources

Because these time windows may differ from the time windows required by section V.B.1 of our Procedures, we require evidence of the state agency's approval for the proposed time windows. Because Columbia Gas has not yet received its WVNDR Stream Activity Permit for the LX Project, we are unable to verify these WVDNR recommended instream work windows. To ensure these resources are crossed in compliance with agency recommendations and permits, **we recommend that:**

- **<u>Prior to construction</u>, Columbia Gas should file with the Secretary a copy of the final WVDNR Stream Activity Permit for the LX Project documenting the state agency's approval of instream work windows and incorporate these time windows into its final construction plans.**

In Pennsylvania, the LX Project would cross Dunkard Fork, a Pennsylvania Fish and Boat Commission (PFBC) Approved Trout Water. Crossings of Dunkard Fork would comply with PFBC's recommendation of no in-stream construction during March 1 to June 15 (PFBC, 2009). Further details regarding Dunkard Fork and other fisheries crossed by the LX project are discussed in section 4.6.2.

Section 10 waterbodies, regulated by the COE, crossed by the LX Project include the Ohio River, Hocking River, and Muskingum River (COE, 2014b, 2014c). As shown in table 4.3.2-4 the Ohio River, Muskingum River, and Hocking River would be crossed via HDD. All activities associated with crossing Section 10 waterbodies would be authorized in conjunction with the Section 404 Permit and Section 401 Water Quality Certification in West Virginia. Proposed HDD locations and crossing lengths are discussed in section 2.3.2.

Waterbodies that Support Fisheries of Special Concern

Several waterbodies crossed by the LX Project in Ohio have the potential to contain suitable habitat for state listed threatened and endangered fish species. Dunkard Fork is classified as an Approved Trout Water by PFBC. Information regarding fisheries of special concern is discussed further in section 4.6.2.2.

Impaired Streams

The LX Project would cross 128 waterbodies in West Virginia and Ohio that are classified as 303(d) listed impaired waters. These waterbodies are listed in appendix K-2 and indicate the source of impairment for each waterbody. No 303(d) listed impaired waters were identified as being impacted by the RXE Project. Based on consultations with state agencies, no specialized construction procedures are required or recommended for crossing 303(d) impaired waters (Cochran, 2015; Joseph, 2015).

Flood Hazard Zones

The LX Project would cross several FEMA identified flood hazard zones, as shown in table 4.3.2-5. According to FEMA, zones A and AE have a 1 percent annual chance of a flood event. These areas are known as the base flood or 100-year floodplain. Approximately 6.6 miles of pipeline facilities are located within the AE floodzone and 1.3 miles are located within the A floodzone. Approximately 0.4 acre of the proposed Oak Hill CS suction/discharge lines and 0.2 acre of the proposed Crawford CS regulator and valve facility are located within the 100-year floodplain. The existing Benton CS (0.3 acre) is entirely located within the 100-year floodplain. Approximately 5.6 acres of the Grayson CS associated with the RXE Project occurs within the 100-year floodplain. The Means CS is not located within a floodzone.

Flash flooding is possible within floodplains during or after large and/or sudden rain events. The LX and RXE Projects could be impacted by flash floods in areas where the project crosses or is in close proximity to streams or rivers, or that are located within the 100-year floodplain (A and AE zones) mapped by FEMA (2014). Flooding could increase the buoyancy of the pipelines, causing them to rise toward the land surface where they may be exposed. In areas where pipe buoyancy is a concern the pipe would be weighted with concrete coating prior to installation. Columbia Gas' and Columbia Gulf's ECSs outline measures to protect from flooding during construction.

The increase in impervious surface in floodzones associated with installation of each aboveground facility would be minor and not expected to adversely impact floodplain functions or increase flooding. Additionally, project-related facilities would be constructed in accordance with federal, state and local building codes and permitting requirements, including compliance with local floodplain ordinances and management of construction storm water discharges.

TABLE 4.3.2-5
Areas Within the 100-year Floodplain Crossed by the LX Project

Facility	Begin MP	End MP	Floodzone
Pipeline Facilities			
LEX	21.3	21.3	Zone AE
	25.3 RR-5	25.9 RR-5	Zone AE
	66.9	67.0	Zone AE
	89.4	89.6	Zone AE
	89.7	89.7	Zone AE
	119.9	120.2	Zone AE
	122.1	122.5	Zone AE
	123.1	123.6	Zone AE
	124.1	124.2	Zone AE
	130.2	130.6	Zone AE
	130.7	130.7	Zone AE
	1.7	1.8	Zone A
	16.1	16.1	Zone A
	42.0	42.0	Zone A
	50.9 RR-6	51.0 RR-6	Zone A
	51.0 RR-6	51.1 RR-6	Zone A
	61.9	62.0	Zone A
	69.3	69.4	Zone A
	79.3	79.3	Zone A
	79.5	79.7	Zone A
	81.6	81.6	Zone A
	82.0	82.1	Zone A
	102.7	102.8	Zone A
	118.1	118.2	Zone A
LEX1	0.8	0.9	Zone AE
R-801 Loop	0.1	0.2	Zone A
BM-111 Loop	0.1	0.4	Zone AE
	0.5	0.7	Zone AE
	2.5	2.8	Zone AE
R-501 Abandonment	0.0	0.7	Zone AE
	1.2	1.2	Zone AE
	1.3	3.4	Zone AE
	4.2	4.3	Zone A
Aboveground Facilities			
Oak Hill Compressor Station Suction/discharge lines	N/A	N/A	Zone A
Benton Compressor Station	N/A	N/A	Zone A
Crawford Compressor Station regulator and valve facility	N/A	N/A	Zone AE

Source: FEMA, 2014

4.3.2.5 Waterbody Construction Procedures

As discussed above, construction of the LX Project would cross 1,083 waterbodies, and 5 waterbodies could be affected by the RXE Project. Columbia Gas and Columbia Gulf would cross all waterbodies according to federal and state-designated timing windows, unless a waiver is granted, as is discussed in section 4.6.2.3. The WVDEP indicates that it does not object to the proposed waterbody crossing methods for waterbodies in its state. However, it does recommend that all restoration activities utilize natural stream design techniques.

Columbia Gas would use the open-cut crossing method at the majority of waterbody crossings. Alternate methods, such as dam and pump, and flume, may be used depending on site-specific conditions at the time of construction. Section 2.3.2.2 describes the open-cut crossing method and alternative methods in further detail. In addition, Columbia Gas would use the HDD crossing method at 24 waterbodies using 7 HDDs, as described in section 2.3.2.3.

Waterbodies in 309 locations along the proposed pipeline route would be within construction workspaces, but not crossed by the pipeline (appendix K). Additionally, waterbodies along the proposed pipeline route where construction equipment and vehicular traffic would cross waterbodies along the construction corridor, or as otherwise needed to facilitate construction activities would have timber matting, portable prefabricated equipment bridges, or other approved equivalent installed prior to construction. Columbia Gas would not install timber matting (or other approved equipment) across all waterbodies within the LX Project area. In some waterbodies, Columbia Gas has indicated that existing infrastructure and natural conditions make it impractical to implement crossing methods discussed in Columbia Gas' ECS and the FERC Procedures. Columbia Gas has identified areas and justifications for additional temporary workspace within 50 feet of waterbodies. These would include hydrostatic water withdrawal in waterbodies, placement of horizontal directional drill boxes near waterbodies, horizontal directional drill stringing areas near waterbodies, placement of excavated soils near waterbodies, road crossings, and the need to provide for safe and efficient construction due to slope conditions. These locations are identified in appendix E. Based on our review, we have determined that the requested modifications are justified. Columbia Gas would follow general and specific construction measures, in addition to following protective measures outlined in the ECS, FERC Plan, and FERC Procedures to minimize impacts on public watersheds and reservoirs.

4.3.2.6 Hydrostatic Testing

To comply with DOT regulations, Columbia Gas and Columbia Gulf would perform hydrostatic testing of the new pipeline segments and aboveground facilities prior to placing them in service. This method involves filling the pipe with water, pressurizing it for a minimum of eight hours, and checking it for pressure losses due to pipeline leakage. Columbia Gas proposes to withdraw approximately 42 million gallons of test water from four local surface waters for pipeline facilities and approximately 1 million gallons of test water from municipal and possible existing water sources for aboveground facilities, as depicted in table 4.3.2-6 and table 4.3.2-7. The RXE Project would use municipal sources for hydrostatic testing.

In response to our recommendation in the draft EIS that Columbia Gas provide evidence confirming that municipal sources could supply the required volume of water, Columbia Gas indicated that they are continuing to identify the specific entities from which municipal water would be purchased for hydrostatic testing. However, they contacted potential municipal suppliers in the vicinity of proposed aboveground facilities to determine whether there was sufficient capacity to meet the required volumes. Potential suppliers contacted included the Marshall County Public Service District No. 3, the Caldwell Water Department, and the Jackson County Water Company. Combined, these suppliers confirmed the availability of more than 2 million gallons of water which is in excess of estimated requirements.

Columbia Gas and Columbia Gulf would be required to obtain permits from the municipalities for water use prior to withdrawing the water. These permits would confirm that the municipalities have required capacity to supply Columbia Gas and Columbia Gulf with hydrostatic test waters. Columbia Gas has identified that sufficient supply exists in the project area for hydrostatic test water supplies.

Surface waterbodies and municipal water resources would provide water sources for all water withdrawals. Columbia Gas would withdraw surface water in a manner that would not reduce water flow to a point that would impair flow or impact fisheries and recreational uses. In addition, intake screens and floats would be used for surface water withdrawals to prevent entrainment of aquatic life and avoid impacts on aquatic invertebrates and fisheries.

TABLE 4.3.2-6
Proposed Hydrostatic Test Water Source and Discharge Locations for Pipeline Facilities

Component	Source	Water Withdrawal Location (MP)	Discharge Location (MP)	Hydrostatic Testing Volume (gallons)
LEX				
	Fish Creek	21.3	0.2	48,765
			12.1	3,124,200
			13.6	380,090
			17.5	1,227,553
			19.4	497,228
			21.3	484,212
	Ohio River	25.7 RR-5	25.7	1,209,113
			42.1	4,391,266
			43.5	354,047
			58.7	4,061,987
			59.9	320,205
			61.7	489,967
			62.0	76,997
			66.0	1,037,888
			67.0	260,329
	Muskingum River	89.4	89.4	5,937,561
			112.1	5,958,635
			115.0	741,937
	Rush Creek	120.0	127.5	3,295,425
			128.2	182,230
			130.6	632,216
			131.3	187,437
LEX1	Rush Creek	120.0	1.2	224,840
R-801 Loop	Rush Creek	120.0	1.4	361,857
			4.7	871,931
			5.3	166,610
			8.4	803,441
			8.8	96,322
			9.0	66,731
			9.8	195,247
			16.1	1,654,298
			22.4	1,675,372
			23.5	278,552
			24.2	179,128
BM-111 Loop	Ohio River	0.1	2.9	731,474

TABLE 4.3.2-7
Proposed Hydrostatic Test Water Source and Discharge Locations for Aboveground Facilities

Component	Source [a]	Water Withdrawal Location (MP)	On-Site Discharge Location (MP) [a,b]	Hydrostatic Testing Volume (gallons)
LEX				
Lone Oak Compressor Station	Municipal	N/A	On-site (7.4)	265,184
Summerfield Compressor Station	Municipal	N/A	On-site (57.1)	68,932
Launcher and Receiver Facilities	Various Pipeline Sources	N/A	Various Pipeline Locations	21,388
Mainline Valves	Various Pipeline Sources	N/A	Various Pipeline Locations	11,909
LEX1				
K-260 Regulator Station	Municipal	N/A	On-site (0.0)	14,349
Launcher and Receiver Facilities	Various Pipeline Sources	N/A	Various Pipeline Locations	7,426
R-801 Loop				
R-System Regulator Station	Municipal	N/A	On-site (0.0)	26,357
Benton Regulator Station	Municipal	N/A	On-site (12.8)	1,526
RS-1286 Regulator Station	Municipal	N/A	On-site (21.6)	95
McArthur Regulator Station	Municipal	N/A	On-site (24.2)	62,248
Launcher and Receiver Facilities	Various Pipeline Sources	N/A	Various Pipeline Locations	16,041
Mainline Valves	Various Pipeline Sources	N/A	Various Pipeline Locations	1,701
BM-111 Loop				
Ceredo Compressor Station	Possible Existing Water System	2.8	On-site (2.9)	386,041
Launcher and Receiver Facilities	Various Pipeline Sources	N/A	Various Pipeline Locations	10,694
Existing Columbia Pipeline System				
Crawford Compressor Station	Existing Water System	0.0 [c]	On-site (0.0 [c])	23,605
Benton Compressor Station Bypass	Municipal	N/A	On-site (5.2 [d])	5,569
Oak Hill Compressor Station	Municipal	N/A	On-site (51.5 [c])	336,371

[a] Refer to table 4.3.2-6 for the various pipeline water sources and discharge locations associated with Launcher and Receiver and Mainline Value facility hydrostatic testing.
[b] On-site discharge locations would be in upland areas within the Project boundary.
[c] Milepost is associated with Columbia's existing Line R-501.
[d] Milepost is associated with Columbia's existing Line R-515.
[e] Milepost is associated with Columbia's existing Mainline 100, 200, and 300.

Following testing and after depressurization of the section, water would pass through an energy-dissipating device prior to release into a well-vegetated, upland area or discharged into a truck and hauled to a separate disposal location. This would minimize the potential for erosion and is in accordance with the FERC Procedures. No significant water quality impacts are anticipated as a result of the withdrawal and discharge from hydrostatic testing. Columbia Gas and Columbia Gulf would construct project

facilities with new steel pipe free from chemicals and lubricants. Water withdrawal and discharge would follow all applicable federal, state, and local permit requirements.

4.3.2.7 General Impacts and Mitigation

Construction of pipeline facilities would likely result in minor, temporary impacts on surface waterbodies crossed. Various crossing methods, such as wet open-cut and HDD, would limit impacts to surface waterbodies. Dry open-cut methods could be used if there is adequate flow at the time of crossing.

In-stream construction activities or construction activities along banks and slopes adjacent to the waterbody could cause impacts on nearby waterbodies and aquatic resources. These activities include trenching; trench dewatering; backfilling; and operation, storage, or refueling of heavy machinery. Potential impacts on surface water resources include modification of aquatic habitat, increased sedimentation and turbidity, decreased dissolved oxygen concentrations, inadvertent release of chemical and nutrient pollutants from sediments, and introduction of chemical contaminants such as fuel or lubricants. To limit sedimentation and turbidity, stream bank disturbance, and duration of in-stream construction, Columbia Gas and Columbia Gulf would conduct construction activities at stream crossing during low-flow periods.

Only minimal permanent impacts on waterbodies are anticipated as a result of construction and operation of the LX Project. Approximately 63 feet of one minor, intermittent waterbody would be permanently filled as a result of construction and operation of the Lone Oak CS and a portion of one minor, intermittent waterbody that would be permanently filled due to modifications within the existing Ceredo CS. Additionally, five streams would be permanently impacted by the construction of new or replacement of existing permanent culvers along three proposed permanent access roads. Columbia Gas would replace four culverts located along two existing roads to allow for permanent access during operation of the Summerfield CS and the K-260 RS. A new permanent culvert would also be constructed within an ephemeral waterbody of the Oak Hill CS tie-in facility. Restoration of waterbodies to previous physical conditions or better would occur following construction. During operation, Columbia Gas would work cooperatively with appropriate government agencies in an effort to minimize impacts of permanent easement maintenance in waterbodies. Specific impacts from construction activities and the proposed mitigation measures are discussed further below.

Stream Bank Erosion

Clearing and grading of vegetation during construction could increase the potential for erosion along stream banks. Movement of heavy equipment in the construction area could increase soil compaction which could accelerate erosion and transportation of sediment into waterbodies. When necessary and where possible, Columbia Gas and Columbia Gulf would use equipment bridges, mats, and pads to minimize erosion and soil compaction impacts on stream banks. Measures outlined in Columbia Gas' and Columbia Gulf's ECS as well as the FERC Procedures would be implemented to further reduce impacts. After construction, Columbia Gas and Columbia Gulf would restore vegetated areas disturbed by construction to pre-construction conditions and install temporary or permanent erosion control devices to protect from future erosion.

Turbidity and Sedimentation

Increased turbidity and sedimentation in surface waters could result from in-stream construction activities, trench dewatering, and stormwater runoff. Increases in suspended sediments could raise the biochemical oxygen demand, thereby reducing levels of dissolved oxygen in localized areas. Increases in suspended sediments also have the potential to temporarily alter chemical and physical characteristics of

the water column, such as color and clarity. Measures to avoid impacts on local fisheries and aquatic life due to increased turbidity and sedimentation are discussed in section 4.6.2.3.

Movement of construction equipment and vehicular traffic across waterbodies could increase turbidity and sedimentation impacts on waterbodies. To minimize this impact, Columbia Gas and Columbia Gulf would install temporary equipment bridges for access along the construction right-of-way. Equipment bridges, such as timber mats or portable prefabricated bridges, would be designed to accommodate normal to high stream flow. Maintenance of equipment bridges would prevent restriction of water flow during construction.

During construction, sedimentation from spoil has the potential to enter the waterbody. To further minimize impacts resulting from sedimentation, Columbia Gas and Columbia Gulf would install silt fence and/or filter socks to border spoil piles near waterbodies. Once construction is complete, excavated material would be immediately replaced and stream banks and stream beds would be restored to pre-construction contours to the maximum extent practicable. To minimize impacts, Columbia Gas and Columbia Gulf would limit in-stream construction activities to 24 to 48 hours. Revegetation along stream banks and riparian areas would occur in accordance with the FERC Plan and Procedures and Columbia Gas' and Columbia Gulf's ECS.

Trench Dewatering

Water from groundwater seepage or precipitation may accumulate in open trenches during construction. If this occurs, accumulated water would be pumped into vegetated upland areas, away from nearby waterbodies. In order to reduce impacts on waterbodies resulting from runoff and trench dewatering, water pumped out of trenches would be discharged through hay/straw bale structures and/or filter bags.

Potential Spills

Spills of fuels, lubricants, or solvents could contaminate surface waters. To minimize or avoid the potential hazard, proper storage, containment, and handling procedures would be implemented, as outlined in Columbia Gas' SPCC Plan. The Plan includes the actions to be taken should a spill occur. These measures are similar to groundwater fuel handling and storage impacts detailed above (section 4.3.1.7).

To further prevent the risk of spills, Columbia Gas would follow measures outlined in the FERC Procedures. Hazardous materials, chemicals, lubricating oils, and fuels used during construction would be stored no less than 100 feet from surface waterbodies and heavy equipment refueling or parking would occur at least 100 feet from surface waterbodies. Extra precautions include continual monitoring of fuel transfer, secondary containment structures, and use of spill kit readiness.

Contaminant Suspension and Mitigation

Rural and urban areas have the potential to contribute to sediment contamination. Contamination from rural areas includes agricultural fields containing fertilizers and pesticides and leachate from feed lots and sanitary fields. Urban area contamination includes stormwater runoff, wastewater discharges, erosion, or leachate from industrial sites such as textiles, petroleum refining, wastewater treatment plants, and landfills. Project construction has the potential to disturb and suspend existing sediments in surface waterbodies. This would temporarily degrade water quality and redistribute contaminants downstream, potentially affecting aquatic and benthic species and downstream uses.

Disturbed workspaces have the potential to release sediment into the stream. Columbia Gas would install erosion control devices, such as temporary diversion or silt fences. After pipeline installation, breakers installed would allow the restriction of water flow between excavated trenches and waterbodies. Once in-stream construction and restoration is complete, Columbia Gas would remove surplus materials and equipment. All trash, litter, and debris would be collected for disposal in an approved solid waste disposal facility.

The LX Project has the potential to impact sensitive, contaminated, or public use waterbodies such as 303(d) listed waterbodies, DWSPAs, Dunkard Fork (Approved Trout Water), and Ohio's superior high quality waters and state resources. As detailed in the ECS, Columbia Gas would use best management practices to minimize impacts on these waterbodies. Construction of the project facilities at all stream crossings would follow BMPs developed in accordance with requirements and recommendations from the OEPA, PADEP, and WVDEP. BMPs would be developed specifically for Dunkard Fork in a Project specific Erosion and Sedimentation Control Plan, which would be developed in accordance with PADEP, and the Greene County Conservation District as described in Section 4.2.2.5, would minimize impacts on this waterbody. Columbia Gas would perform in-stream construction activities outside of the March 1 to June 15 window. The LX Project would likely not affect any sensitive, contaminated, or public use waterbodies.

The LX Project would cross Section 10 waterbodies, which are navigable rivers, including the Ohio River, Muskingum River, and Hocking River. These waterbodies are covered under a Section 10 permit, obtained in conjunction with the 404 and permits and 401 Certification. Columbia Gas would cross these rivers via HDD, thereby avoiding direct impacts. Use of methods outlined in Columbia Gas' ECS and the protective measures in the FERC Procedures, as well as BMPs included in the site-specific construction and mitigation plans for each major waterbody crossing, would minimize impacts on the Ohio River, Muskingum River, and Hocking River.

Hydrostatic Test Water Withdrawal and Discharge

New steel pipe free of chemicals or lubricants would be used to construct the LX and RXE Project facilities. Control measures would be implemented to avoid the introduction and/or spread of aquatic invasive species. Due to concerns related to the spread of invasive species, WVDEP recommended that water withdrawn from the Ohio River either discharge back into the Ohio River (original source) or undergo treatment with a WVDEP-recommended biocide prior to discharge to control the spread of invasive species. With the exception of this requirement, no biocides are proposed for use in hydrostatic testing. Intake screens and floats would be used for surface water withdrawals to prevent entrainment of aquatic life and avoid impacts on aquatic invertebrates and fisheries. In addition, Columbia Gas would withdraw surface water in a manner that would not reduce water flow to a point that would impair flow or impact fisheries and recreational uses.

Following testing and after depressurization of the section, water would pass through an energy-dissipating device prior to release into a well-vegetated, upland area or discharged into a truck and hauled to a separate disposal location. This would minimize the potential for erosion and is in accordance with the FERC Procedures. Hydrostatic test water withdrawal and discharge would be in accordance with Federal, State and Local requirements. Due to these measures, in addition to following measures in the Procedures, hydrostatic test water withdrawal would not likely significantly affect water resources.

4.3.2.8 Surface Water Conclusions

No long-term impacts are anticipated on waterbodies as a result of construction of the LX Project. Columbia Gas would not permanently affect the designated water uses by burying the pipeline beneath the bed of all waterbodies, implementing erosion and sedimentation controls, and restoring streambanks

and streambed contours as close as practical to pre-construction conditions. Additional measures outlined in the ECS would aid in the effective avoidance or minimization of impacts on surface waterbodies. Impacts associated with hydrostatic testing on public and municipal water supplies would be minimized through control measures established by Columbia Gas in accordance with state recommendations. Accidental spills during construction and operation would be avoided through implementation of the SPCC Plan. Due to the measures discussed above, we conclude impacts on waterbodies would be adequately minimized during construction of the LX Project.

Operation of the LX Project would likely result in minimal impacts on waterbodies as streams would be restored to pre-construction conditions. Columbia Gas would also minimize impacts of permanent easement maintenance by working cooperatively with appropriate agencies. Therefore, we conclude that operation of the project would have minimal impacts on waterbodies.

Based on the avoidance and minimization measures described above including measures outlined in the project-specific ECS, as well as our recommendations, we conclude that construction and operation of the project would not have any significant impacts on surface water resources.

4.4 WETLANDS

Wetlands are areas that are permanently inundated or saturated by surface groundwater at a frequency and duration sufficient to support hydric vegetation and soils (Cowardin et al., 1979). Examples of wetlands include swamps, marshes, and bogs. Wetlands provide food and habitat for wildlife, as well as serving many other important biological, physical, and chemical functions.

In the LX and RXE Project areas, wetlands are regulated at the federal (COE) and state (ODNR, PADEP, WVDNR, WVDEP, and KYDEP) levels. The COE regulates discharge of fill or dredge material into waters of the United States, such as wetlands, under Section 404 of the CWA. Section 401 of the CWA requires states to certify that proposed dredging or filling of waters of the United States meets state water quality standards.

4.4.1 Existing Wetland Resources

For the LX Project, Columbia Gas identified and delineated wetlands along the project area during field surveys in 2014 and 2015. Wetlands boundaries were determined and delineated using the methods described in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0) (COE, 2012) and routine determination guidelines provided in the COE Wetland Delineation Manual (Technical Report Y-87-1) (COE, 1987). Wetlands crossed or otherwise affected by the LX Project are listed in appendix L. For areas where Columbia Gas was denied survey access, publicly available NWI mapping was used to approximate the locations and boundaries of wetlands within the project area. At the time of this writing, field surveys are not complete for approximately 3.7 percent or 6.0 miles of the 160.7 total miles of proposed Project pipelines. Biologists conducted the wetland and waterbody delineation of the Project survey area from June through October 2014 and April through December 2015 to ascertain conditions within the 7,556.2-acre survey area. Appendix 2A of the of the March 18, 2016 Supplemental Filing provides a listing of Areas Not Surveyed for Wetlands and Waterbodies. Revised Wetland Delineation Reports are provided as Appendix 2D of the March 18, 2016 Supplemental Filing.[17] Columbia Gas used a survey corridor of 400 feet centered on the proposed centerline, except when co-located with another pipeline. In this situation,

[17] Columbia Gas' Appendix 2D of the March 18, 2016 Supplemental Information Filing available on the FERC's eLibrary website at, http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514, Accession No. 20160318-5002, titled "09_Att_2_RR_02_Mar_2016_App_2A-2E.PDF"

Columbia Gas surveyed 50 feet on the co-located side of the centerline and 350 feet on the workspace side of the centerline. A 100-foot-wide survey corridor was centered on proposed access roads. Additional information on the existing conditions of wetlands surveyed is available in Resource Reports and permitting conducted with cooperating agencies in FERC Docket No. CP15-514-000.

4.4.1.1 Wetland Types

Wetland types are categorized based on the NWI classification hierarchy described by Cowardin et al. (1979). Wetlands in the LX Project area are classified as palustrine (freshwater wetland) and are defined by the dominant vegetative layer present (forested, scrub-shrub, emergent) as described below.

Palustrine forested (PFO) wetlands are dominated by trees and shrubs at least 20 feet in height with no more than 30 percent canopy cover. Forested wetlands contain a heavy overstory with a diverse, dense understory of woody and herbaceous species. Tree species identified in the LX Project area include pin oak, black willow, green ash, and red maple.

Palustrine scrub-shrub (PSS) wetlands contain greater than 30 percent cover of woody vegetation less than 20 feet in height (Cowardin et al., 1979). Species identified in the LX Project area of PSS wetlands include black willow, green ash, buttonbush, and jewelweed. Palustrine emergent (PEM) wetlands are characterized by non-woody vegetation conditioned to grow in wet soils. Common species located in the LX Project area of PEM wetlands include rice cut grass, reed canary grass, green bulrush, deertongue, and shallow sedge.

Columbia Gas submitted an initial district-specific wetland report to the Pittsburgh District COE and the Huntington District COE in November 2015. Columbia Gas submitted updated information, including revised Wetland Delineation Reports, to the Pittsburgh District COE and the Huntington District COE in April 2016. Of the 3,396.1-acre survey area, a total of 22.9 acres of wetlands are in the Pittsburgh District. Within the 7,556.2-acre survey area within the Huntington District, 113.3 acres of wetlands were identified. Appendix L identifies the feature ID, location, hydrologic unit code, NWI classification, crossing method, crossing length, and acreage of each wetland that the LX Project would affect.

For the RXE Project, Columbia Gulf identified one wetland within the survey area at the Means CS site. However, this wetland is not within the proposed workspace and would not be impacted. No wetlands were identified at the Grayson CS site.

Construction of pipeline facilities would affect 15.2 acres of wetlands with 1.3 acres of operational impacts. This includes 13.8 acres of wetlands in Ohio, 1.3 acres of wetlands in West Virginia, and 0.1 acre of wetlands in Pennsylvania that would be affected during construction.

Construction of the Benton Regulator Station along the R-801 Loop would temporarily affect less than 0.1 acre of one PEM wetland. Construction of the Benton CS would temporarily affect 0.2 acre of PEM wetland. The Lone Oak CS in West Virginia would result in the temporary loss of 0.2 acre of PEM wetland impacts during construction.

Although several wetlands would occur within contractor yards as indicated in appendix L, all wetlands would be avoided during construction; therefore, no impacts to wetlands are anticipated as a result of contractor yards.

Construction of LX Project access roads would temporarily affect 23 wetlands for a total of 0.5 acre affected. Access roads associated with LEX Pipeline would affect 16 wetlands for a total of 0.2 acre, access roads associated with the R-801 Loop would affect one wetland with less than 0.1 acre, and access roads associated with R-501 Abandonment would affect 6 wetlands for a total of 0.2 acre. Temporary

access roads would be used during the construction phase of the project. Permanent access roads have been designed to avoid direct impacts on wetlands

4.4.2 Wetland Construction Procedures

A total of 301wetlands would be affected by the LX Project, described in appendix L. In Ohio, the LX Project, including aboveground facilities, access roads, and contractor yards, would cross 257 wetlands, including 20 forested, 21 scrub-shrub, and 216 emergent wetlands. In West Virginia, the LX Project would cross 39 wetlands, including 6 forested, 1 scrub-shrub, and 32 emergent wetlands. The LX Project would cross five emergent wetlands in Pennsylvania.

In the RXE Project area, Columbia Gulf delineated one emergent wetland within the 64-acre survey area at the Means CS site, but this wetland is located approximately 300 feet away from the workspace and would not be affected by the Project. No wetlands were delineated at the Grayson CS site. We do not anticipate temporary or permanent impacts to wetlands during construction or operation of the aboveground facilities at either compressor station site; however, Columbia Gas and Columbia Gulf would employ measures outlined in their ECSs to protect potential downstream wetlands.

Columbia Gas would use conventional pipeline construction methods to cross wetlands in the LX Project area. Soil stability and saturation at the time of construction determines the type of crossing method used. Construction through unsaturated wetlands would be similar to construction through upland areas. Primary measures to minimize impacts on wetlands include:

- segregating topsoil over the trenchline in unsaturated wetlands;
- restoring wetland contours to original conditions; and
- conducting post-construction monitoring to ensure proper wetland restoration.

In areas of saturated wetlands, Columbia Gas would install temporary work surfaces of timber or travel pads adjacent to the pipeline trench. Appropriately stabilized wetlands may be used for construction right-of-way access. When the wetland cannot be appropriately stabilized, access roads in upland areas would be used for all construction equipment that is not needed to install the wetland crossing. In some areas of inundated lowland or saturated wetland areas, installation of the pipe would float through an open trench via the push/float method. This would limit the need for grubbing and grading activities over the trench line or working side of the construction right-of-way.

Use of low-ground-weight construction equipment would prevent mixing of topsoil and subsoil or rutting from equipment. An alternative method includes using timber matting, in good condition, for equipment crossing. All equipment mats and timber matting would be removed during restoration of the wetland. Columbia would not use tree stumps, rock, gravel, or soil imported from outside the wetland or brush to stabilize the construction workspace or as equipment pads in wetlands.

A 50-foot distance would separate the wetland edge and staging areas, except where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land. This distance would be limited to the minimum necessary to construct the crossing. If topographic conditions do not allow a 50-foot setback, at least 10 feet must separate the area from the wetland edge, with prior approval from the EI.

Some construction through wetlands for temporary access roads are anticipated. Erosion control devices, such as matting would be used to protect wetlands. Access roads that traverse through wetlands would require FERC approval and state permitting authorization prior to construction.

Necessity of blasting in wetlands would be determined during pre-planning of crossing wetlands with standing water or saturated soils. Inconclusive evaluations would require testing of wetlands for consolidated rock prior to trenching. If the wetland contains consolidated rock, Columbia Gas would follow measures outlined in their Blasting Plan, as discussed in section 4.1.2.2.

Water removed during trench dewatering would be filtered and discharged through a sediment trap and/or filter bag and/or a series of terra tubes, sediment logs or flocculent logs or into a heavily vegetated area outside the wetland. This would prevent heavily silt-laden water from entering directly into a wetland. The dewatering structure would be removed as soon as possible after completion of dewatering activities. Backfill would consist of spoil from the trench. After backfilling, the conserved topsoil layer would be returned to the surface and sediment filter devices would be promptly installed.

To prevent alteration in wetland hydrology, trench line barriers would be installed and/or Columbia Gas would seal the trench bottom as necessary. Columbia Gas would install permanent interceptor diversion and trench line barriers at the base of the slopes near the boundary between the wetland and adjacent upland areas. Trench barriers would be located immediately upslope of the interceptor diversion.

4.4.3 General Impacts and Mitigation

Table 4.4.3-1 and table 4.4.3-2 below summarize impacts of the proposed LX Project on wetlands. Construction would affect a total of 15.2 acres of wetlands. This includes about 1.4 acres of forested wetlands, 0.8 acre of scrub-shrub wetlands, and 12.9 acres of emergent wetlands.

The effects of construction in wetlands would be greatest during and immediately following construction. The primary impact of construction would be the temporary removal or alteration of wetland vegetation. In emergent wetlands, the impact of construction would be relatively short term because herbaceous vegetation would regenerate quickly. In forested wetlands, the impact from construction would be temporary but long-term and may take 20 years or longer for the wetland forests on the temporary right-of-way to regenerate. Other impacts that could result from construction include temporary changes to wetland hydrology and water quality. Removal of wetland vegetation during construction would alter the capacity of wetlands to function as suitable habitat or as flood and erosion control buffers. The temporary stockpiling of soil and movement of equipment in wetlands could also compact and furrow wetland soils, which could alter the natural hydrologic patterns, inhibit seed germination, or increase seedling mortality. As mentioned above, Columbia Gulf does not anticipate temporary or permanent impacts to wetlands during construction or operation of the aboveground facilities associated with the RXE Project.

Construction of the Lone Oak CS would require temporary impacts on two PEM wetlands, resulting in a total of 0.2 acre of temporary impacts. No wetlands would be permanently filled by the construction or operation of the Lone Oak CS. However, one PEM wetland will be impacted by a new permanent access road for the proposed R-System RS tie-in facility, resulting in less than 0.1 acre of permanent operational impacts. For operation of the pipeline, Columbia Gas would maintain a 10-foot-wide cleared right-of-way along the center of the pipeline. Selective tree removal would occur within a 30-foot-wide corridor where trees exist that could affect the integrity of the pipeline in scrub-shrub and forested wetland areas. This maintenance would periodically disturb wetland vegetation but would not significantly affect wetland ecological functions such as sediment/toxicant retention, nutrient removal/transformation, flood attenuation, groundwater recharge/discharge, and wildlife habitat. About 1.1 acre of forested wetlands would be converted permanently to emergent or scrub-shrub wetlands for the operation of the LX Project.

Inadvertent mixing of topsoil and subsoil can lead to altered soil characteristics. Columbia Gas would remove and conserve topsoil from directly over the trench to prevent topsoil mixing in unsaturated wetlands.

TABLE 4.4.3-1
Summary of Wetlands Resources Impacted by the LX Project Pipeline Facilities

State	Wetland Type[a]	Number of Wetlands Impacted	Construction Impacts (acres)[e]	10-foot Right-of-way Operational Impacts (acres)[b, e]	30-foot Right-of-way Operation Impacts (acres)[c, e]
LEX					
West Virginia	PEM	26	1.1	0.0	0.0
	PSS	1	<0.1	<0.1	<0.1
	PFO	2	0.1	<0.1	0.1
Pennsylvania	PEM	3	0.1	0.0	0.0
Ohio	PEM	181	11.0	0.0	0.0
	PSS	18	0.7	0.1	0.1
	PFO	20	1.2	0.2	0.7
LEX Subtotal		*251*	14.3	0.4	0.9
LEX1					
Ohio	PEM	1	<0.1	0.0	0.0
	PSS	1	0.1	0.0	0.0
LEX1 Subtotal		2	0.1	0.0	0.0
R-801 Loop					
Ohio	PEM	14	0.7	0.0	0.0
R-801 Loop Subtotal		*14*	*0.7*	*0.0*	*0.0*
BM-111 Loop					
West Virginia	PEM	2	<0.1	0.0	0.0
	PFO	3	0.1	<0.1	0.1
BM-111 Loop Subtotal		*5*	*0.1*	*<0.1*	*0.1*
R-501 Abandonment					
Ohio	PEM	2	0.1	0.0	0.0
R-501 Abandonment Subtotal		*2*	*0.1*	*0.0*	*0.0*
Pipeline Facilities Total		***274***	***15.2***	***0.4***	***1.0***

[a] Cowardin Wetland Types: PEM - Palustrine emergent; PSS - Palustrine shrub-scrub; PFO - Palustrine forested

[b] Operational impacts in this column are based on a 10-foot-wide area in PFO and PSS wetlands that would be converted to other wetland types due to pipeline maintenance.

[c] Operation impacts in this column are based on a 10-foot-wide operation impact on PSS wetlands that would be converted to herbaceous wetlands due to pipeline maintenance. Operation impacts on PFO in this column reflect potential for selective thinning of trees within 15 feet of the pipeline that have roots that could compromise the integrity of the pipeline coating.

[d] Further details on the conditions of the wetlands are available on the FERC's eLibrary website at, respectively, http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514, Accession No. 20160318-5002, titled "08_Att_2_RR_02_Mar_2016.PDF".

[e] Construction and operational maintenance would not result in a loss of waters (i.e., streams or wetlands) as the proposed discharges of dredged or fill material into waters of the U.S. would be temporary in nature.

To minimize impacts on wetlands, Columbia Gas would place erosion controls along the downslope edge of the construction right-of-way and surrounding additional temporary workspace. Frequent maintenance of these erosion controls would limit disturbed soils and sediment from entering undisturbed wetland areas. To minimize long-term sedimentation in wetland areas, permanent erosion controls (terraces, interceptor diversion devices, riprap, and vegetative cover) would be placed on adjacent upland areas.

Columbia Gas would minimize compaction by using low ground pressure equipment. Construction activities may also temporarily install timber equipment mats to lower compaction potential. To further reduce the potential for compaction, topsoil would be segregated in unsaturated wetland features. During restoration, frequent testing of soils would occur to assess compaction. Columbia Gas would decompact soils as necessary within the travel lane of the construction right-of-way.

Potential spills during construction could impact and contaminate wetlands found in the LX Project area. To minimize this risk, at least 100 feet would be maintained between wetland boundaries and hazardous materials, chemicals, lubricating oils, and fuels during construction. Parked equipment and refueling would occur at least 100 feet away from wetland boundaries. Columbia Gas would implement continual monitoring of fuel transfer, secondary containment structures, use of spill kit readiness, and other extra precautions if necessary.

Installation and operation of the pipeline has the potential to divert drainage and blockage of water through a wetland, creating long-term impacts on wetland habitat type and quality. In order to maintain the hydrologic characteristic of the wetland, cross-drainage would be used in areas where permanent changes in surface and subsurface hydrology could occur. Columbia Gas would install trench plugs at the entrance and exit of the pipeline to prevent wetland drainage along the pipeline. Breached confining layers would be restored during backfilling, as applicable. All contours would be restored to pre-construction levels.

Columbia Gas is continuing to consult with the corresponding agencies to determine the appropriate mitigation and compensation for wetland impacts, as further discussed in section 4.4.5. Restoration of wetland areas would be monitored for three years following construction. Successful revegetation would occur if native vegetative cover is at least 80 percent of the total area. If revegetation is unsuccessful, a remedial vegetation plan would be developed and implemented per the FERC Procedures.

TABLE 4.4.3-2
Summary of Wetlands Resources Impacted by the LX Project Aboveground Facilities, Access Roads, and Contractor Yards

State	Wetland Type[a]	Number of Wetlands Impacted	Construction Impacts (acres)	Operational Impacts (acres)[b]
Aboveground Facilities				
Lone Oak Compressor Station				
West Virginia	PEM	2	0.2	0.0
Lone Oak Compressor Station Subtotal		*2*	*0.2*	*0.0*
Benton Regulator Station				
Ohio	PEM	1	<0.1	0.0
Benton Regulator Station Subtotal		*1*	*<0.1*	*0.0*
Benton Compressor Station				
Ohio	PEM	1	0.2	0.0
Benton Compressor Station Subtotal		*1*	*0.2*	*0.0*
Aboveground Facilities Total		*4*	*0.4*	*0.0*
Access Roads				
LEX				
West Virginia	PEM	2	0.0	0.0
	PFO	1	<0.1	0.0
Pennsylvania	PEM	2	0.0	0.0
Ohio	PEM	9	0.2	0.0
	PSS	2	<0.1	0.0
	PFO	0	0.0	0.0
LEX Subtotal		*16*	*0.2*	*0.0*
R-801 Loop				
Ohio	PEM	1	0.0	<0.1
R-801 Loop Subtotal		*1*	*0.0*	*<0.1*
R-501 Abandonment				
Ohio	PEM	6	0.2	0.0
R-501 Abandonment Subtotal		6	0.2	0.0
Access Roads Total		*23*	*0.5*	<0.1
Contractor Yards[c]				
TOTAL		**27**		

a Cowardin Wetland Types: PEM - Palustrine emergent; PSS - Palustrine shrub-scrub; PFO - Palustrine forested

b Operation impacts in this column reflect permanent wetland loss due to fill.

c Several wetlands occur within contractor/staging/pipe yards; however, all wetlands would be avoided during construction, and no impacts are anticipated.

d. Further details on the conditions of the wetlands are available on the FERC's eLibrary website at, respectively, http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514, Accession No. 20160318-5002, titled "08_Att_2_RR_02_Mar_2016.PDF".

4.4.4 Alternative Measures

Columbia Gas' ECS is consistent with the FERC Procedures. The ECS stipulates that the construction right-of-way width in wetlands be limited to 75 feet and that all ATWS should be located at least 50 feet from wetlands except where an alternative measure has been requested by Columbia Gas and approved by FERC.

Columbia Gas identified locations where it believes site-specific conditions do not allow for a 50-foot setback of ATWS from wetlands. Table 4.4.4-1 lists the locations where Columbia Gas requested

less than a 50-foot setback from a wetland and the site-specific rationale for the requested modification from our Procedures. Based on our review, we have determined that the requested modifications are justified.

TABLE 4.4.4-1
Areas Where Columbia Gas Requested Additional Extra Workspace in Relation to Wetlands for the LX Project

Workspace ID	Milepost	Justification	Distance from Wetland (feet)
ATWS-1,815	1.7	Waterbody crossing – ATWS is necessary to accommodate additional construction equipment and placement of excavated soils outside of the waterbody.	Workspace overlaps wetland
ATWS-1,816	1.8	Waterbody crossing – ATWS is necessary to accommodate additional construction equipment and placement of excavated soils outside of the waterbody.	21.0
ATWS-2128	8.3 RR-1	Waterbody crossing – ATWS is necessary to accommodate additional construction equipment and placement of excavated soils outside of the waterbody.	IU
ATWS-49	9.7	Road crossing – ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.	Workspace overlaps wetland
ATWS-1,178	21.1	Horizontal directional drill stringing area – ATWS is necessary to accommodate staging of prefabricated section of pipe for HDD.	21.0
ATWS-94	21.1	Horizontal directional drill box – ATWS is necessary to accommodate additional construction equipment.	Workspace overlaps wetland
ATWS-2084	25.9 RR-5	Horizontal Directional Drill Box - ATWS is necessary to accommodate additional construction equipment HDD	IU
ATWS-262	42.8	Road crossing – ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.	Workspace overlaps wetland
ATWS-263	42.8	Road crossing – ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.	32.0
ATWS-2106	54.8 RR-7	Topsoil segregation - ATWS is needed to segregate the topsoil.	IU
ATWS-390	61.9	Road crossing – ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.	49.0
ATWS-422	66.9	Horizontal directional drill box – ATWS is necessary to accommodate additional construction equipment.	Workspace overlaps wetland
ATWS-681	89.8	Horizontal directional drill stringing area – ATWS is necessary to accommodate staging of prefabricated section of pipe for HDD.	Workspace overlaps wetland
ATWS-1,537	108.9	Road crossing – ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.	26.0
ATWS-747	108.9	Road crossing – ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.	Workspace overlaps wetland
ATWS-764	111.4	Waterbody crossing and major Point of Inflection – ATWS is needed to accommodate additional construction equipment necessary to facilitate major Point of Inflection and for placement of excavated soils outside of the waterbody.	33.0
ATWS-772	112.3	Road crossing – ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.	21.0

TABLE 4.4.4-1 (cont'd) Areas Where Columbia Gas Requested Additional Extra Workspace in Relation to Wetlands for the LX Project			
Workspace ID	**Milepost**	**Justification**	**Distance from Wetland (feet)**
ATWS-773	112.3	Road crossing – ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.	Workspace overlaps wetland
ATWS-814	120.1	Horizontal directional drill box – ATWS is necessary to accommodate additional construction equipment.	0.7
ATWS-859	130.2	Horizontal directional drill box – ATWS is necessary to accommodate additional construction equipment.	Workspace overlaps wetland

IU – information unavailable

4.4.5 Compensatory Mitigation

The FERC Procedures require monitoring of wetland restoration for three years following construction. The corresponding permitting agencies would regulate monitoring of restored wetlands in accordance to their specific protocols. Most wetland impacts are anticipated to be temporary and wetlands would revert to pre-existing conditions after construction is complete. However, 0.2 acre of wetlands would be converted to industrial land for the Lone Oak CS and 1.1 acre of forested land would be permanently maintained as either PEM or PSS wetlands during operation of the pipeline. A wetland compensation plan is being developed to address measure to reduce project footprint impacts on wetlands, including development of invasive species management, restoration, monitoring and potential compensation beyond the project's footprint. Since consultations with state or federal agencies on development of a wetland compensation plan is ongoing, **we recommend that:**

- **<u>Prior to construction,</u> Columbia Gas should file with the Secretary its final wetland compensation plan, developed in consultation with the appropriate agencies.**

4.4.6 Conclusion

As discussed above, the LX Project would result in mostly temporary impacts on wetlands. The implementation of the mitigation measures outlined in the ECSs would minimize impacts and help ensure the successful restoration of wetlands disturbed by temporary workspace. Given the current information Columbia Gas and Columbia Gulf have provided at the time of this final EIS and our own research, we conclude that impacts on wetlands would be minor and would be further offset by the implementation of any compensatory mitigation developed in consultation with the agencies. While limited long-term impacts on wetlands would occur, with Columbia Gas' and Columbia Gulf's implementation of the mitigation, and adherence to state agency and COE permit requirements, we conclude the impacts would be reduced to less than significant levels.

4.5 VEGETATION

4.5.1 Existing Vegetation Conditions

The LX Project area is entirely within the Eastern Broadleaf Forest (Oceanic) Province. This province has a wide variety of forest types including the Appalachian oak forest, mixed mesophytic forest, and mixed oak forest. A majority of the LX Project is within the Southern Unglaciated Allegheny Plateau section, characterized by high hills with narrow valleys and steep ridges. A small portion of the

LX Project, in Fairfield County, Ohio, is within the Western Glaciated Allegheny Plateau section, characterized by rounded hills with broad valleys and ridges (USDA, 2014a).

The Grayson CS, as part of the RXE Project, is located within the Eastern Broadleaf Forest (Oceanic) Province described above. Within this province, the Grayson CS is located in the Western Allegheny Plateau, specifically within the Ohio/Kentucky Carboniferous Plateau. This area contains woodland, pastureland, and cropland with mixed deciduous-evergreen forests characterized by oaks and pines. Agriculture, logging, coal mining, and oil production have diminished the quality of streams within this area (Woods et al., 2002).

The Means CS is within the Eastern Broadleaf Forest (Continental) Ecosystem Province, dominated by broadleaf deciduous forest with both oak and hickory species in abundance. The Means CS is located on the boundary between the Western Allegheny Plateau, characterized above, and Interior Plateau Ecoregions. Within these regions, the Means CS is located in the Knobs-Lower Scioto Dissected Plateau and Outer Bluegrass sections. The Knobs-Lower Scioto Dissected Plateau is characterized by rounded hills, ridges, and narrow valleys with oak and oak-pine forests. The Outer Bluegrass section is characterized by rolling and steep hills containing sinkholes, springs, entrenched rivers, and intermittent and perennial streams. This section contains widespread pastureland and cropland with dissected wooded areas (Woods et al., 2002).

The LX Project crosses five major cover types characterized by dominant vegetation and habitat value: agricultural, open land, wetlands, forest, and open water. Additionally, the RXE Project crosses four major cover types including agricultural, open land, water, and forested/woodland. Water resources are further discussed in section 4.3. Developed land, discussed in section 4.8, includes industrial and residential areas which are generally devoid of native vegetation and suitable habitat. Agricultural land includes improved pasture species and some areas of actively cultivated row crops providing minor to moderate habitat. Open land consists of non-forested, non-agricultural areas including existing utility easements and unimproved pastures. Wetlands are discussed in section 4.4. Table 4.5.1-1 contains a list of representative species commonly occurring in each land use type.

TABLE 4.5.1-1 Land Cover Types and Representative Species Occurring in the LX Project Area	
Land Cover	**Representative Species**
West Virginia	
Upland Forests	American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), slippery elm (*Ulmus rubra*), red maple (*Acer rubrum*), black walnut (*Juglans nigra*), white ash (*Fraxinus americana*)
Agricultural Lands - Active hayfields, cultivated land, specialty crops	Hay, alfalfa, corn, soy beans
Open Uplands	Kentucky bluegrass (*Poa pratensis*), meadow fescue (*Festuca pratensis*), reed canary grass (*Phalaris arundicra*), broomsedge bluestem (*Andropogon virginicus*)
Forested Wetlands	Sugar maple, white ash, American tulip tree (*Liriodendron tulipifera*), American elm (*Ulmus americana*), Northern spicebush (*Lindera benzoin*)
Emergent Wetlands	Shallow sedge (*Carex lurida*), Woolgrass (*Scirpus cyperinus*), Dark-green bulrush (*Scripus atrovirens*), Fowl mannagrass (*Glyceria striata*), Pennsylvania smartweed (*Persicaria pennsylvanica*), Broadleaf cattail (*Typha latifolia*), Lamp juncus (*Juncus effuses*), Yellow nutsedge (*Cyperus esculentus*), Bluejoint (*Calamagrostis canadensis*), Canadian clearweed (*Pilea pumila*), Fox sedge (*Carex vulpinoidea*)
Scrub-Shrub Wetlands	Buttonbush (*Cephalanthus occidnetalis*), black willow (*Salix nigra*), twinsisters (*Lonicera tatarica*), Amur honeysuckle (*Lonicera maackii*), sweet woodreed (*Cinna arundinacea*), rice cutgrass (*Leersia oryzoides*)
Pennsylvania	
Upland Forests	Black cherry (*Prunus serotina*), osage orange (*Maclura pomifera*), black walnut, American elm, twinsisters, multiflora rose (*Rosa multiflora*)
Agricultural Lands - Active hayfields, cultivated land, specialty crops	Alfalfa, soybeans, corn, hay
Open Uplands	Red fescue (*Festuca rubra*), orchardgrass (*Dactylis glomerata*), Canada goldenrod (*Solidago canadensis*), spreading dogbane (*Apocynum androsaemifolium*), white clover (*Trifolium repens*), Kentucky bluegrass
Forested Wetlands	American elm, shallow sedge (Carex lurida), sensitive fern (Onoclea sensibilis), giant goldenrod (Solidago gigantea), wingstem (Verbesena altermiflora), broadleaf cattail (Typha latifolia)
Emergent Wetlands	Fox sedge (Carex lurida), small white oldfield aster (Symphyotrichum racemosum), sweet flag (Acorus calamus), broadleaf cattail, harvestlice (Agrimonia pariflora), common boneset (Eupatroium perfoliatum), fowl mannagrass (Glyceria striata)
Scrub-Shrub Wetlands	Black willow, creeping Jenny (Lysimachia nummularia)
Ohio	
Upland Forest	American beech, black cherry, red maple, American tulip tree, white oak (*Quercus alba*), American elm, shagbark hickory (*Carya ovata*), American basswood (*Tilia americana*)
Agricultural Lands - Cultivated land, specialty crops	Soybeans, corn, winter wheat, alfalfa
Open Uplands	Meadow fescue, Kentucky bluegrass, Canada goldenrod, late goldenrod (*Solidago altissima*), white snakeroot (*Ageratina altissima*), American hophornbeam (*Ostrya virginiana*)
Forested Wetlands	Silver maple (*Acer saccharinum*), American elm, pin oak (*Quercus palustris*), red maple, swamp white oak (*Quercus bicolor*), green ash (*Fraxinus pennsylvanica*), black willow, cattail sedge (*Carex typhina*), reed canarygrass, arrow-leaf tearthumb (*Persicaria sagittata*)
Emergent Wetlands	Reed canarygrass, woolgrass (*Scirpus cyperinus*), fox sedge (*Carex vulpinodea*), black bent (*Agrostis gigantea*), swamp smartweed (*Persicaria hydropiperiodes*), wingstem (*Verbesena alterniflora*), blunt spikerush (*Eleocharis obtusa*), fowl bluegrass (*Poa palustris*), lamp juncus (*Juncus effuses*)
Scrub-Shrub Wetlands	American elm, black willow, American elderberry (*Sambucus canadensis*), box elder (*Acer negundo*), stiff dogwood (*Cornus foemina*), watercress (*Nasurtium officinale*), common jewelweed (*Impatiens capensis*), harvestlice, dark-green bulrush (*Scirpus atrovirens*)

4.5.2 Project Facilities and Extra Workspaces

Construction of the LX Project would mostly affect forested, agricultural, and open land habitats, with less disturbance on developed lands and wetland habitats. Maintenance of the right-of-way for operation of the LX Project would permanently convert forested habitat to open land, while agricultural, emergent wetlands and open land habitats would be maintained in their current vegetation types. Further detail on other land use types are discussed in sections 4.5.6 and 4.8.1.

Aboveground Facilities

Construction of LX aboveground facilities would affect agricultural land and forested vegetative types as well as developed and open lands. Operation of aboveground facilities would cause the greatest impact on agricultural and forested land, causing lesser impacts on other habitat types.

Construction of RXE aboveground facilities (Grayson CS, Means CS, and Means M&R Station) would cause the greatest impacts on agricultural and open land habitat types. Operation of the three aboveground facilities would permanently affect agricultural and open land habitat types with minor impacts on forested/woodland areas. These impacts are discussed further in sections 4.5.6 and 4.8.

Contractor Yards

Columbia Gas is evaluating the potential sites for the contractor yards and has identified 29 preferred sites and 10 alternate sites; however, to provide the most wide-ranging assessment of potential impacts, Columbia Gas has included both the preferred and alternative contractor yards in the LX Project land requirement/land use impact calculations. The vegetation types at these facilities are mostly agricultural and open land, with minor amounts of forested and wetland habitat.

Access Roads

Columbia Gas anticipates using both temporary and permanent access roads affecting 95.0 acres during construction and 10.9 acres during operation of the LX Project and aboveground facilities. A total of 167 access roads (temporary and permanent) would be constructed associated with pipeline facilities and 31 access roads (temporary and permanent) would be associated with the aboveground facilities. The permanent access roads would be newly constructed. When possible, construction of roads would occur on existing roads. Operational use of the permanent access roads would result in the permanent conversion of certain undeveloped habitat types to developed land. Columbia Gulf anticipates using existing roads to access the proposed RXE Project facilities.

Cathodic Protection Units

Columbia Gas plans to use buried cathodic protection units along the pipeline, specifically along the LEX Pipeline and R-801 Loop segments and the compressor and regulator stations. These units would be installed either belowground or within facility boundaries.

4.5.3 Vegetation Communities of Special Concern or Value

Consultations with federal and state resource agencies to identify sensitive or protected vegetation types, natural areas, or unique plant communities in the LX Project area are discussed below. LX Project activities would occur near one nature preserve and one metro park. Information on these areas is included in section 4.6. Information on federally or state-listed plant species, including species of concern, is discussed in section 4.7. Temporary workspace associated with the R-501 Abandonment is near the Wayne National Forest but is not within the forest boundaries. No impacts on the Wayne

National Forest would occur as a result of the LX Project. Additionally, no adverse impacts on the Hocking State Forest are anticipated, as the R-801 Loop would not cross the forest boundary. The LEX Pipeline component of the LX Project would cross the Sunfish Creek State Forest. Columbia Gas has submitted a formal application, including an Environmental Assessment, to the ODNR for review and approval. Should this application be accepted, Columbia Gas would be granted a 25-year lease agreement for the permanent pipeline easement within the Sunfish Creek State Forest. Consultations with ODNR regarding impacts, permitting, and regulatory requirements are ongoing for impacts on and restoration of wildlife habitat in the Sunfish Creek State Forest.

No other protected vegetation types, natural areas, or unique plant communities were identified in the LX Project area. Desktop research did not show any state wilderness areas, wildlife preserves, sanctuaries, state game refuges, wildlife management areas, National Wildlife Refuges, and other significant habitat areas within the RXE Project area. The closest sensitive resources to the Means CS and the Grayson CS are the Daniel Boone National Forest and the Grayson Lake Wildlife Management Area (WMA), respectively. Construction and operation of the RXE Project would not affect these two areas.

4.5.4 Interior Forest Habitat

Interior forest habitat is not managed as a federally or state-regulated sensitive area, but does provide habitat for a variety of wildlife species including providing food resources, brooding habitat, and protection from disturbance and predation. Clearing or fragmentation of interior forests creates more edge habitat and smaller contiguous forested tracts, which can affect availability and quality of feeding and nesting habitat for certain species as well as isolate species populations (Rosenberg et al., 1999). Interior forest has a higher habitat value for some wildlife species, may take decades to establish, and is generally considered more rare in the environment compared to edge forest, which has a lower habitat value for many species and can be created immediately with disturbance (Landowner Resource Center, 2000; Sprague et al., 2006).

The LX Project would affect 1,380.6 acres of upland forests and 2.2 acres of wetland forest during construction. Approximately 40 percent of the proposed pipelines would be collocated with existing Columbia Gas rights-of-way or paralleling existing utility corridors. We determined that approximately 13.1 miles of new greenfield edge habitat would be created as a result of construction of the proposed LX Project (including pipeline, access roads, aboveground facilities, and contractor yards).

Most species do not require interior forest habitat for survival. Some common species found in forested/interior forested habitat include white-tailed deer, wild turkey, black bear, beaver, bobcat, timber rattle snake, and fox squirrel. Although breeding habitat for interior forest birds varies significantly, ranging in size from 3 to 6,200 forested acres, in general forest tracts of 100 acres or larger (Jones et al., 2001) represent adequate forest interior dwelling bird habitat. Section 4.6.1.3 provides information on migratory birds potentially affected by the project. Tables 4.6.1-2 and 4.6.1-3 provide a listing of Birds of Conservation Concern potentially occurring in the project area including species known to be reliant on interior forests. Additionally, impacts to important migratory birds to the region were evaluated including the Wood Thrush *(Hylocichla mustelina)*, Cerulean Warbler *(Dendroica cerulea)*, and Worm-eating Warbler *(Helmitheros vermivorus)*. These birds typically require large areas of interior forest for successful breeding. Interior forest acreage required for successful breeding for these birds ranges from greater than 100 acres to 60 acres. Therefore, areas of interior forest tracts that would be impacted that are greater than 100 acres in size were determined. Direct clearing of greenfield interior forest in areas of greater than 100 contiguous acres would be 68.7 acres. Within these areas an additional 342.3 acres of interior forest would be converted to edge habitat.

We are defining interior forest as forested areas greater than 300 feet from the influence of forest edges or open habitat (Jones et al., 2001). Using this definition, existing interior forest tracts along the proposed Project route were identified based on forest cover mapping provided in the National Land Cover Database (Homer et al., 2015). Direct impacts to interior forest habitat were calculated using NAD83 UTM-17N and ESRI hosted Bing ortho imagery. These impacts would include 666.2 acres of interior forest that would be converted to edge habitat in areas where existing ROW would be expanded as well as direct impacts to 522.5 acres of new greenfield clearing of interior forest and 437.9 acres of conversion of greenfield interior forest to edge habitat associated with the greenfield clearing. Figures 4.5.4-1 and 4.5.4-2 provide a schematic view of the calculation on interior forest impacts for expanded existing ROW and new greenfield clearing, respectively. Table 4.5.4-1 below provides a breakdown of those impacts by county.

TABLE 4.5.4-1
Interior Forest Impacts by County from the LX Project

County	State	Interior Forest Impact (acres)
Greene	PA	21.2.
Monroe	OH	224.8
Noble	OH	128.7
Muskingum	OH	30.8
Morgan	OH	102.5
Perry	OH	99.7
Fairfield	OH	40.5
Hocking	OH	103.4
Vinton	OH	129.4
Marshall	WV	251.0
Wayne	WV	11.1

In order to minimize and reduce impacts on sensitive habitat, Columbia Gas would implement a number of measures to reduce adverse effects of construction and operation on forest species, including interior forest species:

- LX Project facilities have been routed to avoid sensitive environmental resources, where possible;
- approximately 40 percent of new pipelines would be co-located with existing Columbia Gas' rights-of-way or paralleling existing utility corridors;
- construction and operation right-of-way widths and temporary land requirements for installation would be limited to the minimum necessary, e.g.75 feet in forested wetlands;
- avoidance of forested areas, especially contiguous forested areas to the extent possible;
- providing mitigation for impacts on sensitive environmental resources; and
- following the measures outlined in the Project's Plans and Procedures during construction and operation of the Project.

Legend

- Interior Forest Conversion Impacts (See Note 1)
- Interior Forest Baseline, NLCD 2011 (See Note 2)
- Existing Edge Habitat
- Project Footprint
- County Boundary

NOTES:

1. Impacts resulting from conversion of existing interior forest to edge habitat due to expansion of existing ROW for the proposed Project.
2. Interior Forest- Forest blocks 300' or greater from any disturbance/open land.
3. Aerial Imagery: ESRI World Imagery Reproduced under license in ArcGIS 10.3
4. NLCD, 2011-Landcover Dataset

N

0 125 250 500
Feet

FIGURE 4.5.4-1
Interior Forest Impacts
Adjacent to Existing ROW

Legend

- Interior Forest Conversion Impacts (See Note 1)
- Direct Greenfield Clearing Impacts
- Interior Forest Baseline (NLCD 2011) (See Note 2)
- Project Footprint

NOTES:
1. Impacts resulting from conversion of existing interior forest to edge habitat.
2. Interior Forest- Forest blocks 300' or greater from any disturbance/open land.
3. Aerial Imagery: ESRI World Imagery Reproduced under license in ArcGIS 10.3
4. NLCD, 2011-Landcover Dataset

N

0 350 700 1,400
Feet

FIGURE 4.5.4-2
Greenfield Interior Forest Impacts

In addition to the direct impacts on interior forest tracts by the proposed clearing during construction and maintenance operations, indirect impacts also would occur on interior forest tracts. Newly created edge habitats would be established by maintenance of the permanent right-of-way and the indirect impacts could extend into remaining forest blocks. The distance an edge effect extends into a woodland is variable, but most studies point to at least 300 feet (Rodewald, 2001; Jones, et al., 2000; Ontario Ministry of Natural Resources, 2000; Robbins, 1988; Rosenberg, et al., 1999). The actual indirect impacts could be less or more depending upon the size, shape, and post-construction status of the remaining adjacent forested areas in relation to the permanent right-of-way. These adjacent areas could remain classified as forest interior blocks with some indirect impacts or their classification as forest interior could be changed altogether based on a reduction in block size. While the indirectly affected lands adjacent to the right-of-way would remain forested, they would have reduced habitat value compared to pre-construction conditions. The creation of edge habitat could increase the risk of establishment of invasive species and other impacts on wildlife species. In section 4.5.5 measures to control invasive species are discussed, and section 4.6.1.4 describes potential impacts of edge habitat on wildlife.

Although Columbia Gas routed the pipeline adjacent to existing disturbance and outside of forested areas to the extent practicable, impacts on the upland forest habitat and migratory birds and other wildlife that use this habitat account for 43 percent of the vegetation impacts. Section 4.6.1.3 describes Columbia Gas' and Columbia Gulf's potential impacts on migratory birds. In addition, permanent clearing of the right-of-way may result in effectively disconnected forested tracts (Jones et al., 2001).

4.5.5 Noxious Weeds and Other Invasive Plant Species

Invasive species have the potential to out-compete native plants, specifically in areas disturbed during and immediately following construction activities. Removing existing vegetation and disturbing soils during construction could create conditions conducive to the establishment or spread of noxious weeds, particularly where new corridors are established in previously forested areas. Columbia Gas would implement several management strategies within the construction corridor and temporary workspaces to minimize the introduction and/or spread of invasive species. Columbia Gas would follow general measures outlined in the ECS as well as additional management and control measures such as:

- minimizing sediment movement and associated movement of invasive species seed;
- limiting the amount of time bare soil is exposed to prevent invasive species establishment;
- segregating topsoil in wetland construction where conditions allow to maintain the existing seedbank;
- stabilizing soil with annual or winter rye to quickly establish vegetative cover; and
- monitoring the construction corridor and other disturbed areas for 3 years after construction to ensure that revegetation was successful and invasive species have not established.

While general measures for minimizing the spread of invasive species are included in the ECS, specific management and control measures in the form of an Invasive Species Management Plan developed in consultation with the appropriate agencies would serve to address site-specific concerns regarding invasive species management. In a letter dated January 21, 2015, FWS requested prevention of non-native invasive plant establishment in order to maintain high quality habitats.

4.5.6 General Impacts and Mitigation

Construction of the LX Project, including construction right-of-way, extra workspace, aboveground facilities, contractor yards, and access roads would impact areas of forested and wetland

habitat, including forested wetlands. Table 4.5.6-1 and table 4.5.6-2 summarize both construction and operational impacts on vegetation types for the LX Project. Table 4.5.6-3 summarizes construction and operational impacts on vegetation types for the RXE Project. Construction impacts on vegetation resources are classified based on the duration and significance of impacts. Temporary impacts generally occur during construction with vegetation returning to preconstruction conditions almost immediately after construction, whereas short-term impacts are those that require up to 3 years to return to preconstruction conditions. Long-term impacts require more than 3 years to revegetate. In early years (1 through 10) shade intolerant seedlings would be present on the impacted areas. Pioneer tree species are generally present by the 10th year and are gradually replaced by taller deciduous forest. Forested areas could take 20 years or longer to regenerate, but conditions would return to their preconstruction state during the life of the project. Permanent impacts are those that modify vegetation resources to the extent that they would not return to preconstruction conditions during the life of the project. Compensatory mitigation related to interior forest related to migratory birds is further discussed in section 4.6.1.3

4.5.6.1 Pipeline Facilities

Primary impacts on vegetation would occur in forested, open land, and agricultural areas along the LX Project route. Vegetation types affected during construction of pipeline facilities would include 1,343.5 acres of upland forest, 941.4 acres of agriculture, 582.6 acres of open lands, and 19.7 acres of wetlands. Primary impacts would result from cutting, clearing, and/or removal of existing vegetation within the proposed right-of-way. Areas cleared for construction would result in long-term impacts in forested areas. Impacts on habitat types as a result of construction and operation of pipeline facilities and their associated access roads, additional temporary work space, contractor yards, and cathodic protection units are outlined in table 4.5.6-1.

Clearing of vegetation in the project area could lead to increased erosion rates. Higher rates of erosion could lead to soil loss. This would reduce soil fertility and potentially lead to a lower rate of revegetation. Columbia Gas would follow soil mitigation procedures and erosion controls guidelines set forth by the WVDEP, ODNR, and PADEP.

Most impacts on agricultural lands would be temporary to short-term because these areas are disturbed annually to produce crops and would typically return to their previous condition shortly following construction, cleanup, and restoration. Impacts on agricultural lands would be minimized though adherence to the ECS. No restoration activities would occur in agricultural lands between the beginning of the spring thaw through May 15, unless otherwise requested by the landowner. Restoration would be coordinated with the landowner's planting schedule. Columbia Gas would remove excess rock from at least the top 12 inches of soil to the extent practicable. Regular testing of topsoil and subsoil for compaction would be conducted in areas disturbed by construction activity. Additionally, Columbia Gas would plow severely compacted agricultural areas with a paraplow or other deep tillage implement or make arrangements with the landowner to plant and plow under a "green manure" crop. This would decrease soil bulk density and improve soil structure. To minimize grazing disturbance on revegetated areas, Columbia Gas would coordinate with willing landowners, grazing permittees, and land management agencies. Revegetation efforts would continue until the land is successfully restored.

Lands currently dominated by herbaceous growth would revegetate quickly, often within one growing season after seeding and otherwise typically within 3 years, depending on a number of factors. Cleared scrub-shrub vegetation would likely require 3 to 5 years to regain their woody composition.

Maintenance of the right-of-way for operation of the LX Project would permanently convert 495.2 acres of forested habitat to open land, while agricultural, emergent wetlands and open land habitats would be maintained in their current vegetation types. Forested land would be cleared for pipeline facilities, including pipelines and associated access roads, additional temporary work space, contractor yards, and cathodic protection units. The greatest impact would be in forested areas. Several

stakeholders expressed concerns about impacts on hardwood forests and effects that loss of vegetation would have on erosion in these areas. Construction in forested lands would remove the tree canopy over the entire width of the construction right-of-way, which would change the structure and environment of the underlying and adjacent areas. Regrowth of forested vegetation in temporary workspace areas would be a long-term effect of the Project. Forested lands within the maintained right-of-way would be permanently converted to an herbaceous cover type. The indirectly affected lands adjacent to the right-of-way would remain forested; however, they would have reduced habitat value compared to preconstruction conditions. The creation of edge habitat could increase the risk of invasive species and other impacts on wildlife species. The regrowth of shrubs and trees within the temporary workspaces would reduce the edge effect on forested land and provide connectivity between adjacent forested tracts to some extent (Tewksbury et al., 2002), but it may take decades before these areas resemble the forest vegetation that was present before construction.

Soils that were previously shaded by the tree canopy would receive increased amounts of light, which could lead to drier soils and higher soil temperatures. Trees on the edge of the right-of-way might be subject to mechanical damage to trunks and branches and root impacts from soil disturbance and compaction, all of which could result in the decreased health and viability of some trees and root systems.

Columbia Gas would follow the measures in the ECP and would use EPA approved herbicides only, following existing regulations and label instructions. Herbicides would not be used within 100 feet of a waterbody or wetland except as specified by the appropriate land management or state agency. Additionally, Columbia Gas would use measures outlined in the Plan to reestablish affected areas. Following construction, reseeding of permanent vegetation would occur within the recommended seeding dates. Temporary sediment barriers would be used to minimize potential for sedimentation into sensitive resources. These would be kept in place until revegetation is successful. Restoration would be considered successful if the right-of-way surface is similar to adjacent undisturbed lands, construction debris is removed, revegetation is successful, and proper drainage has been restored.

TABLE 4.5.6-1
Summary of LX Pipeline Facility Habitat Impacts (acres)

Facility	Forest		Agricultural		Open Land		Developed		Wetland		Open Water		Project Total	
	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b, c]	Const. [a]	Op. [b]	Const. [a]	Op. [b]
Pipeline Facilities														
LEX														
Pipeline	994.9	421.6	550.6	250.2	217.3	107.9	15.0	8.4	15.3	9.4	3.1	2.7	1796.2	800.1
ATWS	100.4	0.0	79.5	0.0	18.9	0.0	3.0	0.0	0.4	0.0	0.0	0.0	202.2	0.0
Access Roads	3.5	0.1	16.4	0.1	16.9	0.2	12.5	1.4	0.2	0.0	0.0	0.0	49.4	1.7
Contractor Yards	6.6	0.0	174.2	0.0	145.8	0.0	68.6	0.0	1.5	0.0	0.3	0.0	397.1	0.0
Cathodic Protection	0.8	0.8	0.6	0.6	0.5	0.5	0.1	0.1	0.0	0.0	0.0	0.0	1.9	1.9
LEX Subtotal	*1106.3*	*422.5*	*821.2*	*250.8*	*399.4*	*108.6*	*99.2*	*9.8*	*17.5*	*9.4*	*3.4*	*2.7*	*2446.9*	*803.7*
LEX1														
Pipeline	6.9	3.1	5.1	2.4	3.6	1.8	0.0	0.0	0.1	0.1	0.0	0.0	15.7	7.3
ATWS	0.2	0.0	0.7	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0
Contractor Yards	0.0	0.0	5.9	0.0	0.7	0.0	2.7	0.0	<0.1	0.0	0.0	0.0	9.3	0.0
LEX1 Subtotal	*7.0*	*3.1*	*11.7*	*2.4*	*4.5*	*1.8*	*2.7*	*0.0*	*0.1*	*0.1*	*0.0*	*0.0*	*26.0*	*7.3*
R-801 Loop														
Pipeline	184.8	60.6	57.2	18.5	69.2	17.3	6.6	1.6	0.6	0.3	0.0	0.0	318.4	98.4
ATWS	20.2	0.0	5.4	0.0	3.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	29.3	0.0
Access Roads	1.5	<0.1	5.1	0.0	5.4	<0.1	5.3	<0.1	0.0	0.0	0.0	0.0	17.3	<0.1
Contractor Yards	0.3	0.0	31.2	0.0	77.3	0.0	1.6	0.0	0.3	0.0	0.0	0.0	110.7	0.0
Cathodic Protection	0.3	0.3	0.0	0.0	0.2	0.2	<0.1	<0.1	0.0	0.0	0.0	0.0	0.5	0.5
R-801 Loop Subtotal	*207.0*	*60.9*	*98.9*	*18.5*	*155.2*	*17.5*	*14.2*	*1.6*	*0.9*	*0.3*	*0.0*	*0.0*	*476.2*	*98.8*
BM-111 Loop														
Pipeline	16.9	8.8	1.2	0.5	5.3	2.7	3.0	1.2	1.0	0.9	2.5	2.3	29.8	16.4
ATWS	3.7	0.0	1.2	0.0	1.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	6.4	0.0
Access Roads	0.1	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.5	0.0
BM-111 Loop Subtotal	*20.7*	*8.8*	*2.3*	*0.5*	*6.7*	*2.7*	*3.4*	*1.2*	*1.0*	*0.9*	*2.5*	*2.3*	*36.6*	*16.4*

TABLE 4.5.6-1 (cont'd)
Summary of LX Pipeline Facility Habitat Impacts (acres)

Facility	Forest		Agricultural		Open Land		Developed		Wetland		Open Water		Project Total	
	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b, c]	Const. [a]	Op. [b]	Const. [a]	Op. [b]
R-501 Abandonment														
Temporary workspace	1.7	0.0	2.3	0.0	7.0	0.0	1.9	0.0	<0.1	0.0	0.0	0.0	12.9	0.0
Access Roads	0.9	0.0	5.0	0.0	9.8	0.0	0.5	0.0	0.2	0.0	0.0	0.0	16.4	0.0
R-501-Abandonment Subtotal	*2.5*	*0.0*	*7.3*	*0.0*	*16.8*	*0.0*	*2.4*	*0.0*	*0.3*	*0.0*	*0.0*	*0.0*	*29.3*	*0.0*
Pipeline Facilities Total	***1,343.5***	***495.2***	***941.4***	***272.3***	***582.6***	***130.6***	***122.0***	***12.5***	***19.7***	***10.7***	***5.9***	***5.0***	***3,015.0***	***926.3***

[a] Operational land use impacts associated with wetlands have been calculated based on the proposed 50-foot–wide permanent easement. Per the FERC Procedures, Columbia Gas would maintain a 10-foot-wide cleared easement in wetlands. Trees within 15 feet of the pipeline with root systems that could compromise the integrity of the pipeline coating would also be electively removed, for a total maintenance corridor of up to 30 feet. Additionally, the areas between horizontal directional drill (HDD) entry and exit locations would not be impacted by construction or operation, with the exception of temporary access roads necessary for hydrostatic test water withdrawal, to minimize and avoid wetland impacts.

[b] Land affected during construction is inclusive of operation impacts (permanent).

[c] Land affected during operation consists only of new permanent impacts.

Since Columbia Gas' ECS does not address the seed mixes proposed for revegetation for the project as recommended by the agencies listed above, **we recommend that**:

- **<u>Prior to construction</u>, Columbia Gas should file with the Secretary, for review and written approval of the Director of OEP, a revised project specific ECS that addresses the agencies requests to apply seed mixes identified in state standards specific to the project region as well as the use of seeds for native pollinator species so as to benefit pollinating insect, bird and bat species.**

During operation of the LX Project, Columbia Gas would maintain a 10-foot-wide vegetative cover on the cleared right-of-way, in accordance with the Plan. A 50-foot-wide easement would be established every 3 years. No clearing activities would occur between April 1 and August 31, per recommendations from FWS. Within wetlands, Columbia Gas would maintain a 10-foot-wide permanent easement. Cutting of trees would occur within 15 feet of the pipeline if roots would compromise the reliability of the pipeline. Clearing would not occur between HDD entry and exit locations. Maintenance activities and other permanent impacts would affect various habitat types, specifically causing impacts on upland forest and wetland habitats. Impacts would convert all land types to an herbaceous state. Columbia Gas routed the pipeline to minimize vegetation impacts as much as possible. In addition to measures outlined in the ECS, Plan, and Procedures, Columbia Gas would provide additional project specific measures.

Aboveground Facilities

Construction and modification of the three new compressor stations and their associated components as part of the LX Project would temporarily and permanently impact various habitat types, as demonstrated in table 4.5.6-2. All current land use at the compressor stations would convert to industrial use after construction, including 20.5 acres of forest and less than 0.1 acre of wetland. Permanent conversion would total 48.7 acres. Forested land within the suction/discharge easement would be converted to open land. Additionally, a majority of the proposed modifications at the Crawford CS would not require an expansion at the existing facility; however, a new regulator and valve facility would be constructed outside the existing fence lines converting 0.4 acre of open land to industrial use, maintained as a graveled, fenced facility. Proposed modifications at the Ceredo CS would require a minor expansion at the facility fence lines resulting in impacts on 2.9 acres of industrial and open land maintained for the operation of the permanent facility. These modifications would result in minor environmental effects in these locations and be mitigated. No permanent impacts are anticipated.

As presented in table 4.5.6-2, construction of four new regulator stations, as part of the LX Project, would affect various habitat types during construction and operation. Current habitat types include forest, industrial, open land, agricultural, and wetlands. All current land use at the regulator stations would convert to industrial use permanently. Modifications at the existing RS-1286 would result in less than 0.1 acre of new permanent impacts on agricultural, open land, and industrial land use. No permanent impacts would result from modifications of the existing RS-1286 station.

Construction impacts on these habitats would be comparable to those described for pipeline facilities and include soil compaction and erosion, and the potential establishment of invasive species. Columbia Gas would restore and seed any previously vegetated areas affected by construction according to its ECS after construction is completed.

Construction of aboveground facilities associated with the RXE Project would primarily affect agricultural and open land habitats, in addition to minor impacts on other habitat types. Developed land areas would be used where possible to minimize impacts on more valuable habitat land types. All

permanent impacts on vegetation would convert existing land to industrial land use. Impacts on specific land use types are outlined below in table 4.5.6-3.

Impacts on vegetation within the RXE Project area would be minor due to the use of agricultural areas and placement adjacent to existing pipeline rights-of-way. Clearing would occur as a result of construction within the proposed aboveground facility limits. Areas not within the permanent easement would be restored to pre-construction conditions and allowed to re-vegetate. Columbia Gulf would follow standards outlined in their ECS for revegetation of disturbed areas.

TABLE 4.5.6-2
Summary of LX Aboveground Facility Habitat Impacts (acres)

Facility	Forest		Agricultural		Open Land		Developed		Wetland		Open Water		Project Total	
	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b, c]	Const. [a]	Op. [b]	Const. [a]	Op. [b]
LEX														
Launcher	0.0	0.0	0.0	0.0	0.3	0.2	0.5	0.4	0.0	0.0	0.0	0.0	0.8	0.6
Mainline Valves	0.1	0.1	0.4	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5
Lone Oak Compressor Station	26.0	15.4	0.0	0.0	9.7	7.3	0.8	0.5	0.2	0.0	0.0	0.0	36.7	23.2
Summerfield Compressor Station	0.0	0.0	6.8	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	4.6
Access Roads	0.3	0.3	0.7	0.7	0.3	0.3	1.3	1.3	0.0	0.0	0.0	0.0	2.5	2.5
LEX1														
Receiver	0.0	0.0	2.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.0
K-260 Regulator Station	3.9	1.1	1.2	0.0	1.7	0.1	2.7	0.0	0.0	0.0	0.0	0.0	9.4	1.2
Incoming Line	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
Tie-in Valve	<0.1	<0.1	0.0	0.0	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	<0.1	<0.1
Access Roads	0.7	0.7	0.9	0.9	0.8	0.8	1.6	1.6	0.0	0.0	0.0	0.0	4.0	4.0
R-801 Loop														
R-System Regulator Station	0.1	0.0	0.0	0.0	4.6	2.2	0.5	<0.1	0.0	0.0	0.0	0.0	5.2	2.3
Incoming Line	0.0	0.0	0.0	0.0	0.4	0.4	<0.1	<0.1	0.0	0.0	0.0	0.0	0.4	0.4
Tie-in Facility	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
Benton Regulator Station	1.5	0.6	0.0	0.0	0.9	0.5	<0.1	<0.1	<0.1	0.0	0.0	0.0	2.4	1.1
RS-1286 Regulator Station [d]	0.0	0.0	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.1
McArthur Regulator Station	2.3	1.5	0.0	0.0	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.8	1.9
Mainline Valve	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Access Roads	0.4	0.4	0.0	0.0	0.5	0.5	0.4	0.4	<0.1	<0.1	0.0	0.0	1.4	1.4
BM-111 Loop														
Launcher	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.0	0.0	0.0	0.0	0.8	0.8
Ceredo Compressor Station [d]	1.3	0.0	0.0	0.0	0.8	0.8	14.2	2.1	0.0	0.0	0.0	0.0	16.4	2.9
Access Road	0.0	0.0	0.0	0.0	0.0	0.0	<0.1	<0.1	0.0	0.0	0.0	0.0	<0.1	<0.1

TABLE 4.5.6-2 (cont'd)
Summary of LX Aboveground Facility Habitat Impacts (acres)

Facility	Forest		Agricultural		Open Land		Developed		Wetland		Open Water		Project Total	
	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b]	Const. [a]	Op. [b, c]	Const. [a]	Op. [b]	Const. [a]	Op. [b]
Existing Columbia Pipeline System														
Crawford Compressor Station [d]	0.0	0.0	0.0	0.0	0.4	0.4	21.6	0.0	0.0	0.0	0.0	0.0	22.0	0.4
Oak Hill Compressor Station	0.1	0.0	18.5	6.4	0.1	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	18.7	6.4
Suction/Discharge Lines	0.3	0.3	3.4	3.4	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	3.7	3.7
Tie-In Facility	0.0	0.0	0.4	0.4	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4
Benton Compressor Station [d]	0.0	0.0	0.0	0.0	1.3	0.2	2.3	<0.1	0.2	<0.1	0.0	0.0	3.8	0.3
R-486 Odorization Site d	0.0	0.0	<0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
R-130 Odorization Site [d]	0.0	0.0	0.0	0.0	0.1	<0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	<0.1
R-543 Odorization Site [d]	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
R-300 / R-500 Odorization Site [d]	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	1.3	0.0
Access Roads	0.1	0.1	1.9	1.1	<0.1	<0.1	1.4	0.1	0.0	0.0	0.0	0.0	3.4	1.3
Aboveground Facilities Total	***37.1***	***20.5***	***36.2***	***19.0***	***22.9***	***14.8***	***50.0***	***7.2***	***0.4***	<0.1	***0.0***	***0.0***	***146.6***	***61.4***

[a] Operational land use impacts associated with wetlands have been calculated based on the proposed 50-foot–wide permanent easement.
[b] Land affected during construction is inclusive of operation impacts (permanent).
[c] Land affected during operation consists only of new permanent impacts.
[d] Project activities would occur at existing aboveground facilities.

TABLE 4.5.6-3 Summary of RXE Aboveground Facility Habitat Impacts (acres)		
Habitat Type	**Construction Impacts**	**Operational Impacts**
Grayson Compressor Station		
Agricultural	7.8	5.7
Open Land	0.6	0.0
Water	0.1	0.0
Developed Land (residential)	2.8	2.8
Forested/Woodland	0.5	0.1
Grayson Total	*11.8*	*8.6*
Means Compressor Station		
Open Land	19.2	7.2
Water	0.1	0.0
Developed Land (industrial)	0.1	0.0
Means CS Subtotal	*19.4*	*7.2*
Means Measurement and Regulation Station		
Developed Land (industrial)	3.2	1.0
Means M&R Station Subtotal	*3.2*	*1.0*
Means Total [a]	*22.6*	*8.2*
Total Aboveground Facility Impacts	***34.4***	***16.8***

[a] Includes impacts on land use type for both the Means CS and the Means M&R station.

4.5.6.2 Contractor Yards

Columbia Gas would use temporary contractor yards to facilitate construction of project components and has identified preferred sites and alternate sites. A total of 517.1 acres within contractor yard construction workspace would be temporarily affected. It is anticipated that approximately 17 contractor yards would be required for construction of the LX Project. Contractor yards would affect approximately 211.3 acres of agricultural land, 223.8 acres of open land, 6.9 acres of forest, and 1.8 acres of wetland. Following construction, areas designated for contractor yard use would revert to pre-construction conditions unless otherwise indicated by the landowner. Impacts from contractor yard construction on vegetation would be similar to those described for pipeline and aboveground facilities.

4.5.6.3 Access Roads

Pipeline facilities and aboveground facilities would use permanent and temporary access roads creating temporary and permanent impacts on land use types. Construction of these roads, temporary and permanent, would affect various land types, including, but not limited to, 34.0 acres of open land and 30.0 acres of agricultural land. Approximately 7.3 acres of forested land would be affected during construction and 1.5 acres would be affected by permanent access roads. Construction impacts on vegetation would be similar to impacts listed above for the proposed pipeline, including the potential for soil compaction and erosion and the introduction and establishment of invasive species. Construction could require tree clearing and if necessary, trees would be felled into the construction work area of the access road. After construction, Columbia Gas would restore impacted areas to pre-construction conditions following protective measures established in the ECS and FERC Procedures. Additional impacts from access road construction on vegetation would be similar to those described for pipeline and aboveground facilities.

4.5.7 Conclusion

Temporary and minor impacts would result due to construction of the LX and RXE Projects. Based on our review of the potential impacts on vegetation as described above, we conclude that the primary impact from construction and operation of the LX Project would be on forested lands and the RXE Project would primarily affect agricultural land. Forested impacts from the construction of the LX Project would be significant; however, due to the prevalence of forested habitats within the project area and eventual regrowth of prior forested areas outside of the permanent right-of-way, in addition to Columbia Gas' mitigation and routing, we conclude that the permanent conversion of forested lands would be reduced to less than significant levels. Additional measures outlined in the Columbia Gas and Columbia Gulf's corresponding ECSs would further minimize impacts to forested lands and other vegetation types.

4.6 WILDLIFE AND AQUATIC RESOURCES

4.6.1 Wildlife

4.6.1.1 Existing Wildlife Resources

The proposed LX and RXE Projects would cross terrestrial and wetland habitats that support a diversity of wildlife species. Wildlife habitats along the proposed route are representative of the local vegetation communities presented in section 4.5 (forest, open land, agricultural, industrial, wetlands, residential, and open water).

TABLE 4.6.1-1
Wildlife Species Potentially Occurring in the LX Project Area

Land Cover	Wildlife Species
Upland Forest	White-tailed deer, gray fox, flying squirrel, eastern chipmunk, wild turkey, black-capped chickadee, downy woodpecker, eastern screech owl, and five-lined skink
Open Upland	Woodchuck, eastern mole, least shrew, eastern cottontail rabbit, American kestrel, American goldfinch, field sparrow, American toad, eastern fence lizard, and garter snake
Agricultural Land	Woodchuck, white-footed mouse, mourning dove, American crow, house finch, barn swallow, and garter snake
Developed Land	Raccoon, eastern cottontail rabbit, mourning dove, house finch, American robin, and northern mockingbird
Wetland	American toad, spring peeper, green frog, garter snake, midland painted turtle, snapping turtle, red-winged blackbird, American wigeon, great blue heron, swamp sparrow, and raccoon
Open Water	Beaver, great blue heron, osprey, belted kingfisher, bullfrog, largemouth bass, smallmouth bass, channel catfish, creek chub, and white sucker

Hardwood forests characterize the forested land, providing food resources, nesting habitat, and cover for a variety of birds and mammals. Open land is characterized by existing utility easements and open areas which provide cover as well as foraging and nesting habitat for a variety of mammals, birds, reptiles, and amphibians. Agricultural land consists of improved pastures and areas of actively cultivated row crops. The agricultural land provides forage and nesting habitat for a variety of birds, mammals, and reptiles. Industrial land includes developed land not characterized as residential with sparse vegetative cover providing minimal habitat for birds and mammals. Wetlands include palustrine emergent wetlands, palustrine scrub-shrub wetlands, and palustrine forested wetlands providing cover, forage, and nesting habitat for a variety of reptiles, amphibians, mammals, and birds. Residential land consists of developed land that includes single and multiple family dwellings and generally lacks vegetation and suitable

wildlife habitat. Open water includes major lakes, ponds, or rivers, including the Ohio and Muskingum Rivers, with bankside vegetation providing habitat for mammals, birds, fish, and amphibians. Representative wildlife species potentially found in the LX Project area is provided in table 4.6.1-1.

Project Facilities

Construction of the LX Project, including pipelines and aboveground facilities, would impact a total of 1,380.6 acres of forest, 20.1 acres of wetlands (of which 1.4 acres would be forested wetland). Impacts of individual project components (the pipeline, aboveground facilities, contractor yards, and access roads) on vegetation types are provided in section 4.5.

4.6.1.2 Sensitive or Managed Wildlife Habitats

Sensitive wildlife habitats associated with wildlife management areas and federally listed, state-listed, and special-status species such as migratory birds would be crossed by the LX and RXE Projects (see section 4.7).

The project consisting of both LX and RXE Projects would not cross any National Park System Units, including national parks and preserves (KDFWR, 2014c:FWS, 2015a; NPS, 2014a). The project would not cross any National Wildlife Refuges or National Wilderness Areas. No protected or sensitive areas containing habitat for unique, sensitive, or protected plant and/or wildlife were identified within West Virginia or Pennsylvania. Consultation with FWS, in a letter dated February 12, 2015 also determined that the LX Project does not cross any federal wilderness areas, wildlife refuges, or designated critical habitat in the Ohio portion of the LX Project. In a letter from WVDNR dated April 22, 2015, the LX Project area would cross portions of Dunkard Fork WMA.

Ohio

The LX Project would directly cross Sunfish Creek State Forest in Ohio. The LX Project would also be within 0.2 mile of Rhododendron Cove State Nature Preserve and its two associated components (Kleinmaier Rhododendron Hollow and Whakeena), Bartley Preserve, Clear Creek Metro Park, Monroe Lake WMA, and Arethusa Springs Park. Temporary workspace associated with the R-501 Abandonment is located 0.4 mile from the Wayne National Forest in Vinton County, Ohio at its closest point (MP 20.9), and the R-801 Loop is located less than 0.1 mile, at its closest point (MP 8.1), west of the Hocking State Forest in Vinton County, Ohio.

Sunfish Creek State Forest

The Sunfish Creek State Forest is managed by the ODNR and consists of 637 acres of forest used for recreational purposes such as hiking and hunting (ODNR, 2015b). The LEX Pipeline section of LX Project crosses the Sunfish Creek State Forest in Monroe County, Ohio from MP 26.1 RR-5 to 26.5 RR-5. Columbia Gas has submitted a formal application, including an Environmental Assessment, to ODNR for review and approval. After approval, Columbia Gas would be granted a 25-year lease agreement for the permanent pipeline easement within the forest. Consultations with ODNR regarding impacts, permitting, and regulatory requirements are ongoing concerning the impacts on and restoration of wildlife habitat in the Sunfish Creek State Forest. Therefore, **we recommend that:**

- **<u>Prior to construction,</u> Columbia Gas should file with the Secretary documentation of its correspondence with ODNR and any avoidance or mitigation measures developed to cross the Sunfish Creek State Forest.**

Hocking Canal

The ODNR manages the Hocking Canal, which would be crossed by the LEX Pipeline component of the LX Project at MP 130.4 in Hocking County, Ohio. ODNR recommends crossing the canal via HDD. Columbia Gas revised and resubmitted its application and associated Environmental Assessment for the LX Project activities within the Sunfish Creek State Forest to also include information associated with the proposed crossing of the Hocking Canal. Columbia Gas would provide additional consultations with the ODNR to the Secretary.

Rhododendron Cove State Nature Preserve

The Rhododendron Cove State Nature Preserve, including the Kleinmaier Rhododendron Hollow Component and Wahkeena Component, in Fairfield County are managed by ODNR, the Appalachia Ohio Alliance, and the Fairfield County Historical Parks, respectively. The nature preserve and associated components are adjacent to temporary workspace associated with the Crawford CS. This preserve supports known populations of state protected and state sensitive plant species as identified in Section 4.7; however, project activities would be approximately 175 feet from documented populations. The Wahkeena Component is 0.2 mile east from the Crawford CS temporary workspace. No permanent impacts are anticipated at the nature preserve or associated components due to the distance of project activities from sensitive species and the restriction of project activities within the existing fence line.

Clear Creek Metro Park

The LEX Pipeline at MP 130.2 in Hocking County is 0.7 mile west from the Clear Creek Metro Park. The park is the state's largest state nature preserve and is managed by Columbus/Franklin County Metro Parks Program. The park contains hemlock-hardwood forest and Appalachian oak forest communities in addition to providing habitat for the black vulture, hermit thrush, and tiger spiketail. No impacts are anticipated due to the distance of the nature preserve from LX Project activities.

Hocking State Forest

The Hocking State Forest, in Hocking County, Ohio, contains over 9,000 acres of land. The forest is managed by the Ohio State Parks division of the ODNR. At its closest point, the R-801 Loop is 0.02 mile west of the Hocking State Forest in Vinton County, Ohio. We do not anticipate any adverse impacts because the LX Project would not cross the forest boundary and is more than one mile from the nearest recreational area. The construction right-of-way would parallel the existing R-501 Line, minimizing impacts and reducing the amount of tree clearing required. No permanent impacts are anticipated. Forests would revegetate after construction and Columbia Gas would follow measures outlined in the Plan and their ECS.

West Virginia

A letter from WVDNR indicated that the alignment of the LX Project would cross portions of Dunkard Fork WMA. The Dunkard Fork WMA is a public hunting and fishing area. The Project has the potential to affect wildlife in this area and WVDNR recommended coordination with the District Wildlife Biologist (WVDNR, 2015). Based upon those communications Columbia Gas would post notification and/or detour signs when construction traffic would traverse or utilize public roadways within the WMA. Columbia Gas would implement BMPs and mitigation measures during construction activities. All land temporarily disturbed by construction within the WMA would be restored to pre-construction conditions through revegetation activities in accordance with the ECS.

Kentucky

A database search did not identify significant habitat areas that would be affected by RXE for federal and state wilderness areas, wildlife preserves, sanctuaries, state game refuges, wildlife management areas, National Wildlife Refuges, and other designated fish and wildlife use (KDFWR, 2014c; FWS, 2015a; Wilderness.net, 2015). At this time, no conservation easements have been identified as being directly affected by the construction and operation of RXE. The closest protected resource to the Means CS would be the Daniel Boone National Forest, located approximately 3 miles to the south and west (KDFWR, 2014c). The closest protected resource to the Grayson CS would be the Grayson Lake Wildlife Management Area, located approximately 8 miles to the southwest.

4.6.1.3 General Impacts and Mitigation

Pipeline Facilities

Construction of the pipeline and extra workspace would affect a total of 2,160.6 acres of vegetated habitat. Following construction, Columbia Gas would implement its ECS to minimize temporary and permanent effects on wildlife and to promote stabilization and revegetation of disturbed areas. During operations, 987.7 acres of vegetated habitat within the permanent right-of-way would convert to an early successional stage, which Columbia Gas would maintain by mowing. This maintenance would result in the conversion of 515.6 acres of upland forest and 0.8 acre of forested wetlands permanently to herbaceous and scrub-shrub habitat. Land cover and acreage associated with the construction of the pipeline facilities and associated extra workspace and access roads are described in further in section 4.8.

Several stakeholders expressed concerns about impacts on wildlife, such as habitat loss and fragmentation of habitat. Agencies have also suggested evaluating impacts resulting from an altered landscape such as wildlife habitat, forest fragmentation, and the change in predator abundance, and the attraction of competitive or parasitic wildlife species to the project area. We also received a comment on the draft EIS questioning the impacts of noise on deer in the project area, as construction is estimated to commence during deer hunting season.

Construction of the pipeline facilities could negatively affect common wildlife species and general wildlife habitat within the immediate vicinity of the pipeline route. Noise and ground disturbance generated by pipeline construction activities may temporarily affect wildlife behavior in their immediate vicinity. Section 4.11.2 of the final EIS describes noise levels developed to protect nearby residences, which are also in place to ensure that construction activities and compressor stations authorized by FERC would not have significant adverse impacts on the environment, including wildlife and potentially sensitive species. Noise would potentially cause wildlife to temporarily disperse to other neighboring habitats during clearing and construction activities; however, the stresses associated with wildlife dispersal are not anticipated to result in any measureable effects on any species at the individual or population level. Other disturbance effects, including direct mortality, could occur due to clearing, grading, trench excavation, and the movement of equipment on the right-of-way and access roads. This would affect less mobile species, including those that hide within burrows along the route, to a greater degree than those that could quickly flee the project area. Therefore, we do not expect that significant direct mortality of wildlife would occur as a result of construction activities.

Removal of vegetation within forested land could cause long-term displacement of some local wildlife populations. Although forested areas would be restored similar to other areas, forested habitat would be converted to successional stages of open herbaceous and scrub-shrub habitat either permanently (as on the permanent right-of-way) or for several years to decades until a mature forest community redevelops on the temporary workspaces. Some wildlife species that rely on forested habitat for foraging, breeding, and nesting would be negatively affected by the long-term loss of forest cover. Other species that prefer open land and scrub-shrub habitat would benefit from the permanent or temporary habitat

conversion. Edge effects or forest fragmentation would increase in certain locations due to project construction, reducing the amount of habitat available for interior forest species (i.e. movement and dispersal corridors). With habitat conversion and forest fragmentation, there is also a risk of intrusion by invasive or noxious species.

The impact of forest fragmentation on wildlife in the eastern United States has emerged as an important issue. Fragmentation generally affects birds through dispersal barriers, absence of suitable microhabitats, small population size, and edge effects (Degraaf and Healy, 1990). Migratory birds are among the best-studied groups of wildlife regarding adverse effects from fragmentation. Edge effects can result in interactions between birds that nest in the interior of forests and species that inhabit surrounding landscape, typically lowering the reproductive success of the interior species. Other evidence suggests that certain mammals, amphibians, reptiles, and plants are also adversely affected by forest fragmentation. Species that require large tracts of unbroken forest land may be forced to seek suitable habitat elsewhere. The loss of forest habitat, expansion of existing corridors, and the creation of open early successional and induced edge habitats could decrease the quality of habitat for forest interior wildlife species in a corridor much wider than the actual cleared right-of-way. The distance an edge effect extends into a woodland is variable, but most studies point to at least 300 feet (Rodewald, 2001; Jones, et al., 2000; Ontario Ministry of Natural Resources, 2000; Robbins, 1988; Rosenberg, et al., 1999). Edge impacts within this distance could include a change in available habitat for some species due to an increase in light and temperature levels on the forest floor and the subsequent reduction in soil moisture; thereby resulting in habitat that would no longer be suitable for species that require these specific habitat conditions, such as salamanders and amphibians. An alteration of habitat could affect the fitness of some species and increase competition both within and between species, possibly resulting in an overall change to the structure of the forest community.

Increased predation could also occur during construction and operation of the pipeline due to the removal of vegetation and loss of cover, which would increase the visibility of prey species. While individual mortality rates could increase, the project would not likely have any population-level impact due to these effects.

The duration of effects on wildlife using other habitats such as agricultural lands and other open lands (including existing rights-of-way) would be shorter than in forested areas. Following construction, vegetation, similar to that existing before construction, would typically become reestablished within months to a few years. It is expected that wildlife would quickly return to the vicinity of the rights-of-way, using them as corridors for travel, refuge, foraging, and nesting.

The degree of impact would depend on the type of habitat affected, the timing of clearing and construction activities, and the rate of recovery for the disturbed area. Impacts on migratory bird habitats are discussed above. Columbia Gas would use a 110-foot-wide construction right-of-way in uplands, except between LEX Pipeline MP 0.0 to MP 40.0. Steep slope conditions exist at this part of the LX Project area and require a construction right-of-way of 125 feet for safety and efficiency during construction. A 50-foot-wide cleared corridor would be maintained following construction, allowing areas outside the permanent easement to return to pre-construction conditions. Some of the easement along the R-801 Loop would overlap up to 20 feet with existing easement, resulting in a 30-foot new permanent easement.

Most of the RXE Project is located on open or agricultural lands. Migratory bird species that prefer open, disturbed areas could utilize nearby existing easements for foraging and would be able to displace to similar adjacent habitats during construction activities. During field surveys, no migratory bird nests were identified. The RXE Project would have potential impact on migratory bird species which can be greatly reduced with appropriate clearing dates and compensatory mitigation for habitat loss as recommended in the final recommendation at the end of section 4.6.1.3. Those actions, coupled with

minimized environmental impacts resulting from the project's design and on implementation of the provisions of the ECS and FERC Plan and Procedures should result in less than significant impacts to migratory bird species. As mentioned earlier, Columbia Gulf has consulted with FWS to minimize the impact on migratory birds within the maintained right-of-way and develop project-specific conservation measures and BMPs to protect BCC and their habitats in the RXE vicinity. In a letter dated February 12, 2016, FWS stated that they concur with Columbia Gulf's avoidance and minimization efforts and have no further comments.

Construction debris would be removed unless an agency determines that it is beneficial for habitat restoration. In the event that rookeries or raptor nests are located within the RXE area prior to or during construction, Columbia Gulf would consult with FWS and KDFWR to develop measures to avoid impacts to these features.

Release or spills of potentially hazardous materials could occur as a result of project construction, negatively impacting surrounding wildlife. Fuel spills would be controlled by regulating fuel storage and refueling activities and requiring immediate cleanup should a spill occur. Columbia Gas would adhere to measures outlined in the ECS and FERC Procedures to minimize the impact of spills on wildlife.

Trenching activities could create potential trap areas for wildlife in the LX Project area. Areas designated for trenching would also be more susceptible to erosion. This could result in the discharge of sediment to waterbodies and wetlands, negatively impacting habitat and wildlife found in these areas. Temporary trench breakers would be installed immediately after trench excavation to prevent erosion to the greatest extent possible.

Blasting may be necessary along the pipeline route in areas of shallow depth to bedrock. Columbia Gas is continuing to evaluate areas designated for blasting. Blasting needs would be determined at the time of crossing. Columbia Gas would obtain any state or federal agency approval prior to blasting activities and would conduct blasting in a cautious manner to avoid injury or damage to wildlife. Columbia Gas has developed an acceptable blasting plan which would limit potential impacts, as described in section 4.1.

Columbia Gas would follow measures outlined in the Procedures, including limiting the size of extra work areas needed to construct the waterbody crossing, to minimize impacts on wildlife found in riparian zones. Additional measures would include revegetating the area with native woody plant species or with conservation grasses and legumes. A riparian strip of at least 25-feet-wide, as measured from the waterbody's mean high water mark, would be allowed to grow.

The pipeline routes have been designed to minimize impacts on sensitive wildlife habitat whenever possible. Columbia Gas plans to further minimize impacts on wildlife habitat by using the measures contained it the ECS, FERC's Plan and Procedures, and any additional mitigation measures required. Actions to minimize impacts include:

- maintaining a 50-foot wide permanent right-of-way width in upland areas;
- no clearing between April 15 and August 1, as well as adherence to seasonal clearing restrictions where required, as discussed in section 4.7;
- requested alternate measures to the FERC Procedures (discussed in appendix E); and
- soil amendments in areas with low revegetation potential.

Aboveground Facilities

Construction and modification of the aboveground facilities including compressor stations, regulator stations, and launcher and receiver facilities would impact 18.9 acres of forest during construction and 14.8 acres of permanent forest impacts for operation, with an additional 0.01-acre of forested wetland during construction, with no permanent forested wetland impacts for operation. Temporary impacts on wildlife would be similar to those described above for pipeline facilities. Wildlife would most likely be permanently displaced from these areas due to lack of suitable habitat and proper vegetation. Several stakeholders expressed concerns about noise impacts on wildlife, specifically from venting of gases at the compressor stations. The increase in ambient noise in the immediate vicinity of these facilities during both construction and operation could also result in a decrease in wildlife use of adjacent habitat. Changes in ambient noise levels are further discussed in section 4.11.2 along with proposed measures to limit noise exposure during both construction and operation of the LX and RXE Projects.

Contractor Yards

The proposed 17 contractor yards would temporarily affect 517.1 acres of land, consisting of 6.9 acres of forest, 223.8 acres of open land, 211.3 acres of agricultural land, 73.0 acres of developed land, 1.8 acres of wetland, and 0.3 acre of open water. Following construction, Columbia Gas would restore and reseed any previously vegetated areas that are affected, and restore contours to pre-construction conditions unless otherwise indicated by the landowner. Use of these areas would temporarily displace wildlife species; however, displaced wildlife would return to these areas following restoration. Therefore, no permanent impacts on wildlife would result from the use of the contractor yards.

Access Roads

Columbia Gas would use a total of 130 temporary access roads during construction and 6 permanent access roads during construction and operation of the pipeline facilities, including the R-501 Abandonment. Aboveground facilities would use 29 permanent and 2 temporary access roads. The permanent access roads would be newly constructed or upgrades on existing roads. Construction of these roads, temporary and permanent, would affect 94.9 acres of land, consisting of 7.3 acres of forest, 34.0 acres of open land, 30.0 acres of agricultural land, 23.2 acres of developed land, and 0.4 acre of wetland. When possible, construction of roads would occur on existing roads with construction requiring modification and improvements. Construction impacts on these habitats would be comparable to those described for pipeline facilities and include soil compaction and erosion, the potential establishment of invasive species, and fragmentation of interior forested tracts. Columbia Gas would restore and seed any previously vegetated areas affected by construction according to its ECS after construction is completed. Operational use of the permanent access roads would result in the permanent conversion of 10.9 acres.

Cathodic Protection Units

Columbia Gas would install a total of 14 cathodic protection units. Nine of these protection units would be installed entirely within aboveground facilities. The five remaining cathodic protection units proposed for installation would be installed along the LX and R-801 Loop belowground and would affect a total of 2.4 acres. After construction, affected areas would be allowed to revegetate and would be maintained as open land or return to agricultural use.

4.6.1.4 Migratory Birds

Migratory birds are species that nest in the United States and Canada during the summer, and then migrate south to the tropical regions of Mexico, Central and South America, and the Caribbean for

the non-breeding season. Migratory birds are protected under the MBTA (16 U.S. Code 703-711). Executive Order 13186 (EO 13186) (66 Federal Register 3853) directs federal agencies to identify where unintentional take is likely to have a measurable negative effect on migratory bird populations and to avoid or minimize adverse impacts on migratory birds through enhanced collaboration with the FWS.

EO 13186 states that emphasis should be placed on species of concern, priority habitats, and key risk factors, and that particular focus should be given to addressing population-level impacts. Additionally, bald and golden eagles are protected under the BGEPA (16USC 668-668d). On March 30, 2011, a Memorandum of Understanding (MOU) was signed between the Federal Energy Regulatory Commission and the U.S. Department of the Interior United States Fish and Wildlife Service Regarding Implementation of Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds." This voluntary memorandum focuses on migratory birds and strengthening migratory bird conservation through enhanced collaboration between FERC and FWS. It does not waive legal requirements under the MBTA, BGEPA, ESA, or any other statues and does not authorize the take of migratory birds. Bald and golden eagles were not identified as being present in the project areas.

FWS established the Birds of Conservation Concern (BCC) designation in response to a 1998 amendment to the Fish and Wildlife Conservation Act. The BCC allows for protection of migratory birds that, without additional conservation actions, would become candidate species under the ESA (FWS, 2008). BCC species are listed at three different scales: Bird Conservation Regions, FWS Region, and National. The projects are in Bird Conservation Region 24 & 28 (Central Hardwoods & Appalachian Mountains region of the United States). Tables 4.6.1-2 and 4.6.1-3 lists the BCC's in the LX in the RXE Project areas, respectively. The species listed in these tables are known or potentially to occur in the LX and RXE Project areas.

In the United States, the National Audubon Society administers the Important Bird Area (IBA) program to identify and conserve a network of sites that provide critical habitat for birds. IBAs are selected according to standardized criteria (i.e., sites for species at risk, sites for responsibility assemblages, and sites for congregations of birds) through a collaborative effort with non-governmental conservation organizations, government agencies, local conservation groups, academics, birders, and others (Burger and Liner, 2005). In Pennsylvania, IBAs are designated by the Pennsylvania Ornithological Technical Committee and are recognized as the most critical regions in the state for conserving bird diversity and abundance. Wayne National Forest-Ironton, Hocking Hills, Clear Creek, and Wilds are Ohio State-recognized IBAs in proximity to the LX Project in Ohio. Enlow Fork –SGL 302 is a Pennsylvania State-recognized IBA in proximity to the LX Project near the border of Pennsylvania. Based on the available Audubon mapping, there are no IBAs in proximity to the LX or RXE Project in West Virginia or Kentucky, respectively.

TABLE 4.6.1-2 Birds of Conservation Concern Potentially Occurring in the LX Project Area	
Common Name	**Scientific Name**
Bald eagle	*Haliaeetus leucocephalus*
Peregrine falcon	*Falco peregrinus*
Upland sandpiper	*Bartramia longicauda*
Northern saw-whet owl	*Aegolius acadicus*
Whip-poor-will[a]	*Caprimugus vociferous*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Olive-sided flycatcher	*Contopus cooperi*
Loggerhead shrike	*Lanius ludovicianus*
Black-capped chickadee	*Poecile atricapillus*
Bewick's wren	*Thryomanes bewickii*
Sedge wren	*Cistothorus platensis*
Wood thrush[a]	*Hylocichla mustelina*
Blue-winged warbler	*Vermivora cyanoptera*
Golden-winged warbler	*Vermivora chrysoptera*
Prairie warbler	*Dendroica discolor*
Cerulean warbler[a]	*Dendroica cerula*
Worm-eating warbler[a]	*Helmitheros vermivorus*
Swainson's warbler[a]	*Limnothlypis swainsonii*
Louisiana waterthursh[a]	*Parkesia motacilla*
Kentucky warbler[a]	*Oporomis formosus*
Canada warbler[a]	*Cardellina Canadensis*
Henslow's sparrow	*Ammodramus henslowii*
Rusty blackbird	*Euphagus carolinus*
Red crossbill	*Loxia curvirostra*

TABLE 4.6.1-3 Birds of Conservation Concern Potentially Occurring in the RXE Project Area	
Common Name	**Scientific Name**
Bachman's sparrow	*Aimophila aestivalis*
Bald eagle	*Haliaeetus leucocephalus*
Bell's vireo	*Vireo bellii*
Bewick's wren	*Thryomanes bewickii*
Black-capped chickadee	*Poecile atricapillus*
Blue-winged warbler	*Vermivora pinus*
Brown-headed nuthatch	*Sitta pusilla*
Canada warbler[a]	*Wilsonia canadensis*
Cerulean warbler[a]	*Dendroica cerulea*
Golden-winged warbler	*Vermivora chrysoptera*
Henslow's sparrow	*Ammodramus henslowii*
Kentucky warble[a]r	*Oporornis formosus*
LeConte's sparrow	*Ammodramus leconteii*
Loggerhead shrike	*Lanius ludovicianus*
Louisiana waterthrush[a]	*Seiurus motacilla*
Northern saw-whet owl	*Aegolius acadicus*
Olive-sided flycatcher	*Contopus cooperi*
Painted bunting	*Passerina ciris*
Peregrine falcon	*Falco peregrinus*
Prairie warbler	*Dendroica discolor*
Red crossbill	*Loxia curvirostra*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Rusty blackbird	*Euphagus carolinus*
Sedge wren	*Cistothorus platensis*
Short-eared owl	*Asio flammeus*
Smith's longspur	*Calcarius pictus*
Swainson's warbler[a]	*Limnothlypis swainsonii*
Upland sandpiper	*Bartramia longicauda*
Whip-poor-will[a]	*Caprimulgus vociferus*
Wood thrush[a]	*Hylocichla mustelina*
Worm-eating warbler[a]	*Helmitheros vermivorus*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Buff-breasted sandpiper	*Tryngites subruficollis*
Solitary sandpiper	*Tringa solitaria*
Black rail	*Laterallus jamaicensis*

[a] Indicates interior forest bird species

FWS provided three recommendations to avoid and minimize impacts on migratory birds. Additionally, they recommended minimizing habitat fragmentation by avoiding large contiguous tracts of wildlife habitat and co-locating project facilities adjacent to previously disturbed or maintained areas such as existing easements. The migratory bird nesting period begins in mid-April and lasts through early-August. To minimize impacts during this period, Columbia Gas would comply with the FWS recommendations and conduct clearing activities from September 1 to March 31 and comply with state and federal regulations such as:

- avoid fragmenting large, contiguous tracts of wildlife habitat;

- maintain contiguous habitat corridors;
- concentrate construction activities, infrastructure, and manmade structures on already altered lands;
- co-locate activities in or immediately adjacent to already-disturbed areas; and
- cluster development features where possible (Lewis, 2015).

The loss of approximately 1,380.6 acre of upland forest and 2.2 acres of forested wetlands associated with pipeline and aboveground facility construction would present a long-term impact for migratory birds that depend on forests. Vegetation clearing and other construction activities could affect egg and young survival. Bird displacement could affect bird migration, nesting, foraging, and mating behaviors. Behavior changes could increase the amount of stress, injury, and mortality experienced by migratory birds. Construction would also reduce the amount of habitat available for foraging and predator protection and would temporarily displace birds into adjacent habitats, which could increase the competition for food and other resources. This in turn could increase stress, susceptibility to predation, and negatively impact reproductive success.

Additionally, increased human presence and noise from construction activities could disturb actively nesting birds. Impacts would not be significant for non-nesting birds, as these individuals would temporarily relocate to avoid construction activities. However, construction activity near active nests during incubation or brood rearing could result in nest abandonment; overheating, chilling, or desiccation of unattended eggs or young causing nestling mortality; premature fledging; and/or ejection of eggs or young from the nest.

Migratory birds, including BCC-listed birds, could also be affected during project operation, which would permanently alter upland forest and forested wetland to scrub-shrub and herbaceous states. The alteration of forest habitat could result in increased competition, parasitic bird species, edge effects, and fragmentation resulting from right-of-way maintenance activities.

Species using the project area in the fall or winter would likely avoid the project area during construction, relocating to nearby habitats. Temporary displacement to less suitable habitat could occur as a result.

Columbia Gas would implement protective measures outlined in its ECS and the FERC Plan during construction of the LX Project. However, the FWS indicated in a letter dated February 12, 2015 and in its comments on the draft EIS that the LX Project has the potential for avian mortality of migratory birds and would result in habitat destruction and alteration within project boundaries and that Columbia Gas should prepare a plan to address this.

The FWS is a cooperating agency in the review of this proposal and has recommended that Columbia Gas avoid, minimize, and provide mitigation funding for impacts to migratory bird habitat to the extent practicable. As discussed above and in section 4.5.4, Columbia Gas has agreed to conduct tree clearing activities during the recommended non-nesting season and has sited about 40 percent of the LX Project along existing disturbed corridors. Construction outside of the breeding period and along existing disturbed corridors is generally recommended minimization measures to reduce the potential population-level effects on migratory birds. For lands covered by Columbia Gas' Multi-Species Habitat Conservation Plan (see additional discussion in section 4.7), avoidance and minimization measures, as well as compensatory mitigation for suitable habitat loss, has been determined. However, the FWS has indicated that about 87.7 miles of the LX Project would occur outside of these covered lands and may require additional mitigation for the loss of migratory bird habitat. Although Columbia Gas routed the

pipeline adjacent to existing disturbance and outside of forested areas to the extent practicable, impacts on the upland forest habitat and migratory birds that use this habitat account for 43 percent of the vegetation impacts. Columbia Gas is consulting with the FWS to develop a draft mitigation proposal to address migratory bird habitat and interior forest impacts and would provide this proposal to the FWS and FERC upon completion Because Columbia Gas has yet to provide a draft of its Migratory Bird Conservation Plan to the FWS and FERC, **we recommend that**:

- **<u>Prior to construction,</u> Columbia Gas should file with the Secretary its final Migratory Bird Conservation Plan along with documentation of its consultation with the FWS regarding avoidance, minimization, and mitigation measures.**

Columbia Gulf has consulted with the FWS Kentucky Field office regarding avoidance and minimization efforts. In a letter dated February 12, 2016, FWS stated that they concur with Columbia Gulf's avoidance and minimization efforts and have no further comments. As such, no conservation plan is required for the RXE Project.

4.6.1.5 Conclusions

Some significant impacts could be related to interior forest habitat, however, the overall impact of the LX and RXE Projects on most wildlife resources would be minor due to the temporary nature of the effects, the amount of similar adjacent habitat available for use, and implementation of the ECS, Plan and Procedures. Columbia Gas and Columbia Gulf would minimize impacts on wildlife through route planning, and a reduced construction right-of-way through wetlands and forests. Impacts on vegetation and wildlife within the RXE Project are not expected to be adverse, because the sites are in predominantly agricultural areas and adjacent to an existing pipeline right-of-way. Forested species may be subject to greater impacts than non-forested species, but we recognize that these would be less than significant impacts given the availability of undisturbed forested habitat adjacent to project workspaces and the ability for individual mobile species to seek refuge in these undisturbed areas. Additionally, the final EIS discusses numerous minimization and mitigation measures that the applicants would implement to protect migratory birds and their habitat. We are recommending that Columbia Gas further mitigate the negative impacts to migratory bird habitat by avoiding or minimizing impacts to the degree practicable, through the development of the Final Migratory Bird Conservation Plan in consultation with the FWS, which may include FWS' recommendations and mitigation measures. Therefore, overall impacts on wildlife from the projects would be long-term in areas of forest, but minor and temporary in other habitats that are previously disturbed.

4.6.2 Aquatic Resources

4.6.2.1 Existing Aquatic Resources

The proposed LX Project pipeline would cross a total of 983 freshwater waterbodies in Ohio, Pennsylvania, and West Virginia, and some of these would be crossed more than once. A more detailed characterization of the waterbodies crossed is provided in section 4.3 and table 4.6.2-1. The proposed RXE Project would cross a total of five freshwater waterbodies. The aboveground facilities and contractor yards would not impact any fisheries resources. A manmade pond, within the existing Crawford CS, would be avoided during construction. Therefore, these facilities are not discussed further in this section.

TABLE 4.6.2-1 Number of Water Crossings Occurring in the LX and RXE Project Area				
	Minor	**Intermediate**	**Major**	**Total**
Ohio	716	65	5	786
Pennsylvania	14	3	0	17
West Virginia	161	14	5	180
Kentucky	3	2	0	5
Total	***894***	***84***	***10***	***988***

Ohio

As discussed in section 4.3, the ODNR classifies waterbodies according to designated use. The Ohio Administrative Code 3745-1 classifies waterbodies as: aquatic life habitat (warmwater, limited warmwater, exceptional warmwater, modified warmwater, seasonal salmonid, coldwater [coldwater habitat, inland trout streams and coldwater habitat, native fauna], and limited resource water [acid mine drainage, small drainage way maintenance, and other specified conditions]), nuisance prevention, water supply (public, agricultural, and industrial), and recreational (bathing waters, primary contact [Class A, Class B, and Class C], and secondary contact).

Piney Fork, Muskingum River, Turkey Run, Hocking River, Ohio River, and Queer Creek are Ohio state-designated superior high quality waters. Superior high quality waters are waterbodies that possess exceptional ecological value. Ohio classifies the Ohio River, Hocking River, and Muskingum River as section 10 waterbodies. Activities associated with crossing Ohio state-designated superior high quality waters would be covered under the OPEA's Section 401 Water Quality Certification. The Section 404 Permit covers activities associated with crossing Section 10 waterbodies. The LX Project would not affect commercial fisheries in Ohio. The Muskingum River, a recreational fishery, would be crossed via HDD, minimizing impacts on fisheries.

Pennsylvania

As discussed in section 4.3, the PADEP characterizes surface waters by protected uses according to the Pennsylvania Water Quality Standards (25 Pa. Code §93.4). Aquatic life use includes coldwater fishes, warm water fishes, migratory fishes, and trout stocking. Water supply use consists of potable water supply, industrial water supply, livestock water supply, wildlife water supply, and irrigation. Recreation and fish consumption use includes boating, fishing, water contact sports, and esthetics. Special protection use characterizes high quality waters and exceptional value waters. Navigation is categorized as other use. The LX Project would cross 18 waterbodies within Pennsylvania, all of which have a Warm Water Fishes Aquatic Life use designation.. Dunkard Fork is designated as an approved trout water by PFBC and contains stocked trout populations. (PADEP, 2015c).

West Virginia

The WVDEP characterizes surface waters by designated use. Under the 47 Code of State Rules 2, surface waters are classified by category. Category A includes public water supply. Category B characterizes aquatic life include warmwater fisheries (B1), trout waters (B2), and wetlands (B4). Category C includes water contact recreation. Category D characterizes agriculture and wildlife uses including irrigation (D1), livestock watering (D2), and wildlife (D3). Category E includes water supply industrial, water transport, cooling, and power, consisting of water transport (E1), cooling water (E2), power production (E3), and industrial (E4). Waterbodies are further classified according to level of protection required to maintain the water's designated and/or high quality use (47 Code of State Rules 2). Tier 1 surface waters maintain and protect existing uses of a waterbody and the water quality conditions

necessary to support such uses. Tier 1 waterbodies include those listed as impaired on the state's 303(d) list as it pertains to the specific pollutant listed. Surface waters listed as Tier 2 maintain and protect "high quality" waters or waterbodies where the level of water exceeds levels necessary to support recreation and wildlife and the propagation and maintenance of fish and other aquatic life. Waterbodies not listed as impaired on the state's 303(d) list are considered Tier 2 waterbodies. A Tier 3 classification maintains and protects water quality in outstanding national resource waters (WVDEP, 2015b).

The LX Project crosses 128 waterbodies listed as 303(d) impaired waters. The LX Project would not affect commercial fisheries in West Virginia. Impacts on Wheeling Creek, a recreational fishery, would be temporary and localized and would likely not affect local fisheries.

Kentucky

Fisheries classifications are broken into two categories in the Commonwealth of Kentucky, coldwater aquatic habitat and warm water aquatic habitat. Coldwater aquatic habitat, also known as cold water fisheries, supports self-sustaining trout populations year-round, as well as other native aquatic species (Kentucky Division of Water [KDOW], 2011). There are no streams classified as coldwater habitat located within the RXE areas. In addition, there are no waters open to commercial fishing impacted by RXE (301 Kentucky Administrative Regulations 1:150) Kentucky designates some waters as special use, including cold-water habitat, exceptional waters, outstanding state resource waters, outstanding national resource waters, state wild rivers, reference reach waters, and federal wild and scenic rivers (KDOW, 2011). Based on a review of the KDOW special waters database, special use waters are not located at the Grayson or Means Compressor Station sites. In addition, no wild and scenic Rivers are present within the RXE Project (National Wild and Scenic Rivers System, 2015).

Waterbodies would not be affected by the construction or operation of the aboveground facilities at the Means CS, other than what is required for temporary access during construction, and the waterbodies would be crossed by means of temporary bridges or culverts. Permanent culverts or bridges may be installed to allow for permanent access to the facilities over S014/S013 at the Means CS. At the Grayson CS, Columbia Gulf is proposing to relocate S041, an ephemeral channel, permanently to the south to accommodate design restrictions. No permanent fill would occur in the waterbody resources, and the stream relocation would occur to avoid any impacts to downstream uses. As dictated by Columbia Gulf's ECS, erosion and sediment controls would be placed on the downslope side of the construction workspace to minimize sedimentation into surface waters.

With the exception of the stream relocation, all impacts on waterbodies located within the RXE Project footprint would be temporary. The majority of identified waterbodies are ephemeral or intermittent ditches utilized for agricultural production and stormwater drainage.

4.6.2.2 Fisheries of Special Concern

Columbia Gas and Columbia Gulf consulted FWS, WVDEP, WVDNR, PFBC, OEPA, ODNR, and the Kentucky State Nature Preserves Commission (KSNPC) to identify surface waterbodies that support fisheries of special concern, including fisheries of exceptional recreational value and waterbodies providing habitat for a protected species or those that are assigned special fishery management regulations. The ODNR identified several waterbodies that could contain suitable habitat for state listed threatened and endangered fish species, further discussed in section 4.7. The PFBC identified Dunkard Fork as an Approved Trout Water. To minimize impacts, PFBC recommends no in-stream construction between March 1 and June 15 (PFBC, 2009). Therefore, Columbia Gas has incorporated this recommendation into their ECS and this is discussed in more detail in section 4.7 below.

The LX Project crosses four West Virginia state-designated high quality waters (Fish Creek, Grave Creek, Ohio River, and Twelvepole Creek) that provide significant or irreplaceable resources for fish, wildlife, and recreation (Brooks, 2015; WVDNR, 2001). WVDNR recommends trenchless crossing methods during fish spawning season (April 1 to June 30) in order to minimize impacts on high quality waters. Dry open-cut methods are advised for crossings occurring outside the fish spawning season. Columbia Gas anticipates using HDD method to cross the Ohio River, Fish Creek, and one crossing of Twelvepole Creek. Columbia Gas would request a waiver from the fish spawning season timing restriction prior to construction.

Additionally, the OEPA identified 43 streams crossed by the LX Project with the potential to have a coldwater habitat existing aquatic life use designation. Consultations with OEPA indicated that Columbia Gas would be permitted to assume these streams contain coldwater habitat in place of conducting site-specific surveys for permitting purposes

No other fisheries of special concern were identified by agencies within the LX Project area in Ohio, Pennsylvania, and West Virginia. According to the National Marine Fisheries Service (NMFS), the LX Project would not cross any essential fish habitat (NMFS, 2014). Although fisheries of special concern are given additional considerations based on the value of their resources, general impacts on each of them would be similar to those for general fisheries.

Kentucky

A review of online resources with the FWS and agency consultations with the KSNPC did not identify special concern habitat within the RXE Project area. In a response from the KSNPC, one threatened fish species (Northern brook lamprey [*Ichthyomyzon fossor*]) and one fish species of special concern (Trout-perch [*Percopsis omiscomaycus*]) were identified within the Grayson CS. Further information on threatened and endangered species can be found in section 4.7.

4.6.2.3 General Impacts and Mitigation

Columbia Gas proposes to cross a majority of the waterbodies in the LX Project area using a wet open-cut method. All other waterbodies would be crossed by dry open-cut and HDD. Dam and pump methods may be used if there is visible flow at the time of crossing. Details regarding waterbody crossings and alternative methods for proposed trenchless crossings are described in section 4.3.2.

Appendix K details the proposed crossing method for each waterbody potentially impacted by the LX Project. Temporary impacts on fisheries could result from increased sedimentation and turbidity, temperature changes, modification of aquatic habitat, entrainment of fish, or water pollution from accidental spills. Trenchless methods generally would not result in direct impacts on the waterbody. Columbia Gas would conduct stream construction activities during low-flow period to minimize effects on aquatic resources.

Agencies proposed recommendations to Columbia Gas to avoid impacts during the spawning season, impacts on trout waters and the spread of aquatic disease organisms. Several measures were recommended by the agencies, including implementing preventative measures, avoiding construction in warmwater streams between April and June, and avoiding construction in trout waters and adjacent tributaries between September 15 and March 31. Columbia Gas plans to submit a request for a waiver with WVDNR and ODNR from this timing restriction, prior to construction. Requesting this waiver is considered an alternate measure from the FERC Procedures, and requires the review and written approval of the Director of OEP. We have recommended in section 4.3.2.4 that Columbia Gas abide by the recommended time windows, unless expressly permitted in writing by the appropriate state agency that the alternate time windows are granted.

Columbia Gas would use specific measures described in its ECS to minimize impacts on fishery resources, as summarized below. Columbia Gas is continuing consultations with corresponding agencies to determine project-specific measures to be incorporated into a project-specific ECS.

The main objective of any waterbody crossing is to construct the pipeline in a manner, which minimizes erosion and subsequent sedimentation into the waterbody and minimize disruption to aquatic life and habitat. Therefore, Columbia Gas' ECS includes the following measures:

- constructing crossings as close as possible to right angles with the waterbody channel;
- adequate downstream flow rates would be maintained at all times to protect aquatic life and prevent the interruption of existing downstream uses;
- each waterbody crossing would be treated as a separate construction entity, such that trenching, pipeline installation, backfilling and temporary stabilization or final restoration are completed in the minimum number of consecutive calendar days possible;
- unless expressly permitted or further restricted by the appropriate federal or state agency in writing on a site-specific basis, in-stream work, except that required to install or remove equipment bridges, must occur during the following time windows:
- Coldwater Fisheries - June 1 through September 30
- Coolwater and Warmwater Fisheries - June 1 through November 30
- locate ATWS at least 50 feet away from the water's edge, with the exception of the requested deviations from the FERC Procedures.
- achieve final grade and restore waterbody, its banks, and 50-foot buffers within 24 hours of backfilling.
- revegetation in riparian areas would include seed mixtures with native species of conservation grasses, legumes, and woody species, similar in density to adjacent undisturbed lands. Liquid mulch binders would not be used within 100 feet of waterbodies.
- use dry-crossing methods for waterbodies up to 30 feet wide that are state-designated as either coldwater or significant coolwater or warmwater fisheries, unless otherwise approved in writing by the appropriate state agency;
- use dry-crossing methods on federally-designated critical habitat;
- provide a schedule identifying when blasting would occur in any coldwater fishery; and
- continue consultations with federal and state conservation authorities to determine what measures are needed to protect aquatic wildlife potentially present in the blasting area.

4.6.2.4 Conventional Open Cut Method

The open-cut method would involve the excavation of the pipeline trench across the waterbody, installation of a prefabricated segment of pipeline, and backfilling of the trench with native material. Columbia Gas would use the dry open-cut method for a total of 85 waterbodies crossed by the proposed LX Project including Grave Creek, Piney Fork, Turkey Run, Blackjack Branch, Little Blackjack Branch, Queer Creek, Elk Fork, and one crossing of Twelvepole Creek (BM-111 Loop MP 2.6).

Open-cut construction would result in increased turbidity and sedimentation in the crossing vicinity, potentially decreasing the dissolved oxygen, thereby potentially suffocating the eggs and larvae of fish and invertebrates. Sedimentation could displace the more mobile species and potentially smother benthic invertebrates, decreasing prey availability for fish. These effects could degrade the quality of the habitat, making it unsuitable for spawning and rearing activities. Generally, the open-cut crossing method

is the quickest way to cross a waterbody, which allows for some impacts to be very short in duration. Impacts from open-cut construction would be temporary and limited to the crossing location and areas immediately downstream. Impacts would normally be limited to a few days, and generally no longer than one month after construction ends, depending on conditions at the crossing, the type and amount of suspended sediment, and other factors. BMPs would be used to further minimize sedimentation in the stream during construction until revegetation is successful.

Columbia Gas would mitigate potential impacts from open-cut crossing methods by following measures outlined in the FERC Procedures and the ECS. Flow would be maintained at all times. Typical backfill cover requirements would be met, contours would be restored within the waterbody, and banks would be stabilized by seeding or the installation of erosion control matting, if necessary. To minimize impacts on water quality and aquatic life, the pipeline trench would be excavated immediately prior to pipe installation, limiting the period of construction within the waterbody. Waterbody crossings of 10 feet or less would be completed within 24 hours. Waterbody crossings of 10 feet or more would be completed within 48 hours. The final 1-foot of fill in the backfilled trench would use clean gravel or native cobbles in coldwater fisheries. To prevent sediment from reentering the waterbody, excavated materials would be stored no less than 10 feet from the edge of the waterbody. Temporary sediment barriers, such as silt fences, would be used.

4.6.2.5 Dam and Pump Crossing Method

The dam and pump crossing method is similar to the open-cut method but allows the trench to remain dry during pipe installation. The dam and pump method would be used as a method to minimize potential impacts on sensitive species in streams where sensitive species have been identified by state or federal agencies as a concern. Sandbags or plastic sheeting would be used as temporary dams and installed upstream and downstream of the proposed waterbody crossing. After dam installation, appropriately sized pumps would be used to dewater and transport the stream flow around the construction work area and trench. Intake screens installed at pipe inlets would prevent entrainment of aquatic life. Energy-dissipating devices installed at the pump discharge points would minimize erosion and stream bed scour. Unless otherwise approved in writing by the state agency, waterbodies classified as coldwater, coolwater, or warmwater fisheries would be crossed by the dam and pump method. Columbia Gas would adhere to measures outlined in the ECS to minimize potential impacts from the dam and pump crossing method.

4.6.2.6 Flume Crossing Method

The flume crossing method directs water flow through one or more flume pipes placed over the excavation area. This method allows pipeline installation under dry conditions without significantly disrupting water flow and minimizing downstream turbidity.

4.6.2.7 Horizontal Directional Drill Crossings

The HDD method is typically used at large or sensitive waterbody crossings, major roadways, significant cultural resources, or other sensitive areas. By not excavating a trench, this method would minimize impacts on native aquatic species. The HDD method would be used at five waterbodies along the LEX Pipeline (Fish Creek, Ohio River [north], Muskingum River, and Rush Creek) and the BM-111 Loop (Ohio River [south]). Columbia Gas would drill a hole significantly below the conventional pipeline depth and pull the pipeline through the pre-drilled hole.

Drilling entry and exit points and workspaces are locations with an increased likelihood of inadvertent releases of drilling fluids and are typically located away from the waterbodies crossed to minimize potential impacts. Although drilling mud consists of non-toxic materials, it may leak through

unidentified fractures below the surface, either along the path of the HDD or in adjacent areas. The majority of inadvertent releases occur close to the HDD entry or exit points; however, drilling mud could also be released into a waterbody and settle on the stream bed, temporarily inundating the habitats used by these species. Benthic and less mobile resources as well as spawning and nursery habitat could be impacted from the settling of drilling mud. In addition, increased sedimentation and turbidity within waterbodies could impact predator/prey interactions and reproductive success. During the HDD process, Columbia Gas would conduct visual and pedestrian inspections along the drill path and continuously monitor drilling mud pressures and return flows. As detailed in the HDD Plan, if drilling mud is released into a waterbody, Columbia Gas would take immediate action to control any inadvertent releases, clean up the affected area, and make adjustments to minimize or prevent recurrence, in accordance with its Horizontal Directional Drill Contingency Plan.

4.6.2.8 Blasting

Blasting would only be used during construction of the LX Project if bedrock is encountered at depths interfering with conventional excavation or rock trenching methods. Columbia Gas would use the project-specific Blasting Plan, provided in the ECS, for any blasting activities. Prior to blasting in designated coldwater fisheries or habitats for threatened and endangered species, Columbia Gas would submit the Blasting Plan and schedule to FERC. Columbia Gas plans to follow applicable federal, state, and local blasting notification requirements, including submitting a Letter of Permission to the ODNR Division of Wildlife prior to any in-stream blasting in Ohio. Columbia Gas would notify FERC of all blasting activities 14 days prior and would give 48 hours' notice to FERC on any changes in the blasting schedule. In order to ensure that FERC has a revised Blasting Plan containing Columbia Gas' proposed schedule for streams requiring blasting, we recommended that Columbia Gas submit an updated Blasting Plan includes a list of streams it intends to cross using blasting, along with a schedule, if applicable.

4.6.2.9 Hydrostatic Test Water Withdrawal and Discharge

Columbia Gas and Columbia Gulf would comply with DOT regulations when performing hydrostatic testing of new pipeline segments and aboveground facilities. Water would be withdrawn from municipal water sources and/or surface waterbodies not determined to be state designated high quality streams or exceptional value waters, waterbodies providing habitat for federally listed threatened or endangered species, or streams used as a public water supply, unless otherwise approved by the appropriate federal and/or state agency. These sources would only be used when other water sources are not readily available. Permits would be obtained from state or local agencies, and water flow would be maintained to minimize the impact to water flow, fish, and recreational uses during the process.

To minimize erosion, the measures contained in the FERC Procedures would be implemented. Columbia Gas would use a dual-action dissipation method. All water withdrawal and discharge would be in compliance with applicable federal, state, and local permit requirements. The permits would detail discharge timing, volume, and locations. Columbia Gas would also use control measures to minimize the risk of invasive species introduction and spread, including returning hydrostatic test water to its source or using biocides. Following testing, each test section would be depressurized, and the water would pass through an energy dissipation device before being discharged. The energy dissipation device would be placed in a well-vegetated, open area. This arrangement would allow dual-action dissipation as the water is dispersed by the dissipation device itself and then from the vegetated area. This method would minimize the potential for stream scour and complies with applicable federal and state regulations and the FERC Procedures. With implementation of the measures described above, we conclude that hydrostatic testing would not significantly affect aquatic resources.

4.6.2.10 Spill Prevention Control and Countermeasures

During construction, hazardous materials could potentially spill, affecting aquatic species in the LX Project area. Impacts would depend on the type of spill and the dispersal characteristics of the waterbody. Release of fuels, lubricants, or solvents into waterbodies would negatively impact aquatic species. Minimization and mitigation procedures related to water quality are discussed in section 4.3. Columbia Gas plans to use measures outlined in the ECS and SPCC Plan to minimize impacts on aquatic wildlife. Specifically, heavy equipment would be stationed at least 100 feet from waterbodies during refueling or when parked. Adherence to these measures would minimize potential impacts from spills on aquatic resources.

4.6.2.11 Conclusion

Temporary and minor impacts on fisheries and aquatic resources could occur as a result of the LX and RXE Projects. To further minimize impacts on fisheries, Columbia Gas and Columbia Gulf would follow measures outlined in the ECS and protective measures found in the Plan and Procedures, which specify time windows for construction, appropriate additional temporary workspace setbacks, spoil setbacks, equipment bridges, erosion and sedimentation control requirements, and restoration requirements. By implementing these measures and agency recommendations, no long-term, permanent effects on coldwater fisheries or fisheries of special concern would occur. With adherence to these measures and our recommendations, we conclude that impacts on fisheries and aquatic resources would be adequately minimized.

4.7 SPECIAL STATUS SPECIES

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. For the purposes of this environmental analysis, special status species of plants and animals include species officially listed by the states of Kentucky, Ohio, Pennsylvania, or West Virginia or the federal government as endangered or threatened (as per the ESA), or species of special concern.

The ESA requires each federal agency to ensure that any actions authorized, funded, or carried out by the agency do not jeopardize the continued existence of a federally listed endangered or threatened species, or result in the destruction or adverse modification of the designated critical habitat of a federally listed species. As the lead federal agency, FERC is required to consult with the FWS to determine whether federally listed endangered or threatened species or designated critical habitat are found in the vicinity of a proposed project, and to determine the proposed action's potential effect on those species or critical habitats.

For actions involving major construction activities with the potential to adversely affect listed species or designated critical habitat, FERC must prepare a biological assessment for those federally listed species that may be affected and report its findings to the FWS. If it is determined that the action would adversely affect a federally listed species, FERC must submit a request for formal consultation to comply with Section 7 of the ESA. In response, the FWS would issue a biological opinion as to whether the federal action would likely jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of designated critical habitat. Because the LX and RXE Projects may affect federally listed species, in compliance with Section 7 of the ESA, FERC requests that the FWS consider the EIS, along with various survey reports prepared by Columbia Gas and Columbia Gulf, as the biological assessment for the LX and RXE Projects.

NiSource, in cooperation with the FWS, National Park Service, U.S. Forest Service, and FERC developed a Multiple Species Habitat Conservation Plan (MSHCP) compliant with Section 10 of the ESA

to streamline consultations under Section 7 of the ESA related to construction, operation, and maintenance of their natural gas pipelines and ancillary facilities (NiSource, 2013). An amendment to the MSHCP to include the northern long-eared bat (NLEB) was approved by the FWS on May 1, 2015, which provides a detailed analysis of impacts, calculates incidental take, and provides mitigation for potential impacts on this species within MSHCP covered lands. The FWS also issued an Incidental Take Permit, in addition to a series of one-time consultation letters for Columbia Gas 'and Columbia Gulf's activities within designated MSHCP covered lands. Covered lands include a 1-mile wide linear corridor of Columbia Gas' existing pipeline facilities and 12 counties where storage fields are located. Columbia Gas would use the MSHCP for the portion of the Project located within the covered lands, which includes all Project activities in Kentucky, Pennsylvania, West Virginia and limited areas in Ohio[18]. Within covered lands, Columbia Gas and Columbia Gulf would implement avoidance and minimization measures (AMMs)[19] for species identified in the MSHCP. Where we determine that the proposed activities are consistent with the MSHCP, programmatic biological opinion and/or resource agency concurrence letters, no further consultation is required. For non-MSHCP species (i.e., species listed within covered lands but not authorized for incidental take under the MSHCP), Columbia Gulf would implement BMPs similar to the AMMs, and additional Section 7 consultation may or may not be required. In addition, consultations with the FWS in compliance with Section 7 of the ESA is required for Project areas that are not covered under the MSHCP (i.e., non-covered lands).

In addition to federal law, Ohio, Pennsylvania, West Virginia, and Kentucky have passed laws to protect state-listed threatened and endangered species. The state-specific regulations include the Ohio ESA (Revised Code §1518.01-1518.99; 1531.25, 1531.99); the Pennsylvania ESA (Pennsylvania Code §58 75.1-75.4), and the Kentucky Administrative Regulations (301 KAR 3:061). West Virginia provides protection for all freshwater mussels under West Virginia §20-2-4 and CSR 58-605.11.

4.7.1 Species Identification

Various sources of available data were reviewed to identified federally and state listed species and other special status species that could potentially be present in the Project area, including letters of request to federal and state resource agencies for technical assistance, informal consultations, review of NiSource's MSHCP database, and field surveys. Further detail regarding agency correspondence, consultations and field surveys are provided in the following subsection. An overview of field survey timing and methodology is provided below.

Columbia Gas conducted habitat evaluations from June 2014 to October 2014 and spring, summer and fall 2015 within a defined survey corridor to identify potential areas of special status species habitat along the LX Project route. The original survey area was typically a 400-foot-wide corridor centered on the proposed pipeline except where co-located with an existing utility easement. When co-located with an existing utility easement, the corridor was adjusted to 100 feet on the co-located side of the centerline and 300 feet on the workspace side of centerline. A 50-foot-wide corridor was centered on proposed access roads. Columbia Gas incorporated route deviations into the LX Project and these areas were surveyed in May 2016.

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18 Refer to appendix M for the MSHCP Coverage Overview Map. Columbia Gas' Threatened and Endangered Species Report is provided in Appendix 3C of the March 18, 2016 Supplemental Information Filing available on the FERC's eLibrary website at, http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514, Accession No. 20160318-5002, titled "11_Att_3_RR_03_Mar_2016_App_3A-3C.PDF",

19 Detailed information regarding AMMs is available in the FWS website at, http://www.fws.gov/midwest/endangered/permits/hcp/nisource/pdf/HCPandNonHCPsppBMPsGuidebook12MARCH14.pdf

Columbia Gulf conducted wetland and waterbody surveys in October 2014 and February and May 2015 that included the overall habitat evaluation of RXE sites, including observation and documentation of vegetation communities and wildlife. This information was used to characterize habitats and determine if potential threatened and endangered species habitat may be present within the RXE Project area.

Based on consultations with the federal and state agencies and our own research, we identified 19 federally-listed species and 36 state-listed species in the general area of the LX and RXE Project areas. The potential effects of the LX and RXE Projects on these species are discussed below.

4.7.2 Federally Listed Species and Species Proposed for Listing

The MSHCP database was reviewed to identify federally threatened and endangered species within the Project area. In addition, Columbia Gas and Columbia Gulf, acting as FERC's non-federal representatives for the purpose of complying with Section 7(a)(2) of the ESA, initiated informal consultation with FWS on September 23, 2014. Columbia Gas submitted consultation letters to three FWS offices in the LX Project area, including the West Virginia field office, Pennsylvania field office and the Ohio Ecological Services field office. Columbia Gulf consulted the FWS Environmental Conservation Online System to identify federally listed species in the RXE Project area.

We reviewed information submitted by the applicants, including informal consultations, field surveys, and the MSHCP. In addition, we performed our own research and consulted with the agencies regarding federally listed species. We identified 19 federally listed species that may be present in the LX Project and RXE Project areas.

Of these 19 species, three are MSHCP species associated entirely with covered lands, five are MSCHP species associated with both covered and non-covered lands, nine are non-MSHCP species, and two species are not addressed by the MSHCP, as listed below:

- gray bat, Virginia big-eared bat, and American burying beetle are MSHCP species associated entirely with covered lands;
- Indiana bat, northern long-eared bat, and the fanshell, sheepnose and clubshell mussels are MSHCP species associated with both covered and non-covered lands;
- Eastern massasauga and the pink mucket, rabbitsfoot, snuffbox, and rayed bean mussels are non-MSHCP likely to adversely affect species;
- Northern monkshood, running buffalo clover, and small whorled pogonia are non-MSHCP not likely to adversely affect species;
- White-haired goldenrod is a non-MSHCP no effect species; and
- Eastern small-footed myotis and Rafinesque’s big-eared bat are not addressed as part of the MSHCP.

Fourteen of the 19 federally listed species were identified as occurring in the LX Project area. Nine of these species have the potential to occur on both MSHCP covered and non-covered lands, and detailed impact evaluations were undertaken for these species. The remaining five species are associated entirely with MSHCP-covered lands and were eliminated from extensive analysis because it was determined that suitable habitat for these species is not present in the project area. Species eliminated from extensive analysis include the American burying beetle, rabbitsfoot mussel, eastern massasauga, northern monkshood, and small whorled pogonia. Although extensive analysis was not undertaken due to

a lack of suitable habitat, a Tiered consultation with FWS has been completed for eastern massasauga and rabbitsfoot mussel, per the MSHCP Biological Opinion for these non-MSHCP species, with determination of "likely to adversely affect."

TABLE 4.7.2-1
Federally Listed Species Potentially Occurring in the LX and RXE Project Areas

Common Name	Scientific Name	Federal Status[a]	State Status	Determination of Effect
Mammals				
Eastern Small-footed Myotis	*Myotis leibii*	SC	KY-T	*No effect.*
Gray Bat	*Myotis grisescens*	E		*Not likely to adversely affect.*
Indiana Bat	*Myotis soldalis*	E	KY-E; OH-E; WV-E; PA-E	*Not likely to adversely affect.*
Northern Long-Eared Bat	*Myotis septentrionalis*	T	KY-E; OH-PE; WV-PE	*Not likely to adversely affect.*
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*	SC	KY-S	*No effect.*
Virginia Big-Eared Bat	*Corynorhinus townsendii virginianus*	E	KY-E	*Not likely to adversely affect.*
Reptiles				
Eastern Massasauga	*Sistrurus catenatus*	pT	OH-E	*Not likely to adversely affect.*
Mollusks				
Fanshell	*Cyprogenia stegaria*	E	KY-E; OH-E; WV-E	*Not likely to adversely affect.*
Pink Mucket	*Lampsilis abrupta*	E	OH-E; WV-E	*Not likely to adversely affect.*
Rabbitsfoot	*Quadrula cylindricacylindrica*	T	OH-E	*Not likely to adversely affect.*
Sheepnose	*Plethobasus cyphyus*	E	OH-E; WV-E	*Not likely to adversely affect.*
Snuffbox	*Epioblasma triquetra*	E	KY-E; OH-E; WV-E	*Not likely to adversely affect.*
Clubshell	*Pleurobema clava*	E	OH-E, WV-E, PA-E	*Not likely to adversely affect*
Rayed bean	*Villosa fabalis*	E	OH-E, WV-E	*Not likely to adversely affect*
Invertebrates				
American Burying Beetle	*Nicrophorus americanus*	E	OH-E	*Not likely to adversely affect*
Vascular Plants				
Northern Monkshood	*Aconitum noveboracense*	T	OH-T	*Not likely to adversely affect.*
Running Buffalo Clover	*Trifolium stoloniferum*	E	OH-E; WV-E	*Not likely to adversely affect*
Small Whorled Pogonia	*Isotria medeoloides*	T	OH-T; WV-T	*Not likely to adversely affect*
White-Haired Goldenrod	*Solidago albopilosa*	T		*No effect.*

Source: NatureServe, 2014; FWS 2014a, 2014b; FWS-WV, 2015; FWS-OH, 2015

[a] E = endangered; PE = proposed as endangered; T = threatened; pT = proposed as threatened, C= Candidate; SC = species of management concern; S = Species of concern; KY = Kentucky; OH = Ohio; WV = West Virginia; PA = Pennsylvania

A total of nine federally listed species were identified as occurring in the RXE Project area. Of the species listed in table 4.7.2-1, five are associated solely with the RXE project, including the gray bat, Virginia big-eared bat, eastern small-footed myotis, Rafinesque's big-eared bat, and the white-haired goldenrod. The remaining four species, the Indiana bat, northern long-eared bat, snuffbox mussel, and running buffalo clover, are listed in both the RXE and LX Project areas. The RXE Project activities would be located entirely within MSHCP-covered lands, and consultation for the identified federally listed species is complete. We have included the signed MSHCP Interagency Endangered Species Act Consultation Checklists for the LX Project and the RXE Project in appendix M-2 and appendix M-4, respectively.

Our determination of effect for each species is summarized in table 4.7.2-1 and described in the species-specific discussions below. A more detailed summary of our determination of effect for each species based on MSHCP coverage is provided in appendix M-1.

4.7.2.1 Mammals

Six species of listed bats could be present within the LX and RXE Project areas (see table 4.7.2-1) as further discussed below.

Eastern Small-footed Myotis

The eastern small-footed myotis is not addressed by the MSHCP. This species is federally listed as a species of management concern and state listed as a threatened species in Kentucky. These bats use a wide variety of habitats for roosting. They occur in caves, mines, protected sites along cliff lines, abandoned buildings, and are occasionally found roosting under rocks on the ground or on the floors of caves. Summer habitat is currently unknown, but may be similar sites.

Within the vicinity of the RXE Project there is the potential for suitable eastern small-footed myotis habitat. In a letter dated June 22, 2015, the KSNPC reported hibernacula and maternity records for eastern small-footed myotis within 5 to 10 miles of the RXE Project area. The KSNPC recommended a thorough survey for the species be conducted if suitable habitat would be disturbed. In order to avoid impacts on bats, bottomland forests and riparian corridors, particularly near caves, should not be disturbed. Desktop analysis and field habitat assessments conducted in October 2014 and February and May 2015 did not identify any suitable habitat in the project area. Therefore, we conclude that the RXE Project would not affect the eastern small-footed myotis and would not threaten the population viability of the species.

Gray Bat

The gray bat is a MSHCP species and federally listed as an endangered species. The gray bat is a year-round cave obligate species, roosting in caves during both hibernation and summer. Foraging habitat is correlated with rivers, streams, lakes, or reservoirs. Forest corridors are used to travel between caves and foraging areas.

The RXE Project area is included under MSHCP covered lands has the potential to include suitable foraging habitat, specifically in Kentucky. In a letter dated September 11, 2015, the FWS recommended that Columbia Gulf survey the project area for caves, rock shelters, and underground mines, to identify any gray bat habitats that may exist on-site and to avoid impacts to those sites pending a gray bat habitat suitability analysis by the regional FWS office. However, based on a review of the MSHCP GIS database, due to the project location and lack of gray bat habitat along the RXE Project route, we determined that the RXE Project is *not likely to adversely affect* this species. As the species is a covered species in covered lands, the FWS concurred with this determination in a letter dated July 20,

2016 and consultation is complete. We have included the signed MSHCP Interagency Endangered Species Act Consultation Checklist in appendix M-4.

Indiana Bat

The Indiana bat is a MSHCP species, federally listed as an endangered species and state listed as an endangered species in Kentucky, Ohio, Pennsylvania, and West Virginia. In winter, Indiana bats hibernate in caves or abandoned mines from November to March. In the summer, they inhabit and use hardwood forests for foraging and roosting. Typical tree species include bitternut hickory, oak, elm, pine, American sycamore, and eastern cottonwood (FWS, 2007a).

Loose tree bark on dead or dying trees within wooded areas is the preferred habitat for roosting. Females roost in groups and prefer roost sites with a diameter at breast height of 10.8 to 25.7 inches. Males roost alone or in small groups with a diameter at breast height of at least 3 inches (Luensmann 2005; FWS, 2007a). Primary roost sites are typically located in forest edges or in canopy gaps. Shaded portions of interior forest can also offer suitable habitat for roosting. Foraging occurs in semi-open forested habitats, forested edges, and riparian areas on terrestrial and aquatic flying insects (Luensmann, 2005).

Primary threats on the Indiana bat include white-nose syndrome and habitat loss due to land development. Habitat loss has adversely modified Indiana bat suitable roosting and foraging habitat. This has caused a decline in reproductive success for the species.

Columbia Gas' and Columbia Gulf's projects are within the known range of the Indiana bat in Kentucky, Ohio, Pennsylvania, and West Virginia, including both MSHCP covered and non-covered lands. Portions of the combined project areas also contain mature hardwood forests and suitable roosting and foraging habitat. The LX Project is located in known Priority 3 and 4 (P3/P4) Indiana bat spring staging and fall swarming habitat within portions of Fairfield, Hocking, and Vinton counties, OH. This indicates that a known P3/P4 winter hibernacula occurs within 10 miles. The Project also crosses five areas with known maternity colonies in Marshall County, WV, Greene County, PA, and Noble County, OH. Indiana bat maternity areas generally consist of one or more primary maternity roost trees that are used repeatedly by large numbers of bats, and varying numbers of alternate roosts, which may be used less frequently and by smaller numbers of bats. In all areas within covered lands, including P3/P4 staging/swarming habitat as well as maternity areas, Columbia would assume presence of suitable summer habitat, hibernacula, and maternity areas and would implement all applicable AMMs and mitigation required in the MSHCP for Indiana bats.

Within MSHCP covered lands, Columbia Gas and Columbia Gulf would implement all required AMMs provided in the MSHCP for the Indiana bat, including adherence to applicable FWS-recommended tree clearing window of October 1 and March 31. In addition, due to the currently proposed Project construction schedule, Columbia Gas would also employ non-mandatory AMMs 14, 30, and 31, as listed below, during Project activities on all MSHCP-covered lands.

- AMM 14: No clearing of suitable spring staging and fall swarming habitat within a 10-mile radius of any Priority 3 and 4 hibernacula from April 1 to May 31 and August 15 to November 14.

- AMM 30: No clearing of suitable summer habitat within the covered lands of the MSHCP from April 1 to May 31 to avoid direct affects to pregnant females and minimize direct effects on Indiana bats in summer habitat.

- AMM 31: No clearing of suitable summer habitat located more than 10 miles from a Priority 1, 2, 3 and 4 hibernacula within the covered lands of the MSHCP from August 2 to October 15 to avoid direct effects to post-lactating females and volant juveniles and minimize direct effects to Indiana bats in summer habitat.

In addition, the incidental take of the Indiana bat in covered lands has been addressed as part of the MSHCP and the applicants would provide compensatory mitigation for unavoidable impacts in accordance with the MSHCP. We have included the signed MSHCP Interagency Endangered Species Act Consultation Checklist in appendix M. The FWS concurred with this determination in a letter dated July 20, 2016 and consultation for Indiana bat within covered lands is complete.

In addition, portions of the project facilities occur outside of the MSHCP covered lands, including approximately 87.7 miles of the LX Project, the Summerfield CS, various contractor/staging/pipe yards, and several access roads, located within Belmont, Guernsey, Monroe, Morgan, Muskingum, Noble, Perry, and Vinton counties, OH. We have provided updated MSHCP Coverage Overview Maps revised to include areas outside covered lands in Appendix M-3.

Project activities in Vinton County, Ohio would occur outside of the MSHCP-covered lands at five contractor yards and associated access roads. However, Columbia Gas has indicated that these five pipe yards are located within open and agricultural land, and no swarming areas or forest would be impacted by Project activities at these locations. Therefore, all forest impacts within Vinton County would occur within lands covered under the MSHCP and no additional disturbances to Indiana bat habitat would occur on the non-covered lands in that county.

In the remaining non-covered lands, we assume presence and Columbia Gas would adhere to winter clearing windows, as coordinated with the FWS during informal consultation for this species. Based on FWS recommendations, Columbia Gas has committed to conducting tree clearing for the LX Project within non-covered lands between October 1 and March 31. Appendix M-3 provides detailed maps of MSHCP covered and non-covered areas which includes the areas outside of covered lands in Belmont, Guernsey and Vinton counties. As indicated in our recommendation below, FERC staff would continue to consult with the FWS Ohio Field Office regarding tree clearing restrictions in order to complete our ESA consultation with the agency, prior to authorizing the start of construction.

Based on adherence to FWS and our recommendations, we have determined that the Project is *not likely to adversely affect* Indiana bat on non-covered lands. Within non-covered lands, consultation is ongoing, and consultation with the FWS would be completed prior to construction.

Northern Long-Eared Bat

The NLEB is a MSHCP species, federally-listed as threatened and state listed as endangered in Kentucky. This species hibernates in caves and mines over the winter, preferring places with large passages and entrances, constant temperatures, and high humidity with no air currents. Summer roosting habitats include cavities and crevices of both live and dead trees. This species has also been known to roost in man-made structures such as barns and sheds. Both male and females prefer trees with a diameter at breast height of greater than or equal to three inches. The northern long-eared bat forages at dusk on insects in forested hillsides and ridges (FWS, 2015).

The northern long-eared bat is found throughout the LX and RXE Project areas, including both MSHCP covered and non-covered lands. The LX Project area contains suitable summertime roosting and foraging habitats. The project area may also contain suitable winter habitat, including caves and mine portals. Construction and operation of the pipeline could impact bat species through direct mortality if

clearing affected occupied roost trees, or indirectly through habitat loss and disruption. Some project-related impacts could occur in Kentucky, West Virginia, Ohio, and Pennsylvania.

Based on the relative similarities between the Indiana bat and the NLEB, NiSource modified the Indiana bat AMMs from the MSHCP and applied them within the range of the NLEB within covered lands. In accordance with the MSHCP, in areas where the Indiana bat and NLEB co-occur, the Indiana bat AMMs would take precedence. The Indiana bat and NLEB co-occur throughout all Project areas; therefore, all required Indiana bat AMMs would be implemented for the NLEB. In addition, the incidental take of the NLEB in covered lands has been addressed as part of the MSHCP. An amendment to the MSHCP, approved by FWS on May 1, 2015, documents the analysis of impacts, incidental take and mitigation for the NLEB. We have included the signed MSHCP Interagency Endangered Species Act Consultation Checklist in appendix M. The FWS concurred with this determination in a letter dated July 20, 2016 and consultation for NLEB within covered lands is complete.

For LX Project activities within non-covered lands, Columbia Gas would assume presence of NLEB. Based on FWS recommendations, Columbia Gas has committed to conducting tree clearing within non-covered lands between October 1 and March 31 to minimize impacts on the NLEB. Therefore, we have determined that the Project is *not likely to adversely affect* NLEB on non-covered lands where all tree clearing would be conducted within the FWS-recommended window. Within non-covered lands, consultation is ongoing, and consultation with the FWS would be completed prior to construction.

Rafinesque's Big-eared Bat

Rafinesque's big-eared bat is not addressed by the MSHCP. This species is federally-listed as a species of management concern and state-listed as a species of concern in Kentucky. This species uses a variety of sites for roosting including caves, protected sites along cliff lines, large, hollow trees, old mine portals, abandoned tunnels, cisterns, and old or seldom used buildings.

Within the vicinity of the RXE Project there is the potential for suitable Rafinesque's big-eared bat habitat. In a letter dated June 22, 2015, the KSNPC reported hibernacula and maternity records for Rafinesque's big-eared bat within five to ten miles of the RXE Project area. The KSNPC recommended a thorough survey for the species be conducted if suitable habitat would be disturbed. In order to avoid impacts to bats, bottomland forests and riparian corridors, particularly near caves, should not be disturbed. After desktop analysis and field habitat assessments conducted in October 2014 and February and May 2015, we have concluded that suitable habitat is not present Therefore, we conclude that the RXE Project would not affect Rafinesque's big-eared bat and would not threaten the population viability of the species.

Virginia Big-Eared Bat

The Virginia big-eared bat is a MSHCP species, federally listed as endangered and state listed as endangered in Kentucky. This species roosts and hibernates in caves in the Appalachian Mountain region. The total population exceeds 10,000 and has increased in recent years. This species occurs only in 15 caves, of which 5 contain the bulk of the population. The Virginia big-eared bat is a medium sized bat weighing less than 0.5 ounce. Hibernation occurs in caves that provide cold but above freezing temperatures. Like the northern long-eared bat, the Virginia big-eared bat exhibits delayed fertilization and gives birth to a single pup in May or June. Females form maternity colonies in warm caves where they rear their young. Virginia big-eared bats forage in a variety of habitats including old fields, hay fields, and forested areas and tend to return to the same feeding area night after night.

The RXE Project area has the potential to include suitable Virginia big-eared bat habitat. In a letter dated June 22, 2015, the KSNPC reported hibernacula and maternity records for Virginia big-eared

bat within five to ten miles of the RXE Project area. The KSNPC recommended a thorough survey for the species be conducted if suitable habitat would be disturbed. In order to avoid impacts on bats, bottomland forests and riparian corridors, particularly near caves, should not be disturbed. Desktop analysis and field habitat assessments conducted in October 2014 and February and May 2015 concluded that suitable habitat for this species is not present in the RXE Project area. Therefore, we have determined that the RXE Project would *not likely adversely affect* this species. The Kentucky FWS Field Office stated their concurrence with these findings. We have included the signed MSHCP Interagency Endangered Species Act Consultation Checklist in appendix M. The FWS concurred with this determination in a letter dated July 20, 2016 and consultation for the Virginia big-eared bat is complete.

Conclusions on Special Status Bat Species

We determined that suitable habitat for the eastern small-footed myotis, gray bat, Rafinesque's big-eared bat, and the Virginia big-eared bat is not present within the LX and RXE Project areas, and the proposed projects would have no effect or would not likely adversely affect these species. The FWS concurred with these determinations for MSHCP-covered lands in a letter dated July 20, 2016.

As recommended by the agencies and the Commission for the Indiana bat an NLEB, Columbia Gas and Columbia Gulf would follow the required MSHCP AMMs for covered lands. In addition, Columbia Gas would restrict tree clearing activities within non-covered lands to between October 1 and March 31, or as determined through further informal consultation with FWS. Section 7 consultation must be completed before commencement of construction activities can be authorized by FERC. Therefore, **we recommend that**:

- **Columbia Gas should not begin construction of the LX Project within lands not covered by the MSHCP in Ohio <u>until</u>:**

  a) **FERC staff completes any necessary ESA Section 7 consultation with the FWS for the Indiana bat and NLEB; and**

  b) **Columbia Gas has received written notification from the Director of OEP that construction and/or use of mitigation (including implementation of conservation measures) may begin.**

4.7.2.2 Reptiles

One species of federally listed reptile could occur within the LX and RXE Project areas (see table 4.7.2-1) as further discussed below.

Eastern Massasauga

The eastern massasauga rattlesnake is a non-MSHCP species, currently federally-listed as a species of concern; however, it is proposed as a federal threatened species. The final rule for listing of this species is expected in September 2016. The eastern massasauga is listed as endangered, threatened, or a species of concern by every state and province in which it lives. Within the LX Project area it is found in Ohio, where it is state-listed as endangered. They live in wet areas (prairies, marshes, etc.) and may use adjacent uplands during part of the year. This species relies on broad-leafed plants, emergent plants, and sedges for cover, avoiding areas of open water. Massasaugas hibernate alone in crayfish burrows, logs and tree roots, or small mammal burrows. They typically hunt small rodents, snakes, frogs, salamanders, toads, and young birds (ODNR, 2015m).

Under the MSHCP, the eastern massasauga is identified as a likely to adversely affect species and further consultation is required per the MSHCP. In a letter dated November 13, 2014, the ODNR

indicated that due to the location and type of habitat present along the LX Project route, the LX Project is not likely to adversely affect this species. Based on the lack of habitat present in the LX Project area and the protective measures proposed by Columbia Gas, we have determined that the project *is not likely to adversely affect* the eastern massasauga within covered lands. We also conclude that population level effects for the eastern massasauga are unlikely and/or would not contribute to a trend toward federal listing of the species. The FWS concurred with these determinations in a letter dated July 20, 2016, therefore no additional consultation for the eastern massasauga is required.

4.7.2.3 Mussels

Seven species of federally listed mussels could occur within the LX and RXE Project areas (see table 4.7.2-1), specifically in the Muskingum River in Morgan County, Ohio and the Ohio River in Lawrence County, Ohio, and Wayne and Marshall Counties, West Virginia.

Pink Mucket

The pink mucket is a non-MSHCP species, federally listed as endangered and state listed as endangered in Ohio and West Virginia. It is a freshwater mussel that prefers a habitat of mud and sand in shallow riffles and shoals swept free of silt in major rivers and tributaries (NatureServe, 2015).

Suitable habitat for the pink mucket is present within the LX Project area at the Muskingum River (Morgan County, Ohio) and Ohio River crossings (Marshall County, West Virginia / Monroe County, Ohio and Lawrence County, Ohio / Wayne County, West Virginia). The first Ohio River crossing associated with the LX Project occurs in both covered and non-covered lands within Marshall County, West Virginia and Monroe County, Ohio, respectively, with the river divided by the state line. However, this species was not identified as occurring in these areas during informal project correspondence with the FWS or listed in the MSHCP database for Monroe County, Ohio. The second Ohio River crossing occurs in covered lands within Lawrence County, Ohio and Wayne County, West Virginia, with the river divided by the state line. The LX Project crosses the Muskingum River within Morgan County, Ohio in non-covered lands. In addition, the WVDNR identified five waterbodies crossed by the Project in West Virginia as potentially containing sensitive freshwater mussel species. Therefore, per WVDNR recommendations, Columbia Gas conducted surveys for mussels in these waterbodies in May, June, and July 2015. No federally listed mussel species were identified within the survey areas.

With the exception of water withdrawal for hydrostatic testing, in-stream work is not proposed at either of the Ohio River crossings or the Muskingum River. Based on recommendations from the FWS, impacts on the pink mucket can be minimized by crossing the Ohio and Muskingum rivers via HDD. To further minimize impacts on listed mussel species in the event of inadvertent release during drilling, Columbia Gas proposes to implement its project-specific Horizontal Directional Drill Contingency Plan. In addition, Columbia Gas would implement all applicable BMPs during hydrostatic test water withdrawal and discharge.

Per the MSHCP Biological Opinion, the pink mucket is identified as a likely to adversely affect species and Tiered Consultation is required with the FWS. Based on Columbia Gas' commitment to implement HDD at these rivers, and with implementation of measures contained in Columbia Gas' Horizontal Directional Drill Contingency Plan in the event of inadvertent spills, and its BMPs, we have determined that the LX Project is *not likely to adversely affect* the pink mucket for both covered and non-covered lands. The FWS concurred with this determination in a letter dated July 20, 2016, therefore, no additional consultation for the pink mucket is required.

Rayed Bean

The rayed bean is a non-MSHCP species, federally listed as endangered and state listed as endangered in Ohio, and West Virginia. The rayed bean typically resides in small headwater creeks with sand or gravel substrate but has also been known to occur in larger rivers. This species can be found in or near shoal or riffle areas and typically prefers habitat within or adjacent to vegetation, as this mussel often buries itself among the roots (NatureServe, 2015).

Suitable habitat for the rayed bean is present within the LX Project area at the Muskingum River (Morgan County, Ohio) and Ohio River crossings (Marshall County, West Virginia / Monroe County, Ohio and Lawrence County, Ohio / Wayne County, West Virginia). The first Ohio River crossing associated with the Project occurs in both covered and non-covered lands within Marshall County and Monroe County respectively, with the river divided by the state line. However, this species was not identified during informal project correspondence with the FWS or listed in the MSHCP database for Monroe County, OH. The second Ohio River crossing occurs in covered lands within Lawrence County, Ohio and Wayne County, West Virginia, with the river divided by the state line. The LX Project crosses the Muskingum River within Morgan County, Ohio in non-covered lands. In addition, the WVDNR identified five waterbodies crossed by the Project in West Virginia as potentially containing sensitive freshwater mussel species. Therefore, per WVDNR recommendations, Columbia Gas conducted surveys for mussels in these waterbodies in May, June, and July 2015. No federally listed mussel species were identified within the survey areas**.**

With the exception of water withdrawal for hydrostatic testing, in-stream work is not proposed at either of the Ohio River crossings or the Muskingum River. Impacts on the rayed bean can be minimized by crossing the Ohio and Muskingum rivers via HDD. To further minimize impacts on listed mussel species in the event of inadvertent release during drilling, Columbia Gas would implement measures contained in its project-specific *Horizontal Directional Drill Contingency Plan*. In addition, Columbia Gas would implement all applicable BMPs during hydrostatic test water withdrawal and discharge.

Per the MSHCP Biological Opinion, the rayed bean is identified as a likely to adversely affect species and Tiered Consultation is required with the FWS. Based on Columbia Gas' commitment to implement HDD at these crossings, and implementation of its Horizontal Directional Drill Contingency Plan and BMPs, we have determined that the LX Project is *not likely to adversely affect* the rayed bean for both covered and non-covered lands. The FWS concurred with this determination in a letter dated July 20, 2016, therefore, no additional consultation for the rayed bean is required.

Fanshell

The fanshell is a MSHCP species, federally-listed as endangered mussel and state-listed as endangered in Kentucky, Ohio, and West Virginia. This mussel is found in medium to large rivers with moderate current. It prefers a sand or gravel substrate in deep water (NatureServe, 2015).

Suitable habitat for the fanshell is present within the LX Project area at the Muskingum River (Morgan County, Ohio) and Ohio River crossings. However, the fanshell was not identified during informal project correspondence with the FWS or listed in the MSHCP database for Monroe County, Ohio. The second Ohio River crossing occurs in covered lands within Lawrence County, Ohio and Wayne County, West Virginia, with the river divided by the state line. The Project crosses the Muskingum River within Monroe County in non-covered lands.

With the exception of water withdrawal for hydrostatic testing, in-stream work is not proposed at either of the Ohio River crossings or the Muskingum River crossing. Impacts on the fanshell can be minimized by crossing the Ohio and Muskingum rivers via HDD. To further minimize impacts on listed

mussel species in the event of inadvertent release during drilling, Columbia Gas would implement the measures in its project-specific *Horizontal Directional Drill Contingency Plan*.

In covered lands, Columbia Gas would implement all required AMMs during HDD and hydrostatic test water withdrawal and discharge and would provide compensatory mitigation for unavoidable impacts, in accordance with the MSHCP. We have included the signed MSHCP Interagency Endangered Species Act Consultation Checklist in appendix M and consultation for the fanshell within covered lands is complete. For LX Project activities within non-covered lands, Columbia Gas would implement FWS recommendations and BMPs and adhere to their *Horizontal Directional Drill Contingency Plan*. Therefore, we have determined that the LX Project is *not likely to adversely affect* the fanshell in non-covered lands. The FWS concurred with this determination in a letter dated July 20, 2016, therefore, no additional consultation for the fanshell is required.

Snuffbox

The snuffbox mussel is a non-MSHCP species, federally-listed as endangered and state-listed as endangered in Kentucky, Ohio, and West Virginia. This species prefers habitat in small- to medium-sized creeks containing a swift current. Populations can also be found in larger rivers. They prefer sand, gravel, or cobble substrate. Reproduction requires attachment of larvae to a fish host (NatureServe, 2015).

Suitable habitat for the snuffbox is present within the LX Project area at the Muskingum River (Morgan County, Ohio) and Ohio River crossings. However, this species was not identified during informal project correspondence with the FWS or listed in the MSHCP database for Monroe County, Ohio. The second Ohio River crossing occurs in covered lands within Lawrence County, Ohio and Wayne County, West Virginia, with the river divided by the state line. The LX Project crosses the Muskingum River within Morgan County, Ohio in non-covered lands. In addition, the WVDNR identified five waterbodies crossed by the Project in West Virginia as potentially containing sensitive freshwater mussel species, including Fish creek which is known to support the snuffbox mussel.. Therefore, per WVDNR recommendations, Columbia conducted surveys for mussels in these waterbodies in May, June, and July 2015. No federally listed mussel species were identified within the survey areas.

With the exception of water withdrawal for hydrostatic testing, in-stream work is not proposed at either of the Ohio River crossings or the Muskingum River. Impacts on the snuffbox can be minimized by crossing the Ohio and Muskingum rivers via HDD. To further minimize impacts on listed mussel species, in the event of inadvertent release during drilling, Columbia Gas would implement measures in its Project-specific *Horizontal Directional Drill Contingency Plan, and* would implement all applicable BMPs during hydrostatic test water withdrawal and discharge.

Per the MSHCP Biological Opinion, the snuffbox is identified as a likely to adversely affect species and Tiered Consultation is required with the FWS. Based on Columbia Gas' commitment to cross affected rivers via HDD, and with implementation of measures contained in the Horizontal Directional Drill Contingency Plan and BMPs, we have determined that the LX Project is *not likely to adversely affect* the snuffbox for both covered and non-covered lands. The FWS concurred with this determination in a letter dated July 20, 2016, therefore, no additional consultation for the snuffbox is required.

Sheepnose

The sheepnose mussel is a MSHCP species, federally-listed as endangered and state-listed as endangered in Ohio and West Virginia. Habitat includes shallow areas of larger streams and rivers with

moderate to swift currents. They prefer sand and gravel substrate but tolerate mud, cobble, and boulder substrate. In large rivers, they are found in deep runs (NatureServe, 2015).

Suitable habitat for the sheepnose is present within the LX Project area at the Muskingum River and Ohio River crossings. The first Ohio River crossing associated with the Project occurs in both covered and non-covered lands within Marshall County, West Virginia and Monroe County, Ohio, respectively, with the river divided by the state line. However, the sheepnose was not identified during informal project correspondence with the FWS or listed in the MSHCP database for Monroe County, Ohio. The second Ohio River crossing occurs in covered lands within Lawrence County, Ohio and Wayne County, West Virginia, with the river divided by the state line. The Project crosses the Muskingum River within Monroe County in non-covered lands.

With the exception of water withdrawal for hydrostatic testing, in-stream work is not proposed at either of the Ohio River crossings or the Muskingum River crossing. Impacts on the sheepnose can be minimized by crossing the Ohio and Muskingum rivers via HDD. To further minimize impacts on listed mussel species, in the event of an inadvertent release during drilling, Columbia would implement its project-specific *Horizontal Directional Drill Contingency Plan*.

In covered lands, Columbia Gas would implement all required AMMs during HDD and hydrostatic test water withdrawal and discharge and would provide compensatory mitigation for unavoidable impacts, in accordance with the MSHCP. We have included the signed MSHCP Interagency Endangered Species Act Consultation Checklist in appendix M and consultation for the sheepnose mussel within covered lands is complete.

For LX Project activities within non-covered lands, Columbia Gas would implement FWS recommendations and BMPs and adhere to their *Horizontal Directional Drill Contingency Plan*. Therefore, we have determined that the LX Project is *not likely to adversely affect* the sheepnose mussel in non-covered lands. The FWS concurred with this determination in a letter dated July 20, 2016, therefore, no additional consultation for the sheepnose is required.

Clubshell

The clubshell mussel is a MSHCP species, federally-listed as endangered and state-listed as endangered in Ohio, Pennsylvania and West Virginia. The clubshell usually occurs in relatively small streams to medium-sized rivers. This mussel inhabits coarse sand and fine gravel substrates in shallow riffles and runs with moderate current, and is commonly found at depths of less than 3 feet. The clubshell is limited to a few populations distributed within a highly restricted range, although population numbers can be high in localized areas (NatureServe, 2015)Suitable habitat for the clubshell is present within the LX Project area at the Muskingum River and Ohio River crossings. The first Ohio River crossing associated with the Project occurs in both covered and non-covered lands within Marshall County, West Virginia and Monroe County, Ohio respectively, with the river divided by the state line. However, the clubshell was not identified during informal project correspondence with the FWS or listed in the MSHCP database for Monroe County, Ohio. The second Ohio River crossing occurs in covered lands within Lawrence County, Ohio and Wayne County, West Virginia, with the river divided by the state line. The Project crosses the Muskingum River within Monroe County in non-covered lands.

With the exception of water withdrawal for hydrostatic testing, in-stream work is not proposed at either of the Ohio River crossings or the Muskingum River crossing. Impacts on the clubshell can be minimized by crossing the Ohio and Muskingum Rivers via HDD. To further minimize impacts on listed mussel species, in the event of inadvertent release during drilling, Columbia Gas would implement its project-specific *Horizontal Directional Drill Contingency Plan*. In covered lands, Columbia Gas would

implement all required AMMs during HDD and hydrostatic test water withdrawal and discharge and would provide compensatory mitigation for unavoidable impacts, in accordance with the MSHCP. We have included the signed MSHCP Interagency Endangered Species Act Consultation Checklist in appendix M and consultation for the clubshell mussel within covered lands is complete.

For LX Project activities within non-covered lands, Columbia Gas would implement FWS recommendations and BMPs and adhere to their Horizontal Directional Drill Contingency Plan. Therefore, we have determined that the LX Project is *not likely to adversely affect* the clubshell mussel in non-covered lands. The FWS concurred with this determination in a letter dated July 20, 2016, therefore, no additional consultation for the clubshell is required.

Rabbitsfoot

The rabbitsfoot is a non-MSHCP species, federally listed as endangered and Ohio listed as endangered. Populations are known to occur in the Muskingum River in Ohio. The rabbitsfoot mollusk inhabits waterways that contain moderate to swift currents up to 10 feet deep. This species prefers sandy or gravel substrate and occasionally occupy small streams on gravel bars close to fast moving currents. The Muskingum River is not crossed by the Project in any of the counties in which the rabbitsfoot is known to occur; therefore, suitable habitat is not present in the Project area.

Per the MSHCP Biological Opinion, the rabbitsfoot is identified as a likely to adversely affect species and Tiered Consultation is required with the FWS. Based on Columbia Gas' commitment to drill the Muskingum River, and implement the Horizontal Directional Drill Contingency Plan and BMPs, and the lack of suitable habitat we have determined that the LX Project is *not likely to adversely affect* the rabbitsfoot for both covered and non-covered lands. The FWS concurred with this determination in a letter dated July 20, 2016 therefore, no additional consultation for the pink mucket is required.

Mussel Mitigation

The primary mitigation measure Columbia Gas would employ is using the HDD method to cross waterbodies that may contain federally listed mussels. Using HDD, direct impacts on mussels would be avoided. However, the HDD method does have the potential to impact aquatic species due to the inadvertent release of drilling mud during ongoing HDD activities.

The FWS is concerned with the potential for the inadvertent release of drilling mud within the Muskingum and Ohio Rivers and resulting negative impacts on water quality and wildlife habitat. To avoid such a situation, the FWS recommended that geotechnical data be carefully examined prior to finalizing drilling plans to ensure that the inadvertent release of drilling mud is not likely. Columbia Gas conducted geotechnical studies at locations along the proposed Project, including within proposed HDD areas (see discussion in section 4.1.2.1). Based on analysis of the results of the geotechnical studies[20], the HDDs are not anticipated to fail. However, in the event that a particular drill is unsuccessful, Columbia Gas would implement its *Horizontal Directional Drill Contingency Plan* which addresses cleanup and response actions that would be implemented. These measures should further minimize, to the extent practicable, the likelihood of adverse impacts on federally-listed mussel species from HDD operations.

[20] Columbia Gas' Results of Geotechnical Engineering Studies for the Lone Oak, Summerfield, Oak Hill, and Ceredo Compressor Stations for the LX Project is available on the FERC's eLibrary website at, respectively, http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514, Accession No. 20151023-5090, titled "20151023_CP15-514-000-44_VolI_RR06_App6G.PDF".

4.7.2.1 Insects

One species of federally listed insect could occur within the LX and RXE Project areas (see table 4.7.2-1).

American Burying Beetle

The American burying beetle is a MSHCP species, federally listed as endangered and state listed in Ohio as endangered. Habitat for this species includes grasslands and open areas of oak hickory forests. During warmer months, the beetles use carrion as a habitat and use soil during winter months (ODNR, 2015r). In a letter dated November 13, 2014, the ODNR indicated that suitable habitat for the American burying beetle is not present in the LX Project area. Therefore, we have determined that the project *is not likely to adversely affect* the American burying beetle. In a letter dated July 20, 2016, the FWS concurred with this determination and consultation for the American burying beetle is complete.

4.7.2.2 Plants

Three species of federally listed plants could occur within the LX and RXE Project areas (see table 4.7.2-1) as further discussed below.

Northern Monkshood

The northern monkshood is non-MSHCP species, federally-listed as threatened and state-listed as threatened in Ohio. This species is typically found on shaded to partially shaded cliffs, talus slopes, or cool streamside sites (FWS, 2014c). The only known population near the LX Project occurs in Crane Hollow State Nature Preserve. This population is approximately 2.3 miles from the LX Project area. Reroutes of the LX Project to avoid cliffs and talus slopes have eliminated potential project-related impacts on this species. Under the MSHCP, this species is identified as a not likely to adversely affect species. Based on the avoidance of northern monkshood habitat within covered lands, we have determined that the LX Project is *not likely to adversely affect* the northern monkshood for both covered and non-covered lands. The FWS concurred with this determination in a letter dated July 20, 2016 and consultation for this species is complete.

Running Buffalo Clover

The running buffalo clover is a non-MSHCP species, federally listed as endangered. This species grows in disturbed areas of partial to filtered sunlight (FWS, 2011).

Based on a review of the MSHCP database, this species has the potential to occur along the LX Project area in Lawrence and Hocking County, Ohio (NatureServe, 2015), and the Project facilities within both counties are located entirely within covered lands. In addition, FWS has identified running buffalo clover as potentially occurring in Hocking and Vinton Counties, Ohio in the Project area. With the exception of five contractor/staging/pipe yards discussed below, all of the Project facilities within Vinton County, Ohio occur within covered lands. Because running buffalo clover has not been identified by the FWS as potentially occurring within the project area in Lawrence County, Ohio during previous correspondence, we have concluded that suitable habitat for this species is not present within the LX Project area.

Per FWS recommendations, Columbia Gas conducted species-specific surveys in Hocking and Vinton Counties for the running buffalo clover in May and June 2015 on both covered and non-covered lands. No populations or individuals were identified within the survey area. However, since completion of the species-specific surveys, Columbia Gas incorporated route deviations that required additional

surveys in Hocking and Vinton Counties, Ohio on covered lands. Due to seasonal survey restrictions, species-specific surveys for running buffalo clover within the areas not previously surveyed were conducted during the flowering period on May 18 and 19, 2016 and no individuals or populations were identified. Columbia Gas submitted the survey results to the FWS on June 14, 2016 and requested the FWS concurrence with a *not likely to adversely affect* determination.

For the five contractor yards located outside of the covered lands in Vinton County, surveys are complete as the project workspace in these locations has not been modified since surveys were conducted. Because no populations or individuals were identified within the survey area, we have determined that the LX Project is *not likely to adversely affect* the running buffalo clover on non-covered lands. Based on the survey results, the FWS concurred in a letter dated July 20, 2016 that the project is *not likely to adversely affect* the running buffalo clover on both covered and non-covered lands and that no additional consultation is required.

Small Whorled Pogonia

The small whorled pogonia is a non-MSHCP species, federally listed as threatened. This species grows in older hardwood forests that have an open understory. Occasionally it grows in softwood forests, such as hemlock. It prefers acidic soils with a thick layer of dead leaves, often on slopes near small streams. It produces one to two flowers from mid-May to mid-June. Threats to the small whorled pogonia include habitat loss and degradation and collection for commercial or personal use (FWS, 2014c).

The LX Project is within range of small whorled pogonia in Hocking County, Ohio and Greene County, Pennsylvania and the project facilities within both counties occur entirely within covered lands. However, small whorled pogonia has not been identified by the FWS Pennsylvania Field Office as potentially occurring within the project area in Greene County during previous informal project correspondence. Therefore, we have concluded that suitable habitat for this species is not present within the LX Project area in Greene County.

Currently, the only known small whorled pogonia populations in Ohio occur within Hocking and Scioto Counties. Per FWS recommendations, Columbia Gas conducted species-specific surveys in Hocking County for the small whorled pogonia in May 2015. No populations or individuals were identified within the survey area. Since completion of the species-specific surveys, Columbia Gas incorporated route deviations that required additional surveys in Hocking and Vinton Counties, Ohio on covered lands. Due to seasonal survey restrictions, species-specific surveys for small whorled pogonia within the areas not previously surveyed were conducted during the flowering period on May 18 and 19, 2016 and no individuals or populations were identified. Columbia Gas submitted the survey results to the FWS on June 14, 2016 and requested the FWS concurrence with a *not likely to adversely affect* determination. Based on the survey results, the FWS concurred in a letter dated July 20, 2016 that the project is *not likely to adversely affect* the small whorled pogonia on both covered and non-covered lands and that no additional consultation is required.

White-Haired Goldenrod

The White-Haired Goldenrod is a non-MSHCP species, federally-listed as threatened. It is endemic to a single river gorge in Kentucky and restricted within this narrow range to sheltered, cave-like "rock house" habitats, which tend to receive intensive recreational use. Many populations have been significantly reduced or extirpated by trampling. Under the MSHCP, this species is identified as a no effect species and BMPs for this species are included in the MSHCP. However, the MSHCP GIS database indicated that potential habitat is not present along the RXE Project route. Therefore, we have

determined that the RXE Project would have *no effect* on this species. Consultation for this species is complete.

4.7.3 State-Listed Species

Information regarding state listed threatened and endangered species or other species of concern was obtained from the WVDNR on October 1, 2014 and from the ODNR on November 13, 2014. Pennsylvania state listed species were identified through the Pennsylvania Natural Diversity Index Environmental Resource Tool and from correspondence with PGC on March 27, 2015 and PDCNR on April 1, 2015. Additionally, Columbia Gas has consulted with the West Virginia Natural Resources Conservation Service (NRCS), and Ohio NRCS. Consultation with ODNR indicated potential impacts on special status species within the LX Project area. WVDNR indicated no known records of rare, threatened, or endangered species occurring in the LX Project area. Consultations with PADCNR indicated potential impacts on special status plants within the LX Project area.

Columbia Gulf sent a request to the KSNPC for information regarding endangered, threatened, or special concern plants and animals or exemplary natural communities that occur near the RXE Project area. A response dated June 22, 2015 was received identifying nine threatened and endangered species and four species of special concern as occurring within Carter, Menifee, or Montgomery Counties. Additional consultation letters were submitted to the Kentucky Division of Forestry and Kentucky Department of Fish and Wildlife Resources (KDFWR).

The state-listed threatened or endangered species and species of special concern identified as potentially present in the combined LX and RXE Project areas are provided on table 4.7.3-1. Eleven of these species, the Indiana bat, northern long-eared bat, eastern Massasauga, pink mucket, fanshell, snuffbox, sheepnose, rabbitsfoot, rayed bean, clubshell and American burying beetle, are federally listed or proposed and are discussed in section 4.7.2 above.

TABLE 4.7.3-1 State Listed Species Potentially Occurring in the LX and RXE Project Areas				
Common Name	**Scientific Name**	**Federal Status[a]**	**State Status**	**Determination of Effect**
Mammals				
Indiana Bat	*Myotis soldalis*	E	KY-E; OH-E; WV-E	*Not likely to adversely affect.*
Northern Long-Eared Bat	*Myotis septentrionalis*	T	KY-E; OH-PE; WV-PE	*Not likely to adversely affect.*
Eastern Small-footed Myotis	*Myotis leibii*	SC	KY-T	*No effect.*
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*	SC	KY-S	*No effect.*
Virginia Big-Eared Bat	*Corynorhinus townsendii virginianus*	E	KY-E	*Not likely to adversely affect.*
Black Bear	*Ursus americanus*		OH-E	*Not likely to adversely affect.*
Birds				
Upland Sandpiper	*Bartramia longicauda*		OH-E	*Not likely to adversely affect.*
Northern Harrier	*Circus cyaneus*		OH-E	*Not likely to adversely affect.*
Vesper Sparrow	*Pooecetes gramineus*		KY-E	*No effect.*
Sharp-shinned Hawk	*Accipiter striatus*		KY-S	*No effect.*
Reptiles				
Eastern Massasauga	*Sistrurus catenatus*	pT	OH-E	*Not likely to adversely affect.*
Kirtland's Snake	*Clonophis kirtlandii*		OH-T	*No effect.*
Timber Rattlesnake	*Crotalus horridus horridus*		OH-E	*No effect.*
Amphibians				
Eastern Spadefoot Toad	*Scaphiopus holbrookii*		OH-E	*No effect.*
Eastern Hellbender	*Cryptobranchus alleganiensis*		KY-E; OH-E	*Not likely to adversely affect.*
Green Salamander	*Aneides aeneus*		OH-E	*Not likely to adversely affect.*
Mussels				
Butterfly	*Ellipsaria lineolate*		OH-E	*Not likely to adversely affect.*
Creek Heelsplitter	*Lasmigona compressa*		KY-E	*No effect.*
Fanshell	*Cyprogenia stegaria*	E	OH-E; WV-E	*Not likely to adversely affect.*
Fawnsfoot	*Truncilla donaciformis*		OH-T	*Not likely to adversely affect.*
Little Spectaclecase	*Villosa lienosa*		KY-S; OH-E	*Not likely to adversely affect.*
Long-Solid	*Fusconaia maculate maculate*		OH-E	*Not likely to adversely affect.*
Monkeyface	*Quadrula metanevra*		OH-E	*Not likely to adversely affect.*
Ohio Pigtoe	*Pleurobema cordatum*		OH-E	*Not likely to adversely affect.*
Pink Mucket	*Lampsilis abrupta*	E	OH-E; WV-E	*Not likely to adversely affect.*
Pyramid Pigtoe	*Pleurobema rubrum*		OH-E	*Not likely to adversely affect.*

TABLE 4.7.3-1 (cont'd)
State Listed Species Potentially Occurring in the LX and RXE Project Areas

Common Name	Scientific Name	Federal Status[a]	State Status	Determination of Effect
Rabbitsfoot	*Quadrula cylindrical cylindrical*	T	OH-E	*Not likely to adversely affect.*
Salamander Mussel	*Simpsonaias ambigua*		KY-T	*No effect.*
Sharp-Ridged Pocketbook	*Lampsilis ovata*		OH-E	*Not likely to adversely affect.*
Sheepnose	*Plethobasus cyphyus*	E	OH-E; WV-E	*Not likely to adversely affect.*
Snuffbox	*Plethobasus cyphyus*	E	OH-E; WV-E	*Not likely to adversely affect.*
Threehorn Wartyback	*Obliquaria reflexa*		OH-T	*Not likely to adversely affect.*
Fishes				
Channel Darter	*Percina copelandi*		OH-T	*Not likely to adversely affect.*
Goldeye	*Hiodon alosoides*		OH-E	*Not likely to adversely affect.*
Mountain Madtom	*Noturus eleutherus*		OH-T	*Not likely to adversely affect.*
Northern Madtom	*Noturus stigmosus*		OH-E	*Not likely to adversely affect.*
Northern Brook Lamprey	*Ichthyomyzon fossor*		KY-T	*No effect.*
Ohio Lamprey	*Ichthyomyzon bdellium*		OH-E	*Not likely to adversely affect.*
Paddlefish	*Polyodon spathula*		OH-T	*Not likely to adversely affect.*
Popeye Shiner	*Notropis ariommus*		OH-E	*No impact.*
Pugnose Minnow	*Opsopoeodus emiliae*		OH-E	*Not likely to adversely affect.*
Shortnose Gar	*Lepisosteus platostomus*		OH-E	*Not likely to adversely affect.*
Trout-perch	*Percopsis omiscomaycus*		KY-S	*No effect.*
Vascular Plants				
Nuttal's Hedge Nettle	*Stachys cordata*		PA-E	*No effect*
American Beakgrain	*Diarrhena americana*		PA-PE	*No effect*
Leaf-Cup	*Smallanthus uvedalius*		PA-PR	*No effect*
Single-Headed Pussytoes	*Antennaria solitaria*		PA-PE	*Pending*
Invertebrates				
American Burying Beetle	*Nicrophorus americanus*	E	OH-E	*No effect.*

Source: NatureServe, 2014; FWS, 2014a, 2014b

[a] E = endangered; PE = proposed as endangered; PR = proposed as rare; T = threatened; C= Candidate; S = Species of concern; KY = Kentucky; OH = Ohio; PA = Pennsylvania; WV = West Virginia

4.7.3.1 Mammals

One species of state listed mammal could occur within the LX and RXE Project areas (see table 4.7.2-1).

Black Bear

The black bear is a state-listed endangered species in Ohio. Black bears inhabit wooded areas ranging from swamps and wetlands to dry upland hardwood and coniferous forests. Bears prefer wooded cover with a thick understory. The black bear uses fallen trees, hollow logs, tree cavities, and dense ground cover for denning. The species forge on a variety of fruits, grasses, and meats. This species is known to occur in Ashtabula County, Ohio and suitable habitat may be present in the LX Project area (NatureServe, 2015). Consultations with ODNR indicate that this species is highly mobile and would likely avoid the LX Project area; therefore, LX Project activities are not likely to adversely affect the black bear.

4.7.3.2 Reptiles

Two species of state listed reptile could occur within the LX and RXE Project areas (see table 4.7.2-1). Columbia conducted surveys for each of these species as discussed below.

Kirtland's Snake

The Kirtland's snake is a state-listed threatened species in Ohio. Typical habitat includes wetlands and wet meadows. This species is known to occur in western and southwestern Ohio and suitable habitat may be present sporadically throughout the LX Project area. The Kirtland's snake feeds on earthworms and slugs (ODNR, 2015l). Habitat suitability surveys conducted in April 2015 identified suitable habitat for this species in the LX Project area. Presence/absence surveys were conducted in these areas in July and October 2015. During these surveys, no individuals of this species were documented; therefore, the LX Project would have no effect on the Kirtland's snake.

Timber Rattlesnake

The timber rattlesnake is an Ohio-listed endangered species and a federally-listed species of concern. This species prefers wooded habitats with sunlit gaps in the canopy. Overwintering occurs in deep rock crevices. The timber rattlesnake feeds on mice, rats, chipmunks, and squirrels (ODNR, 2015n). Habitat suitability surveys conducted in April 2015 identified suitable habitat for this species in the LX Project area. Presence/absence surveys were conducted in these areas in July and October 2015. During these surveys, no individuals of this species were documented; therefore, the LX Project would have no effect on the Timber rattlesnake.

4.7.3.3 Amphibians

The eastern spadefoot toad is an Ohio-listed endangered species. Habitat for the eastern spadefoot toad includes areas of sandy soils associated with river valleys. Breeding occurs in these habitats, as well as in flooded agricultural fields or other water-holding depressions. This species is known to occur in southeastern Ohio (ODNR, 2014q). Habitat suitability surveys conducted in April 2015 identified suitable habitat in the LX Project area. Presence/absence surveys were conducted in these areas in June and July 2015. The results of these surveys would be submitted to ODNR with Columbia's concurrence request in November 2016. During these surveys, no individuals of this species were identified; therefore, the LX Project would have no effect on the eastern spadefoot toad.

The eastern hellbender is an Ohio-listed endangered species and federally-listed species of concern. They prefer large, swift flowing perennial streams with large rocks for hiding. The eastern hellbender is known to occur in Muskingum and Vinton counties; however, counties crossed by the LX Project area do not contain suitable habitat. Therefore, the LX Project is not likely to adversely affect this species (ODNR, 2015o).

The green salamander is an Ohio-listed endangered species. The green salamander forages on small insects. Habitat for the green salamander includes deep moist cracks in limestone cliffs during the day and cliff faces at night (ODNR, 2015p), but can reside under fallen or standing trees providing damp habitat under loose bark and in cracks (NatureServe, 2015). This species is known to occur in Lawrence County, Ohio but no suitable habitat is located in the LX Project area for this county. Therefore, the LX Project is not likely to adversely affect this species.

4.7.3.4 Mussels

In a letter dated November 13, 2014, ODNR indicated that the LX Project must avoid impacts on any freshwater native mussel species. Additionally, ODNR identified a number of state-listed threatened or endangered mussel species that could occur in the LX Project area and those are listed in table 4.7.4-2.

To minimize impacts on freshwater mussel species, Columbia Gas must adhere to measures outlined in the Ohio Mussel Survey Protocol. All Group 2, 3, and 4 streams require a mussel survey. Group 1 streams and unlisted streams with a watershed of 100 square miles or larger above the point of impact would be assessed using the Reconnaissance Survey for Unionid Mussels. All open cut perennial streams that drain to an area greater than 10 square miles would require a mussel survey unless crossed via bore or HDD. Prior to any in-stream work, Columbia Gas must verify that no mussel impacts would occur. Mussel relocation by a professional malacologist is required if mussels are found in the stream and impacts cannot be avoided.

WVDNR identified five waterbodies crossed by the LX Project in West Virginia may contain sensitive freshwater mussel species, including the Ohio River, Fish Creek, Grave Creek, Dunkard Fork, and Twelvepole Creek. Columbia Gas conducted surveys for freshwater mussels in Fish Creek, Grave Creek, Dunkard Fork, and Twelvepole Creek in May, June, and July 2015. Surveys conducted in Fish Creek in July 2015 indicated that freshwater mussels are present at the pipeline crossing location and relocations prior to construction would be necessary. The access road crossing of Fish Creek, however, did not identify any mussels and no further action is recommended in this area. Surveys of Grave Creek, Dunkard Fork, and Twelvepole Creek were conducted in May and June 2015. No live mussels were identified within the survey area in Dunkard Fork or Grave Creek and LX Project activities in these areas are not likely to adversely affect mussels. Live mussels were identified in Twelvepole Creek. To minimize impacts on mussels within Twelvepole Creek during construction, Columbia Gas would relocate individuals prior to initiating in-stream activities. The Ohio River would be crossed via HDD, thereby avoiding impacts on mussels that may be present at the time of crossing. All surveys and relocations would be conducted in accordance with WVDNR-approved protocols for freshwater mussels. Columbia Gas submitted the results of these surveys to WVDNR and FWS for review and approval on October 19, 2015. Consultations with WVDNR to determine the potential impacts of LX Project activities on state-listed mussels are ongoing, pending the completion of surveys.

In Ohio state-listed mussel reconnaissance surveys were conducted in May 2015. The results of the reconnaissance survey were submitted to ODNR on August 26, 2015. Of the 11 sites that were surveyed, four contained live mussels, three could not be surveyed via reconnaissance methods due to waterbody depth, and four did not contain live mussels. Group 1 surveys would be conducted prior to construction at the seven sites that contained live mussels or could not be surveyed using reconnaissance methods. All live mussels identified during these preconstruction surveys would be relocated upstream;

thereby avoiding impacts associated with in-stream LX Project activities. The results of these surveys would be submitted to ODNR with Columbia Gas' concurrence request in November 2016. As a result, the LX Project is not likely to adversely affect freshwater mussel species in Ohio. Since state-listed mussel surveys are not yet complete in Ohio and West Virginia, **we recommend that:**

- **<u>Prior to construction in water in Ohio and West Virginia,</u> Columbia Gas should continue consultations with the applicable state agencies to identify any additional mitigation measures for state-protected mussel species and the need for additional surveys in Ohio and West Virginia. The results of such consultations and any state recommended mitigation measures should be filed with the Secretary.**

Consultations with KDFWR identified two state-listed endangered or threatened mussels that could potentially occur in the RXE Project area (creek heelsplitter and the salamander mussel). However, the RXE Project would not directly impact the waterbodies where these species are found. Therefore, we have determined that the project would have no effect on these mussels.

4.7.3.5 Fish

Consultations with ODNR identified nine listed threatened or endangered fish that could potentially occur in the LX Project area (Ohio lamprey, shortnose gar, goldeye, pugnose minnow, popeye shiner, northern madtom, channel darter, paddlefish, and mountain madtom). The Ohio, Hocking, and Muskingum Rivers would be crossed via the HDD method and LX Project activities would not likely impact species located in these rivers, specifically the Ohio lamprey, shortnose gar, goldeye, channel darter, paddlefish, and mountain madtom (ODNR, 2014b).

The only known population of popeye shiner in Ohio occurs in Scioto Bush Creek, which would not be crossed by the LX Project; therefore, no impacts on the popeye shiner are expected (ODNR, 2014b).

The pugnose minnow prefers clear water streams containing aquatic vegetation with a substrate of organic debris or sand (ODNR, 2014b). Suitable habitat may be found in the project area in the Ohio, Muskingum, and Hocking Rivers. Columbia Gas would cross the Ohio and Muskingum Rivers via the HDD method, thereby not likely impacting the pugnose minnow. To further minimize impacts, the ODNR recommended no in-stream construction between March 15 and June 30; however, a waiver may be granted for the construction time period to extend construction outside the recommended time frame.

The northern madtom is found in deep swift riffles of large rivers in and around cobbles and boulders, specifically in the Muskingum, Scioto, and Little Miami River drainages (ODNR, 2014b). Known populations of northern madtom are in the Muskingum River. The project would cross the Muskingum River via the HDD method; therefore, LX Project activities are not likely to adversely affect the northern madtom.

Consultations with KDFWR identified two listed threatened or species of concern fish that could potentially occur in the RXE Project area (northern brook lamprey and trout-perch). However, the waterbodies these species are found in would not be directly impacted by the RXE Project; therefore, no effect on these fish are anticipated as a result of the RXE Project.

4.7.3.6 Vascular Plants

Consultations with PDCNR identified four species of special concern that could potentially occur in the LX Project area:, American beakgrain, leaf-cup, Nuttal's hedge-nettle, and single-headed

pussytoes. PADCNR requested Columbia Gas perform surveys for these species of concern. Initial species-specific surveys conducted in July and August 2015 did not identify any populations or individuals;

The American beakgrain is currently not listed in Pennsylvania but is proposed endangered. It is locally documented on a woody slope and prefers rich woods. The American beakgrain produces a flower and fruits between July and mid-September (Bowen 2015). Concurrence with the determination that the Project would have no effect on American beakgrain was issued by PADCNR on January 6, 2016.

The leaf-cup is currently not listed in Pennsylvania but is proposed as rare. This species is locally documented in an open right-of-way. This species prefers ravines, thickets, roadsides, and river or stream banks. The leaf-cup flowers between July and September (Bowen, 2015). Concurrence with the determination that the Project would have no effect on leaf-cup was issued by PADCNR on January 6, 2016.

Nuttall's hedge-nettle is a Pennsylvania-listed endangered species. This species is found on mesic wooded roadside slopes and prefers wooded mountain slopes. The flowering period for Nuttal's hedge nettle is between June and July (Bowen, 2015). Concurrence with the determination that the Project would have no effect on Nuttall's hedge nettle was issued by PADCNR on January 6, 2016.

The single-headed pussytoes has a current undetermined status in Pennsylvania but is proposed endangered. It is locally documented on a wooded slope and prefers rich woods. This species flowers from April to late May (Bowen, 2015). Consultations with PADCNR are ongoing for singleheaded pussytoes, pending the completion of surveys. Therefore, **we recommend**:

- **<u>Prior to construction in Pennsylvania,</u> Columbia Gas should file with the Secretary survey results and any mitigation measures developed in consultation with the PADCNR for single-headed pussytoes.**

4.7.3.7 Birds

As discussed in Section 4.6.1.3, most native migratory birds are protected under the Migratory Bird Treaty Act (MBTA) originally passed in 1918. Executive Order 13186 (2001) directs federal agencies to consider the effects of agency actions on migratory birds, with emphasis on bird species of concern. Through consultations with the protected species agencies and research, we have identified four state-listed species (upland sandpiper, northern harrier, vesper sparrow, and sharp-shinned hawk) in the general area of the LX Project and RXE Project (table 4.7.4-2). The potential effects of the LX Project and RXE Project on these species are discussed below.

Upland Sandpiper

The upland sandpiper is a state-listed endangered bird species in Ohio. This species prefers nesting in dry grasslands, including native grasslands, pasture, hayfields, and seeded grasslands (FWS, 2014c). This species builds nests on the ground consisting of tall grass and broad-leafed weeds to conceal the nest. The upland sandpiper does not prefer mudflats or other wet areas and does not commonly breed in Ohio. These birds forage in grasses for insects and seeds (National Audubon Society, 2015). This species is known to occur in Ohio and suitable habitat may be present in the LX Project area. Columbia Gas would conduct clearing outside of the nesting season. Disturbance from construction would most likely deter upland sandpipers from nesting in the LX Project area. Therefore, LX Project activities are not likely to adversely affect this species.

Northern Harrier

The northern harrier is a state-listed endangered bird species in Ohio. This species builds nests in large marshes and grasslands. Breeding occurs in wetland areas containing thick vegetation. Nests are made on the ground in large, undisturbed wetlands and grasslands with low, dense vegetation in the summer months. In the winter, this species occurs in areas of low vegetation, such as pasturelands, croplands, dry plains, grasslands, estuaries, open floodplains, and marshes (Cornell Lab of Ornithology, 2015). This species is known to occur in Ohio year-round and suitable habitat may be present in the LX Project area. Columbia Gas would conduct clearing activities outside of the nesting season. This species is highly mobile and would likely relocate to similar adjacent habitats during the non-nesting season. Therefore, LX Project activities would not likely adversely affect the northern harrier.

Vesper Sparrow

The vesper sparrow is a state-listed endangered bird species in Kentucky. This species is found in plains, prairie, dry shrub lands, savanna, weedy pastures, fields, sagebrush, arid scrub, and woodland clearings. Breeding occurs along fencerows between agricultural fields. Nests are made on the ground, often in a small depression near a clump of grass (NatureServe, 2015). This species in known to occur in Kentucky; however, there is no suitable habitat near the RXE Project area. Therefore, no effects on the vesper sparrow are anticipated as a result of the RXE Project.

Sharp-shinned Hawk

The sharp-shinned hawk is a state-listed species of concern in Kentucky. This species is found in Forest and open woodland, coniferous, mixed, or deciduous, primarily in coniferous. It migrates through various habitats, mainly along ridges, lakeshores, and coastlines. Nests generally seem to be in a stand of dense conifers near a forest opening (NatureServe, 2015). This species in known to occur in Kentucky; however, there is no suitable habitat near the RXE Project area. Therefore, no effects on the sharp-skinned hawk are anticipated as a result of the project.

4.7.3.8 Bald Eagle

Bald eagles while no longer listed as threatened or endangered under Federal regulations remain protected under the federal Bald and Golden Eagle Act, Migratory Bird Act, and Lacey Act and certain state regulations. These regulations generally prohibit activities that would disturb, molest or result in the take of bald eagles, their parts, nest or eggs.

There are no known active bald eagle nests within the LX Project limits. The open water associated with the water bodies and open land can provide foraging habitat for bald eagles. Project implementation while resulting in a loss of open land would not likely have a significant negative effect on bald eagles. Columbia Gas would coordinate with FWS and appropriate state agencies to avoid adversely affecting bald eagles.

4.7.4 Conclusion

Columbia Gulf began implementing the MSHCP in January 2014 and would implement the appropriate avoidance and minimization measures per the MHSCP, such as clearing or cutting trees in the winter. The RXE Project activities would be located entirely within MSHCP-covered lands, and consultation for the identified federally listed species is complete. We have included the signed MSHCP Interagency Endangered Species Act Consultation Checklist in appendix M-4.

Where we determined that the proposed activities are consistent with the MSHCP, programmatic biological opinion and/or resource agency concurrence letters, no further consultation is required. For non-MSHCP species, Columbia Gas would implement BMPs similar to the AMMs, and additional Section 7 consultation is requested. In addition, consultations with the FWS in compliance with Section 7 of the ESA are required for Project areas that are not covered under the MSHCP (i.e., non-covered lands). We have determined that the LX Project is *not likely to adversely affect* most species in the LX Project area, and are recommending addition surveys for the running buffalo clover and small whorled pogonia, prior to construction, in order to complete consultation for these species.

The LX Project would have no effect on 8 state listed species, and the Project is not likely to adversely affect 29 state listed species. Columbia Gas continues consultations for the single-headed pussy toes. Additionally, Columbia Gas modified the LX route (South Fork crossing MP 50.9 RR-6) in several locations which would require additional mussel surveys prior start of construction. RXE would have no effect or is not likely to adversely affect any of the federal- and state-listed species identified as potentially occurring in Carter, Menifee, and Montgomery counties in Kentucky.

4.8 LAND USE, RECREATION, SPECIAL INTEREST AREAS, AND VISUAL RESOURCES

This section discusses the land requirements for construction and operation of the LX and RXE Projects, the current use of those lands, and an evaluation of the project-related effects. As described in section 2.0, the LX Project consists of nearly 160 miles of new natural gas pipelines across 11 counties in Ohio, 2 counties in West Virginia, and 1 county in Pennsylvania. The LX Project also includes abandonment in place of more than 28 miles of existing natural gas pipeline; construction or modification of 34 aboveground facilities, including compressor, regulator, and odorization stations, mainline valve sites, and launcher/ receiver facilities; and construction of 35 permanent access roads, including 6 associated with operation of the pipeline facilities and 29 associated with operation of the aboveground facilities. Construction of the LX Project would require temporary access roads, as well as contractor, staging, and pipe yards.

The RXE Project includes the installation of two new compressor stations on the existing transmission system for delivery of gas. These aboveground facilities would occupy land in portions of three counties in northeastern Kentucky.

4.8.1 Land Use

Seven general land use types would be affected by the LX and RXE Projects. Table 4.8.1-1 summarizes the acreage of each land use type that would be affected by the LX Project, while table 4.8.1-2 summarizes land use types affected by the RXE Project.

TABLE 4.8.1-1
Acreage Affected by Construction and Operation of the LX Project[d]

Facilities[a]/ County	Forest		Open Land		Agricultural		Industrial		Residential		Wetland		Open Water		Total	
	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.
Pipeline Facilities (Including Permanent and Temporary Right-of-Way and Cathodic Protection)																
West Virginia																
Marshall	224.2	87.2	28.7	13.1	102.7	44.1	1.8	1.0	1.1	0.4	1.1	0.6	1.4	1.3	361.1	147.6
Wayne	16.9	8.8	5.1	2.6	1.2	0.5	0.6	0.6	0.9	0.4	1.0	0.9	2.4	2.3	28.1	16.1
Pennsylvania																
Greene	20.3	8.0	3.0	1.4	2.2	0.9	0.2	0.1	0.0	0.0	0.1	0.1	<0.1	<0.1	25.9	10.6
Ohio																
Fairfield	61.3	28.3	9.0	4.5	15.2	7.8	0.3	0.2	<0.1	0.0	0.3	0.1	0.0	0.0	86.1	40.8
Hocking	153.3	56.8	50.9	16.0	72.9	27.8	2.5	1.3	0.8	0.3	4.7	3.2	0.4	0.3	285.5	105.7
Lawrence	0.0	0.0	0.2	0.2	0.0	0.0	1.5	0.2	0.0	0.0	0.0	0.0	0.1	0.1	1.7	0.4
Monroe	223.8	87.9	41.7	24.5	118.5	52.7	3.5	1.9	0.1	<0.1	2.2	1.5	0.3	0.3	390.1	168.7
Morgan	92.0	42.1	26.3	12.6	39.8	19.1	0.8	0.4	0.2	0.1	1.7	1.1	0.6	0.6	161.3	75.9
Muskingum	55.2	23.4	27.7	13.5	32.4	16.0	0.7	0.5	0.1	0.0	0.5	0.2	0.1	0.0	116.6	53.6
Noble	152.8	69.2	55.9	25.7	88.2	41.3	3.0	1.8	0.9	0.4	2.6	1.6	0.3	0.2	303.6	140.2
Perry	129.9	59.1	19.0	9.3	122.6	55.7	1.6	1.0	<0.1	<0.1	2.7	1.5	<0.1	<0.1	275.7	126.5
Vinton	74.8	24.3	28.8	7.2	19.1	6.3	3.8	0.7	0.1	0.0	0.2	0.1	<0.1	0.0	126.8	38.6
Pipeline Facilities Subtotal	***1,204.5***	***495.1***	***296.2***	***130.4***	***614.6***	***272.1***	***20.2***	***9.6***	***4.3***	***1.6***	***17.0***	***10.7***	***5.5***	***5.0***	***2,162.4***	***924.5***
Additional Temporary Workspace (ATWS)																
West Virginia																
Marshall	27.8	0.0	3.2	0.0	16.4	0.0	0.4	0.0	0.2	0.0	0.2	0.0	0.0	0.0	48.1	0.0
Wayne	3.7	0.0	1.2	0.0	1.2	0.0	<0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	6.4	0.0
Pennsylvania																
Greene	1.9	0.0	0.8	0.0	0.3	0.0	<0.1	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	3.0	0.0
Ohio																
Fairfield	4.6	0.0	0.6	0.0	1.6	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	7.4	0.0
Hocking	16.2	0.0	7.0	0.0	12.0	0.0	1.0	0.0	1.0	0.0	<0.1	0.0	0.0	0.0	37.4	0.0
Monroe	31.2	0.0	2.1	0.0	17.1	0.0	0.9	0.0	0.0	0.0	0.1	0.0	0.0	0.0	51.3	0.0
Morgan	10.4	0.0	1.9	0.0	6.2	0.0	0.1	0.0	0.1	0.0	<0.1	0.0	0.0	0.0	18.7	0.0
Muskingum	4.0	0.0	1.9	0.0	3.4	0.0	0.2	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	9.4	0.0
Noble	9.4	0.0	5.7	0.0	11.6	0.0	0.5	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	27.3	0.0

TABLE 4.8.1-1 (cont'd)
Acreage Affected by Construction and Operation of the LX Project[d]

Facilities[a]/ County	Forest		Open Land		Agricultural		Industrial		Residential		Wetland		Open Water		Total	
	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.
Perry	8.6	0.0	2.0	0.0	18.0	0.0	0.2	0.0	<0.1	0.0	0.2	0.0	0.0	0.0	29.0	0.0
Vinton	8.1	0.0	3.9	0.0	1.3	0.0	0.5	0.0	0.2	0.0	<0.1	0.0	0.0	0.0	13.9	0.0
ATWS Subtotal	***126.2***	***0.0***	***30.2***	***0.0***	***89.0***	***0.0***	***4.1***	***0.0***	***1.8***	***0.0***	***0.4***	***0.0***	***0.0***	***0.0***	***251.9***	***0.0***
Access Roads[b]																
West Virginia																
Marshall	0.6	0.1	2.5	0.2	7.9	0.1	8.4	1.3	0.3	0.1	<0.1	0.0	0.0	0.0	19.8	1.7
Wayne	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Pennsylvania																
Greene	0.1	0.0	0.7	0.0	0.1	0.0	<0.1	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.9	0.0
Ohio																
Fairfield	0.9	0.7	1.3	0.8	2.2	0.9	1.4	1.3	0.3	0.3	0.0	0.0	0.0	0.0	6.1	4.0
Hocking	1.3	<0.1	12.1	0.2	5.5	0.0	1.6	0.4	0.4	0.0	0.3	0.0	0.0	0.0	21.2	0.6
Jackson	0.1	0.1	<0.1	<0.1	1.9	1.1	1.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	3.4	1.3
Lawrence	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Monroe	0.6	0.1	2.5	0.2	7.9	0.1	8.4	1.3	0.3	0.1	<0.1	0.0	0.0	0.0	19.8	1.7
Morgan	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5
Muskingum	0.6	<0.1	7.1	0.0	1.0	0.0	0.3	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	9.0	<0.1
Noble	1.0	0.0	1.4	0.0	0.6	0.0	<0.1	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	3.0	0.0
Perry	0.0	0.0	<0.1	<0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	<0.1
Vinton	0.4	0.2	1.1	0.3	1.5	0.4	3.8	1.1	0.1	0.0	0.1	0.0	0.0	0.0	6.9	2.0
Access Roads Subtotal	***7.3***	***1.4***	***34.0***	***1.8***	***29.8***	***2.6***	***22.1***	***4.6***	***1.2***	***0.3***	***0.4***	***0.0***	***0.0***	***0.0***	***94.9***	***10.8***
Contractor Yards																
West Virginia																
Marshall	4.2	0.0	13.5	0.0	6.7	0.0	9.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.7	0.0
Ohio																
Belmont	0.0	0.0	42.6	0.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.6	0.0
Fairfield	0.0	0.0	0.7	0.0	11.0	0.0	3.4	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	15.2	0.0
Guernsey	0.0	0.0	0.0	0.0	55.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	55.6	0.0
Hocking	0.3	0.0	15.3	0.0	12.2	0.0	1.6	0.0	0.0	0.0	0.1	0.0	0.0	0.0	29.4	0.0
Monroe	0.3	0.0	0.0	0.0	38.9	0.0	22.4	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	61.6	0.0
Morgan	0.7	0.0	1.3	0.0	18.5	0.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.4	0.0
Muskingum	0.0	0.0	80.4	0.0	0.0	0.0	11.7	0.0	0.0	0.0	0.5	0.0	0.3	0.0	92.9	0.0
Noble	1.2	0.0	0.2	0.0	27.0	0.0	15.6	0.0	0.0	0.0	0.3	0.0	0.0	0.0	44.3	0.0

TABLE 4.8.1-1 (cont'd)
Acreage Affected by Construction and Operation of the LX Project[d]

Facilities[a]/ County	Forest		Open Land		Agricultural		Industrial		Residential		Wetland		Open Water		Total	
	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.
Perry	0.2	0.0	7.8	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	8.2	0.0
Vinton	<0.1	0.0	62.0	0.0	19.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	81.3	0.0
Yards Subtotal	***6.9***	***0.0***	***223.8***	***0.0***	***211.3***	***0.0***	***73.0***	***0.0***	***0.0***	***0.0***	***1.7***	***0.0***	***0.3***	***0.0***	***517.1***	***0.0***
Tie-In Facilities, Incoming/Outgoing Lines, Launcher/Receiver Facilities [c]																
West Virginia																
Marshall	0.0	0.0	0.3	0.2	0.0	0.0	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.6
Ohio																
Fairfield	0.1	0.1	0.1	0.1	2.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	1.3
Hocking	0.0	0.0	0.5	0.5	0.0	0.0	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5
Jackson	0.0	0.0	<0.1	<0.1	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4
Lawrence	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8
Subtotal	***0.1***	***0.1***	***0.9***	***0.9***	***2.4***	***1.4***	***1.3***	***1.2***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***4.7***	***3.5***
New or Modified Compressor Stations, Regulator Stations, and Odorization Stations (including MLVs)																
West Virginia																
Marshall	26.0	15.4	9.7	7.3	0.1	0.1	0.8	0.5	0.0	0.0	0.2	0.0	0.0	0.0	36.9	23.3
Wayne	1.3	0.0	0.8	0.8	0.0	0.0	14.2	2.1	0.0	0.0	0.0	0.0	0.0	0.0	16.4	2.9
Ohio																
Fairfield	3.9	1.1	2.1	0.5	1.2	0.0	24.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	31.5	1.6
Hocking	1.7	0.7	6.8	3.0	0.0	0.0	2.8	<0.1	0.0	0.0	0.2	<0.1	0.0	0.0	11.6	3.8
Jackson	0.1	0.0	0.2	0.1	18.5	6.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.1	6.5
Lawrence	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
Monroe	<0.1	<0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Muskingum	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Noble	<0.1	<0.1	0.0	0.0	6.8	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	4.6
Perry	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Vinton	2.3	1.5	0.5	0.4	<0.1	<0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0
Aboveground Facilities Subtotal	***35.3***	***18.7***	***20.1***	***12.0***	***26.8***	***11.4***	***43.5***	***2.6***	***0.4***	***0.0***	***0.4***	***0.0***	***0.0***	***0.0***	***126.8***	***44.8***
Suction/Discharge Lines																
Ohio																
Jackson	0.3	0.3	<0.1	<0.1	3.4	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	3.7
Lines Subtotal	***0.3***	***0.3***	***<0.1***	***<0.1***	***3.4***	***3.4***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***3.7***	***3.7***
County Project Subtotals																

TABLE 4.8.1-1 (cont'd)
Acreage Affected by Construction and Operation of the LX Project[d]

Facilities[a]/ County	Forest		Open Land		Agricultural		Industrial		Residential		Wetland		Open Water		Total	
	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.
West Virginia																
Marshall	282.9	102.7	57.9	20.8	133.9	44.4	21.5	3.5	1.6	0.4	1.5	0.6	1.4	1.3	500.7	173.7
Wayne	22.1	8.8	7.3	3.4	2.3	0.5	14.9	2.7	1.1	0.4	1.0	0.9	2.4	2.3	51.1	19.0
Subtotal West Virginia	***304.9***	***111.5***	***65.2***	***24.2***	***136.3***	***44.9***	***36.4***	***6.2***	***2.7***	***0.8***	***2.4***	***1.5***	***3.8***	***3.6***	***551.8***	***192.7***
Pennsylvania																
Greene	22.4	8.0	4.5	1.4	2.5	0.9	0.3	0.1	0.0	0.0	0.1	0.1	<0.1	<0.1	29.8	10.6
Subtotal Pennsylvania	***22.4***	***8.0***	***4.5***	***1.4***	***2.5***	***0.9***	***0.3***	***0.1***	***0.0***	***0.0***	***0.1***	***0.1***	***<0.1***	***<0.1***	***29.8***	***10.6***
Ohio																
Belmont	0.0	0.0	42.6	0.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.6	0.0
Fairfield	70.9	30.1	13.9	5.9	33.3	9.7	29.4	1.5	0.9	0.3	0.3	0.1	0.0	0.0	148.6	47.7
Guernsey	0.0	0.0	0.0	0.0	55.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	55.6	0.0
Hocking	172.8	57.6	92.6	19.7	102.6	27.8	9.6	1.8	2.3	0.3	5.3	3.2	0.4	0.3	385.6	110.6
Jackson	0.5	0.3	0.3	0.2	24.2	11.4	1.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	26.6	11.9
Lawrence	0.0	0.0	0.3	0.2	0.0	0.0	3.7	1.0	0.0	0.0	0.0	0.0	0.1	0.1	4.0	1.2
Monroe	255.9	87.9	50.8	24.5	175.6	52.8	27.0	1.9	0.1	0.0	2.3	1.5	0.3	0.3	512.0	168.8
Morgan	104.1	42.1	30.9	12.6	65.1	19.1	9.8	0.4	0.2	0.1	1.7	1.1	0.6	0.6	212.4	75.9
Muskingum	59.3	23.4	109.9	13.5	35.8	16.1	12.8	0.5	0.1	0.0	1.0	0.2	0.4	0.0	219.2	53.6
Noble	163.8	69.4	62.9	26.0	135.2	46.3	22.8	3.0	1.0	0.4	3.0	1.6	0.3	0.2	389.0	147.1
Perry	139.2	59.1	31.2	9.3	144.5	55.7	2.0	1.0	0.2	<0.1	2.9	1.5	<0.1	<0.1	32<0.1	126.6
Vinton	86.9	26.2	100.3	8.0	44.4	6.4	8.9	0.7	0.3	0.0	0.4	0.1	0.0	0.0	241.2	41.3
Subtotal Ohio	***1053.3***	***396.1***	***535.7***	***119.7***	***838.7***	***245.2***	***127.7***	***11.8***	***5.0***	***1.1***	***17.5***	***9.2***	***2.0***	***1.4***	***2,259.9***	***784.7***
LX PROJECT TOTAL	***1,380.6***	***515.6***	***605.4***	***145.4***	***977.6***	***291.2***	***164.2***	***17.8***	***7.8***	***1.9***	***20.1***	***10.7***	***5.9***	***5.0***	***3,161.6***	***987.7***

[a] Impacts associated with MLVs and cathodic protection are included in the pipeline facility impacts. Tie-in facility and tie-in valve impacts are associated with aboveground facilities.

[b] Includes access roads associated with pipeline facilities as well as aboveground facilities (i.e., Compressor Stations, Odorization Sites, etc.)

[c] Impacts associated with launcher and receiver facilities are only listed for cases where these facilities are not collocated with other aboveground facilities.
Subtotals and totals may not add up due to rounding.

TABLE 4.8.1-2
Acreage Affected by Construction and Operation of the RXE Project

	Forest		Open Land		Agricultural		Industrial		Residential		Wetland		Open Water		Total	
Facilities[a]/ County	**Const.**	**Op.**	**Const.**	**Op.**	**Const.**	**Op.**	**Const.**	**Op.**	**Const.**	**Op.**	**Const.**	**Op.**	**Const.**	**Op.**	**Const.**	**Op.**
Aboveground Facilities																
Kentucky																
Carter	0.5	0.1	0.6	0.0	7.8	5.7	0.0	0.0	2.8	2.8	0.0	0.0	0.1	0.0	11.8	8.6
Menifee	0.0	0.0	12.4	6.6	0.0	0.0	3.3	1.0	0.0	0.0	0.0	0.0	0.0	0.0	15.7	7.6
Montgomery	0.0	0.0	6.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	6.9	0.6
Aboveground Facilities Subtotal	***0.5***	***0.1***	***19.8***	***7.2***	***7.8***	***5.7***	***3.3***	***1.0***	***2.8***	***2.8***	***0.0***	***0.0***	***0.2***	***0.0***	***34.4***	***16.8***
RXE PROJECT TOTAL	***0.5***	***0.1***	***19.8***	***7.2***	***7.8***	***5.7***	***3.3***	***1.0***	***2.8***	***2.8***	***0.0***	***0.0***	***0.2***	***0.0***	***34.4***	***16.8***

The definitions of each land use type are as follows:

- agricultural land: actively cultivated or specialty crops, including hayfields;
- industrial/commercial: manufacturing or industrial plants, paved areas, landfills, and commercial or retail facilities, and sand/gravel pits or quarries;
- open land: open fields, grazed lands, existing unpaved utility rights-of-way, herbaceous and scrub-shrub uplands, non-forested lands, and non-paved roads;
- open water: waterbody crossings greater than 100 feet;
- wetlands: emergent wetlands, scrub-shrub wetlands, and forested wetlands;
- forest/woodland: upland forest lands; and
- residential: existing developed residential areas and planned residential developments, including large developments, residentially zoned areas that have been developed, and short segments of the route at road crossings with homes near the route alignment.

4.8.1.1 Environmental Setting

Construction of the LX Project would affect a total of 3,161.6 acres, while operations would affect approximately 987.7 acres. Table 4.8.1.1-1 shows the existing land uses affected by the LX Project during both construction and operation. Right-of-way alone (including permanent and temporary right-of-way and ATWS) would account for approximately 76.6 percent of all affected land during the construction phase, and approximately 95.0 percent of all affected land during the operations phase.

The primary land use types affected during LX Project construction would be forest (43.7 percent of all affected land), agriculture (30.9 percent), and open land (19.1 percent). Industrial, wetlands, residential, and open water would comprise the remaining land affected during construction.

Construction of the RXE Project would affect a total of 34.4 acres during construction. Table 4.8.1.1-2 shows the existing land uses affected by the RXE Project during both construction and operation. The primary land use types affected by the RXE Project would be open land (57.6 percent of all affected land during construction) and agriculture (22.7 percent). Industrial, residential, forest, and open water would comprise the remaining area affected by construction of the RXE Project.

Following construction, lands outside of the permanent right-of way, aboveground facilities (for both LX and RXE Project components), and permanent access roads would be allowed to revert to their original land use type, including water resources. Operation of the LX Project would permanently affect approximately 987.7 acres. The primary land use types affected during project operation include forested (52.2 percent) and agriculture (30.9 percent). Open land, industrial, wetlands, residential, and open water would comprise the remaining land affected.

Operation of the RXE Project would permanently affect approximately 16.8 acres. The primary land use types affected during RXE Project operation include open land (46.4 percent) and agriculture (33.9 percent). Residential, industrial, and forest would comprise the remaining land affected by operation of the RXE Project.

4.8.1.2 Pipeline Facilities

Information in this section refers only to the LX Project. The LX Project consists of approximately 160.7 miles pipeline (132.4 miles for LEX Pipeline, 24.2 miles for the R-801 Loop, and 2.9 miles for the BM-111 Loop), as well as 1.2 miles of new 30-inch-diameter pipeline (LEX1), and abandonment in-place of 28.2 miles of the existing 20-inch R-501 Line. Table 4.8.1.1-1 summarizes the types of land crossed by the LX Project.

Predominant land uses along the pipeline corridors are forested, agricultural land, open land, and wetlands. The remaining land is comprised of residential, commercial/industrial (including roadways), and open water. Residences and other structures within 50 feet of the construction workspace are discussed in section 4.8.3.1.

In general, land use-related impacts associated with the LX Project would include the disturbance of existing uses within the right-of-way during construction, and a new permanent right-of-way for operation of the pipeline. Columbia Gas would use a 110-foot-wide construction right-of-way, consisting of 50 feet of permanent right-of-way and 60 feet of temporary construction workspace. In wetland areas, Columbia Gas would use a 75-foot-wide construction right-of-way (including a 50-foot-wide permanent right-of-way) except where a modification has been requested and found acceptable (section 4.4.4). Between LEX Pipeline MPs 0.0 and 39.0, Columbia Gas would use a 125-foot-wide construction right-of-way (including a 50-foot-wide permanent right-of-way) for added safety in steep terrain.

In addition to the construction right-of-way, various extra workspaces would be used for project construction. As discussed in section 2.2.1, Columbia Gas identified several areas where site-specific conditions require the use of extra workspace outside of the standard construction right-of-way. Appendix N lists the locations of these extra workspaces, their dimensions, area affected, justification, and other information.

Where the pipeline would be installed at the same location as existing pipelines or electric transmission lines, the permanent right-of-way could consist of a portion of the existing, cleared permanent right-of-way and some additional new right-of-way. Columbia Gas would overlap temporary workspace to the extent feasible while maintaining a safe distance of separation between the proposed and existing pipelines/electric transmission lines.

Areas disturbed by construction that are not part of the new permanent easement would be allowed to revegetate to previous land use conditions. All contours within the construction right-of-way would be restored to pre-construction conditions following the completion of construction activities. The land retained as new permanent right-of-way would generally be allowed to revert to its former use, except for forested land as discussed below. Certain activities such as the construction of permanent structures, including houses, house additions, garages, patios, pools, or other objects not easily removable, or the planting of trees, would be prohibited within the permanent right-of-way. To facilitate pipeline inspection, operation, and maintenance, the entire permanent right-of-way in upland areas (mainly non-wetland areas) would be maintained in an herbaceous/scrub-shrub vegetated state. This maintained right-of-way would be mowed no more than once every 3 years, but a 10-foot-wide strip centered over the pipeline might be mowed annually to facilitate corrosion and other operational surveys. As discussed in section 4.6.1.3, annual mowing would not be allowed during the bird nesting season.

Specific effects on agricultural land, industrial/commercial, open land, and forest/woodland areas are discussed below and land effects are detailed in table 4.8.1-1. Impacts on residential areas and specialty crops are discussed in sections 4.8.3.1 and 4.8.4, respectively. Wetlands and surface waters (open water) are discussed in sections 4.4 and 4.3.2, respectively.

Forested land potentially affected by the LX Project consists mainly of oak and maple species (section 4.5.1). Although trees cleared within temporary construction work areas would be allowed to regenerate to pre-construction conditions following construction, effects on forest resources in these areas would be long-term and last for several years. Following construction, the permanent right-of-way in uplands would remain permanently converted to a non-forested condition under the mowing regime described above (section 4.5.5). The use of forest lands for recreation is discussed in section 4.8.4.

Agricultural land affected by construction primarily includes improved pasture land, with some actively cultivated row crops. Farmers would experience some temporary loss of crop production in areas directly disturbed by construction-related activities. Farmers may have to alter sowing patterns in order to best farm areas that may have limited access due to construction activity. Grazing animals could be moved to different areas or other fields, and/or be penned with gates.

After construction, Columbia Gas would restore disturbed agricultural areas in accordance with the ECS, as well as all other applicable federal, state, and local permit requirements. Typical mitigation measures include topsoil segregation, stone removal, repair and/or replacement of irrigation and drainage structures damaged by construction, restoration of pre-existing contours, and compensation for damage or loss of production. During operation of the pipeline, pre-construction use and productivity of agricultural right-of-way would be allowed to resume. Impacts on and mitigation for prime farmlands and statewide important farmlands are discussed in section 4.2.2.7.

Open lands affected by the LX Project include open fields, existing utility rights-of-way, herbaceous and scrub-shrub uplands, other non-forested lands, and non-paved roads. Construction-related impacts on open land would include the removal of vegetation and disturbance of soils. Following construction, most open land uses would return to their former condition using state-approved seed mixtures.

Industrial/commercial land and residential uses could be temporarily affected during construction of the LX Project pipeline by increased dust from exposed soils, construction noise, and traffic congestion. Columbia Gas would minimize impacts on commercial land and residential uses by coordinating driveway crossings with business owners to provide access across the construction right-of-way.

4.8.1.3 Aboveground Facilities

LX Project

Columbia Gas proposes to construct 10 new aboveground facilities (3 compressor stations, 4 regulator stations, and 3 standalone launcher/receiver facilities) and modify 8 existing aboveground facilities (modification at 2 compressor stations, modifications at 1 regulator station, and installation of odorization at 5 existing facilities). Additionally, Columbia Gas would construct the 10 remaining bi-directional launcher/receiver facilities proposed as part of the LX Project within the limits of other proposed aboveground facilities. All of these facilities would be adjacent to the permanent pipeline right-of-way (including segments of the existing R-System pipeline) or within existing aboveground facility footprints. In addition, Columbia Gas proposes to construct nine new mainline valve assemblies, within the permanent right-of-way along the pipeline, and are included in the discussion of pipeline facilities in section 4.8.1.2. Figure 2.1-1 shows the location of these aboveground facilities.

Facilities that would require new areas of land disturbance (temporary or permanent) include:

- three new compressor stations (the Lone Oak CS and Summerfield CS along LEX Pipeline, and Oak Hill CS along the existing Columbia system), with new suction and discharge lines at two of these facilities (Lone Oak and Oak Hill);
- four new regulator stations (K-260 RS, R-System RS, Benton RS, and McArthur RS);
- five new odorization stations (Benton CS OS, R-486 OS, R-130 OS, R-543 OS, R-300/R-500 OS) along Columbia's existing pipeline system;
- modifications to two existing compressor stations (Ceredo CS along the BM-111 Loop and Crawford CS along the existing Columbia System); and
- modifications to one existing regulator station (RS-1286).

The acreages and impacts discussed in the remainder of this section apply only to the aboveground facilities listed above.

A total of approximately 146.6 acres of land would be disturbed by construction of these aboveground facilities and associated access roads. The impact acreage for the facilities specifically identified (excluding access roads) would be 133.6 acres. Of this total, approximately 61.4 acres would be permanently retained for operation. Table 4.8.1-3 summarizes the land requirements and land uses for the aboveground facilities, except for MLVs, which are addressed as part of pipeline facilities in section 4.8.1.2, and access roads, which are addressed in section 4.8.1.5.

Construction of aboveground facilities and associated access roads would affect approximately 49.4 acres of industrial land, 36.2 acres of agricultural land, 37.1 acres of forest, and 22.9 acres of open land, with minimal effects on residential lands, wetlands, or open water. The operational footprint of aboveground facilities would permanently affect approximately 20.5 acres of forest, 19.0 acres of agricultural land, 14.8 acres of open land, and 7.0 acres of industrial land.

Following construction, affected land outside of permanent aboveground facility footprints would be restored to previous land uses, in accordance with Columbia Gas' ECS. This would include planting trees in former forested areas and using approved seed mixes in former open lands.

RXE Project

Columbia Gulf proposes to construct and operate two new compressor stations and to modify one existing aboveground facility on its existing natural gas transmission system in northeastern Kentucky. These facilities include the new Grayson CS in Carter County, Kentucky, the new Means CS in Menifee and Montgomery Counties, Kentucky, and modifications to the existing Means Measurement and Regulation Station in Menifee County, Kentucky. Table 4.8.1-4 summarizes the land requirements and land uses for these aboveground facilities.

TABLE 4.8.1-3
Acreage Affected by Construction and Operation of Proposed LX Project Aboveground Facilities

Facility	Forest		Open Land		Agricultural		Industrial		Residential		Wetland		Total	
	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b, c]	Const.[a]	Op.[b]
LEX														
Lone Oak CS	26.0	15.4	0.0	0.0	9.7	7.3	0.8	0.5	0.2	0.0	0.0	0.0	36.7	23.2
Summerfield CS	0.0	0.0	6.8	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	4.6
LEX Launcher	0.0	0.0	0.0	0.0	0.3	0.2	0.5	0.4	0.0	0.0	0.0	0.0	0.8	0.6
LEX Subtotal	*26.0*	*15.4*	*6.8*	*4.6*	*10.0*	*7.5*	*1.3*	*0.9*	*0.2*	*0.0*	*0.0*	*0.0*	44.3	28.4
LEX1														
K-260 RS	3.9	1.1	1.2	0.0	1.7	0.1	2.4	0.0	0.0	0.0	0.4	0.0	9.6	1.2
LEX1 Receiver	0.0	0.0	2.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.0
LEX1 Subtotal	*3.9*	*1.1*	*3.3*	*1.0*	*1.7*	*0.1*	*2.4*	*0.0*	*0.0*	*0.0*	*0.4*	*0.0*	*11.7*	*2.2*
R-801 Loop														
R-System RS	0.1	0.0	0.0	0.0	4.6	2.2	0.5	<0.1	0.0	0.0	0.0	0.0	5.2	2.2
Benton RS	1.5	0.6	0.0	0.0	0.9	0.5	<0.1	<0.1	<0.1	0.0	0.0	0.0	2.4	1.1
RS-1286 RS	0.0	0.0	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.0	0.0	0.0	0.0	*7.6*	*3.3*
McArthur RS	2.3	1.5	0.0	0.0	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.8	1.9
R-801 Loop Subtotal	*3.9*	*2.1*	*0.0*	*0.0*	*6.0*	*3.1*	*0.6*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*10.5*	*5.3*
BM-111 Loop														
Ceredo CS	1.3	0.0	0.0	0.0	0.8	0.8	14.2	2.1	0.0	0.0	0.0	0.0	16.3	2.9
BM-111 Loop Launcher	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.0	0.0	0.0	0.0	0.8	0.8
BM-111 Loop Subtotal	*1.3*	*0.0*	*0.0*	*0.0*	*0.8*	*0.8*	*15.0*	*2.9*	*0.0*	*0.0*	*0.0*	*0.0*	17.1	3.7
Existing Columbia Pipeline System														
Crawford CS	0.0	0.0	0.0	0.0	0.4	0.4	21.6	0.0	0.0	0.0	0.0	0.0	22.0	0.4
Oak Hill CS	0.1	0.0	18.5	6.4	0.1	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	18.7	6.4
Oak Hill CS Suction/Discharge Lines	0.3	0.3	3.4	3.4	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	3.7	3.7
Benton CS	0.0	0.0	0.0	0.0	1.3	0.2	2.3	<0.1	0.2	<0.1	0.0	0.0	3.8	0.2
R-486 Odorization Station	0.0	0.0	<0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
R-130 Odorization Station	0.0	0.0	0.0	0.0	0.1	<0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0
R-543 Odorization Station	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.1

TABLE 4.8.1-3 (cont'd)
Acreage Affected by Construction and Operation of Proposed LX Aboveground Facilities

Facility	Forest		Open Land		Agricultural		Industrial		Residential		Wetland		Total	
	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b, c]	Const.[a]	Op.[b]
R-300/R-500 Odorization Station	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	1.3	0.0
Existing System Subtotal	*0.4*	*0.3*	*21.9*	*9.8*	*2.0*	*0.7*	*25.5*	*0.0*	*0.2*	*0.0*	*0.0*	*0.0*	*50.0*	*10.8*
Total, Aboveground Facilities	***35.5***	***18.9***	***32.0***	***15.4***	***20.5***	***12.2***	***44.8***	***3.9***	***0.4***	***0.0***	***0.4***	***0.0***	***133.6***	***50.5***

[a] Land affected during construction is inclusive of operation impacts (permanent).
[b] Land affected during operation consists only of new permanent impacts.
[c] Operational land use impacts associated with wetlands have been calculated based on the proposed 50-foot–wide permanent easement. Per the FERC Procedures, Columbia would maintain a 10-foot-wide cleared easement in wetlands. Trees within 15 feet of the pipeline with root systems that could compromise the integrity of the pipeline coating would also be selectively removed, for a total maintenance corridor of up to 30 feet. Additionally, the areas between horizontal directional drill (HDD) entry and exit locations would not be affected by construction or operation, with the exception of temporary access roads necessary for hydrostatic test water withdrawal, to minimize and avoid wetland impacts.
[d] There would be no impacts to open water.

TABLE 4.8.1-4
Acreage Affected by Construction and Operation of Proposed RXE Aboveground Facilities

Facility	Forest		Open Land		Agricultural		Industrial		Residential		Open Water		Total[c]	
	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b]	Const.[a]	Op.[b, c]	Const.[a]	Op.[b]
Grayson CS	0.5	0.1	0.6	0.0	7.8	5.7	0.0	0.0	2.8	2.8	0.1	0.0	11.8	8.6
Means CS	0.0	0.0	19.2	7.2	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	19.4	7.2
Means Measurement and Regulation Station	0.0	0.0	0.0	0.0	0.0	0.0	3.2	1.0	0.0	0.0	0.0	0.0	3.2	1.0
RXE Total	***0.5***	***0.1***	***19.8***	***7.2***	***7.8***	***5.7***	***3.3***	***1.0***	***2.8***	***2.8***	***0.2***	***0.0***	***34.4***	***16.8***

[a] Land affected during construction is inclusive of operation impacts (permanent).
[b] Land affected during operation consists only of new permanent impacts.
[c] There would be no impacts to wetlands.

4.8.1.4 Project Contractor Yards

Columbia Gas identified 39 potential sites for contractor yards, of which it estimates only about 17 would be used. The use of 39 potential sites would temporarily affect approximately 517.1 acres. The most commonly used land use type would be open land for approximately 223.8 acres. Additional effects on other land types are shown in table 4.8.1-5. Residences and businesses near the contractor yards would experience temporary noise, dust, and traffic impacts during construction. Following construction, areas used for staging would revert to pre-construction conditions, and no permanent impacts would result from contractor yards.

TABLE 4.8.1-5
Acreage Affected by Proposed Contractor Yards (Construction Phase Only) for the LX Project

State/ County	Forest	Open Land	Agricultural	Industrial	Residential	Wetland	Open Water	Total
West Virginia								
Marshall	4.2	13.5	6.7	9.3	0.0	0.0	0.0	33.7
Ohio								
Belmont	0.0	42.6	23.0	0.0	0.0	0.0	0.0	65.6
Fairfield	0.0	0.7	11.0	3.4	0.0	<0.1	0.0	15.2
Guernsey	0.0	0.0	55.0	0.0	0.0	0.6	0.0	55.6
Hocking	0.3	15.3	12.2	1.6	0.0	0.1	0.0	29.4
Monroe	0.3	0.0	38.9	22.4	0.0	<0.1	0.0	61.6
Morgan	0.7	1.3	18.5	9.0	0.0	0.0	0.0	29.4
Muskingum	0.0	80.4	0.0	11.7	0.0	0.5	0.3	92.9
Noble	1.2	0.2	27.0	15.6	0.0	0.3	0.0	44.3
Perry	0.2	7.8	0.0	0.1	0.0	0.1	0.0	8.2
Vinton	<0.1	62.0	19.0	0.1	0.0	0.2	0.0	81.3
Total	***2.7***	***210.3***	***204.6***	***63.7***	***0.0***	***1.7***	***0.3***	***483.4***

Columbia Gulf would use the proposed temporary work areas within the facility boundary for all construction staging, equipment, and material storage. No additional contractor yards, staging or laydown areas, or rail yards are proposed as part of the RXE Project.

4.8.1.5 Access Roads

In addition to public roads, Columbia Gas proposes to construct 130 temporary access roads for pipelines and 6 permanent access roads for construction and operation of the pipeline facilities. Columbia Gas would use 2 temporary access roads and 29 permanent access roads for construction and operation of aboveground facilities. During construction, temporary and permanent access roads for pipeline facilities and aboveground facilities would affect about 94.9 total acres. Permanent access roads would affect approximately 10.8 acres during operations. Following construction, all temporary roads would be restored to pre-construction conditions and reseeded according to Columbia Gas' ECS. Table 4.8.1-6 identifies the land use effects of these access roads. Columbia Gas' proposed access roads are discussed further in sections 2.2.4 and 4.8.6.4.

Columbia Gulf would use existing access roads to access the proposed facilities. To access the Grayson CS, Columbia Gulf would use Beckwith Branch Road. Columbia Gulf would use Hawkins Branch road to access the Means CS. Road improvements are being evaluated and Columbia Gulf would notify FERC if additional temporary or permanent improvements were needed.

TABLE 4.8.1-6
Acreage Affected by Construction [a] and Operation [b] of Proposed LX Project Access Roads

Facility (Access Roads Serving)	Forest		Open Land		Agricultural		Industrial		Residential		Wetland		Open Water		Project Total	
	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.	Const.	Op.
Pipeline Facilities																
LEX	3.5	0.1	16.4	0.1	16.9	0.2	11.9	1.3	0.2	0.0	0.5	0.1	0.0	0.0	49.4	1.7
LEX1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R-801 Loop	1.5	<0.1	5.1	0.0	5.4	<0.1	5.2	<0.1	0.0	0.0	0.1	0.0	0.0	0.0	17.3	<0.1
BM-111 Loop	0.1	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
R-501 Abandonment	0.9	0.0	5.0	0.0	9.8	0.0	0.2	0.0	0.2	0.0	0.3	0.0	0.0	0.0	16.4	0.0
Pipeline Facilities Subtotal	***6.0***	***0.1***	***26.5***	***0.1***	***32.3***	***0.2***	***17.5***	***1.3***	***0.4***	***0.0***	***0.9***	***0.1***	***0.0***	***0.0***	***83.6***	***1.7***
Aboveground Facilities																
LEX	0.3	0.3	0.7	0.7	0.3	0.3	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5
LEX1	0.7	0.7	0.9	0.9	0.8	0.8	1.3	1.3	0.0	0.0	0.3	0.3	0.0	0.0	4.0	4.0
R-801 Loop	0.4	0.4	0.0	0.0	0.5	0.5	0.4	0.4	<0.1	<0.1	0.0	0.0	0.0	0.0	1.4	1.4
BM-111 Loop	0.0	0.0	0.0	0.0	0.0	0.0	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	<0.1	<0.1
Existing Columbia Pipeline System	0.1	0.1	1.9	1.1	<0.1	<0.1	1.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	3.4	1.3
Aboveground Facilities Subtotal	***1.5***	***1.5***	***3.5***	***2.7***	***1.6***	***1.6***	***4.4***	***3.1***	***0.0***	***0.0***	***0.3***	***0.3***	***0.0***	***0.0***	***11.3***	***9.2***
Project Total	**7.5**	**1.6**	**30.0**	**2.8**	**33.9**	**1.8**	**21.9**	**4.4**	**0.4**	**0.0**	**1.2**	**0.4**	**0.0**	**0.0**	**94.9**	**10.9**

[a] Construction impacts include temporary and permanent access roads.
[b] Operational impacts include permanent access roads maintained for the life of the LX Project.

Columbia Gas submitted a supplemental filing in March 2016 that proposed two new access roads and additional temporary workspace needed for the construction of the K-260 RS. Our review indicates that these additional workspace and access roads would affect 2.1 more acres of forested land (an additional 53 percent) from that of the originally proposed access roads. Columbia Gas provided information that would remove the original 4,000 foot DEIS access road PAR-F-22 used for the K-260 RS.

Columbia Gas and Columbia Gulf are currently reviewing all identified access roads in various states of finish, including two-track paths, dirt covered, graveled and paved. Road improvements necessary to handle proposed construction loads are currently being evaluated. The new access roads already identified have been surveyed or would be surveyed for environmental resources such as cultural and biological resources. Columbia Gas and Columbia Gulf would file any newly information regarding improvement of roads necessary for construction with the Secretary, for the review and written approval by the Director of OEP, prior to construction.

4.8.2 Landownership and Easement Requirements

Pipeline operators must obtain easements from existing landowners to construct and operate authorized facilities, or acquire the land on which the facilities would be located. Easements can be temporary, granting the operator the use of the land during construction (e.g., extra workspaces, temporary access roads, contractor yards), or permanent, granting the operator the right to operate and maintain the facilities once constructed. Columbia Gas would need to acquire new easements or acquire the necessary land to construct and operate the new pipeline. These new easements would convey both temporary (for construction) and permanent (no greater than 50-feet-wide for operation) rights-of-way to Columbia Gas.

An easement agreement between a company and a landowner typically specifies compensation for losses resulting from construction, including losses of non-renewable and other resources, damages to property during construction, and restrictions on existing uses that would not be permitted on the permanent right-of-way. Compensation would be fully determined through negotiations between Columbia Gas or Columbia Gulf and the landowner.

If an easement cannot be negotiated with a landowner and if the LX and RXE Projects are approved by the Commission, Columbia Gas and Columbia Gulf may use the right of eminent domain to acquire the property necessary to construct and operate its Projects. This right would apply to all project-related workspace covered by an approval, including the temporary and permanent rights-of-way, aboveground facility sites, contractor yards, access roads, and extra workspaces. Columbia Gas and Columbia Gulf would still be required to compensate the landowner for the right-of-way and damages incurred during construction. However, the level of compensation would be determined by a court according to federal or state law.

4.8.3 Existing Residences, Commercial and Industrial Facilities, and Planned Developments

As currently designed, LX Project construction would affect approximately 7.8 acres of residential land, consisting of 7.1 acres of pipeline facilities and 0.6 acres of aboveground facilities. The LX project would also affect approximately 164.2 acres of industrial land, including 114.8 acres associated with the pipelines and 49.4 acres associated with aboveground facilities. Following construction, 1.7 acres of residential land and 10.9 acres of industrial land would be within the permanent pipeline right-of-way and would be subject to restrictions on certain activities, such as planting large trees or the placement of certain structures. An additional 7.0 acres of industrial land and 0.3 acres of residential land would be within the boundaries of LX Project aboveground facilities. The remaining residential land and industrial land would not be subject to any restrictions.

RXE Project construction would permanently affect 2.8 acres of residential land, all within the Grayson CS construction workspace. Three residences and six other unoccupied structures are located within the construction workspace for the Grayson CS. Columbia Gulf has purchased these residences; they are currently vacated, and would be removed prior to construction. The existing Means M&R Station consists of 3.2 acres of industrial land. This area would be used as workspace during construction of the Means CS.

All residential and industrial lands affected by LX and RXE Project construction would be restored to preconstruction conditions to the extent possible. In restoring properties, Columbia Gas and Columbia Gulf would adhere to their ECSs and any specific requirements identified by landowners and agreed to during negotiations. In most cases, property owners would be able to use the permanent right-of-way as they did before construction, as long as the use does not conflict with project operation and the terms of the landowner's negotiated easement agreement. No planned residential or commercial developments were identified within the LX project area. No future developments have been identified within 0.5 mile of the LX project to date.

4.8.3.1 Existing Residences and Commercial and Industrial Facilities

Multiple residences, businesses, and other structures, such as barns, sheds, or garages, occur within 50 feet of any proposed LX Project construction work area. Columbia Gas' construction work area for the LX Project would be within 50 feet of 43 residential structures, including 3 vacant structures; 5 businesses; and 69 other structures. Of these structures, 23 residences, 5 businesses, and 40 other structures are within 25 feet of the construction work area. No residential, commercial or industrial structures would be located within 50 feet of the construction work area for the RXE Project.

Of these structures, residences within 50 feet of the construction work area would be most likely to experience the effects of LX Project construction and operation. In general, as the distance to the construction work area increases, the impacts on residences decrease. In residential areas, the two greatest impacts associated with construction and operation of a pipeline are temporary disturbances during construction and the encumbrance of a permanent right-of-way, which would prevent the construction of permanent structures within the right-of-way, as well as certain other limitations or restrictions.

Columbia Gas and Columbia Gulf would notify affected residents a minimum of two weeks in advance of construction activities. Potential impacts on residences within 50 feet of the work areas would be minimized by:

- conducting construction activities during daytime whenever feasible;
- installing temporary safety fencing for at least 100 feet on either side of the residence and maintaining it while the trench is open;
- coverage of open trenches with steel plates during non-construction hours;
- avoiding removal of trees;
- avoiding interruption of utility service wherever possible, and notifying affected landowners if such interruptions are necessary;
- revegetation of affected lands as soon as feasible;
- maintaining traffic flow and vehicle access, and clearance of debris from roads; and
- use of specialized construction techniques (e.g., stovepipe or drag section techniques), as needed.

TABLE 4.8.3-1 Structures Within 50 Feet of the Construction Workspace for the LX Project			
Structure Type	**Milepost/Facility**	**Distance from Edge of Construction Workspace (feet)**	**Distance from Proposed Pipeline Centerline (feet)**
Pipeline Facilities			
LEX			
Shed	8.0 RR-1	46	180
Residence	8.0 RR-1	44	139
Unoccupied residence	8.0 RR-1	0	0 [a]
Shed	8.0 RR-1	42	92
Shed	8.0 RR-1	4	54
Shed	10.3	28	58
Tank	10.8	34	75
Residence	13.3	27	153
Barn	13.3	0	45
Barn	14.2 RR-2	0	22
Shed	14.2 RR-2	0	0 [b]
Residence	14.7 RR-2	44	139
Building	17.0 RR-3	26	121
Building	17.0 RR-3	46	141
Shed	20.2	47	77
Shed	29.2	27	57
Residence	31.8	38	68
Residence	43.3	42	87
Trough	45.5	45	75
Residence	47.3	50	93
Barn	48.9	10	58
Shed	49.2	13	75
Shed	51.1	10	90
Residence	**51.5**	**10**	**120**
Shed	51.5	0	0 [b]
Barn	59.7	6	86
Residence	**60.7**	**5**	**30**
Residence	67.6	28	58
Business	80.1	14	94
Garage	80.2	7	79
Residence	**82.9**	**10**	**80**
Barn	101.5	23	53
Tank	101.5	14	94
Residence	102.8	47	178
Mobile residence	104.3	18	148
Shed	105.5	27	57
Residence	112.3	44	124
Barn	116.7	0	76
Barn	127.9	21	101
Shed	128.0	35	130
Garage	128.0	37	187
Shed	128.0	38	191
Residence	128.0	35	110

TABLE 4.8.3-1 (cont'd) Residences Within 50 Feet of the Construction Workspace for the LX Project			
Structure Type	**Milepost/Facility**	**Distance from Edge of Construction Workspace (feet)**	**Distance from Proposed Pipeline Centerline (feet)**
R-801 Loop			
Shed	0.2	36	66
Barn	0.9	0	42
Barn	1.0	38	118
Barn	2.2	0	76
Barn	3.3	50	1430
Barn	3.3	0	69
Residence	4.9	20	110
Shed	5.1	13	70
Residence	5.1	14	59
Shed	5.1	33	94
Barn	5.1	0	46
Residence	5.2	17	117
Residence	**8.9**	**3**	**104**
Residence	8.9	27	132
Residence	9.7	22	132
Shed	9.7	0	34
Barn	14.2	16	658
Residence	14.2	12	634
Residence	21.4	50	125
Barn	23.2	0	80
Barn	23.2	2	27
Barn	23.2	45	75
Shed	23.2	45	75
Shed	23.4	9	89
Barn	23.4	2	102
BM-111 Loop			
Residence	0.1	18	158
Residence	0.1	38	173
Business	0.7	25	50
Residence	1.3	14	159
Garage	1.4	7	120
Barn	2.3	50	75
Shed	2.4	5	35
Shed	2.4	49	79
Shed	2.5	1	80
R-501 Abandonment			
Garage	4.1	25	N/A
Garage	4.1	45	N/A
Shed	4.1	46	N/A
Residence	4.1	23	N/A
Residence	4.1	27	N/A
Residence	4.1	16	N/A
Residence	4.1	40	N/A
Shed	4.4	44	N/A
Residence	5.4	20	N/A
Residence	5.4	42	N/A
Garage	5.4	0	N/A

TABLE 4.8.3-1 (cont'd) Residences Within 50 Feet of the Construction Workspace for the LX Project			
Structure Type	**Milepost/Facility**	**Distance from Edge of Construction Workspace (feet)**	**Distance from Proposed Pipeline Centerline (feet)**
Shed	5.9	27	N/A
Barn	20.3	38	N/A
Residence	20.9	23	N/A
Shed	21.0	44	N/A
Garage	27.2	11	N/A
Residence	27.2	24	N/A
Garage	27.3	14	N/A
Aboveground Facilities			
LEX			
Unoccupied residence	LEX launcher	0	N/A
Barn	LEX launcher	0	N/A
Unoccupied residence	Lone Oak CS	0	N/A
Barn	Lone Oak CS	0	N/A
BM-111 Loop			
Shed	BM-111 Loop launcher	0	N/A
Shed	BM-111 Loop launcher	0	N/A
Unoccupied office building	BM-111 Loop launcher	0	N/A
Unoccupied office building	BM-111 Loop launcher	0	N/A
Unoccupied office building	BM-111 Loop launcher	0	N/A
Unoccupied residence	BM-111 Loop launcher	0	N/A
Shed	BM-111 Loop launcher	3	N/A
Shed	BM-111 Loop launcher	11	N/A
Shed	BM-111 Loop launcher	13	N/A
Residence	BM-111 Loop launcher	17	N/A
Residence	BM-111 Loop launcher	17	N/A
Residence	BM-111 Loop launcher	18	N/A
Shed	BM-111 Loop launcher	25	N/A
Residence	BM-111 Loop launcher	38	N/A
Residence	BM-111 Loop launcher	40	N/A
Residence	BM-111 Loop launcher	43	N/A
Residence	BM-111 Loop launcher	44	N/A
Shed	Ceredo CS	31	N/A
Shed	Ceredo CS	45	N/A
Existing Columbia Pipeline System			
Shed	R-130 Odorization Site	31	N/A
Barn	R-130 Odorization Site	48	N/A

[a] Residence occurs within project workspace, but was irreparably damaged by fire. Columbia Gas has received documented consent from the landowner regarding the proposed pipeline right-of-way through this area and a signed letter of no objection for demolition of the structure.

[b] Structure is crossed by the proposed pipeline and would be permanently relocated or demolished for construction and operation of the Project. Negotiations with the landowner are ongoing.

Columbia Gas is continuing to prepare site-specific residential construction plans for all residences within 50 feet of construction work areas of the LX Project pending completion of civil

surveys. Plans provided to date that show the residences within 50 feet of the construction workspace are provided in appendix O.

Table 4.8.3-1 lists residences, businesses, and other structures, such as barns, sheds, or garages, within 50 feet of any proposed LX Project construction work area by MP, and indicates the distance and orientation of each from the work areas.

Four of the residences displayed in appendix O and table 4.8.3-1, while not within the construction workspace, would be within 10 feet of the workspace due to the construction constraints along those portions of the LX Project's route. Because of the increased potential for construction of the LX Project to disrupt these residences and to ensure that property owners have adequate input to a construction activity occurring so close to their homes, **we recommend that:**

- **<u>Prior to construction</u>, Columbia Gas should file with the Secretary, for the review and written approval of the Director of OEP, evidence of landowner concurrence with the site-specific residential construction plans for all locations identified by MP in table 4.8.3-1 of the EIS where the LX Project construction work areas would be within 10 feet of a residence.**

Our experience has shown that when project sponsors maintain communication with landowners during construction and restoration phases, issues in and near residential areas can be effectively managed and resolved. Columbia Gas and Columbia Gulf have developed an environmental complaint resolution procedure that they would implement during project construction and restoration. Columbia Gas and Columbia Gulf would work to notify affected landowners or complainants (even if they are not the landowner) within 24 hours of receiving a complaint. If contact is not possible within 48 hours, the complainant has the option to call Columbia Gas' and Columbia Gulf's Operations Center in Charleston, West Virginia. If either of these methods for contacting and resolving complaints is unsatisfactory to the complainant, FERC's Dispute Resolution Service Helpline may be called. All complaints and follow-up correspondence to Columbia Gas and Columbia Gulf or FERC would be documented, and any action required to resolve the issue would be discussed with the affected landowner and/or complainant. Columbia Gas and Columbia Gulf have yet to identify the company representative responsible for contacting regarding the landowner complaint and resolution procedures.

Commercial structures in proximity to the LX Project could also experience short-term disruptions to businesses as a result of in-street construction, detours, or restricted access due to lane closures. These impacts and corresponding mitigation measures are discussed further in section 4.9.4. Implementation of Columbia Gas' general construction methods for working near commercial areas, such as boring of public roadways, avoidance of road closures, development of site-specific plans, and the complaint resolution procedure would minimize disruption to commercial areas to the extent practicable.

Operational impacts associated with the LX Project would be limited to approximately 1.9 acres of residential lands and the 17.8 acres of commercial/industrial land within the permanent right-of-way and aboveground facilities, which would have restricted use. Specifically, no trees within 15 feet of the pipeline with roots that could compromise the integrity of the pipeline or permanent structures would be allowed within the permanent right-of-way. Affected industrial land not already within the boundaries of aboveground facilities would be permanently converted to pipeline-related industrial uses.

4.8.3.2 Planned Developments

Columbia Gas and Columbia Gulf contacted local and county officials in the affected municipalities of West Virginia, Pennsylvania, Ohio, and Kentucky in 2014 and 2015 to identify planned

residential, commercial, or industrial developments near the projects. No such planned developments were identified.

4.8.4 Recreation and Special Interest Areas

The LX Project would not cross or come within 0.2 mile of any National Park System unit (including National Wild, Scenic, and/or Recreational Rivers), Indian Reservation, National Forest, National Wildlife Refuge, National Wilderness Area, or National Landmark (NPS, 2014a, 2014b, 2014c; U.S. Forest Service, 2014; U.S. Fish and Wildlife Service, 2014). The LX Project does not cross any rivers in the National Wild and Scenic Rivers System (National Wild and Scenic Rivers System, 2009). The RXE Project does not cross or come within 0.2 miles of any public or private recreational or special interest areas.

The LX Project would directly cross public recreation and special interest areas, including one scenic byway, one state forest, three recreational trails, one wildlife management area, and one outdoor recreation areas. The LX Project would also be within 0.2 mile of private recreation and special interest areas, including one nature preserve and its two associated components, an additional nature preserve, one public park, one historic canal, one conservation preserve, and two state parks.

One of the primary concerns when crossing recreation and special interest areas is the impact of construction on the purpose for which the recreational or special interest area was established (e.g., the recreational activities, public access, and human and natural resources the area aims to protect). Construction and operation could alter visual aesthetics by removing existing vegetation and disturbing soils. Construction could pose a nuisance to recreational users given the expected generation of dust, noise, and increased vehicular traffic. Construction could interfere with or diminish the quality of the recreational experience through its disturbance of environments important to wildlife movements, hunting, hiking or aquatic activities.

In general, impacts on recreational and special interest areas would be temporary and limited to the period of active construction, which typically would only last a few days to several weeks in any one area. These impacts would be minimized by implementation of the measures contained in Columbia Gas' and Columbia Gulf's ECSs. Following construction, most open land uses would be able to continue. Columbia Gas is continuing to consult with the owners and managing agencies of recreation and special interest areas regarding the need for specific construction mitigation measures.

Temporary workspace associated with the R-501 Abandonment is located 0.4 mile from the Wayne National Forest in Vinton County, Ohio at its closest point (MP 20.9), and the R-801 Loop is located less than 0.1 mile, at its closest point (MP 8.1), west of the Hocking State Forest in Vinton County, Ohio. Table 4.8.4-1 provides information about the affected recreational and special interest areas. Further discussion of these areas is provided below.

The two crossings of the North Country National Scenic Trail would occur in locations where the trail follows public roads. One of the five proposed Buckeye Trail crossings is at a public road, while the remaining four would be located at off-road trail segments. The Buckeye Trail Association, a non-profit group, manages both the Buckeye Trail and the affected portion of the North Country National Scenic Trail. The Warrior Trail crossing would occur at a public road and would be accomplished via conventional bore. Columbia would maintain traffic flow along on-road trail segments.

TABLE 4.8.4-1
Federal, State, Recreation, and Conservation Lands Located Within 0.25 Mile of the LX Project

State/County	Component and MP Location(s)/ Facility	Name of Area/Resource	Landowner/Manager	Existing Land Use[a]	Approximate Crossing Length (miles)[b]		Proximity (miles)[c]
					Constr.	Oper.	
West Virginia							
Marshall	LEX MP 17.6	Warrior Trail	Warrior Trail Association	I	<0.1	<0.1	N/A
Marshall	LEX MP 1.7 to 2.1	Dunkard Fork Wildlife Management Area	Wheeling Creek Watershed Commission, WVDNR	R	0.5	P[e]	N/A
Ohio							
Fairfield	Crawford CS	Rhododendron Cove State Nature Preserve	ODNR, Division of Natural Areas and Preserves	F	0.0	0.0	0.0[d]
Fairfield	Crawford CS	Kleinmaier Rhododendron Hollow Component	ODNR, Division of Natural Areas and Preserves	F	0.0	0.0	0.0[d]
Fairfield	Crawford CS	Wahkeena Component	ODNR, Division of Natural Areas and Preserves	F	N/A	N/A	0.2
Fairfield	LEX MP 119.7 to MP 120.1; LEX1 MP 0.3 to MP 0.5	Rush Creek Conservancy Easements	Rush Creek Conservancy	F, R	0.5	<0.1	N/A
Hocking	LX MP 130.4	Hocking Canal	ODNR				
Hocking	R-801 Loop MP 12.8 to MP 15.5 (Approximate)	Hocking State Forest	Ohio State Parks Division, ODNR	F, OS	N/A	N/A	<0.1
Hocking	R-801 Loop MP 6.4	North Country National Scenic Trail	NPS, Buckeye Trail Association	I	<0.1	<0.1	N/A
Hocking	R-801 Loop MP 1.1 to MP 1.4	Clear Creek Metro Park	ODNR, Division of Natural Areas and Preserves	F	N/A	N/A	0.1
Hocking	R-801 Loop MP 3.0 to MP 3.2; R-501 Abandonment MP 1.7 to MP 2.3	Conservation Easements	Ohio Appalachia Alliance	R	0.8	P[e]	N/A
Hocking	R-801 MP 3.8	Bartley Preserve	Ohio Appalachia Alliance	R	N/A	N/A	0.3
Hocking	R-501 Abandonment MP 3.2	Wetland Reserve Program Easement	NRCS	W, OW	0.0	0.0	0.0[d]
Jackson	Oak Hill CS Temporary Access Road	Conservation Easement	Ohio Valley Conservation Coalition	W, F	<0.1	<0.1	N/A
Monroe	LEX MP 26.2 to MP 26.9	Sunfish Creek State Forest	ODNR	F, R	0.7	P[e]	N/A
Monroe	LEX MP 25.9	Ohio River National Scenic Byway	Ohio DOT, Scenic Byways Program	I	<0.1	<0.1	N/A
Morgan	PY 7 and PY 28	Muskingum River State Park	ODNR, Division of State Parks	R	0.0	0.0	0.0[d]
Muskingum	LEX MP 77.5 to 78.5	ReCreation Land [f]	American Electric Power Company	R	1.0	<0.1	N/A

TABLE 4.8.4-1 (cont'd) Federal, State, Recreation, and Conservation Lands Located Within 0.25 Mile of the LX Project							
State/County	Component and MP Location(s)/ Facility	Name of Area/Resource	Landowner/Manager	Existing Land Use[a]	Approximate Crossing Length (miles)[b]		Proximity (miles)[c]
					Constr.	Oper.	
Noble	LEX MPS 69.5, 72.4, 72.4, 72.69, 73.3	Buckeye Trail	Buckeye Trail Association	R	<0.1	<0.1	N/A
Noble	LEX MP 66.5	North Country National Scenic Trail	NPS, Buckeye Trail Association	I	<0.1	<0.1	N/A
Noble	LEX MP 71.1 to MP 75.2	ReCreation Land [f]	American Electric Power Company	R	4.1	<0.1	N/A
Perry	LEX MP 102.5 to MP 102.5	CRP Property	USDA Farm Service Agency, Private	A	<0.1	<0.1	N/A
Perry	LEX MP 106.5	Arethusa Springs Park	Village of New Lexington	OL	N/A	N/A	0.1

[a] I = Industrial/commercial (including public roads); OL = Open Land; OW = Open Water; W = Wetland; F = Forest/Woodland; R = Outdoor Recreation; A = Agricultural; NA – Not Applicable

[b] Impacts based on a 110-foot-wide construction right-of-way except for 125-foot-wide construction right-of-way for LEX Pipeline MP 0.0 to 39.2; operational impacts are based on a 50-foot-wide right-of-way.

[c] For areas within 0.25 mile of, but not crossed by the Project.

[d] Located adjacent to, but not within resource.

[e] Impacts on these lands are pending agency recommended mitigation measures.

[f] Columbia Gas describes Reclamation lands as reclaimed abandoned mines currently managed as outdoor recreation areas.

A Supplemental Filing was made just prior to going to print in which Columbia Gas expanded the project area. Due to the lateness of the filing, our review of this information is incomplete and the analyses presented in this table may not be reflective of these changes.

As listed in table 4.8.4-1, two Ohio state nature preserves would be within 0.2 mile of the Crawford CS, one Ohio state nature preserve would be within 0.2 mile of the R-801 Loop, and a municipal park in New Lexington, Ohio would be within 0.2 mile of the LEX Pipeline. The LX Project would not cross or directly affect these areas. The Project would cross the Dunkard Fork Wildlife Management area in Marshall County, West Virginia. Additionally, the pipeline would cross a portion of the Hocking Canal in Hocking County, Ohio.

4.8.4.1 State Forests

At its closest point, the R-801 Loop is less than 0.1 mile west of the Hocking State Forest in Vinton County, Ohio. Columbia Gas anticipates no adverse impacts because the LX Project would not cross the forest boundary and is more than one mile from the nearest recreational area.

The LEX Pipeline crosses the Sunfish Creek State Forest in Monroe County, Ohio from MP 26.1 RR-5 to MP 26.5 RR-5. Columbia Gas has submitted a formal application, including an Environmental Assessment, to ODNR for review and approval. After approval, Columbia Gas would be granted a 25-year lease agreement for the permanent pipeline easement within the forest. In order to properly review all necessary approvals, we have recommended in section 4.6.1.2 that Columbia Gas provide documentation of all correspondence with ODNR (including the formal application and Environmental Assessment) prior to construction.

4.8.4.2 Organic Farm Lands and Specialty Crops

The LX Project would not cross any organic farm lands or specialty crop areas.

4.8.4.3 Conservation and Other Special Land Uses

As shown in table 4.8.3-1, the LX Project would cross one parcel enrolled in the Conservation Reserve Program (CRP), three conservation easements owned by Rush Creek Conservancy, two conservation easements owned by the Ohio Appalachia Alliance, and one easement owned by the Ohio Valley Conservation Coalition. The Project would also occur within 0.3 mile of one state forest and one easement within the Wetland Reserve Program.

The USDA Farm Services Administration (FSA) administers the CRP by paying a stipend to landowners who voluntarily remove land from active agricultural production (USDA, 2015). CRP land affected by the Project would be restored to pre-construction conditions, in accordance with FERC Plan and landowner agreements.

The LEX Pipeline section would cross easements owned by the Ohio Appalachia Alliance in Hocking County, Ohio from MPs 130.5 to 130.6, while temporary construction workspace associated with the R-801 Loop would cross similar easements in Hocking County near MP 3.2. Columbia Gas has coordinated with the Appalachia Ohio Alliance to develop the currently proposed LEX Pipeline route across these easements and would continue to consult with their representatives regarding BMPs and mitigation measures to be implemented during construction activities in these areas. Additionally, all land temporarily disturbed by construction of the LX Project would be restored to pre-construction conditions through revegetation activities, in accordance with the protective measures contained in the ECS and FERC Plan.

4.8.5 Hazardous Waste Sites

Areas of contamination for the LX Project, including polychlorinated biphenyl (PCB), hydrocarbon, mercury, and heavy metals, were previously identified within the Ceredo CS, Crawford CS, and Benton CS. Columbia Gas performed a comprehensive site-wide assessment and soil remediation to remove or contain the sources of contamination at the Benton CS in 2002 as well as at the Ceredo CS and the Crawford CS from May through October 2012 and from February through September 2012, respectively. A total of 18 previously leaking underground storage tanks have also been identified within 0.5 mile of the LX Project area. Information on contaminated soil, groundwater, and sediments at these sites is provided in sections 4.2.2, 4.3.1.6, and 4.3.3. No contaminated sites occur within 1 mile of the RXE Project.

In the event of the discovery of unanticipated contamination along the pipeline route, Columbia Gas would follow its *Plan for the Unanticipated Discovery of Contaminated Environmental Media* (part of its ECS).

4.8.6 Visual Resources

"Visual resources" refers to the composite of basic terrain features, geologic features, hydrologic features, vegetation patterns, and anthropogenic features that influence the visual appeal of an area for residents or visitors. The LX Project would cross state and privately owned lands, including less than one mile of state forest. The LX Project would also cross one National Scenic Byway, but would not cross any federal lands, or national or state designated wild or scenic rivers.

4.8.6.1 Pipelines

Visual resources along the pipeline routes are a function of geology, climate, and historical processes, and include topographic relief, vegetation, water, wildlife, land use, and human uses and development. Approximately 41 percent of the new pipelines would be installed within or parallel to

existing pipeline and/or utility rights-of-way. As a result, the visual resources along this portion of the LX Project have been previously affected by other similar activities.

The area crossed by the pipeline is a mix of forest lands, open lands, agriculture, and other uses, as discussed in section 3.8.1.2. Columbia Gas proposes to generally use a 110-foot-wide construction right-of-way, consisting of 50 feet of permanent right-of-way and 60 feet of temporary construction workspace for the pipelines. As discussed in section 3.8.1, the construction right-of-way would generally be narrowed to 75 feet in wetlands and widened to 125 feet in the steeper terrain between LEX Pipeline MPs 0.0 and 39.0. In the forested portions of the construction right-of-way, trees would be allowed to re-grow; however, larger trees likely would not grow to maturity within the construction right-of-way for decades.

4.8.6.2 Aboveground Facilities

The LX and RXE Projects' aboveground facilities would be installed at locations with aesthetics and topography similar to that described for the pipeline. As described in section 4.8.1.3, aboveground new facilities for both the LX and RXE Project components would primarily affect areas characterized as agricultural, industrial, open land, and forest.

MLVs along the LX Project operational right-of-way would be enclosed by an approximate 50-foot by 50-foot fenced gravel area. Ten of thirteen launchers and receivers would be constructed within the boundaries of existing aboveground facilities, thereby minimizing impacts on visual resources.

Other aboveground facilities, discussed in section 4.8.1.3, would be new industrial facilities. The Lone Oak CS, Oak Hill CS, R-System RS, Grayson CS, and Means CS, would be less than 0.25 mile from the nearest residence. The Lone Oak CS, R-System RS, and Grayson CS would be screened by trees, while the Oak Hill CS and Grayson CS would not be screened. Other regulator stations would generally be screened from view by vegetation.

The Oak Hill site would place a large compressor station into a large cleared agricultural site in plain view of 5 residences that would be located within 1,400 feet north and west of the proposed facility. it would pose new permanent visual impacts on the view shed of nine nearby residences. Columbia Gas has committed to planting evergreen trees and shrubs around the northwest side of the facility. In response to landowner comments, **we recommend that:**

- **<u>Prior to construction</u>, Columbia Gas should file with the Secretary, for review and written approval by the Director of OEP, a visual screening plan for the proposed Oak Hill Compressor Station.**

While the use of the existing Means Meter Station Site for its construction and operation of the proposed Means CS would not be inconsistent with other land uses in the immediate area, it would pose new permanent visual impacts on the view shed of nine nearby residences. In response to our question asking if Columbia Gulf would install visual barriers for these residences, Columbia Gulf replied it would agree to construct a visual barrier if requested and required by agreements or negotiations or required as a noise mitigation measure. However, we believe that visual screening of the proposed Means CS would be a long-term benefit to nearby residences, almost all of which would be located within 100 to 1000 feet. Therefore, **we recommend that:**

- **<u>Prior to construction</u>, Columbia Gulf should file with the Secretary, for review and written approval by the Director of OEP, a visual screening plan for the proposed Means Compressor Station.**

4.8.6.3 Contractor Yards

The contractor yards would be on lands classified as forest, open land, agriculture, open water, one PFO wetland, and developed land. Following construction, the disturbed areas would be allowed to revegetate and contours would be restored to pre-construction conditions, unless otherwise dictated by the landowner.

4.8.6.4 Access Roads

Columbia Gas would construct temporary and permanent access roads as a part of pipeline and aboveground facility construction, as described in section 4.8.1.5. Access roads would be maintained at a width of either 10 or 25 feet. Most of these roads are currently paved, graveled, or have dirt surfaces, and would require minor improvements. Such improvements would not substantially change visual conditions in the LX Project area. Construction of the LX Project would require some tree clearing for access roads, in addition to grading and graveling, affecting 94.9 acres.

After construction, roads used for temporary access would be returned to pre-construction conditions, unless another arrangement is mutually agreed upon with the landowner. The permanent access roads retained for operation would require 10.8 acres of land. In general, permanent roads would not substantially change visual conditions in the LX or RXE Project areas. Columbia Gulf does not propose to construct any access roads as part of the RXE Project and would use existing roads.

4.8.6.5 Scenic Byways

The LEX Pipeline route crosses the Ohio River National Scenic Byway at MP 25.4 in Monroe County, Ohio. To avoid disruption of the roadway and traffic flow, Columbia Gas proposes to use the HDD construction technique to cross the byway, resulting in minimal potential visual impacts. During construction, some activity may be seen from the roadway. This impact would be temporary, occurring only during construction activities associated with the HDD. Any additional mitigation measures required would be addressed through the permitting process with the Ohio DOT.

4.8.6.6 Agricultural Lands and Open Lands

About 40 percent of the pipeline route would be within or adjacent to existing rights-of-way for pipelines, electric transmission lines, or roads. Visual impacts associated with pipeline construction in agricultural and open land areas along the route would be temporary, due to the presence of construction equipment and post-construction visual scarring. In agricultural land, visual scarring would remain within the right-of-way until new crops are planted. After replanting, remaining visual impact from pipeline construction would be minor, but visual evidence of construction may last for a few years. Visual impacts at new aboveground facilities in agricultural or open lands would be permanent.

4.8.6.7 Forested Land

The LX Project would affect 1,380.6 acres of forested land during construction, of which, 515.6 acres would be within the permanent right-of-way or within boundaries of aboveground facilities. The RXE Project would affect 0.5 acre of forested land during construction, of which 0.1 acre would be within the boundary of the Grayson CS. Trees within the construction right-of-way would be cleared. Columbia Gas would restore trees and vegetation in the construction right-of-way according to the FERC Plan. The permanent right-of-way would be periodically mowed, and tree growth would be prevented for the life of the LX Project. In the construction right-of-way, trees would be allowed to re-grow; however, larger trees likely would not grow to maturity within the construction right-of-way for decades. Removal of trees along both the permanent and construction rights-of-way in otherwise forested areas would leave a

corridor that would persist for the duration of pipeline operation and that would be visible from vantage points in the LX Project area, particularly roads and trails that cross the pipeline corridor, or locations that offer expansive views of the landscape in the vicinity of the Projects.

4.8.7 Conclusion

Based on our review of potential impacts, the primary land use affected from construction and operation of the LX Project would be long-term impacts on forested land. Implementation of measures in Columbia Gas' and Columbia Gulf's ECSs would minimize impacts on forest to less than significant levels. Visual impacts resulting from the Projects would also be localized within the project areas.

4.9 SOCIOECONOMICS

The socioeconomic conditions and impacts associated with the proposed pipelines, abandonment, compressor stations, regulator stations, odorization stations and bi-directional launcher and/or receiver facilities are discussed below. The primary socioeconomic impacts of the LX Project include influx of construction workers, and temporary impacts on housing from this influx. Secondary effects include impacts on traffic conditions, public services, and tax revenue.

4.9.1 Population and Employment

Table 4.9.1-1 provides information about selected existing socioeconomic conditions in areas affected by the proposed LX and RXE Projects. The Projects would be in southern Ohio, western Pennsylvania, western West Virginia, and northern Kentucky.

The project areas are generally rural with county population densities lower than those of the respective states. The total population of the counties and other communities that would be affected by the proposed projects is approximately 643,000 (table 4.9.1-1). Per capita incomes are generally lower than those of the respective states. Unemployment rates in 2014 varied widely from a low of 3 percent to a high of 19 percent. The major occupations in the project areas include educational, health, and social services, retail, and manufacturing.

Construction of the LX Project pipelines would temporarily increase the population in the general vicinity of the project. Table 4.9.1-2 lists the size of the estimated construction workforce for the projects by spread and facility. The LX construction workforce would be comprised of five spreads of 250 to 600 workers each for an estimated peak workforce of 3,075 during the approximately 12 month long construction period. Construction of the RXE Project would require a peak workforce of 140 workers and take about 9 months to complete. Combined, this number of workers would represent an estimated 0.5 percent increase in the projects area population. A peak total workforce of 600 workers may be present within a single county during periods of coinciding construction spreads. In addition to direct hires, the LX Project would be expected to provide a number of temporary indirect and induced jobs as purchases are made by non-local workers on items such as food, clothing, lodging, gasoline, and entertainment. The jobs would have a temporary, stimulatory effect on the local economy (section 4.9.6). A study commissioned by Columbia Gas to examine the economic benefits found that the projects would generate approximately 3,700 indirect and induced jobs in Ohio and West Virginia in 2017 with approximately $250 million in labor income[21] (Kleinhenz & Associates, 2014).

Population impacts are expected to be temporary and minor in the LX and RXE Project areas. The LX Project pipeline effects on the total population would include the influx of non-local construction workers and any family members accompanying them. Assuming the construction workforce comprises a

[21] Indirect impacts are changes in spending by suppliers whose goods and services are used in the Project. Induced impacts result from changes in the directly and indirectly affected industry sectors.

maximum of 3,215 individuals and approximately 75 percent of the total workforce would be non-local; there would be an influx of about 2,400 workers into the area due to the project. The influx may be higher, however, if workers bring family members with them. The U.S. Census Bureau (2014) reports the average household size as 2.6 persons. Assuming that half these workers bring family members with them the population in the area could increase by an additional 1,900 people during construction for a total of approximately 4,300. Given the population of the project area (approximately 643,000) and distribution of the construction workforce, the addition of 4,300 people would not be a significant change.

TABLE 4.9.1-1
Existing Socioeconomic Conditions in the LX and RXE Project Areas

Geography	Population 2014[a]	Population Density 2010[b]	Per Capita Income 2013 (dollars)	Civilian Labor Force, 2014	Unemploy-ment Rate 2014 (percent)	Top Three Industries[a]
LX						
Ohio	11,560,380	282	$26,046	5,848,381	5.8	A, B, C
Fairfield County	148,067	290	$27,031	75186	4.7	A, C, B
Sugar Grove Village	411	1,473	$16,902	249	12.3	A, D, E
Hocking County	29,111	70	$21,037	13,665	5.7	A, B, C
Rockbridge CDP	226	481.8	$10,072	111	n/a	C, F, D
Jackson	32,952	79	$19,405	14,846	11.8	A, B, C
Oak Hill Village	1,777	1,359	$18,477	741	7.4	A, F ,B
Lawrence County	62,100	138	$21,365	26,621	4.6	A, B, C
Monroe County	14,590	32	$21,487	6,136	8.4	A, C, F
Morgan County	14,977	36	$21,027	6,376	4.8	A, B, C
Muskingum County	85,947	130	$20,775	40,881	5.8	A, C, B
Noble County	14,561	37	$18,853	4,821	4.1	A, B, C
Summerfield Village	235	684	$23,671	80	19.0	A, C, F
Perry County	36,000	88	$19,372	16,454	6.4	A, B, C
Vinton County	13,319	33	$18,101	5,808	6.7	A, B, F
McArthur Village	1,883	1,262	$19,058	830	7.9	A, B, F
Pennsylvania	12,758,729	284	$28,502	6,502,948	8.6	A, B, C
Greene County	38,171	67	$21,819	16,021	3.2	A, G, C
West Virginia	1,853,881	77	$22,966	820,262	4.4	A, C, D
Marshall County	32,716	108	$24,329	14,578	4.2	A, C, D
Moundsville City	8,960	3,205	$28,909	3,951	5.4	A, C, D
Wayne County	41,735	84	$19,497	16,714	9.5	A, C, B
RXE						
Kentucky	4,413,457	110	$23,741	2,063,756	5.5	A, B, C
Carter County	27,439	68	$19,536	11,571	12.1	A, C, B
Grayson City	4,148	1,633	$18,872	1,996	7.0	A, C, D
Menifee County	6,287	31	$16,464	2,490	16.6	A, B, C
Montgomery County	27,474	134	$21,057	12,209	13.2	B, A, C

Incorporated Places and CDPs included only for new, not abandoned facilities
Sources: U.S. Census Bureau 2014; U.S. Census Bureau 2015
CDP = Census Designated Place
n/a - not available
a. A = Educational services, and health care and social assistance; B = Manufacturing; C = Retail Trade; D = Arts, entertainment, and recreation, and accommodation and food services; E = Public Administration; F = Construction; G = Agriculture, forestry, fishing and hunting, and mining;

TABLE 4.9.1-2 Anticipated Construction Schedule and Workforce Requirements			
Pipeline/Facility	**Anticipated Duration of Tree Felling**	**Anticipated Duration of Pipeline/Facility Installation**	**Number of Workers Anticipated During Peak Construction Periods**
LX			
Pipeline Facilities			
Spread 1			
LEX (MPs 0.0 - 24.5)	11/15/16 - 3/31/17	3/29/17 - 10/31/17	575
Spread 2			
LEX (MPs 24.5 - 69.5)	11/1/16 - 3/31/17	3/13/17 -10/27/17	600
Spread 3			
LEX (MPs 69.5 - 110.5)	11/1/16 - 3/31/17	4/17/17 - 9/30/17	525
Spread 4			
LEX (MPs 110.5 - 129.6)	11/15/16 - 3/15/17	4/17/17 - 9/30/17	600
LEX1			
R-801 Loop			
R-501 Abandonment			
Spread 5			
BM-111 Loop	11/1/16 - 3/31/17	4/1/17 - 10/31/17	250
Pipeline Facilities Subtotal			***2,550***
Aboveground Facilities			
Compressor Stations			
Lone Oak CS	11/15/16	3/15/17 –11/1/17	70
Summerfield CS	11/15/16	3/15/17 –11/1/17	70
Oak Hill CS	N/A	1/1/17 –11/1/17	70
Crawford CS	N/A	1/1/17 –11/1/17	70
Ceredo CS	N/A	1/1/17 –11/1/17	70
Regulator Stations			
K-260 RS	11/15/16	1/1/17 –11/1/17	20
R-System RS	11/15/16	1/1/17 –11/1/17	20
Benton RS	11/15/16	1/1/17 –11/1/17	20
RS-1286	11/15/16	1/1/17 –11/1/17	20
McArthur RS	11/15/16	1/1/17 –11/1/17	20
Odorization Sites			
Benton CS	N/A	1/1/17 –11/1/17	15
R-486 OS	11/15/16	1/1/17 –11/1/17	15
R-130 OS	11/15/16	1/1/17 –11/1/17	15
R-543 OS	11/15/16	1/1/17 –11/1/17	15
R-300/R-500 OS	11/15/16	1/1/17 –11/1/17	15
Aboveground Facilities Subtotal			***525***
LX Total			**3,075**
RXE			
Grayson CS			70
Means CS			70
RXE Total			**140**
Projects Total			***3,215***

Columbia Gas and Columbia Gulf estimate that they would hire new full-time, local employees to operate and maintain the facilities as follows: 15 to 20 for the LX facilities and 8 for the RXE compressor stations. The addition of up to 28 households would not be a significant change for the local population. Columbia Gas and Columbia Gulf intend to hire local workers to the extent practicable including local unemployed and local low income workers.

Columbia Gas expects the LX Project construction workforce would consist of personnel hired locally as well as from outside the LX Project area and would include pipeline construction specialists, supervisory personnel, and inspectors who would temporarily relocate to the LX Project area. Columbia Gas expects that up to 50 percent of the construction workers would be local hires, including those from local labor unions. Columbia Gas intends to hire local workers to the extent practicable including local unemployed and local low income workers. Columbia Gulf expects the RXE construction workforce would consist of personnel hired from outside the RXE area and would include compressor station construction specialists, supervisory personnel, and inspectors, who would temporarily relocate to the area. The result of LX and RXE Projects would be a temporary, but positive impact on employment for counties within the project areas.

4.9.2 Housing

Housing statistics for the counties affected by the proposed project are presented in table 4.9.2-1. Based on a five-year average (2010-2014), the number of vacant housing units across the 16 potentially affected counties ranged from a high of approximately 4,500 vacant units in Fairfield County, Ohio to a low of approximately 1,100 vacant units in Noble County, Ohio (U.S. Census Bureau 2013). Rental vacancy rates varied from 3.0 percent in Carter County, Kentucky to 16 percent in Menifee County, Ohio.

Temporary housing availability varies within the counties and communities near the proposed facilities. Temporary housing is available in the form of daily, weekly, and monthly rentals in approximately 60 motels and hotels as well as recreational vehicle parks (see table 4.9.2-1). Other temporary housing such as bed and breakfast facilities, apartments, and vacation properties, would also be available. Therefore, the actual availability of temporary housing would be greater than presented in table 4.9.2-1.

Construction of the projects could temporarily decrease the availability of housing in the area. The projects could have a short-term positive impact on the area rental industry through increased demand and higher rates of occupancy; however, no significant impacts on the local housing markets are expected. Assuming that the local construction workers do not require housing, a total of about 3,000 housing units may be required during peak construction activities. Given the vacancy rates (4.2 percent to 8.3 percent) and the number of vacant housing units in the counties that would be affected by the project (approximately 36,000 among all 16 affected counties), construction crews should not encounter difficulty in finding temporary housing. At a maximum, the workforce would use about 9 percent of the vacant housing units. While some of the construction activity would be conducted during the tourism season, sufficient temporary housing is still likely to be available, though may be more difficult to find and/or more expensive to secure.

The estimated 15 to 28 new long-term employees required for operation of the projects would have no measurable impact on housing in the project areas.

TABLE 4.9.2-1
Housing by County in the LX and RXE Project Areas

State/County	Total Housing Units[a]	Renter Occupied Units[a]	Rental Vacancy Rate (percent)[a]	Vacant Housing Units[a]	Units for Seasonal, Recreational, or Occasional Use [b]	Number of RV Parks [b]	Number of Hotels and Motels [c]
LX							
Ohio							
Fairfield	59,107	15,428	5.6	4,526	719	5	7
Hocking	13,367	2,903	6.6	1,941	936	7	3
Jackson	14,574	4,115	4.2	1,370	277	2	6
Lawrence	27,474	6,123	6.9	3,852	284	4	2
Monroe	7,525	1,369	7.7	1,469	686	1	2
Morgan	7,858	1,393	8.9	1,802	1,158	5	3
Muskingum	37,906	11,076	8.1	3,746	528	10	12
Noble	6,037	886	6.9	1,121	763	1	1
Perry	15,162	3,608	6.2	1,525	374	2	1
Vinton	6,240	1,289	12.2	1,103	486	2	0
Pennsylvania							
Greene	16,440	3,864	6.0	2,057	414	4	7
West Virginia							
Marshall	15,866	3,156	9.0	2,019	507	4	5
Wayne	19,235	3,745	10.0	2,478	258	3	2
RXE							
Kentucky							
Carter	12,287	2,365	3.0	1,762	327	3	5
Menifee	3,890	567	16.1	1,486	873	2	
Montgomery	11,711	3,597	7.2	1,423	89	0	4

a. U.S. Census Bureau 2014
b. U.S. Census Bureau 2015
c Good Sam Club, 2014; Google Maps, 2015

4.9.3 Public Services

A wide range of public services and facilities is present in communities in the projects areas including law enforcement, emergency services, fire departments, and community and medical services (see table 4.9.3-1). Community medical services typically provide short term or continuing general health care services and can respond to minor or routine medical needs. Emergency medical services include facilities able to respond to injuries or illnesses that require immediate medical attention and include hospitals equipped with trauma centers and 24-hour emergency clinics.

Based on the number of public services and facilities, there appears to be adequate public service infrastructure in the project vicinity to accommodate the temporary needs of the peak total workforce of 600 workers that may be present within a single county during periods of coinciding construction spreads.

TABLE 4.9.3-1 Existing Public Services and Facilities by County in the LX and RXE Project Areas				
State/County	**Community Medical Services [a]**	**Emergency Medical Services [a]**	**Police Services**	**Fire Services**
LX				
Ohio				
Fairfield	7	7	14	25
Hocking	1	1	3	9
Jackson	3	3	5	8
Lawrence	2	4	6	16
Monroe	1	1	6	17
Morgan	2	0	2	6
Muskingum	2	2	6	19
Noble	2	0	2	5
Perry	1	0	10	10
Vinton	1	0	3	5
Pennsylvania				
Greene	12	5	5	16
West Virginia				
Marshall	1	1	7	15
Wayne	1	1	8	8
RXE				
Kentucky				
Carter	0	0	2	3
Menifee	0	0	2	1
Montgomery	1	1	2	4

Source: Google Earth, 2014., U.S. Census, 2007

Columbia Gas and Columbia Gulf states that the projects would fully adhere to regulatory requirements pertaining to safety and that these safety regulations would be reinforced by Columbia Gas' and Columbia Gulf's comprehensive and strictly enforced corporate practices. In the event of an accident, there could be need for police, fire, and/or medical services, depending on the type of emergency; however, the anticipated demand for these services is not expected to exceed the existing capabilities of the emergency service infrastructure. Short-term impacts on certain other public services are possible, which would include the need for localized police assistance or certified flaggers to control traffic flow during construction activities. Additional discussion of traffic and public service assistance necessary to support traffic controls is provided in section 4.9.4.

No schools are within 100 feet of the proposed pipeline route. The closest school to the LX Project facilities is Berne Union High School in the Village of Sugar Grove, Fairfield County Ohio, approximately 0.4 miles from the LEX1 Pipeline. Based on the duration of the construction schedule, it is unlikely that families of workers would relocate to the area, since this would require temporarily switching students to a new school, and presumably back to their previous school the following year. Therefore, we conclude that a small number of construction workers would choose to relocate their families. Those students that are relocated would reside throughout the LX Project area and would be dispersed among multiple schools and school districts. Based on the number of schools in the pipeline LX Project area, there appears to be adequate education infrastructure in the vicinity of the proposed pipeline to accommodate any temporary educational needs of the non-local construction workers and their families.

In summary, there are ample public services available in the area to meet the needs of the projects. Additional discussion on the safety measures that would be implemented for the projects is provided in section 4.12.

The estimated 15 to 28 new long-term employees required for operation of the LX Project would have a permanent but negligible impact on public services in the LX Project areas.

4.9.4 Transportation and Traffic

Principal roadways providing access to the projects' area include I-70 and I-64. However, the majority of the projects would be in rural areas, and most of the roads impacted by the LX Project would be county or private roads. Table 4.9.4-1 lists the major roads that would be used by project traffic, in addition to proposed access roads.

Construction of the projects could affect transportation and traffic across and within roadways and railroads due to increased vehicle traffic associated with the commuting of the construction workforce to the work area as well as the movement of construction vehicles and delivery of equipment and materials. We received a comment that in past, the contractors for pipeline projects in this area stop traffic to load/unload instead of using off-road staging areas. The commenter requests that at least one lane be kept open for unimpeded traffic by the residents.

Columbia Gas and Columbia Gulf anticipate that workers for both projects would carpool to the worksites in order to keep traffic to a minimum. Columbia Gas and Columbia Gulf would establish parking areas for construction workers as necessary. Once equipment and materials reach the construction workspace, the majority of construction traffic would be confined to those spaces.

Columbia Gas states they would minimize the amount of heavy traffic, including oversize/overweight loads, during the peak travel times of the day, and during the school year. It also states it would work with the local school districts to minimize heavy traffic during school bus pick up and drop off times in the vicinity of the projects.

Columbia Gas has prepared a Traffic Control Plan[22] to manage traffic flow through the project area. The plan gives consideration to the safety of employees and contractors working on the project as well as to the public traveling through the work zone in motor vehicles, bicycles or as pedestrians. Columbia Gas would initiate discussions with local officials about minimizing the short-term, localized impacts on roadways, and that it would use appropriate traffic control measures, such as flagmen and signs, as necessary, to ensure local traffic safety.

Based on the anticipated size of the workforce, scale of construction of the proposed projects, and the capacity of existing project area roadways, the projects would be expected to have only minor and temporary impacts on area traffic and transportation.

[22] Columbia Gas' Traffic Control Plan for the LX Project is available on FERC's eLibrary website at http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514, Accession No. 20151023-5090, file titled "20151023_CP15-514-000-27_Vol_I_RR05_App5A-5B.PDF" (Appendix B)

TABLE 4.9.4-1 Major Roads by County in the LX and RXE Project Areas	
State/County	**Roads**
LX	
Ohio	
Fairfield	US 22, US 33, OH 37, OH 188
Hocking	US 33, OH 56, OH 93, OH 328, OH 664
Jackson	US 35, OH 32, OH 93
Lawrence	US 52, OH 775, OH 243
Monroe	OH 7, OH 78, OH 800
Morgan	OH 60, OH 78, OH 669, OH 376
Muskingum	I-70, US 22, US 40, OH 16, OH 284
Noble	I-77, OH 78, OH 821
Perry	US 22, OH 13 , OH 93, OH 312, OH 668
Vinton	US 50, OH 32, OH 56, OH 93
Pennsylvania	
Greene	US 79, PA2 21
West Virginia	
Marshall	US 250, WV 2, WV 88, WV 891
Wayne	I 64, US 52, US 60, WV 75, WV 152, WV 75
RXE	
Kentucky	
Carter	I-64, US-60, KY-1
Menifee	US 460W, KY 713 (Hope-Means Road and Hawkins Branch Road)
Montgomery	I-64, US 460E, KY 713 (Hope-Means Road)
Source: Google Maps 201.	

4.9.4.1 Construction Across and Within Roadways and Railroads

The LX Project pipeline elements would require 365 road, railroad, and major utility crossings, including 180 road crossings, 180 utility crossings, and 5 railroad crossings. The RXE Project would not require roadway or railroad crossings. Roads would either be conventionally bored, open-cut, or crossed by HDD. All railroads would be crossed by HDD except for one abandoned railroad (at milepost 107.2) which would be crossed by conventional bore.

Potential impacts associated with crossings include disruption of traffic flows, disturbance of existing underground utilities such as water and sewer lines, and hindrance of emergency vehicle access. Any impacts would be temporary. Columbia Gas would be responsible for obtaining crossing permits from the applicable federal, state, and local agencies, which would dictate specific requirements for the day-to-day construction activities and methods at each crossing, and bonding. Columbia Gas has committed to coordinating with the applicable federal, state, or local authority to develop a plan to repair any damaged road to pre-construction conditions. Based on Columbia Gas' proposed avoidance and mitigation measures, we expect the impacts from construction across and within roadways and railroads to be minor and temporary.

4.9.5 Property Values

We received comments concerning compensation for loss of resources, and concern of use of easement agreements to use properties. A specific comment asked the Commission to consider the value of pasture land especially in southeastern Ohio and West Virginia where in some counties the value of

pastureland is greater than crop land and many small farms in the region focus on animal husbandry as the major portion of on-farm income.

Columbia Gas has committed to mitigate for impacts on agricultural producers by compensating landowners affected by the LX Project for lost crop production, and to compensate for construction related damages, such as those associated with residential areas, crops, and pasture. As stated is section 4.8.1.2, areas disturbed by construction would be allowed to revegetate to previous conditions and contours would be restored to pre-construction conditions following the completion of construction activities. Restoration of the pasture land would, therefore, minimize the potential impacts on the value of the property. If the LX and RXE Projects require temporary or permanent use of land affecting property owner income, normal practice is for local appraisers to review the placement of the pipeline or facilities, and conduct appraisals on an individual property basis as a basis for compensation. As such, we conclude that impacts on property values, especially with regard to pasture land, would not be significant.

4.9.6 Economy and Tax

Construction and operation of the LX and RXE Projects would positively benefit local communities through increased sales and property tax revenues, increased construction payroll, local material purchased, and use of local vendors.

Table 4.9.6-1 provides data regarding construction expenditures for the proposed LX and RXE Projects and estimated property taxes that would be paid upon completion of the Projects. Columbia Gas anticipates construction payroll would total approximately $568 million, including approximately $427 million in Ohio and approximately $141 million in West Virginia[23]. Columbia Gulf estimates construction payroll for RXE at $3.5 million. Material costs are estimated at approximately $924 million for LX and approximately $1.7 million for RXE[24].

Columbia Gas estimates that additional money would be spent locally on construction equipment and materials such as cement, asphalt, concrete block, gasoline, steel wire, and truck transportation services. Additional items required for construction would be purchased locally. Approximately 50 percent of pipeline construction workers would be non-local hires, who would most likely temporarily relocate to the pipeline project area. Workers would spend payroll earnings locally, increasing local sales tax revenue totaling approximately $50 million for the affected counties.

While most of the materials for project construction would be purchased from national vendors, common supplies (e.g., stone and concrete) would likely be purchased from vendors in the Project areas. Construction of the Projects would also result in increased state and local sales tax revenues associated with the purchase of some construction materials, as well as goods and services, by the construction workforce.

As noted above in section 4.9.1, in addition to direct hires, the LX Project pipeline would be expected to provide a number of temporary indirect and induced jobs as purchases are made by non-local workers on items such as food, clothing, lodging, gasoline, and entertainment. A study commissioned by Columbia Gas to examine the economic benefits of the proposed LX Project found that the project would generate approximately 3,700 indirect and induced jobs in Ohio and West Virginia in 2017 with approximately $250 million in labor income (Kleinhenz & Associates, 2014). Over the five year construction period, the study found that economic output would total approximately $2.3 billion.

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[23] Columbia Gas did not estimate economic impacts in Pennsylvania. Based on the extent of the project in Pennsylvania, these impacts would be small.

[24] Estimated local purchases only.

TABLE 4.9.6-1
Socioeconomic Impact from Construction and Operation of the LX and RXE Projects

State/County	Construction Expenditures ($millions) Labor	Construction Expenditures ($millions) Materials[a]	Property Taxes ($millions (annual, upon completion)
LX[c]			
Ohio	$ 426.5	$ 694.9	
Fairfield			$ 3.7
Hocking			$ 5.9
Jackson			$ 2.5
Lawrence			<$ 0.1
Monroe			$ 6.0
Morgan			$ 2.9
Muskingum			$ 2.2
Noble			$ 6.2
Perry			$ 5.2
Vinton			$ 2.1
West Virginia	$ 141.1	$ 229.9	
Marshall			$ 2.3
Wayne			$ 1.6
Total LX	**$ 567.6**	**$ 924.8**	
Grand Total LX		**$1,492.5**	**$ 40.6**
Kentucky (RXE)	$ 3.5	$1.7[b]	To be determined
Grand Total LX and RXE		**$1,496**	**$ 40.6**

[a] Includes other expenditures such as right of way and property owner compensation.
[b] Estimated local purchases only.
[c] Pennsylvania not included, see text.
Sources: Kleinhenz & Associates, 2014, Columbia Gas and Columbia Gulf, 2015.

We do not expect the LX and RXE Projects to have any long-term negative economic impact. The pipeline would be installed underground, and any surface impacts, such as damaged roads, would be repaired. Once installed, the pipeline would not impede normal surface traffic or access to businesses, and most pre-construction property uses would be allowed.

The long-term positive economic impacts from the proposed pipeline include an increase in annual property taxes ranging from approximately $6 thousand per year in Lawrence County, Ohio to $6.2 million in Noble County, Ohio. Columbia Gas estimates total annual property taxes at approximately $41 million including $36.7 million in Ohio and $3.9 million in West Virginia. This increase in property taxes paid would benefit the local governments and their budgets annually for the life of the projects. Columbia Gas would be responsible for paying any increased property tax resulting from operation of the LX Project. The landowner would not bear responsibility for increased property taxes resulting from installation or operation of the pipeline. Columbia Gas would compensate landowners in accordance with the terms of the existing permanent easement agreements and for the acquisition of new property and easements, including compensation for construction related damages, such as those associated with residential areas, crops, and pasture land. In the event that a landowner observes damage after the restoration is complete, Columbia Gas would work with the landowner to correct the situation. The effect that an easement may have on property values is an issue that Columbia Gas and landowners negotiate during the easement acquisition process. The easement acquisition process focuses on providing fair compensation to landowners for the right to use the property for pipeline construction and operation.

4.9.7 Environmental Justice

Executive Order 12898 (EO 12898) on Environmental Justice recognizes the importance of using NEPA process to identify and address, as appropriate, any disproportionately high and adverse health or environmental effects of federal programs, policies, and activities on minority populations and low-income populations. Consistent with EO 12898, the CEQ called on federal agencies to actively scrutinize the following issues with respect to environmental justice (CEQ 1997):

- the racial and economic composition of affected communities;
- health related issues that may amplify project effects on minority or low-income individuals; and
- public participation strategies, including community or tribal participation in the process.

The EPA's Environmental Justice Policies focus on enhancing opportunities for residents to participate in decision making. The EPA (2011) states that Environmental Justice involves meaningful involvement so that: "(1) potentially affected community residents have an opportunity to participate in decisions about a proposed activity that would affect their environment and/or health; (2) the public's contributions can influence the regulatory agency's decision; (3) the concerns of all participants involved would be considered in the decision-making process; and (4) the decision makers seek out and facilitate the involvement of those potentially affected."

As discussed in section 2, Columbia Gas and Columbia Gulf have provided many opportunities for public input and comments about the proposed LX and RXE Projects. Columbia Gas and Columbia Gulf met with multiple different stakeholders during the initial developmental stage of the route including local residents and affected landowners. Multiple open house meetings were also held in the LX Project and RXE Project areas for the affected communities and local authorities. The companies also established and maintain a website to share information about the Projects with the public.

In its comments on the draft EIS, the EPA recommended the use of EPA's online Environmental Justice screening and mapping tool "EJSCREEN" which can be accessed at https://www.epa.gov/ejscreen.

Minority populations, defined as African-Americans, Hispanic, Asian, and Native American persons comprise less than 10 percent of the population in each of the counties, incorporated places or CDPs that would be crossed by the LX Project. To further assess whether the minority population in the affected region is substantially greater than the minority population in surrounding areas, we compared county-level demographics to the respective statewide proportions. The proportion of individual minority populations is approximately less than respective state-level statistics in all of the counties affected by the LX and RXE Projects (table 4.9.7-1). According to the 2010 U.S. Census block group statistics and EPA's EJSCREEN tool regarding ethnicity, median income, and poverty levels, FERC did not identify any communities in the LX or RXE project areas in which minority populations were either greater than the state average or greater than 50 percent, which is the EPA's guideline. Therefore, no disproportionate effects of the Projects would result to minority populations.

TABLE 4.9.7-1 Minority Populations in the LX and RXE Project Areas							
Geography	**White Non-Hispanic (%)**	**Black (%)**	**Hispanic (%)**	**Asian (%)**	**Native American (%)**	**Other (%)**	**Two or more races (%)**
United States	**63**	**12**	**17**	**5**	**0.7**	**0.2**	**2**
LX							
Ohio	**81**	**12**	**3**	**2**	**0.1**	**0.1**	**2**
Fairfield County	89	6	2	1	0.1	0.1	2
Sugar Grove Village	100	0.0	0.0	0.0	0.0	0.0	0.3
Hocking County	97	0.8	0.7	0.3	0	0	1
Rockbridge CDP	100	0.0	0.0	0.0	0.0	0.0	0.0
Jackson County	96	0.5	0.9	0.1	0.1	0.1	2
Oak Hill Village	96	0.0	0.0	0.0	0.0	0.0	4
Lawrence County	95	2	0.8	0.2	0.2	0.2	2
Monroe County	98	0.4	0.6	0.0	0.2	0	1
Morgan County	93	4	0.7	0.4	0.3	0.1	2
Muskingum County	92	3	0.8	0.4	0.1	0.2	3
Noble County	92	6	1	0.0	0.2	0.0	1
Summerfield Village	95	0.0	0.0	0.0	0.0	0.0	5
Perry County	97	0.2	0.6	0.2	0.1	0.0	2
Vinton County	97	0.0	0.0	0.1	0.1	0.0	2
McArthur Village	92	0.0	0.1	0.5	0.0	0.0	8
Pennsylvania	**79**	**11**	**6**	**3**	**0.1**	**0.1**	**2**
Greene County	92	5	1	0.4	0.2	0	1
West Virginia	**93**	**3**	**1**	**0.7**	**0.1**	**0.1**	**2**
Marshall County	97	0.7	0.9	0.5	0.1	0.0	0.7
Wayne County	98	0.1	0.6	0.2	0.1	0.0	1
RXE							
Kentucky	**86**	**8**	**3**	**1**	**0.3**	0.0	0.0
Carter County	97	0.7	1	0.2	0.3	0.0	0.0
Grayson City	94	3	1	0.2	0.0	0.0	0.0
Menifee County	95	3	0.8	0.1	0.1	0.0	0.0
Montgomery County	93	3	3	0.7	0.2	0.0	0.0

Sources: Columbia Gas and Columbia Gulf, 2015; Columbia Gas and Columbia Gulf, 2015

The U.S. Census Bureau defines "low-income populations" as those living below the established poverty level. The U.S. Census Bureau also reports the percentage of populations with an income below the poverty level. In order to evaluate the potential for a low-income population to be impacted disproportionately, we compared poverty level rates for counties and places within the LX and RXE Project areas to those of their respective state levels. Income statistics for the project areas are provided in table 4.9.7-2

TABLE 4.9.7-2 Income Statistics for the LX and RXE Project Areas		
Country/State	**Median Household Income (2013)**	**Persons Below Poverty Level, 2014 (%)**
United States	**$53,046**	**15**
LX[a]		
Ohio	**$48,308**	**16**
Fairfield County	$58,786	12
Sugar Grove Village	$50,625	29
Hocking County	$42,089	16
Rockbridge CDP	$35,515	58[c]
Jackson County	$36,356	25
Oak Hill Village	$28,583	29
Lawrence County	$41,552	18
Monroe County	$40,573	19
Morgan County	$37,865	20
Muskingum County	$40,524	18
Noble County	$38,290	15
Summerfield Village	$29,750	9
Perry County	$41,446	20
Vinton County	$36,705	21
McArthur Village	$30,250	35
Pennsylvania	**$52,548**	**13**
Greene County	$44,388	15
West Virginia	**$41,043**	**18**
Marshall County	$40,681	16
Wayne County	$36,964	20
RXE[b]		
Kentucky	**$43,036**	**19**
Carter County	$36,406	20
Grayson City	$34,855	23
Menifee County	$29,108	28
Montgomery County	$37,312	25

Sources: [a] Columbia Gas Transmission, 2015; [b] Columbia Gas Transmission, 2015 [C] US Census Bureau, 2014

Many of the counties crossed by the LX and RXE Projects have poverty rates higher than the national average. Four counties have poverty rates that are meaningfully greater (i.e., over 20 percent higher) than rates for their respective states: Jackson, and Vinton Counties in Ohio and Menifee and Montgomery Counties in Kentucky. In addition several places have very high poverty rates: Sugar Grove Village, Rockbridge CDP, Oak Hill Village and McArthur Village. Several of these counties and places would have the pipeline and/or pipeline facilities (such as regulator stations and compressor facilities).

Impacts on low income populations could occur if such populations were exposed to a disproportionate extent to noise, emissions from exhaust fumes or fugitive dust, or from traffic delays that might, for example, delay workers reaching their jobs. Impacts could also occur to the extent such populations were less able to manage these impacts.

Since the Leach XPress Project would be primarily an underground, linear structure and construction activities would be temporary, FERC utilized the EJSCREEN tool for the permanent aboveground Compressor Stations to evaluate the potential for EJ populations. The Grayson and Means

Compressor Stations are proposed in areas that the U.S. Census identified as containing low-income populations. According to EJSCREEN, 42% of the population within the census block group that the Grayson CS was proposed was identified as low-income. Since 40 percent of the population in Kentucky was identified in the 2010 U.S. Census as low income, this would not be a meaningfully greater population. The Means CS was proposed in two different census blocks, Menifee County and Montgomery County. According to EJSCREEN, 56% of the population in the vicinity of the proposed Means CS was identified as low-income. Although the percentage of low-income populations is 16% above the State average, the Means CS Project would be to expand and existing facility.

As described above, the LX and RXE Projects would have negligible to minor negative impacts and minor to moderate positive impacts on socioeconomic characteristics and economies within the projects area. As discussed throughout this EIS, potentially negative environmental effects associated with the Projects would be minimized and/or mitigated, as applicable. Although the economic composition of the counties and places traversed by the proposed projects shows some deviations from state-level statistics, there is no evidence that the Projects would cause a disproportionate share of adverse environmental or socioeconomic impacts on any racial, ethnic, or socioeconomic group.

The primary health issues related to the proposed Projects would be the temporary increases in dust, equipment emissions, noise, and traffic from project construction. These impacts would occur along the entire pipeline route and in areas with a variety of socioeconomic backgrounds. Columbia Gas would implement a series of measures to minimize such impacts including proven construction related practices to control fugitive dust outlined in the Fugitive Dust Control Plan (4.11.1.3), equipment emissions would meet the standards for mobile sources established by the EPA non-road source emission regulations and imposed on equipment manufacturers. Noise control measures would be implemented during project construction and operation to ensure that noise attributable to the new aboveground facilities would be either less than 55 dBA L_{dn} at nearby NSAs, or where the noise currently attributable to a particular station is greater than 55 dBA L_{dn} the noise attributable to the station modifications would cause no perceptible change to station noise levels. Traffic Management Plans have also been developed for the Project as described in section 4.9.4.

Based on the identified estimated emissions from operation of the proposed operation of the proposed project facilities and review of the modeling analysis, the LX and RXE Projects would result in continued compliance with the NAAQS, which are protective of human health, including children, the elderly, and sensitive populations (see section 4.11.1.4). The project facilities would also be designed, constructed, operated and maintained in accordance with or to exceed PHMSA's minimum federal safety standards in 49 CFR 192. These regulations, which are intended to protect the public and to prevent natural gas facility accidents and failures, apply to all areas along the proposed pipeline routes regardless of the presence or absence of minority or low income populations.

We expect that any impacts on low income populations would be minor and temporary provided Columbia Gas and Columbia Gulf manage noise, air quality, and traffic pursuant to its proposed construction and operation procedures.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA requires FERC to take into account the effects of its undertakings (including the issuance of Certificates) on historic properties and to provide the Advisory Council of Historic Preservation (ACHP) an opportunity to comment on the undertaking. Columbia Gas and Columbia Gulf, as non-federal parties, are assisting FERC in meeting its obligations under Section 106 by providing information, analyses, and recommendations as authorized by 36 CFR 800.2(a)(3). To meet consultation procedures for NEPA, FERC issued NOIs to federal, state, and local agencies, and federally recognized Indian tribes (Tribes) on January 13, 2015 (Docket No. PF14-23-000) and on September 4,

2015 (Docket Nos. CP15-514 and CP15-539). The NOIs contained a paragraph about section 106 of the NHPA, and stated that we use the notice to initiate consultations with State Historic Preservation Offices (SHPOs)[25], and to solicit their views and those of other government agencies, interested Tribes, and the public on the projects' potential effects on historic properties.

4.10.1 Ohio (LX Project)

4.10.1.1 Results of Cultural Resource Investigations in Ohio

From 2014 to 2016, Columbia Gas conducted Phase I archaeological surveys of the LX Project's area of potential effects (APE) for archaeological resources in Ohio, which totals 7,237.5 acres[26] and consists of a 400-foot wide survey corridor (300 foot wide for the R-801 Loop), a 100-foot wide corridor for access roads, and the total acreage for associated facilities. The surveys identified 100 archaeological sites, which range in date from the Middle Archaic period (6000-3500 BC), through the Early and Middle Woodland periods (600 BC-AD 500), to the 19th and 20th centuries. Of the 100 sites, 76 have been determined or were recommended not eligible for listing in the NRHP. Another 21 sites are of undetermined eligibility, but all but two of these sites (33MG224 and 33MG225) would be avoided by reroutes or workspace modifications. The remaining three sites have been determined eligible for listing in the NRHP. One of these sites would be avoided by a reroute, but the other two sites could not be avoided (33VI227 and 33VI781). Columbia Gas has committed to the following measures to mitigate impacts to archaeological sites in Ohio:

- monitoring of 33VI227 and 33VI781 during construction;
- limiting impacts to areas with no intact deposits for 33VI227;
- protection of 33VI781 by matting;
- protection of 33MG224 by matting (for temporary access road); and
- avoidance of 33MG224 and 33MG225 by HDD (for pipeline).

Site plans for avoidance of impacts on 33MG224 and 33MG225 were filed in March 2016. Columbia Gas has not filed other plans for the remainder of these sites or completed the archaeological surveys in Ohio. Pending areas consist of 2.6 miles of pipeline (128.0 acres), 2.1 miles of access roads (25.8 acres), 2.3 acres of temporary workspace along the pipeline abandonment, and 0.9 acres of workspace at compressor station sites.

In 2014 and 2015, Columbia Gas conducted architectural reconnaissance surveys of the LX Project's APE for historic aboveground resources in Ohio, which was defined as a 0.5-mile radius around any proposed permanent aboveground facility that has the potential to visually diminish or alter the setting of a historic property, and on a case-by-case basis for roads. The surveys identified 149 historic aboveground resources, all of which date to the 19th and/or 20th centuries. One of the resources is listed in the NRHP (Frederick Kindleberger Stone House and Stone Barn, MOE0002104), 46 have been determined or were recommended as not eligible, and the remaining 102 are of undetermined eligibility. Additionally, 96 historic farms were reported located in Monroe, Noble, Morgan, Perry, Fairfield, Hocking, Vinton and Jackson counties. The surveys identified no resources with the potential for direct impacts (i.e., physical alteration or demolition) from the LX Project. Columbia Gas recommends further

[25] The SHPO is represented by the Ohio History Connection in Ohio, West Virginia Division of Culture and History in West Virginia, Kentucky Heritage Council in Kentucky and the Pennsylvania Historical and Museum Commission – Bureau for Historic Preservation in Pennsylvania.

[26] The APE for archaeological resources is larger than the land affected during construction as indicated in Section 2 because the survey corridors agreed to with the SHPO are wider.

investigation of Site 69 (ca. 1835 Federal brick house), Site 95 (ca. 1870 Italianate house with late 19th and early 20th century outbuildings), Site 103 (late 19th century dwelling), Site 136 (early 20th century dwelling and late 20th century barn), and Site 140 (the Bell Farmstead, a ca. 1830 dwelling and ca. 1960 outbuildings) to assess indirect (i.e., visual) impacts. Columbia Gas recommends no adverse effects on the remaining 144 resources. Columbia Gas has not filed a report recommending effects to Site 69, Site 95, Site 103, Site 136, and Site 140.

4.10.1.2 Ohio SHPO Consultation

On May 5, 2014, Columbia Gas submitted a cultural resources survey research design for the LX Project to the Ohio SHPO. On September 23, 2015, Columbia Gas provided the Ohio SHPO with information about the LX Project. Initial archaeological survey and architectural reconnaissance reports were submitted to the Ohio SHPO on February 18, 2015. The Ohio SHPO concurred with the archaeological survey report and its recommendations (for 63 archaeological sites) on February 28, 2015. The Ohio SHPO concurred with the architectural reconnaissance report and its recommendations (for 124 resources) on March 24, 2015, but requested that the 34 resources identified for potential impacts be evaluated for NRHP eligibility, and that an assessment of effects be conducted for resources recommended as NRHP eligible. A supplemental archaeological survey report and an addendum architectural reconnaissance report were submitted to the Ohio SHPO on October 16, 2015. The latter report recommends no adverse effects on 33 of the 34 resources mentioned above, and an NRHP evaluation of the remaining resource (Site 103). The Ohio SHPO provided comments on the supplemental archaeological survey report on January 8, 2016, and a revised report was submitted to the Ohio SHPO on February 16, 2016. The Ohio SHPO requested a summary before reviewing the addendum architectural reconnaissance report, which was submitted to the Ohio SHPO on January 21, 2016. A second supplemental archaeological survey report was submitted to the Ohio SHPO on March 16, 2016. The Ohio SHPO provided it comments to the first supplemental archaeological report in a letter dated April 15, 2016, and to the second supplemental archaeological report in a letter dated April 26, 2016. In a letter dated July 8, 2016, Columbia Gas filed a revised summary table for the architectural reconnaissance survey, and stated that additional information regarding the architectural investigations will be addressed in a third report. No additional comments have been filed from the Ohio SHPO.

4.10.2 West Virginia (LX Project)

4.10.2.1 Results of Cultural Resource Investigations in West Virginia

From 2014 to 2016, Columbia Gas conducted Phase I archaeological surveys of the LX Project's APE for archaeological resources in West Virginia, which totals 1,502.8[27] acres and consists of a 400-foot wide survey corridor, a 100-foot wide corridor for access roads, and the total acreage for associated facilities. The surveys identified two archaeological sites and three historic cemeteries. All five sites are of undetermined eligibility, but all but one of these (46MR238) would be avoided by reroutes or workspace modifications. Columbia Gas has committed to the following measures for archaeological sites in West Virginia:

- Avoidance of 46MR238 by HDD.

Columbia Gas has not filed the avoidance plan for this site or completed the archaeological surveys in West Virginia. Pending areas consist of 1.6 miles of pipeline (75.2 acres), 0.1 miles of access roads (0.7 acres), 4.0 acres of pipe yards, and 1.2 acres of workspace at Lone Oak CS.

[27] The APE for archaeological resources is larger than the land affected during construction as indicted in Section 2 because the survey corridors agreed to with the SHPO are wider.

In 2014 and 2015, Columbia Gas conducted architectural reconnaissance surveys of the APE for historic aboveground resources in West Virginia, which was defined as a 0.5-mile radius around any proposed permanent aboveground facility that has the potential to diminish or alter the setting of a historic property, and on a case-by-case basis for access roads. The surveys identified 16 historic aboveground resources that date to the 19th and/or 20th centuries. Additionally, 9 historic farms were reported in Wayne and Marshall Counties. Columbia Gas recommends 14 of the resources, as well as the Ceredo CS in Wayne County, as not eligible for listing in the NRHP. Columbia Gas recommends the two remaining resources as undetermined, but recommends no adverse effects from the LX Project.

4.10.2.2 West Virginia SHPO Consultation

On May 5, 2014, Columbia Gas submitted a cultural resources survey research design for the LX Project to the West Virginia SHPO. On September 23, 2015, Columbia Gas provided the West Virginia SHPO with information on the LX Project. Initial archaeological survey and architectural reconnaissance reports were submitted to the West Virginia SHPO on February 18, 2015. The West Virginia SHPO concurred with the archaeological survey report and its recommendations (for 2 archaeological sites) on March 20, 2015. The West Virginia SHPO concurred with the architectural reconnaissance report and its recommendations (for 1 resource) on March 20, 2015, but requested that a Historic Property Inventory form be submitted for the resource (currently designated as FS 1). A supplemental archaeological survey report and an addendum architectural reconnaissance report were submitted to the West Virginia SHPO on October 16, 2015. The West Virginia SHPO concurred with the reports and their recommendations on November 30, 2015. A second supplemental archaeological survey report was submitted to the West Virginia SHPO on March 16, 2016. In a letter dated April 11, 2016, the West Virginia SHPO responded and stated that the portion of the project area reviewed in the supplemental report did not contain historic properties and no further archaeological investigation would be necessary in this area. However, it was their understanding that additional surveys would be conducted in Spring 2016 for the remainder of the project in West Virginia..

4.10.3 Pennsylvania (LX Project)

4.10.3.1 Results of Cultural Resource Investigations in Pennsylvania

In 2015, Columbia Gas conducted a Phase I archaeological survey of the LX Project's APE for archaeological resources in Pennsylvania, which totals 88.5 acres[28] and consists of a 400-foot wide pipeline corridor and a 100-foot wide corridor for access roads. The survey identified one previously recorded archaeological site dating to the undefined pre-contact and historic periods in the project area. No archaeological resources were encountered during the field investigation, however, including in subsurface excavations conducted within the portion of the previously recorded site that intersects the project area. Data from previous investigations suggest that the site was incorrectly mapped and is actually located just south of the project area.

4.10.3.2 Pennsylvania SHPO Consultation

On April 13, 2015, Columbia Gas submitted a Project Review Form to the Pennsylvania SHPO. On May 8, 2015, the Pennsylvania SHPO responded that a Phase I archaeological survey should be performed and requested additional information before determining the necessity of an architectural reconnaissance survey. Columbia Gas provided the additional information on June 2, 2015, and the Pennsylvania SHPO responded that the proposed LX Project would not affect historic aboveground

[28] The APE for archaeological resources is larger than the land affected during construction as indicted in Section 2 because the survey corridors agreed to with the SHPO are wider.

resources in a letter dated July 8, 2015. Columbia Gas provided project redesign information on August 17, 2015, and the Pennsylvania SHPO reiterated their previous response that the proposed LX Project would not affect historic aboveground resources in a letter dated September 9, 2015. The archaeological survey report was submitted to the Pennsylvania SHPO on October 16, 2015. Pennsylvania SHPO comments were filed and dated November 20, 2015. The Pennsylvania SHPO agrees with the recommendations and that no further archaeological work is necessary.

4.10.4 Kentucky (RXE Project)

4.10.4.1 Results of Cultural Resource Investigations in Kentucky

In October 2014 and February 2015, Columbia Gulf conducted a cultural resources survey of the RXE Project in Kentucky. The APE for archaeological resources totals 33.8[29] acres and consists of the Means CS (20.9 acres) and the Grayson CS Site 6 (12.9 acres). The APE for historic aboveground resources was defined as the geographic area from which any permanent infrastructure has the potential to visually diminish or alter the setting of a historic property. The archaeological survey of the Grayson CS identified two archaeological sites. Both sites were recommended not eligible for listing in the NRHP. The archaeological survey of the Means CS identified three previously recorded and no new archaeological sites. One of the sites has been recommended not eligible for listing in the NRHP. The other two sites have been recommended as undetermined (15MF490 and 15MF492). Columbia Gulf has committed to the following measures for archaeological sites in Kentucky:

- Avoidance or Phase II archaeological evaluation of 15MF490 and 15MF492.

Columbia Gulf has not filed avoidance plans or archaeological evaluation reports for these two sites. The architectural reconnaissance survey identified no historic aboveground resources within the APE of the Means CS or the Grayson CS Site 6.

4.10.4.2 Kentucky SHPO Consultation

On October 1, 2014, Columbia Gulf submitted a cultural resources survey research design for the RXE Project to the Kentucky SHPO. A cultural resources survey report was submitted to the Kentucky SHPO on July 15, 2015. Kentucky SHPO comments on the report have not been filed.

4.10.5 Tribal Consultation

On May 8, 2014, Columbia Gas sent notification letters for the proposed LX Project to the following 25 federally recognized Indian tribes (Tribes): Absentee-Shawnee Tribe of Oklahoma; Catawba Indian Nation; Cayuga Nation; Cherokee Nation; Citizen Potawatomi Nation of Oklahoma; Delaware Nation; Delaware Tribe of Indians; Eastern Band of Cherokee Indians; Eastern Shawnee Tribe of Oklahoma; Forest County Potawatomi Community, Wisconsin; Miami Tribe of Oklahoma; Oneida Indian Nation; Oneida Tribe of Indians of Wisconsin; Onondaga Nation; Ottawa Tribe of Oklahoma; Peoria Tribe of Oklahoma; Seneca Nation of Indians; Seneca-Cayuga Tribe of Oklahoma; Shawnee Tribe of Oklahoma; St. Regis Mohawk Tribe; Tonawanda Band of Seneca Indians; Turtle Mountain Band of Chippewa Indians of North Dakota; Tuscarora Nation; United Keetoowah Band of Cherokee Indians; and Wyandotte Nation. The letters were sent to inform each tribe about the LX Project and to request that they communicate any potential concerns they might have with respect to potential impacts on cultural resources, including traditional cultural properties.

[29] Slightly larger than the land affected during construction as indicated in Section 2, which is 32.2 acres.

Due to deviations in the LX Project, update letters were sent on March 27, 2015 to the following 14 previously contacted tribes: Absentee-Shawnee Tribe of Oklahoma; Cayuga Nation; Delaware Nation; Delaware Tribe of Indians; Eastern Shawnee Tribe of Oklahoma; Oneida Indian Nation; Oneida Nation of Wisconsin; Onondaga Nation; Seneca Nation of Indians; Seneca-Cayuga Tribe of Oklahoma; Shawnee Tribe of Oklahoma; St. Regis Mohawk Tribe; Tonawanda Seneca Nation; and Tuscarora Nation. In addition, a Project notification letter was sent on March 27, 2015 to the Stockbridge-Munsee Band of the Mohican Nation, Wisconsin.

The Delaware Tribe of Indians responded in a letter dated June 27, 2014 in which they requested to participate as a consulting party. They also requested an archaeological survey, a copy of the final archaeological survey report, that construction not begin until they review the report and provide written comments, and that they be notified if any human remains are discovered. Copies of the archaeological survey reports were sent to the tribe on October 19, 2015. In a letter dated January 28, 2016, the Delaware Tribe of Indians responded agreeing with the avoidance of cultural resources. They also indicated that there are no known religious or culturally significant sites in the project area and have no objection to the project reroutes. Columbia Gas submitted additional reporting to the Delaware Tribe of Indians on March 16, 2016. No other responses have been filed.

The Catawba Indian Nation responded in a letter dated July 22, 2015 that they have no immediate concerns within the boundaries of the proposed project areas, but requested that they be notified if any unanticipated discovery is encountered during construction. No other responses have been filed.

On June 6, 2015, FERC sent consultation letters to the following 19 Tribes to request their comments on the proposed LX Project: Absentee-Shawnee Tribe of Oklahoma; Cayuga Nation; Delaware Nation; Delaware Tribe of Indians; Eastern Shawnee Tribe of Oklahoma; Miami Tribe of Oklahoma; Oneida Indian Nation; Oneida Tribe of Indians of Wisconsin; Onondaga Nation; Ottawa Tribe of Oklahoma; Peoria Tribe of Oklahoma; Seneca Nation of Indians; Seneca-Cayuga Tribe of Oklahoma; Shawnee Tribe of Oklahoma; St. Regis Mohawk Tribe; Stockbridge-Munsee Band of the Mohican Nation; Tonawanda Band of Seneca Indians; Tuscarora Nation; and Wyandotte Nation. The letters are provided in appendix Q. None of the tribes responded.

On June 30, 2015, Columbia Gulf sent notification letters for the proposed RXE Project to the following Tribes: Delaware Nation; Eastern Bank of Cherokee Indians of North Carolina; Miami Tribe of Oklahoma; Peoria Tribe of Indians of Oklahoma; and United Keetoowah Band of Cherokee Indians in Oklahoma. The letters were to inform each tribe about the RXE Project and to request that they communicate any potential concerns they might have with respect to cultural resources, including traditional cultural properties. No responses have been filed.

4.10.6 Unanticipated Discovery Plans

For the LX Project, Columbia Gas filed "Unanticipated Discoveries and Emergency Procedures" for the unanticipated discovery of cultural resources or human remains during construction in Ohio, Pennsylvania, and West Virginia. The plans were submitted to the Ohio and West Virginia SHPOs on January 16, 2015, and to the Pennsylvania SHPO, on April 13, 2015. The West Virginia SHPO concurred with the plan on February 3, 2015, and the Pennsylvania SHPO concurred on May 8, 2015. No other comments have been filed. FERC staff finds the plans acceptable.

For the RXE Project, Columbia Gulf filed a "Procedure Guiding the Discovery of Unanticipated Cultural Resources and Human Remains." Columbia Gulf has not filed documentation that the plan has been submitted to the Kentucky SHPO. However, FERC staff finds the plan acceptable.

4.10.7 General Impacts and Mitigation

Compliance with Section 106 of the NHPA has not been completed for the Projects. To ensure that FERC's responsibilities under the NHPA and its implementing regulations are met, **we recommend that:**

- **Columbia Gas and Columbia Gulf should not begin construction of facilities and/or use of (all) staging, storage, or temporary work areas and new or to-be improved access roads in Ohio, West Virginia, Pennsylvania, or Kentucky <u>until</u>:**

  a. Columbia Gas and Columbia Gulf file with the Secretary:

  i. cultural resource identification survey reports for any previously unreported areas in Ohio, and West Virginia;

  ii. evaluation studies, as necessary, to provide NRHP-eligibility recommendations for historic aboveground resources Site 103, Site 136, and Site 140 in Ohio and archaeological sites 15MF490 and 15MF492 in Kentucky;

  iii. any other reports, evaluation studies, or plans (monitoring, avoidance, etc.) not yet submitted; and

  iv. comments on survey reports, UDPs, and any other studies or plans from the Ohio, West Virginia, and Kentucky SHPOs and any other consulting parties;

  b. The ACHP is afforded an opportunity to comment if historic properties would be adversely affected; and

  c. FERC staff reviews and the Director of OEP approves the cultural resources reports and plans, and notifies Columbia Gas and Columbia Gulf in writing that treatment plans/mitigation measures may be implemented and/or construction may proceed.

  All material filed with the Commission containing location, character, and ownership information about cultural resources must have a cover and any relevant pages therein clearly labeled with the following in bold lettering: "CONTAINS PRIVILEGED INFORMATION - DO NOT RELEASE."

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

Air quality would be affected by construction and operation of the proposed LX and RXE Projects. Though air emissions would be generated by operation of equipment during construction of the projects' facilities, most air emissions associated with the projects would result from the long-term operation of the compressor stations. This section of the EIS addresses the potential effects on air quality resulting from emissions from construction and operation of the proposed projects, and describes the applicable regulatory requirements.

4.11.1.1 Existing Air Quality

The regional climate of the LX and RXE Project areas, including northwest and southwest West Virginia, southwest Pennsylvania, southeast Ohio, and northeast Kentucky, is generally warm during

summer, cold during winter, and precipitation is generally well distributed throughout the year. Based on climatological data measured in McConnelsville, Ohio, which is located near the center of the affected LX Project region, the annual mean temperature is 52 °F with an annual mean daily minimum of 40 °F and an annual mean daily maximum of 63 °F. Climatological data measured in Grayson and Mount Sterling, Kentucky, which are representative of the climatic conditions of the RXE Project area, identifies the annual mean temperature of 53 °F with an annual mean daily minimum of 41 °F and an annual mean daily maximum of 66 °F.

Ambient Air Quality Standards

The CAA was enacted by Congress to protect the public from the adverse effects of air pollution. The EPA has developed National Ambient Air Quality Standards (NAAQS) to protect human health and welfare. The CAA identifies two types of NAAQS, primary and secondary. Primary standards set limits to protect human health, including the health of "sensitive" populations, such as children, the elderly, and those with chronic respiratory problems. Secondary standards set limits designed to protect public welfare, including economic interests, such as protection from damage to animals, crops, vegetation, and buildings, and protection against decreased visibility.

NAAQS have been developed for six criteria air pollutants, including sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM), ozone (O_3), and lead (Pb). The PM standard includes two categories, PM with a diameter of 10 microns or less (PM_{10}) and PM with a diameter of 2.5 microns or less ($PM_{2.5}$). Ozone, unlike the other substances for which NAAQS have been established, is not emitted directly into the air from emission sources. It is, however, formed near ground level as a result of a chemical reaction between oxides of nitrogen (NO_X) and volatile organic compounds (VOCs) in the presence of sunlight. As a result, emissions of NO_X and VOCs are regulated by the EPA as they are considered "precursors" to the formation of ozone. The current NAAQS are listed on EPA's website at http://www3.epa.gov/ttn/naaqs/criteria.html. The KYDEP, WVDEP, OEPA, and PADEP have all adopted the NAAQS, as promulgated by the EPA.

The EPA also defines air pollution to include a mix of six long-lived and directly emitted greenhouse gases (GHGs), finding that the presence of these GHGs in the atmosphere may endanger public health and welfare through climate change. As with any fossil fuel-fired project or activity, the proposed LX and RXE Projects would contribute GHG emissions. The primary GHGs that would be produced by the proposed projects include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Emissions of GHGs are typically quantified and regulated in units of carbon dioxide equivalents (CO_2e). The CO_2e takes into account the global warming potential (GWP) of each GHG. The GWP is a ratio relative to CO_2 of a particular GHG's ability to absorb solar radiation as well its residence time within the atmosphere. Thus, CO_2 has a GWP of 1, CH_4 has a GWP of 25, and N_2O has a GWP of 298.[30] To obtain the CO_2e quantity, the mass of the particular GHG is multiplied by the corresponding GWP. The CO_2e value for each of the GHG compounds is summed to obtain the total CO_2e GHG emissions.

Air Quality Control Regions and Attainment Status

Air quality control regions (AQCR) are areas established by EPA and local agencies, in accordance with section 107 of the CAA, for air quality planning purposes in which State Implementation Plans describe how NAAQS would be achieved and maintained. The AQCRs are intra- and interstate regions such as large metropolitan areas where improvement of the air quality in one portion of the

[30] These GWPs are based on a 100-year time period. We have selected their use over other published GWPs and other timeframes because these are the GWPs EPA has established for reporting of GHG emissions and air permitting requirements. This allows for a consistent comparison with these regulatory requirements.

AQCR requires emission reductions throughout the AQCR. Each AQCR, or portion thereof, is designated based on compliance with the NAAQS. Areas are designated attainment, unclassifiable, nonattainment, or maintenance on a pollutant-by-pollutant basis. Areas in compliance, or below the NAAQS, are designated as attainment, while areas not in compliance, or above the NAAQS, are designated as a nonattainment. Areas that were designated nonattainment but have since demonstrated compliance with the NAAQS are designated as "maintenance" for that pollutant. Maintenance areas may be subject to more stringent regulatory requirements to ensure continued attainment of the NAAQS pollutant. Areas that lack sufficient data to determine attainment status are designated unclassifiable and treated as attainment areas.

The entirety of the LX Project is designated attainment or unclassifiable for all criteria air pollutants, except as indicated below:

- Fairfield County, Ohio, is a marginal nonattainment area for the 2008 8-hour ozone standard. [31]
- The Clay, Franklin, and Washington tax districts within Marshall County, West Virginia, are designated as nonattainment for SO_2.
- Marshall and Wayne Counties, West Virginia, and Fairfield and Lawrence Counties, Ohio, are maintenance areas for the 1997 $PM_{2.5}$ standard.

The LX facilities located within the nonattainment areas or maintenance areas identified above include the following:

- The Crawford CS and portions of LEX and LEX1 Pipelines are located within the Fairfield County ozone nonattainment area and $PM_{2.5}$ maintenance area.
- Portions of LEX Pipeline are located within the Marshall County SO_2 nonattainment area.
- The Lone Oak CS and portions of LEX Pipeline are located within the Marshall County $PM_{2.5}$ maintenance area.
- The Ceredo CS and portions of the BM-111 Loop are located within the Wayne County $PM_{2.5}$ maintenance area.
- Portions of the BM-111 Loop and R-300/R-5000 OS are located within the Lawrence County $PM_{2.5}$ maintenance area.

All RXE Project facilities located in Kentucky are in areas classified as attainment/unclassifiable for all pollutants and averaging periods, and are not maintenance areas for any pollutants.

Air Quality Monitoring and Existing Air Quality

The EPA and state and local agencies have established a network of ambient air quality monitors located throughout each state serving a variety of purposes, but mainly to determine the air quality conditions in representative areas. Monitoring data obtained from the EPA AirData network (EPA, 2008)

[31] In a final rule, published on May 4, 2016, the EPA issued determinations of attainment by the attainment date, extensions of the attainment date, and reclassifications of several areas for the 2008 ozone national ambient air quality standards. The EPA determined that the Columbus, Ohio area achieved attainment of the 2008 ozone standard by July 20, 2015. The finding is effective as of June 3, 2016.

for 2011-2014 were reviewed to characterize ambient air quality related to regulated criteria pollutants in the vicinity of the LX and RXE Project areas.

4.11.1.2 Air Regulatory Requirements

The proposed project would be subject to a variety of federal, state, and local regulations pertaining to the construction or operation of air emission sources. KYDEP, WVDEP, OEPA, and PADEP have the primary jurisdiction over air emissions produced by the proposed RXE Project in Kentucky, West Virginia, Ohio, and Pennsylvania, respectively. Each state agency enforces its own regulations as well as EPA's federal requirements.

The CAA is the basic federal statute governing air pollution in the United States. The provisions of the CAA that are applicable to the LX and RXE Projects are discussed below.

Air Permitting

New Source Review (NSR) is a pre-construction permitting program designed to protect air quality when air pollutant emissions are increased either through the modification of existing sources or through the construction of a new source of air pollution. In areas with good air quality, NSR ensures that the new emissions do not degrade the air quality, which is achieved through the implementation of the Prevention of Significant Deterioration (PSD) permitting program for major sources or state permit programs for minor sources. In areas with poor air quality, Nonattainment NSR ensures that the new emissions do not inhibit progress toward cleaner air. In addition, NSR ensures that any large, new, or modified industrial source uses air pollution control technology.

Based on the operating emissions presented in tables 4.11.1-1 through 4.11.1-5, a major source NSR permit would not be required for any of the new CSs. Further, the modifications at the Ceredo CS or Crawford CS are not subject to any NSR permitting requirements, as the revisions to the existing CSs would not cause an increase in operational emissions. For the installation and operation of the new CSs, minor NSR permits must be obtained from the state or local permitting authority, as follows:

- Lone Oak CS – WVDEP Minor NSR Permit to Construct that authorizes construction and initial operation.
- Summerfield CS – OEPA Permit-to-Install and Operate that authorizes both construction and operation.
- Oak Hill CS – OEPA Permit-to-Install that authorizes construction and initial operation.
- Grayson CS – KYDEP Initial Operating Permit that authorizes both construction and operation.
- Means CS – KYDEP State-Origin Permit that authorizes both construction and operation.

All initial permit applications were submitted for the LX and RXE Projects described above.

Title V is an operating permit program run by each state. Based on the potential emission rates shown in tables 4.11.1-1 through 4.11.1-5, the following CSs would be subject to Title V permitting for the LX and RXE Projects: Lone Oak, Oak Hill, Grayson, and Ceredo Compressor Stations. Columbia Gas and Columbia Gulf would need to obtain or modify a Title V permit for each of these facilities within 12 months of commencing operation.

TABLE 4.11.1-1
Potential Emission Rates Associated with the Lone Oak Compressor Station (tpy)

Emission Source	NO_X	CO	VOC	SO_2	$PM_{2.5}$ / PM_{10}	Formaldehyde	Total HAP	GHG (CO_2e)
Turbine #1 [a]	31.2	46.6	3.8	0.4	3.8	0.4	0.6	66,609
Turbine #2 [a]	31.2	46.6	3.8	0.4	3.8	0.4	0.6	66,609
Turbine #3 [a]	31.2	46.6	3.8	0.4	3.8	0.4	0.6	66,609
Emergency Generator	1.3	0.8	<0.1	<0.1	<0.1	0.1	0.2	266
Fuel Gas Heater	0.4	0.4	<0.1	<0.1	0.0	<0.1	0.0	513
Catalytic Space Heaters	1.2	1.0	0.1	<0.1	0.1	<0.1	0.0	1,477
Storage Tanks	--	--	<0.1	--	--	--	--	0.0
Condensate Loading	--	--	<0.1	--	--	--	--	0.0
Equipment Leaks	--	--	0.6	--	--	--	--	387
Natural Gas Venting	--	--	9.3	--	--	--	--	6,025
Facility-Wide Totals	**96.7**	**142.1**	**20.7**	**1.2**	**11.4**	**1.3**	**2.0**	**208,108**

[a] Emission rate of the Solar Mars 100 turbines are for normal operation at 0 °F.

TABLE 4.11.1-2
Potential Emission Rates Associated with the Summerfield Compressor Station (tpy)

Emission Source	NO_X	CO	VOC	SO_2	$PM_{2.5}$ / PM_{10}	Formaldehyde	Total HAP	GHG (CO_2e)
Turbine #1[a]	26.8	39.3	1.9	0.2	2.0	0.2	0.3	34,654
Turbine #2 [a]	26.8	39.3	1.9	0.2	2.0	0.2	0.3	34,654
Emergency Generator	1.3	0.8	<0.1	<0.1	0.0	0.1	0.2	266
Fuel Gas Heater	0.2	0.2	<0.1	<0.1	0.0	<0.1	<0.1	256
Catalytic Space Heaters	1.2	1.0	0.1	<0.1	0.1	<0.1	<0.1	1,477
Storage Tanks	--	--	<0.1	--	--	--	--	0.0
Condensate Loading	--	--	<0.1	--	--	--	--	0.0
Equipment Leaks	--	--	0.4	--	--	--	--	258
Natural Gas Venting	--	--	7.9	--	--	--	--	5,100
Facility-Wide Totals	**56.3**	**80.7**	**11.9**	**0.4**	**4.0**	**0.5**	**0.8**	**76,407**

[a] Emission rate of the Solar Taurus 60 turbines are for normal operation at 0 °F.

TABLE 4.11.1-3
Potential Emission Rates Associated with the Oak Hill Compressor Station (tpy)

Emission Source	NO_X	CO	VOC	SO_2	$PM_{2.5}$ / PM_{10}	Formaldehyde	Total HAP	GHG (CO_2e)
Turbine #1 [a]	31.9	47.3	3.8	0.4	3.8	0.4	0.6	68,118
Turbine #2 [a]	31.9	47.3	3.8	0.4	3.8	0.4	0.6	68,118
Turbine #3 [a]	31.9	47.3	3.8	0.4	3.8	0.4	0.6	68,118
Emergency Generator	1.3	0.8	<0.1	<0.1	<0.1	0.1	0.2	266
Fuel Gas Heater	0.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	385
Catalytic Space Heaters	1.2	1.0	0.1	<0.1	0.1	<0.1	<0.1	1,477
Storage Tanks	--	--	<0.1	--	--	--	--	0.0
Condensate Loading	--	--	<0.1	--	--	--	--	0.0
Equipment Leaks	--	--	0.6	--	--	--	--	387
Natural Gas Venting	--	--	9.3	--	--	--	--	6,025
Facility-Wide Totals	**98.7**	**144.1**	**20.9**	**1.3**	**11.7**	**1.4**	**2.0**	**212,506**

[a] Emission rate of the Solar Mars 100 turbines are for normal operation at 0 °F.

TABLE 4.11.1-4
Potential Emission Rates Associated with the Grayson Compressor Station (tpy)

Emission Source	NO_X	CO	VOC	SO_2	$PM_{2.5}$ / PM_{10}	Formaldehyde	Total HAP	GHG (CO_2e)
Mars 100 Turbine #1[a]	31.9	55.2	3.9	0.4	3.9	0.4	0.6	68,340
Mars 100 Turbine #2[a]	31.9	55.2	3.9	0.4	3.9	0.4	0.6	68,340
Titan 130 Turbine	38.7	69.6	4.8	0.5	4.7	0.5	0.7	82,806
Emergency Generator	1.0	0.6	<0.1	<0.1	<0.1	0.1	0.1	200
Heat Exchanger	0.5	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	564
Catalytic Heaters	1.2	1.0	0.1	<0.1	0.1	<0.1	<0.1	1,477
Equipment Leaks	--	--	0.6	--	--	--	--	387
Venting	--	--	11.1	--	--	--	--	7,189
Facility-Wide Totals	**105.0**	**182.0**	**23.8**	**1.4**	**12.5**	**1.4**	**2.1**	**228,914**

[a] Annual PTE for turbines includes 50 hours per year of low load operation and 20 hours per year of low temperature operation (both non-SoLoNOx operation) and 50 startup/shutdown cycles per year (totaling 17 hours/year).

TABLE 4.11.1-5 Potential Emission Rates Associated with the Means Compressor Station (tpy)								
Emission Source	**NO_X**	**CO**	**VOC**	**SO_2**	**$PM_{2.5}$ / PM_{10}**	**Formaldehyde**	**Total HAP**	**GHG (CO_2e)**
Taurus 70 Turbine #1[a]	22.1	45.7	2.7	0.3	2.5	0.3	0.4	44,981
Taurus 70 Turbine #2[a]	22.1	45.7	2.7	0.3	2.5	0.3	0.4	44,981
Emergency Generator	1.0	0.6	<0.1	<0.1	<0.1	0.1	0.1	200
Heat Exchanger	0.5	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	564
Catalytic Heaters	1.2	1.0	0.1	<0.1	0.1	<0.1	<0.1	1,477
Equipment Leaks	--	--	0.4	--	--	--	--	258
Venting	--	--	16.6	--	--	--	--	10,743
Facility-Wide Totals	**47.0**	**93.5**	**22.2**	**0.6**	**5.2**	**0.6**	**0.9**	**102,946**

[a] Annual PTE for turbines includes 50 hours per year of low load operation and 240 hours per year of low temperature operation (both non- SoLoNOx operation) and 100 startup/shutdown cycles per year (totaling 33 hours/year).

Mandatory Green House Gas Reporting Rule (40 CFR 98)

The final Mandatory GHG Reporting Rule requires applicable sources of GHG emissions to report their actual GHG operating emissions if they exceed 25,000 metric tons of CO_2e in 1 year. This rule is not a permit and does not limit or control emissions. Although this rule does not apply to construction emissions, GHG construction emission estimates are provided, as CO_2e, for accounting and disclosure purposes in section 4.11.1.3. Operational GHG emission estimates for the LX and RXE Projects are presented, as CO_2e, in tables 4.11.1-1 through 4.11.1-5. Based on the emission estimates presented, GHG emissions from operation of each LX and RXE compressor station has the potential to exceed the 25,000 metric tons per year (tpy) reporting threshold. Therefore, if the actual emissions during operations from any of the compressor stations are equal to or greater than 25,000 metric tpy, Columbia Gas and Columbia Gulf would need to report GHG emissions for that facility.

New Source Performance Standards (40 CFR 60)

The EPA promulgates New Source Performance Standards (NSPS) to establish pollutant emission limits and monitoring, reporting, and recordkeeping requirements for various emission sources based on source type and size. These regulations apply to new, modified, or reconstructed sources. NSPS Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines) sets emission standards for NO_X, CO, and VOC. The emission standards of Subpart JJJJ would apply to the emergency generators at the LX and RXE Projects. Columbia Gas and Columbia Gulf would comply with the emission standards. NSPS Subpart KKKK (Standards of Performance for Stationary Combustion Turbines) sets emission limits for NOx and SO_2. The combustion turbines at the Lone Oak CS, Summerfield CS, Oak Hill CS, Grayson CS, and Means CS would be subject to Subpart KKKK and Columbia Gas and Columbia Gulf would demonstrate compliance with the NOx emission limits through annual performance tests. Columbia Gas and Columbia Gulf would demonstrate compliance with the SO_2 limits through the use of pipeline quality natural gas. The LX and RXE Projects would not trigger any additional NSPS at the existing facilities.

National Emission Standards for Hazardous Air Pollutants (40 CFR 61 and 63)

The CAA Amendments established a list of 189 hazardous air pollutants (HAPs), resulting in the promulgation of National Emission Standards for Hazardous Air Pollutants (NESHAP). The NESHAPs regulate HAP emissions from major sources of HAP emissions and specific source categories by setting emission limits, monitoring, testing, record keeping, and notification requirements. Subpart ZZZZ (*National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*) would apply to the emergency electrical power generators at the LX and RXE Projects. Columbia Gas and Columbia Gulf would be subject to all applicable Subpart ZZZZ monitoring, recordkeeping, and reporting requirements and/or would comply with NESHAPs Subpart ZZZZ by complying with NSPS Subpart JJJJ requirements for the compressor stations. The LX and RXE Projects would not trigger any additional NESHAPs at the existing facilities.

General Conformity (40 CFR 93, Subpart B)

The General Conformity Rule was developed to ensure that federal actions in nonattainment and maintenance areas do not impede states' attainment of the NAAQS. The lead federal agency must conduct a conformity determination if a federal action's construction and operational activities is likely to result in generating direct and indirect emissions that would exceed the General Conformity Applicability threshold levels (*de minimis*) of the pollutant(s) for which an air basin is designated nonattainment or maintenance. Conforming activities or actions should not, through additional air pollutant emissions:

- cause or contribute to new violations of the NAAQS in any area;
- increase the frequency or severity of any existing violation of any NAAQS; or
- delay timely attainment of any NAAQS or interim emission reductions.

The General Conformity Rule entails both an applicability analysis and a subsequent conformity determination, if applicable. According to the General Conformity regulations, emissions from sources that are subject to any NSR permitting and/or licensing (major or minor) are exempt and are deemed to have conformed. A General Conformity Determination must be completed when the total direct and indirect emissions of a project would equal or exceed the specified pollutant thresholds on a calendar year basis for each nonattainment or maintenance area.

Columbia Gas and Columbia Gulf are required to obtain minor NSR permits for the operational emissions of the compressor stations, which are the only Project facilities to have operational emissions of the pollutants, including precursors, for which an air basin is designated nonattainment or maintenance. Therefore, the operational emissions are exempt from applicability, and the General Conformity applicability analysis must compare only the direct and indirect emissions associated with construction activities to the applicability threshold levels.

Table 4.11.1-6 identifies the nonattainment and maintenance areas for the LX and RXE Projects and the associated construction emissions compared to the applicability threshold levels. Detailed emission calculations for the construction activities identified in table 4.11.1-6 were filed on the record on October 23, 2015. As presented in table 4.11.1-6, emissions during construction of the LX and RXE Projects would not exceed General Conformity applicability thresholds for any nonattainment or maintenance area, and a general conformity determination is not required.

TABLE 4.11.1-6 Comparison of Construction Emissions to General Conformity *De Minimis* Thresholds[c]				
Air Pollutant	**$PM_{2.5}$**	**NO_X**	**VOC**	**SO_2**
Wheeling, OH-WV $PM_{2.5}$ Maintenance Areas				
Marshall County, WV				
2016 Construction Emissions	4.4	4.7	NA	<0.1
2017 Construction Emissions	26.4	95.4	NA	0.1
General Conformity Threshold[a]	100	100	NA	100
Greater than *de minimis* threshold?	No	No	NA	No
Huntington-Ashland $PM_{2.5}$ Maintenance Areas				
Wayne County, WV				
2016 Construction Emissions	0.4	0.7	NA	<0.1
2017 Construction Emissions	2.4	14.7	NA	<0.1
Lawrence County, OH				
2016 Construction Emissions	<0.1	0.1	NA	<0.1
2017 Construction Emissions	0.2	0.7	NA	<0.1
Maintenance Area Total Emissions	4.4	15.3	NA	<0.1
General Conformity Threshold[a]	100	100	NA	100
Greater than *de minimis* threshold?	No	No	NA	No
Columbus, OH Ozone Nonattainment Area and $PM_{2.5}$ Maintenance Area				
Fairfield County, OH				
2016 Construction Emissions	1.1	1.7	0.2	<0.1
2017 Construction Emissions	7.5	38.7	3.2	0.1
General Conformity Threshold[a]	100	100	100	100
Greater than *de minimis* threshold?	No	No	No	No

[a] General Conformity *de minimis* threshold is based on the severity of the nonattainment area or maintenance area for each air pollutant.

[b] NA – pollutant is not a precursor for the designated pollutant.

[c] Detailed emission calculations are provided in Columbia Gas' Appendix 9B of the March 18, 2016 Supplemental Information Filing available on the FERC's eLibrary website at, http://ferc.gov/docs-filing/elibrary.asp, by searching Docket No. CP15-514, Accession No. 20160318-5002, titled "21_Att_8_RR_09_Mar_2016_App_9A-9G.PDF"

Should the project construction schedule change or actual conditions result in varied equipment, there is a possibility that emissions may exceed the general conformity threshold. The General Conformity regulations require that, if an agency has originally determined that a General Conformity Determination is not necessary, but changes in the project result in the total emissions being above the General Conformity applicability thresholds, then the agency must at that time make a General Conformity Determination. Because emissions are very close to one of the applicability thresholds and to ensure that the construction schedule does not trigger General Conformity, **we recommend that:**

- **<u>Prior to construction,</u> Columbia Gas should file with the Secretary for review and written approval by the Director of OEP, a Construction Emission Plan identifying how Columbia Gas would track its construction schedule for each component of the LX Project within the Wheeling, OH-WV $PM_{2.5}$ Maintenance Area and ensure construction emissions of NO_x would remain under the General Conformity applicability threshold. If a change in the construction schedule or project results in emissions of NO_x greater than the General Conformity applicability threshold of 100 tpy, Columbia Gas should provide and document all mitigation measures under 40 CFR 93.158 it would implement to comply with the General Conformity Regulations.**

State Air Quality Requirements

The construction and operation of the LX and RXE Projects would be subject to additional state air regulations, including but not limited to those described below.

Kentucky

- 401 KAR 59:015 (New Source Standards for New Indirect Heat Exchangers) sets forth emission standards for particulate matter, SO_2, and opacity for new heaters. The proposed units are inherently compliant with the requirements by means of combusting only pipeline quality natural gas and exempt from the opacity and SO_2 monitors for the same reasons.

West Virginia

- 45 CSR 2 (Particulate Air Pollution Control – Combustion in Indirect Heat Exchangers) establishes smoke and PM limits on fuel burning equipment. The proposed sources of emissions at the Lone Oak CS are inherently compliant with this requirement by combusting only pipeline quality natural gas.

- 45 CSR 10 (SO_2 Emission Control) prevents SO_2 pollution. As previously discussed, the turbines would be subject to NSPS Subpart KKKK, which limits fuel sulfur content in compliance with this regulation. The combustion of natural gas produces inherently low SO_2 emissions, which ensures that the emergency generators and heaters also would be in compliance with this regulation.

- 45 CSR 10 (SO_2 Emission Control) prevents SO_2 pollution. As previously discussed, the turbines would be subject to NSPS Subpart KKKK, which limits fuel sulfur content in compliance with this regulation. The combustion of natural gas produces inherently low SO_2 emissions, which ensures that the emergency generators and heaters also would be in compliance with this regulation.

Pennsylvania

- 25 PA Code Chapter 123 (Standards For Contaminants) specifies limits on opacity, fugitive emissions, PM, and SO_2. Project facilities located in Pennsylvania do not include stationary combustion sources; therefore, project facilities would only be subject to the fugitive emission limits, which would be satisfied by operating in accordance with the Fugitive Dust Control Plan, as discussed below.

- Pennsylvania Diesel Powered Motor Vehicle Idling Act include air quality regulations controlling emissions from mobile sources, including those used for construction activities. Compliance with these requirements would be achieved through implementation of vehicle idling reduction policies.

Ohio

- OAC-3745-17 (PM Emissions) establishes PM limitations. The proposed sources are inherently compliant with this requirement by combusting only pipeline quality natural gas.

- OAC-3745-18 (SO_2 Emissions) limits SO_2 emissions from fuel burning equipment. However, natural gas-fired fuel-burning equipment, stationary combustion turbines, and internal combustion engines are exempt from these SO_2 emission limitations.

4.11.1.3 Construction Emissions, Mitigations, and Impacts

Construction of the proposed LX and RXE Projects would result in temporary increases of pollutant emissions from the use of diesel- and gas-fueled equipment, as well as temporary increases in fugitive dust emissions from earth/roadway surface disturbance. Equipment associated with the construction of the proposed LX and RXE Projects would include large earth-moving equipment (e.g., bulldozers, track hoes), skid loaders, trucks, and other mobile sources. These may be powered by diesel or gasoline engines and would be sources of NO_X, CO, VOC, PM_{10}, $PM_{2.5}$, small amounts of SO_2, and trace amounts of HAPs. Indirect emissions would be generated from delivery vehicles and vehicles associated with construction workers traveling to and from work sites.

Combustion emissions from construction equipment would be minimized because the engines on construction equipment must meet the standards for mobile sources established by the EPA non-road source emission regulations and imposed on equipment manufacturers. Emissions also would be controlled by purchasing commercial gasoline and diesel fuel products, specifications of which are controlled by federal and state air pollution control regulations applicable to fuel suppliers and distributors. Vehicle emissions also would be controlled through on-site management practices, in accordance with the applicable federal state requirements, such as state inspection and maintenance program rules (e.g., OAC Chapter 3745-26) and Pennsylvania's Heavy-Duty Diesel Emissions Control Program (25 PA Code Chapter 126, Subchapter E).

Emissions of NO_X, CO, VOC, PM_{10}, $PM_{2.5}$, SO_2, GHGs, and HAPs from construction equipment engines were calculated based on the proposed non-road and on-road equipment and their use levels. Diesel and gasoline on-road vehicle emission factors used the EPA's Motor Vehicle Emission Simulator (EPA MOVES 2013) model, while diesel and gasoline non-road equipment engine emission factors used the EPA's NONROAD model. Emission factors using Tier 2 diesel engine standards were assumed to apply to construction equipment engines during the construction period and do not reflect the anticipated phasing-in of more stringent emissions standards. Ultra-low sulfur diesel use was assumed for both the non-road and on-road diesel vehicles.

Fugitive dust would occur from land clearing, grading, excavation, and vehicle traffic on both paved and unpaved roads. The volume of fugitive dust generated would be dependent upon the area disturbed and the type of construction activity, along with the soil's silt and moisture content, wind speed, and the nature of vehicular/equipment traffic. Fugitive dust emissions from construction operations are positively correlated with the silt content of the soil, as well as construction vehicle weight and speed, and negatively correlated with soil moisture content. Fugitive dust emissions generally would be greater during dry summer and autumn months and in fine-textured soils.

Columbia Gas developed an adequate Fugitive Dust Control Plan, including mitigation measures that would be employed during construction activities to prevent and control fugitive PM (dust) emissions. The site supervisors would be responsible for implementing these measures, which may include, but are not limited to, the following:

- use of water or chemicals for control of dust during construction operations, road grading or land clearing;
- application of asphalt, oil, water or suitable dust suppressants on unpaved roads, material stockpiles and other surfaces;
- paving and maintenance of roadways;

- street cleaning to remove soil or other material from paved streets onto which it has been transported by trucking or earth moving equipment, erosion by water, or other means;
- proper maintenance of equipment;
- covering open-bodied trucks while transporting materials;
- minimizing soil disturbance;
- use of off-site parking and shuttle buses to minimize traffic (if necessary); and
- implementation of vehicle idling reduction policies.

Dust suppression measures would be proactively implemented as necessary to protect persons (general public and workforce) and property from air pollution and nuisances caused by the generation of fugitive PM (dust) emissions. The decision to implement dust suppression is generally not based on a specific threshold (e.g., numeric value of suspended particulate concentration). Instead, dust suppression measures may be implemented based on a visual determination of need, atmospheric conditions (persistence of dry, windy conditions), and compliance with a local ordinance for control of fugitive dust emissions. In general, dust suppression measures would be implemented as necessary to mitigate fugitive dust emissions that would come off the construction sites. However, Columbia Gas currently anticipates using water from a municipal source to control fugitive dust during construction of the LX Project, which is estimated to require approximately 22,500 gallons of water per day along each of the five pipeline spreads for a period of approximately 184 days (total of approximately 20,700,000 gallons).

Fugitive dust emissions from soil disturbance due to construction activities would be intermittent, generally low-level releases, and would consist of larger dust particles that are expected to settle out of the atmosphere within close proximity to their release point. For this reason, long-range transport of fugitive particulate emissions from soil disturbance is not anticipated. As a result of these factors, construction equipment emissions and fugitive dust emissions from soil disturbance would not cause exceedances of ambient air quality standards.

Table 4.11.1-7 provides a summary of total emission estimates for construction of the LX and RXE Projects during calendar years 2016 and 2017 (duration of construction varies by project component).

TABLE 4.11.1-7 Summary of Potential Construction Emissions from the Proposed LX and RXE Projects (tons)[a]								
Activity and Location	**NO_X**	**CO**	**VOC[b]**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**GHG[c]**	**HAPs[d]**
Pipeline Facilities Construction								
Ohio								
LEX	434.1	205.9	26.0	716.7	121.8	0.6	57,783.6	1.8
LEX 1	13.2	27.5	1.7	7.2	1.7	0.0	2,424.8	0.1
R-801 Loop	135.2	50.8	7.5	204.6	34.8	0.2	17,555.3	0.5
BM-111 Loop	15.4	5.8	0.9	22.4	3.9	0.0	1,994.3	0.0
Ohio Subtotal	**597.9**	**290.1**	**36.1**	**950.9**	**162.2**	**0.8**	**79,758.9**	**2.3**
Pennsylvania								
LEX	7.2	4.4	0.5	12.5	2.1	0.0	1,007.4	0.0
Pennsylvania Subtotal	**7.2**	**4.4**	**0.5**	**12.5**	**2.1**	**0.0**	**1,007.4**	**0.0**
West Virginia								
LEX	97.9	59.2	7.1	170.5	29.1	0.1	13,619.4	0.4
BM-111 Loop	0.6	0.2	0.0	0.9	0.2	0.0	77.7	0.0
West Virginia Subtotal	**98.5**	**59.4**	**7.1**	**171.4**	**29.3**	**0.1**	**13,697.1**	**0.4**
PIPELINE FACILITIES SUBTOTAL	***703.6***	***353.9***	***43.7***	***1,134.7***	***193.6***	***0.9***	***94,463.4***	***2.9***
Aboveground Facilities Construction								
Kentucky								
Grayson and Means CS	2.9	5.5	0.0	27.7	5.0	0.4	493.0	0.0
Kentucky Subtotal	**2.9**	**5.5**	**0.0**	**27.7**	**5.0**	**0.4**	**493.0**	**0.0**
Ohio								
Oak Hill CS	2.0	6.3	0.4	1.7	0.5	0.0	420.0	0.0
Summerfield CS	2.0	6.3	0.4	.7	0.5	0.0	420.0	0.0
Regulator Stations	2.6	7.7	0.5	2.4	0.7	0.0	520	0.0
Odorization Stations	1.0	1.9	0.1	1.2	0.3	0.0	168.0	0.0
Ohio Subtotal	**7.6**	**22.3**	**1.4**	**6.9**	**2.0**	**0.0**	**1,528.0**	**0.1**
West Virginia								
Lone Oak CS	2.0	6.3	0.4	1.7	0.5	0.0	420.0	0.0
West Virginia Subtotal	**2.0**	**6.3**	**0.4**	**1.7**	**0.5**	**0.0**	**420.0**	**0.0**
ABOVEGROUND FACILITIES SUBTOTAL	***12.6***	***34.0***	***1.8***	***36.2***	***7.4***	***0.4***	***2,441.0***	***0.1***
TOTAL	***716.1***	***387.9***	***45.5***	***1,171.0***	***201.0***	***1.3***	***96,904.4***	***3.0***

[a] Includes construction equipment or nonroad engine exhaust (tailpipe) emissions, on-road vehicle engine exhaust (tailpipe) emissions, paved and unpaved vehicle travel fugitive dust (non-tailpipe) emissions, and construction activity fugitive dust (non-tailpipe) emissions.

[b] VOC – non-methane/ethane volatile organic compounds

[c] GHG – as carbon dioxide equivalents (CO2e)

[d] HAPs – as aggregated total HAPs

4.11.1.4 Operation Emissions, Mitigation, and Impacts

Emissions generated during operation of the proposed LX and RXE Projects include primarily NO_X, CO, GHG, and PM emissions, with lesser amounts of SO_2, VOC, and HAP emissions. Operation emissions were calculated based on manufacturer data, emission factors obtained from the EPA's Compilation of Air Pollutant Emission Factors (AP-42), and engineering mass balance calculations. Tables 4.11.1-1 through 4.11.1-5, previously presented, summarize the annual potential emission rates of criteria pollutants, formaldehyde, total HAP, and GHGs associated with the proposed Lone Oak CS, Summerfield CS, Oak Hill CS, Grayson CS, and Means CS, respectively. The annual PTE listed in these tables include emissions attributable to non-SoLoNOx turbine operation such as low load operation (less

than 50 percent load), low temperature operation, and startups and shutdowns. Note that non-SoLoNOx emissions may be greater than emissions associated with normal operation for certain pollutants such as NO_X, CO, and VOC for which emission rates are not directly associated with the fuel combustion rate. For other pollutants, such as SO_2 and PM, the greater fuel consumption rate during normal operation results in greater emission rates than during reduced load operations or startup and shutdown events.

Additionally, the annual PTE listed in these tables include emissions associated with an emergency generator, which is based on the same, preliminary emergency generator model selection for each of the proposed compressor stations. More detailed emissions estimates for these facilities, including a discussion of the calculation methodologies employed, sample calculations, and supporting documentation, are included in the air permit applications as submitted to the KYDEP, WVDEP and OEPA.

Emissions from the proposed Solar combustion turbines would be controlled by Solar's SoLoNOx technology during normal operation and would comply with applicable federal emissions regulations (NSPS and NESHAP). Other emissions sources would have limited use (emergency generators) or are insignificant sources (process heaters and space heaters). For all of these combustion units, natural gas would be the only fuel consumed, and emissions of NO_X, SO_2, PM_{10}, $PM_{2.5}$, and GHGs are inherently low when compared to other commercial fuels.

Although the GHG emissions for construction and operation of the LX and RXE Projects appear large, the emissions are very small in comparison to the GHG emissions for each of state. The Projects' GHG emissions compared to the GHG emissions for each state are shown in table 4.11.1-8.

TABLE 4.11.1-8
Comparison of the Projects' GHG Emissions to State-Wide GHG Emissions

State	State-Wide CO_2 Emissions[a] (mmt/yr)	Project Construction CO_2e (mmt/yr)	Percentage of State-Wide CO_2e Emissions	Project Operations CO_2e (mmt/yr)	Percentage of State-Wide CO_2e Emissions
		Construction		Operations	
Pennsylvania	243.9	0.001	0.0005%	0	0%
West Virginia	93.3	0.016	0.017%	0.23	0.2%
Ohio	228.7	0.09	0.04%	0.32	0.14%
Kentucky	137.0	0.0005	0.0004%	0.36	0.27%

[a] State energy-related CO_2 emissions for the year 2013 (U.S. DOE, 2015).
[b] Project operations emissions are potential GHG emissions for the CSs (tables 4.11.1-1 through 4.11.1-5).
mmt/yr million metric tons per year

No state or regional GHG emission reduction initiatives were identified or are applicable to any of the LX or RXE Project activities. However, Columbia Gas has committed to minimizing venting of natural gas during start-up, shut-down, and malfunctions using preventative maintenance and standard operating procedures.

As part of air permit applications, Columbia Gas performed air dispersion modeling analyses for the Summerfield CS and the Oak Hill CS, in accordance with Ohio regulations, using AERMOD, EPA's preferred detailed dispersion model. Columbia Gas and Columbia Gulf also participate in the EPA's Natural Gas STAR program.

Although dispersion modeling was not required for the minor NSR permit applications in West Virginia or Kentucky, air dispersion modeling analyses were performed for the Lone Oak CS, Grayson CS, and Means CS. The results of the dispersion modeling analyses for the proposed Summerfield, Oak

Hill, Lone Oak, Grayson, and Means compressor stations are summarized below and detailed in the air permit applications for each of these facilities, as needed.

For each new compressor station, AERMOD was run using five years of recent meteorological data. The meteorological data was processed through the AERMET meteorological preprocessor and the AERMAP terrain processor was used to generate receptor elevations consistent with the terrain surrounding each proposed compressor station.

Structures can influence modeling results because of building-induced downwash, which can increase predicted concentrations at receptors located in proximity to the stacks (e.g., fence line receptors). USEPA's Building Profile Input Program for PRIME (BPIPPRM dated 04274) was used to simulate the influence of downwash effects from structures located near emission sources by generating an AERMOD input file with the proper direction-specific building downwash parameters. The proposed locations of the combustion turbines and building structures at each compressor station were used as input to BPIPPRM, along with the combustion turbine stack heights and building heights.

Table 4.11.1-9 provides the current ambient monitored data, the Project impact, the combined concentration, and a comparison with the NAAQS for the Lone Oak CS, Summerfield CS, Oak Hill CS, Grayson CS, and Means CS. Results demonstrate that the LX and RXE Projects' compressor stations would not exceed the NAAQS and the project areas would continue to remain protective of human health and public welfare for all listed pollutants.

TABLE 4.11.1-9
Air Dispersion Modeling Results for LX and RXE Compressor Stations in Comparison to the NAAQS

Pollutant	Averaging Period	Project Impact ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Lone Oak Compressor Station					
NO_2	1-hour	28.9	66.4	95.4	188
CO	1-hour	185.5	1,259.0	1,445.0	40,000
	8-hour	70.6	1,145.0	1,215.0	10,000
PM_{10}	24-hour	2.9	47.0	49.8	150
$PM_{2.5}$	24-hour	1.8	25.3	27.1	35
	annual	0.1	11.6	11.7	12
SO_2	1-hour	2.1	108.2	110.3	196
	24-hour	1.23	34.0	35.3	365
Summerfield Compressor Station					
NO_2	1-hour	57.6	66.4	124.1	188
CO	1-hour	190.3	1,259.0	1,450.0	40,000
	8-hour	161.2	1,145.0	1,306.0	10,000
PM_{10}	24-hour	3.2	47.0	50.2	150
$PM_{2.5}$	24-hour	2.6	17.0	19.6	35
	annual	0.1	8.5	8.6	12
SO_2	1-hour	2.7	108.2	110.9	196
	24-hour	1.1	34.0	35.1	365
Oak Hill Compressor Station					
NO_2	1-hour	59.1	56.4	115.5	188
CO	1-hour	229.0	2,976.0	3,205.0	40,000
	8-hour	196.0	1,832.0	2,028.0	10,000
PM_{10}	24-hour	7.2	35.0	42.2	150
$PM_{2.5}$	24-hour	4.0	19.7	23.7	35
	annual	0.1	9.7	9.8	12
SO_2	1-hour	5.7	37.5	43.2	196
	24-hour	3.1	26.2	29.3	365
Grayson Compressor Station					
NO_2	1-hour	38.0	57.7	95.6	188
CO	1-hour	175.0	1,717.0	1,892.0	40,000
	8-hour	117.0	1,145.0	1,262.0	10,000
PM_{10}	24-hour	3.2	23.0	26.2	150
$PM_{2.5}$	24-hour	2.5	20.7	23.2	35
	Annual	0.2	10.2	10.3	12
SO_2	1-hour	3.2	41.9	45.1	196
Means Compressor Station					
NO_2	1-hour	63.9	80.2	144.0	188
CO	1-hour	145.0	1,717.0	1,863.0	40,000
	8-hour	66.0	1,145.0	1,211.0	10,000
PM_{10}	24-hour	1.7	23.0	24.7	150
$PM_{2.5}$	24-hour	1.3	17.3	18.6	35
	Annual	0.1	8.8	8.9	12
SO_2	1-hour	5.4	34.9	40.3	196

4.11.2 Noise

The LX and RXE Projects would contribute to increased noise levels during both construction and operation. The magnitude and frequency of environmental noise varies considerably during the day, week, season, and is based on weather conditions as well as seasonal vegetative cover, along with the types of activities occurring. Two standard measures that relate the time-varying quality of environmental noise to its known effect on people are the 24-hour equivalent sound level (L_{eq}) and day-night sound level (L_{dn}). The L_{eq} is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The L_{dn} is the L_{eq} plus 10 decibels (dB) on the A-weighted scale (dBA) added to account for people's greater sensitivity to nighttime sound levels (typically considered between the hours of 10:00 PM and 7:00 AM). The A-weighted scale is used to assess noise impacts, as human hearing is less sensitive to low and high frequencies than mid-range frequencies. The human ear's threshold of perception for noise change is considered to be 3 dB; a change of 6 dB is clearly noticeable to the human ear, and a change of 10 dB is perceived as a doubling of noise (i.e., twice as loud).

4.11.2.1 Noise Regulatory Requirements

Federal Noise Regulations

The EPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin on Safety* in 1974, which evaluated the effects of environmental noise on public health and safety. The EPA determined an L_{dn} of 55 dBA is the threshold that would prevent outdoor activity interference or annoyance from continuous noise. We have adopted this criterion for new compression and associated facilities, and it is used here to assess the potential noise impact during operation of the LX and RXE Projects at noise sensitive areas (NSAs) such as residences, schools, hospitals, or religious facilities. L_{dn} of 55 dBA corresponds to a continuous L_{eq} sound level of 48.6 dBA.

State and Local Noise Regulations

No applicable state, county, or local noise regulations have been identified for the Projects.

4.11.2.2 Construction Noise Impacts and Mitigation

Noise would be generated during construction of the LX and RXE Projects. Construction would consist of multiple work crews at various locations along the pipeline route. Each crew's work rate would vary based on specific activities, but would be limited to short durations over a period of three to four weeks at any one location based on the nature of right-of-way construction sequencing. Construction equipment would be operated on an as-needed basis and receptors near the construction areas may experience an increase in perceptible noise, but the effect would be temporary and local. It is anticipated that the highest level of construction-related noise would occur during site earthwork activities, such as site grading and clearing, when the largest amount of construction equipment would be operating.

Controlled blasting during pipeline construction activities would be conducted in accordance with the measures outlined in section 2.3.2.10 and further detailed in the project -specific Blasting Plan. The amount of explosives per borehole would be limited by the proximity of existing structures and utilities. Instantaneous sound levels from typical blasting activities would be greater than conventional pipeline construction activities at a distance of 50 feet. In comparison with other construction noise, the sound resulting from blasting would be brief and infrequent.

Columbia Gas and Columbia Gulf acknowledge that construction noise may be periodically audible at nearby NSAs; however, long-term impacts are not anticipated and typical construction of the pipelines and aboveground facilities would be predominantly scheduled during daylight hours. An exception to daytime construction may be certain HDD activities, which have been proposed at seven locations. HDD activities would use a wide variety of equipment, with the majority of equipment at the HDD entry point. Noise levels at the HDD exit points are generally lower than at the entry points. The length of activity at each HDD site would range from a few weeks to a few months.

Columbia Gas conducted ambient surveys in April 2015to establish baseline noise conditions near the seven HDD entry and exit points. The closest NSAs within 0.5 mile of each HDD entry and exit site, along with the calculated ambient L_{dn} sound levels collected during the noise survey are presented in table 4.11.2-1. This table also includes the estimated noise contribution from HDD activities at the NSAs and the effect of noise control. Additional NSAs may exist further from each HDD site; however, the noise impacts would be lower than those presented in the table due to additional noise attenuation.

All engines used for the HDD activities would be fitted with residential-grade exhaust silencers to reduce noise. The noise levels attributable to the HDD activities at Fish Creek Exit, Ohio River #1 Entry, Highway I-77 Exit, Muskingum River Entry and Exit, and Rush Creek Entry and Exit locations would meet our noise criteria of an L_{dn} of 55 dBA with the general mitigation measures proposed. Without any site-specific mitigation measures (i.e. additional mitigation measures), the noise levels attributable to the HDD activities at Fish Creek Entry, Highway I-77 Entry, Highway I-33 Entry and Exit, and Ohio River #2 Entry and Exit locations would exceed our noise criteria of an L_{dn} of 55 dBA. Therefore, in addition to the general mitigation measures, Columbia Gas has proposed site-specific mitigation measures (temporary barriers during construction) as outlined in table 4.11.2-1 for these locations. The addition of the site-specific mitigation measures would reduce the noise from HDD activity to below an L_{dn} of 55 dBA at all HDD locations, except for Ohio River #2 Entry location. Aside from use of temporary barriers during construction, Columbia Gas not identified additional site-specific mitigation measures to further reduce HDD noise levels from the Ohio River #2 Entry location to below 55 dBA L_{dn} at the closest NSAs. Based on the current information available, and our belief that additional mitigation is feasible for the site, we conclude that noise impacts from the Ohio River #2 Entry location would be significant, but can be further mitigated. Therefore, **we recommend that:**

- **<u>Prior to construction,</u> Columbia Gas should file with the Secretary, for review and written approval by the Director of OEP, a revised HDD noise mitigation analysis for the Ohio River #2 Entry location. The revised plan should identify additional mitigation measures that Columbia Gas commits to implementing and the resulting projected noise level at the NSAs with implementation of the mitigation measures.**

  and

- **Columbia Gas should file in the weekly construction status reports the following for each HDD entry and exit site:**

  a) the noise measurements from the nearest NSA for each drill entry/exit site, obtained at the start of drilling operations;

  b) the noise mitigation that Columbia Gas implements at the start of drilling operations; and

  c) any additional mitigation measures that Columbia Gas would implement if the initial noise measurements exceeded an L_{dn} of 55 dBA at the

nearest NSA and/or increased noise is over ambient conditions greater than 10 decibels.

TABLE 4.11.2-1
Calculated HDD Noise Levels at the Nearest NSAs for the LX Project

HDD Site	Nearest NSA (All Residences)	Distance and Direction of NSA to Drill Site (feet)	Ambient Sound Level (L_{dn}) dBA	Estimated Sound Level (L_{dn}) of the HDD dBA	Estimated Total Sound Level (HDD L_{dn} + Ambient L_{dn}) [a, b] dBA	Potential Increase above Ambient dB
Fish Creek Entry	NSA #1	750 N	41.2	52.0 [c]	52.3 [c]	11.1
Fish Creek Exit	NSA #2	775 S	41.2	52.4	52.7	11.5
Ohio River #1 Entry	NSA #1	1,350 N	55.2	53.1	57.3	2.1
Ohio River #1 Exit	NSA #2	No NSAs within 0.5 mile.	N/A	N/A	N/A	N/A
Highway I-77 Entry	NSA #1	950 NE	61.5	49.6 [c]	61.8 [c]	0.3
Highway I-77 Exit	NSA #2	1,325 W	43.5	41.8	45.7	2.3
Muskingum River Entry	NSA #1	1,125 S	45.2	52.0	52.9	7.7
Muskingum River Exit	NSA #2	800 NE	43.5	47.0	48.6	5.0
Rush Creek Entry	NSA #1	1,500 S to SW	35.5	45.2	45.7	10.2
Rush Creek Exit	NSA #2	1,750 SE	39.2	32.2	40.0	0.8
Highway I-33 Entry	NSA #1	225 SE	56.5	63.3 [c]	64.1 [c]	7.6
Highway I-33 Exit	NSA #2	1,450 NW	51.5	40.9 [c]	51.8 [c]	0.3
Ohio River #2 Entry	NSA #1	150 NW	52.0	66.9 [c]	67.1 [c]	15.1
Ohio River #2 Exit	NSA #2	225 E	52.4	51.8 [c]	55.1 [c]	2.7

HDD = horizontal directional drill

NSA = noise sensitive area

L_{dn} = Day-night sound level

dBA = A-weighted decibel; dB = decibel

N/A = not applicable

[a] Includes the noise generated by the HDD plus ambient sound levels measured at the NSA.

[b] Includes the effect of a residential-grade exhaust silencer that would be employed on equipment engines as a general noise control measure for all HDD sites.

[c] Includes the effect of the anticipated additional noise control measures for the drill at the following HDD sites: Fish Creek Entry: Install a 16-foot high partial barrier on the north and south-southwestern sides of the entry point to reduce HDD noise at the nearest NSAs; Highway I-77 Entry: Install a 16-foot high partial barrier on the north and east sides of the entry point to reduce HDD noise at the nearest NSAs; Highway I-33 Entry: Install a 12-foot high partial barrier on the southwest, south, and southeast sides of the entry point to reduce HDD noise at the nearest NSAs; Highway I-33 Exit: Install a 16-foot high partial barrier on the southwest, south, and southeast sides of the entry point to reduce HDD noise at the nearest NSAs; Ohio River #2 Entry: Install a 16-foot high perimeter site barrier to reduce HDD noise at the nearest NSAs that surround the entry point; Ohio River #2 Exit: Install a 16-foot high perimeter site barrier to reduce HDD noise at the nearest NSAs that surround the entry point.

Construction of the LX Project aboveground facilities would also generate noise from earthwork (e.g., site grading and clearing) and installation of the facility site foundations and equipment. The most prevalent noise-generating equipment during construction of the aboveground facilities would be from internal combustion engines of construction equipment (up to 85 dBA at 50 feet). Site earthwork would result in the highest construction noise due to multiple pieces of equipment operating simultaneously.

The noise levels experienced at NSAs would depend on the type of equipment used, the mode of operation of the equipment, the length of time the equipment is in use, the amount of equipment used simultaneously, and the distance between the noise generation source and the receptor. Columbia Gas would limit construction at aboveground facilities to daylight hours to prevent nighttime noise impacts. While construction could produce noise levels that would be perceptible above the ambient noise conditions, the noise increment would be temporary and local. The estimated peak daytime construction noise levels of proposed and existing aboveground facilities at the closest NSAs are outlined in table 4.11.2-2.

TABLE 4.11.2-2
Estimated Peak Construction Noise Levels at Proposed and Existing Aboveground Facilities for the LX Project

Facility Type	Estimated Noise Level (dBA)
Compressor Stations	
Lone Oak Compressor Station	59
Summerfield Compressor Station	56
Oak Hill Compressor Station	60
Crawford Compressor Station [a]	65
Ceredo Compressor Station [a]	65
Grayson Compressor Station	72 [b]
Means Compressor Station	69 [b]
Regulator Stations	
K-260 RS	55
R-System RS	63
Benton RS	43
McArthur RS	61
RS-1286[a]	66
Odorization Stations	
R-486 OS	63
R-130 OS	82
R-543 OS	79
R-300/R-500 OS	73

[a] Indicates modification at existing facility
[b] based on worst case scenario of all equipment running simultaneously (a total sound power level of 123 dBA

Based on the analyses conducted, we conclude that construction of the LX Project pipelines (including HDD activities and mitigation measures proposed), compressor stations, regulator station and odorization stations would not result in significant noise impacts on NSAs.

4.11.2.3 Operational Noise Impacts and Mitigation

Columbia Gas' sources of operational noise would include daily operation of three new compressor stations (Lone Oak CS, Summerfield CS, and Oak Hill) and infrequent blowdown events, four new regulator stations (K-260 RS, R-System RS, Benton RS, and McArthur RS), four new odorization sites (R-486 OS, R-130 OS, R-543 OS and R-300/R-500 OS), and modifications to two existing compressor stations (Crawford CS and Ceredo CS) and one existing regulator station (RS-1286). Columbia Gulf's sources of operational noise would include daily operation of two new compressor stations (Grayson CS and Means CS). Potential noise impacts associated with the operation of these aboveground facilities would be limited to the vicinity of the facilities.

Compressor Stations

Ambient noise measurements at the proposed compressor station sites were conducted from January 2015 through August 2015. Columbia Gas and Columbia Gulf first identified NSAs within 1 mile of each compressor station site and then conducted ambient noise level measurements. Appendix Q includes figures depicting the location of the NSAs relative to corresponding compressor stations. An acoustical analysis was conducted to estimate the operational noise levels at the nearest NSAs from each new and modified compressor station. Noise generating equipment at Columbia Gas' and Columbia Gulf's compressor stations would include engines, gas aftercoolers, utility coolers, fuel gas regulation skids, discharge and suction piping, blowdown vents, engine air intakes, engine exhaust systems, and compressor and engine casings.

Table 4.11.2-3 shows the distance and direction of all NSAs within 1 mile of each compressor station, calculated ambient L_{dn} based on measured daytime and nighttime L_{eq}, and predicted compressor station operating noise levels at the NSAs within 1 mile. The operational noise analysis includes Columbia Gas' and Columbia Gulf's use of its identified mitigation measures, including:

- acoustically treated compressor building walls, roofs, and doors;
- adequate silencer on compressor building ventilation, exhaust, and intake; and
- acoustical pipe insulation on discharge piping (gas cooler header).

TABLE 4.11.2-3
Calculated Operational Noise Levels for New and Existing Compressor Stations

NSA	Distance and Direction of NSA to Compressor Station Site (feet)	Ambient Sound Level, L_{dn} (dBA)	Estimated Sound Level (L_{dn}) of each Station [a] (dBA)	Estimated Total Sound Level (Station L_{dn} + Ambient L_{dn}) [b] (dBA)	Potential Increase Above Ambient (dB)
Lone Oak Compressor Station (New)					
NSA #1 (Residences)	1,100 W	56.8	48.2	57.4	0.6
NSA #2 (Residence)	1,400 NW	58.7	45.5	58.9	0.2
NSA #3 (Residences)	2,100 S to SW	44.0	41.9	46.1	2.1
Summerfield Compressor Station (New)					
NSA #1 (Residence)	1,700 NW	39.4	43.0	44.5	5.1
NSA #2 (Residences)	3,300 SW	34.6	35.3	38.0	3.4
NSA #3 (Residences)	2,600 W	35.3	38.1	39.9	4.7
Oak Hill Compressor Station (New)					
NSA #1 (Residences)	1,100 N to NW	35.4	47.7	48.0	12.6
NSA #2 (Residences)	1,900 SW	32.1	42.3	42.7	10.6
NSA #3 (Residence)	3,200 S	36.7	36.9	39.9	3.2
NSA #4 (Residence)	3,800 SE	33.2	35.2	37.3	4.1
Crawford Compressor Station (Existing - Additional Regulator Building and Related Facilities)					
NSA #1 (Residences)	250 NE	61.5	43.0	61.5	0.0
NSA #2 (Residences)	500 SW	51.8	32.4	51.8	0.0
NSA #3 (Residences)	1,600 S	59.2	25.8	59.2	0.0
NSA #4 (Residence)	1,600 E	58.1	25.9	58.1	0.0
NSA #5 (Residence)	700 NW	51.8	34.2	51.8	0.0

TABLE 4.11.2-3 (cont'd)
Calculated Operational Noise Levels for New and Existing Compressor Stations

NSA	Distance and Direction of NSA to Compressor Station Site (feet)	Ambient Sound Level, L_{dn} (dBA)	Estimated Sound Level (L_{dn}) of each Station [a] (dBA)	Estimated Total Sound Level (Station L_{dn} + Ambient L_{dn}) [b] (dBA)	Potential Increase above Ambient (dB)
Ceredo Compressor Station (Existing - Additional Compression)					
NSA #1 (Residences)	725 SE	75.3	50.4[c]	73.5	-1.8
NSA #1A (Residences)	800 ESE	70.4	48.0[c]	67.2	-3.2
NSA #2 (Residences)	1,275 S	65.1	41.5[c]	62.9	-2.2
NSA #3 (Residences)	1,500 NNW	60.8	38.1[c]	57.7	-3.1
NSA #4 (Residence)	1,350 NNE	60.9	39.5[c]	57.9	-3.0
Grayson Compressor Station (New)					
NSA #1 (Church)	760 SSE	60.3	52.4	61.0	0.7
NSA #2 (Residences)	1,450 SSW	58.3	36.0	58.3	0.0
NSA #3 (Residences)	3,220 SW	59.0	39.7	59.1	0.1
NSA #4 (Residence)	1,580 N	51.1	34.9	51.2	0.1
NSA #5 (Residence)	4,000 E	52.4	28.1	52.4	0.0
NSA #6 (Residence)	3,400 SE	53.0	26.3	53.0	0.0
Means Compressor Station (New)					
NSA #1 (Residences)	760 NE	58.0	52.2	59.0	1.0
NSA #2 (Residences)	1,340 NNW	58.0	44.0	58.2	0.2
NSA #3 (Residences)	2,270 SW	59.6	39.8	59.6	0.0
NSA #4 (Residence)	1,780 SE	55.6	43.0	55.8	0.2

NSA = noise sensitive area
L_{dn} = day-night sound level
dBA = A-weighted decibel
dB = decibel

[a] Includes the effect of the anticipated noise control measures for the compressor units.

[b] Includes the noise generated by each compressor station plus ambient sound levels measured at the NSA.

[c] Includes the existing compressor station noise level plus the noise level of the compressor station after the installation of the new compressor units and decommissioning of an existing compressor unit at nearby NSAs. Most of the estimated total sound level (Station + Ambient L_{dn}) at nearest NSAs to Ceredo CS are less than the ambient sound level because of the decommissioning of an existing compressor unit.

Columbia Gas would implement the following noise control measures to reduce noise impacts from proposed meter building and associated facilities at the existing Crawford CS:

- acoustically treated meter building walls, roofs, and doors;
- acoustical louvers for meter building ventilation air inlets; and
- acoustical sound baffle for the building ridge vent.

As shown in table 4.11.2-3**,** noise levels from each new and modified compressor station are projected to be below the FERC criterion of 55 dBA L_{dn} at the closest NSAs. Also, noise level increases would be undetectable at NSAs for all compressor stations, except the new Summerfield and Oak Hill CSs. Noise level decreases at closest NSAs to the modified Ceredo CS would also be undetectable. Operation of the new Summerfield and Oak Hill CSs would result in a perceptible increase in noise levels at some NSAs, but total noise levels would remain below our 55 dBA L_{dn} criterion. Operation of the modified Ceredo CS (addition of two compressor units and decommissioning of an existing unit) would result in a 2 to 3 dB decrease in noise levels at the closest NSAs due to the high noise levels of the

existing compressor units. However, to ensure that the actual noise levels produced as a result of the LX and RXE Projects compressor stations are not significant, **we recommend that:**

- **Columbia Gas and Columbia Gulf should file a noise survey with the Secretary <u>no later than 60 days</u> after placing the Lone Oak, Summerfield, Oak Hill, Grayson, and Means Compressor Stations in service. If a full load condition noise survey of the entire station is not possible, Columbia Gas and Columbia Gulf should instead file an interim survey at the maximum possible horsepower load and file the full load survey <u>within 6 months</u>. If the noise attributable to the operation of all of the equipment at any compressor station under interim or full horsepower load conditions exceeds 55 dBA L_{dn} at any nearby NSAs, Columbia Gas and Columbia Gulf should file a report on what changes are needed and should install the additional noise controls to meet the level <u>within 1 year</u> of the in-service date. Columbia Gas and Columbia Gulf should confirm compliance with the 55 dBA L_{dn} requirement by filing a second noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.**

  and

- **Columbia Gas should file noise surveys with the Secretary <u>no later than 60 days</u> after placing the authorized units at the Crawford and Ceredo Compressor Stations in service. If a full load condition noise survey of the entire station is not possible, Columbia Gas should file an interim survey at the maximum possible horsepower load and file the full load surveys <u>within 6 months</u>. If the noise attributable to the operation of the modified compressor station at full or interim power load conditions exceeds existing noise levels at any nearby NSAs that are currently at or above an L_{dn} of 55 dBA, or exceeds 55 dBA L_{dn} at any nearby NSAs that are currently below 55 dBA L_{dn}, Columbia Gas should file a report on what changes are needed and should install the additional noise controls to meet the level <u>within 1 year</u> of the in-service date. Columbia Gas should confirm compliance with the above requirement by filing a second noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.**

The site noise sources that could cause perceptible vibration (such as turbine exhaust noise) would be adequately mitigated; therefore, there would not be any perceptible increase in vibration at any NSA during operation of the LX or RXE Project compressor stations.

In addition to the operational noise discussed above, blowdown events would also generate noise impacts. The duration of a blowdown depends on factors such as the extent of the maintenance activity and the gas pressure, and would generally last between 20 minutes and 2 hours. The maximum estimated noise attributable to a blowdown event at the closest NSA to each new compressor station as well as additional compression at Ceredo CS is as follows:

- Lone Oak CS – 44 dBA;
- Summerfield CS – 45 dBA;
- Oak Hill CS – 44 dBA;
- Ceredo CS – 47 dBA;

- Grayson CS – 63 dBA; and,
- Means CS – 68 dBA.

Planned blowdown events could allow for slower gas release and be scheduled for daytime hours, thus reducing the noise impacts. Unplanned pipeline blowdowns occur only in emergency situations. Unplanned events could occur at any time, but are typically infrequent and of short duration.

Regulator Stations

Columbia Gas first identified NSAs within a 0.5 mile of each regulator station site and then conducted ambient noise level measurements. Ambient noise measurements for regulator stations were conducted in January 2015. Appendix Q contains the figures depicting the location of the NSAs relative to corresponding new and modified regulator station locations.

An acoustical assessment was conducted by evaluating sound levels produced by a typical regulator station operating at a level with the highest potential for noise at the nearest NSAs. Columbia Gas would implement the following noise control to reduce noise impacts from proposed regulator building and associated facilities at new and existing regulator stations:

- acoustically treated regulator building walls, roofs, and doors;
- adequate silencer on regulator building ventilation, exhaust, and intake;
- Globe syle control valves with noise attenuating trim;
- Low noise' box-type water bath heater assembly designed to meet a maximum sound level of 55 dBA at 50 feet from the heater perimeter at maximum operating conditions; and
- Buried aboveground piping (to the extent possible) and if necessary, acoustical lagging for aboveground piping would be installed in the event piping noise becomes problematic.

Columbia Gas calculated the maximum noise level for the new and modified regulator stations using the site layout, specification for each noise source, and an acoustical design goal of 55 dBA L_{dn} (or 48.6 dBA L_{eq}) at the nearest NSA. Table 4.11.2-4 summarizes the ambient sound level in the vicinity of each regulator station, the estimated sound level at the closest NSAs contributed by each station, including the effect of the anticipated noise control measures described above, and the potential increase in sound level above the ambient sound levels during project operations.

As shown in table 4.11.2-4, the noise attributable to the four new regulator stations and modifications to one existing regulator station would be lower than our 55 dBA L_{dn} requirement at the closest NSAs.

TABLE 4.11.2-4 Calculated Operation Noise Levels for New and Existing Regulator Stations					
NSA	**Distance and Direction of NSA to Regulator Station Site (feet)**	**Ambient Sound Level (L_{dn}) (dBA)**	**Estimated Sound Level (L_{dn}) of each Station [a] (dBA)**	**Estimated Total Sound Level (Station L_{dn} + Ambient L_{dn}) [b] (dBA)**	**Potential Increase above Ambient (dB)**
K-260 Regulator Station (New)					
NSA #1 (Residences)	1,300 W	51.9	42.3	52.4	0.5
NSA #2 (Residences)	1,900 S	49.7	37.9	49.9	0.2
R-System Regulator Station (New)					
NSA #1 (Residence)	500 N	50.6	52.7	52.7	4.2
NSA #2 (Residence)	1,400 W	50.6	41.8	41.8	0.5
NSA #3 (Residence)	1,700 E	51.6	39.5	39.5	0.3
Benton Regulator Station (New)					
NSA #1 (Residence)	2,900 W	33.0	32.1	35.6	2.6
McArthur Regulator Station (New)					
NSA #1 (Residence)	650 S	40.3	50.1	50.5	10.2
NSA #2 (Residences)	1,550 W	35.4	40.6	41.7	6.3
NSA #3 (Residences)	1,600 E	47.5	40.2	48.3	0.8
RS-1286 Regulator Station (Existing)					
NSA #1 (Residence)	350 W to SW	42.8	50.8	51.4	8.6
NSA #2 (Residence)	400 SE	42.8	49.5	50.3	7.5
NSA #3 (Residence)	750 N to NE	42.8	43.3	46.1	3.3

NSA = noise sensitive area
L_{dn} = day-night sound level
dBA = A-weighted decibel
dB = decibel
[a] Includes the effect of the anticipated noise control measures for each regulator station.
[b] Includes the noise generated by each regulator station plus ambient sound levels measured at the NSA.

Odorization Stations

Columbia Gas first identified NSAs within a 0.5 mile of each odorization sites and then conducted ambient noise level measurements. Ambient noise measurements for odorization stations were conducted in January of 2015. Appendix Q contains the figures depicting the location of the NSAs relative to corresponding odorization locations.

An acoustical assessment was conducted by evaluating sound levels produced by a typical odorization station operating at a level with the highest potential for noise at the nearest NSA. However, an acoustical assessment associated with the proposed odorization modifications at the existing Benton CS was not conducted, as no new sources of operational noise would occur at this site. Columbia Gas would implement the following noise control to reduce noise impacts from proposed odorization skid and associated facilities at new odorization sites:

- Standard double poly control enclosure on odorization skid instead of the optional stainless steel enclosure which is less effective in containing venting noise associated with the internal small pneumatic diaphragm pump;
- Buried aboveground piping (to the extent possible) and if necessary, acoustical lagging for aboveground piping would be installed in the event piping noise becomes problematic; and

- Absorptive barriers in the project design in the event that noise from the new odorization skid becomes problematic for the adjacent NSAs.

Columbia Gas calculated the maximum noise level for the new odorization stations using the site layout, specification for each noise source, and an acoustical design goal of 55 dBA L_{dn} (or 48.6 dBA L_{eq}) at the nearest NSA.

Table 4.11.2-5 provides the results of the calculated daily operational noise levels for the new odorization stations. The table summarizes the ambient sound level near each odorization station, the estimated sound level at the closest NSAs contributed by each station, including the effect of the anticipated noise control measures described above, and the potential increase in sound level above the ambient sound levels during project operations.

As shown in table 4.11.2-5, the noise attributable to the four new odorization stations would be lower than our 55 dBA L_{dn} requirement at the closest NSAs. Also, noise level increases would be undetectable at NSAs for all odorization stations, except the R-130 Odorization Station. Noise increase from operation of the R-130 Odorization Station would be perceived as twice as loud at its closest NSA, but total noise levels would remain below our 55 dBA L_{dn} criterion.

TABLE 4.11.2-5
Calculated Operation Noise Levels for New Odorization Stations

NSA	Distance and Direction of NSA to Odorization Station (feet)	Ambient Sound Level (L_{dn}) (dBA)	Estimated Sound Level (L_{dn}) of each Odorization Station[a] (dBA)	Estimated Total Sound Level (Odorization Site L_{dn} + Ambient L_{dn})[b] (dBA)	Potential Increase above Ambient (dB)
R-486 Odorization Station					
NSA #1 (Residence)	500 W to NW	35.3	36.7	39.1	3.8
R-130 Odorization Station					
NSA #1 (Residences)	100 NW and E	40.7	51.8	52.1	11.4
R-543 Odorization Station					
NSA #1 (Residences)	150 W and NE	49.1	48.1	51.7	2.6
R-300/R-500 Odorization Station					
NSA #1 (Residence)	300 NW	48.8	44.7	50.2	1.4

NSA = noise sensitive area
L_{dn} = day-night sound level
dBA = A-weighted decibel
dB = decibel
[a] Includes the effect of the anticipated noise control measures for each odorization site.
[b] Includes the noise generated by each regulator site plus ambient sound levels measured at the NSA.

4.12 RELIABILITY AND SAFETY

The transportation of natural gas by pipeline involves some incremental risk to the public due to the potential for accidental release of natural 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 asphyxiate, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death. Methane is inactive biologically and essentially nontoxic. It is not listed in the International Agency for Research on Cancer, National

Toxicology Program, or by the Occupational Safety and Health Administration as a carcinogen or potential carcinogen.

Methane has an auto-ignition temperature of 1,000 °F and is flammable at concentrations between 5 percent and 15 percent in the air. Unconfined mixtures of methane in air are not explosive; however, it may ignite if there is an ignition source. However, a flammable concentration within an enclosed space in the presence of an ignition source can explode. It is buoyant at atmospheric temperatures and disperses rapidly in air.

4.12.1 Safety Standards

The DOT is mandated to provide pipeline safety under Title 49, USC Chapter 601. PHMSA's Office of Pipeline Safety administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards that set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve the required safety standard.

PHMSA ensures that people and the environment are protected from the risk of pipeline incidents. This work is shared with state agency partners and others at the federal, state, and local level. The DOT provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the federal standards. A state may also act as the DOT's agent to inspect interstate facilities within its boundaries. Ohio, and West Virginia perform inspections on interstate natural gas pipeline facilities. DOT federal inspectors perform inspections on interstate natural gas pipeline facilities in Pennsylvania and Kentucky. The DOT is also responsible for enforcement action in all of the LX and RXE Project states.

The DOT pipeline standards are published in 49 CFR Parts 190-199. Part 192 specifically addresses natural gas pipeline safety issues. Under a *Memorandum of Understanding on Natural Gas Transportation Facilities* dated January 15, 1993, between the DOT and FERC, the DOT is recognized as having the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of FERC's regulations require that an applicant certify that it would design, install, inspect, test, construct, operate, replace, and maintain the facility for which a Certificate is requested in accordance with federal safety standards and plans for maintenance and inspection, or should certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with Section 3(e) of the Natural Gas Pipeline Safety Act. FERC accepts this certification and does not impose additional safety standards other than the DOT standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the memorandum to promptly alert the DOT. The memorandum also provides instructions for referring complaints and inquiries made by state and local governments and the general public involving safety matters related to pipelines under the Commission's jurisdiction.

FERC also participates as a member of the DOT's Technical Pipeline Safety Standards Committee, which determines if proposed safety regulations are reasonable, feasible, and practicable.

The pipeline and aboveground facilities associated with the LX and RXE Projects would be designed, constructed, operated, and maintained in accordance with or to exceed the DOT *Minimum Federal Safety Standards* in 49 CFR 192. These regulations, which are intended to protect the public and to prevent natural gas facility accidents and failures, include specifications for material selection and qualification; minimum design requirements; and protection of the pipeline from internal, external, and atmospheric corrosion.

The DOT defines area classifications based on population density in the vicinity of the pipeline, and specifies more rigorous safety requirements for populated areas. Pipe wall thickness and pipeline design pressures, hydrostatic test pressures, MAOP, inspection and testing of welds, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas. The class locations 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 below:

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 on at least 5 days a week for 10 weeks in any 12-month period; and

Class 4 - Location where buildings with four or more stories aboveground are prevalent.

In accordance with federal standards, class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Pipelines constructed on land 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. All pipelines installed in navigable rivers, streams, and harbors must have a minimum cover of 48 inches in soil or 24 inches in consolidated rock. Class locations also specify the maximum distance to sectionalized block valves (that is 10.0 miles in Class 1, 7.5 miles in Class 2, 4.0 miles in Class 3, and 2.5 miles in Class 4).

Preliminary class locations for the LX Project have been developed based on the relationship of the pipelines centerline to other nearby structures and manmade features. Table 4.12.1-1 shows the area classifications for the LX Project. About 88 percent of the proposed pipeline route would cross Class 1 locations, about 11 percent of the route would cross Class 2 locations, and only 1 percent of the route would cross Class 3 locations. No Class 4 areas would be crossed by the LX Project.

If Columbia Gas' LX Project is approved, the regulations require that the pipeline be designed, at a minimum, to the appropriate class location standards and that the spacing between the mainline valves meets the DOT requirements.

During operation of a pipeline, if a subsequent increase in population density adjacent to the right-of-way indicates a change in class location for the pipeline, Columbia Gas would be required to reduce the MAOP or replace the segment with pipe of sufficient grade and wall thickness, if required, to comply with the DOT regulations for the new class location.

The Pipeline Safety Improvement Act of 2002 also requires operators to develop and follow a written integrity management program that contains all the elements described in 49 CFR 192.911 and addresses the risks on each transmission pipeline segment. Specifically, the law establishes an integrity management program that applies to all high consequence areas (HCA).

The DOT published rules that define HCAs where a gas pipeline accident could do considerable harm to people and their property and requires an integrity management program to minimize the potential for an accident. This definition satisfies, in part, the Congressional mandate for the DOT to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area.

The HCAs may be defined in one of two ways. In the first method, an HCA includes:

- current Class 3 and 4 locations;
- any area in Class 1 or 2 locations where the potential impact radius is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle[32]; or
- any area in Class 1 or 2 locations where the potential impact circle includes an identified site.
- An identified site is an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least 5 days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

In the second method, an HCA includes any area within a potential impact circle that contains:

- 20 or more buildings intended for human occupancy; or
- an identified site.

Once a pipeline operator has determined the HCAs on its pipeline, it must apply the elements of its integrity management plan to those segments of the pipeline within the HCAs. The DOT regulations specify the requirements for the integrity management plan at Part 192.911. The HCAs for the LX Project have been determined based on aerial photography review, field surveys, consultation with emergency response officials, and database searches. Less than 1 percent, or about 1.2 miles of the area along the proposed route for the LX Project would be classified as HCA. The locations of these areas are presented in table 4.12.1-2.

The pipeline integrity management rule for HCAs requires inspection of the pipeline every 7 years.

After construction, and as required by the DOT regulations, the pipeline facilities would be marked at line-of-sight intervals and at crossings of roads, railroads, and other key points. The markers would indicate the presence of the pipeline and provide a telephone number and address where a company representative could be reached in the event of an emergency or before any excavation in the area of the pipeline by a third-party. Columbia Gas and Columbia Gulf would also participate in the "Call Before You Dig" and "One Call" programs and other related pre-excavation notification organizations in the states in which they operate. Columbia Gas and Columbia Gulf would develop and employ an integrity management plan for the LX and RXE Projects. Columbia Gas would also follow a Continuing Pipeline Surveillance Plan, which specifies procedures for performing routine surveillance of the pipeline.

[32] The potential impact circle is a circle of radius equal to the potential impact radius.

TABLE 4.12.1-1 Class Locations Crossed by the LX Project			
Class	**Begin Milepost**	**End Milepost**	**Length (miles)**
LEX			
3	0.0	0.2	0.2
1	0.2	12.1	11.9
2	12.1	13.6	1.5
1	13.6	17.5	3.9
2	17.5	19.4	1.9
1	19.4	42.1	22.7
2	42.1	43.5	1.4
1	43.5	58.7	15.2
2	58.7	59.9	1.2
1	59.9	61.7	1.9
3	61.7	62.0	0.3
1	62.0	66.0	3.9
2	66.0	67.0	1.0
1	67.0	112.1	45.2
2	112.1	115.0	2.9
1	115.0	127.5	12.5
2	127.5	128.2	0.7
1	128.2	130.6	2.4
2	130.6	131.3	0.8
LEX1			
1	0.0	1.2	1.2
R-801 Loop			
2	0.0	1.4	1.4
1	1.4	4.7	3.3
2	4.7	5.3	0.6
1	5.3	8.4	3.1
2	8.4	8.8	0.4
3	8.8	9.0	0.3
2	9.0	9.8	0.8
1	9.8	22.4	12.6
2	22.4	23.5	1.1
1	23.5	24.2	0.7
BM-111 Loop			
3	0.0	1.1	1.1
2	1.1	2.6	1.5
3	2.6	2.9	0.3

TABLE 4.12.1-2 High Consequence Areas Crossed by the LX Project			
Milepost		Distance from Project	
Begin	End	(feet)	Description
LEX			
0.0	0.1	0	Industrial facility
61.7	62.1	240	Church
R-801 Loop			
8.7	9.1	223	Campground/lodges
BM-111 Loop			
0.0	0.3	0	Heavily populated area

The DOT prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Each pipeline operator must establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. Key elements of the plan would include procedures for:

- receiving, identifying, and classifying emergency events such as gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- emergency shutdown of system and safe restoration of service;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and
- protecting people first and then property, and making them safe from actual or potential hazards.

Columbia Gas would prepare an emergency response plan that would provide procedures to be followed in the event of an emergency that would meet the requirements of 49 CFR 192.615. The plan would include the procedures for communicating with emergency services departments, prompt responses for each type of emergency, logistics, emergency shut down and pressure reduction, emergency service department notification, and service restoration.

Compressor stations associated with the LX and RXE Projects would be designed in accordance with the standards specified in 49 CFR 192.163, which includes the following requirements:

- All buildings containing pressurized gas piping greater than two inches in diameter and/or gas handling equipment for non-domestic purposes must be constructed of noncombustible materials;
- The main compressor building must be located at a safe distance from adjacent properties;
- Each operating floor of a main compressor building and each fence around a compressor station must have at least two separated and unobstructed exits; and
- Electrical equipment and wiring must conform to the National Electric Code (NEC) National Fire Protection Act (NFPA) 70.

4.12.2 Pipeline Accident Data

The DOT requires all operators of natural gas transmission pipelines to notify the DOT of any significant incidents and to submit a report within 30 days. Significant incidents are defined as any leaks that:

- cause a death or personal injury requiring hospitalization; or
- involve property damage of more than $50,000 in 1984 dollars.[33]

During the 20-year period from 1996 through 2015, a total of 1,310 significant incidents were reported on the more than 300,000 total miles of natural gas transmission pipelines nationwide.

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 4.12.2-1 provides a distribution of the causal factors, as well as the number of each incident by cause.

The dominant incident cause of pipeline incidents are corrosion and pipeline material, weld, or equipment failure, and excavation constituting 66.7 percent of all significant incidents. The pipelines included in the data set in table 4.12.2-1 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 significant incidents is strongly dependent on pipeline age. Older pipelines have a higher frequency of corrosion incidents, since corrosion is a time-dependent process.

Table 4.12.2-2 provides a distribution of state-specific significant incident data for the past 20 years where the projects would be located. This data shows that over the past 20 years there have been a total of 26 significant incidents in Kentucky, 25 in Ohio, 40 in Pennsylvania, and 18 in West Virginia. One fatality and 12 injuries were recorded for these 109 significant incidents in these four states.

The use of both an external protective coating and a cathodic protection system, required on all pipelines installed after July 1971, significantly reduces the corrosion rate compared to unprotected or partially protected pipe.

Outside forces, including excavations and natural events were the cause of 33.5 percent of significant pipeline incidents nationwide from 1996 to 2015. Table 4.12.3-3 provides a breakdown of outside force incidents by cause. These mostly result from the encroachment of mechanical equipment such as bulldozers and backhoes; earth movements due to soil settlement, washouts, or geologic hazards; weather effects such as winds, storms, and thermal strains; and willful damage.

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[33] $50,000 in 1984 dollars is approximately $112,955.73 as of May 2015 (U.S. Department of Labor, Bureau of Labor Statistics, 2015).

TABLE 4.12.2-1
Natural Gas Transmission Pipeline Significant Incidents by Cause (1996-2015) [a]

Cause	Number of Incidents	Percentage
Pipeline material, weld, or equipment failure	354	27.0
Corrosion	311	23.7
Excavation	210	16.0
All other causes [b]	165	12.6
Natural forces [c]	146	11.1
Outside force [d]	84	6.4
Incorrect operation	40	3.1
Total	**1,310**	**100**

[a] All data gathered from PHMSA's Oracle BI Interactive Dashboard website for Significant Transmission Pipeline Incidents, https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages&NQUser=PDM_WEB_USER&NQPassword=Public_Web_User1&PortalPath=%2Fshared%2FPDM%20Public%20Website%2F_portal%2FSC%20Incident%20Trend&Page=Significant&Action=Navigate&col1=%22PHP%20-%20Geo%20Location%22.%22State%20Name%22&val1=%22%22 (DOT, 2016a). Accessed on 2/17/2016.

[b] All other causes include miscellaneous, unspecified, or unknown causes.

[c] Natural force damage includes earth movement, heavy rain, floods, landslides, mudslides, lightning, temperature, high winds, and other natural force damage.

[d] Outside force damage includes previous mechanical damage, electrical arcing, static electricity, fire/explosion, fishing/maritime activity, intentional damage, and vehicle damage (not associated with excavation).

TABLE 4.12.2-2
Natural Gas Transmission Pipeline Significant Incidents by State (1996-2015) [a]

State	Number of Incidents	Causes
Kentucky	26	Material /Weld/Equipment Failure, Corrosion, Excavation Damage, Natural Force Damage, Outside Force, Other
Ohio	25	Material /Weld/Equipment Failure, Corrosion, Excavation Damage, Natural Force Damage, Outside Force, Incorrect Operation
Pennsylvania	40	Material /Weld/Equipment Failure, Corrosion, Excavation Damage, Natural Force Damage, Outside Force, Incorrect Operation, Other
West Virginia	18	Material /Weld/Equipment Failure, Corrosion, Excavation Damage, Natural Force Damage, Outside Force, Incorrect Operation, Other
Total	**109**	

[a] All data gathered from PHMSA's Oracle BI Interactive Dashboard website for Significant Transmission Pipeline Incidents, https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages&NQUser=PDM_WEB_USER&NQPassword=Public_Web_User1&PortalPath=%2Fshared%2FPDM%20Public%20Website%2F_portal%2FSC%20Incident%20Trend&Page=Significant&Action=Navigate&col1=%22PHP%20-%20Geo%20Location%22.%22State%20Name%22&val1=%22%22 (DOT, 2016a). Accessed on 2/17/2016.

TABLE 4.12.3-3 Excavation, Natural Forces, and Outside Force Incidents by Cause (1996-2015) [a]		
Cause	**Number of Excavation, Natural Forces, and Outside Force Incidents**	**Percentage of All Incidents [b,c]**
Third party excavation damage	172	13.1
Heavy rain, floods, mudslides, landslides	74	5.7
Vehicle (not engaged with excavation)	49	3.7
Earth movement, earthquakes, subsidence	32	2.4
Lightning, temperature, high winds	27	2.1
Operator/contractor excavation damage	25	1.9
Unspecified excavation damage/previous damage	13	1.0
Other or unspecified natural forces	13	1.0
Fire/explosion	9	0.7
Fishing or maritime activity	9	0.7
Other outside force	9	0.7
Previous mechanical damage	6	0.5
Electrical arcing from other equipment/facility	1	0.1
Intentional damage	1	0.1
Total	**440**	**33.5**

[a] All data gathered from PHMSA's Oracle BI Interactive Dashboard website for Significant Transmission Pipeline Incidents, https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages&NQUser=PDM_WEB_USER&NQPassword=Public_Web_User1&PortalPath=%2Fshared%2FPDM%20Public%20Website%2F_portal%2FSC%20Incident%20Trend&Page=Significant&Action=Navigate&col1=%22PHP%20-%20Geo%20Location%22.%22State%20Name%22&val1=%22%22 (DOT, 2016a). Accessed on 2/17/2016.

[b] Percentage of all incidents was calculated as a percentage of the total number of incidents natural gas transmission pipeline significant incidents (i.e., all causes) presented in table 4.12.3-1

[c] Due to rounding, column does not equal 33.6 percent.

4.12.3 Impact on Public Safety

The service incident data summarized in table 4.12.2-1 include pipeline failures of all magnitudes with widely varying consequences.

Table 4.12.3-1 presents the annual injuries and fatalities that occurred on natural gas transmission lines between 2011 and 2015. The data has been separated into employees and nonemployees to better identify a fatality rate experienced by the general public. Fatalities among the public averaged 1.2 per year over the 5-year period from 2011–2015.

TABLE 4.12.4-1 Injuries and Fatalities – Natural Gas Transmission Pipelines [a]				
	Injuries		**Fatalities**	
Year	**Employees**	**Public**	**Employees**	**Public**
2011	1	0	0	0
2012	3	4	0	0
2013	0	2	0	0
2014	1	0	1	0
2015	12	2	6	0

[a] All data gathered from PHMSA Pipeline Incident Flagged Files website on March 6, 2015 http://phmsa.dot.gov/pipeline/library/data-stats/flagged-data-files (U. S. DOT, 2015).

The majority of fatalities from pipelines involve local distribution pipelines (not included in table 4.12.4-2). These are natural gas pipelines that are not regulated by FERC and that distribute natural gas to homes and businesses after transportation through interstate natural gas transmission pipelines. In

general, these distribution lines are smaller diameter pipes, often made of plastic or cast iron rather than welded steel, and tend to be older pipelines that are more susceptible to damage. In addition, distribution systems do not have large rights-of-way and pipeline markers common to the FERC-regulated natural gas transmission pipelines.

The nationwide totals of accidental fatalities from various manmade and natural hazards are listed in table 4.12.4-2 in order to provide a relative measure of the industry-wide safety of natural gas transmission pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. Furthermore, the fatality rate is more than 25 times lower than the fatalities from natural hazards such as lightning, tornados, floods, earthquakes, etc.

TABLE 4.12.4-2
Nationwide Accidental Fatalities by Cause

Type of Accident	Annual Number of Deaths
Motor vehicle [a]	35,369
Poisoning [a]	38,851
Falls [a]	30,208
Drowning [a]	3,391
Fire, smoke inhalation, burns [a]	2,760
Floods [b]	81
Tornado [b]	72
Lightning [b]	49
Hurricane [b]	47
Natural gas distribution lines [c]	13
Natural gas transmission pipelines [c]	2

[a] Accident data presented for motor vehicle, poisoning, falls, drowning, fire, smoke inhalation, and burns represent the annual accidental deaths recorded in 2013 (Centers for Disease Control and Prevention, 2013; Deaths: Final Data for 2013; http://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_02.pdf. Accessed 2/17/2016.)

[b] Accident data presented for floods, tornados, lightning, and hurricanes represent the 30 year average of accidental deaths between 1985 and 2014 (NOAA, 2016. National Weather Service, Office of Climate, Water and Weather Services, National Hazard Statistics, 30 year average (1985-2014); Available at: http://www.nws.noaa.gov/om/hazstats.shtml. Accessed 2/17/2016.)

[c] Accident data presented for natural gas distribution lines and transmission pipelines represent the 20-year average between 1996 and 2015 (U.S. Department of Transportation, 2016. Pipeline and Hazardous Materials Safety Administration, Pipeline Significant Incident 20 Year Trend: 20-Year Average (1996-2015); Available at: http://opsweb.phmsa.dot.gov/primis_pdm/significant_inc_trend.asp. Accessed 2/17/2016.)

The available data show that natural gas transmission pipelines continue to be a safe, reliable means of energy transportation. From 1996 to 2015, there was a national average of 65.4 significant incidents, 9.1 injuries and 2.3 fatalities per year. For the four states involved in the LX and RXE Projects, over the past 20 years there was an average of 5.5 incidents and 0.6 injuries per year with only 1 fatality over that time period, well below the national average. The number of significant incidents over the more than 300,000 miles of natural gas transmission lines indicates the risk is low for an incident at any given location. The operation of the Projects would represent a slight increase in risk to the nearby public.

4.13 CUMULATIVE IMPACTS

In accordance with NEPA, we considered the cumulative impacts of Columbia Gas' and Columbia Gulf's LX and RXE Projects and other projects or actions in the area. Cumulative impacts represent the incremental effects of a proposed action when added to impacts associated with past, present, or reasonably foreseeable future projects, regardless of what agency or person undertakes such other actions. Although the individual impact of each separate Project may be minor, the additive or

synergistic effects of multiple projects could be significant. The direct and indirect impacts of the LX Project and the RXE Project on environmental resources are discussed in other sections of this EIS.

The purpose of this analysis is to identify and describe cumulative impacts that would potentially result from implementation of the LX and RXE Projects. This cumulative impacts analysis uses an approach consistent with the methodology set forth in relevant guidance (CEQ, 1997b, 2005; EPA, 1999). Under these guidelines, inclusion of actions within the analysis is based on identifying commonalities of impacts from other actions to potential impacts that would result from the projects. In order to avoid unnecessary discussions of insignificant impacts and projects, and to adequately address and accomplish the purposes of this analysis, the cumulative impacts analysis for the proposed Projects was conducted using the following guidelines:

- A project must impact a resource category potentially affected by the proposed LX and RXE Projects. For the most part, these projects are located in the same general area that would be directly affected by construction of the proposed Projects. The effects of more distant projects are in most cases not assessed, because their impacts would tend to be localized and not contribute significantly to the impacts of the proposed Projects. Potential cumulative impacts on air quality and watersheds, however, were considered on a broader, more regional basis.

- The distance into the past and future that other projects could cumulatively impact the area of the proposed LX and RXE Projects is based on whether the impacts are short-term, long-term, or permanent. The majority of the impacts relating to the proposed projects would occur during the construction phase. Columbia Gas proposes to begin construction of the LX Project in November 2016 and Columbia Gulf proposes to begin construction in the 4th Quarter of 2016 for the RXE Project to meet the planned in-service date of November 2017 for both projects.

- Where a potential for cumulative impacts exists, those impacts are quantified to the extent practicable; however, in some cases the potential impact can only be described qualitatively. This is particularly the case for projects that are in the planning stages; are contingent on economic conditions, availability of financing, and/or the issuance of permits; or for which there is a lack of comprehensive information available.

The following cumulative analysis considered projects meeting one or more of the criteria listed below. These criteria define the projects' regions of influence used in this analysis to describe the general area for which the proposed projects could potentially contribute to cumulative impacts. The region of influence varies with the resource discussed. Specifically, this includes:

- geological and soil resources within the proposed projects' footprint; projects within the proposed projects' boundaries of the same eight-digit hydrologic unit code watersheds affecting water resources and aquatic resources;

- projects located within 0.5 mile of the proposed Projects' areas that may also impact wildlife, vegetation, and land use;

- socioeconomic conditions in counties within the proposed projects' construction areas and where non-local workers are expected to reside during construction and operations personnel are expected to reside permanently;

- projects located within 0.5 mile of the proposed Projects' construction workspaces that may affect short-term air quality, and projects located within 4 kilometers (2.5 miles) of the

Projects' aboveground facilities proposing additional natural gas compressor engines that may affect long-term air quality; and

- projects occurring 0.5 mile or less from facilities creating operational noise associated with the proposed projects.

In addition, up to an additional 15 miles into the adjacent counties were evaluated for portions of the proposed projects near a county border.

We have identified three types of projects that could potentially cause a cumulative impact when considered with the proposed projects. These include: (1) infrastructure; (2) FERC jurisdictional and non-jurisdictional linear pipeline projects; and (3) major residential, commercial, and industrial development projects within counties affected by the Projects (see table 4.13-1**)**. We identified these projects through scoping and independent research, as well as information provided by Columbia Gas and Columbia Gulf. These projects are listed in table 4.13-1.

In addition, although we do not examine the impacts associated with shale development activities to the same extent as the proposed LX and RXE Projects in this final EIS, we consider the general development of shale resources in proximity to the proposed projects within the context of cumulative impacts. A more specific analysis of these activities is outside the scope of this analysis because the exact location, scale, and timing of future facilities are unknown.

Of the projects listed in table 4.13-1, the greatest potential for cumulative impacts is with projects occurring within the resource-specific regions of influence listed above.

We reviewed the projects identified with the projects' regions of influence and determined that the greatest potential for cumulative impacts associated with the construction and operation of the proposed projects would be in Monroe and Noble Counties, Ohio and Marshall County, West Virginia, where there is a concentration of proximal and overlapping activities associated with past, present, and future projects and development activities. These projects include a number of other FERC-jurisdictional projects and oil and gas resource development and processing projects, as well as other energy-related projects. Further description of the other Columbia Gas and Columbia Gulf projects, as well as other FERC-jurisdictional projects, that are discussed in detail in this assessment is provided below. In addition, a summary of the non-jurisdictional facilities related to the proposed projects and discussion of shale development activities are also provided.

TABLE 4.13-1
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Rover Pipeline, LLC – Rover Pipeline Project (FERC Docket No. CP15-93)	Doddridge and Marshall, WV; Washington, PA; Noble, Monroe, Carroll, Wayne, Crawford, Defiance, and Harrison, OH	Approximately 511 miles of new natural gas supply laterals and mainlines, the installation of ten compressor stations	January 2016 - December 2016[a]	>0.1[b]	Rover's Seneca pipeline would parallel the proposed LEX Pipeline for approximately 17 miles in Monroe and Noble counties, OH. In addition, the Majorsville Lateral would be located approximately 0.6 mile west of the proposed LEX Pipeline at MP 0.5 in Marshall County, WV at its closest point, and the Sherwood lateral will intersect the proposed LEX Pipeline at MP 38.2 in Monroe County, OH. The Majorsville CS would be located approximately 5.5 miles northeast from the proposed Lone Oak CS in Marshall County, WV; the Seneca CS will be located approximately 2.2 miles northeast of the proposed Summerfield CS in Noble County, OH; and the Clarington CS would be located approximately 1.0 mile north of the proposed LEX Pipeline at MP 29.0 in Monroe County, OH.
Texas Eastern Transmission, LP – Appalachian Lease Project (FERC Docket Nos. PF15-11 and CP16-23	Monroe and Clarington, OH	Approximately 4.5 miles of a new pipeline loop segment located along Texas Eastern's mainline system in Monroe County, OH. Installing flow reversal facilities at the existing regulator and receiving sites near Clarington, OH.	March 2017 - October 2017	>0.1[b]	Parallel the proposed LEX Pipeline for approximately 3 miles in Monroe County, OH.
Equitrans, LP – Ohio Valley Connector Project (FERC Docket No. CP15-41)	Monroe and Wetzel, OH; northwestern West Virginia and southeastern Ohio	Approximately 50 miles of natural gas pipeline. Construction of two new natural gas powered compressor stations in Monroe and Wetzel counties, OH.	August 2015 – June 2016	0.0[c]	Intersects the proposed LEX Pipeline near MP 28.2. Additionally, the proposed Plasma CS in Monroe County, OH is approximately 0.5 mile north of the proposed LEX Pipeline at MP 28.5.
Tennessee Gas Pipeline Company, LLC – Abandonment and Capacity Restoration Project (FERC Docket No. CP15-88)	Morgan, OH	The abandonment in place of several natural gas pipeline facilities and the sale of these to an affiliate, which would convert the abandoned facilities for the transportation of natural gas liquids. Construction of new compressor station facilities along the pipeline system.	October 2016 - June 2017	2.4	Approximately 2.4 miles south of the proposed LEX Pipeline at MP 91.5.
Dominion Transmission, Inc. – Supply Header Project (FERC Docket No. CP15-555)	Greene, PA; Marshall, WV	Constructing new pipeline loops from Pennsylvania to West Virginia. Modification of existing compressor stations including increasing compression; and piping and valve modifications at existing stations in Green County, PA and Marshall County, WV, respectively	March 2017 - November 2018	14.8	Modifications at the existing Crayne CS in Greene County PA would occur approximately 23.6 miles southeast of the proposed LEX Pipeline at MP 1.5. The existing Burch Ridge CS is approximately 14.8 miles southwest of the proposed Lone Oak CS in Marshall County, WV.

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Columbia Transmission, LLC – SM-80 MAOP Restoration Project (FERC Docket No. CP15-549)	Wayne, WV	Construction of approximately 4 miles of 30-inch diameter pipeline loop.	March 2017 – August 2017	0.1	The terminus of the SM-80 pipeline loop would be located approximately 400 feet south of the Ceredo CS
Columbia Transmission, LLC – Mountaineer XPress Project (FERC Docket No. CP16-357)	Various counties in West Virginia including Marshall, Cabell, Doddridge, WV	Approximately 162.1 miles of new 36-inch-diameter natural gas pipeline from the LEX Pipeline in Marshall County, WV to the existing SM-System in Cabell County, WV, and approximately 4.6 miles of new 24-inch-diameter natural gas pipeline in Doddridge County, WV as well as the replacement of approximately 0.4 mile of special permit pipe located on the existing Line SM-80 and SM-80 Loop. Construction of one new regulator station and three new compressor stations as well as the installation of additional hp at three existing compressor stations and the construction of new and/or modification of other existing appurtenant facilities in West Virginia.	January 2018 – October 2018	0.0[c]	The new 36-inch-diameter Mountaineer XPress pipeline would extend from LEX Pipeline in Marshall County, WV and continue southwest. Additionally, one natural gas compressor unit would be installed at the Lone Oak CS, and an existing natural gas compressor unit would be replaced with a new electric compressor unit at the Ceredo CS.
Columbia Midstream Services, LLC – Gibraltar Pipeline Project	Washington, PA; Marshall, WV	Installation of approximately 16.5 miles of new 36- and 16-inch-diameter natural gas pipeline extending from Columbia's existing Claysville Meter Tie-in facility in Washington County, PA to its existing Line 1528 Tie-in facility at the Majorsville CS in Marshall County, WV. In addition, new over pressure protection will be installed at the existing Line 1528 Tie-in.	March 2016 – November 2016	0.3	The terminus of the new Gibraltar Pipeline Project would be located approximately 1,300 feet northwest of the proposed LEX launcher facility at MP 0.0 in Marshall County, WV.
Columbia Gas Transmission, LLC – Tri-County Bare Steel Replacement Project (FERC Docket No. CP15-95)	Allegheny, Washington, and Greene, PA	Replacement of 34 miles of 20-inch diameter natural gas pipeline with 37.5 miles of 20-inch diameter pipe in three segments. In addition, replacement of 7 mainline valves, abandonment/removal of one MLV and 37 taps, and construction of 2 new pig launchers/receivers.	March 2016 – November 2017	>15 miles	Segment 1 in Greene County, Pennsylvania is the closest proposed facility to the project and includes replacement of approximately 14 miles with 14.9 miles from Hero Valve to Waynesburg Compressor Station in Greene County.

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Moundsville Power, LLC – Moundsville Power Plant	Marshall WV	549-megawatt natural gas power plant	2015 – 2018	11.7	Proposed facility would be approximately 11.7 miles northwest of Lone Oak CS in Marshall County, WV.
Ohio DOT – Highway 33 Interchange Project	Fairfield, OH	A new highway interchange is being constructed for Highway 33 in the Village of Carroll	2015 – 2017	14.0	The new highway interchange would be approximately 14 miles northwest of the existing Crawford CS.
Heron Crossing Subdivision	Fairfield, OH	A new subdivision consisting of more than 180 single family homes is proposed for construction in Fairfield County, OH.	2016[d]	>15 miles	The Heron Crossing Subdivision would be located along Refugee Road approximately 21 miles northwest of LEX1 Pipeline MP 1.0.
Columbia Gulf Transmission, LLC – Gulf XPress Project	Rowan, Garad, and Metcalfe, KY; Davidson and Wayne, TN; Union and Grenada, MS	Construction of seven new compressor stations on the mainline pipeline system. Could include installation of additional hp at the Grayson CS.	2017 – 2018	0.0[e]	Additional hp would be installed at the Grayson CS, a component of RXE.
Dominion Transmission, Inc. – Allegheny Storage Project (FERC Docket No. CP12-72)	Monroe, OH; Frederick, MD; Lewis, WV; Tioga, PA	Construction of two new natural gas compressor stations and associated auxiliary facilities located in Monroe County, OH and Frederick County, Maryland; modifications at one existing compressor station in Lewis County, WV; and the replacement of approximately 2 miles of pipelines in Tioga County, PA.	February 2014 – October 2014 [c]	1.5	The Mullet CS location is located 1.5 miles north of LEX Pipeline MP 28.6 in Monroe County, OH.
Dominion Transmission, Inc. – Clarington Project (FERC Docket No. CP14-496)	Monroe, OH; Marshall, WV	Addition of compression at two existing compressor stations; two new meter and regulator stations; and approximately 6,400 feet of new suction/discharge pipe	November 2015 – November 2016	1.5	The Burch Ridge CS is located 4.1 miles south of LEX Pipeline MP 22.7 and 14.8 miles southwest of the Lone Oak CS. The Mullett CS and new suction/discharge pipe is located 1.5 miles north of LEX Pipeline MP 28.6 in.
Appalachian Resin, Inc. – Ethane Cracker Plant	Monroe, OH	Construct and operate an ethane cracker plant to process approximately 18,000 barrels per day of ethane into ethylene and polyethylene.	2019 (anticipated in-service date)	2.0	The proposed ethane cracker plant location has not been defined; however, it is planned to be located near Clarington, Ohio, which is approximately 2 miles south of MP 27.0 of LEX Pipeline.
Texas Eastern Transmission, LP – OPEN (Ohio Pipeline Energy Network Project) (FERC Docket No. CP14-68)	Columbiana, Carroll, Jefferson, Belmont, Monroe, OH	Construction of 76 miles of new 30-inch-diameter natural pipeline; one new compressor station ; and modifications to existing compressor stations and associated facilities along the new pipeline.	February 2015 – November 2015 (in-service)	0.5	The pipeline is located approximately 0.5 mile north of LEX Pipeline MP 28.6 in Monroe County, OH.
Texas Eastern Transmission, LP – Access South, Adair	Monroe, Noble, Athens, Meigs Perry, OH;	Natural gas pipeline looping; piping modifications at existing compressor stations along Texas Eastern's existing	March 2017 – November 2017	0.0[e]	The terminus of the new Athens to Berne Loop pipeline will be located 1.6 miles south of LEX Pipeline MP 51.9 in Monroe County, OH. The Berne

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Southwest, and Lebanon Extension Projects (FERC Docket No. CP16-3)	Monroe, KY	mainline; and the installation of electric hp at an existing compressor station.			to Holbrook Loop pipeline will parallel LEX Pipeline for approximately 0.5 mile in Monroe County, OH and will intersect LEX Pipeline at MP 36.1. Station piping modifications at the existing Holbrook CS will occur 4.8 miles southeast of LEX Pipeline MP 1.7 in Greene County, PA. Station piping modifications at the existing Somerset CS will occur 6.8 miles north of LEX Pipeline MP 111.8 in Perry County, OH. Station piping modifications and installation of a new launcher/receiver at the existing Berne CS will occur 1.74 miles south of LEX Pipeline MP 51.9 in Monroe County, OH.
Blue Racer Midstream, LLC – Berne Natural Gas Processing Complex	Monroe, OH	Two cryogenic natural gas processing plants constructed in two phases between 2013 and 2015, and each plant has 200 million cubic feet per day (MMcf/d) of nameplate capacity.	2013 – January 2015 (first unit) November 2014 – June 2015 (second unit)	2.1	The Berne Natural Gas Processing Complex is located 2.1 miles south of LEX Pipeline MP 52.9 in Monroe County, OH.
Blue Racer Midstream, LLC – Natrium II Natural Gas Processing Plant	Marshall, WV	Expansion of Blue Racer Midstream's existing Natrium Natural Gas Processing Plant increasing the facility's overall nameplate processing capacity by 200 million cubic feet per day.	2013 – March 2014	3.8	The Natrium Natural Gas Processing Plant is located 3.8 miles southwest of LEX Pipeline MP 23.6 in Marshall County, WV.
Texas Eastern Transmission, LP – Texas Eastern Appalachia to Market 2014 Project (FERC Docket No. CP13-84)	Various counties throughout Pennsylvania, West Virginia, Ohio, Kentucky, Tennessee, Alabama, and Mississippi	Construction of seven new 36-inch-diameter natural gas pipeline loops, totaling approximately 33 miles, as well as horsepower upgrades at four existing compressor stations located in south-central Pennsylvania. Piping modifications at 41 existing facilities located along Texas Eastern's existing pipeline system.	March 2014 – December 2014	1.3	Modifications at the existing launcher/receiver sites occurred approximately 2.3 miles north of LEX Pipeline MP 25.4\ RR-4 in Marshall County, WV; 1.8 miles north of LEX Pipeline MP 26.2 RR-4 in Monroe County, OH; 1.8 miles south of LEX Pipeline MP 51.7 in Monroe County, OH; 2.9 miles south of LEX Pipeline MP 56.4 in Noble County, OH. Modifications at the Summerfield CS occurred approximately 1.3 miles north of LEX Pipeline MP 54.5 RR-6 and the Somerset CS approximately 6.8 miles north of LEX Pipeline MP 113.0.
Rockies Express Pipeline, LLC – Seneca Compressor Expansion Project (FERC Docket No. CP14-194)	Noble, OH	Installation of three new compressors at the existing Rockies Express Seneca CS. Installation of upgraded metering equipment at the existing MarkWest Seneca Processing Plant.	May 2014 – October 2014	1.1	The Seneca CS is located 8.6 miles north of LEX Pipeline MP 49.4 in Noble County, OH, and the MarkWest Seneca Processing Plant is located 1.1 miles north of LEX Pipeline MP 54.8 RR-6 in Noble County, OH.

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Rockies Express Pipeline, LLC – Zone 3 East-to-West (FERC Docket No. CP14-498)	Various counties in Ohio, Illinois, and Indiana	Modifications at existing facilities located along the existing Rockies Express Pipeline in Ohio, Illinois, and Indiana to enable bi-directional flow capability within Rockies Express Zone 3.	March 2015 – September 2015	1.4	Modifications at the existing Clarington Hub Interconnect occurred 1.4 miles north of LEX Pipeline MP 28.3 in Monroe County, OH. Modifications at the existing Chandlersville CS occurred 7.5 miles north of LEX Pipeline MP 83.4 in Muskingum County, OH.
Consolidation Coal Company – McElroy Facility Conveyor System and River Unloading Facility	Marshall, WV	Construct a conveyor system and river unloading facility at existing McElroy coal preparation plant to unload and handle coal combustion product from barges.	Anticipated completion January 2017	0.8	The McElroy Facility is located approximately 0.8 mile northeast of LEX Pipeline MP 25.1 RR-4 in Marshall County, WV.
Williams Ohio Valley Midstream LLC – Moundsville Fractionation Plant Expansion	Marshall, WV	Expansion of the existing Moundsville Fractionation Plant to increase capacity.	Completed in 2012	5.6	The Moundsville Fractionation Plant is located approximately 5.6 miles northwest of LEX Pipeline MP 16.8 RR-3 in Marshall County, WV.
MarkWest – Majorsville Fractionation Plant	Marshall, WV	Expansion of the existing Majorsville Fractionation Plant to increase capacity.	Completed in November 2013	0.2	The Majorsville Fractionation Plant is located approximately 0.2 mile northwest of LEX Pipeline MP 0.0 in Marshall County, WV.
Texas Eastern Transmission, LP - Bailey East Mine Panel 2L Project (FERC Docket No. CP14-545)	Marshall, WV	Replacement and temporary elevation of Lines 10,15, and 25 and perform maintenance activities on Line 30.	March 2015 - October 2016	6.2	The Bailey Mine is located approximately 6.2 miles southeast of LEX Pipeline MP 3.5 in Marshall County, WV.
American Electric Power - Mitchell Plant Coal Combustion Residuals Landfill	Marshall, WV	An approximately 170 acres site and attendant features with the residuals being placed in approximately 58 of those acres.	2013-2014 (operation began in May 2014)	0.9	The Mitchell Plant Coal Combustion Residuals Landfill is located approximately 0.9 mile west of LEX Pipeline MP 19.0 in Marshall County, WV.
American Energy Corporation - Century Mine Coarse Refuse Disposal Area Expansion	Monroe, OH	Encompassing approximately 96 acres including construction of an earthen embankment and non-impounding refuse disposal facility.	IU	5.5	The Century Mine Coarse Refuse Disposal Area Expansion is located approximately 5.5 miles north of LEX Pipeline MP 37.0 in Monroe County, OH.
Georgetown Marine-Minerals Surface Mine	Belmont, OH	An approximately 156 acres mine located south of Wolfhurst in Belmont County, OH.	July 2015 - IU	14.8	The Minerals Surface Mine is located in Belmont County, OH and approximately 14.8 miles northwest of LEX Pipeline MP 16.7.

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
MarkWest Liberty Midstream & Resources-Majorsville 3/4/5/6 Natural Gas Processing Facility	Marshall, OH	Clearing and grading 58 acres to build the expansion of the Majorsville1/2 Natural Gas Processing Facility including 4 cryogenic plants and 3 de-ethanizer units capable of processing 800 million standard cubic feet per day of natural gas.	December 2013 - IU	<0.1	The Majorsville 3/4/5/6 Natural Gas Processing Plant is located approximately <0.1 mile west from LEX Pipeline MP 0.0 in Marshall County, WV.
Williams Ohio Valley Midstream LLC – Oak Grove Natural Gas Processing Plant	Marshall, WV	Processing raw natural gas collected from surrounding producer's wells, and send it to market via pipeline including pad construction, access road construction, and the ancillary structures.	May 2014 - IU	1.1	The Oak Grove Natural Gas Processing Plant is located approximately 1.1 miles northwest of LEX Pipeline MP 14.0 in Marshall County, WV.
Williams Ohio Valley Midstream, LLC – Ft. Beeler Processing Plant and Groves Dehydration Station	Marshall, WV	Modifications at the Fort Beeler Processing Plant included a new processing flare, and generator were added. Modifications made to the Groves facility included one new dehydration unit and associated reboiler.	2014 - 2015	0.1	The complex is located approximately 0.1 mile northwest of the Project at LEX Pipeline MP 8.1 RR-1 and approximately 0.2 mile southwest of the Lone Oak CS in Marshall County, WV.
CNX Gas LLC - Switz 6 Production Facility	Monroe, OH	Construction of oil and gas well processing facilities, including a new flare and associated auxiliary facilities located in Monroe County, OH.	2015 - IU	0.6	The Switz 6 Production facility is located approximately 0.6 mile north of LEX Pipeline MP 30.80, in Monroe County, OH.
Melvin Stone – Oak Hill Quarry	Jackson, OH	Construction of an aggregate processing plant and other associated appurtenant facilities at its existing Oak Hill Quarry in Jackson County, OH.	2014	1.3	Melvin Stone's Oak Hill Quarry is located approximately 1.3 miles north of the Oak Hill CS in Jackson County, OH.
HarbisonWalker International, Inc. – Bag Breaker Facility	Jackson, OH	Construction of a 25 TPH Bag Breaker manufacturing facility for Pre-sized Material handling process vented to an 8,000 acfm baghouse.	June 2014	0.3	HarbisonWalker International, Inc.'s manufacturing facility is located approximately 0.3 mile east of the Oak Hill CS in Jackson County, OH.
Eureka Midstream, LLC – Zink Compressor Station	Monroe, OH	Installation of additional compression at the existing Zink CS via removing two 1,380 hp engines and replacing with larger 2,730 hp engines and adding a 4,735 hp engine.	2015 - 2016	0.5	The Zink CS is located approximately 0.5 mile north of LEX Pipeline MP 29.1 in Monroe County, OH.
CNX Gas, LLC - Noble 39 Production Facility	Noble, OH	Construction of a new oil and gas production facility in Noble County, OH.	2015 - 2016	0.9	The Noble 39 Production facility is located approximately 0.9 mile northeast of LEX Pipeline MP 58.9 and approximately 1.3 miles northwest of the Summerfield CS in Noble County, OH

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Consol Energy - Noble 30	Noble, OH	Construction of an oil and gas production facility with associated unpaved roadways and parking areas associated with the facility.	2014 - 2015	1.6	The Noble 30 Production facility is located approximately 1.6 miles northeast of LEX Pipeline MP 59.4 and approximately 12.0 miles northwest of the Summerfield CS in Noble County.
MarkWest Liberty Midstream & Resources, LLC - Majorsville 7 Natural Gas Processing Facility	Marshall, WV	Installation of an additional cryogenic plant capable of processing 200 million standard cubic feet per day of natural gas within the existing footprint of the Majorsville Natural Gas Processing Facility.	December 2013 - IU	<0.1	The Majorsville 7 Natural Gas Processing Plant is located approximately <0.1 mile west of LEX Pipeline MP 0.0 in Marshall County, WV.
MarkWest Liberty Midstream & Resources, LLC – Majorsville 8/9 & 10 Natural Gas Processing Facility	Marshall, WV	Expansion to include the new 8/9 & 10 Natural Gas Processing units. Facility components include three cryogenic plants and an additional de-ethanizer plant capable of processing 600 million standard cubic feet per day of natural gas and 68,000 barrel per day of ethane extraction.	December 2013 – IU	0.1	The Majorsville 8/9 & 10 Natural Gas Processing Plant is located approximately 0.1 mile southwest of LEX Pipeline MP 0.0 in Marshall County, WV.
Consol Pennsylvania Coal Company - Bailey Central Mine Complex Coal Refuse Disposal Expansion	Greene, PA	Expansion of the coal refuse capacity at the Bailey Central Mine Complex includes construction of the Coal Refuse Disposal Areas No. 7 and 8 which encompasses approximately 1,736 acres. Construction includes placement of coal refuse and appurtenant facilities.	IU	9.5	The Bailey Central Mine Complex is located approximately 9.5 miles southeast of LEX Pipeline MP 4.8 in Greene County, PA.
Emerald Coal Resources - Refuse Area No. 3	Greene, PA	The Emerald Coal Resources Refuse Area No. 3 is a combination of a coarse coal refuse and slurry impoundment. The site will encompass approximately 250 acres and is located in Greene County, PA at the Emerald Mine.	May 2015 - IU	>15 miles	The Emerald Mine is located in Greene County, PA and 17.6 miles southeast of LEX Pipeline MP 3.5.
Cumberland Coal Resources, LP- Cumberland Coal Refuse Disposal Area No. 3	Greene, PA	Construct the Coal Refuse Disposal Area No. 3 located within the Cumberland Mine Complex in Greene County, PA encompasses approximately 549 acres.	May 2015 - IU	>15 miles	The Cumberland Mine Complex is located in Greene County, PA and 23.1 miles southeast of LEX Pipeline MP 4.8.

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Equitrans, L.P. – Equitrans Expansion Project (FERC Docket No. CP16-13)	Greene, PA	Construct new natural gas pipelines in Washington Greene, and Allegheny counties, PA; a new natural gas-driven compressor station in Greene County; and ancillary facilities. Abandon and demolish an existing compressor station located in Greene County following the construction of the new compressor station.	New pipelines and CS: December 2016 – April 2018 / CS abandonment and demolition: May 2018 – December 2018	>15 miles	The new pipeline segments are located 35.9 miles northeast of LEX Pipeline MP 0.2 in Washington County, PA and 20.4 miles east of LEX Pipeline MP 0.9 in Greene County, PA. The new Redhook CS is located in Greene County and 21.7 miles east of LEX Pipeline MP 3.4.
Tennessee Gas Pipeline Company, L.L.C. – Broad Run Expansion Project (FERC Docket No. CP15-77)	Kanawha, WV; Madison, Powell, Boyd, KY; Davidson, TN	Construct two new compressor stations in Kanawha County, WV; a new compressor station in Madison County, KY; a new compressor station in Davidson County, TN; and modifications, including abandonment and replacement of certain compression units, at the existing Clay City CS 106 in Powell County, KY and the Catlettsburg CS 114 in Boyd County, KY	March 2016 – June 2017	7.6	The Catlettsburg CS is located in Boyd County, KY and approximately 7.6 miles southwest of the existing Ceredo CS.
Rockspring Development, Inc. – Right Fork of Camp Creek Refuse Disposal Facility	Wayne, WV	Construction of the Right Fork of Camp Creek Refuse Disposal Facility, located in Wayne County, WV, includes an approximate 259-acre expansion of an existing impoundment to store refuse generated by an existing adjacent underground mine and preparation plant.	IU	>15 miles	The Right Fork of Camp Creek Refuse Disposal Facility location is approximately 18.6 miles southeast of the existing Ceredo CS in Wayne County, WV.
West Virginia Public Port Authority – Prichard Intermodal Facility Project	Wayne, WV	An intermodal container cargo-transfer facility, involving an approximate 78-acre site located adjacent to an unnamed tributary of the Big Sandy River within Wayne County, WV.	3rd Quarter 2012 – 3rd Quarter 2015	10.2	The Prichard Intermodal Facility is located 10.2 miles southwest of the existing Ceredo CS in Wayne County, WV.
West Virginia Department of Transportation – West Virginia Route 2 Franklin to Woodlands Project	Marshall, WV	Upgrade the West Virginia Route 2 which would begin in Franklin and end in Woodlands, Marshall County, WV. Construction includes widening 1.2 miles of Route 2 to a four- lane highway with a continuous center turn lane.	IU	1.1	The West Virginia Route 2 Franklin to Woodlands is located 1.1 miles northeast of LEX Pipeline MP 25.2 RR-4.
Oxford Mining Company, LLC – No. 8 Coal Seam	Noble, OH	Developing and mining the coal reserves in the No. 8 Coal Seam within Noble County, OH.	IU	10.3	The No. 8 Coal Seam is located approximately 10.3 miles north of LEX Pipeline MP 49.4 in Noble County, OH.

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Sergeant Stone, Inc. – Deavertown Limestone Mine Site	Perry, Morgan, OH	Mine limestone for commercial use along the border of Perry and Morgan counties, OH.	January 2015 – January 2020	0.6	The Deavertown Limestone Mine Site is located along the border of Perry and Morgan counties, OH and approximately 0.6 mile south of LEX Pipeline MP 97.9.
Rolling Hills Generating, LLC – Rolling Hills Generating Facility	Vinton, OH	Expand their existing Rolling Hills Generating Facility, which is located just north of Wilksville, OH, in Vinton County. This expansion would allow the facility to convert from simple cycle electric facility to a combined cycle electric generating facility. The conversion would require the installation of heat recovery generators and steam recovery generators for the combustion turbines. In addition, a 17-miles water pipeline easement would be required for water pipelines from the facility to the Ohio River. A new pump station and access road would be required for the expansion.	IU	12.7	The Rolling Hills Generating Facility is located approximately 15.3 miles southeast of the McArthur RS and approximately 12.7 miles southeast of the R-486 OS in Vinton County, OH.
Meadow Fork Mining Company, LLC – Powdermill Surface Mine	Wayne, WV	Mine coal in the 5-Block coal seam and adjacent seams. The mine will be located southeast of Fort Gay, in Wayne County, WV.	IU	>15 miles	The Powder Surface Mine is located 22.0 miles south of the existing Ceredo CS in Wayne County, WV.
Oxford Mining Company – Oxford Mining Company's 10490 Surface Mining Control and Reclamation Act of 1977	Muskingum, OH	Mine approximately 742,100 tons of coal within Muskingum County, OH.	IU	>15 miles	The Oxford Mining is located 17.4 miles northwest of LEX MP 82.6 Muskingum County, OH.
MarkWest Energy Partners, LP – Seneca Processing Complex	Noble, OH	A greenfield natural gas processing plant in Noble County to process field gas mainly gathered from the Utica shale formation. Plants #1 and #2 installed at the Seneca Gas Processing Plant were designed to each process up to 230 million standard cubic feet per day (mmscfd) of field gas to produce pipeline grade natural gas and a mixture of heavier hydrocarbons (i.e., natural gas liquids [NGLs]) intended for delivery via	2013 - 2014	1.7	The Seneca Processing Complex is located 1.7 miles northeast of the Summerfield CS in Noble County, OH.

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
		pipeline to off-site fractionation facilities.			
MarkWest Energy Partners, LP – Seneca Processing Complex Expansion	Noble, OH	MarkWest Energy Partners, L.P. expanded the existing Seneca Processing Complex located in Noble County, OH to include a new natural gas processing plant (#3) and two new well pads.	Completed in 2nd Quarter 2015	1.7	The Seneca Processing Complex is located 1.7 miles northeast of the Summerfield CS in Noble County, OH.
MarkWest Energy Partners, LP – Seneca Processing Complex Expansion	Noble, OH	MarkWest Energy Partners, L.P. expanded the existing Seneca Processing Complex located in Noble County, OH to include two new natural gas processing plant (#4 and #5).	2015 - 2016	1.7	The Seneca Processing Complex is located 1.7 miles northeast of the Summerfield CS in Noble County, OH.
AEP Ohio Transmission Company – Hocking-West Lancaster 138 kV Transmission Line Rebuild Project	Fairfield, Hocking, OH	AEP Ohio Transmission Company replaced approximately 19.3 miles of transmission line in Fairfield and Hocking Counties, Ohio. The project includes the replacement of 118 existing structures, and construction of 115 new structures.	July 2014 – November 2015	0.0[c]	LEX1 Pipeline is co-located with the Hocking-West Lancaster transmission line for 0.9 mile in Fairfield County, OH. LEX1 Pipeline will cross the transmission line at MP 0.7, and LEX Pipeline will cross the transmission line at MP 127.4 in Fairfield County.
AEP Ohio Transmission Company – South Caldwell Station Expansion	Noble, OH	AEP Ohio Transmission expanded their existing South Caldwell Station in Noble County, OH from 8,000 square feet to 31,000 square feet.	March 2016 – May 2017	3.8	The Caldwell Station is located approximately 3.8 miles south of LEX Pipeline MP 67.5 in Noble County, OH
AEP Ohio Transmission Company – Poston-Lick 138 kV Transmission Line	Jackson, OH	AEP Ohio Transmission Company is proposing to rebuild approximately 21.7 miles of the existing Poston-Lick Transmission Line in Jackson County, OH.	July 2016 – June 2018	4.4	The Poston-Lick Transmission Line is located approximately 4.4 miles southeast of the R-486 RS, and approximately 8.7 miles northwest of the Oak Hill CS in Jackson County, OH.
AEP Ohio Transmission Company – Poston-Hocking 138 kV Transmission Line Rebuild	Athens, Hocking, Logan, OH	Rebuild approximately 16 miles of existing single circuit transmission line in Athens and Hocking Counties, OH. The terminus of the rebuild is the Hocking Substation in Logan, OH.	Fall 2015 – June 2017	5.8	The existing single circuit transmission line is located approximately 5.8 miles west of R-801 MP 4.4 in Hocking County, OH.
AEP Ohio Transmission Company – Muskingum River-Tidd 345 kV Relocation and Installation of the Holloway Station	Belmont, OH	AEP Ohio Transmission Company constructed a new substation and relocated less than 1 mile of transmission lines in Belmont County, OH.	May 2014 – December 2015	10.7	The new substation and transmission lines are located approximately 10.7 miles north of LEX Pipeline MP 26.9 RR-4 Belmont County, OH.

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Project					
AEP Ohio Transmission Company - Ohio Central 345kV Extension Project	Muskingum, OH	AEP Ohio Transmission Company constructed 2.2 miles of new transmission line in Muskingum County, OH. The new line is a looping line from the existing Ohio Central Substation to the Conesville-Bixby transmission line.	June 2014 – September 2014	>15 miles	The new transmission line is located approximately 24.0 miles north of LEX Pipeline MP 82.6 in Muskingum County, OH.
AEP Ohio Transmission Company – Summerfield-Texas Eastern Berne 138 kV Transmission Line Relocation and Blue Racer Station Installation	Noble, OH	AEP Ohio Transmission Company relocated the existing Summerfield-Texas Eastern Berne transmission line and constructed a new transmission switching substation, known as the Blue Racer Station, in Noble County, OH.	June 2014 – November 2014	2.1	The Summerfield-Texas Eastern Berne transmission line and Blue Racer Station are located approximately 2.1 miles south of LEX Pipeline MP 51.9 in Noble County, OH.
AEP West Virginia Transmission Company, Inc. – Calis Switch Station	Marshall, WV	AEP West Virginia Transmission Company, Inc. constructed improvements and additions to the Wheeling Power Company's Warton Hill Station located in Marshall County, WV. In addition, AEP constructed the Calis Switch Station in Marshall County, WV and 0.2 mile of new transmission line to connect the two stations.	October 2013 – May 2014	2.5	The Calis Switch Station is located approximately 2.5 miles north of LEX Pipeline MP 0.0 in Marshall County, WV.
Marshall County Public Service District #2 Upgrades	Marshall, WV	The Marshall County Public Service District #2, in West Virginia, proposed to conduct various activities throughout the public service district including relocating pipelines, installing various facilities including fire hydrants, assemblies, and meters. The project also includes rehabilitation of various facilities throughout the district.	February 2014[f]	4.9	Marshall County Public Service District #2 is located at its closest point approximately 4.9 miles northeast of LEX Pipeline MP 14.1 in Marshall County, WV. The upgrade activities occurred across the service district.
City of Benwood, WV Stormwater Upgrades	Marshall, WV	The City of Benwood, in Marshall County, WV proposed to install approximately 9,200 feet of sewer lines, 260 feet of encased piping, 870 feet of various storm drains, 72 manholes, and other appurtenances related.	Anticipated December 2016[f]	0.0	The City of Benwood is located approximately 12 miles west of LEX Pipeline MP 0.0 in Marshall County, WV.

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Lavalette Public Service District – Nestlow II Project	Wayne, WV	The Lavalette Public Service District installed approximately 63.300 feet of 8-inch water line, 1,900 feet of 6-inch water line, and 4,500 feet of 2-inch water line in Wayne County, WV. In addition, the Nestlow II Project included the installation of new fire hydrants and other necessary appurtenances.	September 2012 [f]	5.6	The Lavalette Public Service District is located at its closest point approximately 5.6 miles southeast of the existing Ceredo CS in Wayne County, WV.
Northern Wayne County Public Service District – Sewage Collection System	Wayne, WV	The Northern Wayne County Public Service District proposed to construct a sewage collection system for eight residential lots.	August 2012 [f]	4.8	The Northern Wayne County Public Service District is located at its closest point approximately 4.8 miles southeast of the existing Ceredo CS in Wayne County, WV.
City of Kenova – Storm and Sanitary Sewer Separation System	Wayne, WV	The City of Kenova proposed to construct a storm and sanitary sewer separation system facility in Wayne County, WV.	March 2014 [f]	2.2	The proposed storm and sanitary sewer separation system facility location could not be identified; however, City of Kenova in which the facility will be constructed is located approximately 2.2 miles west of BM-111 Loop MP 0.5 in Wayne County, WV.
AEP Ohio Transmission Company - Elk 138 kV Transmission Line	Jackson, Vinton, OH	AEP Ohio Transmission Company constructed the Elk 138 kV Transmission Line, which consisted of approximately 17.2 miles of loop transmission line running from Jackson to Vinton Counties, OH.	October 2014 - October 2015	3.8	The Elk 138 kV Transmission Line is located at its closest point approximately 3.8 miles east of R-801 Loop MP 22.1 in Vinton County, OH.
Rice Energy Inc. – Rice Poseidon Pipeline	Washington, Greene, PA	The Poseidon Pipeline included the 18-mile expansion of an existing gathering pipeline system located in Washington and Greene Counties, PA.	April 2014 – November 2014	>15 miles	Rice Energy Inc.'s gathering system is located in Washington and Greene Counties, PA and approximately 27.4 miles east of LEX Pipeline MP 0.8.
CONE Midstream Partners, LP, - Gathering Line	Marshall, WV; Greene, Washington, PA	CONE Midstream Partners LP, expanded their existing pipeline gathering system surrounding the Majorsville CS in Marshall County, WV and Greene and Washington Counties, PA.	2014 - 2015	0.0[c]	The pipeline gathering system ties into the Majorsville CS located adjacent to the LEX launcher facility in Marshall County, WV.

TABLE 4.13-1 (cont'd)
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts for the LX and RXE Projects

Project	Location (County, State)	Description	Estimated Construction Date	Distance to Project (miles)	Location Relative to the Proposed Project
Columbia Gas Transmission, LLC – Line 1570 Project (FERC Docket No. CP13-478)	Greene, Washington, PA	Columbia's Line 1570 Project consisted of the replacement of approximately 19 miles of existing 20-inch-diameter natural gas pipeline with 24-inch pipe and associated aboveground appurtenant facilities located along their existing Line 1570 pipeline system in Greene and Washington Counties, PA. In addition, the project included the installation of additional compression at the existing Waynesburg CS located in Greene County, which resulted in the increase of horsepower from 3,240 hp to 4,700 hp.	March 2014 – October 2014	>15 miles	The Waynesburg CS is located 16.1 miles southeast of LEX MP 0.9 in Greene County, PA.
Columbia Gas Transmission, LLC – B-System Project (FERC Docket No. PF16-4)	Franklin, Fairfield, OH	Construction of new pipeline, replacement of existing pipeline, and upgrades to ancillary equipment and facilities located along Columbia's existing B-System. The project includes the abandonment of f existing pipeline and removal of appurtenant facilities along the B-System.	October 2017 – September 2018 (in-service)	8.7	Abandonment activities associated with the B-System Project will occur within the existing Crawford CS in Fairfield County, OH. The new Line K-270 pipeline will be located 8.7 miles northwest of LEX1 Pipeline MP 0.9 in Fairfield County, OH.
Columbia Gas Transmission, LLC – The Smithfield III Expansion Project	Washington, Greene, PA; Monongalia, Wetzel, Gilmer, Roane, Kanawha, WV	As part of the Smithfield III Expansion Project, Columbia Gas constructed one new compressor station, modifications at three existing compressor stations, and modifications at two existing valve settings located in Greene and Washington counties, PA, and Monongalia, Wetzel, Gilmer, Roane, and Kanawha counties, WV.	February 2014 – October 2014	>15 miles	The new Redd Farm CS is located in Washington County, PA and 21.2 miles northeast of LEX Pipeline MP 0.8. Modifications at the existing Hero-Jollytown Valve setting occurred in Greene County, PA, which is located 16.4 miles southwest of LEX Pipeline MP 8.0 RR-1. Modifications at the existing Smithfield CS in Wetzel County, WV occurred 25.2 miles southeast of LEX Pipeline MP 23.60.

[a] Estimated construction schedule is associated with only those facilities located within the identified cumulative impact area.
[b] Project parallels the Leach XPress Project
[c] Project intersects or extends from the Leach XPress Project
[d] Construction of the Heron Crossing Subdivision is anticipated to initiate in 2016; however, the duration and extent of the construction is dependent on market conditions and is not known at this time.
[e] Project intersects or extends from the Rayne XPress Expansion Project
[f] The estimated construction schedule could not be identified via review of publicly available resources. Therefore, the identified date corresponds to the issuance of the state public utility commission's order of approval for the referenced activities.

IU = information unavailable

4.13.1 Columbia Gas and Columbia Gulf Projects

Columbia Gas is currently developing five additional projects which are located in the vicinity of portions of the proposed LX Project facilities. These projects include the SM-80 MAOP Restoration Project (FERC Docket No. CP15-549), Mountaineer XPress Project (FERC Docket No. PF15-31), Gibraltar Pipeline Project, the Tri-County Bare Steel Replacement Project (FERC Docket No. CP15-95), and the B-System Project (FERC Docket No. PF16-4).

The SM-80 MAOP Restoration Project consists of the construction of in-place abandonment of about 3.3 miles of the existing 30-inch-diameter SM-80 pipeline system and the replacement of about 3.9 miles of new 30-inch-diameter pipeline loop and associated ancillary facilities in Wayne County, West Virginia, near the Ceredo CS. Construction of the SM-80 MAOP Restoration Project is anticipated to begin in October 2016 in order to meet a planned in-service date of April 2017.

The Mountaineer XPress Project consists of the installation of about 162.1 miles of new 36-inch-diameter natural gas pipeline extending from the LEX Pipeline in Marshall County, West Virginia to the existing SM-System in Cabell County, West Virginia; about 4.6 miles of new 24-inch-diameter natural gas lateral pipeline in Doddridge County, West Virginia; as well as the replacement of about 0.4 mile of special permit pipe located on the existing Line SM-80 and SM-80 Loop in Cabell County, West Virginia. The project also consists of the construction of one new regulator station and three new compressor stations; the installation of additional hp at three existing (at the time of construction) compressor stations, including the Lone Oak CS and the Ceredo CS; and the construction of new and/or modification of other existing appurtenant facilities in West Virginia. Construction of the Mountaineer XPress Project is anticipated to begin in November 2017 in order to meet a planned in-service date of November 1, 2018.

The Gibraltar Pipeline Project consists of the installation of about 16.5 miles of new 36- and 16-inch-diameter natural gas pipeline extending from Range Resource Corporation's existing Claysville Meter Tie-in facility in Washington County, Pennsylvania to Columbia Gas' existing Line 1528 Tie-in facility at the Majorsville CS in Marshall County, West Virginia. The project also consists of the installation of over pressure protection at the existing Line 1528 Tie-in facility. Tree clearing associated with the Gibraltar Pipeline Project is anticipated to occur in February and March 2016. However, ground disturbing construction activities are not anticipated to begin until April 2016, and would be completed by the end of the year.

The Tri-County Bare Steel Replacement Project proposes to construct a new replacement pipeline segment along its existing Line 1570 pipeline system. The replacement pipeline would replace approximately 34 miles of 20-inch-diameter natural gas pipeline with 37.5 miles of new 20-inch diameter pipe in three segments in Allegheny, Washington, and Greene Counties, Pennsylvania. About 25.8 miles, or 76 percent of the Project, would replace the existing pipeline in the same location or offset the existing Line 1570 (or Line 1983) by about 25 feet. In addition, Columbia Gas would replace 7 mainline valves (MLVs), abandon/remove one MLV, abandon/remove 37 taps, and construct 2 new bi-directional pig launchers/receivers.

Line 1570 Project constructed by Columbia Gas consisted of the replacement of approximately 19 miles of existing 20-inch-diameter natural gas pipeline with 24-inch pipe and associated aboveground appurtenant facilities located along their existing Line 1570 pipeline system in Greene and Washington counties, PA. In addition, the project included the installation of additional compression at the existing Waynesburg CS located in Greene County, which resulted in the increase of horsepower from 3,240 hp to 4,700 hp.

The B-System Project proposes to construct approximately 7.6 miles of new pipeline, replacement of approximately 14.0 miles of existing pipeline, and upgrades to ancillary equipment and facilities along Columbia Gas' existing B-System in Franklin and Fairfield Counties, Ohio. In Fairfield and Franklin Counties, Ohio, the project would abandon approximately 17.5 miles of existing pipeline and removal of appurtenant facilities along the B-System. This project is identified as an eligible facility requiring replacement due to age and condition. Abandonment activities would occur within the existing Crawford CS in Fairfield County, Ohio. Additionally, the new pipeline proposed would be within the vicinity of the LEX1 Pipeline in Fairfield County, Ohio.

Columbia Gulf is currently developing one additional project which is located in the vicinity of portions of the proposed RXE Project facilities, referred to as the Gulf XPress Project. The Gulf XPress Project, as currently planned, would consist of the construction of seven new compressor stations on Columbia Gulf's mainline pipeline system. The Gulf XPress Project could also include the installation of additional horsepower at the Grayson CS, which would be constructed as part of the RXE Project. Columbia Gulf's preliminary engineering review indicates that the new compressor stations would be located in Rowan County, Kentucky; Garrard County, Kentucky; Metcalfe County, Kentucky; Davidson County, Tennessee; Wayne County, Tennessee; Union County, Mississippi; and Grenada County, Mississippi. The anticipated FERC filing date for the Gulf XPress Project is the 2nd Quarter of 2016 and construction is expected to begin during the 4th Quarter 2017 in order to meet a planned in service date of November 2018.

4.13.2 Other FERC-Jurisdictional Projects

Rover Pipeline LLC proposed by Energy Transfer Partners consists of 511 miles of supply laterals and 42 inch mainlines, compressor stations and other facilities located in the vicinity of portions of the LX Project facilities in Monroe and Noble County, Ohio. This project would carry Marcellus and Utica shale gas from West Virginia, Pennsylvania, and Ohio to an interconnect with Vector Pipeline in Michigan. The project is currently pending before the Commission, and the applicant's planned construction schedule is anticipated to begin in summer 2016. The LEX Pipeline route would closely overlap the right-of-way proposed by Rover Pipeline LLC for its pipeline project for about 13 miles in Monroe County, Ohio. Given that the Rover Pipeline LLC project is still subject to Commission approval, the exact timing of any construction is uncertain, it but could take place concurrently with the construction of the proposed LEX Pipeline. Rover Pipeline LLC and Columbia Gas have proposed to locate the Seneca Lateral of the Rover project and the LEX Pipeline within the same non-exclusive easement with a width of 50 feet. Both applicants have committed to coordinate construction schedules and timing of crews to minimize impacts on the environment.

The Appalachian Lease Project proposed by Texas Eastern Transmission, LP (TETCO) consists of approximately 4.4 miles of new 36-inch-diameter pipeline loop in Texas Eastern Zone M2, connecting pipeline, and two new compressor stations in the vicinity of the LX Project pipeline in Monroe County, Ohio. The project is designed to provide pipeline capacity to deliver production from the Appalachian Basin to NEXUS Gas Transmission, LLC proposed pipeline facilities. The project is currently pending before the Commission. Construction of this project is proposed to begin in March 2017.

Ohio Valley Connector Project proposed by Equitrans, LP (EQT) consists of construction of 37.0 miles of 16- to 30-inch-diameter natural gas pipeline and two new compressor stations in the vicinity of the Columbia Gas pipeline in Monroe County, Ohio. The project would transfer natural gas from the central Appalachian Basin into the existing pipeline systems of Rockies Express Pipeline, LLC (REX). The project was recently approved by the Commission. Construction of the Ohio Valley Connector project began in January 2016.

Allegheny Storage Projects constructed by Dominion Transmission, Inc. included the construction of two new natural gas compressor stations and associated auxiliary facilities located in Monroe County, Ohio and Frederick County, Maryland; modifications at one existing compressor station in Lewis County, West Virginia; and the replacement of approximately 2 miles of pipelines in Tioga County, Pennsylvania.

The Clarington Project proposed by Dominion Transmission, Inc. consists of additional compression at two existing compressor stations in the vicinity of the Columbia Gas Lone Oak and LEX Pipeline in Marshall County, West Virginia and Monroe County, Ohio, respectively. The Burch Ridge compressor station upgrades would increase the natural gas throughout the existing downstream mainline. The Mullet compressor station upgrades would increase the natural gas throughput for delivery to TETCO and REX. The project also is proposing construction of two new meter and regulator stations in Monroe County, Ohio to connect to TETCO and REX with approximately 6,400 feet of new suction/discharge pipe at the Mullett compressor station in Monroe County, Ohio. The project was approved by the Commission in August 2015 and construction of the project began in December 2015.

The Ohio Pipeline Energy Network Project constructed by TETCO consisted of the construction of 76 miles of new 30-inch-diameter natural pipeline in Columbiana, Carroll, Jefferson, Belmont, and Monroe counties, Ohio; one new compressor station in Belmont County; and modifications to existing compressor stations and associated facilities along the new pipeline.

The Access South, Adair Southwest, and Lebanon Extension Projects proposed by TETCO consists of 15.8 miles of 36-inch diameter pipeline looping segments and related appurtenances and would modify twelve compressor stations in the vicinity of the LX Project's LEX Pipeline in Monroe County, Ohio and Greene County, Pennsylvania. The project would provide incremental pipeline transportation service from the Appalachia area natural gas supply basins to different markets in the Midwest and Southeast by creating additional firm pipeline capacity necessary to deliver natural gas on a long-term basis. The project is currently pending before the Commission with construction scheduled to start in March 2017.

Texas Eastern Appalachia to Market 2014 Project constructed by TETCO included the construction of seven new 36-inch-diameter natural gas pipeline loops, totaling approximately 33 miles, as well as horsepower upgrades at four existing compressor stations located in south-central Pennsylvania. In addition, the TEAM 2014 Project included piping modifications at 41 existing facilities located along Texas Eastern's existing pipeline system in Pennsylvania, West Virginia, Ohio, Kentucky, Tennessee, Alabama, and Mississippi to accommodate bi-directional flow.

Seneca Compressor Expansion Project constructed by REX consisted of the installation of three new compressors, totaling 12,250 hp of additional horsepower, at the existing Rockies Express Seneca CS in Noble County, OH. The project also included the installation of upgraded metering equipment at the existing MarkWest Seneca Processing Plant in Noble County.

Zone 3 East-to West constructed by REX included modifications at existing facilities located along the existing Rockies Express Pipeline in Ohio, Illinois, and Indiana to enable bi-directional flow capability within Rockies Express Zone 3.

The Bailey East Mine Panel 2L Project proposed by TETCO consists of the replacement and temporary elevation of three different pipelines in order to monitor and mitigate potential strains and stresses of these pipelines that could result from longwall coal mining activities at the Bailey Mine. Once mining activities are complete, TETCO would perform maintenance activities on the pipeline segment before returning it underground. Additional maintenance would be performed on a segment of a fourth pipeline, including the temporary installation of pipeline facilities aboveground during longwall mining

activities to ensure continuation of natural gas services to shippers using this segment of pipe. The Bailey Mine is located within the vicinity of the LX Project's LEX Pipeline in Marshall County, West Virginia. The project was approved by the Commission in March 2015 and construction of the project began in April 2015.

The Equitrans Expansion Project proposed by EQT consists of the construction of approximately 7.9 miles of pipeline, a new compressor station, an interconnect with the proposed Mountain Valley Pipeline, and ancillary facilities, and abandonment of an existing compressor station within the vicinity of the LX Project LEX Pipeline in Greene County, Pennsylvania. The project would provide shippers with additional flexibility to transport natural gas produced in the central Appalachian Basin to meet the growing demand in local, northeastern, Mid-Atlantic, and southeastern regions. The project is currently pending before the Commission with construction scheduled to start in December 2016.

The Broad Run Expansion Project proposed by Tennessee Gas Pipeline Company, L.L.C. consists of the construction of four new compressor stations and modifications at two existing compressor stations. Modifications at the Catlettsburgh compressor station in Boyd County, Kentucky would be within the vicinity of the LX Project Ceredo CS. The project would provide additional natural gas and would increase the efficiency of the existing compressor stations. The Commission issued an EA in March 2016 and the project is pending before the Commission.

4.13.3 Non-Jurisdictional Project-related Facilities

Two new POR facilities, considered to be non-jurisdictional facilities, are proposed related to the proposed LX Project that would be constructed by third-party midstream companies near the existing MarkWest Plant in Marshall County, West Virginia and in the Clarington, Monroe County, Ohio area. Columbia Gas would use these POR facilities to connect the proposed Project facilities and its existing pipeline system to third-party systems in the Majorsville, West Virginia and Clarington, Ohio areas in order to obtain the new firm transportation service for the proposed Project. The two new proposed POR facilities would consist of approximately 200-foot by 200-foot (20,000 sq. ft.) fenced facility. The POR facilities would be constructed, owned, and operated by currently unidentified outside parties in accordance with all applicable state and local permits. The scope of these POR facilities is still in development by outside parties, and the necessary facilities have not yet been determined. Since the proposed POR facilities would involve a limited footprint with limited environmental impacts, the cumulative impacts associated with these proposed facilities would not be significant.

The following additional non-jurisdictional Project-related facilities are proposed that would involve the installation of electric lines and distribution panels, communication systems, and several sewerage systems:

- Lone Oak CS – new electric line, communication system, and sanitary sewer;
- Summerfield CS – new electric line, communication system, and sanitary sewer;
- Oak Hill CS – new electric line and transformer, communication system, and septic system;
- Ceredo CS – new electric substation and transformer;
- Benton CS - extension of existing power service;
- K-260 RS – new electric line and distribution panel;
- LEX1 Receiver – new electric line and distribution panel;
- R-System RS – new electric line and distribution panel;

- Benton RS – new electric line and distribution panel;
- RS-1286 – extension of existing power service;
- R-543 OS – extension of existing power service and distribution panel.

The proposed LX and RXE Project facilities were not sited based on the location of power supplies, therefore, the non-jurisdictional facilities did not affect the location or configuration of project-related facilities. In addition, only the non-jurisdictional facilities associated with the Lone Oak Cs and Summerfield CS are located in the areas with the greatest potential for cumulative impacts (i.e., Monroe and Noble Counties, Ohio and Marshall County, West Virginia). Further, with the exception of new electrical power lines, the majority of the non-jurisdictional utilities would be construction at the proposed project-related compressor and regulator stations. To-date, Columbia Gas has not received resource-specific information for these electrical facilities to assess impacts; however, given the location of the non-jurisdictional facilities and limited extent of construction outside of the proposed projects' footprint, any potential cumulative impacts would be expected to be limited and not contribute significantly to cumulative impacts.

Based on the above, non-jurisdictional facilities are not further considered in the cumulative impact analysis.

4.13.4 Shale Formation Development

Background

Several shale formations occur in the Project area, including the well-known Marcellus and Utica Shales. The Marcellus Shale is an approximately 385-million-year-old, organic-rich shale formation that exists beneath 145,313 square miles of Pennsylvania, southern New York, eastern Ohio, and northern West Virginia. The Utica Shale is an older formation at approximately 460 million-years-old and is over twice the size of the Marcellus Shale. The Utica Shale largely overlaps the range of Marcellus Shale at greater depths, but extends farther west into Ohio and farther north into New York. Where the Utica and Marcellus Shales overlap, the Marcellus Shale has been the first target of development since it occurs at shallower depths and is therefore easier to drill. Marcellus Shale development has focused on the formation in Pennsylvania, West Virginia, and New York, while the Utica Shale formation is a larger focus in Ohio because the Marcellus Shale is only located along the eastern edge of the state.

The USGS has estimated that the Marcellus Shale contains about 84 trillion cubic feet of technically recoverable natural gas (Coleman et al., 2011). An additional 38 trillion cubic feet of recoverable natural gas was estimated to be locked within the Utica Shale according to USGS estimates (Schenk et al., 2012). For comparison, in 2012, the United States consumed approximately 25.5 trillion cubic feet of natural gas (EIA, 2015a); thus, the Marcellus and Utica Shales represents a significant natural gas deposit in close proximity to the high population centers of the northeastern United States. The Marcellus region, primarily Pennsylvania and West Virginia, has seen a dramatic increase in production rising from rates of approximately 2 Bcf/d in 2010 to 15 Bcf/d by 2015 (EIA, 2015a). By comparison the harder to reach Utica Shale formation has seen production rates rise from 250 mcf/d to 2 Bcf/d in the same time period (EIA, 2015a).

The EIA maintains records of energy production and usage on a national and state level. Those records document the rise in the production rates in the states where the LX Project would be located. Although it does not identify the source of the shale gas, be it Marcellus or Utica Shale, the EIA does identify natural gas developed by "Shale Gas Wells" as a whole (EIA, 2015b). Natural gas from shale gas wells in West Virginia accounted for 547 bcf of production in 2013, which was an increase from the 344 bcf produced in the state in 2012. Pennsylvania produced 3,048 bcf from its shale gas wells in 2013,

which was an increase from 2,042 bcf produced in 2012. Ohio, where gas development occurs primarily within the Utica Shale has not seen the same level in comparison to the Marcellus Shale. It produced 88 bcf in 2013, which was still a dramatic increase from the 12 bcf produced in the previous year.

Natural gas production from shale resources involves the drilling and completion of wells and construction of gathering systems and consequent rights-of-way. We received comments concerning the development of natural gas reserves in the Marcellus and Utica Shale. Development of shale natural gas resources is not the subject of this EIS. Production and gathering activities, and the pipelines and facilities used for these activities, are not regulated by FERC but are overseen by the affected region's state and local agencies with jurisdiction over the management and extraction of the Marcellus and Utica Shale gas resources. FERC's authority under the NGA review requirements relate only to natural gas facilities that are involved in interstate commerce. Thus, the facilities associated with the production of natural gas are not under FERC-jurisdiction.

Each of the states that contain Marcellus and Utica shale gas resource development have specific offices within their respective environmental departments that handle the permitting as well as and enforcement of applicable laws. In each of the states, there are specific branches of local government tasked with permitting of gas resources which includes:

- In Pennsylvania – PADEP's Bureau of Oil and Gas Management;
- In West Virginia – WVDEP's Office of Oil and Gas;
- In Ohio – OHDNR's Division of Oil & Gas Resources; and

Each organization has developed BMPs for the construction and operation of upstream oil and gas production facilities as part of their permitting process. These BMPs include erosion and sediment control practices; setback requirements from springs, wetlands, and waterbodies; wetland and waterbody crossing procedures; access road construction practices; soil amendment procedures; and right-of-way restoration measures.

4.13.5 Natural Gas Production

As stated above, natural gas production from shale resources involves improvement or construction of roads, preparation of a well pad, drilling and completion of wells, and construction of gathering systems and consequent rights-of-way. Multiple FERC non-jurisdictional intrastate natural gas wells and gathering/interconnection systems are either proposed, under construction, or have been constructed in the vicinity of the proposed LX and RXE Projects. It is likely that development activities would continue through the construction of the proposed projects, but the exact extent of such drilling is unknown. Construction activities associated with these development activities would be similar to the construction activities associated with interstate natural gas transmission facilities, although land requirements would typically be less for these FERC non-jurisdictional facilities due to the smaller and more localized extent of activities and installation of smaller diameter pipe.

Our review of publicly available data identified more than 250 existing and planned natural wells that have been permitted since 2000 within 0.5 mile of the LX Project in Ohio, West Virginia, and Pennsylvania (ODNR, 2016; PASDA, 2016; PASDA, 2016a; WVDEP, 2016; WVDEP 2016a). However, for a number of the identified wells available records indicate that permits have expired, and there is no information that indicates these wells were constructed. Columbia Gas would field verify the locations of oil and gas wells within the LX Project workspaces through civil surveys prior to the start of construction.

Indirect effects of shale formation development activities may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR 1508.8(b)). Typically, the growth-inducing potential of a project would be considered adverse if it fosters growth or a concentration of population above what is assumed in local and regional land use plans, or in projections made by regional planning authorities. Growth impacts could also occur if a project provides infrastructure or service capacity to accommodate growth levels beyond those permitted by local or regional plans and policies. The purpose of the proposed projects is to meet market demand for the transportation of natural gas supplies from the production region to areas of higher demand, premium markets. The project area is already served by various natural gas transmission lines so the Project would not extend public service to areas currently unserved by natural gas transmission lines. However, LDCs may build additional lines to serve new customers, but it is highly speculative to assume where the new lines would go and predict any resulting impacts. Further, economic activity is already taking place. The demand for energy and the proposed projects are a result of, rather than a precursor to, development in this region. Therefore, the Project would not result in adverse growth-inducing effects.

4.13.6 Potential Cumulative Impacts of the Proposed Action

The potential impacts that we consider as part of our cumulative review pertain to geology and soils; water resources; vegetation; wildlife; fisheries and aquatic resources; land use, recreation, special interest, and visual resources; socioeconomics; cultural resources; air quality and noise; and reliability and safety. In the following analysis, we discuss the potential cumulative impacts associated with the projects mentioned above and their contribution to impacts on sensitive resources in conjunction with Columbia Gas' and Columbia Gulf's LX and RXE Projects.

4.13.6.1 Geology and Soils

Cumulative effects on geology and soils crossed by the proposed projects would be limited primarily to the combined impacts of projects located within the same construction footprint as the proposed projects and recently completed or concurrent construction activities along the same route as the proposed projects. The primary effects of the proposed LX and RXE Projects on geologic and soil resources would be temporary, but direct. However, the direct effects would be highly localized and limited primarily to the period of construction. The construction of some of the projects listed in table 4.13-1, such as the Rover Pipeline Project, Appalachian Lease Project, Abandonment and Capacity Restoration Project, Ohio Valley Connector Project, SM-8- MAOP Restoration Project, Mountaineer XPress Project, Gibraltar Pipeline Project, Texas Eastern Access South, Adair Southwest, and Lebanon Extension Projects, and Gulf XPress Project, as well as shale development activities, could coincide with the schedule for the proposed projects as well as overlap with, or occur in close proximity to the proposed projects. Excavation, grading and blasting (if required) associated with these projects would also have temporary, but direct impacts on near-surface geology and soils, although like the proposed projects, the duration and effect of these projects would be minimized by the implementation of erosion control and restoration measures and blasting mitigation measures (if required). The potential for cumulative soil impacts resulting from one or more of these projects is low and primarily temporary because construction of other pipeline facilities would generally not result in loss of soils. Other FERC-regulated projects would be held to the same restoration and mitigation standards as the proposed projects. In addition, we expect these projects would be required by the state permitting agencies to adhere to BMPs similar to those proposed by Columbia Gas and Columbia Gulf. Therefore, it is unlikely any construction areas would be left unrestored following construction completion, thereby minimizing exposure of soils to erosive forces.

Columbia Gas has contracted geotechnical experts to conduct desktop and field assessments of the project area to identify areas where the greatest risks of slip and landslide events exist. In addition, Columbia Gas and Columbia Gulf would follow measures contained in their ECS as well as the recommendations from applicable local, state, and federal agencies to take the necessary precautions to avoid and mitigate geology and soil impacts. In addition, if approved by FERC, the other projects above would be required to adhere to the measures contained in the FERC Plan, which minimize impacts on soils. Non-jurisdictional project-related facilities would likely follow BMPs similar to those proposed by Columbia Gas and Columbia Gulf. Therefore, we conclude that the proposed projects are not expected to significantly contribute to potential cumulative impacts on geology and soils.

4.13.6.2 Water Resources

Groundwater

The proposed LX Project and RXE Project would not withdraw groundwater for construction or operation and, no water wells located within 150 feet of the projects' areas would be impacted by the proposed projects' activities. Disturbances from construction and operation of the proposed projects would be temporary and localized.

Any of the projects listed in table 4.13-1, as well as shale development activities that are within the same watershed(s) as the proposed projects and involve ground disturbance or excavation could result in cumulative impacts on groundwater resources[34]. The major construction activities that could affect groundwater include the clearing of vegetation, excavation and dewatering of trenches and bore pits, soil mixing and compaction, heavy equipment and associated fuel usage, and hazardous material handling. Implementation of proper storage, containment, and handling procedures would minimize the chance of such releases. The proposed projects' SPCC Plans address the preventative and mitigate measures that would be implemented to avoid or minimize the potential impacts of hazardous material spills during construction. As such, impacts from the proposed projects are expected to be short-term and minor. Each of the major projects listed above would be required to obtain water use and discharge permits and would implement their various SPCC Plans as mandated by federal and state agencies.

For these reasons, we anticipate that the proposed projects would not significantly contribute to cumulative impacts on groundwater.

Waterbodies and Wetlands

Projects that occur in the same watersheds as the proposed projects and that could be under construction during the same time as the proposed projects could result in impacts on waterbodies and wetlands. As stated previously these projects include the Rover Pipeline Project, Appalachian Lease Project, Abandonment and Capacity Restoration Project, Ohio Valley Connector Project, SM-80 MAOP Restoration Project, Mountaineer XPress Project, the Gibraltar Pipeline Project, the Gulf XPress Project, Texas Eastern Access South, Adair Southwest and Lebanon Extension Projects, Consolidation Coal Company McElroy Facility Conveyor System, Texas Eastern Ohio Pipeline Energy Network project, and shale development activities. Thus, there is the potential that cumulative impacts could result if the proposed projects were constructed during the same time period as these other projects.

[34] Columbia Gas' July 2016 data request response is available on the FERC's eLibrary website at, respectively, http://ferc.gov/docs-filing/elibrary.asp <http://ferc.gov/docs-filing/elibrary.asp> , by searching Docket No. CP15-514, Accession No. 20160719-5028, titled "20160719_CP15-514-000-Supp. Resp to 7-11-16 Data Req.PDF"

Generally, impacts resulting from pipeline construction across waterbodies are localized and short-term. Cumulative impacts would only occur in the event that more than one project impacts the same waterbody within a similar period of time. The LX Project would require 1,083 waterbody crossings. These include 170 perennial waterbody crossings, 390 intermittent waterbody crossings, 516 ephemeral waterbody crossings, and 7 open water crossings. The RXE Project would affect a total of 5 waterbodies, including 2 intermittent waterbodies and 3 ephemeral waterbodies. The majority of these would be crossed using the open-cut method; however, 24 waterbodies would be crossed using 7 HDDs.

The greatest potential for cumulative impacts associated with construction and operation of the proposed projects would be in Monroe County, and Noble counties, Ohio, and Marshall County, West Virginia, where there is a concentration of proximal and overlapping activity with other projects in the region of influence. In Monroe County, there would be a total of 156 waterbody crossings by the LX Project, 80 waterbody crossings by the Rover Pipeline Project, 14 waterbody crossings by the Appalachian Lease Project, 12 waterbody crossings by the Texas Eastern Access South Project, and 20 waterbody crossings by the Ohio Valley Connector Project. Specifically, the LX Project and the Rover Pipeline Project would cross tributaries and/or main branches of the following waterbodies: Paine Run, Ackerson Run, Sunfish Creek, East Fork, Piney Fork, Death Creek, Grassy Creek, Baker Fork, Wheeler Run, and South Fork. The LX Project, as well as the Ohio Valley Connector and the Appalachian Lease Projects would cross tributaries and/or main branches of Stillhouse Run. The Texas Eastern Access South Project would cross tributaries of Ackerson Run and Sunfish Creek and Ackerson Run. In addition, the Ohio Valley Connector Project would cross Johnson Run and its tributaries, and the Appalachian Lease Project would cross Paine Run and its tributaries, which are also crossed by the LX Project.

In Noble County, Ohio there would be a total of 149 waterbody crossings by the LX Project, 8 waterbody crossings by the Texas Eastern Access South Project, Specifically, the LX Project would cross tributaries and/or main branches of the following waterbodies: Barnes Run, Blanchard Run (trib), Buffalo Creek, Coal Run (trib), Dog Run (trib), Dyes Fork (trib), East Fork Duck Creek, Greasy Run (trib), Sharon Fork (trib), South Fork (trib), Tiltons Run (trib), West Fork Duck Creek, and Wolfpen Run. The Texas Eastern Access South Project would cross Greasy Run, and tributaries to Duck Creek.

In Marshall County, there would be a total of 155 waterbody crossings by the LX Project, 58 waterbody crossings by Mountaineer Xpress Project and 1 waterbody crossing by the Consolidated Coal McElroy Facility. Specifically, the LX Project would cross tributaries and/or main branches of the following waterbodies: Bartletts Run (main), Big Tribble Creek (main), Cedar Run, Dunkard Fork (trib), Fish Creek, French Run, Granny Run, Grave Creek, Howard Run, Lick Run, Little Tribble Creek (trib), Long Run, Middle Grave Creek (trib), Ohio River, Tribble Creek, Williams Run, and Wolf Run. Mountaineer XPress would cross tributaries to Piney Fork, Piney Fork, tributaries to Fish Creek, Fish Creek, and tributaries to Tribble Creek. Therefore, cumulative impacts to these waterbodies may occur associated with construction of these projects. However, impacts on these surface waters would be temporary and short-term, ending shortly after the completion of construction activities. Siting of well pads related to shale resource development typically avoids wetland impacts, and construction impacts related to upstream gathering lines and interconnections would be similar to the construction activities associated with interstate natural gas transmission facilities, although impacts would be smaller and more localized due to installation of smaller diameter pipe. A more specific analysis of upstream facility impacts was not conducted in the cumulative impact assessment because the exact location, scale, and timing of future facilities are unknown.

In addition to the temporary impacts discussed above, construction of aboveground facilities would result in some permanent waterbody impacts. Columbia Gas is consulting with COE, WVDEP, and OEPA to determine appropriate mitigation for permanent waterbody impacts.

Columbia Gas would hydrostatically test new pipeline segments and appropriate aboveground facility components in accordance with PHMSA pipeline safety regulations in 49 CFR 192 prior to placing the pipeline facilities into service. Water for pipeline facility testing would primarily be obtained from surface water sources. Water for aboveground facility testing would primarily be obtained from municipal sources, and some would be appropriated from pipeline hydrostatic test water sources. To our knowledge, the only overlapping water source for the proposed project and the other projects identified in the region of influence would be the Ohio River; however, specific withdrawal locations do not appear to overlap. Hydrostatic test water withdrawal would follow the measures outlined in the Procedures. Further, withdrawals and discharges from surface water sources would be performed in accordance with applicable state permits and approvals and would not impair flow or impact fisheries and recreational uses. Similarly, water allocation for shale development activities would be regulated by applicable regional, state, and local agencies. Therefore, long-term impacts on surface water sources would not be anticipated as a result of hydrostatic testing activities, and we expect the cumulative impacts of the projects in the region of influence on surface water resources to be minor.

The majority of wetland impacts associated with the proposed projects would be short-term impacts on emergent wetlands. However, project construction would also result in long-term construction impacts and permanent operational impacts from clearing and maintenance activities associated with conversion of forested and scrub-shrub wetlands to emergent or other types of wetlands. While these types of impact do result in a wetland type conversion, they do not result in a loss of wetland, as these wetlands return to functioning wetlands, although in a different form. In addition, construction of the proposed projects would result in a minor amount of permanent wetland impact from filling. The potential for cumulative impacts is greatest associated with impacts on scrub-shrub and forested wetland types, which have longer revegetation time frames and are more susceptible to cumulative impacts. Table 3.12-2 summarizes the long-term and permanent forested and scrub-shrub wetland impacts associated with projects occurring in the LX Project region of influence in Monroe and Noble County, Ohio, and Marshall County, West Virginia (the area with the greatest potential for project-related cumulative impacts).

While there is a potential for cumulative impacts on forested and scrub-shrub wetlands associated with the construction and operation of these projects, the extent of impacts to these resources is limited where these projects are co-located in Monroe and Noble County, Ohio, and Marshall County, West Virginia within the region of influence. In addition, the LX Project would mitigate unavoidable impacts on wetlands by implementing the wetland protection and restoration measures outline in the ECS and by complying with the conditions of the wetland permits that could be issued by the COE and state regulatory agencies as well as compensatory mitigation. Similar mitigation would be required for any unavoidable wetland impacts associated with the other FERC jurisdictional projects. Although construction of the LX Project along with the other projects in the area could result in the conversion or reduction in the amount of existing forested and scrub-shrub wetlands in the vicinity, these impacts are expected to be appropriately mitigated which would minimize any cumulative wetland effects.

Based on the above, we conclude that the proposed projects would not contribute significantly to long-term cumulative impacts on waterbodies and wetlands because the majority of the potential impacts would be temporary and short-term. In addition, best management practices, mitigation, and adherence to regulatory requirements reduces longer-term impacts to less than significant levels.

TABLE 4.13-2 Forested and Scrub-Shrub Wetland Impacts [a]		
Project	**Forested Wetland Impacts (acres)**	**Scrub-Shrub Wetland Impacts (acres)**
Marshall County, WV		
LX Project[b]	0.1	0.04
Ohio Valley Connector Project [e]	0.07	0.0
Total		
Monroe County, OH		
LX Project [b]	0.1	0.2
Rover Pipeline Project [c]	0.4	0.3
Appalachian Lease Project [d]	0.05	0.07
Ohio Valley Connector Project [e]	0.0	0.02
Texas Eastern Access South Project [f]	0.0	0.03
Ohio Pipeline Energy Network Project [g]	0.0	0.02
Total	**0.6**	**0.6**
Noble County, OH		
LX Project[b]	0.1	0.2
Total	0.1	0.2

[a] Includes both long-term and permanent impacts associated with construction and operation
[b] Leach XPress Project Supplemental Information, Appendix 2E (March 18, 2016)
[c] Draft Environmental Impact Statement for the Rover Pipeline Project, Appendix M-1 (February 2016)
[d] Texas Eastern Appalachia Lease Project, Resource Report 2, Water Use and Quality, Table 2.4-1 (November 2015)
[e] Ohio Valley Connector Project, Environmental Assessment, Appendix I (October 2015)
[f] Texas Eastern Access South, Adair Southwest, and Lebanon Extension Projects, Appendix 2B (October 2015)
[g] Texas Eastern Ohio Pipeline Energy Network Project, Appendix I (August 2014)

4.13.6.3 Vegetation

Cumulative effects on vegetation would be limited primarily to the combined impacts of projects located within the same region of influence as the proposed projects and recently completed or concurrent construction activities along the same route as the proposed projects. These include projects listed in table 4.13-1, such as the Rover Pipeline Project, Appalachian Lease Project, Abandonment and Capacity Restoration Project, Ohio Valley Connector Project, SM-80 MAOP Restoration Project, Mountaineer XPress Project, Gibraltar Pipeline Project, and Gulf Xpress Project, Texas Eastern Ohio Pipeline Energy Network Project, Texas Eastern Access South, Adair Southwest , and Lebanon Extension Projects as well as shale development activities. Vegetation impacts associated with these projects range from temporary to permanent; however, the greatest potential for cumulative impacts on vegetation is where the proposed projects and other nearby projects would have long-term or permanent impacts within the region of influence (e.g., 0.5 mile).

Clearing and grading of pipeline rights-of-way, contractor yards, and temporary access roads for the proposed projects and other nearby projects would result in vegetation impacts ranging from temporary to permanent. Impacts on agricultural areas, open lands and other herbaceous areas would be temporary, as these areas would be restored quickly following construction. Longer-term impacts would occur where forested areas are cleared for temporary workspaces because these areas could take decades to return to pre-construction conditions. Permanent impacts would occur where forested lands are cleared for establishment and maintenance of permanent rights-of-way or access roads. We have concluded that the LX Project would have significant impact on forest resources.

The greatest potential for cumulative impacts associated with construction and operation of the proposed projects would be in Monroe County, Ohio where there is a concentration of proximal and overlapping activity with other projects in the region of influence. In Monroe County, the proposed project would result in long-term impacts to 255.9 acres of forested land and permanent impacts to 87.9 acres of forested land associated with construction and operation, respectively. We previously concluded (FERC, 2016) that the Rover Pipeline Project would significantly impact forested resources within its project area. In Monroe County, Ohio, the Seneca Lateral of the Rover Pipeline Project parallels the LX project for about 17 miles and would result in long-term impacts to 272.8 acres and permanent impacts to 94.1 acres of forested land, respectively. The Ohio Valley Connector Project and the Appalachian Lease Project, Texas Eastern Ohio Pipeline Energy Network Project, and Texas Eastern Access South, Adair Southwest, and Lebanon Extension Projects would impact forested land; however, impacts associated with these projects are limited within the project's region of influence. In addition, based on the location of wells within 0.5 mile of the LX Project in Monroe County, Ohio (permitted since 2000) and a review of 2015 aerial photography [Google Earth, 2016]) about 15 of these wells may have impacted forest resources. While the siting of the proposed projects and the other pipeline projects listed above within and adjacent to existing rights-of-way, where possible, minimizes forest fragmentation and additional impacts to forested lands, we acknowledge that these types of impacts widen the right-of-way corridor and move the edge effects into new areas of forest. Therefore, cumulative impacts on forest resources could occur in this area.

Construction of new aboveground facilities for the proposed projects would result in some permanent impacts on forested lands. However, the extent of permanent impacts associated with new aboveground facility construction is limited. The limited extent of impacts, in combination with the distance of these facilities from other projects' construction activities in the region of influence, minimizes the potential for cumulative vegetation impacts.

Columbia Gas and Columbia Gulf would be required to restore vegetation in temporarily disturbed areas, and the other FERC-jurisdictional projects in the region of influence would be held to the same restoration standards as the proposed projects. The non-jurisdictional project-related facilities would likely be held to similar best management practice standards by state permitting agencies. Further, the Rover Pipeline Project would develop and implement a Forest Mitigation Plan in coordination with the FWS to minimize and offset impacts on forests, which would further reduce the potential for cumulative impacts to occur. The Rover Forest Mitigation Plan is currently being developed and finalized through the environmental review process for that project. A determination on the adequacy of that plan would be discussed in that project's docket.

Potential cumulative impacts on forested areas from construction and operation of the projects discussed above, together with the proposed projects would not be inconsequential. However, siting of pipeline projects within and adjacent to existing rights-of-way, where possible, along with implementation of best management practices, Columbia Gas' ECS and FERC's Plan and Procedures, adequately minimizes and mitigates impacts on forested lands. Additionally, a Final Migratory Bird Conservation Plan that would be developed in consultation with the FWS may include additional FWS recommendations and mitigation measures. The overall impact of these projects with the proposed mitigation, and our recommendations made throughout this EIS, would reduce overall cumulative impacts to less than significant levels.

4.13.6.4 Wildlife

Cumulative effects on wildlife would occur where projects are constructed in the same general timeframe and location or which represent permanent or long term loss of habitat types important to wildlife. Within the region of influence, such projects could include the Rover Pipeline Project, Appalachian Lease Project, Abandonment and Capacity Restoration Project, Ohio Valley Connector

Project, SM-80 MAOP Restoration Project, Gibraltar Pipeline Project, Mountaineer XPress Project, Texas Eastern OPEN, Access South, Adair Southwest, and Lebanon Extension Projects, Majorsville Fractionation Plan, Majorsville 3/4/5/6 Natural Gas Processing Facility, Majorsville 7, 8/9, and 10, CONE midstream gathering line, and Gulf Xpress Project, as well as shale development activities. Construction activities such as right-of-way and other workspace clearing and grading would result in loss of vegetation cover and soil disturbance, alteration of wildlife habitat, displacement of wildlife species from the construction zone and adjacent areas, mortality of less mobile species, and other potential indirect effects as a result of noise created by construction and human activity in the area. Overall impacts would be greatest where projects are constructed in the same timeframe and area as the proposed projects or that have long-term or permanent impacts on the same or similar habitat types. Accordingly, the greatest potential for cumulative impacts associated with construction and operation of the proposed projects would be in Monroe County, Ohio, where there is a concentration of proximal and overlapping activity with other projects in the region of influence, and there is the potential for cumulative impacts on forested areas.

In general, displaced wildlife is expected to return to disturbed areas following the completion of construction activities, with the exception of areas permanently affected by aboveground facility construction and operation. Clearing and grading of pipeline rights-of-way, contractor yards, and temporary access roads for the proposed projects and other nearby projects would result in a loss of wildlife habitat. The effect of workspace clearing on forest-dwelling wildlife species would be greater than on open habitat wildlife species. As discussed above, forests could take decades to return to pre-construction condition in areas used for temporary workspace, and would be permanently prevented from re-establishing on the operational right-of-way. This may result in the cumulative loss of individuals of small mammal species, amphibians, reptiles, nesting birds, and non-mobile species. However, the siting of the proposed projects and the other pipeline projects listed above within and adjacent to existing rights-of-way, where possible, reduces habitat fragmentation. In addition, given the availability of undisturbed habitats adjacent to project workspaces, it is expected that individual mobile species would seek refuge in these undisturbed areas during construction and return to restored areas after construction is completed.

Construction of aboveground facilities for the proposed projects would result in some permanent impacts on wildlife habitat. Temporary impacts on wildlife associated with construction activities would be similar to those described above, and permanent operational impacts would result in displacement of wildlife from these areas due to lack of suitable habitat and proper vegetation. In addition, the increase in ambient noise in the immediate vicinity of these facilities during both construction and operation, could also result in a decrease in wildlife use of adjacent habitat. However, the limited extent of permanent impacts on wildlife habitat associated with aboveground facility construction, in combination with the distance of proposed aboveground facilities from one another and the localized region of influence (i.e., 0.5 miles), minimizes the potential for cumulative wildlife impacts.

The majority of wildlife impacts from the proposed projects and other nearby projects would be minor and temporary, and permanent impacts are limited in areal and geographic extent. Additionally, a Final Migratory Bird Conservation Plan that would be developed in consultation with the FWS may include additional FWS recommendations and mitigation measures. Forested species may be subject to greater impacts than non-forested species, but we recognize that these would represent less than significant impacts given the availability of undisturbed forested habitat adjacent to project workspaces and the ability for individual mobile species to seek refuge in these undisturbed areas. While some adverse impacts on wildlife would occur as a result of construction and operation of the proposed projects, cumulative impacts are expected to be minimal for individual wildlife species relative to existing populations in the region of influence.

4.13.6.5 Fisheries and Aquatic Resources

Cumulative impacts on fisheries and aquatic resources could occur if other projects are constructed within the same segment of a waterbody and have similar construction timeframes as the proposed LX Project or RXE Project, or that could result in permanent or long-term impact on the same or similar habitat types. As stated previously, the Rover Pipeline Project, Appalachian Lease Project, Abandonment and Capacity Restoration Project, Ohio Valley Connector Project, SM-80 MAOP Restoration Project, Mountaineer XPress Project, the Gibraltar Pipeline Project, and the Gulf XPress Project, Texas Eastern Access South, Adair Southwest and Lebanon Extension Projects, Consolidation Coal Company McElroy Facility Conveyor System, Texas Eastern Ohio Pipeline Energy Network project, as well as shale development activities occur in the same watersheds as the proposed projects. Thus, there is the potential that cumulative impacts on fisheries could occur if construction of these projects affects the same waterbodies as the proposed projects in a similar timeframe. These impacts may include sedimentation and turbidity; habitat alteration; stream bank erosion; fuel and chemical spills; water depletions; entrainment or entrapment due to water withdrawals or construction crossing operations; blasting; and operational pipeline failure.

Fisheries and aquatic resource impacts resulting from construction and operation of these projects are expected to be localized and short-term, consistent with the waterbody impacts discussed previously. The greatest potential for cumulative impacts associated with construction and operation of the proposed projects would be in Monroe County, Ohio, where there is a concentration of proximal and overlapping activity with other projects in the region of influence. The majority of waterbodies that would be crossed by the proposed project in Monroe and Noble Counties, Ohio and Marshall County, West Virginia are intermittent or ephemeral. Perennial waterbodies that would be crossed include both warmwater and coldwater fisheries. Only one waterbody that would be crossed in Monroe County by the LX Project is designated as a sensitive surface water. This waterbody is Piney Fork and is designated as a superior high quality stream. French Run, Long Run, and Henderson Hollow would be crossed in Marshall County, West Virginia. No sensitive waterbodies would be crossed in Noble County, Ohio. Of the other projects identified above, only the Rover Pipeline Project would also cross Piney Fork.

The proposed projects would minimize fisheries impacts through adherence to timing restrictions for construction, as well as implementation of appropriate setbacks, erosion and sediment control measures, best management practices and restoration requirements as specified in the ECS. In addition, the other FERC-regulated projects would be designed to minimize impacts on waterbodies, and therefore fisheries, to the extent possible. Any impacts on waterbodies that could not be avoided would be minimized through implementation of best management and restoration practices in accordance with the respective federal, state, and local regulatory requirements.

Therefore, we conclude that the fishery impacts discussed above are not expected to be cumulatively significant because of the limited overlap of construction activities affecting the same sensitive resources, the temporary nature of impacts, and the avoidance and mitigation measures that would be implemented. Further, operation of the proposed LX Project and RXE Project would not result in any additional impacts unless maintenance activities occur in or near streams.

4.13.6.6 Special Status Species

The species discussed in section 4.7 of this EIS could potentially be affected by construction and operation of other projects occurring within the same area as the proposed projects. Columbia Gas and Columbia Gulf, and all other companies' projects are required to consult with the appropriate Federal, state, and local agencies to evaluate the types of species that may be found in the area of the projects, identify potential impacts from construction and operation of the projects to any species identified, and implement measures to avoid, minimize, or mitigate impacts on special status species and their habitat.

Habitat and population assessments are still ongoing for some identified species within the LX Project area. Habitat and population assessments have been completed for identified species within the RXE Project area. Based on implementation of the MSHCP, surveys completed to-date, projected impacts, and proposed mitigation measures, we have determined that project activities were determined to have no effect, not impact, not likely impact, or not likely to adversely affect Federally- and state-listed endangered and threatened species.

All federal undertakings, including the projects listed in table 4.13-1, are required by law to coordinate with the FWS, which would take into account regional activity and changing baseline conditions in determining the extent of impacts on a federally listed or proposed species. Consultation with the FWS is pending, and final consultation would be required prior to the start of construction of the proposed projects. Non-federal projects are also required to adhere to the ESA, although the FWS has a different mechanism for evaluation and minimizing impacts. Consequently, we conclude that past and present projects in combination with the proposed projects would have minor cumulative impacts on special status species.

4.13.6.7 Land Use, Recreation, Special Interest Areas, and Visual Resources

Projects with new permanent aboveground components, such as buildings, residential projects, roads, and aboveground electrical transmission lines would generally have greater impacts on land use than the operational impacts of a pipeline, which would be buried and thus allow for most uses of the land following construction. Therefore, with the exception of new aboveground facilities and permanent (operational) rights-of-way, pipeline projects typically only have temporary impacts on land use and would not significantly contribute to cumulative impacts.

The projects listed in table 4.13-1 would disturb thousands of additional acres of land affecting a variety of land uses. This analysis focuses on potential cumulative land use impacts by projects located within 0.50 mile of the proposed projects or immediately adjacent to the proposed construction workspaces. Of the projects listed in table 4.13-1, those with the greatest potential for cumulative impacts with the LX Project include the Rover Pipeline Project, Appalachian Lease Project, Abandonment and Capacity Restoration Project, Ohio Valley Connector Project, SM-80 MAOP Restoration Project, Gibraltar Pipeline Project, Texas Eastern OPEN, Access South, Adair Southwest, and Lebanon Extension Projects, Majorsville Fractionation Plan, Majorsville 3/4/5/6 Natural Gas Processing Facility, Majorsville 7, 8/9, and 10, CONE midstream gathering line, and Mountaineer XPress Project, as well as shale development activities. The Gulf XPress Project is the only project that could contribute cumulative impacts to the RXE Project.

Impacts on agricultural land and other non-forested land use types would be temporary, as most land uses would be allowed to revert to prior uses following construction. However, long-term impacts on forested lands would result from clearing activities. Any impacts would be minimized or mitigated to the greatest extent practicable through the use of resource-specific construction plans (for example, Columbia Gas' and Columbia Gulf's ECSs, FERC Plan and Procedures) and consultation with state agencies, Federal agencies, and landowners. It is anticipated that other projects in the region of influence would be required to implement similar construction and restoration best management practices to minimize impacts on land use. FERC-jurisdictional projects would be required to adhere to the measures contained in our Plan to minimize impacts on land use.

Columbia Gas' and Columbia Gulf's projects, if built at the same time as other foreseeable future projects, could result in cumulative impacts on recreation and special-interest areas if other projects affect the same areas or feature at the same time. At this time, we have not determined that any of the projects listed in table 4.13-1 or shale development activities would cumulatively impact any of the recreation and special-use areas crossed by the LX Project (as described further in section 4.8.4 of this EIS). However,

if one or more of these other projects was constructed at the same time as the LX Project, then temporary cumulative impacts could occur and recreational users could experience a decreased quality of recreational activities.

The visual character of the existing landscape is defined by historic and current land uses such as agriculture, residential, industrial, and undeveloped land. The visual qualities of the landscape are further influenced by existing linear installations such as highways, railroads, pipelines, and electrical transmission and distribution lines. Within this context, the Rover Pipeline Project, Appalachian Lease Project, the Ohio Valley Connector Project, and shale development, in combination with the LX Project, would have the greatest potential to cumulatively impact visual resources in Monroe County, Ohio. The proposed construction and/or modifications of aboveground facilities would primarily affect agricultural land, industrial, open land, and forest. Disturbed areas not permanently converted to industrial use would be revegetated as appropriate. Existing vegetation around some of the aboveground facilities would shield surrounding areas from visual impacts, while other facilities would not be screened Columbia Gas and Columbia Gulf would provide visual screening of aboveground facilities on a site-by-site basis, depending on existing topography and vegetation. In addition, we recommended in section 4.8.6.2 that Columbia Gulf develop a visual screening plan for the proposed Means Compressor Station.

We conclude that the proposed LX and RXE Projects' contributions to cumulative impacts on land use, recreation, special interest areas, and visual resources would predominantly be limited to the construction phase and would be temporary and minor. Further, while permanent visual impacts associated with operational rights-of-way and new aboveground facilities may be locally noticed, generally they would be consistent with the existing visual character of the area.

4.13.6.8 Socioeconomics

Present and reasonably foreseeable future projects and activities could cumulatively impact socioeconomic conditions in the region of influence for the projects. The socioeconomic issues considered in the area of the proposed projects include employment, housing, public services, transportation, property values, economy and tax revenues, and environmental justice.

Employment

The projects considered in this section would have cumulative effects on employment during construction if more than one project is built at the same time. Columbia Gas estimated that the pipeline portion of the LX Project would employ additional workers for each spread of the pipeline and each of the compressor stations, regulator stations, and odorization stations therefore creating new jobs in and around the project area. Total new jobs for the project are anticipated to number approximately 3,325. Local hires could include surveyors, welders, equipment operators, and general laborers. Due to the relatively low populations within the project area, if multiple similar projects are built at the same time, the demand for workers could exceed the local supply of appropriately skilled labor.

A small number of new permanent employees would be hired to operate the proposed facilities and would not have a measurable impact on the economy or employment. As no new permanent employees would be added as a result of operations of the Gulf XPress Project, no cumulative impacts are expected to occur from the RXE Project.

Temporary Housing

Temporary housing would be required for construction workers not drawn from the local area. Given the current vacancy rates, the number of rental housing units in the area, and the number of hotel/motel rooms available in the vicinity of the projects, construction workers should not have difficulty

in finding temporary housing. If construction occurs concurrently with other projects, particularly during peak tourist periods, temporary housing would still be available but may be slightly more difficult to find and/or more expensive to secure. Regardless, these effects would be temporary, lasting only for the duration of construction, and there would be no long-term cumulative impact on housing.

Infrastructure and Public Service

The cumulative impact of the proposed LX Project, RXE Project, the other projects listed in table 4.13-1 and shale development on infrastructure and public services would depend on the number of projects under construction at one time. The small incremental demands of several projects occurring at the same time could become difficult for police, fire, and emergency service personnel to address. However, the problem would be temporary, occurring only for the duration of construction.

In addition, increased use of local roadways from multiple projects could accelerate degradation of roadways and require early replacement of road surfaces. Columbia Gas and Columbia Gulf would coordinate with local agencies to ensure that truck weights are within acceptable standards for the roadways that would be travelled. No long-term cumulative effect on infrastructure and public services is anticipated.

Transportation and Traffic

Construction of the proposed project could result in temporary impacts on road traffic in some areas and could contribute to cumulative traffic, parking, and transit impacts if other projects are scheduled to take place at the same time and in the same area. The local road and highway system in the vicinity of the proposed projects is readily accessible by interstate highways, U.S. highways, state highways, secondary state highways, county roads, and private roads. However, the majority of Columbia Gas' and Columbia Gulf's projects are located in rural areas and most of the roads impacted by the project would be county or private roads.

The addition of traffic associated with construction personnel commuting to and from the projects could also contribute to cumulative regional traffic congestion. However, any contribution of the proposed project to cumulative traffic impacts would be temporary and short-term. Parking lots would be constructed, and Columbia Gas and Columbia Gulf anticipates that many of its workers would travel to project workspaces via carpools. It is unlikely that other projects listed in table 4.13-1 and shale development activities would have similar commuting schedules or reach peak traffic conditions simultaneously.

Columbia Gas and Columbia Gulf stated that they would further minimize impacts associated traffic through coordination with local authorities to minimize heavy construction traffic during peak travel times, and to minimize traffic impacts during school drop-off and pick-up times. It is anticipated that other projects would develop similar procedures.

We conclude that the proposed LX Project would not contribute to any long-term cumulative impact on the transportation infrastructure, because only a small number of new permanent employees would be required to operate Columbia Gas' project. Additionally, the proposed RXE Project would not contribute to long-term cumulative impacts on transportation infrastructure due to construction and operation of the Gulf XPress Project because only a small number of new permanent employees would be required to operate the RXE Project.

Economy

Permanent jobs created by construction of the LX Project and other potential projects that would be constructed and operated in the area of influence could lead to increased local spending by non-local workers. Addition of permanent jobs could also lead to long-term permanent spending in local areas. This would likely result in a minor positive cumulative impact on the local economy. No cumulative impacts resulting from construction and operation of the RXE Project are anticipated because the number of permanent jobs added is minimal.

4.13.6.9 Cultural Resources

Cumulative impacts on cultural resources would only occur if other projects were to impact the same historic properties impacted by the proposed projects. Where direct impacts on significant cultural resources are unavoidable, mitigation (e.g., recovery of data and curation of materials) would occur before construction. Non-federal actions would need to comply with any mitigation measures required by the affected states. Columbia Gas and Columbia Gulf developed project-specific plans to address unanticipated discoveries of cultural resources and human remains in the event they are discovered during construction. Therefore, the proposed projects may incrementally add to the cumulative effects of other projects that may occur at the same time. However, this incremental increase would not be significant.

4.13.6.10 Air Quality and Noise

Air Quality

Construction of the LX Project and the projects listed in table 4.13-1 that have yet to be constructed, as well as shale development activities would involve the use of heavy equipment that would generate air emissions (including fugitive dust), and noise. The majority of these impacts, with the exception of those associated with compressor stations, would be minimized, as the construction activities would occur over a large geographical area and would be moving regularly. The majority of emissions associated with Columbia Gas' and Columbia Gulf's projects would be temporary, resulting from construction activities, and minimized by mitigation measures such as using properly maintained vehicles and controlling pollutants with commercial gasoline and diesel fuel products.

Construction air emissions would be temporary and highly localized. Therefore, the region of influence for cumulative short-term air quality impacts is defined as 0.5 mile from the construction work areas. Operation of the Projects' CSs would result in long-term air quality impacts. Therefore, the region of influence for cumulative long-term air impacts was defined based on the project-specific area within which air emissions resulting from operation of a compressor station would exceed a "significant impact level", as defined by the National Ambient Air Quality Standards (NAAQS). Based on this approach, the region of influence was determined to be 4 kilometers (2.49 miles) for the Lone Oak CS in Marshall County, West Virginia; Summerfield CS in Noble County, Ohio; and Oak Hill CS in Jackson County, Ohio.

Of the projects listed in table 4.13-1, those with the greatest potential for cumulative impacts regarding construction related emissions include the Rover Pipeline Project, Appalachian Lease Project, Ohio Valley Connector Project, SM-80 MAOP Restoration Project, Gibraltar Pipeline Project, Majorsville 3/4/5/6 Natural Gas Processing Facility, Majorsville 7, 8/9, and 10, and Mountaineer XPress Project for construction related emissions. Construction vehicles have the potential to release tailpipe emissions and construction activities have the potential to stir up fugitive dust near ground level. This would result in maximum impacts in proximity to the sources. The Appalachian Lease Project and SM-80 MAOP Restoration Project could have potentially overlapping construction schedules as the LX Project. The Appalachian Lease Project parallels the LX Project for approximately 3 miles, limiting

construction emissions to a small area relative to the length of the proposed pipeline. The SM-80 MAOP Restoration Project, located south of the Ceredo CS, consists of approximately 4 miles of pipeline looping, resulting in minor and localized construction emissions.

Minor and temporary cumulative impacts would result from construction related emissions due to concurrent construction of the projects would decrease as the distance from the source increases. The construction equipment emissions from all cumulative projects would result in short-term emissions that would be highly localized, temporary, and intermittent. Further the proposed Projects and other FERC jurisdictional projects would include mitigation measures to reduce fugitive dust and identify compliance with federal and state air regulations. Emissions generated during construction of the LX Project and surrounding projects in the region of influence would not have a significant cumulative impact on the air quality in the region.

The greatest potential for cumulative impacts of operational related emissions from the Projects' CSs include emissions from the operation of the Rover Pipeline Project's new Seneca CS, Mountaineer XPress Project's new Lone Oak CS, Rockies Express Pipeline Project's Seneca CS expansion, Williams Ohio Valley Midstream's expansions of the Fort Beeler Processing Plant and Groves Dehydration Station, CNX Gas' new Noble 39 Production Facility, and MarkWest Energy Partners' Seneca Processing Complex. Columbia Gas reviewed publicly available information to evaluate potential operational emissions of criteria pollutants and HAPs associated with the facilities identified within the cumulative impact area for each of the Projects' CSs (table 4.13.2-1). Based on this analysis, we have determined that anticipated cumulative impacts on air quality within these areas as a result of concurrent operation of the identified facilities would likely be minor, as discussed below.

The Lone Oak CS, part of the LX Project, in Marshall County, West Virginia, would be located in an area designated as attainment/unclassifiable (considered attainment) for all criteria pollutants. Operation of the Mountaineer XPress Project's new Lone Oak CS and Williams Ohio Valley Midstream's expansions of the Fort Beeler Processing Plant and Groves Dehydration Station would contribute operational emissions to the cumulative impact area for the Lone Oak CS. Individually, each Project's potential emissions are less than the PSD major source threshold. In aggregate, potential operational emissions associated with these Projects are not expected to exceed the PSD major threshold for any pollutant except CO, nor are they expected to cause or significantly contribute to a NAAQS violation. These projects are subject to WVDEP regulations and have received the appropriate air quality permits for construction and initial operation of their emission units. Therefore, we conclude that operation of the facilities located within the Lone Oak CS cumulative impact area would not have a significant cumulative impact on air quality in the region.

The Summerfield CS, part of the LX Project, in Noble County, Ohio, would be located in an area designated as attainment/unclassifiable for all criteria pollutants. Operation of the Rover Pipeline Project's new Seneca CS, Rockies Express Pipeline Project's Seneca CS expansion , CNX Gas' new Noble 39 Production Facility, and MarkWest Energy Partners' Seneca Processing Complex would contribute operational emissions to the cumulative impact area for the Summerfield CS. Individually, each Project's potential emissions are less than half of the PSD major source threshold. These projects are subject to OEPA regulations and have received the appropriate air quality permits for construction and operation of their emission units. Therefore, operation of the facilities located within the Summerfield CS cumulative impact area are not expected to cause or significantly contribute to a NAAQS violation, and we conclude that they would not have a significant cumulative impact on air quality in the region.

TABLE 4.13.2-1
Potential Emission Rates Associated with Operation of the LX Project and Other Projects Potentially Contributing to Cumulative Impacts

Emission Source	NO_x	CO	VOC	SO_2	$PM_{2.5}/PM_{10}$	Formaldehyde	Total HAP	GHG (CO_2e)
Annual Potential Emissions (tpy)								
Leach XPress Project – Lone Oak Compressor Station	96.7	142.1	20.7	1.2	11.4	1.3	2.0	208,108
Mountaineer XPress Project – Lone Oak Compressor Station [a]	127.9	188.7	27.5	1.6	15.2	1.7	2.5	276,725
Williams Ohio Valley Midstream, LLC – Ft. Beeler Processing Plant and Groves Dehydration Station [b]	2.15	7.37	25.18	0.02	0.24	NPA	2.18	NPA
Leach XPress Project – Ceredo Compressor Station	N/A [c]	N/A [c]	N/A [c]	N/A [c]	N/A [c]	N/A [c]	N/A [c]	N/A [c]
Mountaineer Xpress Project – Ceredo Compressor Station [c]	32.4	57.0	19.3	0.7	6.4	0.7	1.0	122,595
Leach XPress Project – Summerfield Compressor Station	56.3	80.7	11.9	0.4	4.0	0.5	0.8	76,407
Rover Pipeline Project – Seneca Compressor Station	94.6	35.5	72.6	0.5	6.3/ 6.4	11.9	18.0	74,969
Rockies Express Pipeline, LLC – Seneca Compressor Station Expansion [b]	104	39.1	66.5	NPA	7.4	13.1	NPA	NPA
CNX Gas LLC - Noble 39 Production Facility	38.1	96.4	76.5	7.6	4.2	NPA	NPA	NPA
MarkWest Energy Partners, LP – Seneca Processing Complex [b]	27.2	27.2	32.0	0.4	11.2	NPA	NPA	NPA
Permitting Requirement Thresholds								
PSD Major Source Thresholds [d]	250	250	250	250	250	N/A	N/A	N/A
PSD Significance Level [f]	40	100	40	40	10 / 15	N/A	N/A	N/A
Title V Major Source Thresholds [g]	100	100	100	100	100	10	25	N/A

[a] Potential emission rates include the collective emissions from the Lone Oak CS following the installation of a fourth Solar Mars 100 compressor unit.
[b] Potential emission rates based on permit allowable emission limits; NPA indicates no permitted allowable emission limits for that pollutant included in the permit(s).
[c] Air emissions associated with the proposed operation of additional compression at the existing Ceredo CS are anticipated to be minor and limited, as the new compressor units at this facility would be powered by purchased electricity.
[d] Potential emission rates include the collective emissions from the Ceredo CS following the installation of a Solar Titan 250 compressor unit.
[e] The PSD major source thresholds were obtained from 40 CFR 52.21(b)(1)(b) for areas in attainment of the NAAQS. HAP emissions are not covered by the PSD permitting program.
[f] The PSD significance levels were obtained from 40 CFR 52.21(b)(23) for areas in attainment of the NAAQS.
[g] The Title V major source thresholds were obtained from 40 CFR 70.2 for areas in attainment of the NAAQS.
N/A – not applicable

Cumulative impact analysis for the RXE Project includes all projects identified within the affected counties (Menifee, Carter, and Montgomery Counties, Kentucky). Ambient impacts are greatest near the source and within approximately 1.5 miles; projects outside this radius were determined to have negligible contributes to cumulative impacts on air quality. RXE would be completed prior to construction of the Gulf XPress Project. Additionally, modifications at the Grayson CS, as part of the Gulf XPress Project, would be subject to regulations under the NAAQS and would obtain all necessary permits prior to construction and operation. Therefore, cumulative impacts resulting from this project would be minimal.

Noise

The proposed LX and RXE Projects could contribute to cumulative noise impacts. However, the impact of noise is highly localized and attenuates quickly as the distance from the noise source increases; therefore, cumulative impacts are unlikely unless one or more of the projects listed in Table 4.13-1 and shale development facilities are constructed at the same time and location. The cumulative impact evaluation for noise accounts for recent or planned projects within 0.5 mile of the proposed Projects area. This area was selected because it is appropriate to the level of impact associated with the proposed LX and RXE Project construction activities and has been used in other FERC natural gas pipeline and compressor station analyses. Based on the schedule and proximity of these activities to the pipeline route, there may be some cumulative noise impacts (see Table 4.13-1). However, because the majority of noise impacts associated with the Projects would be limited to the period of construction, and most construction activities would occur during daytime hours and be intermittent rather than continuous, the proposed contribution from the LX and RXE Projects to cumulative noise impacts would primarily be for only short periods of time when the construction activities are occurring at a given location.

Operation of the CSs would contribute long-term, localized noise impacts within 1 mile of each station. Potential noise impacts associated with past and present actions did not require further analysis as a part of the cumulative impacts assessment because any impacts from those actions have been documented in the baseline sound surveys conducted at the LX and RXE project sites from January 2015 through August 2015. Therefore, the contribution of the LX and RXE projects in addition to these actions is included in the pre-construction noise studies for each of the new and/or modified above ground facilities (compressor stations, regulator stations, and odorization stations). The following is a summary of the cumulative noise impact evaluation.

Table 4.13-1 indicates the following projects would include the installation of new natural gas powered CS(s) or additional compression to existing facilities within 1 mile of the LX or RXE Project CSs (noise sources from the planned projects that are beyond a 1-mile radius are not listed):

- Columbia Gas Transmission, LLC - Mountaineer XPress Project:- one natural gas compressor unit would be installed at the Lone Oak CS, and an existing natural gas compressor unit would be replaced with a new electric compressor unit at the Ceredo CS (both are components of LX); and

- Columbia Gulf Transmission, LLC - Gulf XPress Project: - additional horsepower would be installed at the Grayson CS (a component of RXE).

Operation of the projects listed above may result in cumulative noise impacts. However, implementation of best-management practices, engineering controls, and the mitigation proposed for the LX and RXE projects in Section 4.11.2.3, *Operational Noise Impacts and Mitigation*, would minimize noise impacts for the proposed project. In addition, construction and operation of other FERC-jurisdictional projects would be required to adhere to similar noise requirements and mitigations measures

as the Project. This would mean that when the impacts of the proposed LX and RXE projects are added to the impacts from other identified projects, the cumulative impacts would be minimal.

4.13.6.11 Climate Change

Climate change is the change in climate over time, whether due to natural variability or as a result of human activity, and cannot be represented by single annual events or individual anomalies. For example, a single large flood event or particularly hot summer are not indications of climate change, while a series of floods or warm years that statistically change the average precipitation or temperature over years or decades may indicate climate change.

The Intergovernmental Panel on Climate Change (IPCC) is the leading international, multi-governmental scientific body for the assessment of climate change. The United States is a member of the IPCC and participates in the IPCC working groups to develop reports. The leading U.S. scientific body on climate change is the U.S. Global Change Research Program (USGCRP). Thirteen federal departments and agencies[35] participate in the USGCRP, which began as a presidential initiative in 1989 and was mandated by Congress in the Global Change Research Act of 1990.

The IPCC and USGCRP have recognized that:

- globally, GHGs have been accumulating in the atmosphere since the beginning of the industrial era (circa 1750);
- combustion of fossil fuels (coal, petroleum, and natural gas), combined with agriculture and clearing of forests is primarily responsible for this accumulation of GHG;
- these anthropogenic GHG emissions are the primary contributing factor to climate change; and
- impacts extend beyond atmospheric climate change alone, and include changes to water resources, transportation, agriculture, ecosystems, and human health.

In May 2014, the USGCRP issued a report, *Climate Change Impacts in the United States*, summarizing the impacts that climate change has already had on the United States and what projected impacts climate change may have in the future (USGCRP, 2014). The report includes a breakdown of overall impacts by resource and impacts described for various regions of the United States. Although climate change is a global concern, for this cumulative analysis, we would focus on the potential cumulative impacts of climate change in the LX and RXE Project areas.

The USGCRP's report notes the following observations of environmental impacts with a high or very high level of confidence that may be attributed to climate change in the Midwest region:

- average temperatures have risen about 1.5 °F between 1900 and 2010 and are projected to increase another 4 to 5 °F over the next several decades;
- an increase in health risks due to projected additional heat stress and poor air quality;

[35] The following departments comprise the USGCRP: EPA, DOE, U.S. Department of Commerce, U.S. Department of Defense, USDA, U.S. Department of the Interior, U.S. Department of State, PHMSA, Department of Health and Human Services, National Aeronautics and Space Administration, National Science Foundation, Smithsonian Institution, and Agency for International Development.

- the agricultural crop growing season has lengthened since 1950 and is projected to continue lengthening due to the earlier occurrence of the last spring freeze, potentially increasing crop production in the short-term;

- increased temperature stress, wetter springs, and the continued occurrence of springtime cold air outbreaks are projected may reduce crop yields overall in the long-term (particularly corn and soybeans);

- a change in range and/or elevation is projected for many tree species with potential declines in paper birch, quaking aspen, balsam fir, and black spruce and increases in oaks and pines;

- tree species in flat terrain may have difficultly migrating the long distances needed to reach temperatures suitable for the species, resulting in some potential decline in forests;

- increased insect outbreaks, forest fire, and drought may result in increased tree mortality and the reduction in beneficial carbon sinks;

- annual precipitation has increased by about 20 percent over the past century, particularly from increased high intensity rainfall events, and this trend is projected to continue;

- surface water temperatures in the Great Lakes have increased several degrees between 1968 and 2002, and are projected to increase by about 7 to 12 degrees by the end of the century; and

- increased surface water temperatures, increased precipitation, and longer growing seasons are projected to result in an increase in blue-green and toxic algae in the Great Lakes, harming fish and reducing water quality.

The GHG emissions associated with construction and operation of the LX and RXE Projects are discussed in more detail in section 4.11.1. Emissions of GHGs from the proposed Projects and other regional projects would not have any direct impacts on the environment in the Projects areas. Currently, there is no standard methodology to determine how a project's relatively small incremental contribution to GHGs would translate into physical effects on the global environment.

However, the USGCRP report states that in the Midwest region "per capita GHG emissions are 22 percent higher than the national average due, in part, to the reliance on fossil fuels, particularly coal for electricity generation." Natural gas emits less CO_2 compared to other fuel sources (e.g., fuel oil or coal). Therefore, the USGCRP report also notes that increased use of natural gas in the Midwest may reduce emissions of GHGs. We find that the Project along with other planned natural gas projects in the Midwest region may result in the displacement of some coal use or encourage the use of lower carbon fuel for new growth areas, thereby regionally offsetting some GHG emissions.

We received comments from EPA requesting that we identify the impacts of forest clearing on carbon sequestration and climate change. Currently there are no federal or state regulations regarding carbon sequestration. According to the EPA, carbon sequestration is the process through which plant life removes CO_2 from the atmosphere and stores it in biomass. The Projects would impact about 1,381.1 acres of forested land, primarily throughout Ohio, of which about 865.4 acres (63 percent) would be allowed to revert back to forest. While there would be a slight long-term effect of reduced carbon sequestration due to removal of trees from the permanent right-of-way, temporary right-of-way would be allowed to revert back to pre-existing conditions. Young, fast-growing trees in particular would remove significantly larger amounts of carbon dioxide from the atmosphere than mature canopy. The young vegetation of the restored temporary right-of-way would continue to perform the carbon sequestration

process. The carbon sequestration ability of the permanent right-of-way would be reduced; however, this amount represents about 0.006 percent of Ohio's forest and carbon sequestration ability. Therefore, we do not believe that the impact of the Project would have significant impacts on Ohio's carbon sequestration, or would significantly exacerbate ongoing climate change.

4.13.6.12 Reliability and Safety

Impacts on reliability and public safety would be mitigated through the use of the DOT Minimum Federal Safety Standards in 49 CFR 192, which are intended to protect the public and to prevent natural gas facility accidents and failures. In addition, Columbia' construction contractors would be required to comply with the Occupational Safety and Health Administration Safety and Health Regulations for Construction in 29 CFR 1926. Other construction projects would be required to conform to the same or similar safety standards. We conclude that no cumulative impacts on safety and reliability are anticipated to occur as a result of the proposed projects.

4.13.7 Conclusion

The majority of cumulative impacts would be temporary and minor when considered in combination with past, present, and reasonably foreseeable activities. However, some long-term cumulative impacts would occur on wetland and upland forested vegetation and associated wildlife habitats. In particular, we identified that some short-term cumulative impacts could occur primarily in Monroe County, Ohio where Rover and Columbia Gas would construct two pipelines in the same non-exclusive easement. As discussed throughout this section, adverse cumulative effects related to these two projects may occur on wetlands, water resources, vegetation, and soils, particularly if construction occurs concurrently or immediately preceding one another. We acknowledge that both of these pipelines operators have committed to minimize impacts through coordination of construction, but we are unable to assess the specifics of how these commitments would manifest into reduced impacts on the environment. **Therefore we recommend that:**

- **Prior to construction, Columbia Gas should file with the Secretary, for the review and written approval of the Director of OEP, a construction coordination plan that identifies the specific construction measures (such as retention of the same contractor, re-use of equipment bridges, coordinated installation of erosion control devices, or restoration commitments) that Rover Pipeline LLC and Columbia Gas have agreed to implement in the construction of the parallel portions of their respective projects in the non-exclusive easement.**

Short-term cumulative benefits would also be realized through jobs and wages and purchases of goods and materials. There is also the potential that the proposed projects would contribute to a cumulative improvement in regional air quality if a portion of the natural gas associated with the proposed projects displaces the use of other more polluting fossil fuels.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS OF THE ENVIRONMENTAL ANALYSIS

The conclusions and recommendations presented in this section are those of FERC environmental staff. Our conclusions and recommendations were developed with input from the EPA, COE, FWS, OEPA, PADEP, PADCNR, WVDEP, WVDNR, and KYDEP as cooperating agencies. The federal cooperating agencies may adopt the EIS per 40 CFR 1506.3 if, after an independent review of the document, they conclude that their permitting requirements and/or regulatory responsibilities have been satisfied. However, these agencies would present their own conclusions and recommendations in their respective and applicable records of decision. Otherwise, they may elect to conduct their own supplemental environmental analysis, if necessary.

We determined that construction and operation of Columbia Gas' LX Project would result in some adverse environmental impacts. These impacts would occur during both construction and operation of the Project on vegetation, aquatic resources, wetlands, and wildlife as discussed in Section 4. However, if the proposed Project is constructed and operated in accordance with applicable laws and regulations, the mitigating measures discussed in this final EIS, and our recommendations, these impacts would be reduced to less than significant levels. Forest clearing resulting from the LX Project would result in significant impacts; however, due to the expected regrowth of these forests outside the permanent right-of-way and Columbia Gas's proposed mitigation, we conclude that the permanent conversion of forested land would be reduced to less than significant levels. This determination is based on a review of the information provided by Columbia Gas and further developed from data requests; field investigations; scoping; literature research; alternatives analyses; and contacts with federal, state, and local agencies as well as individual members of the public. As part of our review, we developed specific mitigation measures that we determined would appropriately and reasonably reduce the environmental impacts resulting from construction and operation of the Projects. We are therefore recommending that our mitigation measures be attached as conditions to any authorizations issued by the Commission. A summary of the anticipated impacts, our conclusions, and our recommended mitigation measures is provided below, by resource area.

Geology and Paleontological Resources

The primary effect of the proposed LX and RXE Projects on geologic resources would be the disturbance to steep topographic features, the excavation of consolidated or shallow bedrock during the construction of the pipeline and aboveground facilities, and the establishment of temporary contractor yards and access roads, affecting the local geologic resource within discrete areas of the project footprints.

Based upon a review of publicly available resources, there are a total of 64 oil and gas wells within the LX Project area in Ohio, Pennsylvania, and West Virginia, including 11 active wells, 51 inactive wells, and 2 historic wells. As part of the RXE Project, the Means CS and Grayson CS would not be located within 1 mile of any active or inactive oil and gas wells. If an oil or gas well is encountered, Columbia Gas would determine an appropriate buffer and construction procedure around the well based on site-specific conditions and coordination with the owners of the well. If an oil or gas well is unexpectedly impacted during construction, Columbia Gas would stop work immediately, contain any spilled product, secure the area, and notify FERC as well as the appropriate state and/or local agency. Due to the presence of active and inactive oil and gas well within the LX Project area, we are recommending conducting civil surveys identifying the location of any conventional or unconventional oil and gas well locations (including permitted, drilled, producing and abandoned oil and gas wells)

within the LX Project footprint, as well as identify measures to minimize hazards for any wells located within 100 feet of the proposed LX Project pipelines.

No mine spoil areas are located within 0.5 mile of the Projects and no active quarries are located within 0.2 mile of the Projects. During the post-filing process, Columbia Gas redesigned the Lone Oak CS footprint on the proposed site, moving it toward the south, to address and avoid future conflict with longwall mining activities. However, since publication of the draft EIS, Columbia Gas confirmed with the mine operator that longwall mining activities are tentatively scheduled to occur in the area between 2023 and 2025 and are not expected to result in impacts in the vicinity of the Lone Oak CS. Therefore, Columbia Gas moved the proposed Lone Oak CS facility site back to the northern portion of the property.

Approximately 45 percent of the LX Project is characterized by shallow bedrock. Columbia Gas would adhere to blasting procedures and safety measures outlined in their Blasting Plan. The RXE Project does not cross areas of shallow bedrock.

We do not anticipate that construction of the LX and RXE Projects would uncover significant paleontological resources, and no known paleontological sites have been identified. However, there is the potential for an unanticipated discovery of fossils along the LEX Pipeline route, especially if unanticipated areas of shallow bedrock occur along the trenchline or where bedrock removal is necessary. We do not anticipate any significant discoveries of paleontological resources during construction of the Means CS or the Grayson CS, as part of the RXE Project in Kentucky. Columbia Gas filed the "Unanticipated Discoveries and Emergency Procedures" and Columbia Gulf filed a "Procedure Guiding the Discovery of Unanticipated Cultural Resources and Human Remains", which FERC staff finds the plans acceptable. Given these measures, we conclude that potential impacts on paleontological resources would be adequately minimized.

Based on the avoidance, minimization, and mitigation measures developed by Columbia Gas and Columbia Gulf, including measures outlined in the ECS, Longwall Mining Plan, and Blasting Plan, we conclude that construction and operation of the LX and RXE Projects would not have any significant adverse effects on geologic resources.

Soils

Construction activities such as clearing, grading, trench excavation, backfilling, and the movement of construction equipment would affect soil resources during the construction of the pipeline, and aboveground facilities, and the establishment of temporary contractor yards and access roads. Clearing removes protective cover and exposes the soil to the effects of wind and rain, which increases the potential for erosion and sedimentation of sensitive areas. Grading, spoil storage, and equipment traffic can compact soil, reducing porosity and increasing runoff potential. Excess rock or fill material brought to the surface during trenching activities could hinder restoration of the right-of-way.

To minimize or avoid impacts on soils during construction and operation of the LX and RXE Projects, Columbia Gas and Columbia Gulf would implement soil mitigation procedures outlined in their project-specific ECSs, which adopts and incorporates the FERC Plan and Procedures, and guidance provided by WVDEP, PADEP, PADCNR, and ODNR.

Columbia Gas and Columbia Gulf would minimize adverse impacts on land, including agricultural, prime farmland and residential areas, by implementing the BMPs identified in their ECSs. Columbia Gas and Columbia Gulf would coordinate with the applicable agencies and landowners in these areas to ensure the proper restoration of any impacted agricultural or residential areas, including replacement of segregated topsoil, stone removal, and to ensure compliance with reseeding recommendations. Columbia Gas and Columbia Gulf would protect active pastureland during

construction through the installation of temporary fencing, the use of alternative locations for livestock to cross the construction corridor, and/or developing grazing deferment plans, as negotiated with the landowner.

In consideration of the above, we conclude that construction and operation of the LX and RXE Project facilities proposed by Columbia Gas and Columbia Gulf would not have any significant adverse effects on soil resources.

Water Resources

Groundwater

Groundwater resources in the area of the Projects come from Pennsylvanian and Mississippian principal aquifers. Neither Project would cross, or come within close proximity of, any designated SSAs, and no state-designated aquifers have been identified in the Projects' area(s). Columbia Gas identified 15 DWSPAs for public water systems associated with groundwater sources located within 0.5 mile of the LX Project. Five of these DWSPAs occur within the LX Project workspace including Sugar Grove Village, Wellston, Bremen Village, Lancaster City, and McArthur Village. No WHPAs were identified within the RXE Project area.

Permanent impacts on groundwater are not expected as a result of construction and operation. Disturbances resulting from construction or operation of the LX and RXE Project would be shallow, temporary and localized excavation. Columbia Gas and Columbia Gulf would employ erosion controls, restore the natural ground contours, and revegetate the right-of-way. Implementation of the Projects' ECSs, SPCC Plan, and the appropriate measure of the FERC Plan and Procedures would further reduce impacts on groundwater resources. Temporary, minor, and localized impacts could result during trenching activities in areas of shallow groundwater (less than 10 feet below the ground surface) crossed by the LX Project pipeline. The potential for hazardous waste spills poses the greatest impact on groundwater resources in the project area. Columbia Gas' and Columbia Gulf's measures to prevent spills are summarized in the SPCC Plan included in their ECSs. With the implementation of the measures discussed above, the depth of the aquifers, and the relatively shallow nature of construction, we have concluded that construction and operation of the Projects would not significantly impact aquifers and groundwater resources.

Surface Water

Approximately 63 feet of one minor, intermittent waterbody would be permanently filled as a result of construction and operation of the proposed Lone Oak CS. In addition, approximately 100 feet of one minor, ephemeral waterbody would be permanently relocated to accommodate a new storm water management pond within the existing Ceredo CS. No other long-term impacts are anticipated on waterbodies as a result of construction of the Projects. Columbia Gas and Columbia Gulf would not permanently affect the designated water uses, would bury the pipeline beneath the bed of all waterbodies, they would implement erosion and sedimentation controls, and would restore streambanks and streambed contours as close as practical to pre-construction conditions. Additional measures outlined in the ECSs would aid in the effective avoidance or minimization of impacts on surface waterbodies. Activities associated with crossing West Virginia state-designated high quality waters would be covered under the WVDNR Stream Activity Permit for Marshall and Wayne Counties, West Virginia. Columbia Gas intends to request a waiver from the fish spawning season timing restriction prior to construction. Because these time windows may differ from the time windows required by section V.B.1 of our Procedures, we require evidence of the state agency's approval for the proposed time windows. Because Columbia Gas has not yet received its WVNDR Stream Activity Permit for the LX Project, we are unable to verify these WVDNR recommended instream work windows. Impacts associated with hydrostatic

testing on public and municipal water supplies would be minimized through control measures established by Columbia Gas and Columbia Gulf in accordance with state recommendations. Accidental spills during construction and operation would be avoided through implementation of the SPCC Plan. Due to the measures discussed above, we conclude impacts on waterbodies would be adequately minimized during construction of the Projects.

Operation of the LX and RXE Projects would likely result in minimal impacts on waterbodies. Streams would be restored to pre-construction conditions. Columbia Gas and Columbia Gulf would also minimize impacts of permanent easement maintenance by working cooperatively with appropriate agencies. Therefore, we conclude that operation of the Projects would have minimal impacts on waterbodies.

Based on the avoidance and minimization measures developed by Columbia Gas and Columbia Gulf, including measures outlined in their project-specific ECSs, as well as our recommendations, we conclude that construction and operation of the LX and RXE Projects would not have any significant impacts on surface water resources.

Surface Water Uses during Construction

Columbia Gas and Columbia Gulf are proposing to use both surface water and municipal water sources for hydrostatic testing. All water used for hydrostatic testing for the LX Project would be obtained from local surface waters and municipal sources. Columbia Gas would require 42 million gallons of test water for pipeline facilities and 1 million gallons of test water for aboveground facilities. The RXE Project would obtain water from municipal sources.

Impacts associated with the withdrawal and discharge of water would be effectively minimized by the implementation of the mitigation measures outlined in Columbia Gas' and Columbia Gulf's ECSs and FERC's Procedures. In addition, Columbia Gas and Columbia Gulf would obtain appropriate NPDES discharge permits prior to conducting hydrostatic testing. Accidental spills during construction and operations would be prevented or adequately minimized through implementation of Columbia Gas' and Columbia Gulf's SPCC Plan.

Based on the avoidance and minimization measures developed by Columbia Gas and Columbia Gulf, including measures outlined in their project-specific ECSs, we conclude that the Projects would not have adverse impacts on surface water resources.

Wetlands

Construction of the LX Project (including temporary pipeline impacts, aboveground facility impacts, and access road impacts) would affect a total of 16.1 acres of wetlands. This includes 1.4 acres of forested wetlands, 0.8 acre of scrub-shrub wetlands, and 13.9 acres of emergent wetlands. Columbia Gas would maintain a 10-foot-wide corridor in wetlands and would also selectively remove trees and shrubs within a 30-foot-wide corridor where trees exist that could affect the integrity of the pipeline in scrub-shrub and forested wetland areas. Environmental wetland surveys are complete except where landowner permission had not been acquired. About 1.0 acre of wetlands would be converted permanently to emergent or scrub-shrub wetlands as a result of the 30-foot operational corridor for the operation of the LX Project. We do not anticipate temporary or permanent impacts on wetlands during construction or operation of the aboveground facilities associated with the RXE Project.

Columbia Gas requested alternative measures from FERC's Procedures in several areas where it concluded that site-specific conditions do not allow for a 50-foot setback of extra workspace from wetlands. Based on our review, we have determined that the requested modifications are justified.

Given the current information Columbia Gas and Columbia Gulf have provided at the time of this draft EIS and our own research, we conclude that impacts on wetlands would be minor and would be further offset by the implementation of any compensatory mitigation developed in consultation with the agencies. Therefore, we are recommending that Columbia Gas provide its final wetland compensation plan, developed in consultation with the appropriate agencies. While limited long-term impacts on wetlands would occur, with Columbia Gas' and Columbia Gulf's implementation of the mitigation, and adherence to state agency and COE permit requirements, we conclude the impacts would be reduced to less than significant levels.

Vegetation

Construction of the LX Project, including the construction right-of-way, extra workspace, aboveground facilities, contractor yards, and access roads would result in impacts on 3,161.6 acres of vegetated lands. This total includes 1,380.6 acres of upland forest. During operations, Columbia Gas would mow no more than once every 3 years, and maintain a 50-foot-wide permanent right-of-way; however, a 10- foot-wide corridor centered on the pipeline may be mowed more frequently to facilitate routine patrols and emergency access to the pipeline centerline. Operation of the LX Project would result in impacts on 987.7 acres of vegetated lands, including 515.6 acres of upland forest. The area of impacted interior forest blocks was calculated and we determined that approximately 1,142.9 acres of interior forest block habitat would be impacted by the proposed LX Project. We determined that approximately 13.1 miles of new edge habitat would be created as a result of construction of the proposed LX Project.

Columbia Gas would use temporary access roads during construction activities and permanent access roads during construction and operation. The access roads would impact 95.0 acres of vegetated lands during construction and 10.9 acres of vegetated lands during operation.

The greatest impact on vegetation would be on forested areas because of the time required for tree regrowth back to pre-construction conditions. Construction in forest lands would remove the tree canopy over the width of the construction right-of-way, which would change the structure and local setting of the forest area. The regrowth of trees outside the permanent right-of-way would take years and possibly decades. Moreover, the forest land on the permanent right-of-way would be permanently impacted by ongoing vegetation maintenance during operations, which would preclude the re-establishment of trees on the right-of-way.

Interior forest has a higher habitat value for some wildlife species, may take decades to establish, and is generally considered more rare in the environment compared to edge forest. These habitats provide protection from disturbance and predation, food resources, and brooding habitat for wildlife. Although Columbia Gas has attempted to route the LX Project adjacent to existing disturbance and outside of forested areas, impacts on interior forest areas would still occur and measures proposed to reduce impacts and offset temporary and permanent impacts through conservation measures. Most impacts on agricultural lands would be temporary to short-term because these areas are disturbed annually to produce crops and would typically return to their previous condition shortly following construction, cleanup, and restoration. Impacts on agricultural lands would be minimized though adherence to the ECS. No restoration activities would occur in agricultural lands between the beginning of the spring thaw through May 15, unless otherwise requested by the landowner. Restoration would be coordinated with the landowner's planting schedule.

Temporary and minor impacts would result due to construction of the Projects. Based on our review of the potential impacts on vegetation as described above, we conclude that the primary impact from construction and operation of the LX Project would be on forested lands and the RXE Project would primarily affect agricultural land. Forested impacts from the construction of the LX Project would be

significant; however, due to the prevalence of forested habitats within the LX Project area and eventual regrowth of prior forested areas outside of the permanent right-of-way, in addition to Columbia Gas' mitigation and routing, we conclude that the permanent conversion of forested lands would be reduced to less than significant levels. Additional measures outlined in the Columbia Gas' and Columbia Gulf's corresponding ECSs, and recommendations and potential mitigation measures from FWS in the Final Migratory Bird Conservation Plan would further minimize impacts to forested lands and other vegetation types. We have also recommended that Columbia Gas provide FERC with a revised project-specific ECS that accommodates the agencies requests to apply seed mixes that contain native pollinator plant species so as to benefit pollinating insect, bird, and bat species.

Wildlife and Aquatic Resources

The overall impact of the Projects on most wildlife resources would not be significant due to the temporary nature of the effects, the amount of similar adjacent habitat available for use, and implementation of the ECS, Plan, and Procedures, although some forested species may experience a higher level of impacts. Columbia Gas and Columbia Gulf would minimize impacts on wildlife through route planning, and a reduced construction right-of-way through wetlands and forests. Impacts on vegetation and wildlife within the RXE Project are not expected to be adverse, because the sites are in predominantly agricultural areas and adjacent to an existing pipeline right-of-way. Forested species may be subject to greater impacts than non-forested species, but we recognize that these would be less than significant impacts given the availability of undisturbed forested habitat adjacent to project workspaces and the ability for individual mobile species to seek refuge in these undisturbed areas. Therefore, overall impacts on wildlife from the Projects would be minor and temporary. Additionally, we are recommending that Columbia Gas provided documentation of its correspondence with ODNR and any avoidance or mitigation measures developed to cross the Sunfish Creek State Forest.

A variety of migratory bird species, including BCCs, are associated with the habitats that would be affected by the LX Project pipeline. The clearing of vegetation during the nesting season could have direct impacts on individual migratory birds. Columbia Gas intends to conduct clearing activities associated with project construction during the non-nesting season to the extent practicable in accordance with recommendations received from the FWS Midwest Regional Office. Columbia Gas has developed a Migratory Bird Conservation Plan that details impacts on upland forest habitat and measures proposed to reduce impacts and offset temporary and permanent impacts. A final plan developed in coordination with the applicable agencies prior to construction would identify measures to further reduce impacts. We are recommending that Columbia Gas file their Final Migratory Bird Conservation Plan, developed in consultation with the FWS regarding avoidance, minimization, and mitigation measures.

Given the impact avoidance, minimization, and mitigation measures proposed by Columbia Gas and Columbia Gulf, as well as our recommendations, we conclude that the LX and RXE Projects would not have a significant adverse effect on wildlife overall, although some forested species may experience a higher level of impact due to the long-term loss of forested habitat.

Consultations with state agencies identified that the LX Project would cross several waterbodies in Ohio that could contain suitable habitat for special status species and one Approved Trout Water. Temporary and minor impacts on fisheries and aquatic resources could occur as a result of the LX Project. To further minimize impacts on fisheries, Columbia Gas would follow measures outlined in the ECS, which specify time windows for construction, appropriate additional temporary workspace setbacks, spoil setbacks, equipment bridges, erosion and sedimentation control requirements, and restoration requirements. Additionally, Columbia Gas would minimize the effects of its LX Project on aquatic resources at waterbody crossings through the use of HDD technology, where practicable.

Waterbodies would not be affected by the construction or operation of the aboveground facilities at the Means CS, other than what is required for temporary access during construction, and the waterbodies would be crossed by means of temporary bridges or culverts. Permanent culverts or bridges may be installed to allow for permanent access to the facilities over S014/S013 at the Means CS. At the Grayson CS, Columbia Gulf is proposing to relocate S041, an ephemeral channel, permanently to the south to accommodate design restrictions. No permanent fill would occur in the waterbody resources, and the stream relocation would occur to avoid any impacts to downstream uses. In accordance with Columbia Gulf's ECS, erosion and sediment controls would be placed on the downslope side of the construction workspace to minimize sedimentation into surface waters. With the exception of the stream relocation, all impacts on waterbodies located within the RXE Project footprint would be temporary.

Based on our review of potential impacts on aquatic resources as described above, we conclude that the LX Project would result in some temporary impacts on aquatic resources, but that these impacts would be adequately mitigated through adherence to the measures described in Columbia Gas' ECS, agency recommendations regarding the timing of construction activities, and our recommendations regarding sensitive waterbody crossings.

Special Status Species

To comply with Section 7 of the ESA, we consulted either directly or indirectly (through the applicants' informal consultation) with the FWS and state resource agencies regarding the presence of federally listed, proposed for listing, or state-listed species in the Projects' area. In compliance with Section 7, we requested that the FWS consider the draft EIS, along with various survey reports prepared by Columbia Gas and Columbia Gulf, as the Biological Assessment for the Projects.

Columbia Gas and Columbia Gulf began implementing the MSHCP in January 2014 and would implement the appropriate avoidance and minimization measures per the MHSCP, such as clearing or cutting trees in the winter. We determined that construction and operation of the Projects for covered lands is *not likely to adversely affect* the gray bat, the Indiana bat, the Virginia big-eared bat or the northern long-eared bat and would have *no effect* on the eastern small-footed myotis or Rafinesque's big-eared bat.

Based on Columbia Gas and Columbia Gulf's consultations with FWS and our review of existing records, 16 federally listed threatened or endangered species are potentially present in the project areas. We have determined that construction and operation of the Projects in accordance with Columbia Gas and Columbia Gulf's proposed measures and our recommendations would not likely adversely affect the Indiana bat, northern long-eared bat, gray bat, Virginia big-eared bat, fanshell, pink mucket, rabbitsfoot, sheepnose, snuffbox, clubshell, rayed bean, American burying beetle, northern monkshood, running buffalo clover or small whorled pogonia. We have determined that the proposed projects would have no effect on white-haired goldenrod. In addition, we are recommending that Columbia Gas not begin construction of the LX Project within lands not covered by the MSHCP in Ohio until FERC staff completes any necessary ESA Section 7 consultation with the FWS for the Indiana bat and northern long-eared bat.

In addition, through desktop analysis and field habitat assessments, we have determined that after implementation of the MSHCP and any additional impact minimization measures specified by the FWS and state agencies, the LX and RXE Projects would have no effect or are not likely to adversely affect any species federally listed as proposed threatened or species of management concern, as well as state-listed species, with the exception of single-headed pussytoes. Consultation with PADCNR is ongoing for this species pending the completion of field survey reports.

We are recommending Columbia Gas and Columbia Gulf provide results from all outstanding surveys, correspondence, and mitigation measures prior to construction of the Projects.

Land Use, Recreation, Special Interest Areas, and Visual Resources

Construction of the LX Project would affect a total of 3,161.6 acres, and operation of the LX Project would affect approximately 987.7 acres. The new pipeline would require a 50-foot-wide permanent right-of-way. To facilitate pipeline inspection, operation, and maintenance, the entire permanent right-of-way in upland areas, except at HDD crossings, would be maintained in an herbaceous/scrub-shrub vegetated state. This maintained right-of-way would be mowed no more than once every 3 years, but a 10-foot-wide corridor centered over the pipeline may be mowed annually to facilitate operational surveys. Construction of the RXE Project would affect a total of 34.4 acres during construction. Operation of the RXE Project would permanently affect approximately 16.8 acres.

Columbia Gas's construction work area for the LX Project would be within 50 feet of 43 residential structures, 5 businesses, and 69 other structures. Of these structures, 23 residences, 5 businesses, and 40 other structures are within 25 feet of the construction work area. Columbia Gas has prepared site-specific plans for all residences within 50 feet of construction work areas. Additionally, we are recommending that Columbia Gas file for the review and written approval, evidence of landowner concurrence with the site-specific residential construction plans for all locations identified by MP in table 4.8.3-1 of the EIS where LX Project construction work areas would be within 10 feet of a residence. Three residences and six other structures occupy the site of the Grayson CS, and Columbia Gulf intends to acquire and remove these structures. No other residential, commercial, or industrial structures are within 50 feet of the proposed work areas for the RXE Project. Columbia Gas and Columbia Gulf would notify affected residents a minimum of two weeks in advance of construction activities.

In general, impacts on recreational and special interest areas would be temporary and limited to the period of active construction, which typically would last only several days to several weeks in any one area. These impacts would be minimized by implementation of Columbia Gas's and Columbia Gulf's ECSs.

The LX Project would not cross or come within 0.2 mile of any National Park System unit (including National Wild, Scenic, and/or Recreational Rivers), Indian Reservation, National Forest, National Wildlife Refuge, National Wilderness Area, or National Landmark. The LX Project also does not cross any rivers in the National Wild and Scenic Rivers System.

The LX Project would directly cross one state forest, three recreational trails, one wildlife management area, and one outdoor recreation area. The LX Project would also be within 0.2 mile of one nature preserve and its two associated components, an additional nature preserve, one public park, one conservation preserve, and two state parks. The LX Project would cross state and privately owned lands, including less than one mile of state forest. The LX Project would also cross one National Scenic Byway, but would not cross any federal lands, or national or state designated wild or scenic rivers. The RXE Project would not cross any of these types of resources.

Visual resources along the pipeline route are a function of geology, climate, and historical processes, and include topographic relief, vegetation, water, wildlife, land use, and human uses and development. Approximately 40 percent of the new LX Project pipelines would be installed within or parallel to existing pipeline and/or utility rights-of-way. As a result, the visual resources along this portion of the LX Project have been previously affected by other similar activities.

The Projects' aboveground facilities would be installed at locations with aesthetics and topography similar to that described for the pipeline. Aboveground new facilities for both the LX and

RXE Project components would primarily affect areas characterized as agricultural, industrial, open land, and forest. MLVs along the LX Project operational right-of-way would be enclosed by an approximate 50-foot by 50-foot fenced gravel area with the exception of MLV #2, for which a 50-foot by 90-foot fenced area would be retained. Columbia Gas would construct 10 of 13 launchers and receivers within the boundaries of existing aboveground facilities, thereby minimizing impacts on visual resources.

Based on our review of potential impacts, the primary land use affected from construction and operation of the Projects would be on forested land. In accordance with the FERC Plan and Columbia Gas' and Columbia Gulf's ECSs, permanent impacts would be minimized in these areas. Visual impacts resulting from the Projects would also be minor and localized within the project areas. We conclude that significant impacts on specific land use types and visual resources as a result of project construction and operation would be adequately minimized and similar to those discussed above for vegetative impacts.

Socioeconomics

Construction of the Projects would not have a significant adverse impact on local populations, housing, employment, or the provision of community services. There would be short-term increases in traffic levels due to the commuting of the construction workforce to the area of the Projects as well as the movement of construction vehicles and delivery of equipment and materials to the construction right-of-way. To address traffic impacts related to construction across and within roadways and railroads, Columbia Gas has developed an acceptable Traffic Control Plan.

Based on our research and analysis, there is no evidence that the Projects would result in disproportionately high and adverse health or environmental effects on minority or low-income communities. We did not identify any communities in the LX or RXE project areas in which disproportionate effects of the Projects would result in effects on minority populations. The long-term socioeconomic effect of the LX and RXE Projects is likely to be beneficial, based on the increase in tax revenues that would accrue in the counties affected by the LX and RXE Projects. Columbia Gas would compensate landowners in accordance with the terms of the existing permanent easement agreements and for the acquisition of new property and easements, including compensation for construction related damages, such as those associated with residential areas, crops, and pasture land. Based on the analysis presented, and our recommendations regarding other resources, we conclude there would not be a significant adverse effect on the socioeconomic conditions within the Projects' area.

Cultural Resources

Columbia Gas and Columbia Gulf conducted archival research and surveys for the proposed Projects to identify cultural resources and locations for additional subsurface testing in areas with potential for prehistoric and historic archaeological sites.

In West Virginia, Columbia Gas identified two archaeological sites and three historic cemeteries. All five sites are of undetermined eligibility. Four sites would be avoided by reroutes, workspace modifications, and/or HDD. Columbia Gas has committed to measures to mitigate impacts to the remaining site; however, these measures have not been filed. As of March 2016, this section of the LX Project includes 1.6 miles of pipeline, 0.1 mile of access roads, 1.2 acres of workspace at the Lone Oak CS and 4.0 acres of pipe yards that have yet to be surveyed for archaeological sites.

In Pennsylvania, the SHPO stated in a letter dated September 9, 2015 that the Project would not affect architectural resources and no surveys would be required. In a letter dated November 20, 2015, the Pennsylvania SHPO confirmed that the LX Project would not affect historic archaeological resources.

In Ohio, Columbia Gas identified 100 archeological sites, of which 76 had either been determined or were recommended not eligible for listing in the NRHP. Twenty-one sites were of undetermined eligibility, but 19 would be avoided by reroutes. The remaining 3 sites have been determined eligible for listing in the NRHP and Columbia Gas has committed to measures to avoid impacts. Columbia Gas filed two site plans for avoidance of impacts in March 2016; however, not all plans have been filed. As of March 2016, this section of the LX Project includes 2.6 miles of pipeline, 3.1 acres of temporary workspaces, and 2.1 miles of access roads that have yet to be surveyed for archaeological sites.

In Kentucky, Columbia Gulf identified no previously recorded and two new archaeological sites within the construction footprint for the Grayson CS. Both sites were recommended not eligible for listing in the NRHP. The archaeological survey of the proposed Means CS identified three previously recorded and no new archaeological sites in the direct APE. One of the sites has been recommended not eligible for listing in the NRHP. The other two sites have been recommended as undetermined. Avoidance or Phase II archaeological evaluations have been recommended for these two sites. No historic architectural resources were identified within the indirect APE of the proposed Grayson CS or the proposed Means CS.

FERC staff, Columbia Gas, and Columbia Gulf contacted tribes to provide them an opportunity to comment on the proposed Projects. The letters were sent to inform each tribe about the proposed Projects and to request that they communicate any potential concerns they might have with respect to cultural resources, including traditional cultural properties. The Delaware Tribe of Indians responded to the LX Project notification letters with a letter dated June 27, 2014. They requested that they continue to participate as a consulting party. The Catawba Indian Nation responded with a letter dated July 22, 2015 that they have no immediate concerns within the boundaries of the LX Project area, but requested that they be notified if any unanticipated discovery is encountered during construction. The Delaware Tribe of Indians agreed with Columbia Gas' avoidance plans in a letter dated January 28, 2016. As of March 2016, no responses had been filed from the remaining tribes within the LX Project area. As of July 2015, no responses had been filed for tribes within the RXE Project area.

Compliance with Section 106 of the NHPA has not been completed for the proposed Projects. To ensure that our responsibilities under Section 106 of the NHPA are met, we are recommending, except in Pennsylvania, that construction should not begin until Columbia Gas and Columbia Gulf have filed any outstanding cultural resources surveys and SHPO comments, and any necessary site-specific plans. The studies and impact avoidance, minimization, and measures proposed by Columbia Gas and Columbia Gulf, and our recommendation, would ensure that any adverse effects on cultural resources would be appropriately addressed.

Air Quality and Noise

Air Quality

Air quality impacts associated with construction of the Projects would include emissions from fossil-fueled construction equipment and fugitive dust. Such impacts would generally be temporary and localized and are not expected to cause or contribute to a violation of applicable air quality standards. Once construction activities in an area are completed, fugitive dust and construction equipment emissions would subside and the impact on air quality due to construction would go away completely. Further, construction emissions do not exceed the General Conformity thresholds in areas of degraded air quality. We are recommending that Columbia Gas prepare a Construction Emission Plan identifying how Columbia Gas would track its construction schedule for each component of the LX Project within the Wheeling, OH-WV $PM_{2.5}$ Maintenance Area and ensure construction emissions of NOx would remain under the General Conformity applicability threshold. Therefore, we conclude that the Projects' construction-related impacts would not result in a significant impact on local or regional air quality.

The LX Project would include the construction and operation of three new compressor stations and four new regulator stations, as well as modifications at two existing compressor stations and one existing regulator station. The LX Project would also require the installation of 13 bi-directional launcher and/or receiver facilities. The RXE Project includes the installation of two compressor stations on the existing transmission system for delivery of gas. The majority of emissions from the LX and RXE Projects would result from operation of the compressor stations.

Emissions generated during operation of the pipeline portion of the LX Project would be minimal, limited to emissions from maintenance vehicles and equipment and fugitive emissions (considered negligible for the pipeline). The LX and RXE Projects are located in maintenance and nonattainment areas for $PM_{2.5}$. Columbia Gas has developed a Fugitive Dust Control Plan which includes mitigation measure that would be employed during construction activities to prevent and control fugitive dust PM emissions. Columbia Gas and Columbia Gulf submitted applications for construction and operation of each compressor station to the WVDEP, OEPA, and KYDEP. The Lone Oak CS, Ceredo CS, and Oak Hill CS would require Title V permits for operation. The Means CS and Grayson CS would require an Origin Operating Permit for operation. Columbia Gas and Columbia Gulf would ensure that emissions from combustion sources would be minimized by engine maintenance, use of pipeline-quality natural gas, and that annual performance tests would be conducted. The modeled ground-level concentrations associated with the Lone Oak CS, Summerfield CS, Oak Hill CS, Grayson CS, and Means CS, plus the corresponding background concentrations are below the NAAQS for each pollutant and averaging period. As with pipeline operations, any emissions resulting from operation of Columbia Gas' and Columbia Gulf's compressor stations would not have significant impacts on local or regional air quality.

Noise

Construction equipment for Columbia Gas' and Columbia Gulf's Projects would be operated on an as-needed basis and receptors near construction areas may experience an increase in perceptible noise. However, the effect would be temporary and local. The most prevalent noise-generating equipment during construction of aboveground facilities and pipelines would be construction equipment engines operating during site earth work. Controlled blasting during pipeline construction activities would be conducted in accordance with the measures outlined in the project-specific Blasting Plan. Columbia Gas and Columbia Gulf would limit construction to daylight hours to prevent nighttime noise impacts, with the exception of HDD activity. Aside from the use of temporary barriers during construction, Columbia Gas has not identified additional site-specific mitigation measures to further reduce HDD noise levels from the Ohio River #2 Entry location to below 55 dBA L_{dn} at the closest NSAs. Based on the current information available, there would be noise impacts from the Ohio River #2 Entry location, but they could be mitigated. Therefore, we are recommending that Columbia Gas file with the Secretary, for review and written approval by the Director of OEP, a revised HDD noise mitigation analysis for the Ohio River #2 Entry location. The revised plan would identify additional mitigation measures that Columbia Gas commits to implementing and the resulting projected noise level at the NSAs with implementation of the mitigation measures. Additionally, we are recommending that Columbia Gas file weekly construction status reports for each HDD entry and exit site that document the noise measurements from the nearest NSA for each drill entry/exit site; the noise mitigation that Columbia Gas implements at the start of drilling operations; and any additional mitigation measures that Columbia Gas will implement if the initial noise measurements exceeded an L_{dn} of 55 dBA at the nearest NSA and/or increased noise is over ambient conditions greater than 10 decibels. Based on modeled noise levels, Columbia Gas' and Columbia Gulf's proposed mitigation measures, and our recommendation, we conclude that Columbia Gas' and Columbia Gulf's Projects would not result in significant noise impacts on residents and the surrounding communities for HDD activity or any other construction activity.

Operation of Columbia Gas' and Columbia Gulf's new and modified compressor stations and regulator stations, as well as the new odorization stations, would not result in a perceptible noise increase or exceed our noise level criteria. Noise from planned or unplanned blowdown events could exceed our noise criteria, but would be infrequent and of relative short duration. Therefore, we are recommending Columbia Gas and Columbia Gulf file noise surveys with the Secretary no later than 60 days after placing Lone Oak, Summerfield, Oak Hill, Grayson, and Means Compressor Stations in service while at full load conditions. Additionally we are recommending Columbia Gas plant trees around the perimeter of the Oak Hill CS to provide additional visual screening to uphill noise NSAs, particularly the residence located 1,000 feet northwest. Based on the analyses conducted, mitigation measures proposed, and our recommendations, we conclude that operation of Columbia Gas' and Columbia Gulf's Projects would not result in significant noise impacts on residents and surrounding communities. In addition, the operation of the Projects are not expected to result in a perceptible increase in vibration at any NSA, as gas turbines and electric-driven motors do not produce as high of levels of vibration as compared to reciprocating engines.

Reliability and Safety

The pipeline and aboveground facilities associated with the Projects would be designed, constructed, operated, and maintained to meet the DOT Minimum Federal Safety Standards in 49 CFR 192 and other applicable federal and state regulations. These regulations include specifications for material selection and qualification; minimum design requirements; and protection of the pipeline from internal, external, and atmospheric corrosion. The DOT rules require regular inspection and maintenance, including repairs as necessary, to ensure the pipeline has adequate strength to transport the natural gas safely.

Columbia Gas would implement its own management plan for its pipeline facilities which would be clearly marked at line-of-sight intervals and at other key points to indicate the presence of the pipeline. The proposed facilities include many equipment features that are designed to increase the overall safety of the system and protect the public from a potential failure of the system due to accidents or incidents beyond the company's control. The pipeline system would be inspected to observe right-of-way conditions and identify soil erosion that may expose the pipe, dead vegetation that may indicate a leak in the pipeline, conditions of the vegetation cover and erosion control measures, unauthorized encroachment on the right-of-way such as buildings and other structures, and other conditions that could present a safety hazard or require preventive maintenance or repairs. Columbia Gas and Columbia Gulf would employ the use of a SCADA system that would allow for continuous monitoring and control of the Projects.

We conclude that Columbia Gas's and Columbia Gulf's implementation of the above measures would protect public safety and the integrity of the proposed facilities.

Cumulative Impacts

Three types of projects (past, present, and reasonably foreseeable projects) could potentially contribute to a cumulative impact when considered with the proposed Projects. These projects include Marcellus and Utica Shale development (wells and gathering systems), natural gas facilities that are not under the Commission's jurisdiction, other FERC-jurisdictional natural gas pipelines, and unrelated actions such as electric generation and transmission projects, transportation projects, and residential or commercial development projects. The region of influence for cumulative impacts varies depending on the resource being discussed. Specifically, we included:

- projects within the proposed Projects' boundaries of the eight-digit hydrologic unit code watersheds affecting water resources and aquatic resources;

- projects located within 0.5 mile of the proposed Projects' areas that may impact wildlife, vegetation, and land use;
- counties within the proposed Projects' construction areas and where non-local workers are expected to reside during construction and operations personnel are expected to reside permanently and an additional 10 to 15 miles into the adjacent counties for portions of the proposed Projects near a county border;
- the proposed footprint for geological resources within each of the Projects';
- projects within 0.5 miles of the proposed Projects' workspace for construction related short-term air emissions;
- projects within 2.5 miles of the proposed Projects' aboveground facilities that may affect long-term air quality; and
- projects occurring 0.5 mile or less from facilities creating operational noise associated with the proposed Projects.

Our cumulative impacts assessment also considers cumulative impacts related to 12 planned, proposed, or existing FERC-jurisdictional natural gas transmission projects that have portions within 25 miles of the proposed LX and RXE Projects. Of these projects, the Rover Pipeline, the Appalachian Lease Project, the Ohio Valley Connector Project, the SM-80 MAOP Restoration Project, the Mountaineer XPress Project, the Gibraltar Pipeline Project, and the Gulf XPress Project would be the closest to the LX and RXE Projects. All of the FERC-jurisdictional projects would be constructed and maintained in accordance with our approved procedures and other construction, operation, and mitigation measures that may be required by federal, state, or local permitting authorities, further reducing the potential for cumulative impacts.

Impacts associated with the proposed Projects in combination with other projects such as residential developments, electric generation, and transportation projects, would be relatively minor overall. It is anticipated that any adverse impacts on sensitive resources resulting from each of the other projects considered in our analysis would be regulated through project design, BMPs, and agency permitting. Therefore, we conclude that the cumulative impacts associated with the Projects, when combined with other known or reasonably foreseeable projects, would be effectively limited.

Alternatives

As an alternative to the proposed action, we evaluated the no-action alternative, system alternatives, route alternatives, and aboveground facility site alternatives. While the no-action alternative would eliminate the short- and long-term environmental impacts identified in the EIS, the stated objectives of Columbia Gas's and Columbia Gulf's proposals would not be met.

Our analysis of system alternatives included an evaluation of whether existing or proposed natural gas pipeline systems could meet the Projects' objectives while offering an environmental advantage. There is no available and suitably located capacity for existing pipeline systems to transport the required volumes of natural gas, nor are they connected to the LX Project's gas supply area in the Marcellus and Utica Shale regions of West Virginia, Pennsylvania, and Ohio. No existing pipeline system with the capacity to transport the contracted load connects the Marcellus and Utica Shale regions to serve the Project markets. Therefore, we do not consider use of existing pipeline systems as feasible alternatives for the proposed Projects.

We evaluated two major route alternatives for the LX Project LEX Pipeline segment. Due to increased impacts on environmental resources and residential areas, in addition to the potential for greater

impacts on forested areas, other wildlife habitat, and protected public resources, we have removed these major alternative routes from consideration.

Construction of the proposed R-801 Loop would provide optimal discharge pressure required for a system design to accommodate additional capacity created by the proposed LX Project through construction of one new relay compressor station near Oak Hill in Jackson County, Ohio. Construction of the BM-111 Loop would expand the capacity of the existing Line BM-111 near the existing Burlington Meter Station in Lawrence County, Ohio, which serves as a point of connection for lines R-500, R-601, and R-701 lines, as required to accommodate the new capacity associated with the proposed Project. Additionally, the use of co-location with the R-801 Loop and the BM-111 Loop further minimizes environmental impacts in addition to construction costs. Therefore, no route alternatives to the R-801 Loop and the BM-111 Loop were evaluated.

Based on consultations with landowners, resource agencies, municipal governments, field review, and impact assessment, we evaluated landowner requested variations, agency requested variations, and minor route alternatives for incorporation into the proposed LX Project to avoid site-specific features such as topography, landowner concerns, sensitive habitat, or structures. Since the issuance of the draft EIS, Columbia Gas has incorporated minor route variations into the proposed LX Project pipeline routes, as disclosed in section 3. However, since there are still landowner requests that Columbia Gas is considering, we are recommending that Columbia Gas further assess minor route evaluations in coordination with the landowners and either incorporate a route that avoids the resources of concern, or otherwise explain how potential impacts on resources have been effectively avoided, minimized, or mitigated.

A portion of the proposed LX Project route would be adjacent to Texas Eastern Transmission, LP's (Texas Eastern) existing permanent pipeline for about 17 miles between LEX Pipeline mileposts (MP) 34.6 and 52.2. Within this portion, the LEX Pipeline would closely overlap Rover Pipeline LLC's (Rover) Seneca Lateral (part of the Rover Pipeline Project) for about 13 miles in Monroe County, Ohio. In response to a FERC information request, Rover and Columbia reached an agreement in early July of 2016 to design their respective pipeline facilities in a manner such that both pipelines would be constructed and operated safely with minimal environmental and stakeholder impacts. Columbia Gas and Rover Pipeline LLC have tentatively agreed to use a non-exclusive easement for this overlap, which includes a mutual new permanent right-of-way width of 50 feet located on the south side of Texas Eastern's right-of-way. Their tentative design would be to distance their pipelines 20 feet from each other. Whichever pipeline is installed first in time would be located 40 feet from Texas Eastern's closest pipeline (a 30-inch-diameter pipeline), and that pipeline's temporary right-of-way would overlap Texas Eastern's permanent right-of-way overlap by 10 feet (Appendix C).

Columbia Gas has determined that it would have to deviate from the tentative mutual route agreed with by Rover Pipeline LLC, should the LEX Pipeline be the outside (southernmost) installed pipeline, for five minor route deviations. These deviations would allow the outside pipeline's route to accommodate construction constraints caused by steep terrain, geologic features, residences and waterbodies. Given that these deviations have not been identified, we are recommending that as part of its Implementation Plan, Columbia Gas confirm the location of the LEX Pipeline within its non-exclusive easement and identify any locations where the LEX Pipeline would deviate from the non-exclusive easement. In addition, in order to minimize the potential for repetitive impacts of these two additional pipelines on resources adjacent to the existing Texas Eastern right-of-way, we are recommending Columbia Gas file a construction coordination plan developed with Rover Pipeline LLC.

Columbia Gas redesigned the Lone Oak CS site after consulting with the mine operator to avoid potential conflicts with future longwall mining activities. Thus, we did not continue consideration of

alternative locations for this compressor station. Two alternatives to the proposed Oak Hill CS site were evaluated, but were discarded as alternative sites given the expected increased impacts on noise sensitive receptors. No environmental issues were identified to warrant alternative analysis for the Crawford CS or the Ceredo CS. We evaluated one site alternative to the proposed K-260 RS and two sites close to Columbia Gas' existing R-501, R-601, and R-701 lines, one alternative to the Benton RS, and one alternative for the McArthur RS. Proposed modification on the existing RS-1286 did not require an alternative analysis. As part of the proposed LX Project, five odorization stations would be constructed. These sites were chosen based on their existing locations along Columbia Gas' pipeline system and are required to maintain compliance with the DOT Minimum Federal Safety Standards (49 CFR 192). No environmental concerns were identified to warrant alternative analysis for the odorization stations.

We evaluated three alternative sites for Columbia Gulf's proposed Grayson CS and two alternative sites for the its proposed Means CS. We did not find any sites that would reduce impacts associated with these sites.

5.2 FERC STAFF'S RECOMMENDED MITIGATION

If the Commission authorizes the LX and RXE Projects, we recommend that the following measures be included as specific conditions in the Commission's Order. We conclude that these measures would further mitigate the environmental impact associated with construction and operation of the proposed LX and RXE Projects.

1. Columbia Gas and Columbia Gulf shall each follow the construction procedures and mitigation measures described in its application and supplements, including responses to staff data requests and as identified in the EIS, unless modified by the Order. Columbia Gas and Columbia Gulf must:

    a. request any modification to these procedures, measures, or conditions in a filing with the Secretary of the Commission;

    b. justify each modification relative to site-specific conditions;

    c. explain how that modification provides an equal or greater level of environmental protection than the original measure; and

    d. receive approval in writing from the Director of OEP **before using that modification**.

2. The Director of OEP has delegated authority to take whatever steps are necessary to ensure the protection of all environmental resources during construction and operation of the Projects. This authority shall allow:

    a. the modification of conditions of the Order; and

    b. the design and implementation of any additional measures deemed necessary (including stop-work authority) to ensure continued compliance with the intent of the environmental conditions as well as the avoidance or mitigation of adverse environmental impact resulting from construction and operation of the Projects.

3. **Prior to any construction**, Columbia Gas and Columbia Gulf shall each file an affirmative statement with the Secretary, certified by a senior company official, that all company personnel, EIs, and contractor personnel will be informed of the EIs' authority and have been or will be trained on the implementation of the environmental mitigation measures appropriate to their jobs **before** becoming involved with construction and restoration activities.

4. The authorized facility locations shall be as shown in the final EIS, as supplemented by filed alignment sheets. **As soon as they are available and before the start of construction**, Columbia

Gas and Columbia Gulf shall file any revised detailed survey alignment maps/sheets at a scale not smaller than 1:6,000 with station positions for all facilities approved by the Order. All requests for modifications of environmental conditions of the Order or site-specific clearances must be written and must reference locations designated on these alignment maps/sheets.

Columbia Gas' exercise of eminent domain authority granted under NGA Section 7(h) in any condemnation proceedings related to the Order must be consistent with these authorized facilities and locations. Columbia Gas' right of eminent domain granted under NGA Section 7(h) does not authorize it to increase the size of its natural gas pipeline to accommodate future needs or to acquire a right-of-way for a pipeline to transport a commodity other than natural gas.

5. Columbia Gas and Columbia Gulf shall file detailed alignment maps/sheets and aerial photographs at a scale not smaller than 1:6,000 identifying all route realignments or facility relocations, and staging areas, contractor yards, new access roads, and other areas that would be used or disturbed and have not been previously identified in filings with the Secretary. Approval for each of these areas must be explicitly requested in writing. For each area, the request must include a description of the existing land use/cover type, and documentation of landowner approval, whether any cultural resources or federally listed threatened or endangered species would be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps/sheets/aerial photographs. Each area must be approved in writing by the Director of OEP **before construction in or near that area**.

   This requirement does not apply to extra workspace allowed by the Columbia Gas's and Columbia Gulf's Plans and/or minor field realignments per landowner needs and requirements which do not affect other landowners or sensitive environmental areas such as wetlands.

   Examples of alterations requiring approval include all route realignments and facility location changes resulting from:

   a. implementation of cultural resources mitigation measures;

   b. implementation of endangered, threatened, or special concern species mitigation measures;

   c. recommendations by state regulatory authorities; and

   d. agreements with individual landowners that affect other landowners or could affect sensitive environmental areas.

6. **Within 60 days of the acceptance of the Certificate and before construction begins**, Columbia Gas and Columbia Gulf shall file their respective Implementation Plans for review and written approval by the Director of OEP. Columbia Gas and Columbia Gulf must file revisions to their plans as schedules change. The plans shall identify:

   a. how Columbia Gas and Columbia Gulf will implement the construction procedures and mitigation measures described in its application and supplements (including responses to staff data requests), identified in the EIS, and required by the Order;

   b. how Columbia Gas and Columbia Gulf will incorporate these requirements into the contract bid documents, construction contracts (especially penalty clauses and specifications), and construction drawings so that the mitigation required at each site is clear to onsite construction and inspection personnel;

   c. the number of EIs assigned, and how the company will ensure that sufficient personnel are available to implement the environmental mitigation;

d. company personnel, including EIs and contractors, who will receive copies of the appropriate material;

e. the location and dates of the environmental compliance training and instructions Columbia Gas and Columbia Gulf will give to all personnel involved with construction and restoration (initial and refresher training as the Projects progress and personnel change) with the opportunity for OEP staff to participate in the training sessions;

f. the company personnel (if known) and specific portion of Columbia Gas's and Columbia Gulf's organization having responsibility for compliance;

g. the procedures (including use of contract penalties) Columbia Gas and Columbia Gulf will follow if noncompliance occurs; and

h. for each discrete facility, a Gantt or PERT chart (or similar project scheduling diagram), and dates for:

   i. the completion of all required surveys and reports;
   ii. the environmental compliance training of onsite personnel;
   iii. the start of construction; and
   iv. the start and completion of restoration.

7. Columbia Gas shall employ at least one EI per construction spread and Columbia Gulf shall employ one EI for the RXE Project. The EIs shall be:

   a. responsible for monitoring and ensuring compliance with all mitigation measures required by the Order and other grants, permits, certificates, or other authorizing documents;

   b. responsible for evaluating the construction contractor's implementation of the environmental mitigation measures required in the contract (see condition 6 above) and any other authorizing document;

   c. empowered to order correction of acts that violate the environmental conditions of the Order, and any other authorizing document;

   d. a full-time position, separate from all other activity inspectors;

   e. responsible for documenting compliance with the environmental conditions of the Order, as well as any environmental conditions/permit requirements imposed by other federal, state, or local agencies; and

   f. responsible for maintaining status reports.

8. Beginning with the filing of its Implementation Plan, Columbia Gas shall file updated status reports with the Secretary on a **weekly basis until all construction and restoration activities are complete**. Columbia Gulf shall file updated status reports with the Secretary on a **monthly basis until construction and restoration activities are complete**. On request, these status reports will also be provided to other federal and state agencies with permitting responsibilities. Status reports shall include:

   a. an update on efforts to obtain the necessary federal authorizations;

   b. the construction status of the their respective Project facilities, work planned for the following reporting period, and any schedule changes for stream crossings or work in other environmentally sensitive areas;

   c. a listing of all problems encountered and each instance of noncompliance observed by the EIs during the reporting period (both for the conditions imposed by the Commission and

any environmental conditions/permit requirements imposed by other federal, state, or local agencies);

d. a description of corrective actions implemented in response to all instances of noncompliance, and their cost;

e. the effectiveness of all corrective actions implemented;

f. a description of any landowner/resident complaints that may relate to compliance with the requirements of the Order, and the measures taken to satisfy their concerns; and

g. copies of any correspondence received by Columbia Gas and Columbia Gulf from other federal, state, or local permitting agencies concerning instances of noncompliance, and Columbia Gas's and Columbia Gulf's responses.

9. Prior to receiving written authorization from the Director of OEP to commence construction of their respective Project facilities, Columbia Gas and Columbia Gulf shall file documentation that they have received all applicable authorizations required under federal law (or evidence of waiver thereof).

10. Columbia Gas and Columbia Gulf must receive written authorization from the Director of OEP **before placing their respective projects into service**. Such authorization will only be granted following a determination that rehabilitation and restoration of areas affected by the Projects are proceeding satisfactorily.

11. **Within 30 days of placing the authorized facilities in service**, Columbia Gas and Columbia Gulf shall file an affirmative statement with the Secretary, certified by a senior company official:

    a. that the facilities have been constructed in compliance with all applicable conditions, and that continuing activities will be consistent with all applicable conditions; or

    b. identifying which of the Certificate conditions Columbia Gas and/or Columbia Gulf has complied or will comply with. This statement shall also identify any areas affected by their respective Projects where compliance measures were not properly implemented, if not previously identified in filed status reports, and the reason for noncompliance.

12. As part of its Implementation Plan, Columbia Gas shall confirm the location of the LEX Pipeline between MPs 34.6 to 52.2 within its non-exclusive easement and identify any locations where the LEX Pipeline along this segment would deviate from the non-exclusive easement in accordance with recommendation 5. *(section 2.1.1)*

13. **Prior to construction,** Columbia Gas shall further assess any outstanding minor route variations in coordination with the landowners, including those at LEX Pipeline MPs 15.4, 31.0, 35.8, 62.8, 86.6, and 109.7, and Columbia Gas shall either incorporate a route within the same landowner's property that addresses or avoids the resources or issue of concern, or otherwise explain how potential impacts on resources have been effectively avoided, minimized, or mitigated to the extent practical.

    Columbia Gas shall file with the Secretary, for the review and written approval by the Director of OEP, revised alignment sheets, documentation of its landowner consultations, and a summary of the resources (e.g. forests, wetlands, sensitive species, and cultural resources) affected by the revised routes. *(section 3.3.3)*

14. **Prior to construction,** Columbia Gas shall file with the Secretary the results of civil surveys identifying the location of any conventional or unconventional oil and gas well locations (including permitted, drilled, producing and abandoned oil and gas wells) within the LX Project footprint, as well as identify measures to minimize hazards for any wells located within 100 feet of the proposed LX Project pipelines. (*section 4.1.1.2*)

15. **Prior to construction**, Columbia Gas shall file with the Secretary a copy of the final WVDNR Stream Activity Permit for the LX Project documenting the state agency's approval of instream work windows and incorporate these time windows into its final construction plans. *(section 4.3.2.4)*

16. **Prior to construction,** Columbia Gas shall file with the Secretary its final wetland compensation plan, developed in consultation with the appropriate agencies. (*section 4.4.5*)

17. **Prior to construction,** Columbia Gas shall file with the Secretary, for review and written approval of the Director of OEP, a revised project specific ECS that addresses the agencies requests to apply seed mixes identified in state standards specific to the project region, as well as the use of seeds for native pollinator species so as to benefit pollinating insect, bird, and bat species. (*section 4.5.6.1*)

18. **Prior to construction,** Columbia Gas shall file with the Secretary documentation of its correspondence with ODNR and any avoidance or mitigation measures developed to cross the Sunfish Creek State Forest. *(section 4.6.1.2)*

19. **Prior to construction,** Columbia Gas shall file with the Secretary its final Migratory Bird Conservation Plan along with documentation of its consultation with FWS regarding avoidance, minimization, and mitigation measures. (*section 4.6.1.4*)

20. Columbia Gas shall not begin construction of the LX Project within lands not covered by the MSHCP in Ohio **until**:

    a. FERC staff completes any necessary ESA Section 7 consultation with the FWS for the Indiana bat and NLEB; and

    b. Columbia Gas has received written notification from the Director of OEP that construction and/or use of mitigation (including implementation of conservation measures) may begin. (*section 4.7.2.1*)

21. **Prior to construction in water in Ohio and West Virginia,** Columbia Gas shall continue consultations with the applicable state agencies to identify any additional mitigation measures for state-protected mussel species and the need for additional surveys in Ohio and West Virginia. The results of such consultations and any state recommended mitigation measures shall be filed with the Secretary. *(section 4.7.3.4)*

22. **Prior to construction in Pennsylvania,** Columbia Gas shall file with the Secretary survey results and any mitigation measures developed in consultation with the PADCNR for single-headed pussytoes. *(section 4.7.3.6)*

23. **Prior to construction**, Columbia Gas shall file with the Secretary, for the review and written approval of the Director of OEP, evidence of landowner concurrence with the site-specific residential construction plans for all locations identified by MP in table 4.8.3-1 of the EIS where the LX Project construction work areas would be within 10 feet of a residence. (*section 4.8.3.1*)

24. **Prior to construction,** Columbia Gas shall file with the Secretary, for review and written approval by the Director of OEP, a visual screening plan located for the proposed Oak Hill Compressor Station. (*section 4.8.6.2*)

25. **Prior to construction,** Columbia Gulf shall file with the Secretary, for review and written approval by the Director of OEP, a visual screening plan for the proposed Means Compressor Station. (*section 4.8.6.2*)

26. Columbia Gas and Columbia Gulf shall not begin construction of facilities and/or use of (all) staging, storage, or temporary work areas and new or to-be improved access roads in Ohio, West Virginia, or Kentucky **until**:

    a. Columbia Gas and Columbia Gulf file with the Secretary:

i. Cultural resource identification survey reports for any previously unreported areas in Ohio, and West Virginia;
ii. Evaluation studies, as necessary, to provide NRHP-eligibility recommendations for historic aboveground resources Site 103, Site 136, and Site 140 in Ohio and archaeological sites 15MF490 and 15MF492 in Kentucky;
iii. Any other reports, evaluation studies, or plans (monitoring, avoidance, etc.) not yet submitted; and
iv. Comments on survey reports, UDPs, and any other studies or plans from the Ohio, West Virginia, and Kentucky SHPOs and any other consulting parties;

b. The ACHP is afforded an opportunity to comment if historic properties would be adversely affected; and

c. FERC staff reviews and the Director of OEP approves the cultural resources reports and plans, and notifies Columbia Gas and Columbia Gulf in writing that treatment plans/mitigation measures may be implemented and/or construction may proceed.

All material filed with the Commission containing location, character, and ownership information about cultural resources must have a cover and any relevant pages therein clearly labeled with the following in bold lettering: **"CONTAINS PRIVILEGED INFORMATION - DO NOT RELEASE."** (*section 4.10.6*)

27. **Prior to construction,** Columbia Gas shall file with the Secretary, for review and written approval by the Director of OEP, a Construction Emission Plan identifying how Columbia Gas would track its construction schedule for each component of the LX Project within the Wheeling, OH-WV $PM_{2.5}$ Maintenance Area and ensure construction emissions of NOx would remain under the General Conformity applicability threshold. If a change in the construction schedule or project results in emissions of NOx greater than the General Conformity applicability threshold of 100 tpy, Columbia Gas shall provide and document all mitigation measures under 40 CFR 93.158 it would implement to comply with the General Conformity Regulations. (*section 4.11.1.2*)

28. **Prior to construction,** Columbia Gas shall file with the Secretary, for review and written approval by the Director of OEP, a revised HDD noise mitigation analysis for the Ohio River #2 Entry location. The revised plan shall identify additional mitigation measures that Columbia Gas commits to implementing and the resulting projected noise level at the NSAs with implementation of the mitigation measures. (*section 4.11.2.2*)

29. Columbia Gas shall file in the **weekly construction status reports** the following for each HDD entry and exit site:

    a. the noise measurements from the nearest NSA for each drill entry/exit site, obtained at the start of drilling operations;

    b. the noise mitigation that Columbia Gas implements at the start of drilling operations; and

    c. any additional mitigation measures that Columbia Gas will implement if the initial noise measurements exceeded an L_{dn} of 55 dBA at the nearest NSA and/or increased noise is over ambient conditions greater than 10 decibels. (*section 4.11.2.2*)

30. Columbia Gas and Columbia Gulf shall file a noise survey with the Secretary **no later than 60 days** after placing Lone Oak, Summerfield, Oak Hill, Grayson, and Means Compressor Stations in service. If a full load condition noise survey of the entire station is not possible, Columbia Gas and Columbia Gulf shall instead file an interim survey at the maximum possible horsepower load and file the full load survey **within 6 months**. If the noise attributable to the operation of all of the equipment at any compressor station under interim or full horsepower load conditions exceeds 55 dBA L_{dn} at any nearby NSAs, Columbia Gas and Columbia Gulf shall file a report on what changes are needed and

shall install the additional noise controls to meet the level **within 1 year** of the in-service date. Columbia Gas and Columbia Gulf shall confirm compliance with the 55 dBA L_{dn} requirement by filing a second noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. (*section 4.11.2.3*)

31. Columbia Gas shall file noise surveys with the Secretary **no later than 60 days** after placing the authorized units at the Crawford and Ceredo Compressor Stations in service. If a full load condition noise survey of the entire station is not possible, Columbia Gas shall file an interim survey at the maximum possible horsepower load and file the full load surveys **within 6 months**. If the noise attributable to the operation of the modified compressor station at full or interim power load conditions exceeds existing noise levels at any nearby NSAs that are currently at or above an L_{dn} of 55 dBA, or exceeds 55 dBA L_{dn} at any nearby NSAs that are currently below 55 dBA L_{dn}, Columbia Gas shall file a report on what changes are needed and shall install the additional noise controls to meet the level **within 1 year** of the in-service date. Columbia Gas shall confirm compliance with the above requirement by filing a second noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. (*section 4.11.2.3*)

32. **Prior to construction,** Columbia Gas shall file with the Secretary, for the review and written approval of the Director of OEP, a construction coordination plan that identifies the specific construction measures (such as retention of the same contractor, re-use of equipment bridges, coordinated installation of erosion control devices, or restoration commitments) that Rover Pipeline LLC and Columbia Gas have agreed to implement in the construction of the parallel portions of their respective projects in the non-exclusive easement. *(section 4.13.7)*

APPENDIX A
Distribution List

Federal Government Agencies

Advisory Council on Historic Preservation
- Office of Federal Programs
  - Charlene D. Vaughn, Assistant Director for Federal Program Development

Army Corps of Engineers
- Huntington District, WV
  - Adam Fannin, Regulatory Project Manager
  - Mike Hatten, Regulatory Branch Chief
  - Ginger Mullins, Chief
- Pittsburgh District, PA
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- Planning and Policy Division
  - John Furry, Senior Policy Advisor

Council on Environmental Quality
- Ellen Athas, Senior Counsel
- Horst Greczmiel, Associate Director for NEPA Oversight

Department of Agriculture
- Conservation and Environmental Program Division
  - Nell Fuller, National Environmental Compliance Manager
- National Resources Conservation Service (NRCS)
  - Andree DuVarney, National Environmental Coordinator
- Forest Service-Ecosystem Management Coordination
  - Joe Carbone, Assistant Director, NEPA

Department of Commerce
- National Oceanic and Atmospheric Administration, National Marine Fisheries Service
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  - Steve Leathery, National NEPA Coordinator

Department of Energy
- Division of Natural Gas Regulatory Activities
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- Office of Environmental Management
  - Mark Whitney, Principal Deputy Assistant Secretary
- Office of NEPA Policy and Compliance
  - Carol M. Borgstrom, Director of Office and General Counsel

Department of Homeland Security
- U.S. Customs and Border Protection
  - Christopher Oh, Branch Chief

Department of Interior
- Bureau of Indian Affairs
  - Marv Keller, Chief, Division of Environmental and Cultural Resources Management
- Bureau of Land Management

Kerry Rogers, Senior NEPA Specialist
Bureau of Ocean Energy Management
James F. Bennett, Chief, Division of Environmental Assessment
Bureau of Safety and Environmental
Charles B. Barbee, Chief Environmental Enforcement Division
Fish and Wildlife Service (USFWS)
Pat Carter, National Coordinator
Ohio Ecological Services Field Office
Angela Boyer, Endangered Species Coordinator
Mary Knapp, Field Supervisor
Pennsylvania Field Office
Robert Anderson, Fish and Wildlife Biologist
West Virginia Field Office
Tiernan Lennon, Fish and Wildlife Biologist
John Schmidt, Project Leader
Northeast Region (5)
Martin Miller, Regulatory Branch Chief
Geological Survey (USGS)
Environmental Management Branch
Esther Eng, Chief
National Parks Service
Patrick Walsh, Chief Environmental Planning and Compliance Branch
Mark Weaver, Superintendent
Rivers, Trails, and Conservation Assistance Program, OH
Andrea Irland
Rory Robinson
Office of Environmental Policy and Compliance, DC
Department of Health and Human Services
Sharunda Buchanan, Director, Division of Emergency and Environmental Health Services
Edward Pfister, Environmental Program Manager
Department of Housing and Urban Development
Office of Environment and Energy
Danielle Schopp, Community Planner
Department of Justice
Environment and Natural Resources Division
Beverly Li, NEPA Coordinator
Department of State
Bureau of Oceans and International Environmental and Scientific Affairs
Alexander Yuan, Foreign Affairs Officer
Department of Transportation
Pipeline and Hazardous Materials Safety Administration
Magdy El-Sibaie, Associated Administrator for Hazardous Materials Safety
Sherri Pappas, Senior Assistant Chief Council

Jeffrey Wiese, Associate Administrator for Pipeline Safety
Office of Pipeline Safety
Bryn Karaus, Senior Attorney
Kenneth Y. Lee, Director, Engineering and Research Division
Karen Lynch, National CATS Coordinator
Office of Assistant Secretary for Transportation Policy
Camille Mittelholtz, Environmental Policy Team Coordinator
Helen Serassio, Senior Environmental Attorney Advisor
Surface Transportation Board
Section of Environmental Analysis
Victoria Rutson, Chief
Environmental Protection Agency
Office of Enforcement and Compliance Assurance
Cynthia Giles, Assistant Administrator
Office of Federal Activities
Susan E. Bromm, Director
Cliff Rader, Director of NEPA Compliance Division
Region 3, NY
Jerome Blackman, Natural Gas STAR
Thomas G.S. UyBarreta, Environmental Protection Specialist, EAID
Region 5, IL
Virginia Laszewski, NEPA Implementation Section

Federal Senators and Representatives

U.S. House of Representatives Congressman, Evan Jenkins, WV
U.S. House of Representatives Congressman, Bill Johnson, OH
U.S. House of Representatives Congressman, David B. McKinley, WV
U.S. House of Representatives Congressman, Alex Mooney, WV
U.S. House of Representatives Congressman, Tim Murphy, PA
U.S. House of Representatives Congressman, Steve Stivers, OH
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Senator, Sherrod Brown, OH
Senator, Shelly Moore Capito, WV
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Senator, Rob Portman, OH
Senator, Robert Casey Jr., PA
Senator, Patrick Toomey, PA
Senate Energy and Natural Resources Committee, Lisa Murkowski

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Senate President Jeffrey V. Kessler
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State Government Agencies

Appalachian Partnership for Economic Growth, OH
- Katy Farber, Project Manager
- Marty Walsh, Vice-President

Hocking County Community Improve District, OH
- Joy Davis, Executive Director

Jobs OH
- David Mustine, Senior Managing Director

State of Kentucky
- Department of Fish and Wildlife Services
  - Karen Waldrop, Wildlife Director
- Division of Forestry
  - Diana Olszowy
- Heritage Council
  - Kary Stakelbeck, Program Administrator
  - Craig A. Potts, Executive Director
- State Nature Preserves Commission
  - Sara Hines, Data Manager
- USFWS Kentucky Ecological Services
  - Lee Andrews, Field Supervisor

Oak Hill Chamber of Commerce, OH
- Kurtis Strickland

State of Ohio
- Governor
  - John Kasich, Governor
- Department of Natural Resources
  - Brian Mitch, Compliance Coordinator
  - Fred Shimp, Assistant Director
  - Jim Zehringer, Director
  - John Navarro, Division of Wildlife
  - Nathan Reardon, Compliance Coordinator, Division of Wildlife
  - John Kessler, Office of Real Estate
  - Tara Paciorek, Office of Real Estate
  - Jeff Johnson, State Parks Division
- Department of Transportation
  - Aaron Wolfe, Director
  - Steve T. Williams, District Deputy Director
- Environmental Protection Agency
  - Craig Butler, Director
  - Holly Tucker, Environmental Manager
  - Karl Gebhardt, Deputy Director for Water Resources
  - Mike Hopkins, Assistant Chief of Permitting Air

- Nick Hammer, Environmental Specialist II
- Rachel Taulbee, Wetland Permitting Unit Supervisor
- Tiffani Kavalec, Assistant Chief
- Harry Kallipolitis, Central District Stormwater Coordinator
- Jeff Bohne, Central District Water Quality Supervisor
- Paul Vandermeer, Central District Stormwater Coordinator
- Carol Siegley
- Scott Foster, Southeast District Stormwater Coordinator
- Aaron Wolfe, Southeast District Stormwater Coordinator

Historic Preservation Office
- David M. Snyder, Archaeology Reviews Manager
- Mark Epstein, Department Head

Natural Resources Conservation Service
- Danielle Balduff
- Terry J. Crosby

State of Pennsylvania

Governor
- Tom Wolf, Governor

Department of Agriculture

Bureau of Farmland Preservation
- Doug Wolfgang, Bureau Director

Department of Conservation and Natural Resources
- Cindy Adams Dunn, Secretary
- Emilee Boyer, Ecological Information Specialist
- Su Ann Shupp, Ecological Information Specialist
- Greg Podniesinski, Director of PA Natural Heritage Program
- Rebecca Bowen, Bureau of Forestry Chief, Ecological Services Section

Department of Environmental Protection
- John Quigley, Secretary
- Joel Koricich, District Mining Manager
- Andrew Zemba, IWO Director
- Dana Drake, Environmental Engineer Manager, Clean Water
- Chris Kriley, Environmental Program Manager, Clean Water
- Don Leone, Environmental Engineer Manager, Clean Water
- Alan Eichler, Environmental Program Manager, Safe Drinking Water
- Bharati Vajjhala, Environmental Engineer Manager, Safe Drinking Water
- Rita Coleman, Environmental Program Manager, Waterways and Wetlands
- Greg Holesh, Civil Engineer Manager, Hydraulic, Waterways and Wetlands

Department of Transportation
- Leslie Richards, Secretary
- Richard Marker, Highway Occupancy Permits Manager

Farm Service Agency, PA
- Michal Kunsman, County Executive Director

Fish and Boat Commission (PFBC)
- Doug Fischer, Ichthyologist
- Heather Smiles, Director of Natural Gas Section

Game Commission
- Mike DiMatteo, Division of Environmental Planning and Habitat Protection Chief

Historical and Museum Commission Bureau for Historic Preservation
- Serena Bellew, Bureau Director, Deputy State Historic Preservation Officer
- Douglass McLearen, Archaeology and Protection Division Chief

State of West Virginia

Governor
- Earl Ray Tomblin, Governor

Commerce Department
- Keith Burdette, Director

Department of Environmental Protection

Jay Fedczak, Assistant Director for Air Permitting
Randy Huffman, Director
Gene Smith, Regulatory Compliance Manager
James Martin, Chief of Oil and Gas
Scott Mandinola, Director, Division of Water and Waste Management
Patrick Burch, Environmental Resources Specialist, Division of Water and Waste Management
Wilma Reip, Environmental Resources Program Manager, Division of Water and Waste Management
Connie Anderson, Division of Water and Waste Management
Brian Carr, Division of Water and Waste Management
Department of Natural Resources
Clifford Brown, Wildlife Resources Section Environmental Resource Specialist
Barbara Sargent, Wildlife Resources Section Environmental Resource Specialist
Natural Resources Conservation Service
William P. O'Donnell
Kevin Wickey
State Preservation Office
Susan Pierce, Deputy State History Preservation Officer

Local Government Agencies

Benton Township, OH
David M. Seymour, Trustee
Dean Stevens, Trustee
Robbie Davis, Trustee
Berne Township, OH
Frank J. Uhl, Trustee
James Carmichael, Trustee
Kelly E. Shull, Trustee
Blue Rock Township, OH
Dana J. Johnson, Trustee
Jerry R. Frame, Trustee
Shane Tysinger, Trustee
Bristol Township, OH
Charlie B. Moore, Trustee
Eric Ball, Trustee
Paul Wickham, Trustee
Center Township, OH
Brent Rossiter, Trustee
Charles Brooks, Trustee
Douglas E. Yontz, Trustee
Drew Dimmerling, Trustee
Melvin Tucker, Trustee
Wendell L. Warner, Trustee
City of Cameron, WV
Julie Beresford, Mayor
Rosemary Humway-Yarmuth, City Council
Ron Walker, City Council
Walter "Rocky" Guzek, City Council
Jack Hart, Sr., City Council
Tommy Hart, City Council
Helen McMasters, City Council
Wayne Simmons, City Council
City of Logan, OH
Martin Irvine, Mayor
Dave Driscoll, City Council
Doug Dicken, City Council
Edward Tucker, City Council
Jim Copenhaver, City Council
Jim Robinson, City Council
Shirley Chapman, City Council
Teresa Scarmack, City Council
City of Moundsville, WV
Eugene Sanders, Mayor
David Wood, Vice Mayor, City Council
Thomas White, Attorney
David S. Haynes, City Council
K. Mark Simms, City Council
Phil Remke, City Council
Ginger DeWitt, City Council
Paul Dude Haynes, City Council
Deerfield Township, OH
Casey Clemens, Trustee

Paul Hinkle Jr., Trustee
Terry L. Nelson, Trustee
Elk Township, OH
Jerry Scarberry, Trustee
Marsha Collins, Trustee
Roy Robinette, Trustee
Terry Walker, Trustee
Fairfield County, OH
Jon Slater Sr., Auditor
David L. Levacy, County Commissioner
Mike Kiger, County Commissioner
Steve Davis, County Commissioner
Jeremiah D. Upp, Engineer
Village of Breman
Douglas L. Hockman, Administrator
Josh Groce, Mayor
Village of Sugar Grove
Falls Township, OH
Chuck Hopkins, Trustee
Sam Eggleston, Trustee
Scott Harden, Trustee
Good Hope Township, OH
Harley Goss
Rich Hacker
Rodney Watkins
Greene County, PA
Archie Trader, County Commissioner
Blair Zimmerman, County Commissioner
Chuck Morris, County Commissioner
Conservation District
Zachary Basinger, Environmental Program Specialist, Soil Conservation
Lisa Sneider, District Manager
Department of Economic Development
Robbie Matesic, Executive Director
Hocking County, OH
Kenneth Wilson. Auditor
Jeff Dickerson, County Commissioner
John Walker, County Commissioner
Sandy Ogle, County Commissioner
William R. Shaw, Engineer
Jackson County, OH
Clyde Holdren, Auditor
Justin Lovett, Prosecutor
Edmund Armstrong, County Commissioner
Jerry Hall, County Commissioner
Paul Haller, County Commissioner
Melissa B. Miller, Engineer
Village of Oak Hill
Roy McCarty, Jr., Mayor
Rob Leonard, City Council President
Chad Jones, City Council
Dan Rhodes, City Council
JoAnne Davis, City Council
Jody Fulk, City Council
Terry McCain, City Council
Laurel Township, OH
Jeff Hatfield, Trustee
Steven Hampshire, Trustee
Lawrence County, OH
Jason Stephens, Auditor
Bill Pratt, County Commissioner
Freddie Hayes Jr., County Commissioner
Les Boggs, County Commissioner
Douglas E. Cade, Engineer
Malta Township, OH
Bill Greuey, Trustee
G. Allen George, Trustee
Rex Copeland, Trustee
Marion Township, OH
Jeff Bates, Trustee
John George, Trustee
Maurice A. Warner, Trustee
Rick Nihiser, Trustee
Scott Kitzmiller, Trustee
Shawn Daubenmire, Trustee
Marshall County, WV
Brian Schambach, County Commissioner
Robert Miller Jr., County Commissioner
Scott Varner, County Commissioner
County Commission

Betsy Wilson Frohnapfel, Staff Administrator
Missy Tschappat, Staff Secretary
Howard W. Coffield, Staff Supervisor of Buildings and Grounds
McConnelsville City, OH
Terry Robison, City Council President
Darrell Newton, City Council
Mark Dille, City Council
Mary Gessel, City Council
Michele Blackburn, City Council
Tom Bragg, City Council
Meigs Township, OH
Rodney E. Dingey, Trustee
Ronald Dee Shook, Trustee
Stephen Zane Bradley, Trustee
Monroe County, OH
Pandora Neuhart, Auditor
Carl Davis, County Commissioner
Mick Schumacher, County Commissioner
Tim Price, County Commissioner
Lonnie E. Tustin, County Commissioner
Village of Beallsville
Jon C. Gramlich, Mayor
Ladonna Carleton, City Council
Mirko Milosavljevic, City Council
Rick Meade, City Council
Tye Neiswonger, City Council
Village of Clarington
Douglas J. Wagner, Mayor
Village of Lewisville
Nathan Betts, Mayor
Village of Woodsfield
L. Williams Bolon, Mayor
Carol Hehr, City Council
Dale E. English, City Council
Matt Vinskovich, City Council
Mike Cox, City Council
Rick Shipp, City Council
William E. Moore, City Council
Morgan County, OH
Gary Woodward, Auditor
Adam Shriver, County Commissioner
Mike Reed, County Commissioner
Tim VanHorn, County Commissioner
Stevan Hook, Engineer
Village of McConnelsville
John W. Finley, Mayor
Morgan Township, OH
Ancil W. King, Trustee
Bo Powell, Trustee
Darel Dee Kuntz, Trustee
Muskingum County, OH
Debra Nye, Auditor
Jerry Lavy, County Commissioner
Jim Porter, County Commissioner
Todd Sands, County Commissioner
Douglas R. Davis, Engineer
Engineer's Office
Matt Russell, Administrative Deputy
Robert C. Heady, Design Engineer
Noble County, OH
Peggy Davis, Auditor
Gary Rossiter, County Commissioner
Stephen Bond, County Commissioner
Virgil Thompson, County Commissioner
Highway Department
Connie Gallaugher, Permitting Coordinator
Village of Caldwell
David Evans, Mayor
Village of Summerfield
Kurt McDowell, President
Martin Lamp, Vice-President
Brian Brant, Treasurer
Jim Johnson, Secretary
Olive Township, OH
Earl Pickenpaugh, Trustee
Jack E. Hayes, Trustee
Oran Way, Trustee
Perry County, OH
Drew Cannon, Auditor
David Freriks, County Commissioner
Ed Keister, County Commissioner

James O'Brien, County Commissioner
Timothy C. Frash, Engineer
Village of Corning
Michelle Davis, Mayor
Village of Crooksville
Darrell Lantz, Mayor
Village of Junction City
Ronald Gleason, Sr., Mayor
Village of New Lexington
Polly Pletcher, City Council President
Al Vandewater, City Council
Dale Eveland, City Council
Dick Anderson, City Council
Jeff Danison, City Council
Kathy Chute, City Council
Tim Fiore, City Council
Trent Thompson, City Council
Richhill Township, PA
Janice Campbell, Secretary
Richard King, Supervisor
Thomas Chess, Chairman
Douglass Grim, Vice-Chariman
Rushcreek Township, OH
Bill Meyers, Trustee
David L. Meyers, Trustee
Hart Van Horn, Trustee
Salem Township, OH
John A. Miller, Trustee
Kenneth Jones, Trustee
Seneca Township, OH
Bradley M. Snyder, Trustee
Kevin D. Weckbacher, Trustee
Sharon Township, OH
Duane Parcell, Trustee
Gary Michel, Trustee
Phillip C. Saling, Trustee
Summit Township, OH
Randy D. Smith, Trustee
Thomas Piatt, Trustee
Sunsbury Township, OH
Randy L. Kindelberger, Trustee
Swan Township, OH
Randall A. Trainer, Trustee
Richard Faulkner, Trustee
Roger Bentley, Trustee
Switzerland Township, OH
James L. Lehman, Trustee
Rodney Newkirk, Trustee
Vinton County, OH
Cindy Owings Waugh, Auditor
Jerry Zinn, County Commissioner
Michael Bledsoe, County Commissioner
Tim Eberts, County Commissioner
Ron Sharett, County Commissioner
Washington County, PA
Diana Vaughan, County Commissioner
Harlan Shober, County Commissioner
Lawrence Maggi, County Commissioner
Economic Development Partnership
Jeff Kotula, President
Conservation District
Tom Ulrich, Agricultural and Erosion and Sediment Technician
Gary Stokum, District Manager
Washington Township, OH
Keith Vermillion, Trustee
Patrick Miller, Trustee
Wayne County, WV
Kenneth Adkins, County Commissioner
Robert Pasley, County Commissioner
David Pennington, County Commissioner
West Finley Township, PA
David Martin, Chairman
Melinda Duncan, Clerk
John Swart, Road Foreman
Robert Scherich, Supervisor

Native American Groups

Absentee-Shawnee Tribe of Oklahoma, OK
George Blanchard, Governor
Catawba Indian Nation, SC
Dr. Wenonah G. Haire
Cayuga Nation, NY
Clint Halftown, Chief
Vernon Isaac, Chief

Timothy Two Guns
Cherokee Nation, OK
Bill John Baker, Principal Chief
Citizen Potawatomi Nation, Oklahoma, OK
John A. Barrett, Jr., Chairman
Delaware Nation, OK
Cleanan Watkins, Acting President
Kerry Holton, Tribal President
Tamara Francis, NAGRAP Contact
Nekole Alligood
Jason Ross
Delaware Tribe of Indians, OK
Paula Pechonick, Chief
Delaware Tribe of Indians, KS
Brice Obermeyer
Eastern Band of Cherokee Indians, NC
Russell Townsend
Eastern Shawnee Tribe of Oklahoma, MO
Glenna J. Wallace, Chief
Robin Dushane, Cultural Preservation Officer
Forest County Potawatomi Community, Wisconsin, WI
Harold Frank, Chairman
Miami Tribe of Oklahoma, OK
Douglas G. Lankford, Chief
George Strack, Tribal Historic Preservation Officer
Oneida Indian Nation, NY
Jesse Bergevin, Historian
Raymond Halbritter, Nation Representative
Oneida Nation of Wisconsin, WI
Cristina Danforth, Chairwoman
Corina Williams
Oneida Tribe of Indians of Wisconsin, WI
Edward Delgado, Chairman
Onondaga Nation, NY
Irving Powless, Jr., Chief
Tony Gonyea, Faithkeeper
Ottawa Tribe of Oklahoma, OK
Ethel E. Cook, Chief
Peoria Tribe of Oklahoma, OK
John P. Froman, Chief
Cynthia Stacy, NAGRPA Contact
Seneca Nation of Indians, NY
Beverly Cook, President
Melissa Bach
Scott Abrams
Seneca-Cayuga Tribe of Oklahoma, OK
LeRoy Howard, Chief
Paul Barton, Historic Preservation Officer
Shawnee Tribe of Oklahoma, OK
Carol Butler, Absentee
Joseph Blanchard, Absentee
Ron Sparkman, Chairman
Kim Jumper, THPO
St. Regis Mohawk Tribe, NY
Randy Hart, Chief
Arnold Printup, Historic Preservation Officer
Stockbridge-Munsee Band of the Mohican Nation, Wisconsin, WI
Robert Chicks, Tribal President
Sherry White
Tonawanda Band of Seneca Indians, NY
Roger Hill, Chief
Tonawanda Seneca Nation, NY
Darwin Hill, Chief
Turtle Mountain Band of Chippewa Indians of North Dakota, ND
Richard McCloud, Chairman
Tuscarora Nation, NY
Leo R. Henry, Chief
Bryan Printup
United Keetoowah Band of Cherokee Indians, OK
George Wickliffee, Chief
Lisa Stopp, NAGRPA Contact
Wyandotte Nation, OK
Billy Firend, Chief
Laura Misita, Land Administrator

Schools

Board of Education of the Berne Union Local School District

Board of Education of the Mount Hope School

Libraries

Briggs Lawrence County Public Library, South Point Branch
Caldwell Public Library
Fairfield County District Library
Fairfield County District Library, Bremen Branch
Herbert Wescoat Memorial Library
John McIntire Muskingum County Library
Kate Love Simpson Morgan County Library
Logan-Hocking County District Library
Menifee County Public Library
Monroe County Public Library
Montgomery County Library
Muskingum County Library, Roseville Branch
Oak Hill Public Library
Perry County District Library, Main Branch
Perry County District Library, Crooksville Branch
Perry County District Library, Junction City Branch
Ceredo-Kenova Public Library
Moundsville-Marshall County Public Library

Organizations

Church-Christ Temple Church Inc.
Cornerstone Family Services of West Virginia LLC
East Sunsbury Baptist Church
The Evangelistical Lutheran Church of Saint James
First Community Church of Columbus
Fork Ridge Christian Church
Hide-A-Way Hills Club
Holiness Community Church
M E Church
Marion Township Trustees
Mount Hope Cemetery
The Northern Wayne County Public Service District
Ohio Valley Conservation Coalition
St. Matthew Evangelical Lutheran Church
Sugar Grove Methodist Church
Village of Sugar Grove, Sugar Grove Cemetery
Wheeling Creek Water Shed Commission
Wilson Willis Cemetery

Companies

A. P. Green Industries Inc.
AEP
Appalachia Ohio Alliance
Appalachian Power Company
B&N Coal
Bennett Candace
Bolton Properties Limited
Bowmore LLC
Bruce Family Trees LLC
Buck Elain, Sayers Investment Co.
CCLC Partners LLC
Central Kentucky Lodging, Inc
Ceredo Corp.
Chesapeake & Ohio Railway Co.
Cheyenne Farms LLC
CNX Land Resources Inc.
CNX Land, LLC.
Columbia Gas Transmission Corp
CONSOL / Pennsylvania Coal Company, LLC
Consolidation Coal Company
Continental Real Estate Company
CRCH-I, LLC
Crow Farms, FLP
Crown Castle
CSX Transportation, Inc.
Daft Family Farms
District 2 W.V. DOT Permits (Attn: Judy Murphy)
Drake & Moore Farms, LLC
DuPont Energy Coal Holding Inc
DW Realty, LTD

E & D Assets Ltd.
Elaine Sayers, Sayers-Bolton
Erickson Huff Tool & Die Corp
Eureka Hunter Pipeline LLC
Five Starr Farms LLC
Fornaro Pietro Trust
Franklin Real Estate Company
Genesee & Wyoming Railroad Services Inc.
Global Signal Acquisitions IV LLC.
Gramps Land Company, LLC
Guernsey County DMV, D&G Bridge Co.
Hirams Estate Family LTD LLP
Hocking Hills Shambhala LLC
Holmes Woodland Inc.
Hydrocarbon Holdings Ltd.
Jefferson Gas, LLC
JPM Properties LLC
Kanawha River Terminals Inc.
Knowton Wilmer B., Blessed Acres Family Ltd Partnership
KTR Farms, LLC
KVKS Corporation
Lawson Real Estate
Link Trucking Co
Lucas John P. & Sally O.
Mark West Liberty Midstream & Resources LLC
Marshall County PSD # 4
McElroy Coal Company
Mike Ross, INC.
Muetzel Family Partnership
Muskingum River Gravel Co.
Norfolk Southern Railroad
Northwood Energy Corp
Old Man's Cave Chalets
Old Man's Cave General Store
Perry Acres Inc.
Rushcreek Valley Farms, Inc.
Sanford Farms, LLC
The Scioto Land Company, LLC
SE Hunting & Fishing Inc.
Shaw-Davidson Inc.
Smith Family Farms
Spectra Energy Corp/ Texas Eastern Transmission
T & D Properties, Ltd.
Tennessee Gas Transmission
The Clarence Cook Trust
The Federal National Mortgage Association
Thompson Cabins LLC.
Tri State Reclamation
Watters Properties
Whitey's Wood Service
Williams Energy
Williams Ohio Valley Midstream LLC

Intervenors

Anadarko Energy Services Company
Atmos Energy marketing LLC
Calpine Energy Services
Chevron U.S.A Inc
Conoco Phillips Company
Cross Timbers Energy Services Inc
Direct Energy Business Marketing, LLC
Duke Energy Kentucky Inc
Emens & Wolper Law Firm CO., LPA, Ohio Landowners
Exelon Corporation
Goldman & Braunstein, Ohio Landowners
Independent Oil & gas Association of West Virginia
Interstate Gas Supply, Inc
National Fuel Gas Distribution Corporation
National Grid Gas Delivery Company
New Jersey Natural Gas Company
New York State Electric & Gas Corporation
NiSource Distribution Companies
NJR Energy Services Company
Ohio Farm Bureau Federation, Inc
Orange and Rockland Utilities, Inc.
Orange and Rockland Utilities, Inc.
Peoples TWP LLC
Piedmont Natural Gas Company, Inc
PSEG Energy Resources & Trade LLC
Public Service Company of North Carolina

Range Resources Appalachia LLC
Rover Pipeline LLC
Roy and Marjorie Waits
Sequent Energy Management, L.P.
Shell Energy North America US L.P
SWEPI LP
UGI Utilities, Inc., UGI Penn Natural Gas, Inc.
and UGI Central Penn Gas, Inc
United States Gypsum Company
Vectren Energy Delivery of Ohio, Inc.
Washington Gas Light Company

Individuals

Deborah Aberegg, OH
Michael Aberegg, Sr., OH
Philip M Ackerman, OH
Richard & Angela Ackley, OH
William Acord, WV
John Adams, OH
Elizabeth Amburgey Adkins, KY
Kathleen M Adkins, OH
Kenneth Adkins, WV
Kenneth & Frances Adkins, WV
Rick Ahle, OH
Toby & Judy Ailes, OH
Claudia R. Akin, OH
Nidal & Michelle Albasha, OH
Lila Gene Allen, OH
Allen Family Trust
Jesse Allen, OH
Kenny Allen, OH
Thomas Allen, WV
Paul Allen, Jr., WV
Ben F. & Mable Ellen Allman, WV
Andrew J. Amburgey, KY
Donald & Marcia Amburgey, KY
J.B. & Geraldine Amburgey, KY
Steven B. & Kris Amburgey, NM
Beverly Anderson, OH
Chad Anderson, OH
Donna & Leroy Anderson, WV
John Anderson, WV
Keith Anderson, OH
Lawrence Eugune Anderson, WV
Rhonda Anderson, WV
Bradley Andrews, OH
John & Debora Angle, OH
Richard & Angela Angles, OH
Frank C. & Linda Applegate, OH
Justin Archer, OH
Thomas Archer, OH
Tom Archer, OH
Ed Armstrong, OH
Wendy J. Arnold & Gary L. Nolan, III, OH
Lloyd & Judith Arnold, OH
Mike Arter, OH
Tony Ashbaugh, OH
Terry & Jody Ashby, WV
Harry S. Jr. & Ricilyn S. Aston, WV
Linda Aston, WV
Mary Margaret Aston, WV
Lewis Aston, Jr., WV
Floyd & Martha Atkinson, OH
John & Alice Ayers, OH
William Ayers, OH
James Bable, OH
Gary R. & Beverly Back, KY
Anthony & Alice Back, KY
Melissa & Scotty Back, KY
Jay Bailey, WV
Angela & James Baker, OH
Garold Baker, OH
Matthew Baker, OH
Frederick & Deborah Bakies, OH
Marvin & E. Jean Baldridge, OH
Bernard Baldy, OH
James & Kathy Ballard, KY
Lillie Banfield, KY
Renne Crow & David Barker, WV
Bennie R. & George A. Barner, OH
Robert & Blanche Barner, OH
David Bradley Barnes, KY
Larry Dexter & Zella Barnes, KY
Steven Earl Barnes, KY
Joanne Barnett, OH

Nancy Barrett, OH
Danny & Vicki Basford, OH
Michael & Tammie Bashore, OH
Ronald & Sarah Bates, OH
Connie Bateson-Jennings, OH
Gary & Marjorie Baumberger, OH
Greg & Nancy Baumberger, OH
Ralph Beatty, OH
Don Beaverson, OH
Gary & Kathy Beddow, OH
Louis H. Bedford & Donna J. Pittman, OH
Donna & Louis Bedford, OH
Carl Bell, WV
Carl L. Bell, Et Ux, WV
Peggy Bentley, OH
David Beveridge, WV
Gregory Biedenbach, OH
Stephen & Susan A Biedenbach, OH
David Bischoff, OH
Gary & Brenda Black, WV
Sandra Black, WV
Earl Blackstone, OH
Herman W. & Evelyn N. Blake, WV
Brad M. & Amanda J. Blake, WV
Loye Blake, WV
Mary Blake, WV
Loye Alfred Blake, Et Ux, WV
Mark & Judith Blazek, OH
Robert Bledsoe, OH
Melissa Blevins, KY
Shirley Blevins, OH
Larry & Kimberly Blosser, OH
Sharon K. Blosser, OH
Geoffrey Blossom, OH
James Bobo, OH
Michael S. Bogard & Cyndi Leasure, WV
Donald & Michael D. Bohonak, PA
Mike Boley, OH
David & Lois Bonnoront, OH
Albert Bowen, WV
Frederick & Pamela Bradford, GA
Sam Brady, OH
Thomas & Tonya Brady, WV
Allen & Ann Brand, OH
William & Sharon Brannon, OH
Susan Brewster, OH
Donald & Beth Bridgeman, OH
James & Linda Britton, OH
Dolores Broadstone, OH
Dennis & Tina Brooks, OH
Josh Brooks, OH
Tina Brooks, OH
Robert Brotherton, OH
James & Susanne Brown, OH
Joshua Brown, WV
Kady Browning, WV
John Browning, OH
Kenneth & Leonta Browning, WV
W. Carroll Browning, WV
Joe Brubach, OH
Kirk & Cheryl Bruce, OH
Robert Bruce, OH
Wesley R. Bryan & Wesley R. Bryan, II, OH
John Bungard, Jr., WV
Timothy Burch, OH
Robin & Marsha Burkes, WV
Kenneth Burkhart, OH
Letha & Brian Burrell, OH
Robert Burton, WV
Thomas & Timothy Burton, OH
Kenneth & Jeri Bush, WV
Shawn Bush, WV
Dennis P. Cadmus, WV
Elizabeth Ann Cain, WV
Martin & Lois Cain, OH
Timothy & Denise Calhoun, WV
Toney & Pamela Calhoun, WV
Christopher Campbell & Michael Dawson, NY
Michael & Patricia Campbell, OH
Richard Campbell, OH
William Allison Campbell, PA
Kenton Cannon, OH
Dennis Canter, OH
Wanda A. Canterberry & Myra Lynn Burt, OH
Joann Canterberry, OH
Alberta Carmichael, WV

Donald Wesley Carn, WV
Mrs. Laura Carn, WV
Matthew Carter, KY
Brandy Castro & Josh Brooks, OH
Corbett Caudill, OH
Rudolph Cebula Jr., WV
Sandra D. Chambers, KY
Bill & Cheryl Chandler, OH
James A. Chicwak, OH
Mark Chilcoli, OH
Jennifer Christain, FL
Clayton Christianson, OH
Robert Christopher, WV
Angela Clark, OH
Eric Clark, OH
Floyd Clark, WV
Garett & Jennifer Clark, OH
Garett William & Jennifer Clark, OH
Tim Clark, OH
Twila Clark, OH
Juanita Clark, OH
Trustee Twila Clark, OH
Jeremy Clay, OH
Darin Clendenning, OH
Mary Clutter, OH
H. Coffield, WV
Harold Dale Coffield Et Al, WV
Robert & Jeannette Coffill, OH
Larry Coffman, OH
Connie Coleman, OH
Joe Coleman, OH
Robert & Debra Collins, OH
Anna Lou Combs, FL
Kevin R. Combs, KY
Brent Conkle, WV
Jay Conner, WV
Robert & Rosemary Conner, WV
Roger & Kim Conrad, OH
Thomas James Jr. Conway, FL
Edwin Cooke, PA
James Copley, OH
Charles Copus Jr., OH
Robert Cordanna, OH
Charles Corns, WV
Charles L. Corns, Jr., WV
Mark Cox, WV
William Cox, OH
Charles Coyle, OH
Charles Lee Coyle, OH
David & Patsy Coyle, OH
Dennis Craft, OH
David Craig, OH
Thomas Craighead, OH
Tammy Crawford, OH
Dennis & Pamela Croft, OH
Victor O. Crow, Et Ux, PA
Douglas C. & Sandra L. Crozier, OH
Robert & Jenny Crum, OH
Dale & Mary Cunningham, WV
Betty Dalton, OH
David Dalton, OH
Thomas & Peggy Dalton, OH
Douglas & Brenda Damron, WV
Lola Darnell, OH
Harold Daubenmire, OH
Gary W. & Pamela Daugherty, KY
Jack & Ruth Daugherty, KY
James Daugherty, WV
Raymond Daugherty, Jr., KY
Walter H. & Rhodema G. Daugherty, KY
The Daugherty Estate, KY
William Davidson, OH
Carl Davis, OH
Clyde, Jr. & Pamela G. Davis, KY
Darrell Davis, OH
Gary Davis, OH
Gary & Kristina Davis, OH
Joy Davis, OH
Mark & Kimberly Davis, OH
Timothy A. & Athlene Davis, KY
Craig Davisson, OH
Jerry Day, Et Al, PA
Thomas S. & Michelle Dean
Beverly DeCoster, OH
John Decker, OH
Cheri Delancey, OH

Beverly Delidow, WV
Dan Dempsey, OH
Daryl Dempsey, OH
James & Judith Dennis, OH
Mark Dent, OH
John Detweiller, OH
Mark Devol, OH
Joseph Dick, OH
Lewis Dick, OH
Christopher Dickson, IN
Paul & Sandra Dietrich, OH
Lisle Dill, OH
James Dimitro, OH
The Dingey Family, OH
Gary Dingey, OH
Gary & Debra Dingey, OH
Jeffrey Dingey, OH
Larry & Nancy Dingey, OH
Matthew Dingey, OH
Kevin & Sarah Dixon, WV
Terry & Diane Dodson, OH
James Ronald Dolan, PA
Mary Doty, WV
Cheryl Dowler
Wendell & Judith Duffy, OH
Jeffrey Duke, OH
Charles Dunlap, WV
Larry Dunlap, WV
Michael Dunn, WV
Michael A. Dunn, Et Ux, WV
Esther Durst, OH
Linda Durst, OH
Christopher & Michelle Dye, OH
John & Sharon Ebbert, WV
John Ebbert, Jr. WV
Richard Eberle, OH
James Eberts, OH
Jon Eichelberger, OH
Joan Eddlebblute, OH
Stanley & Judy Edwards, OH
Stanley Sr. & Judy Edwards, OH
Trustee Kerin Edwards, OH
Darin Keith Eggers, OH
Chris Eiben, OH
Tina M. Elkins, KY
Larry & Lorie Ellinger, OH
Robert & Carolyn Ellis, WV
Charles Emery, WV
Charles Edward Emery, WV
John Ensley, OH
Constantine & Toula Evangelinos, OH
Debra & Gary Evans, OH
Tommy & Donna Evans, KY
Charles & Norma Fairchild, OH
Carl Falter, OH
Kenneth & Patricia Farley, OH
Ida Farmer, OH
Lester Farmer, OH
Judith Fergus, Trustee OH
Joseph Ferguson, OH
Richard and Helen Ferguson, OH
Richard Jr. and Susan Ferguson, OH
Beth Fewell-Overmyer, OH
Beth E. Fewell-Overmyer, OH
John Feyko, Jr., FL
Russell E. Jr. & Richard Fish, WV
Dennis Fish, WV
Nelson & Norma Fisher, OH
Timothy & Sharon Fitzpatrick, WV
James Fitzsimmons, WV
Michele K. Flanery, OH
Nelson & Maxine Fletcher, WV
Jeffrey Flickinger, OH
Maria T. Flores, OH
Melza L. Flowers, MI
David Fluharty, OH
Dennis & Debbie Fogle, OH
David Folk, OH
Richard Forshey, WV
Aaron and Marsha Foster, WV
Keith & Joyce Fox, OH
James & Dorothy Frank, PA
Maynard French, OH
Eileen Friday, FL
Charles Friend, WV
Patricia Friend, WV

Charles & Denise Furr, OH
Charles W. Denise C. Furr, OH
Jeffrey Gadd, OH
Dale R. Gallaher, Et Al, OH
Connie Gallaugher, OH
Kathleen Gardner, OH
Wiley R. & Paul Garey, WV
Dave Gates, OH
Carl & Kathleen Geary, OH
Anthony & Abbey Geho, WV
Donna Geho, WV
Lila Gene, OH
Edward Gibson, WV
Richard L. Gillilan, II, OH
Lawrence & Ann Gingerich, OH
Wanda Lee Gittings, WV
Dwain Glover, WV
Gregory & Brenda Goble, OH
Stephan C. & Kathryn S. Good
Jean Goodnite, OH
Ronnie Goodrich, WV
Jeffrey Gorby, OH
David Gordon, OH
Judy M. Gorman (McCutcheon), OH
Gayle Graham, OH
Warren Graham, SC
M. Lynn Graves & James R Copley, OH
Charles Gray, OH
Greg Greenlee, OH
Charles & Sonya Greer, OH
The Grey Family, OH
Karen, John, & Alice Grey, OH
Marty & Cindy Groves, MD
Chris Gruber, OH
Anthony Guarino, OH
Jeffrey Gunn, OH
Daniel H., OH
Patric Habig, OH
Gerhard Haenisch, OH
Roger Haga, OH
Sharon Hahn, OH
Dean Halcomb, OH
Betty Hale, WV
David Hall, OH
John & Adele Hall, OH
Linda A. & Billy G. Hall, KY
Linda Hamilton, WV
Alonta Rae Hamilton-LIFE, WV
Christopher Hannahs, OH
Michelle & Jayne Hannum, OH
Mike Hannum, OH
Brian Hanson, OH
Warren Harbaugh, OH
John A. & Shelly J. Hare, KY
Ellen Harness, WV
Charles Harper, OH
Marcus & Kendra Harper, OH
Wayne & Lydia Harrah, OH
Brad Harris, OH
Jonathan Harrison, OH
Charles Hart & Joseph Panzone, OH
The Hartley Family, WV
Christopher D. & Heather L. Hartley, WV
Lucille M. Hartley, WV
Chuck Hartley, WV
Patricia & Loren Hartley, WV
James & Deborah Hartshorn, OH
Phillip & Iris Hartshorn, OH
Gary L. Harvey, PA
Lindsay M. Kilbarger Harwood, OH
Richard & Barbara Harwood, OH
Shirley A Harwood, OH
Katherine Haselberger, OH
Tom & Cynthia Hatfield, OH
Joseph Haught, WV
Keith E. Haught Et Al, WV
Gerald Hawkins, WV
Gerald & Julie Hawkins, WV
Scott Hayes, OH
William & Evelyn Hayes, OH
Jack Hays, OH
Samuel & Sandra Heater, WV
Keith Hedges, OH
Diann L. & Lloyd F. Helber, OH
Donald & Elizabeth Helber, OH
Sharon Hendershot, OH

Randy Hensley & Paula Degarmo, OH
Daniel & David Hershberger, OH
The Roy Hicks Estate, KY
Bernard Hill, OH
Linda Hill, OH
Terry & Darlene Hill, WV
MaryLou Hinkle, OH
Ralph & Kathy Hinkle, OH
Lou & Rose Ann Hintz, Trustees, OH
Ray Hipsher, OH
James & Suzanne Hiser, OH
Billy & Dorothy Hivnor, OH
John Hivnor, OH
John Hockingberry, OH
Elmer & Shirley Hodge, WV
Mark Hoffman, OH
Dean Holcomb, OH
Elsie Holcomb, OH
Michael & Lou Holcomb, OH
Beth Holdren, OH
John Holdren, OH
Aaron Paul Holdren, Et Ux, PA
Paul & Stephen Holiday, OH
Jerry & Karla Hollingshead, OH
Ralph & Robin Holmes, WV
Bernard & Roxann Holstine, WV
Ronald & Alma Hoopes, OH
Larry Hoover, OH
Sarah Hoover, OH
Lucas & Lynn Horn, OH
William Horn, OH
David & Jennifer Howard, OH
Lemon Howard, OH
Russell & Polly Howdyshell, OH
Arthur Howell, OH
John & Audra Hoy, OH
Ralph D. & Sally Jane Hoyt, WV
Jack & Jane Hrinko, OH
Scott Huch, OH
Brandy Jo & Doulas J. Hudson, WV
Michael Hufford, OH
James Huggins, OH
Timothy & Rhonda Huggins, WV
Huggins Kenneth R., Gump Debra
Jack Shephard Huggins Jr., Et Al, WV
Alicia Hughes, OH
Brian & Ernest Hughes, OH
Jennifer Hughes, OH
John Hughes, OH
David Hume, OH
Curtis & Mary Hunt, OH
Sam & Rhonda L. Hunt, KY
Jeffery & Sharon Hunter, OH
David Hurd, OH
John & Geraldi Hussell, WV
John & Susan Huston, OH
Martin & Barbara Hutchins, OH
Stephanie & Hughes E. Hutchinson, OH
Kathleen Hutchinson, OH
Donna Hyme, OH
James & Gloria Imler, OH
Loven Isom, GA
Jennie Jackson, WV
James Jackson, Jr., WV
Marsha James, OH
Rondal & Kimberly Jeffers, OH
Griffen Jenkins, OH
Dan Jennings, OH
Larry & Bernadine Jennings, OH
Allen Johnson, OH
Frances & James Johnson, WV
James B. & Elisha Johnson, KY
Ronald R. Johnson, WV
William & Bridgett Johnson, WV
Kimberly Johnston, OH
Carl Jones, OH
James Jones, WV
James Jones, OH
Lester & Lisa Jones, OH
Sharon Jones, OH
Sidney & Freda Jones, WV
Travis Journey, OH
Eunice Jurgensmier, OH
Marianne Jurkowitz, OH
Steve L & Paula Kaiser, OH
Dennis & Cheryl Kallimanis, OH

James & Kim Kallimanis, OH
Neil & Susan Kammiller, OH
Nancy & Karen Kampe, OH
Sherman Kapp, OH
Kaleb Kash, KY
Albert Kazemka, WV
Doyle & Lisa Keeton, KY
The Kessler Family, OH
Surv Patrick, Jeffrey A. & Tangie M Kessler, OH
Roger Keyser, WV
Kimberly C. Kidd, WV
Scott Kiene, OH
Scott & Amy Kiene, OH
Larry & Carolyn Kienzle, OH
James Kilbarger, OH
Blake Kilburn, OH
Bryan Kilburn, OH
Donald & Mary Kilburn, OH
Debra Kindelberger, OH
Thomas J. King, KY
John David Kinney, WV
Mark D. Kinney, WV
David L. Kinney, Et Al, WV
Vernon Kirkbride, OH
Kevin & Bryant Joseph A. Kiser, OH
George R. Kisner, Et Ux, WV
Naaman T. & Susan A. H&W Kitchen/Steinwender, OH
Philip & Deborah Kittle, WV
Philip Alan & Deborah Kay Kittle, WV
Scott Kitzmiller, OH
Charles & Judy Kline, OH
Toni Kline, OH
Jessica Klingelhafer, OH
Wilmer Knowller, OH
Mark & Debbie Koehler, OH
Larry Kornmiller, OH
Larry & Bradley Kornmiller, OH
Timothy Kornmiller, OH
Steven & Debra Kramer, OH
Hubert & Andrea Kuhn, WV
David V & Kelly Kunkler, OH
Jeffrey & Paulette Kunkler, OH
John & Sylvia Kutis, WV
Kent Laforme, WV
David Landefeld, OH
Kathi & Gilbert Larrick, OH
Randall G. Larrick, OH
William Larrick, OH
Elizabeth Leach, OH
Donald Walters Leedy, OH
James Legg, WV
Jeffrey Legg, WV
Timothy Lehman, OH
Rob Leonard, OH
Charles & Deborah Lewis, WV
Mary Lewis & Judith Wheeler, OH
Scott Lewis, OH
Jerry & Carolyn Lilley, WV
Jerry Ivan & Carolyn Lilley, WV
Pauline Lilley, WV
Marvin Lindamood, OH
James & Karen Lipp, OH
James Michael & Khristina Little, KY
Daniel & Jeannette Longworth, WV
Graham Longworth, Jr., WV
Alex Loudermilk, WV
Charles & Paula Love, OH
John & Sally Lucas, OH
Dale Lund, IA
Jane & Dave Lycan, WV
James R. Lyons Et Ux, WV
Eldon & Loretta Mace, OH
Darin & Megan Macke, OH
Ginger Mahan, WV
Mary Kathryn Malay, NC
Karyne & Michael Mallinak, OH
Chris Maness, OH
Terry A. Maness, KY
Timothy W. & Tammy B. Maness, KY
April Melton Manley, KY
Helen Manuel, OH
Karen Marchand, OH
James Marcus (Ball), OH
Keefe Margirene, OH

William & Valeria Marske, OH
The Teddy & Jean Martin Estate, KY
Belinda & Ronald Martindill, OH
Zolar & Sarah Marus, OH
Harold Mathias, OH
Kenneth Mathias, OH
William & Sandra Mauck, OH
Arthur & Barbara Maynard, WV
Cory & Amanda Maynard, WV
John Maynard, WV
Teresa Mazgay, OH
Jack McCleery, OH
Patricia McClintock, WV
William & Terry McClintock, WV
Rodney McClur, WV
Aluah Thomas McCoy, KY
Charlotte McCoy, OH
Robert McCoy, WV
Shirley & Sharon McCoy, KY
Roger D. McCracken, WV
Ronald & Kimberly McCrady, OH
Dave McDonald, OH
John Robert McDonough, WV
Thomas McFall, OH
Randy McGuire, OH
Robert Gregory McGuire, Et Ux, WV
Marvin McMasters, WV
Mary McMillan, PA
Bobby Meadows, OH
Keith & Kara Mendenhall, OH
Manford Merckle, OH
Kenneth & Misty Merinar, WV
Clifford Merinar, Jr., WV
Vincent A. & Carmelinda Messina, NJ
Robert & Deanna Meyer, OH
Charles & Connie Meyer, OH
Charles & Robert Meyer, OH
Charles Meyer, Jr., OH
Raymond & Dorothy Midcap, WV
Charles & Lucille Miller, OH
Debra Miller, WV
Edwin & Kim Miller, WV
Brian K Milliken, FL
Heidi & Troy Mills, OH
Mark & Terri Milosavljevic, OH
Dean & Darla Minamyer, OH
Phillip Miner, WV
George F. Minor, WV
James Mizik, OH
Jeremy Mizik, OH
Joey Moats, OH
Bryan Moffatt, OH
Calvin Moninger, WV
Danny Moore, OH
Dennis Moore, OH
Norman & Debra Moore, OH
Shawn & Bryan Moreland, OH
Ramon & Deborah Morris, OH
James Morrison, WV
Jessica Morrison, WV
Steve & Stacey Morrisson, WV
James & Charlotte Mowery, OH
Martin & Mary Margaret Mudrak, OH
Cathy Mullins, KY
Sheila Mullins, KY
Will Mullins, KY
Craig & Carol Murdock, OH
John & Sandra Murphy, WV
Arthur & Deborah Music, OH
Joshua Myers, WV
Tyler Nalley, OH
Julie Nalley, OH
Howard Nau, OH
Rodney Newkirk, OH
Richard & Karen Newlon, OH
Howard & Beverly Newman, OH
Robert & Tamara Nichols, OH
Harold Nihiser, OH
Jacob & Angel Nihiser, OH
Thomas Niple, OH
Kevin & Caroline Niswonger, OH
Mike Niteswanger, OH
Gary Nolan, III, WV
Josh Norris, OH
Pearl Norris, OH
Megan Nungester, OH

Steven & Lisa Nutter, OH
Steven & Claudia Nye, OH
Danford & Derborah O'Brian, WV
Michael L. O'Donnell, WV
Garret D. O'Neil, WV
Steven &Mindy Osborn, OH
Charles Owen, OH
Charles & Kathryn Owen, OH
David Owen, OH
Charles Jr. & Kathryn Owen, OH
Charles Owens, OH
Mark S. & Lois L. Pack, OH
Jeffrey Paczewski, OH
Albert Paczewski, Jr., WV
Charles Paine, OH
Dale & Lisa Parker, OH
John Parker, WV
Steven M. Parker, OH
Joseph R. Parks, Et Ux,WV
David & Brenda Parmiter, OH
Lloyd & Celia Parmiter, AZ
Nancy Parson, WV
Executrix of the Estate of Alberta Burge Carmichael
Crystal Gayle & Keelan B. Patrick, KY
Vivian Paulus, OH
Asti Payne, OH
Ronald Payne, OH
Douglas Pegg, WV
Marie Pendelton, OH
Francis J. & Margaret M. Penotte, OH
Joshua G. Perry, OH
Wetzel & Rhonda Perry, WV
Kermit Persinger, WV
Lionel Persinger, WV
Robert Petelin, OH
Rudy & Nancy Peters, WV
James & Desiree Peters, OH
Earl Douglas Peyton, KY
Larry Amon Peyton, KY
Larry Joe Peyton, KY
Len Pida, WV
Garry Pierce, OH
Franklin Pierson, WV
Caroline Plank, OH
Marvin Plank, OH
Randall Plant, OH
Thomas Platt, OH
Clarence T. & Robert E. Pletcher, OH
David L. & Kimberly T. Poling, WV
Ronald & Darrin Potts, OH
Daniel L Powell, OH
Robert & Denise Powell, OH
Traci Powell, OH
Mark & Beth Powers, OH
Tony and Phyllis Poynter, KY
Minnie C. Prascik, WV
Virgil & Robin Pratt, OH
Burness Pride, OH
Betty Primer, OH
Charles Pritsel, OH
Surv Charles E. & Wendy J. Pritsel, OH
Kevin Ragsdale, OH
Terry Raines, WV
Darron Rambo, OH
Joseph Ravoira, Jr., Et Al, PA
Dave Ray, OH
Yolanda G. & Sam Rayburn, KY
Thomas L. Rayner, OH
James Redd, WV
Norman Redd, OH
Larry D. Reed, KY
Milly Reed, KY
Vernon & Susan Reed, OH
Sandra K. & Richard P. Reeves, OH
Sandy Reichley, OH
J & S Reusser, OH
William Rex, OH
James & Kathy Reynolds, OH
David & Penny Rheinscheld, OH
Jack & Joanna Rice, PA
Sidney Richardson, OH
Mark Riegel, OH
Clyde Riggle, WV
Mable Riggle, WV
Nicholas Ray Riggle, WV

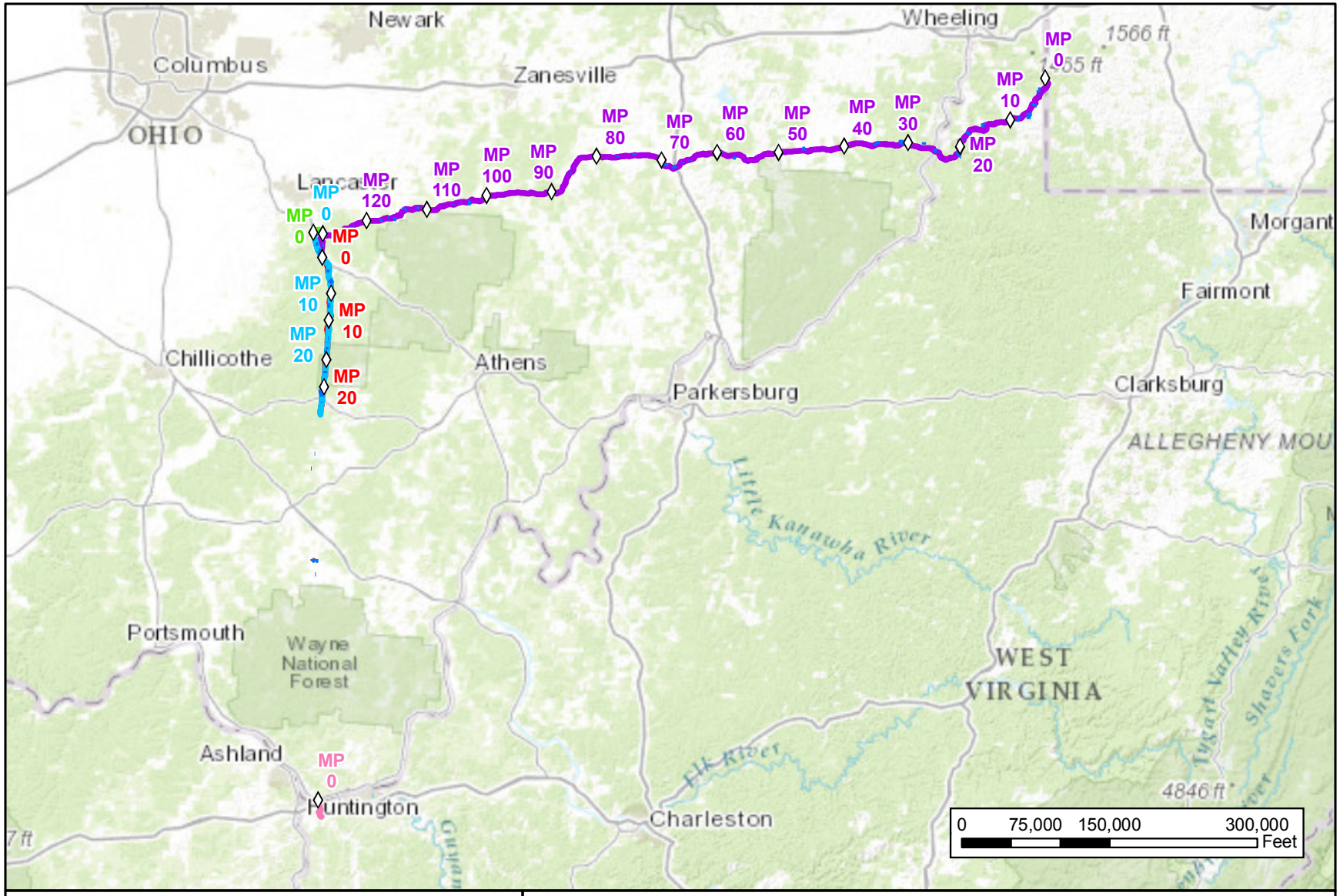
Nicole Riggle, WV
Robert Riggle, WV
Omar Rine, WV
Vernie Rine, WV
Omar Rine Estate, WV
Ellis V. & Wanda P. Rine, WV
Mark T. & Rickilyn R. Roberts, WV
Ronald & Priscilla Robinette, KY
Mary Beth Robinson, OH
Jerry & Linda Rockwell, WV
Donald Rogerson, Sr., WV
Clinton & Sarah Rossell, OH
Jerry Rossiter, OH
Harry Roush, WV
Herman & Judith Rowe, WV
Eric Rowland, OH
Gary & Nancy Rubel, FL
Gary & Nancy Rubel, OH
Stephen Rubel, OH
Jessie Ruckman, WV
Linda & Joseph Rush, WV
Linda M. & Joseph L. Rush, Et Al, WV
John Russell, WV
Matt Russell, OH
Larry Rutan, NC
Jeffrey & Angela Saffles, OH
Launfull Salyer, Jr., OH
Margaret Salyers, WV
James Kevin Sampson, WV
Elroy E. & Trisha L. Sanner, WV
Jeffrey Santilli, OH
Bruce & Stacey Sater, OH
Paul Sater, OH
Randy Sater, IL
Judy Sato, WV
Robert & Judy Sato, WV
Anthony A. & Cheryl F. Saylor, OH
Ruby Schalting, OH
Albert Jr. and Renae Scheiderer, KY
Benjamin Schell, OH
Randall Schmidt, WV
Mark & Marilyn Schneider, OH
Gary Scott, WV
Mary Scott, OH
Philip Scott, OH
John Sebastian, KY
Evelyn Seifert, WV
Ronald & Natalie Seitz, OH
Cindy Shaner, OH
Marsh Shanes, OH
Gary & Connie Sharkey, OH
Paul, Gary & Janet Sharkey, OH
John Sharp, OH
Robert Sharp, OH
Ronald Sharrett, OH
Paul & Debra Shaw, OH
Trust W & J. Shaw, OH
William Shaw, OH
Yancy Shaw, OH
George Shaw, PA
Charles Sheedy, WV
Charles R. Jr. & Tracy Sheedy, WV
Charles Sheedy, Sr., WV
Clark & Cathy Sheets, OH
Nellie & John Sheets, OH
Jackie & Ginger Shephard, WV
Timothy Shrewmaker, KY
Robert & Victoria Shilot, KY
David & Nicole Shipman, WV
Christopher Shippy, OH
Adam Shook, OH
Ronald & Carol Shook, OH
Clyde Shriner, WV
Floyd Shriner, OH
Konrad Shriner, OH
Nelson Shull, OH
Homer, Jr. & Janis Shull, OH
Wayne & Lisa Shumaker, OH
Patricia Silberhorn, OH
Brian G. Sill, OH
Scott & Chris Sills, OH
Patricia Simmons, OH
Gene Simms, WV
Amos & Bonna Sims, OH
Jonas Slabaugh, OH
John Slater, OH

Hershall Slone, KY
Betty Smallwood, KY
Christopher Smith, WV
Phillip Smith, OH
Ralph Smith, OH
Scott Smith, WV
David & Melissa Smith, OH
Harry & Christine Smith, OH
Phillip & Gina Smith, OH
Richard S. & Beth E. Smith, OH
Tara J. Smith, WV
Todd Smittle, OH
Sandra Snider, OH
Vernon Sorg, OH
Hughes Vernon & Frances Sorg, OH
George Spangler, OH
Pamela Sparkman, OH
Brad Spencer, OH
Larry L. Spencer, Et Ux, WV
Jerry Spohn, OH
Randy Spradling, WV
William & Christina Squires, OH
Robert & Lisa Stack, OH
Jason Stacy, OH
Jesse & Lindsay Stalder, OH
Anthony & Karen Stalford, OH
Kevin & Jill Stalter, OH
Alan Stam, OH
Roger Stamper, LA
Kenneth L. Standiford, WV
William Standiford, WV
Fred Steele, FL
Kevin & Melanie Steele, WV
Patrick Steele, OH
Jeffrey & Sharon Steese, GA
Jeffrey Lee & Sharon Steese, GA
Bernard & Teresa Steimer, OH
Kylie Steimer-Slivka, OH
Susan Steinwender, OH
Candy & Terry Stephens, OH
Robert & Patricia Sterling, OH
Herbert Stevey, WV
& Murphy Joe Mc & Evis Stewart, WV
Betty Stewart, WV
Matthew Stiers, OH
Brian Still, OH
Alvin Stillwell, WV
Chance Stoak, OH
Honus Stollar, WV
Ronald Stollar, WV
Daniel Storts, OH
Walter W. Streight Jr., Et Ux, WV
The Strope Family, WV
Charles B. Strope, WV
Russell W. & Craig D. Strope, WV
Annette Marie Studer, OH
Pamela K. Sullivan, OH
Donald & Deborah Sutton, OH
Jacqueline Sutton, OH
Leona Marie Et Al Sutton, WV
Walter & Eloise Sutton, OH
Guy Roy Swann, WV
Eugene Swearengin, OH
Brian Sweeney, OH
David M Sweeney, OH
Thomas Sweeney, OH
Mark & Kelly Sweet, OH
Scott & Tiffany Tackett, WV
Ron Tank, OH
Jesse & Alisha Taylor, VA
Ashbaugh Brenda Louise & Tony R. Wros. Taylor, OH
Bryan Taylor, OH
John Taylor, OH
John & Judith Taylor, OH
Lacey E. Taylor, OH
Robert Taylor, OH
Kenneth & Deloris Teter, OH
Bill Thomas, KY
Paul & Althea Thomas, WI
William D. Thomas, OH
Ernest & Lisa Thompson, OH
C. Lovina Throckmorton Sr., OH
Marvin, Sr. & Brenda Throckmorton, OH
Brent Tisher, OH
William Toland, WV

Mark Tomblin, WV
Shawn Tomblin, WV
Shawn Tomblin, WV
Randall Trainer, OH
Scott Trekal, OH
Stacy & Sherry Trenner, OH
David & Leona Troyer, OH
Melvin Tucker, OH
Philip & Tina Tucker, OH
Hayden & Carol Tuffs, OH
Wayne M. Turk, WV
Lonnie Tustin, OH
Frank Uhl, OH
Christine Unklesbay, OH
Joseph Urbanek, OH
Selwyn & Lila Vanderpool, WV
Donna M. Varner, PA
Mary Day & William Vest, KY
Kirk & Derek Villaloboz, OH
Liley L. Virgil, PA
Roger Wade, OH
Lorre & John Waers, OH
Roy & Marjorie Waits, OH
Roy & Sandra Waits, OH
Roy A. Waldron, OH
Richard Walker, OH
Richard & Kelly Walker, OH
Tom Walker, OH
Robert & Thelma Wallace, OH
Matthew Wallis, OH
Marlene Walls, OH
Maurice Warner, OH
Donald P. Jr. Wasmuth, WV
Trustee Jeffrey Watson, OH
Dan Way, OH
Kevin & Teresa Weaver, OH
James & Paula Webb, OH
John T. Wehrle, OH
Joseph, James, & Denise Wells, OH
Dave Wertz, OH
Wayne West, Jr., WV
Steven & Vicki Westerman, OH
Mark & Sherry Wheeler, OH
Gilbert & Judith A. Wheeler, OH
Subject to the Life Estate of Cheri Delancey
Bruce Whipkey, WV
Jerold Whipkey, WV
John White, WV
Craig White, WV
Charles Albert Whitsberger, II, WV
Karen J. Whitten, OH
Gregg Whittkamper, WV
William F. & Sharon K. Williams, WV
Clyde & Anita Williams, OH
Heath & Laura Williams, OH
Roland Williams, WV
T. Steve Williams, OH
Cary & Trudy Wilson, OK
George & Marie Wilson, WV
George W. & Lenora Marie Wilson, WV
Joseph & Mona Wilson, WV
Randy & Lois Wilson, OH
Tim Wilson, OH
Tim & Susan Wilson, OH
Timothy & Susan Wilson, OH
Jeffery & Heather Winchell, OH
Dennis Wingrove, WV
Nancy Winslow, OH
Jon & Christine Wise, OH
Christopher & April Wisecarver, OH
Theodore & Joleen Wiseman, OH
Fred Wittebrook, OH
Neil Wittenbrook, OH
Patricia C. Wobig, Et Al, WV
Crystal and Terry Woltz, OH
Patricia Wood, OH
Aaron Woodard, WV
David S. Woodard, KY
Catherine Woods, OH
Kenneth Woodward, OH
Homer & Anna Woolum, WV
Beth Wright, OH
Ben Wright,OH
Jack Wucinick, OH
Peter & Jodi Wyman, OH
Alvin A. Yoder, OH

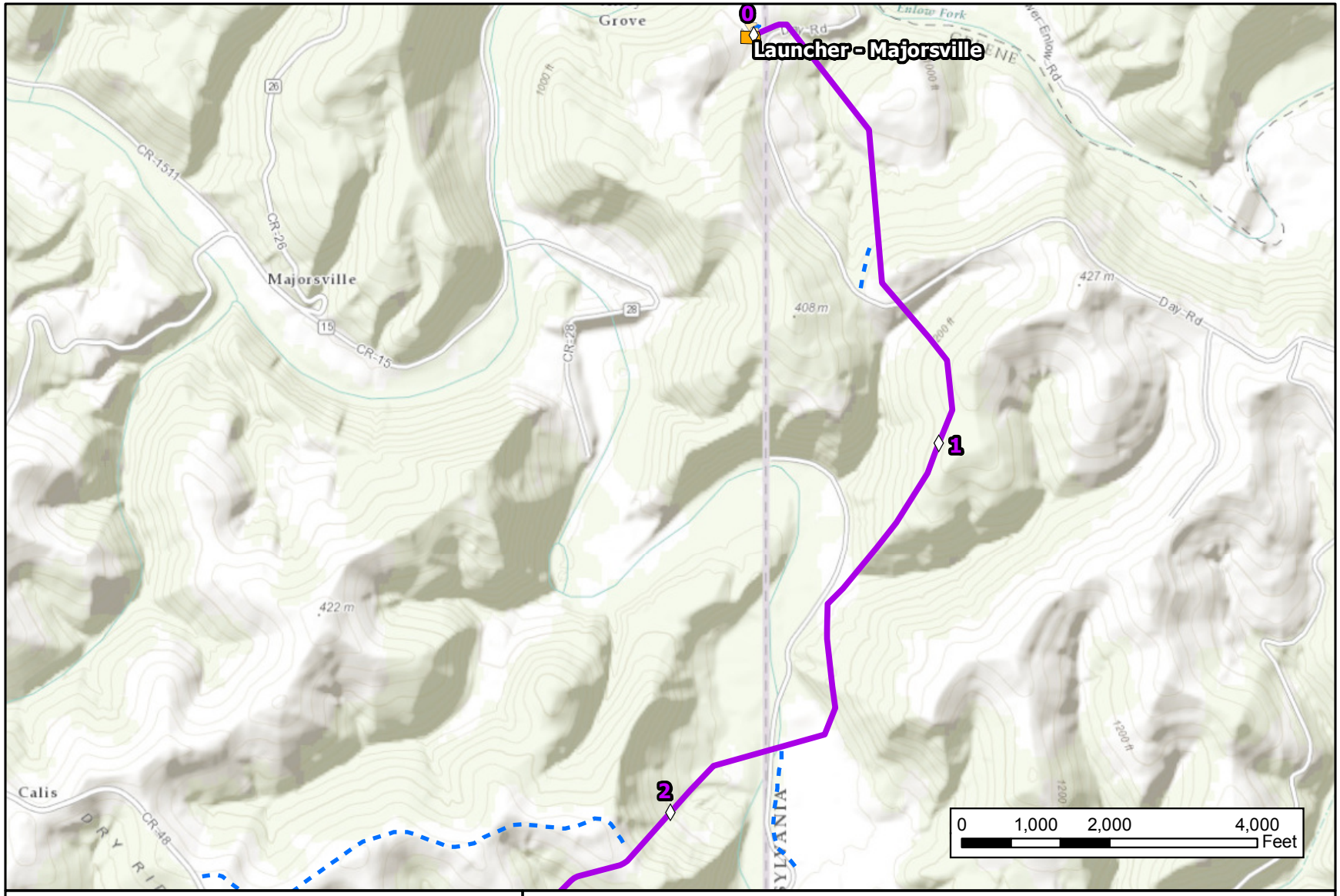
Nathan D. Yoder, OH
Gary Yoho, WV
Ronald Lee Yoho, WV
Charles & Judy Yontz, OH
James & Joy Yontz, OH
Hunter Young, OH
Judith Young, OH
Randy & Polly Young, OH
James Zatezalo, OH
Rose Zatezalo, OH
Jerry W. Zien, WV
Robert Zimmerly, OH
Amy Zwick, OH
Francis & Thelma Zwick, OH

APPENDIX B
Project Overview Maps



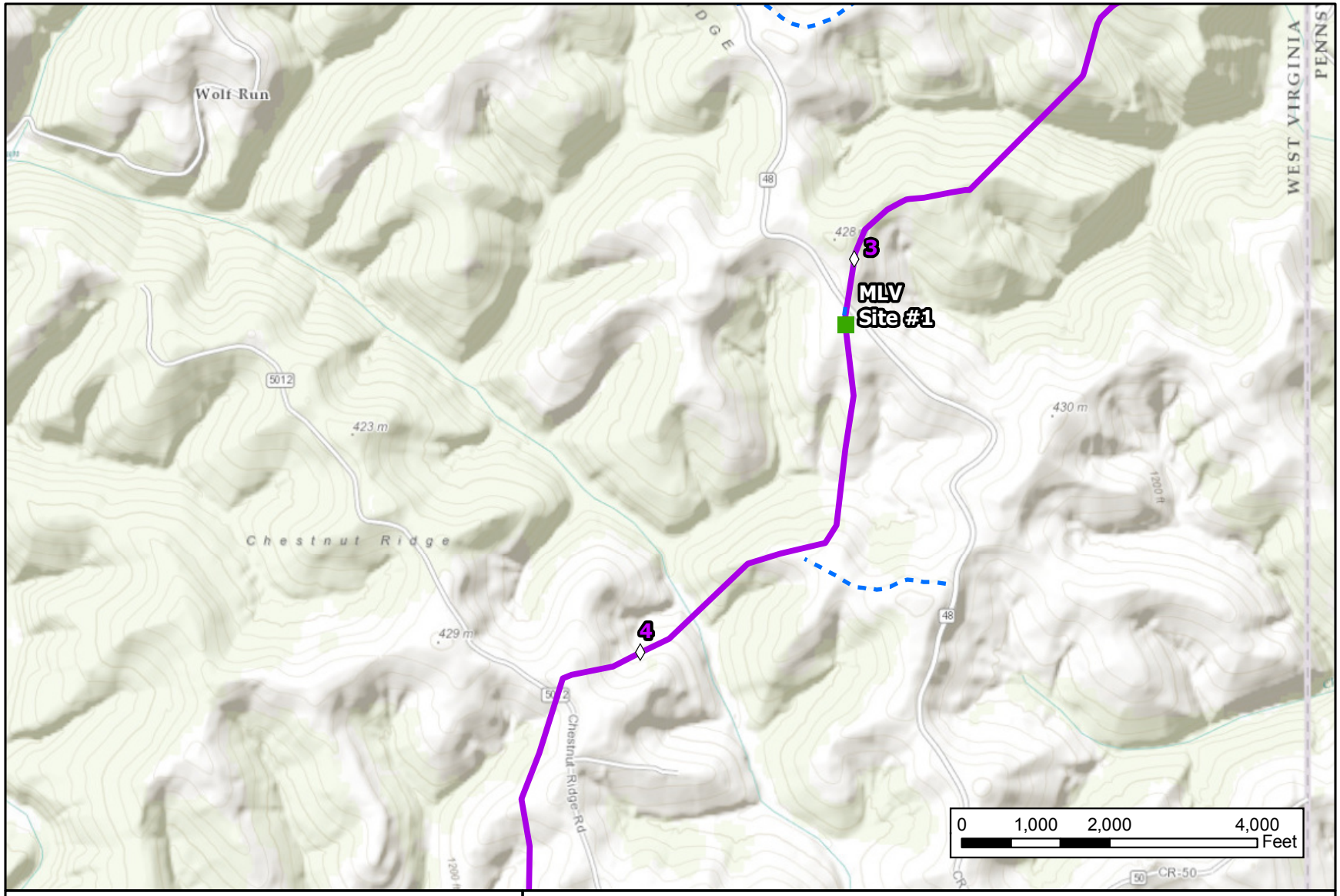
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-1
Leach XPress
Project Overview



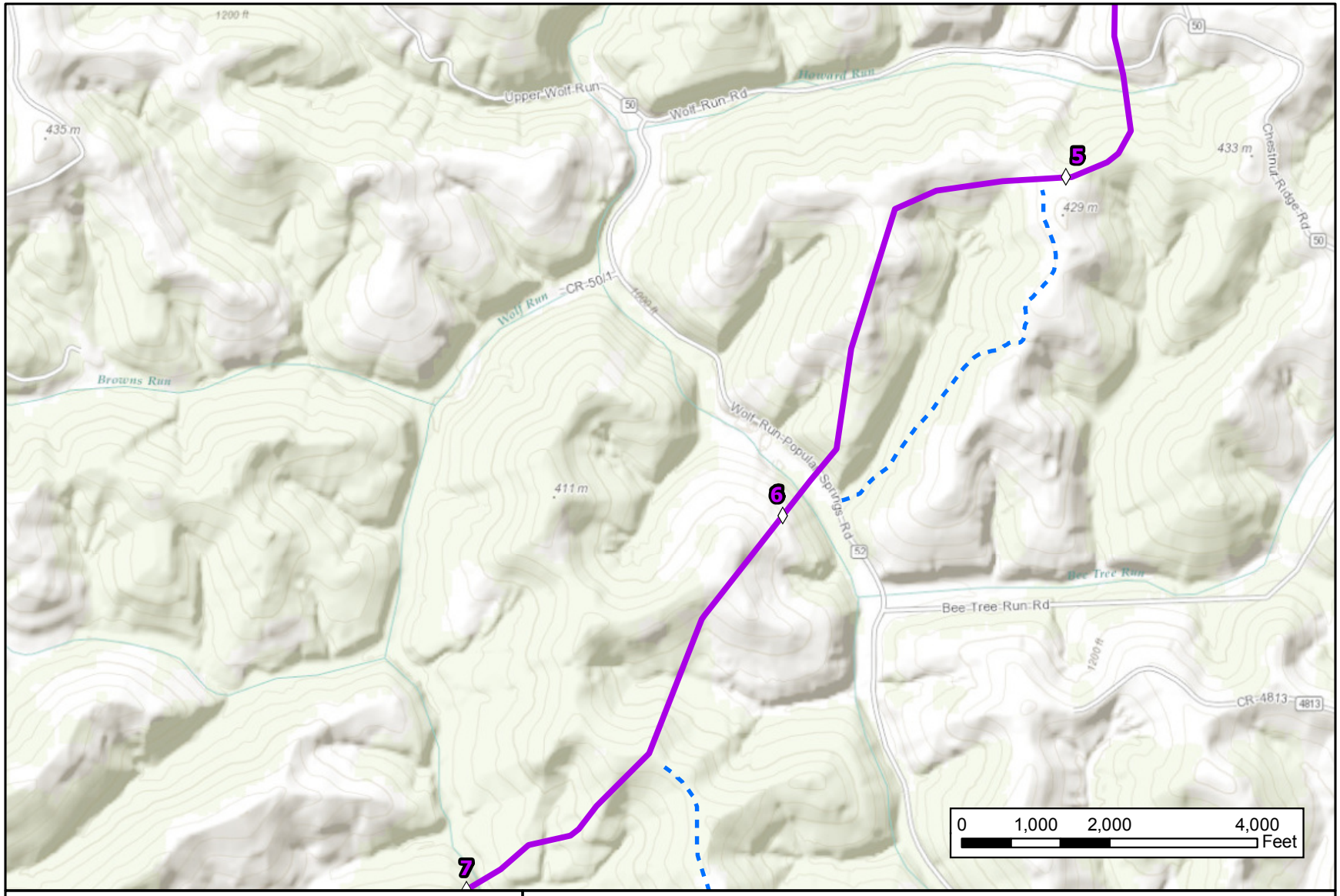
LEX
LEX1
R-801 Loop
R-801 Loop
R-501 Abandonment
Main line Valve
Access Road
Suction Line
Permanent Site Facility
Temporary Workspace
Pipe Yards
Milepost

Appendix B-2
Leach XPress
Project Overview



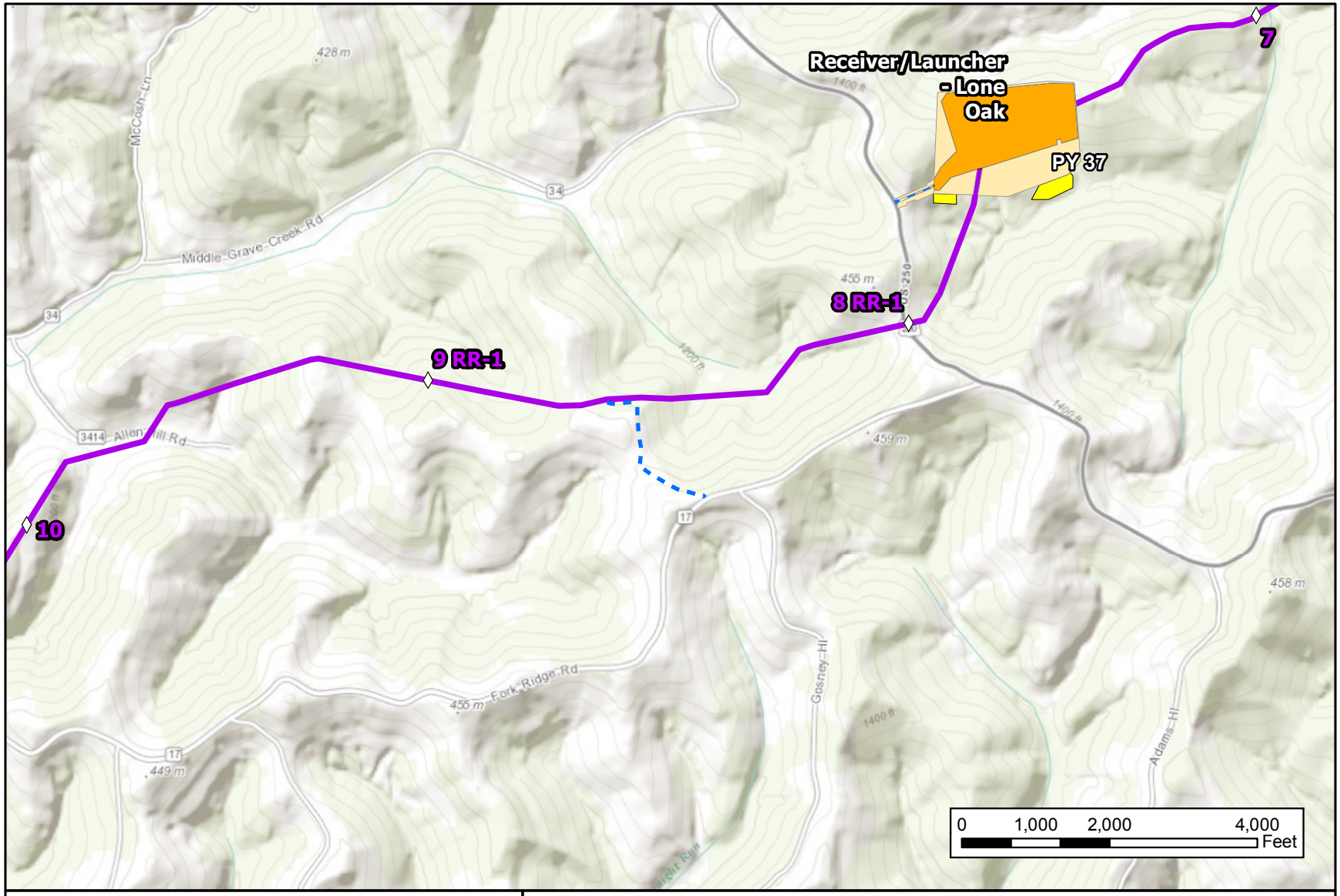
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-3
Leach XPress
Project Overview



LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-4
Leach XPress
Project Overview

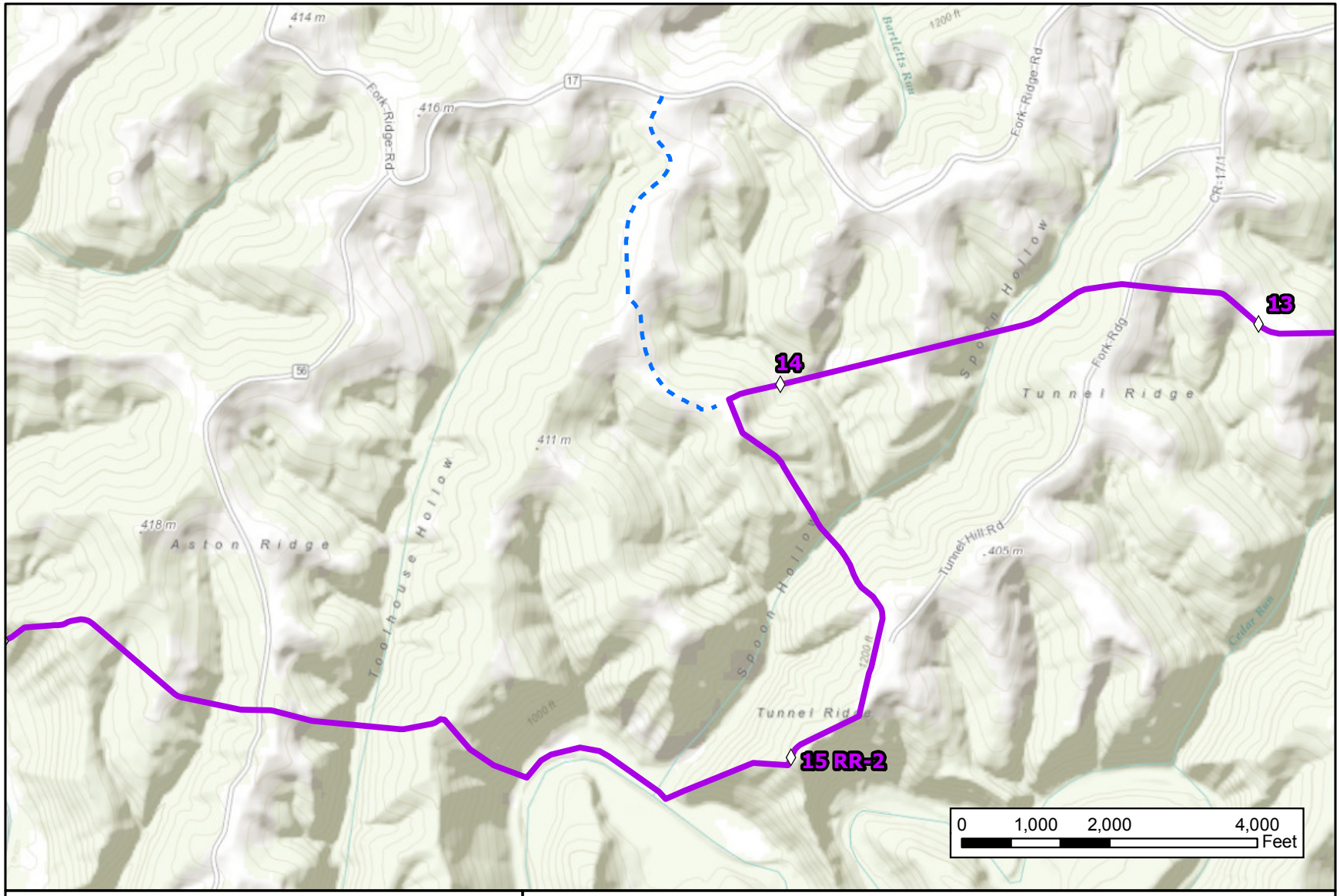


LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-5
Leach XPress
Project Overview

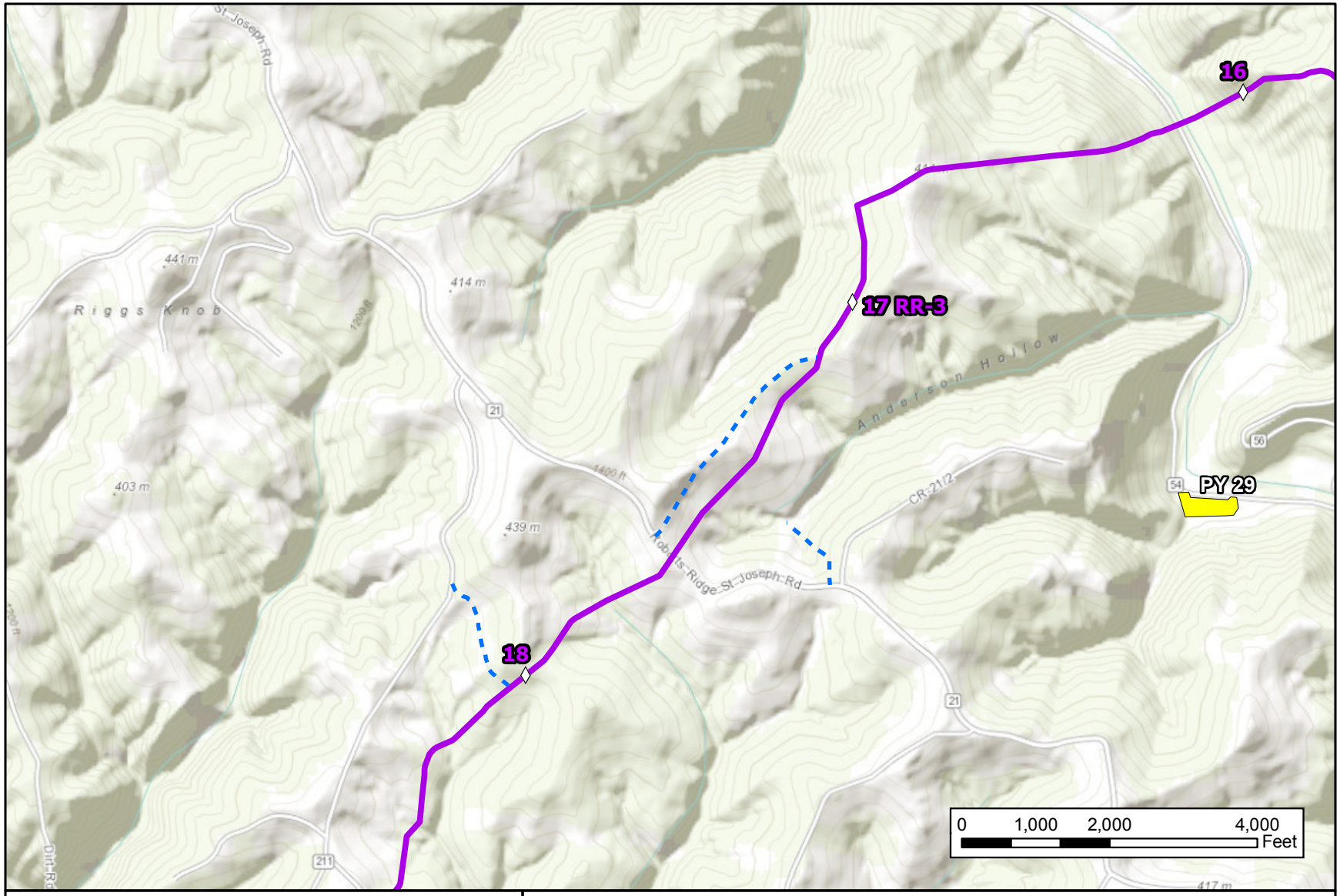
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-6
Leach XPress
Project Overview



LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-7
Leach XPress
Project Overview

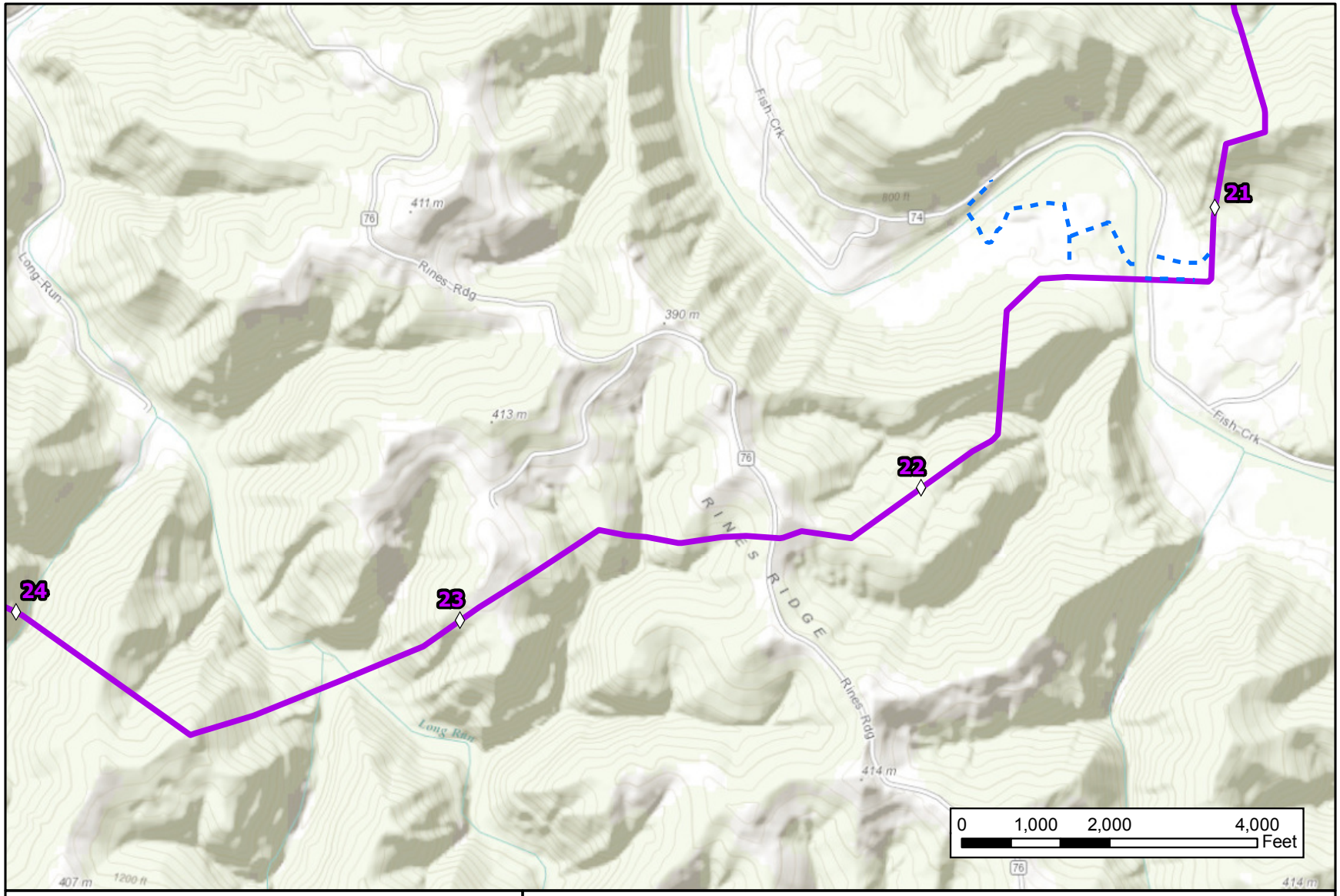


LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-8
Leach XPress
Project Overview

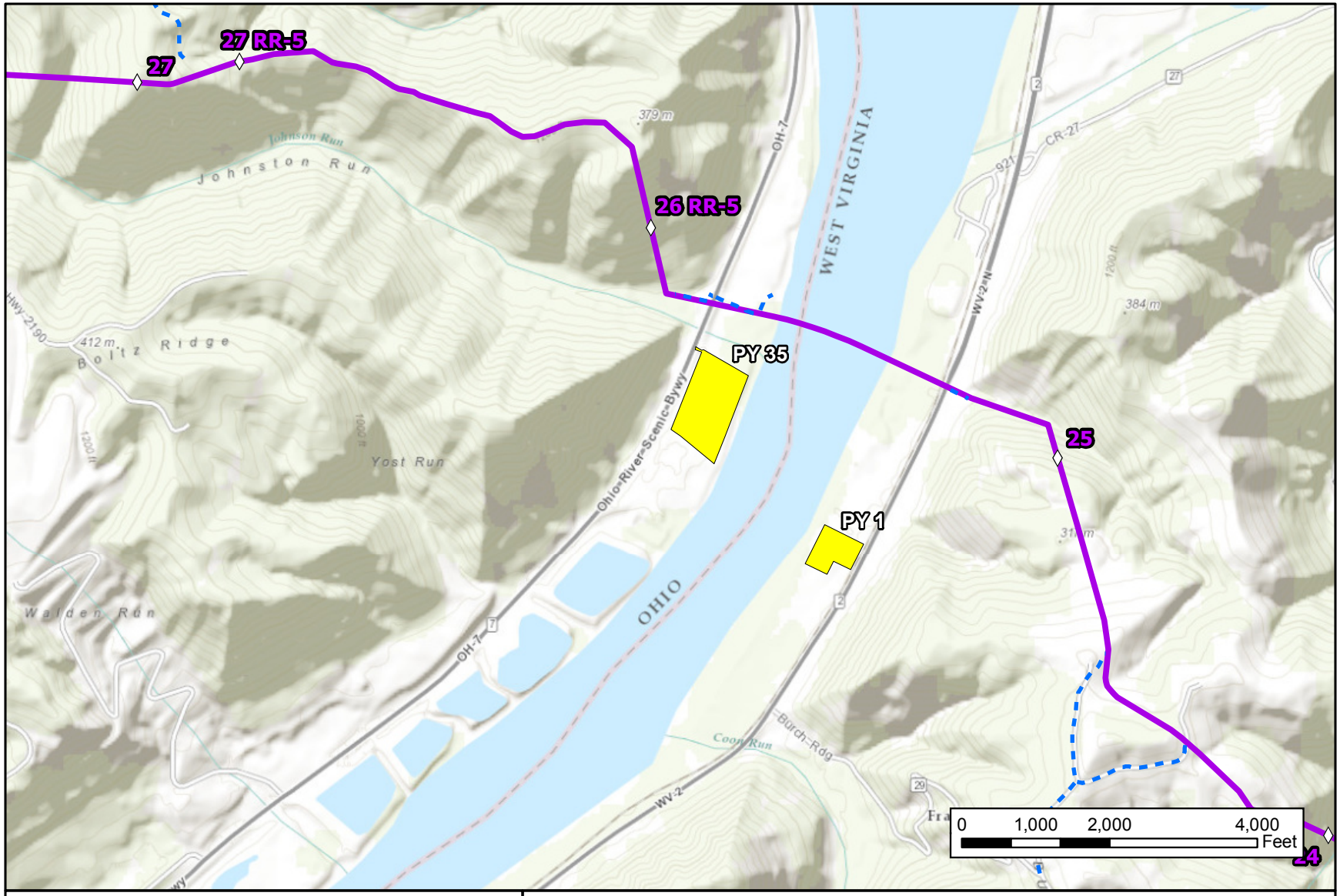
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-9
Leach XPress
Project Overview



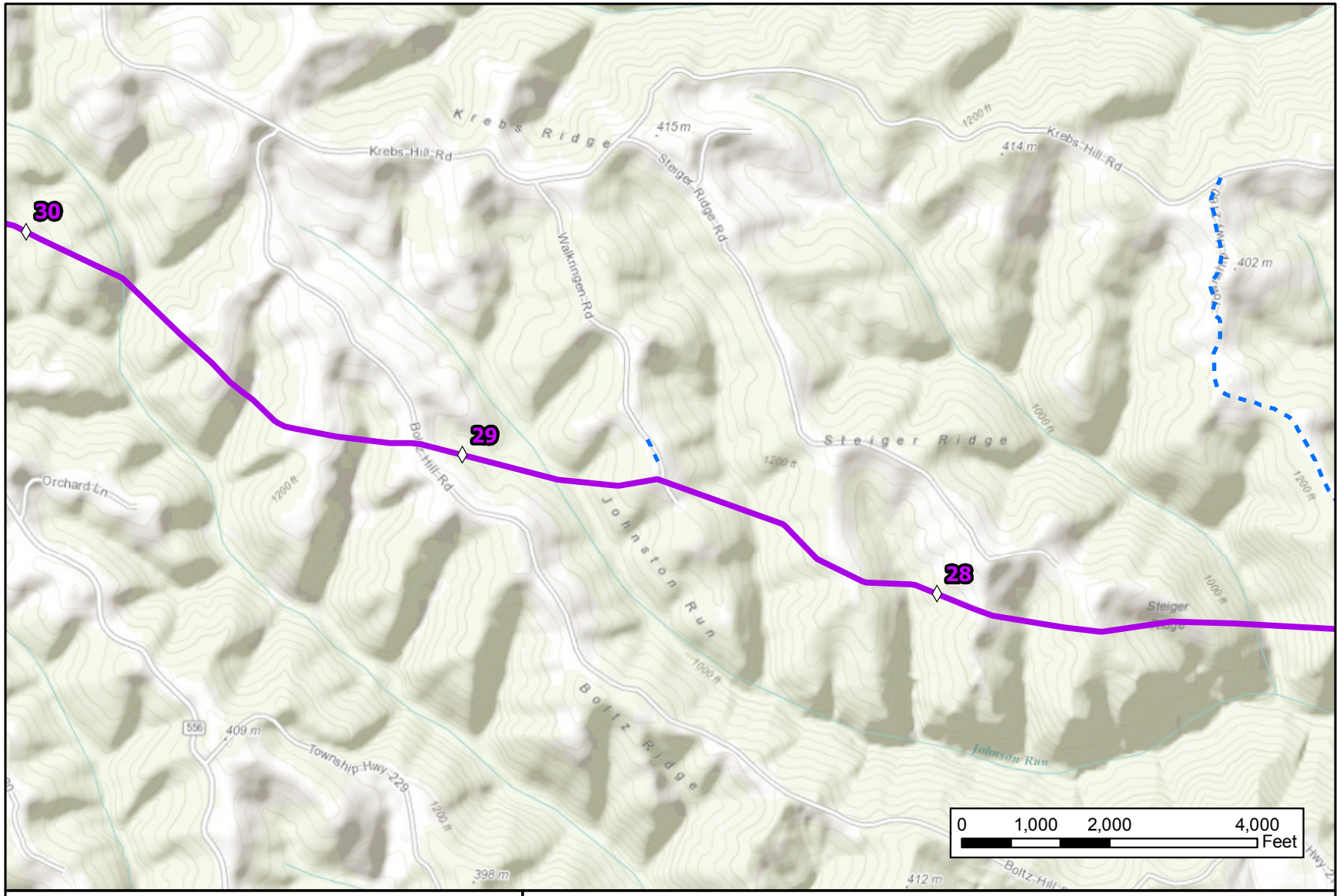
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-10
Leach XPress
Project Overview



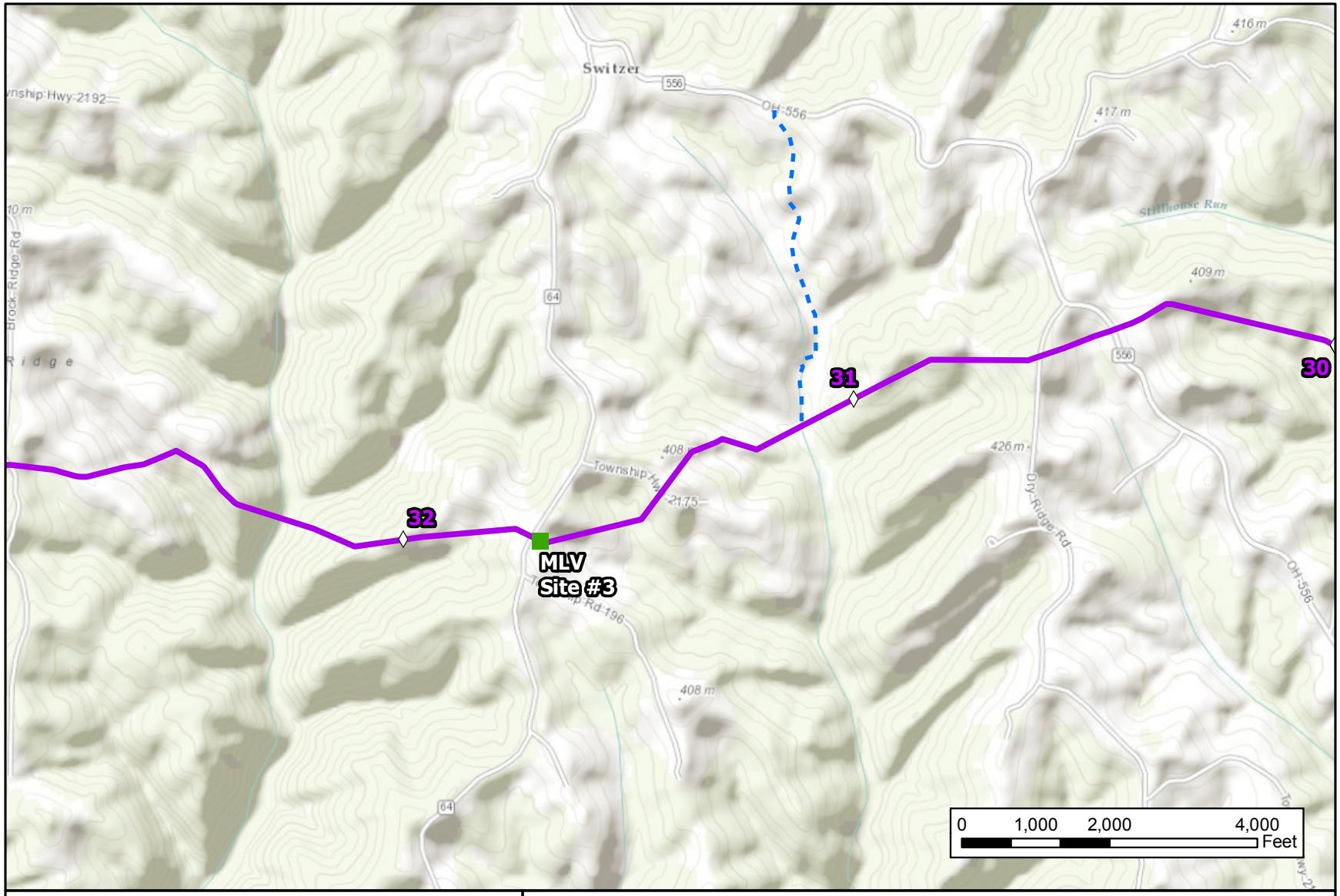
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-11
Leach XPress
Project Overview



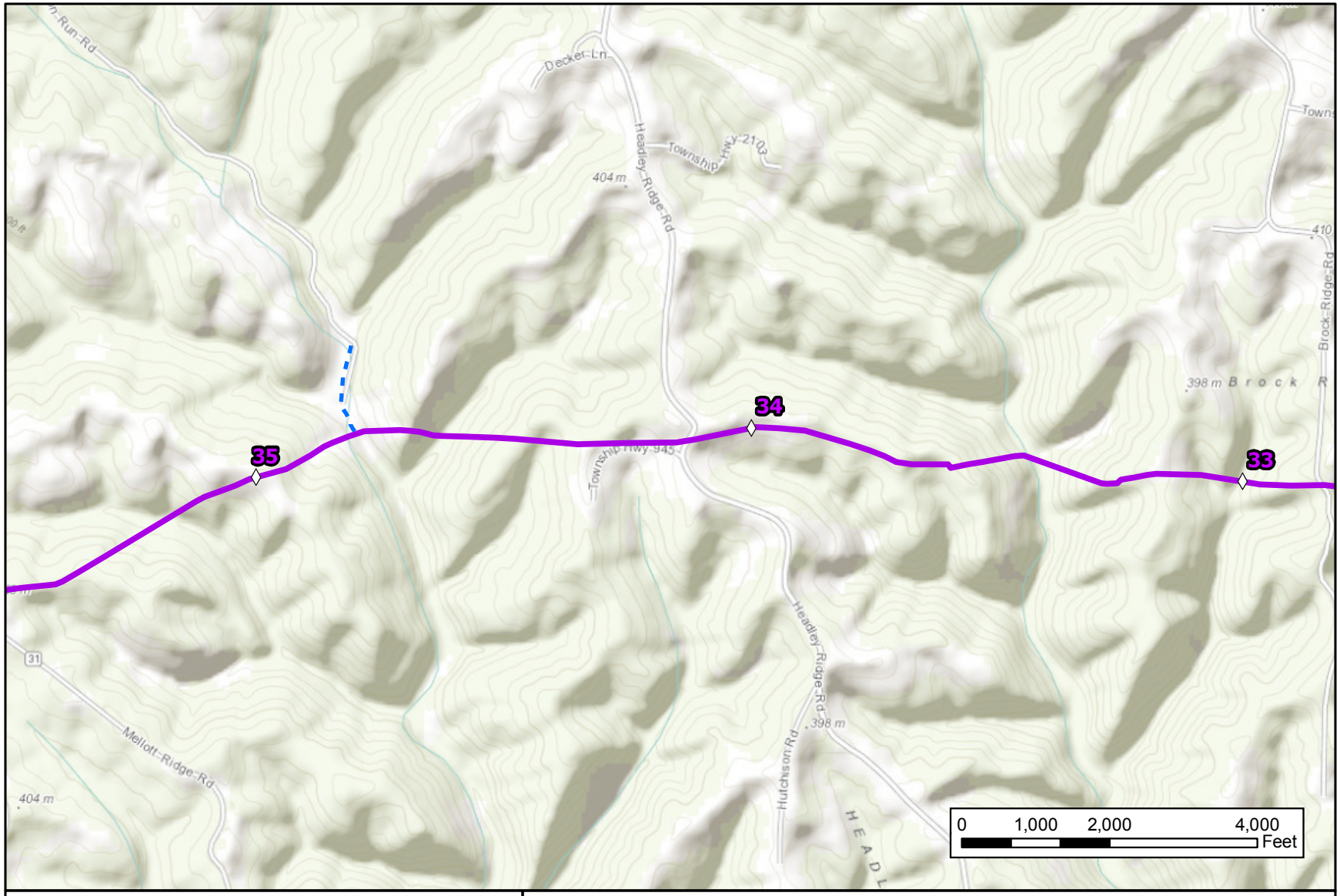
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-12
Leach XPress
Project Overview



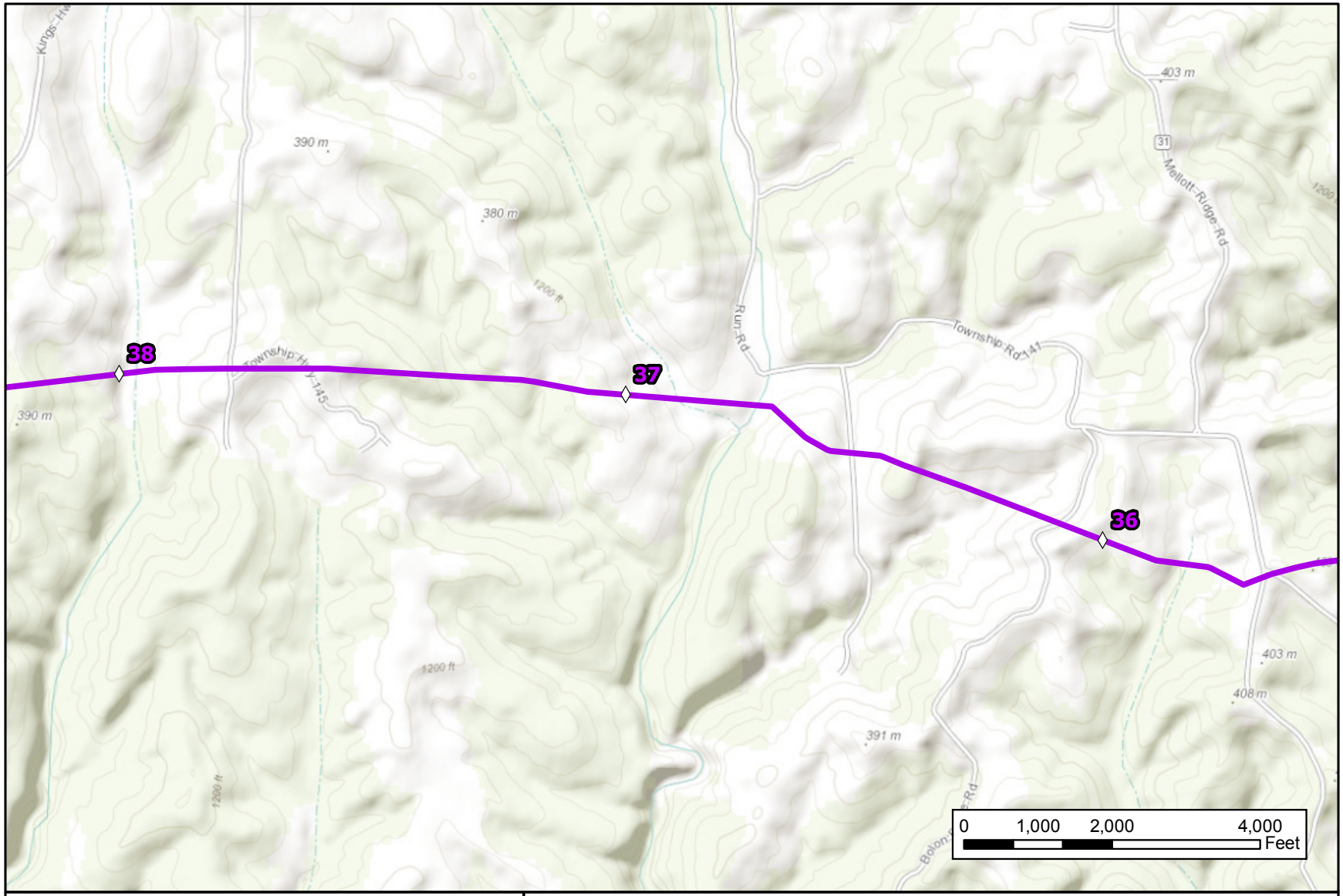
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-13
Leach XPress
Project Overview



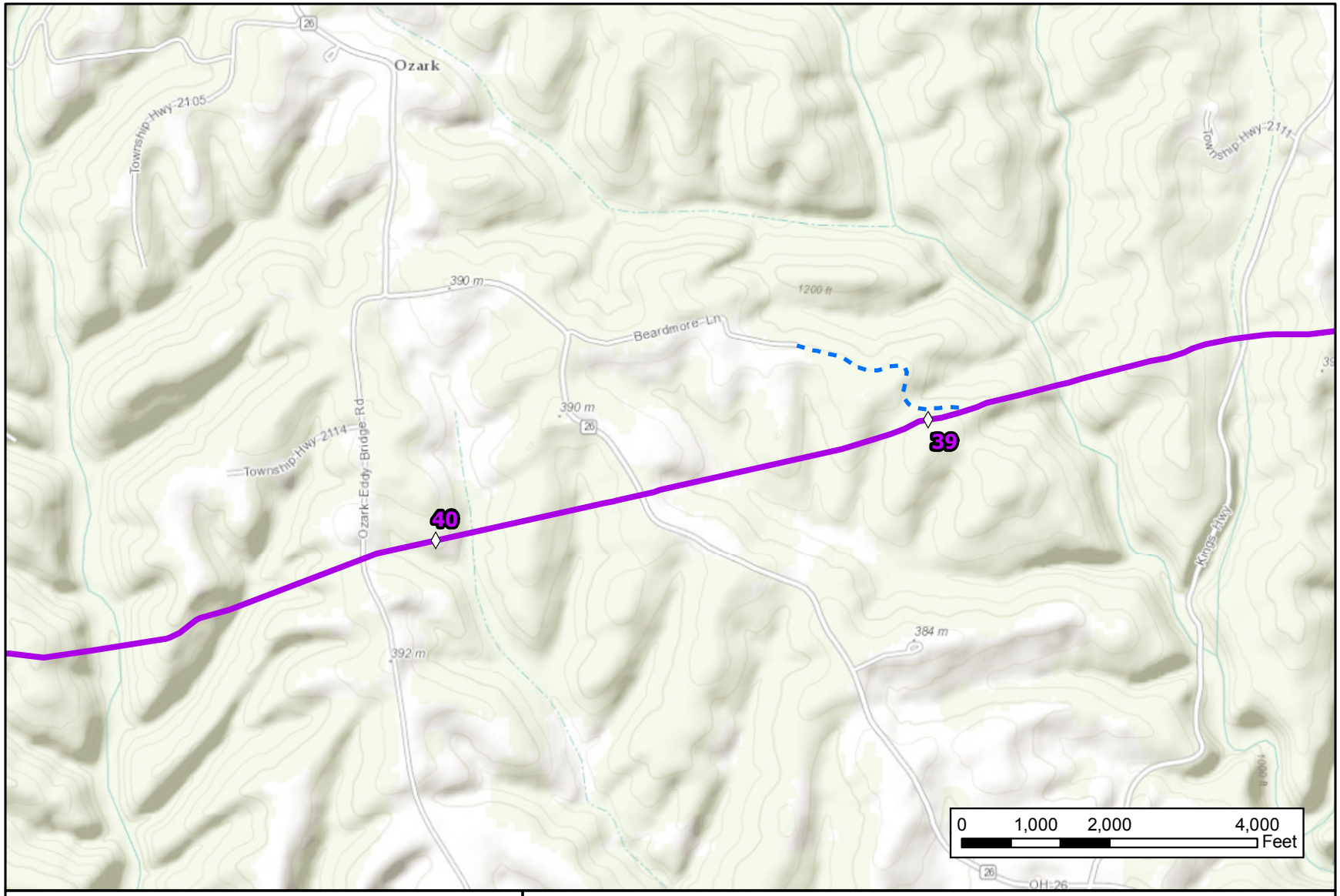
LEX
LEX1
R-801 Loop
R-801 Loop
R-501 Abandonment
Main line Valve
Access Road
Suction Line
Permanent Site Facility
Temporary Workspace
Pipe Yards
Milepost

Appendix B-14
Leach XPress
Project Overview



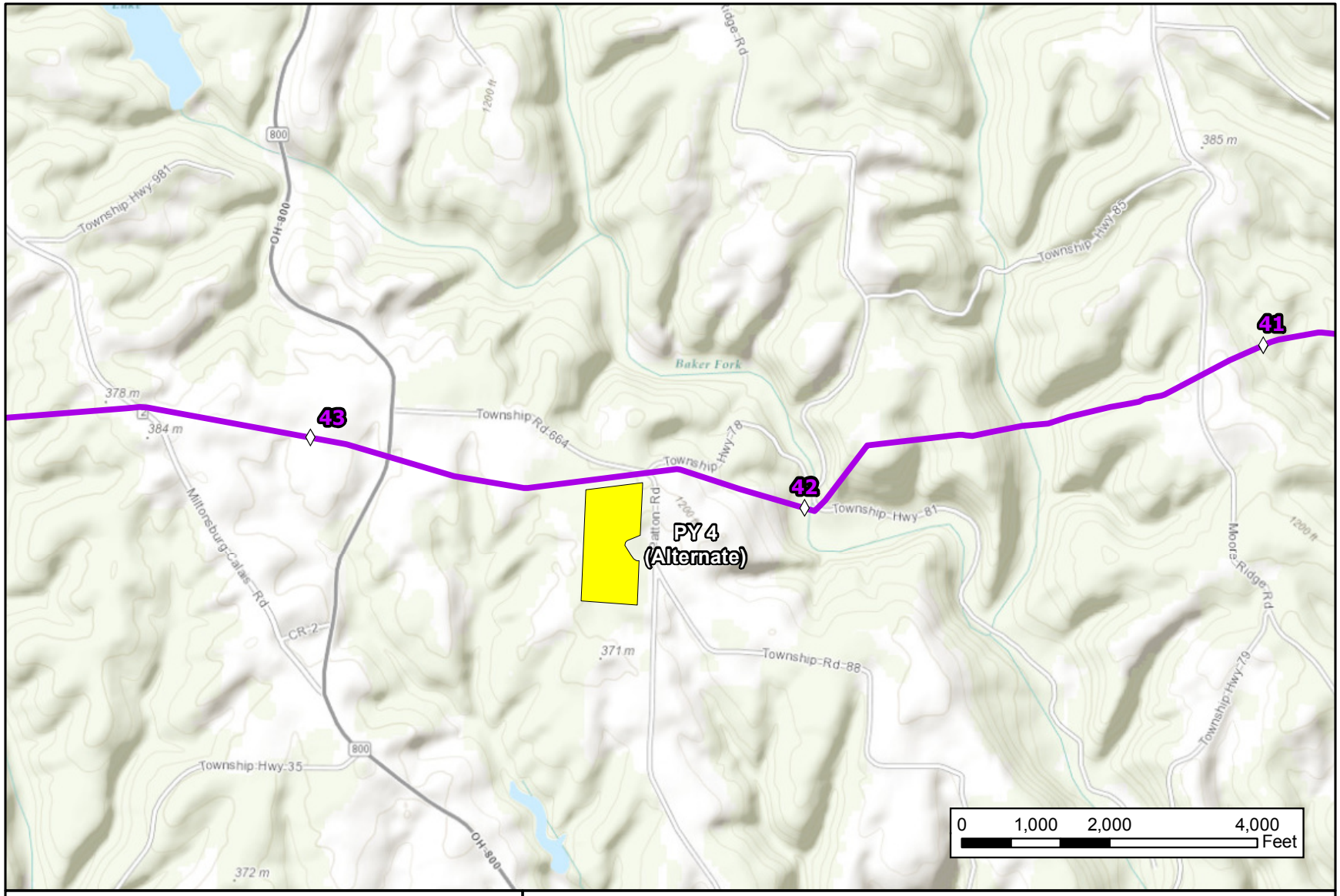
LEX
LEX1
R-801 Loop
R-801 Loop
R-501 Abandonment
Main line Valve
Access Road
Suction Line
Permanent Site Facility
Temporary Workspace
Pipe Yards
Milepost

Appendix B-15
Leach XPress
Project Overview



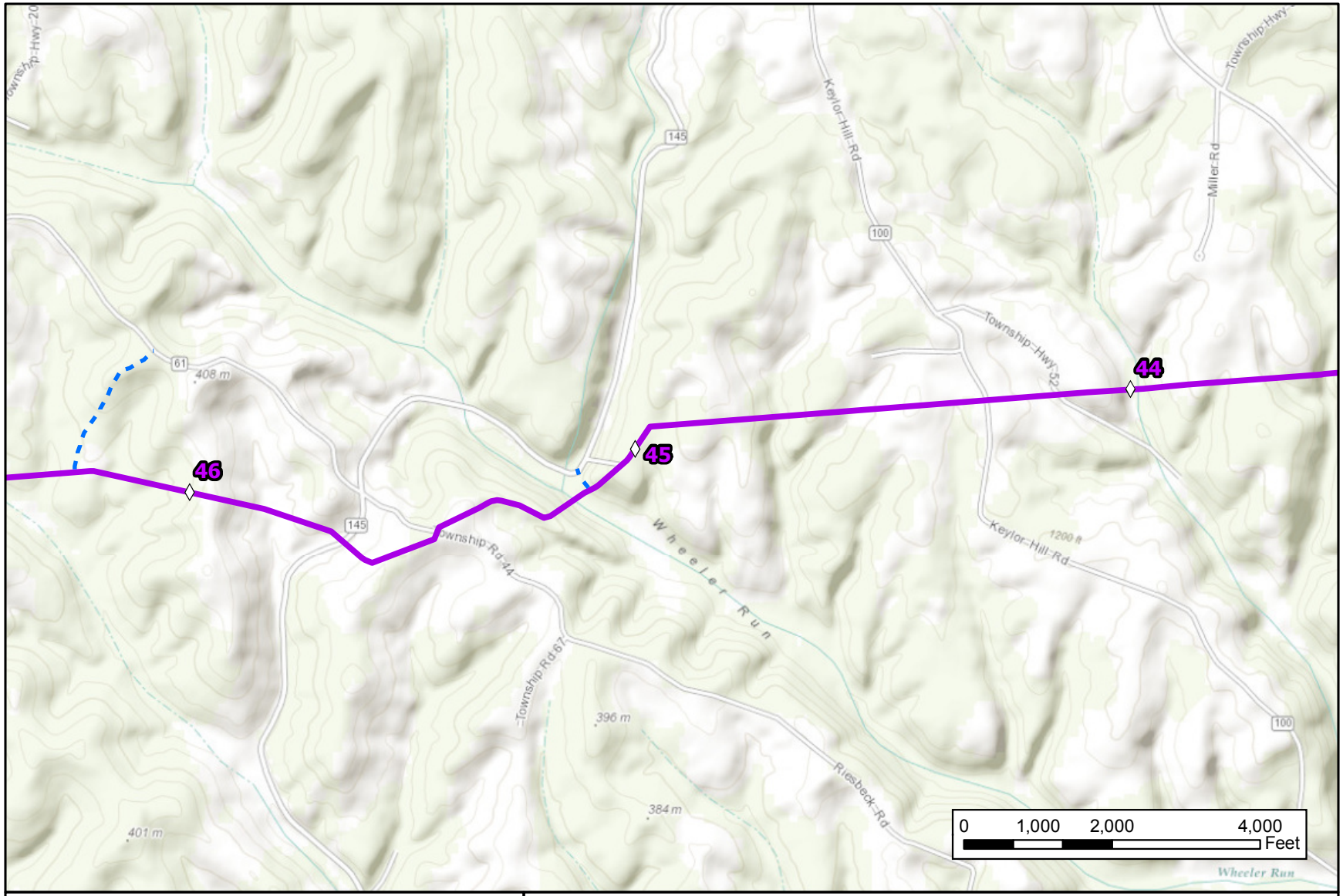
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-16
Leach XPress
Project Overview



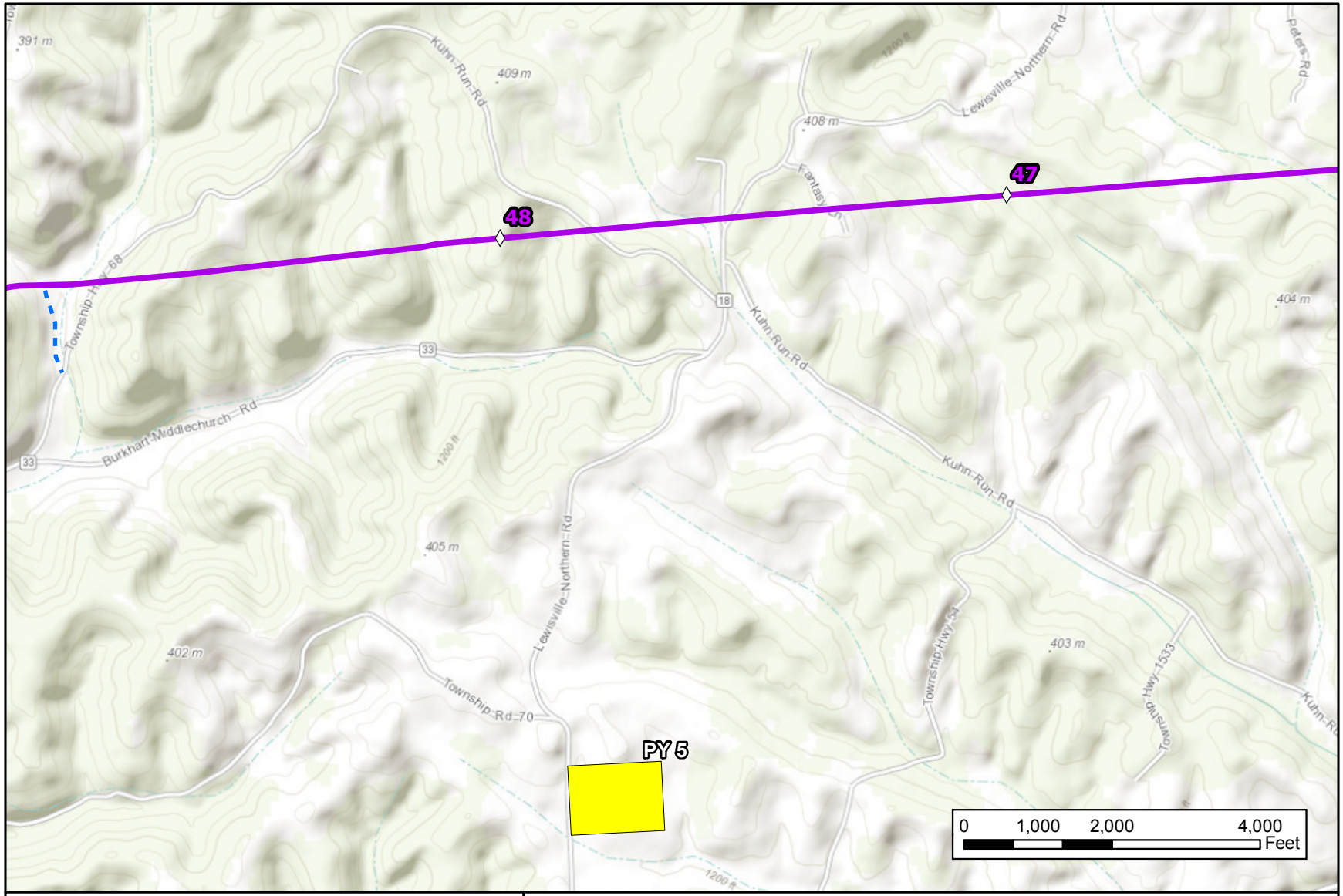
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-17
Leach XPress
Project Overview



LEX
LEX1
R-801 Loop
R-801 Loop
R-501 Abandonment
Main line Valve
Access Road
Suction Line
Permanent Site Facility
Temporary Workspace
Pipe Yards
Milepost

Appendix B-18
Leach XPress
Project Overview

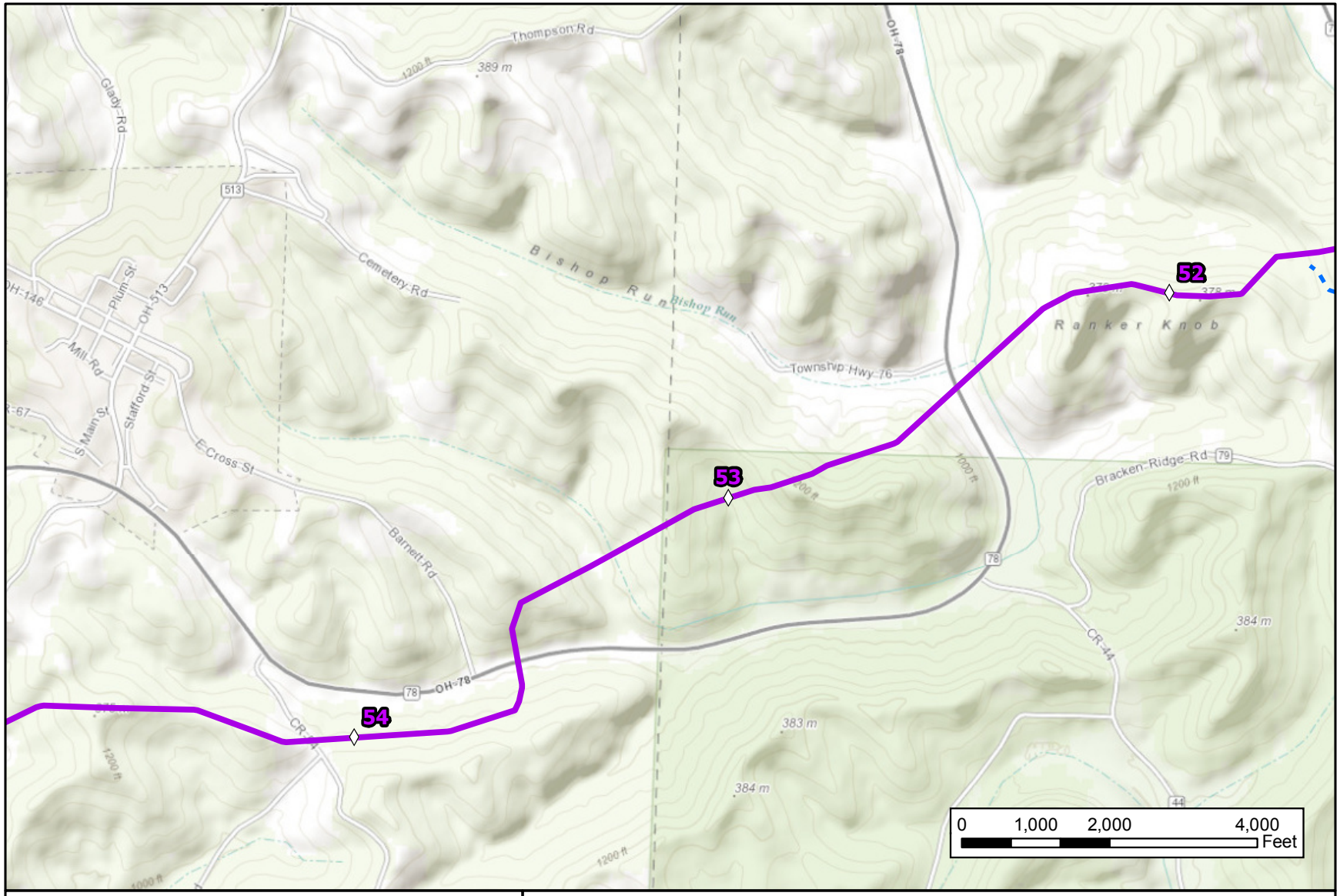


LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-19
Leach XPress
Project Overview

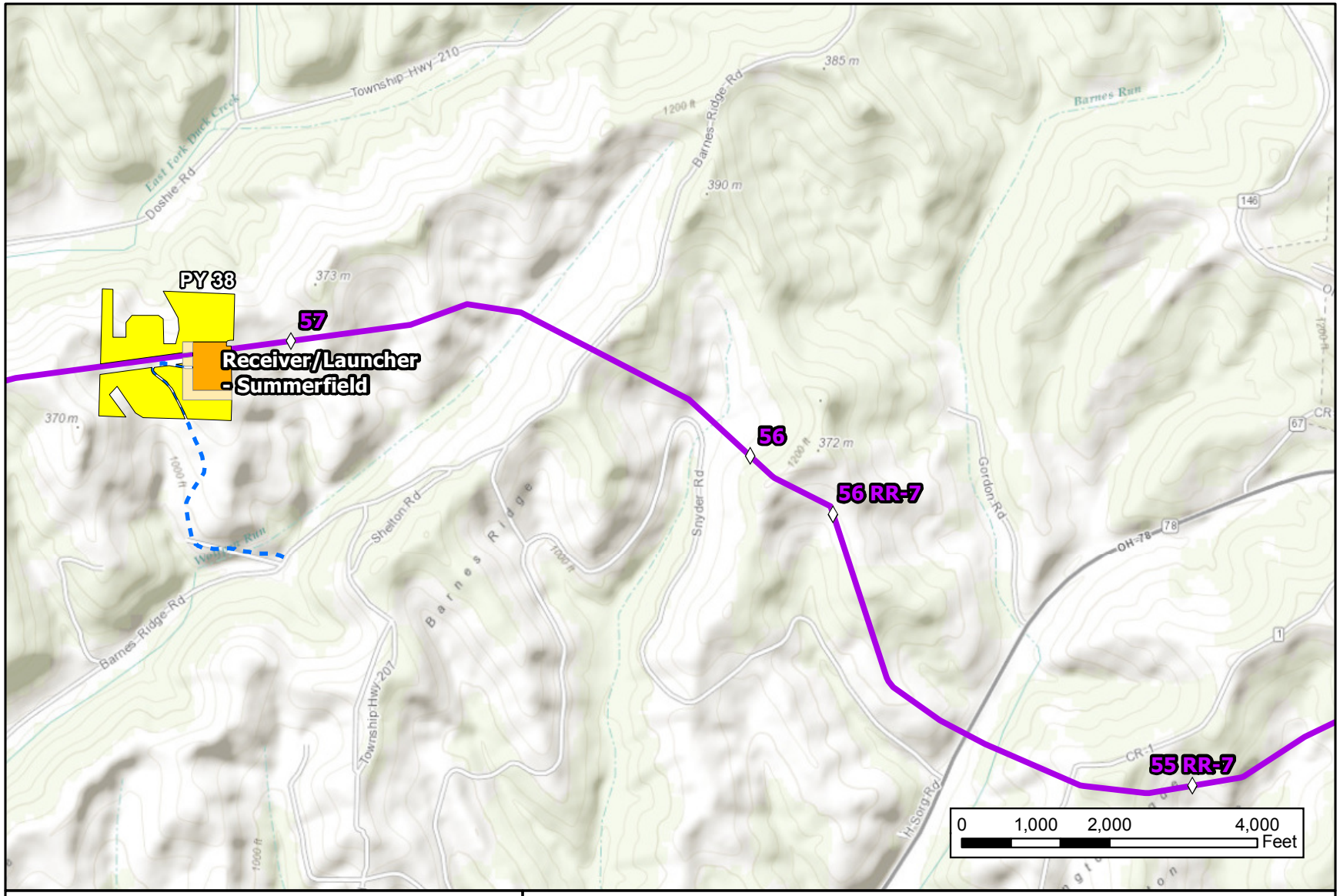
LEX
LEX1
R-801 Loop
R-801 Loop
R-501 Abandonment
Main line Valve
Access Road
Suction Line
Permanent Site Facility
Temporary Workspace
Pipe Yards
Milepost

Appendix B-20
Leach XPress
Project Overview



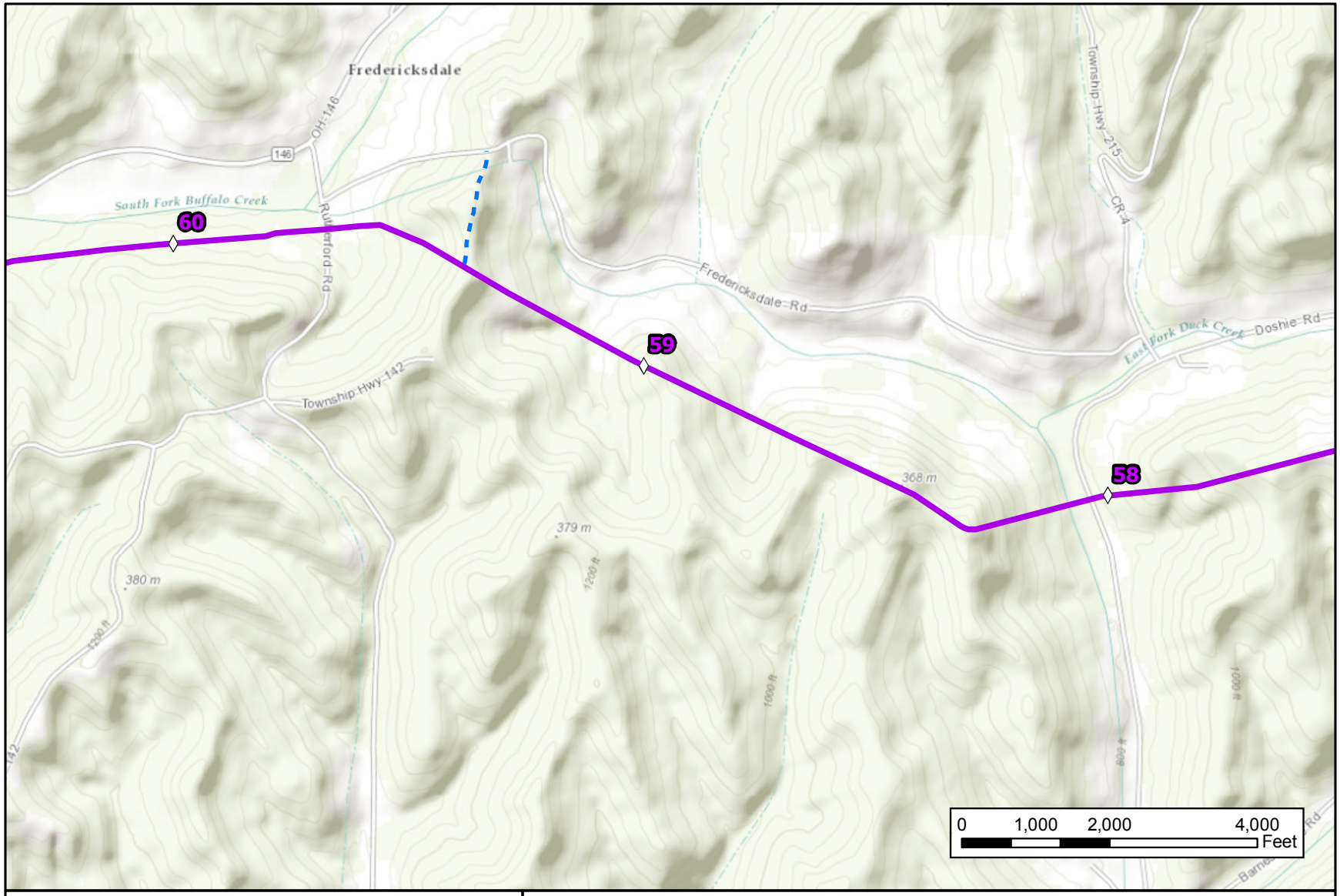
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-21
Leach XPress
Project Overview



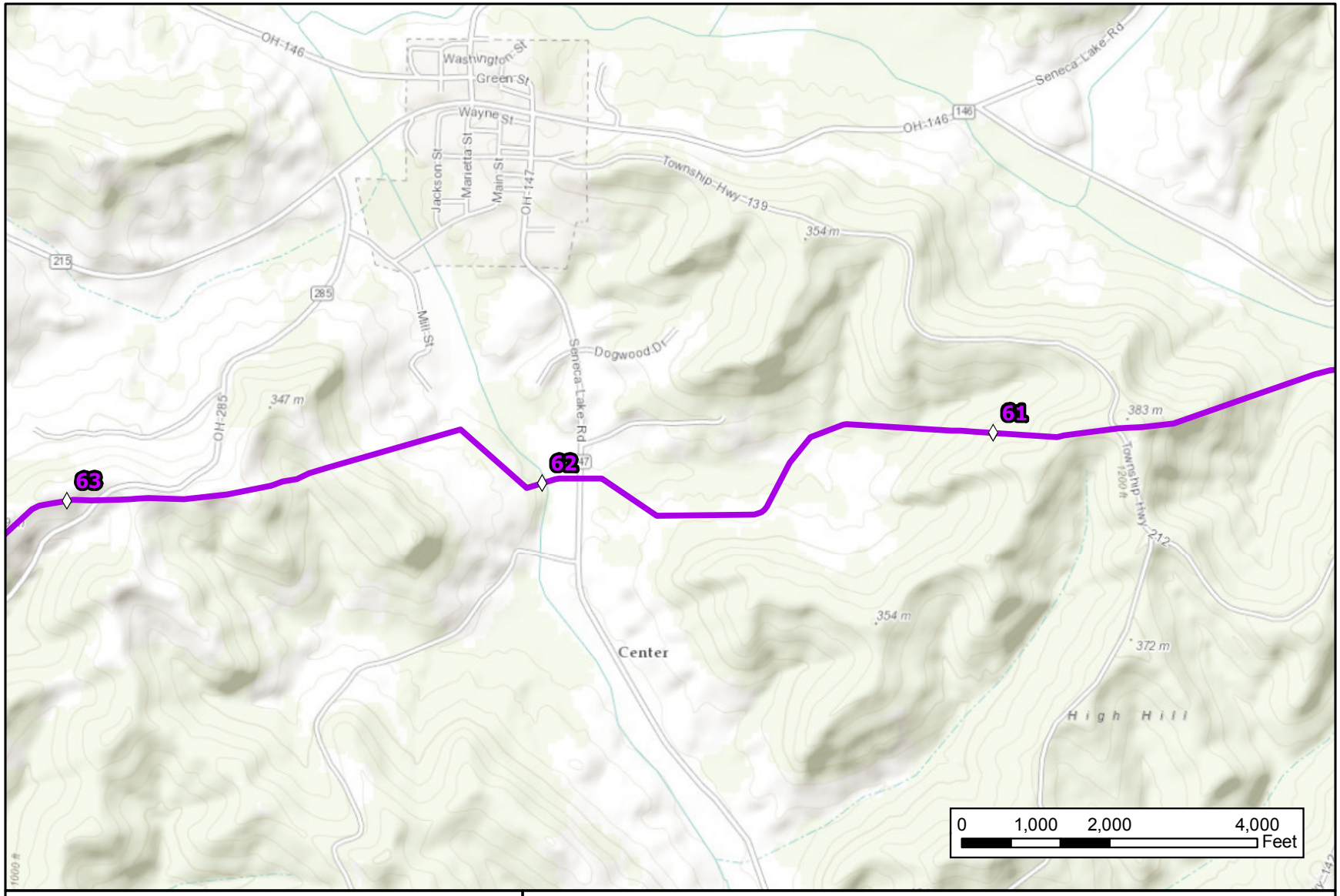
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-22
Leach XPress
Project Overview



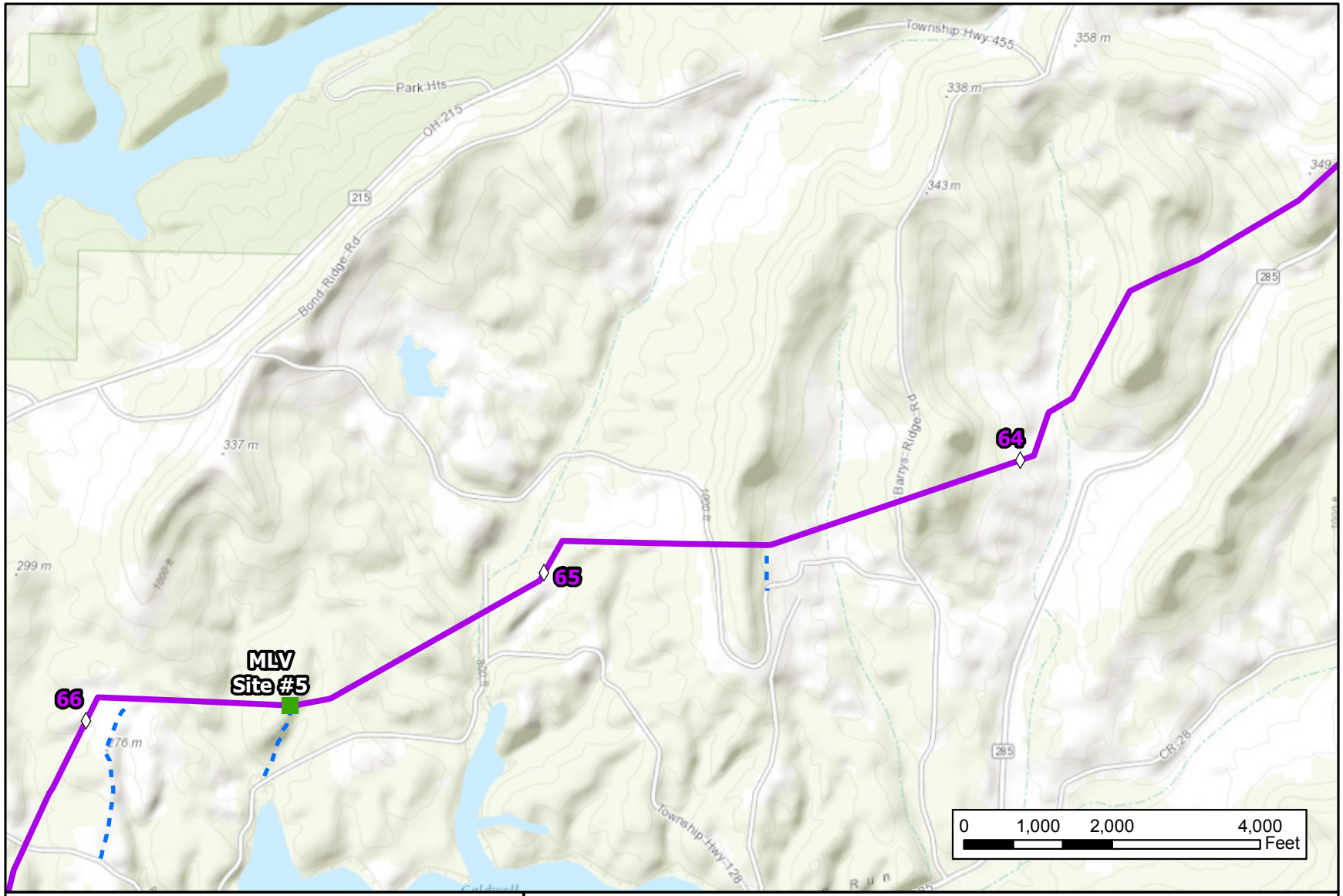
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-23
Leach XPress
Project Overview



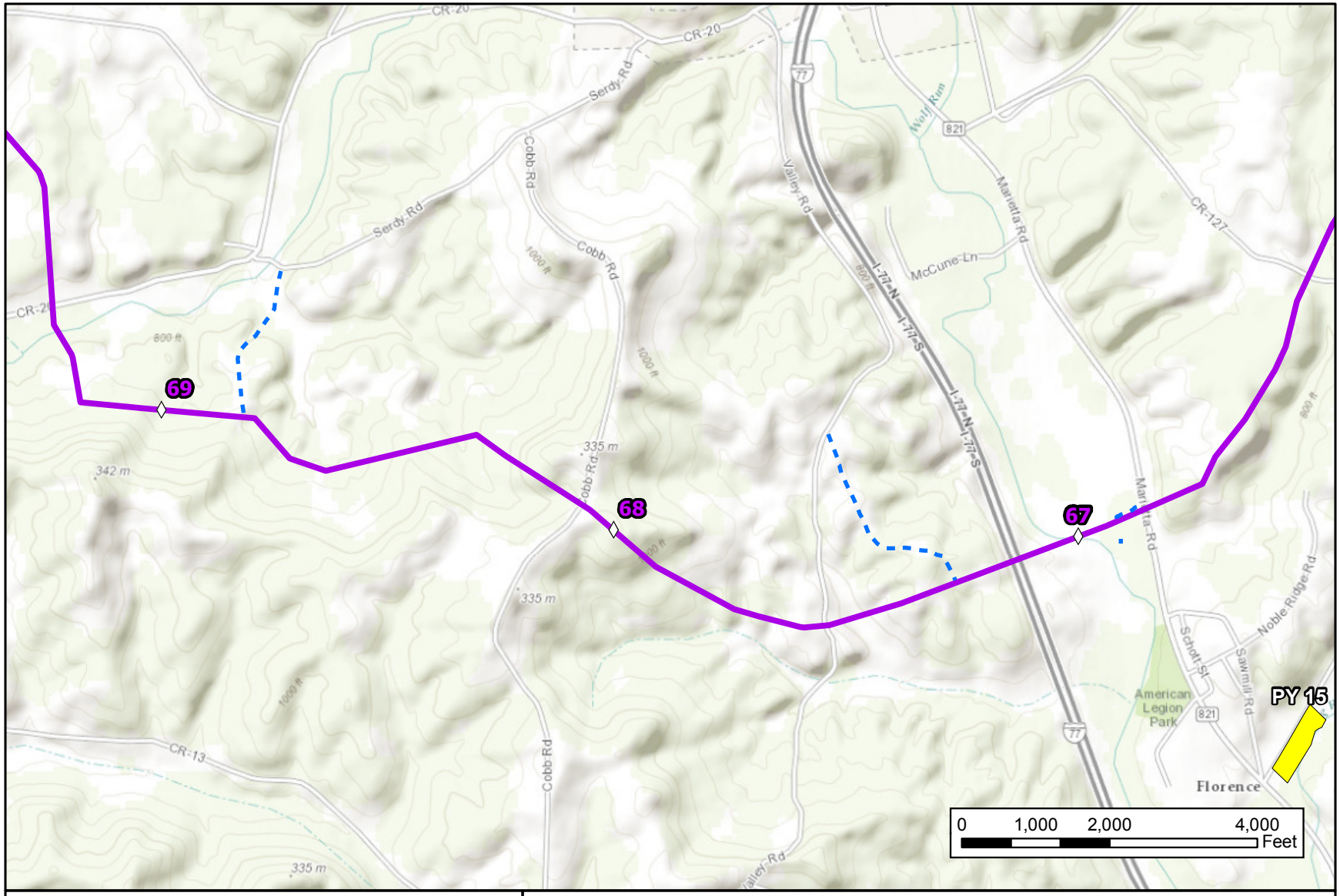
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-24
Leach XPress
Project Overview



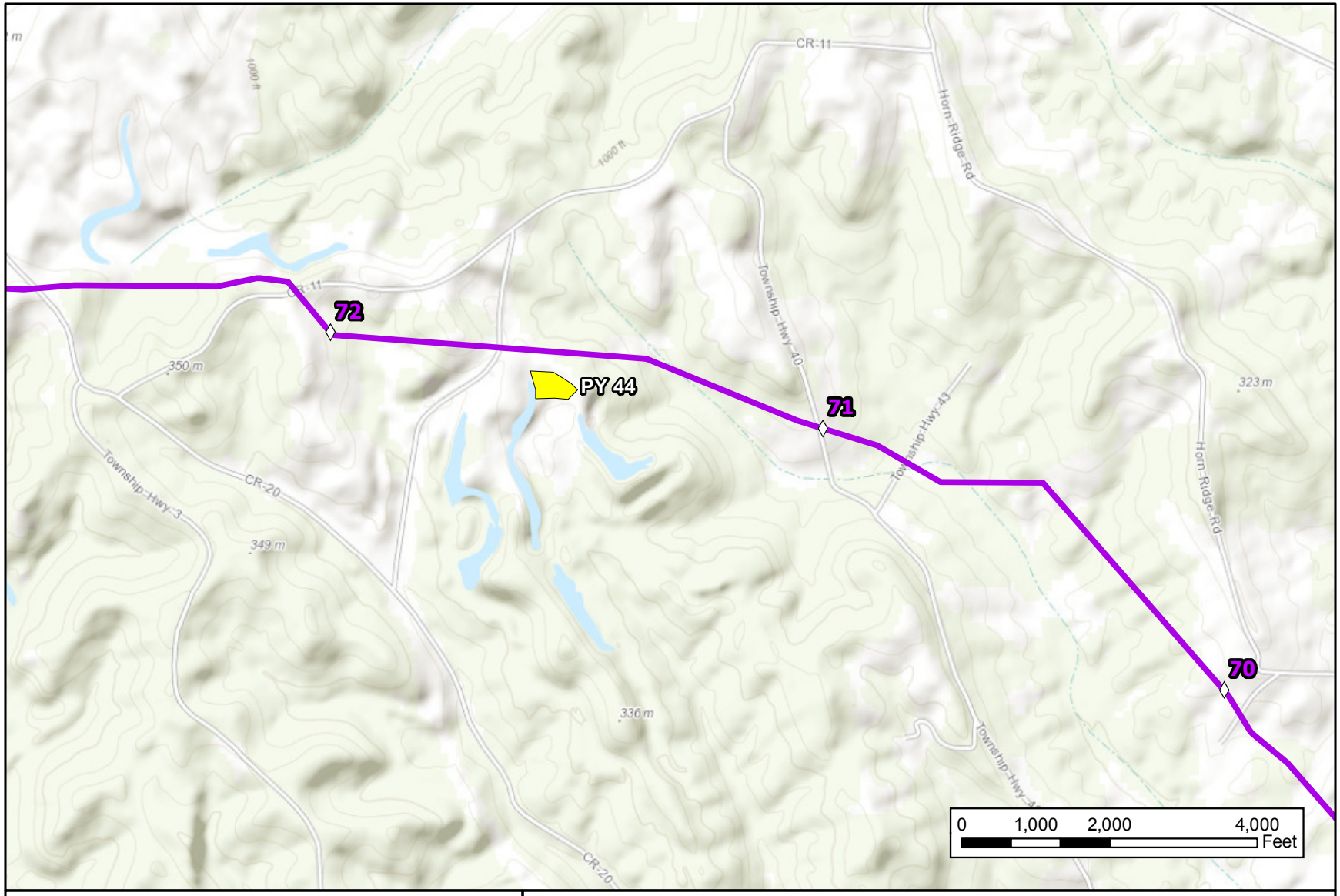
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-25
Leach XPress
Project Overview



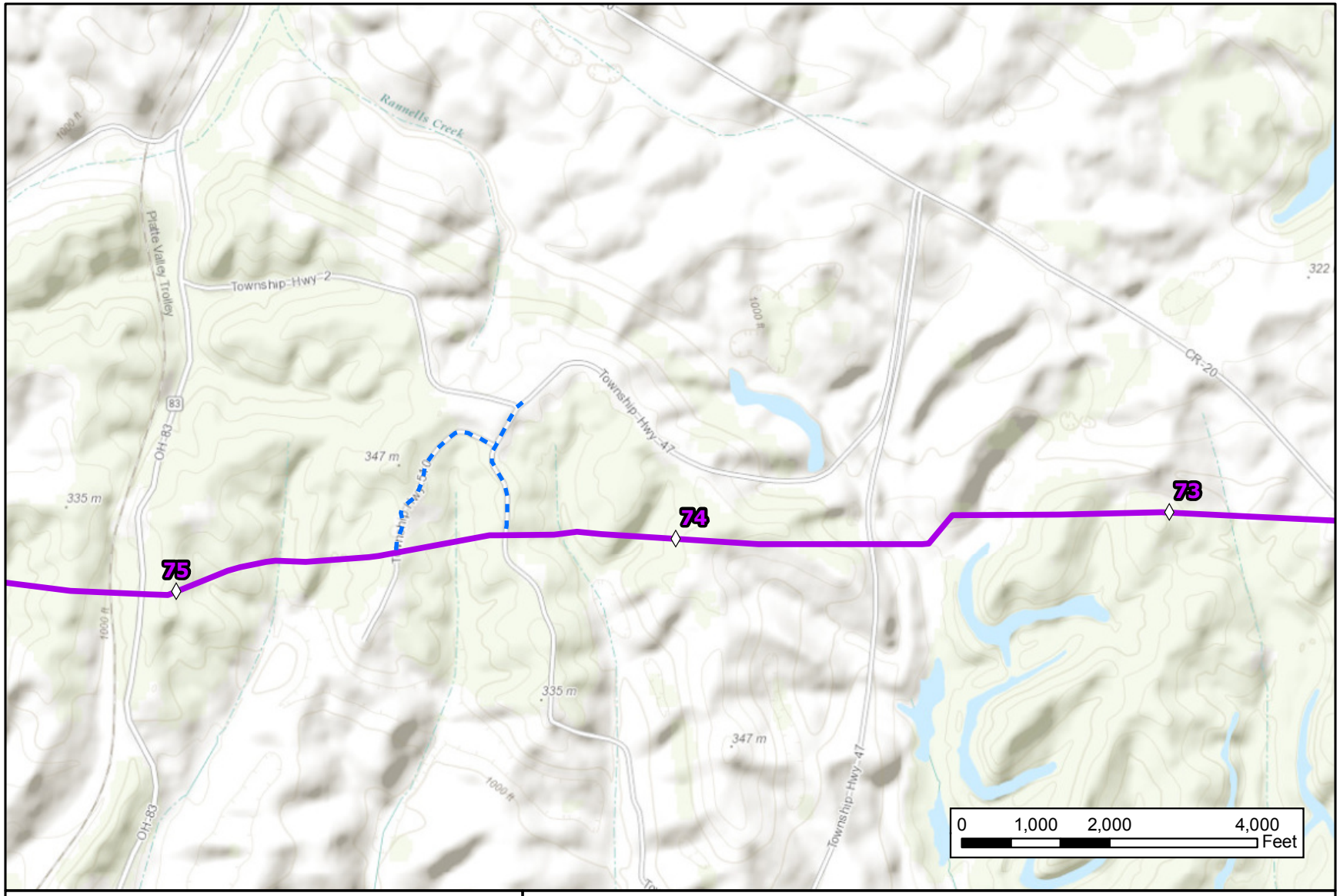
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-26
Leach XPress
Project Overview



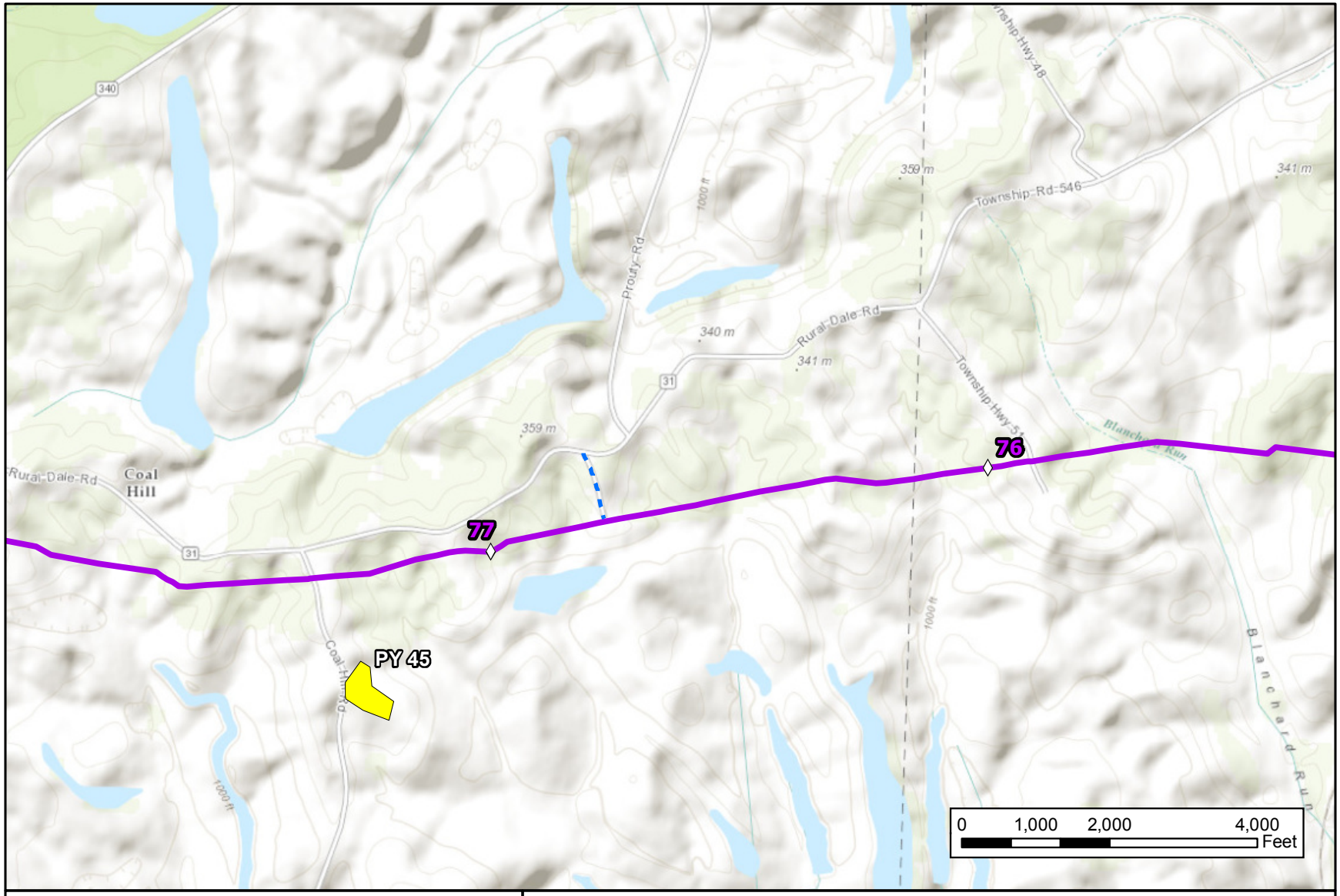
LEX
LEX1
R-801 Loop
R-801 Loop
R-501 Abandonment
Main line Valve
Access Road
Suction Line
Permanent Site Facility
Temporary Workspace
Pipe Yards
Milepost

Appendix B-27
Leach XPress
Project Overview



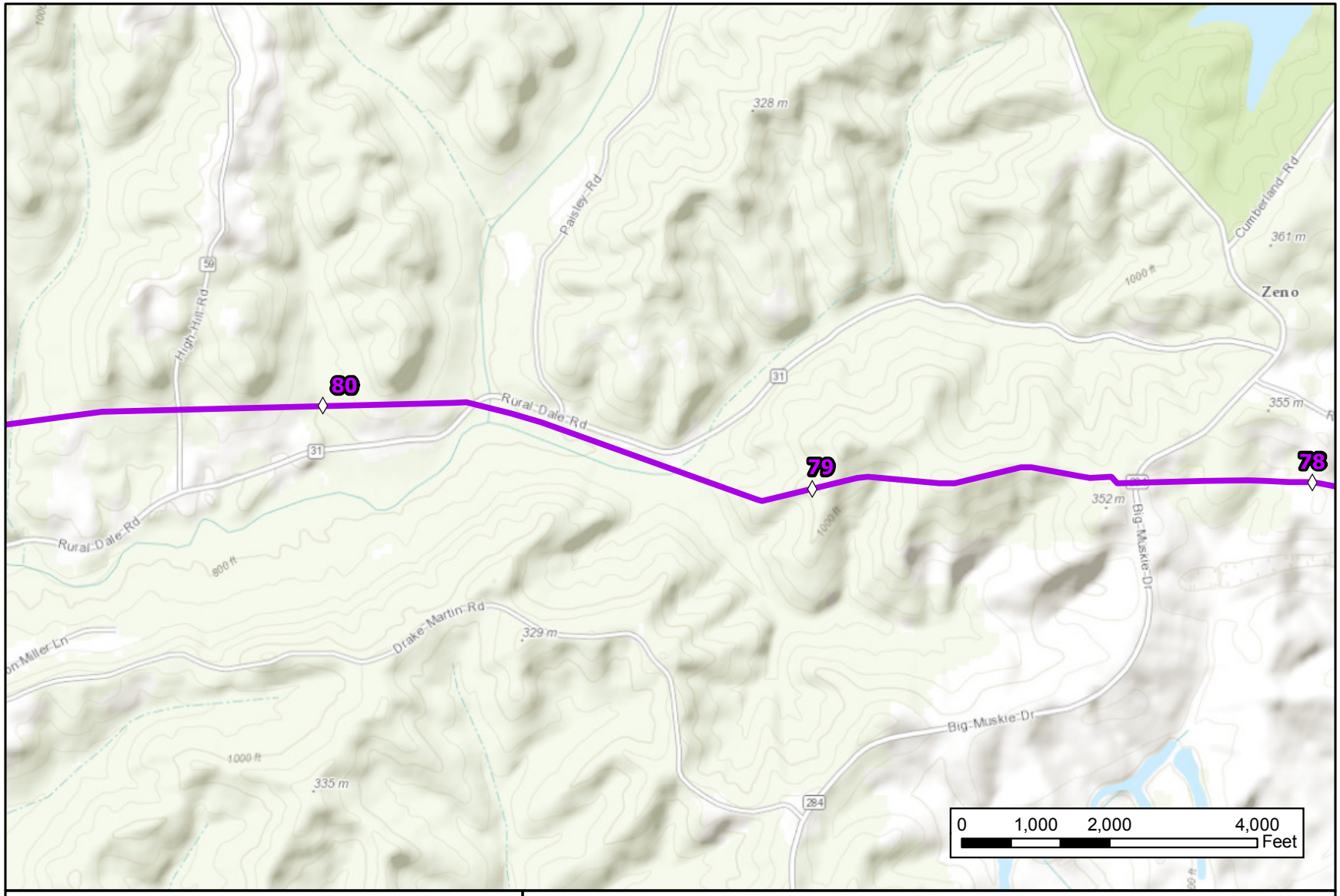
LEX
LEX1
R-801 Loop
R-801 Loop
R-501 Abandonment
Main line Valve
Access Road
Suction Line
Permanent Site Facility
Temporary Workspace
Pipe Yards
Milepost

Appendix B-28
Leach XPress
Project Overview



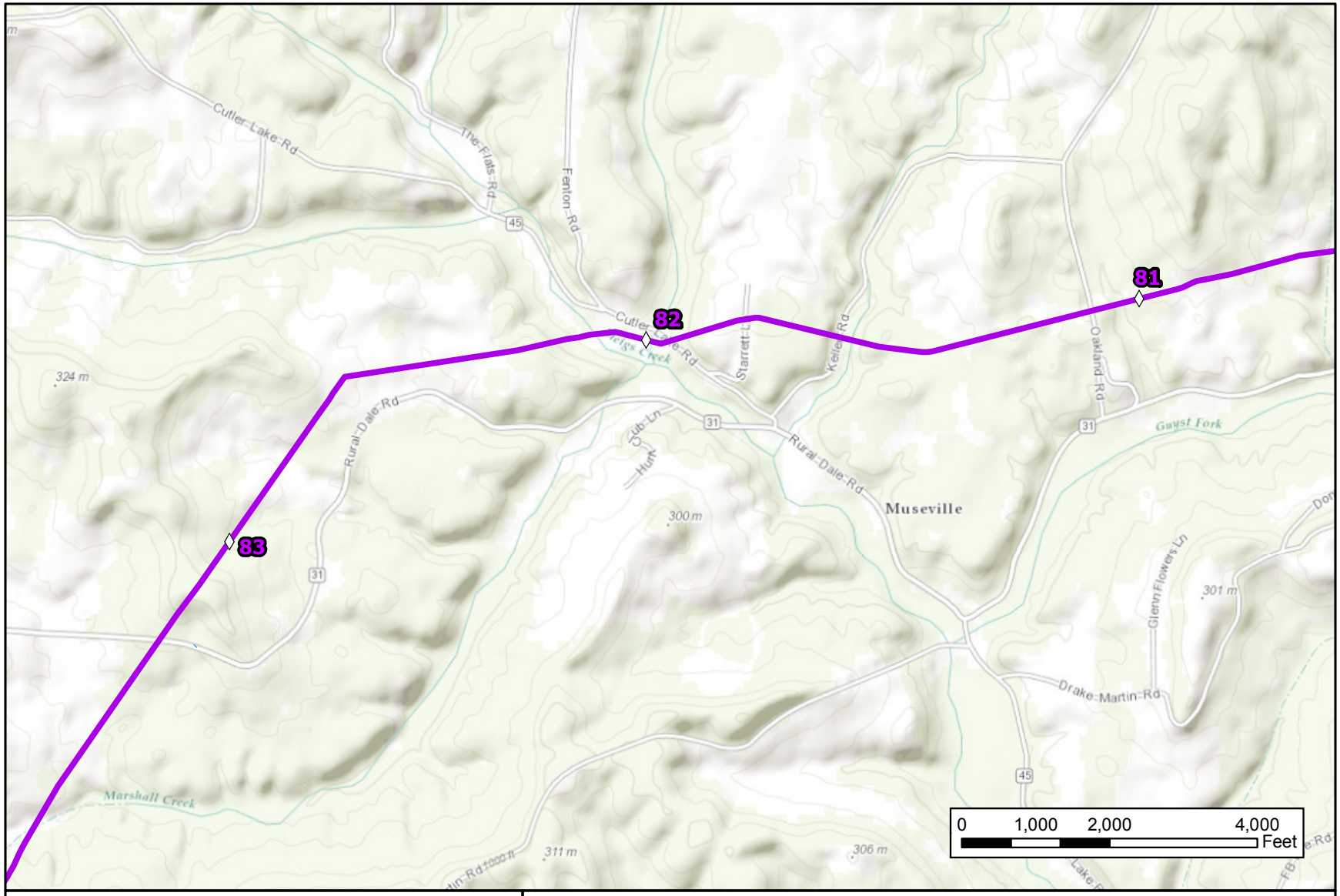
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-29
Leach XPress
Project Overview



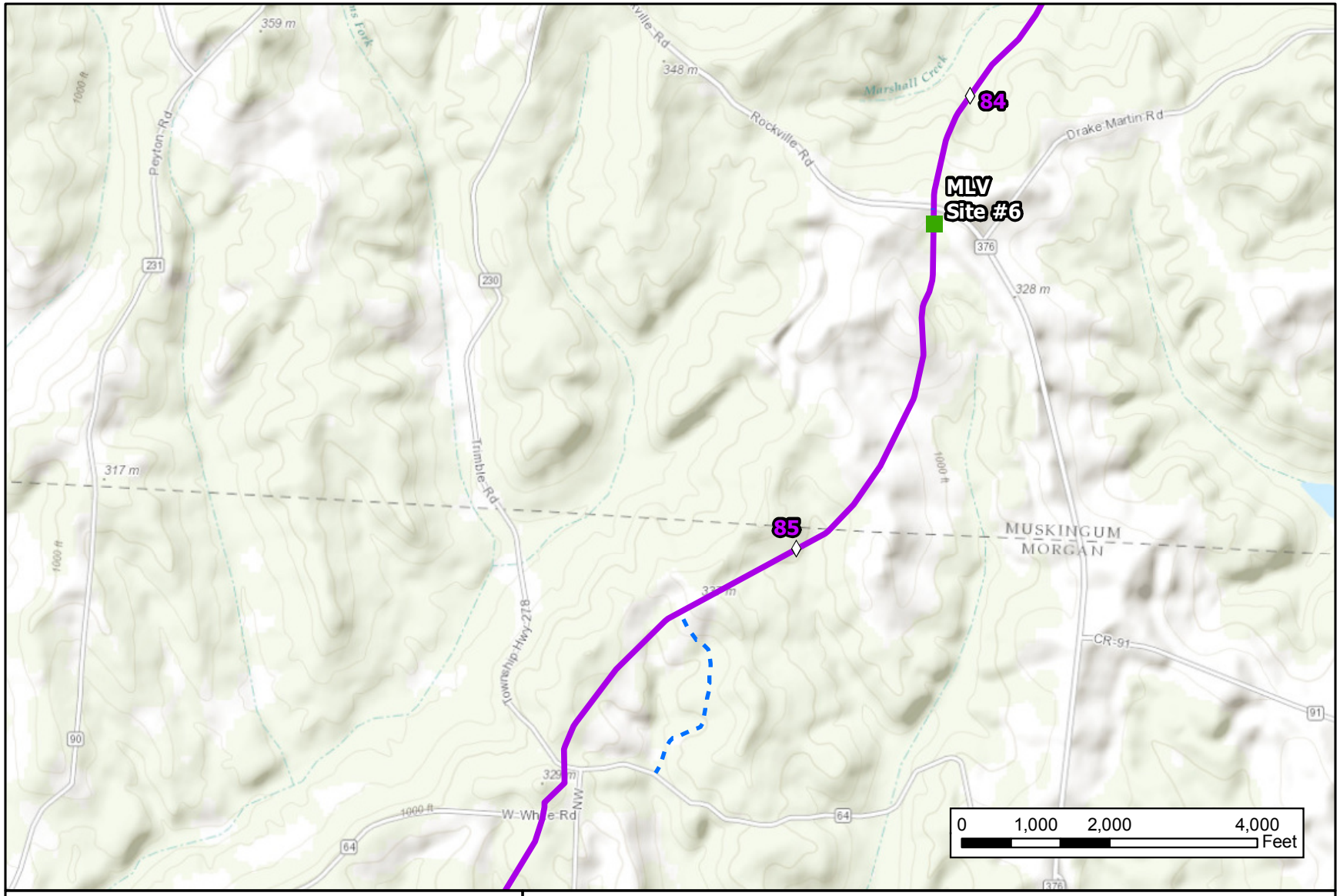
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-30
Leach XPress
Project Overview



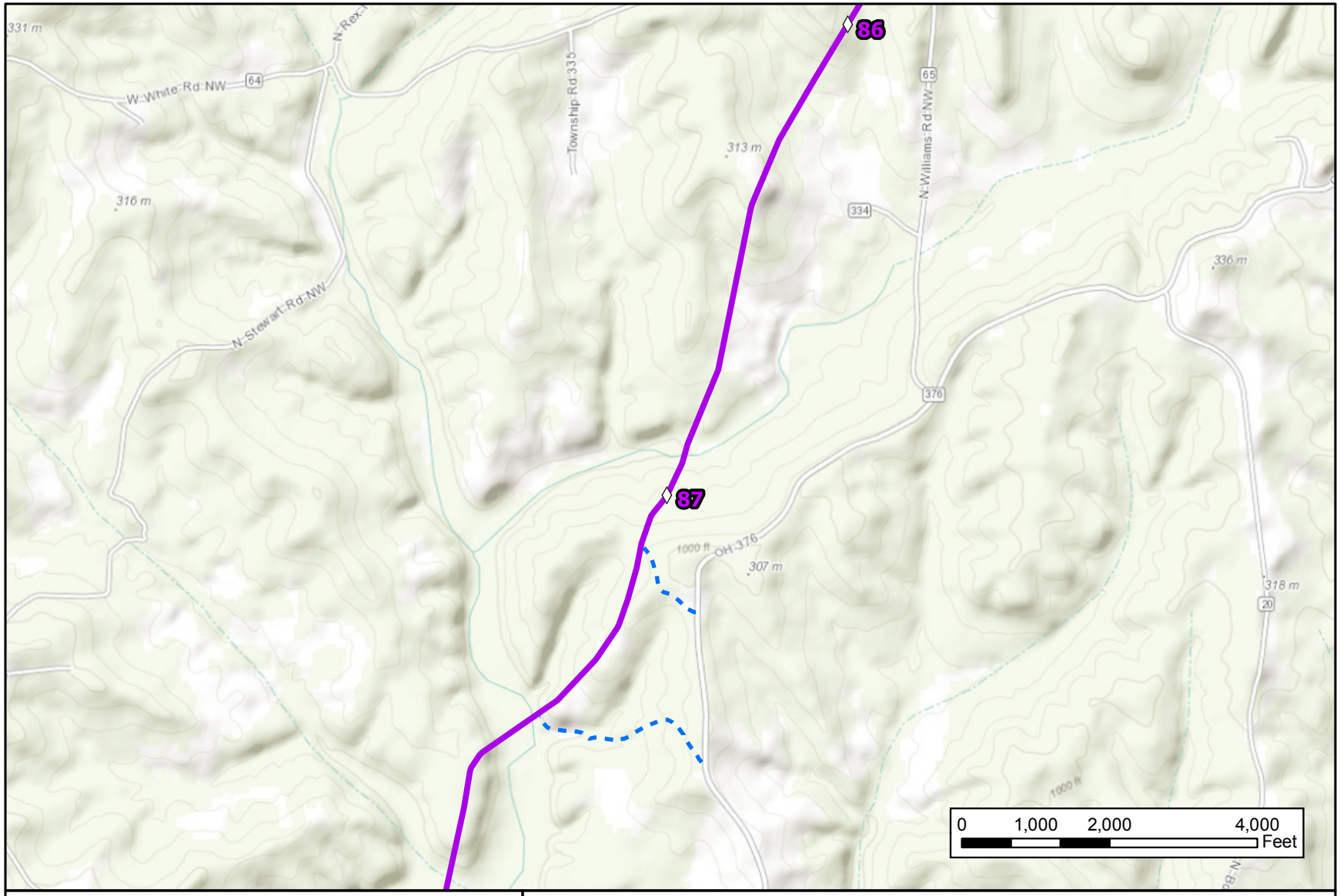
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-31
Leach XPress
Project Overview



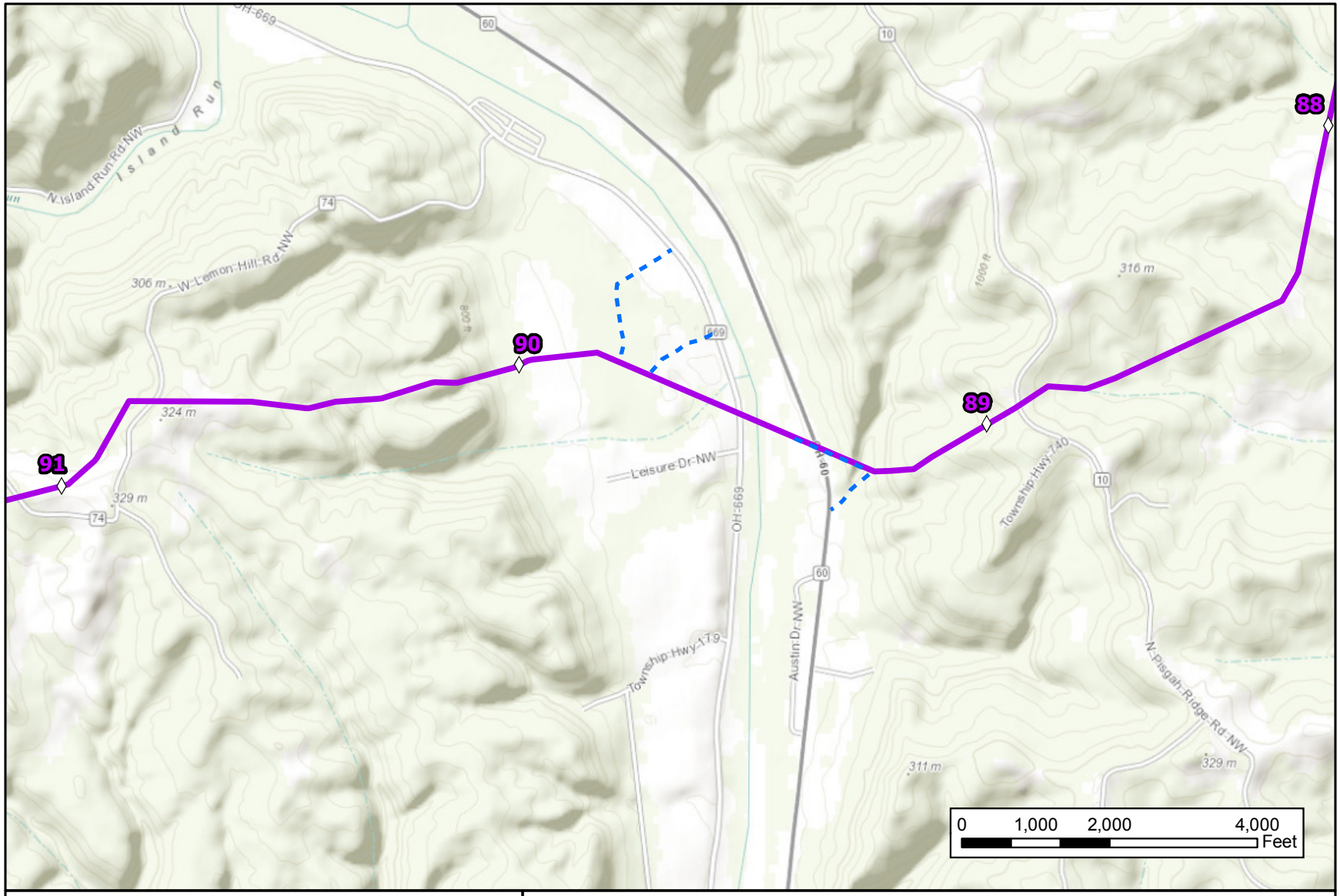
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-32
Leach XPress
Project Overview



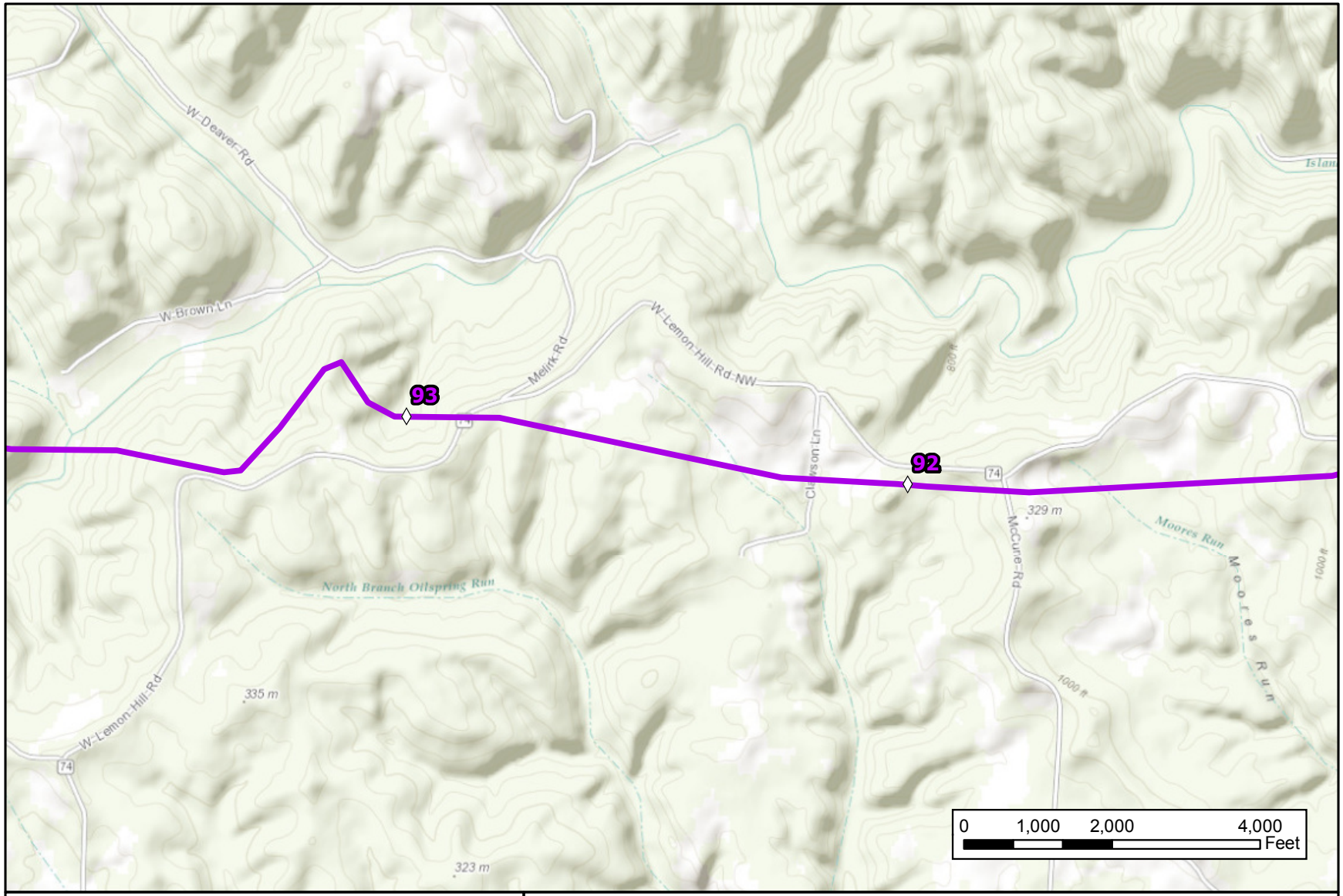
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-33
Leach XPress
Project Overview



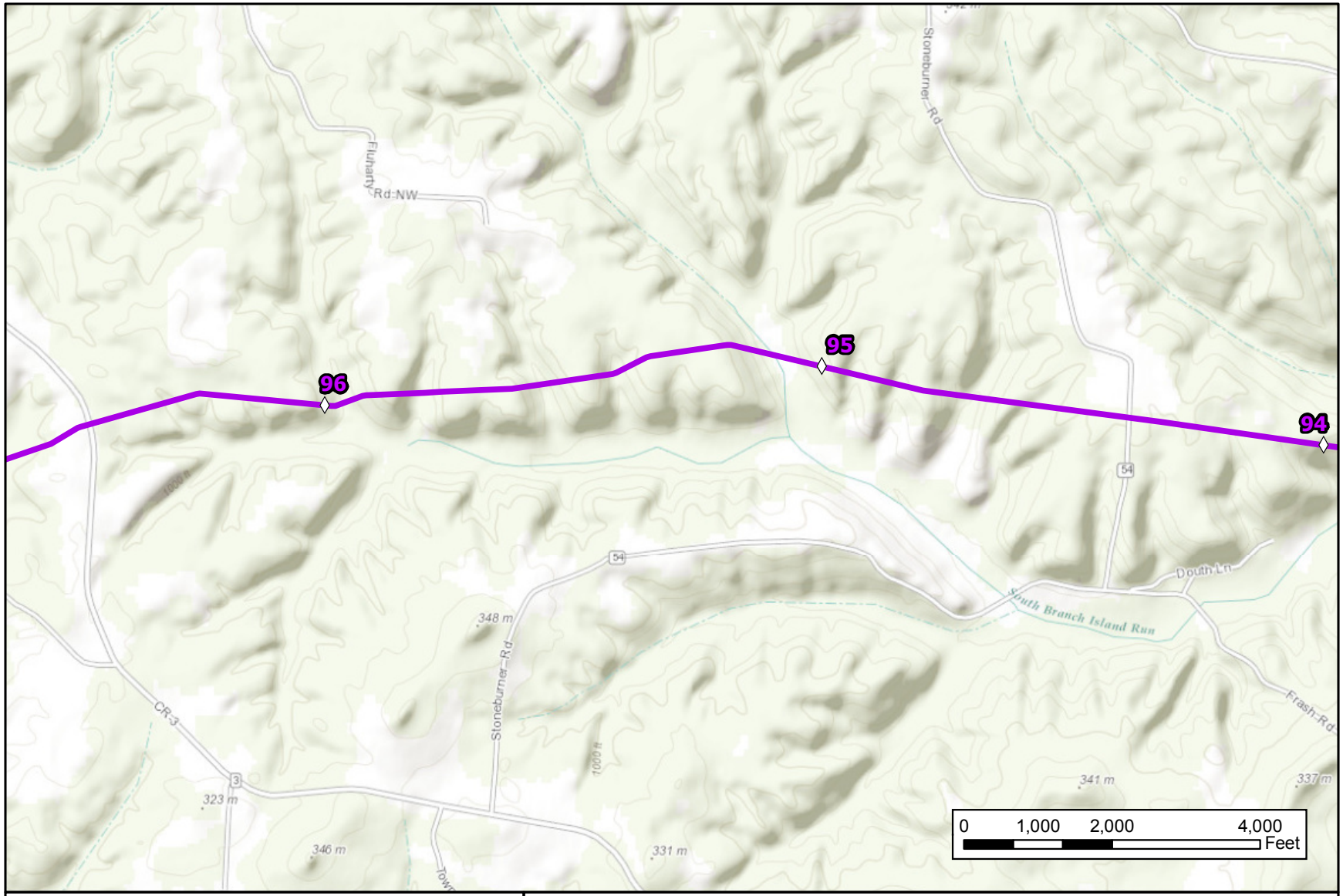
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-34
Leach XPress
Project Overview



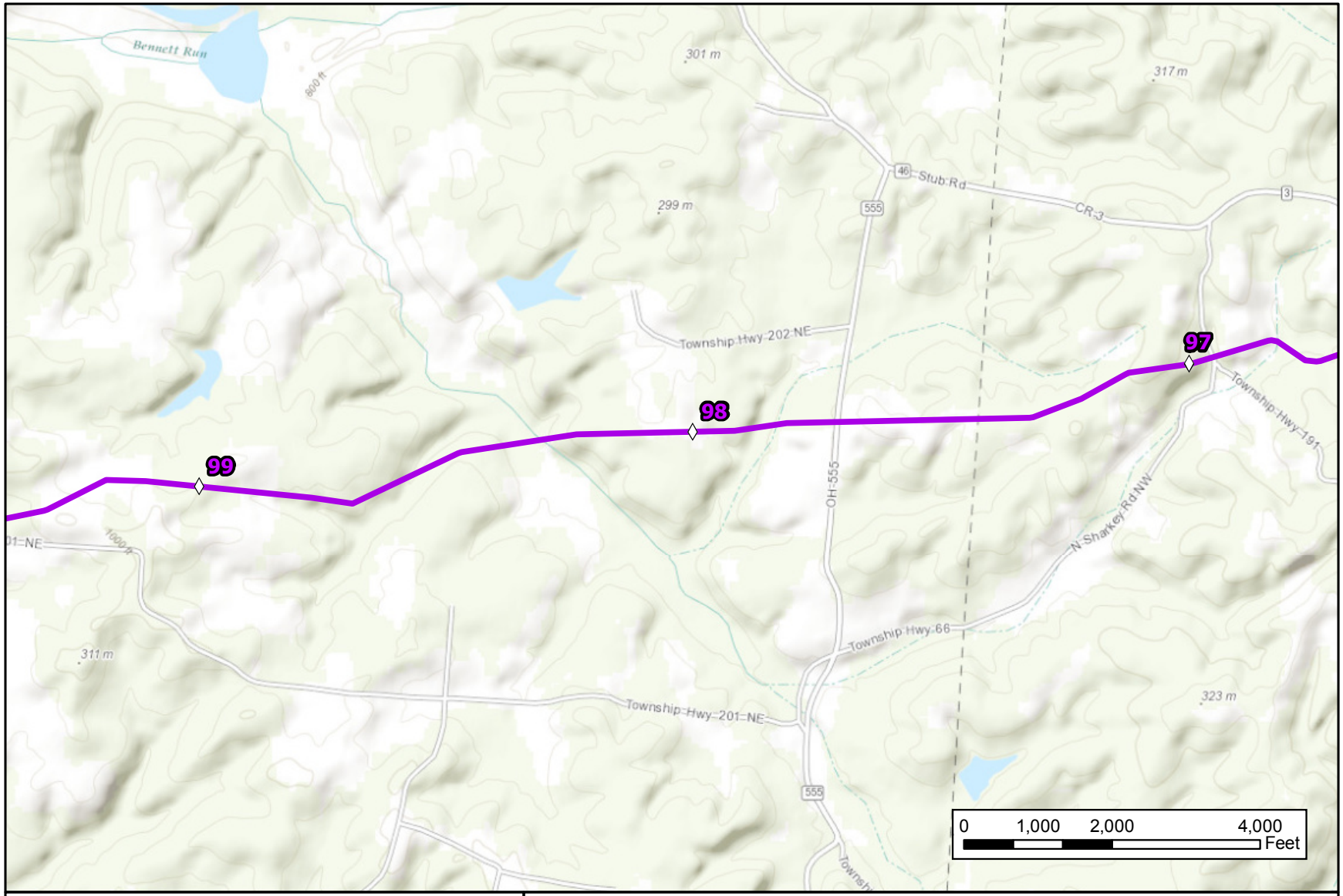
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-35
Leach XPress
Project Overview



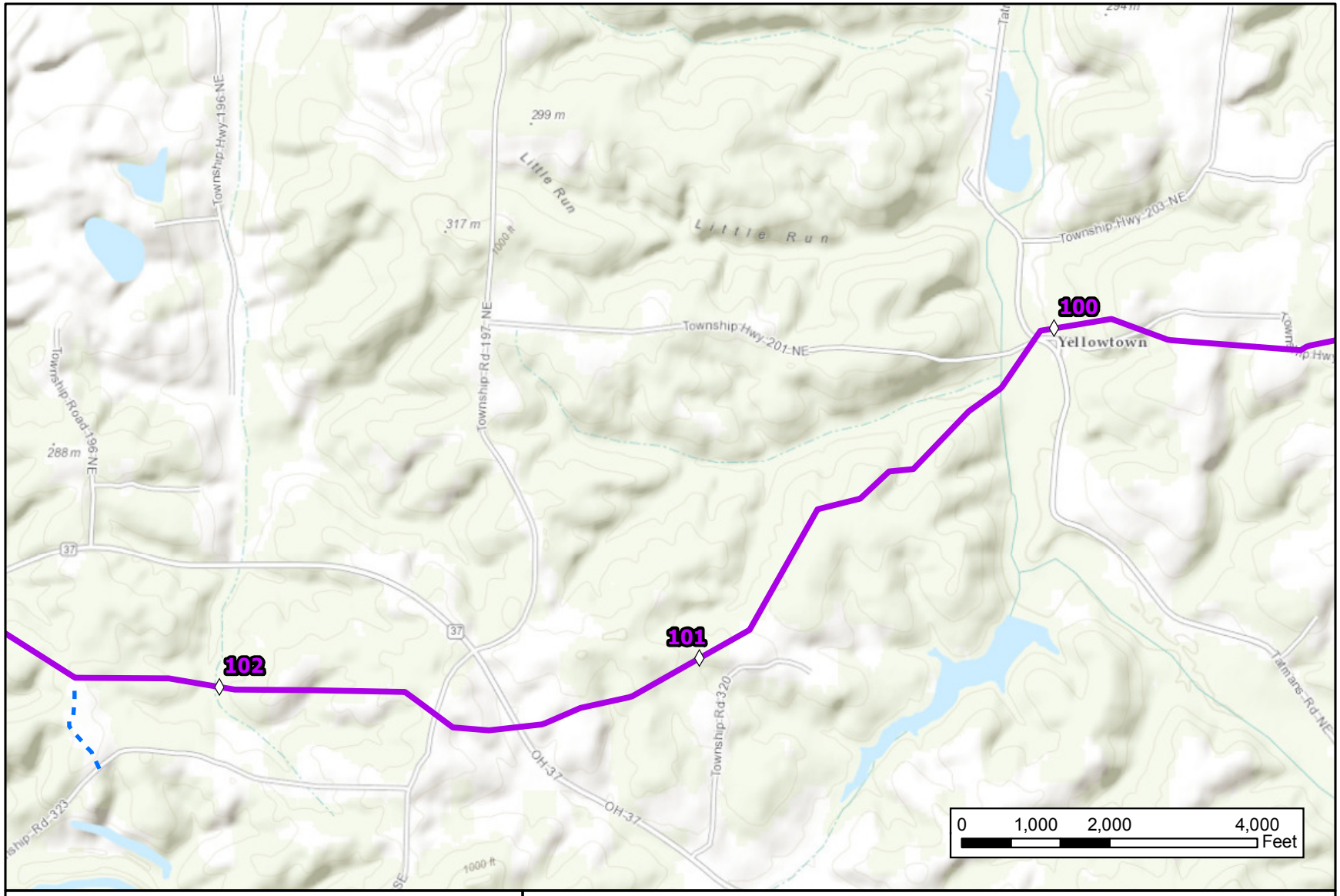
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-36
Leach XPress
Project Overview



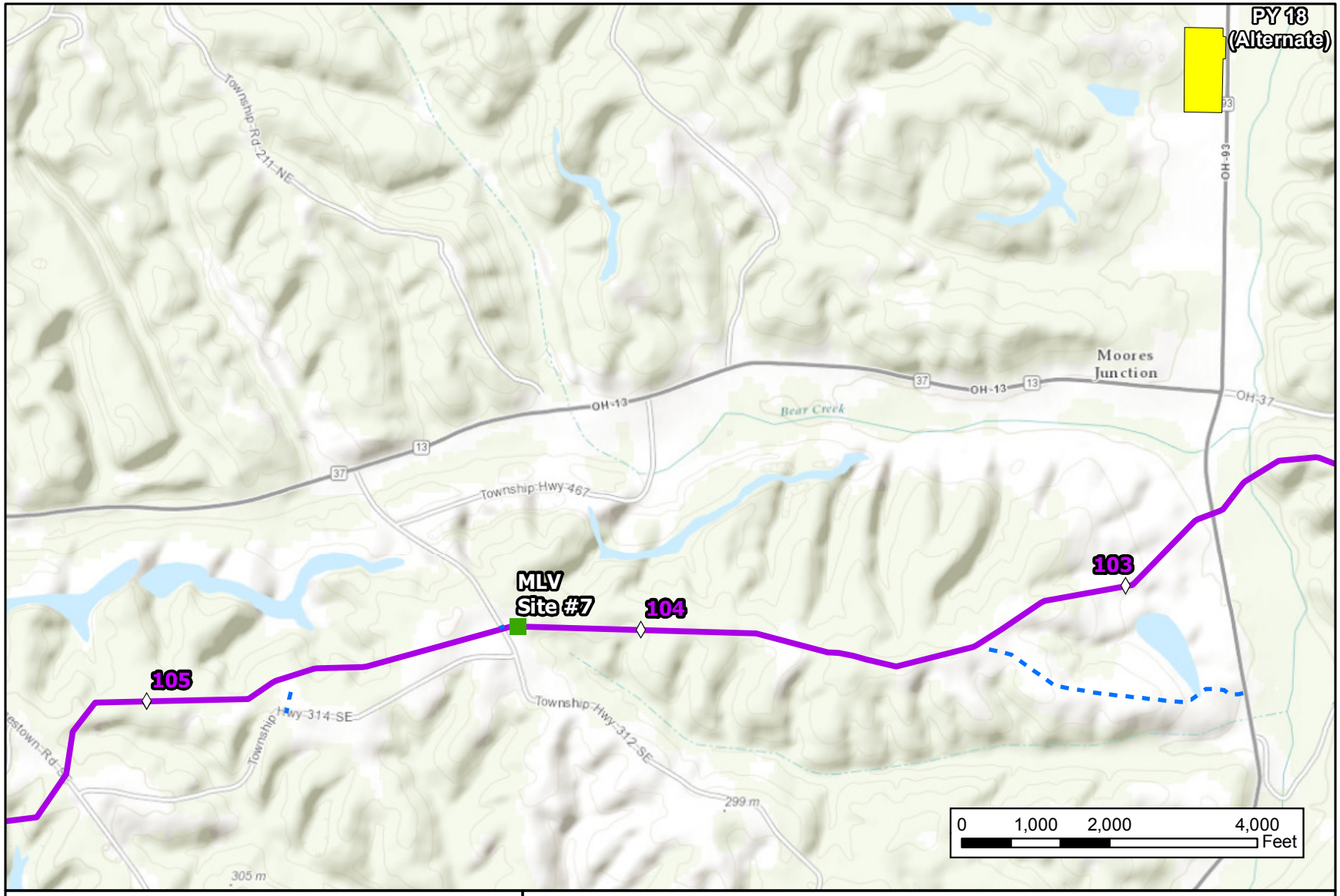
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-37
Leach XPress
Project Overview



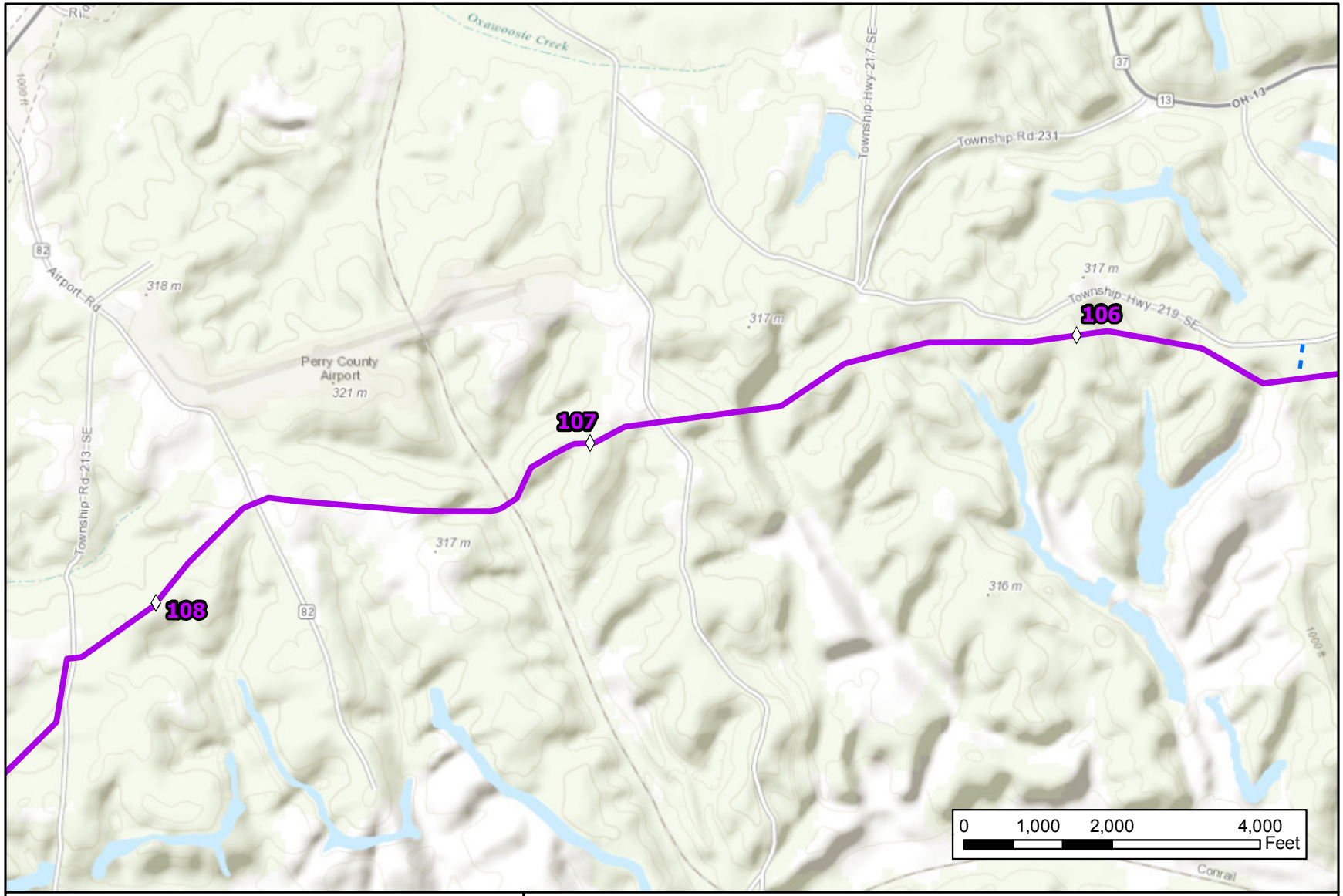
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-38
Leach XPress
Project Overview



LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-39
Leach XPress
Project Overview

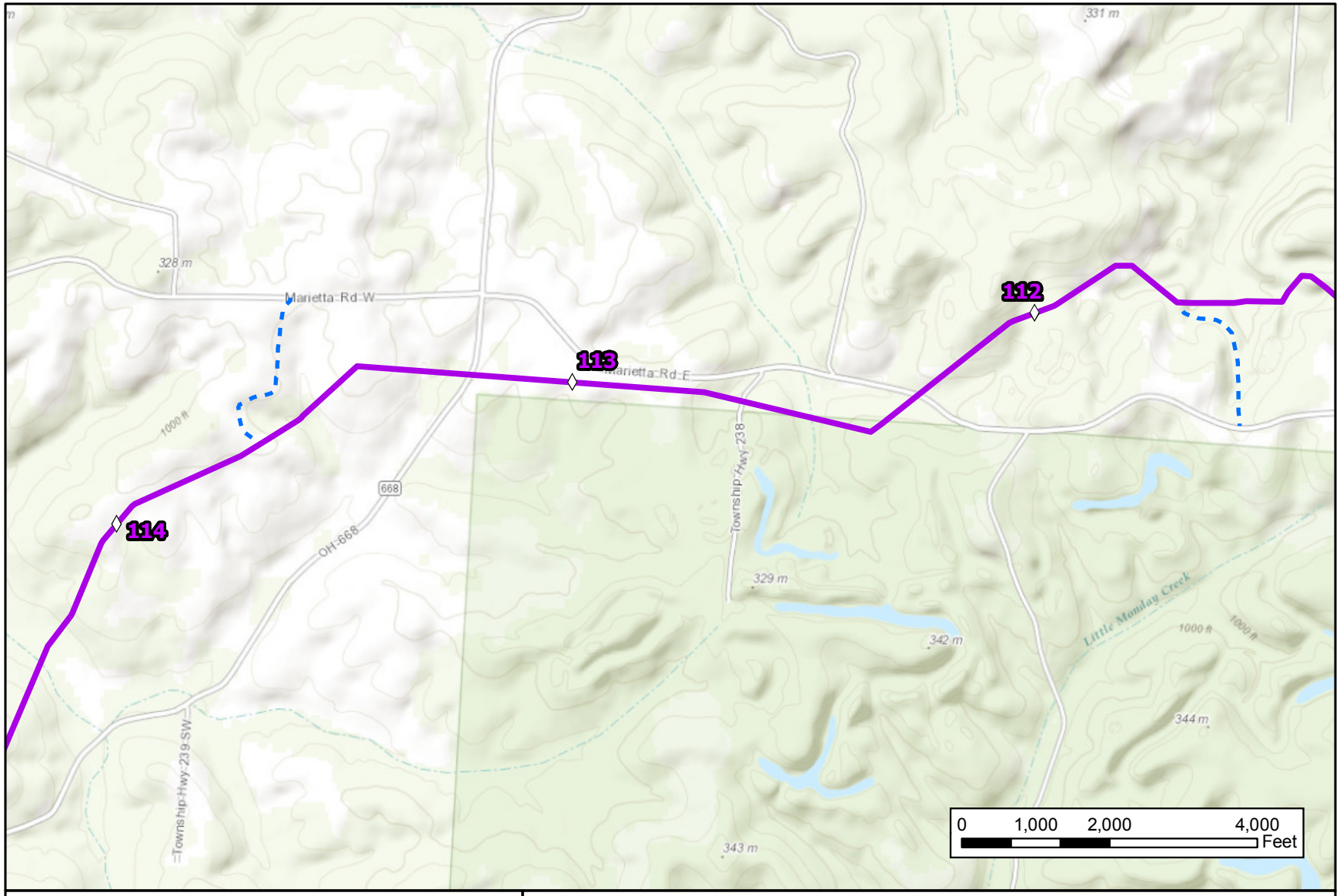


LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-40
Leach XPress
Project Overview

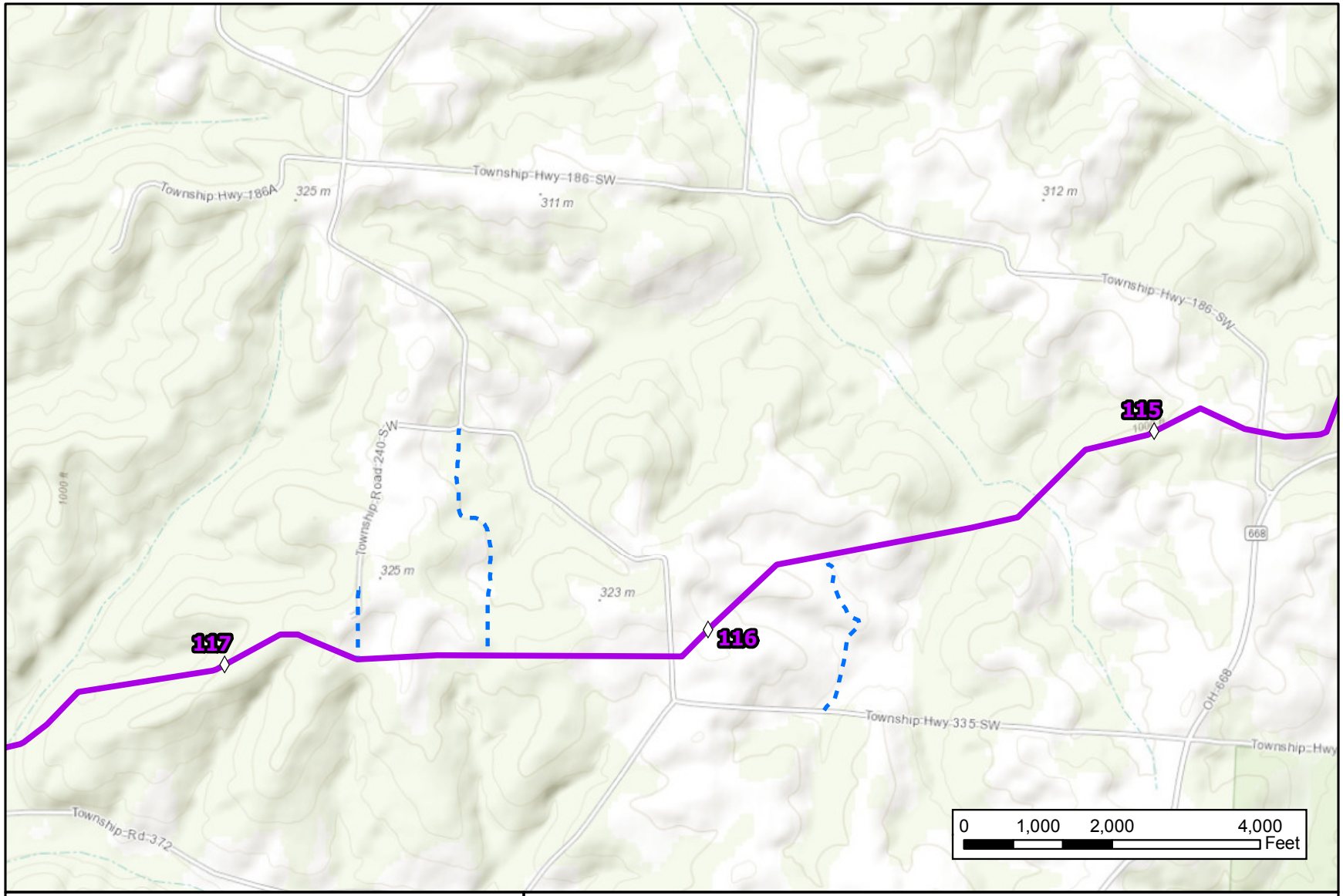
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-41
Leach XPress
Project Overview



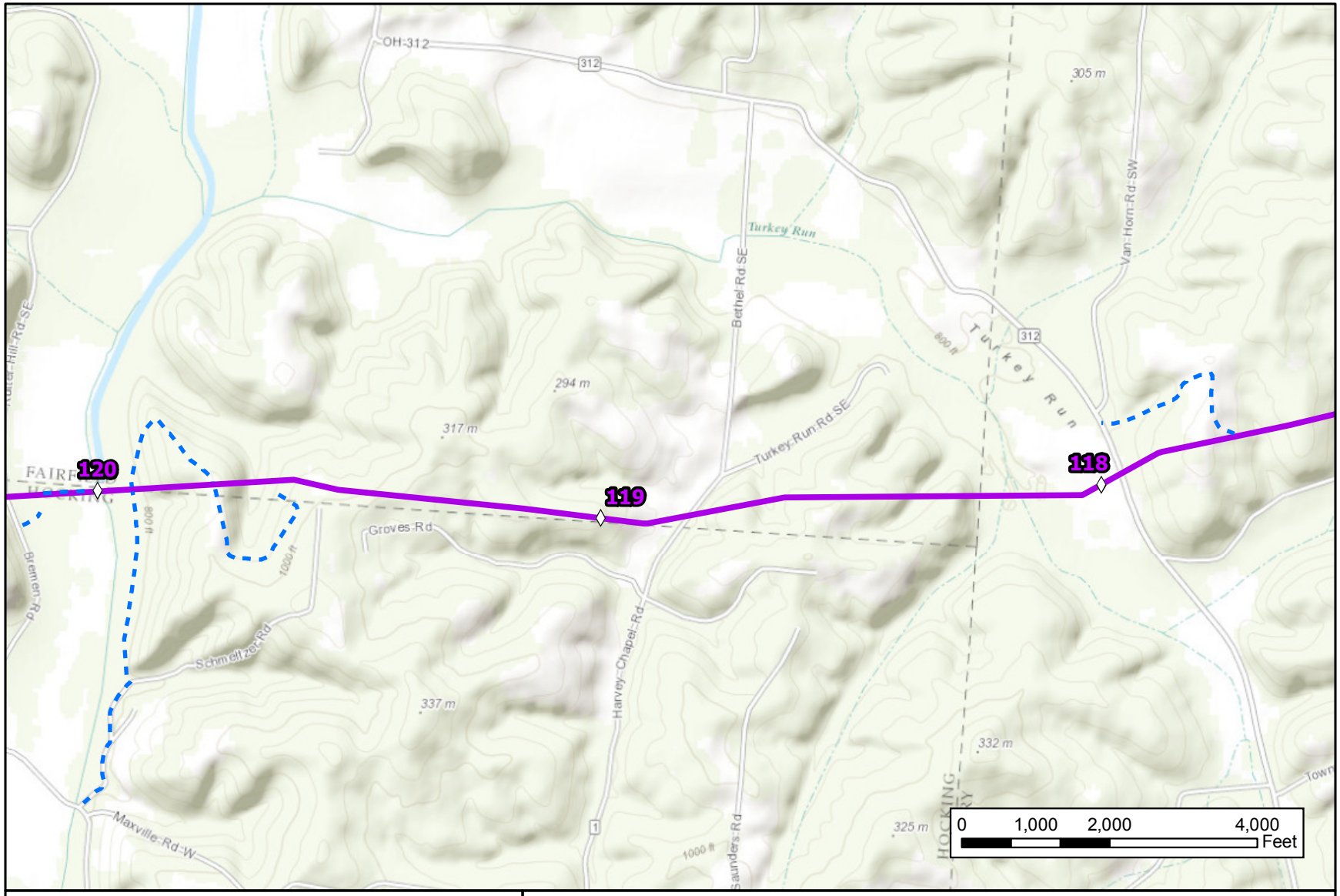
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-42
Leach XPress
Project Overview



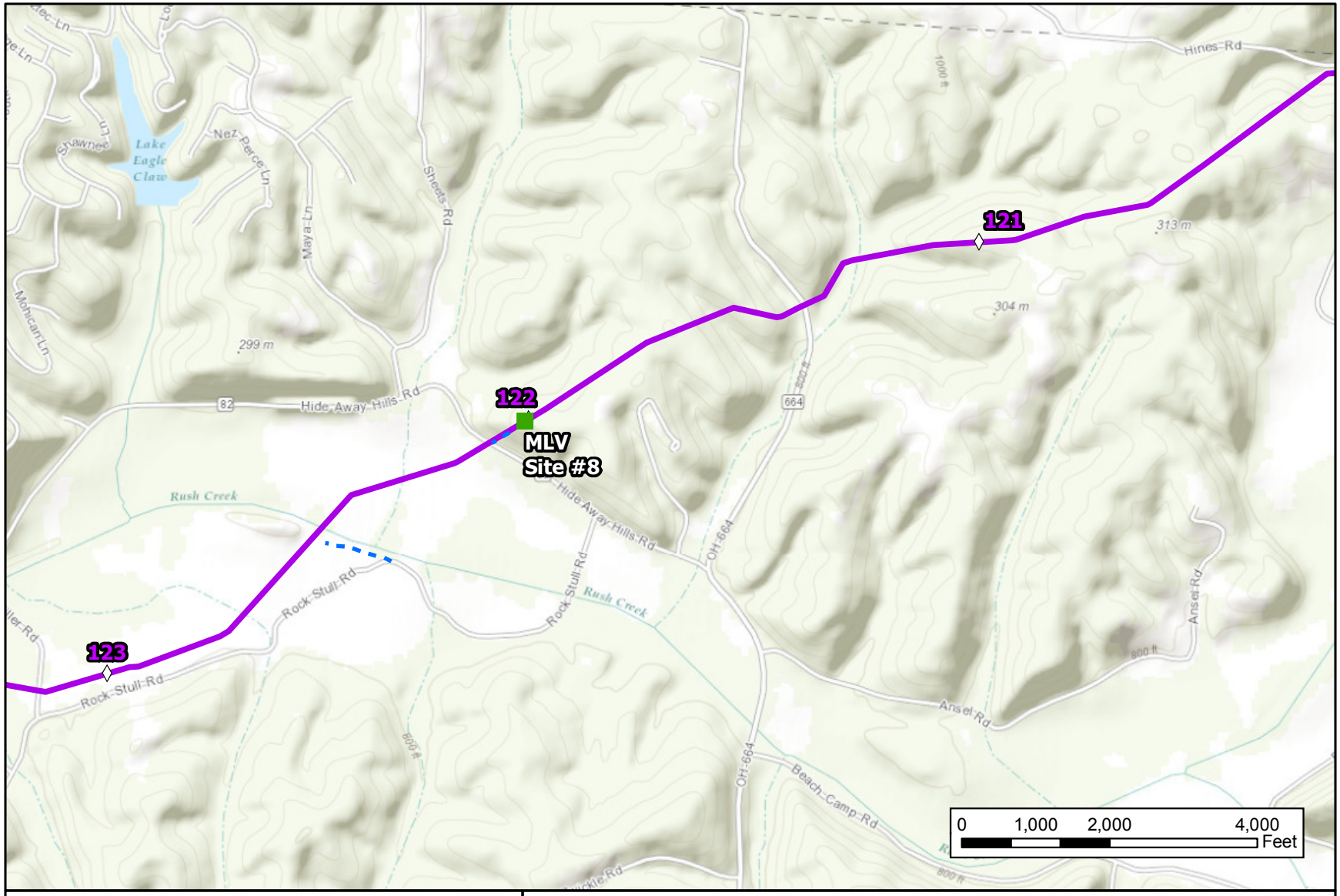
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-43
Leach XPress
Project Overview



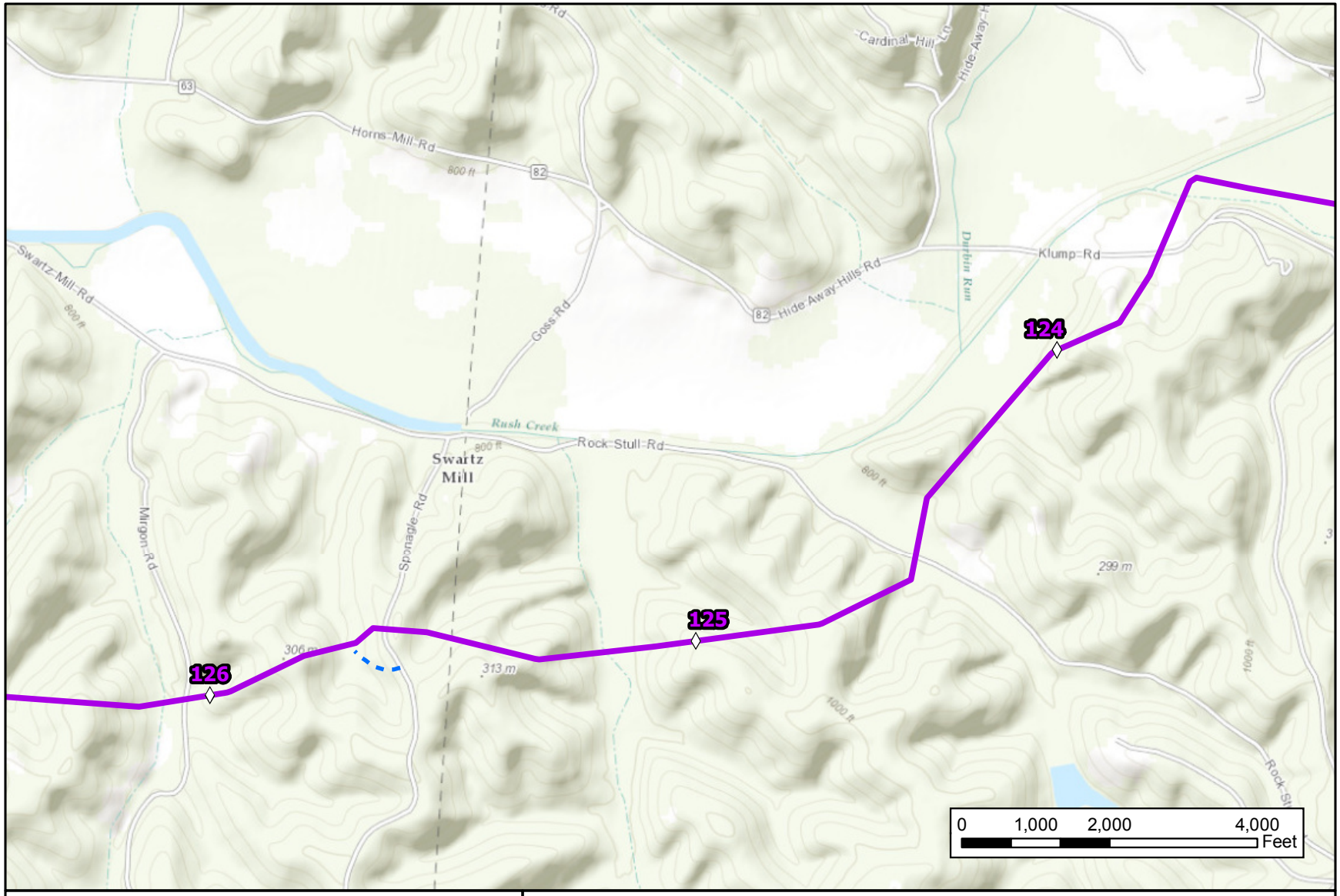
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-44
Leach XPress
Project Overview



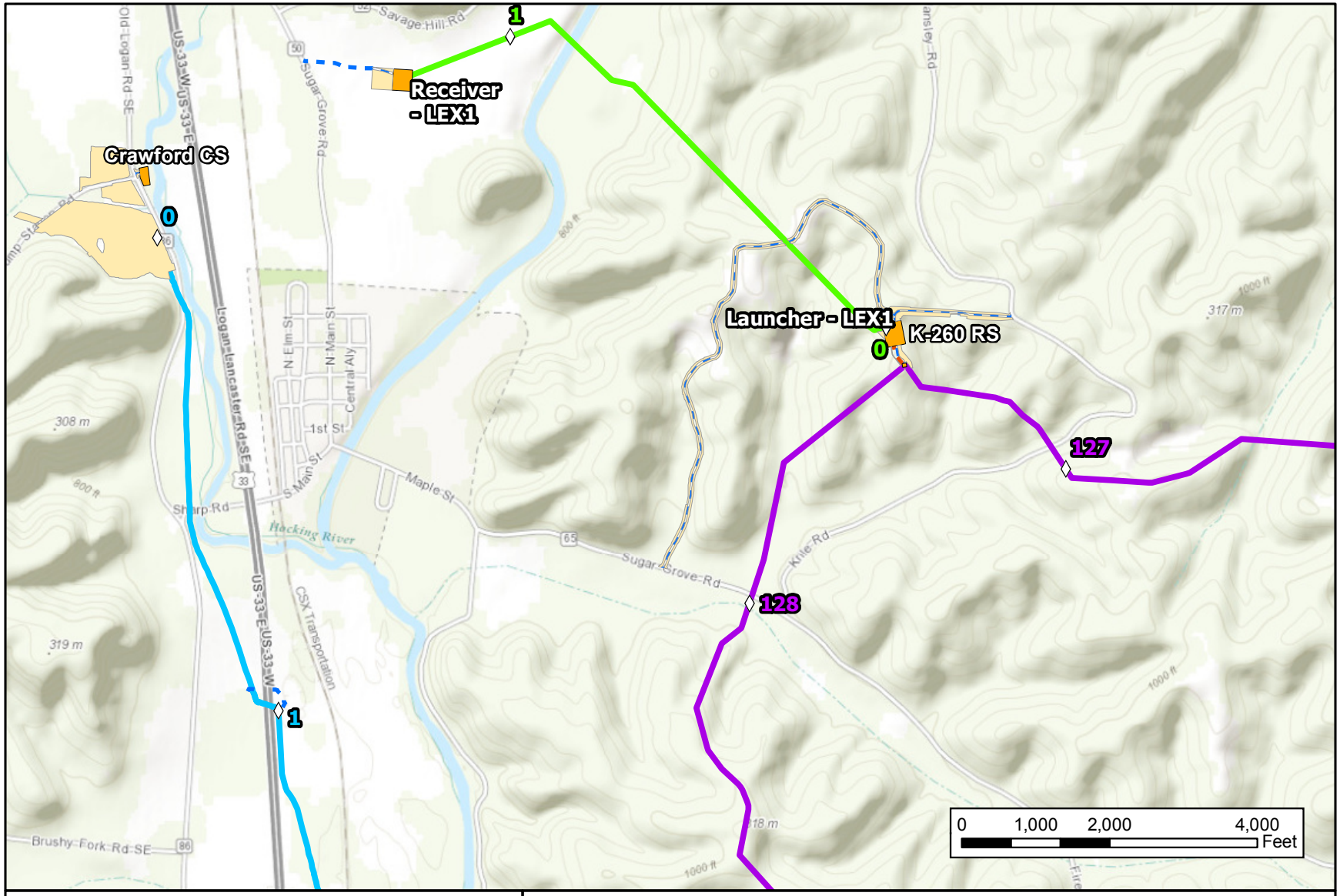
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-45
Leach XPress
Project Overview



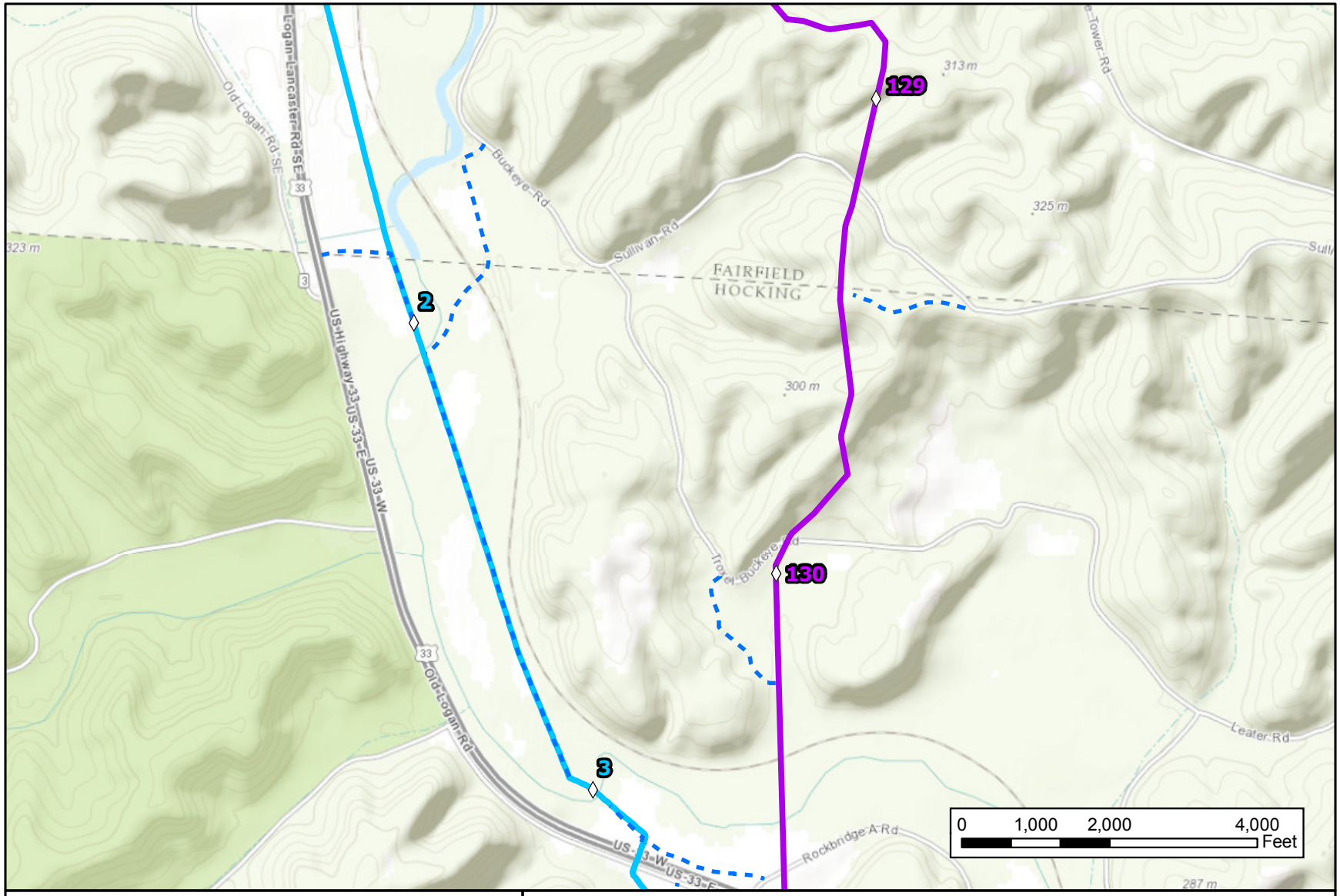
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-46
Leach XPress
Project Overview



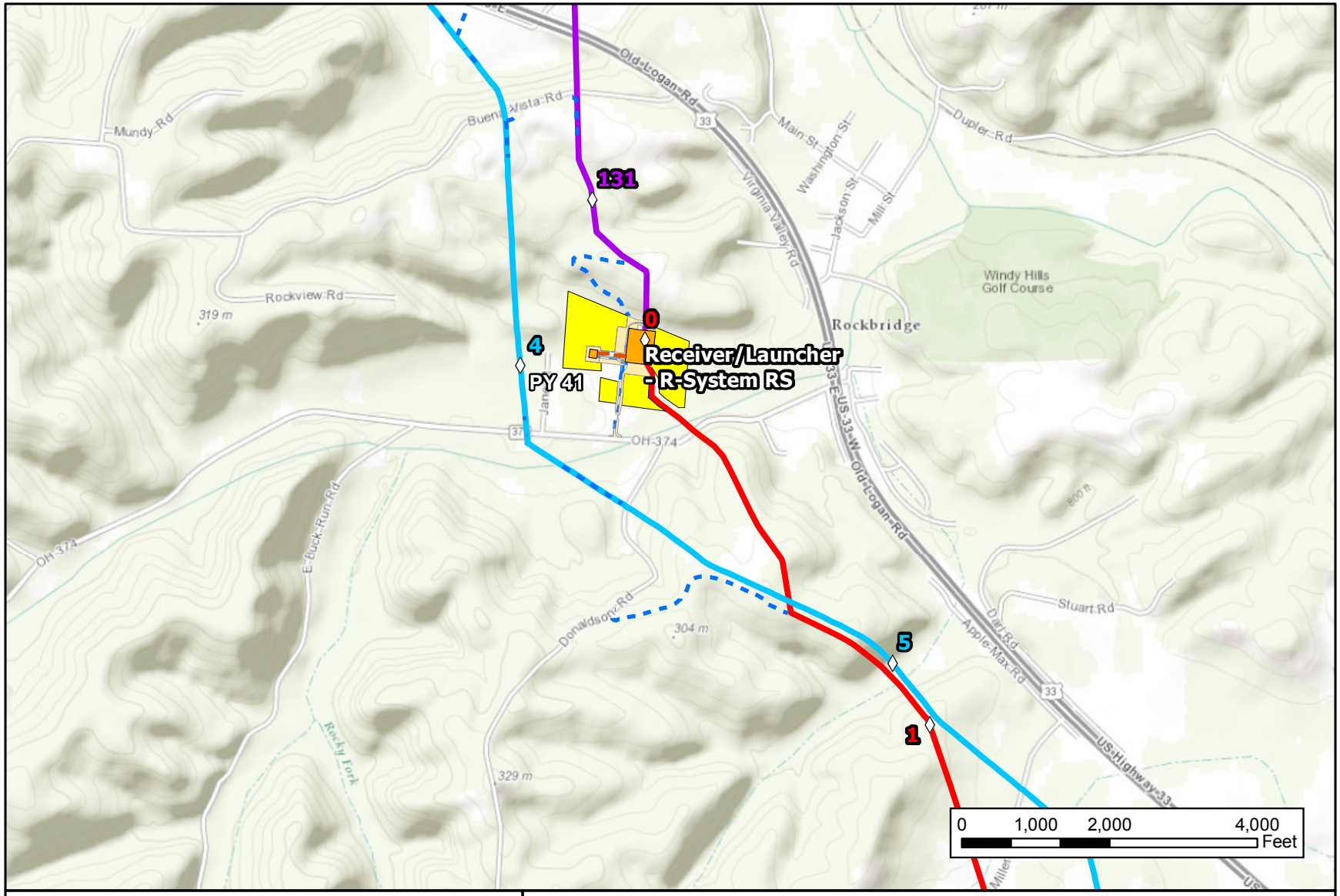
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-47
Leach XPress
Project Overview



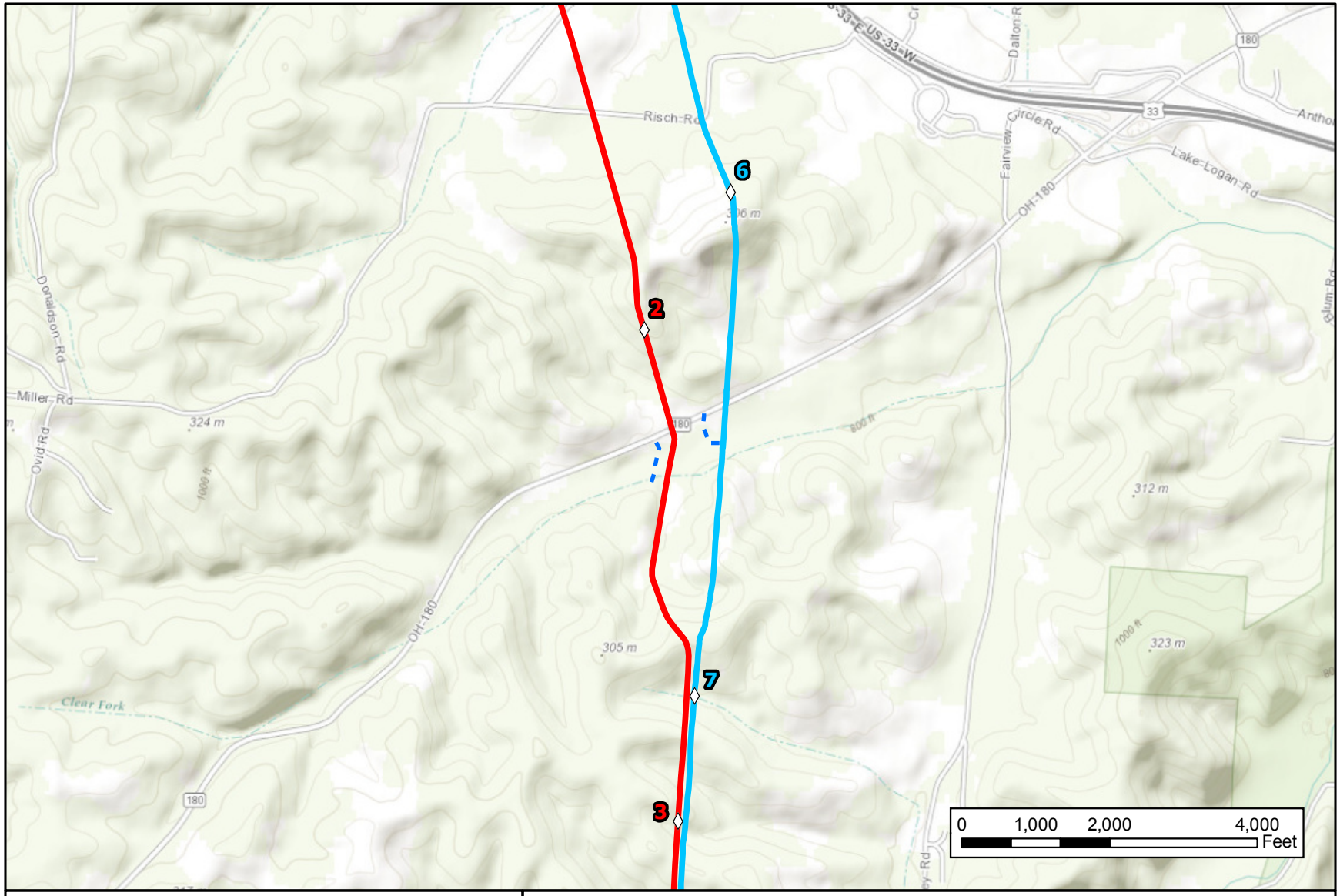
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-48
Leach XPress
Project Overview



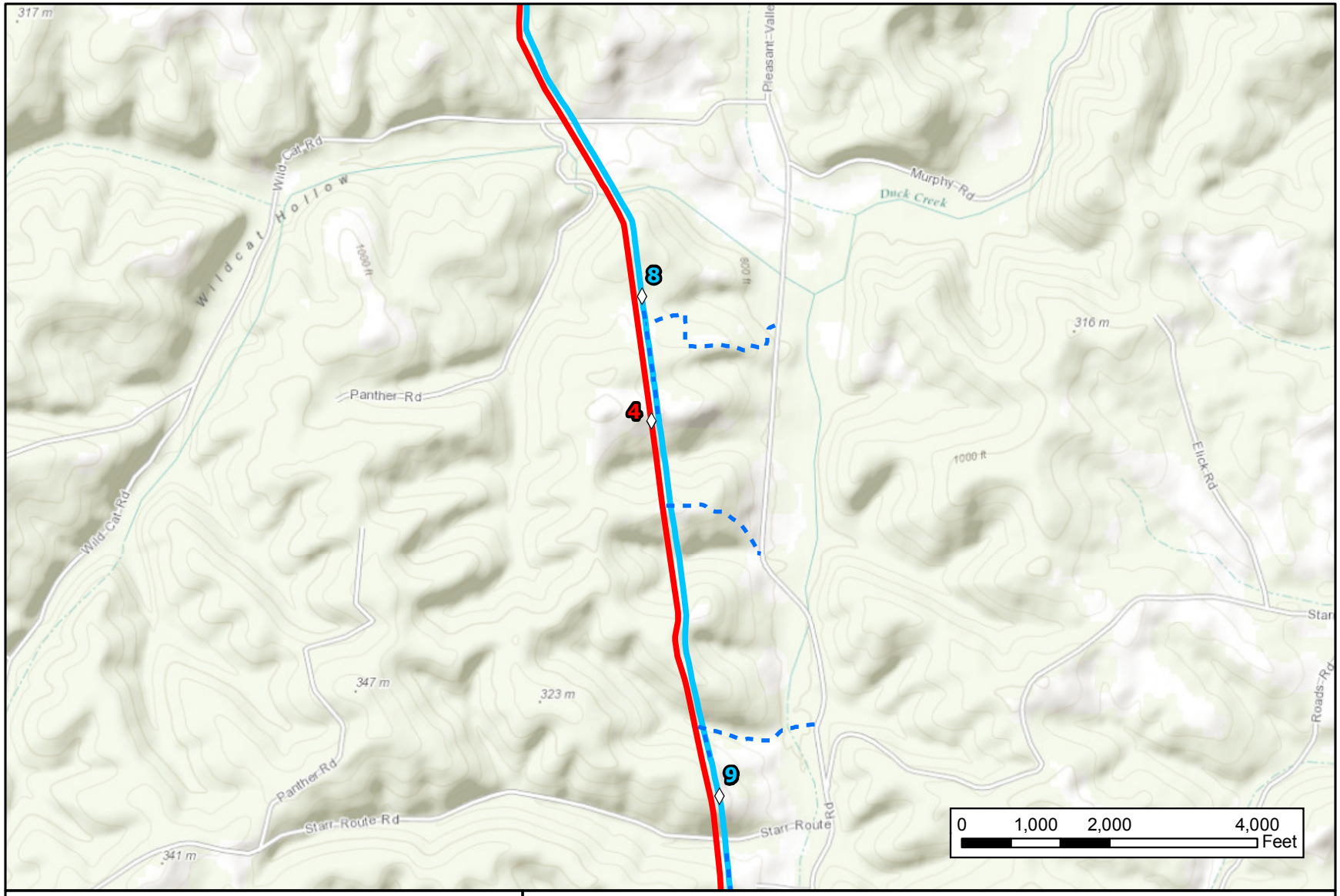
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-49
Leach XPress
Project Overview



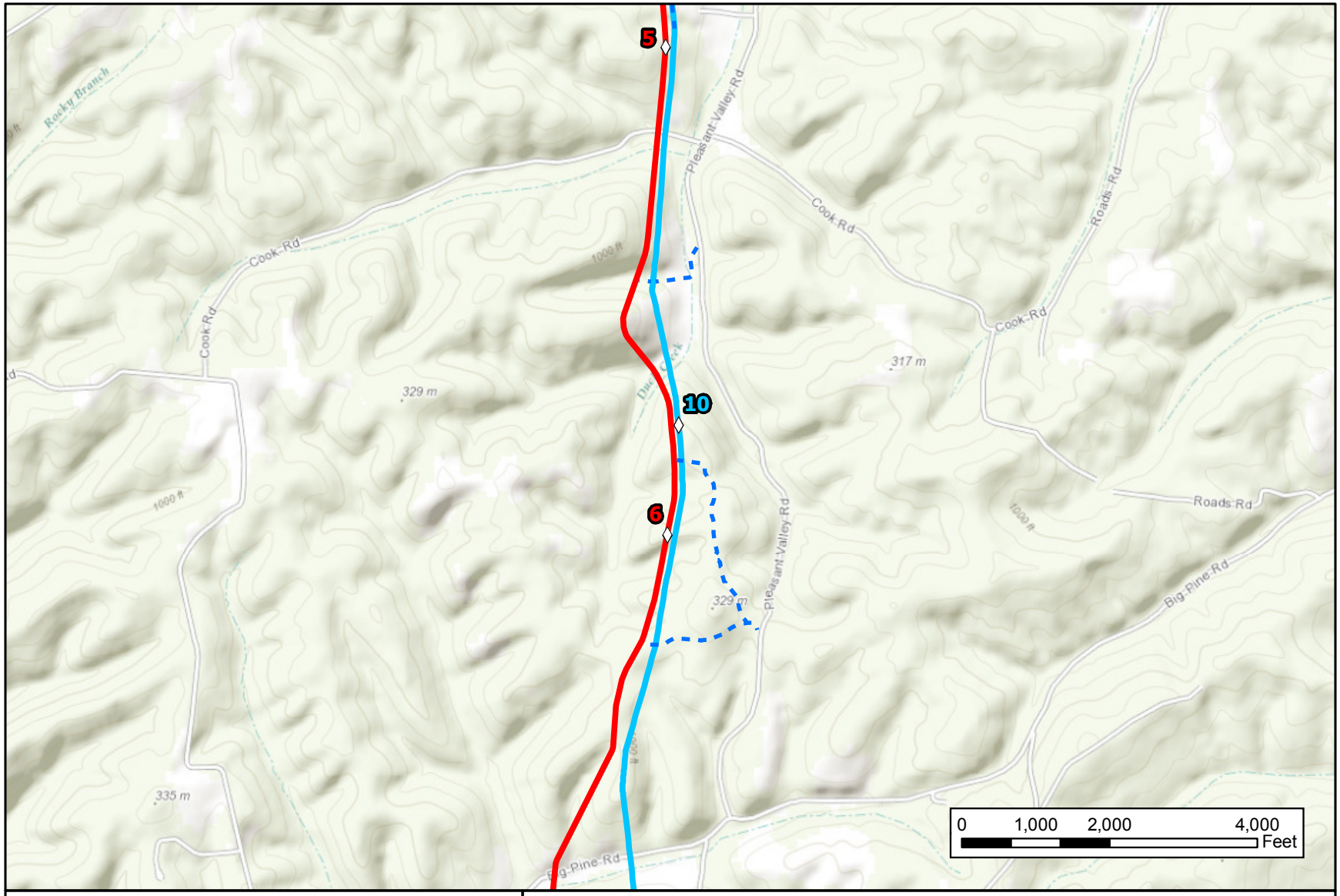
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-50
Leach XPress
Project Overview



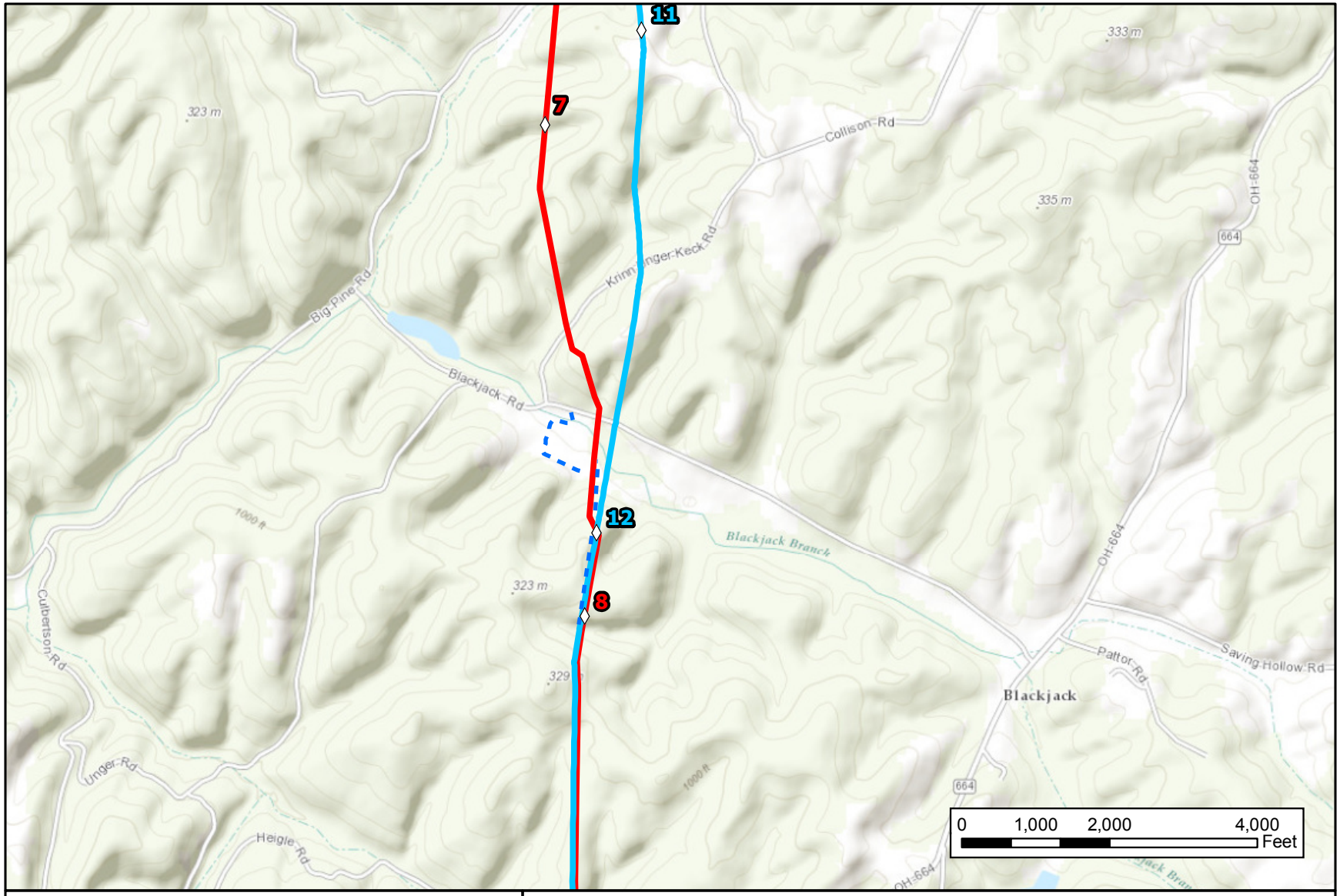
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-51
Leach XPress
Project Overview



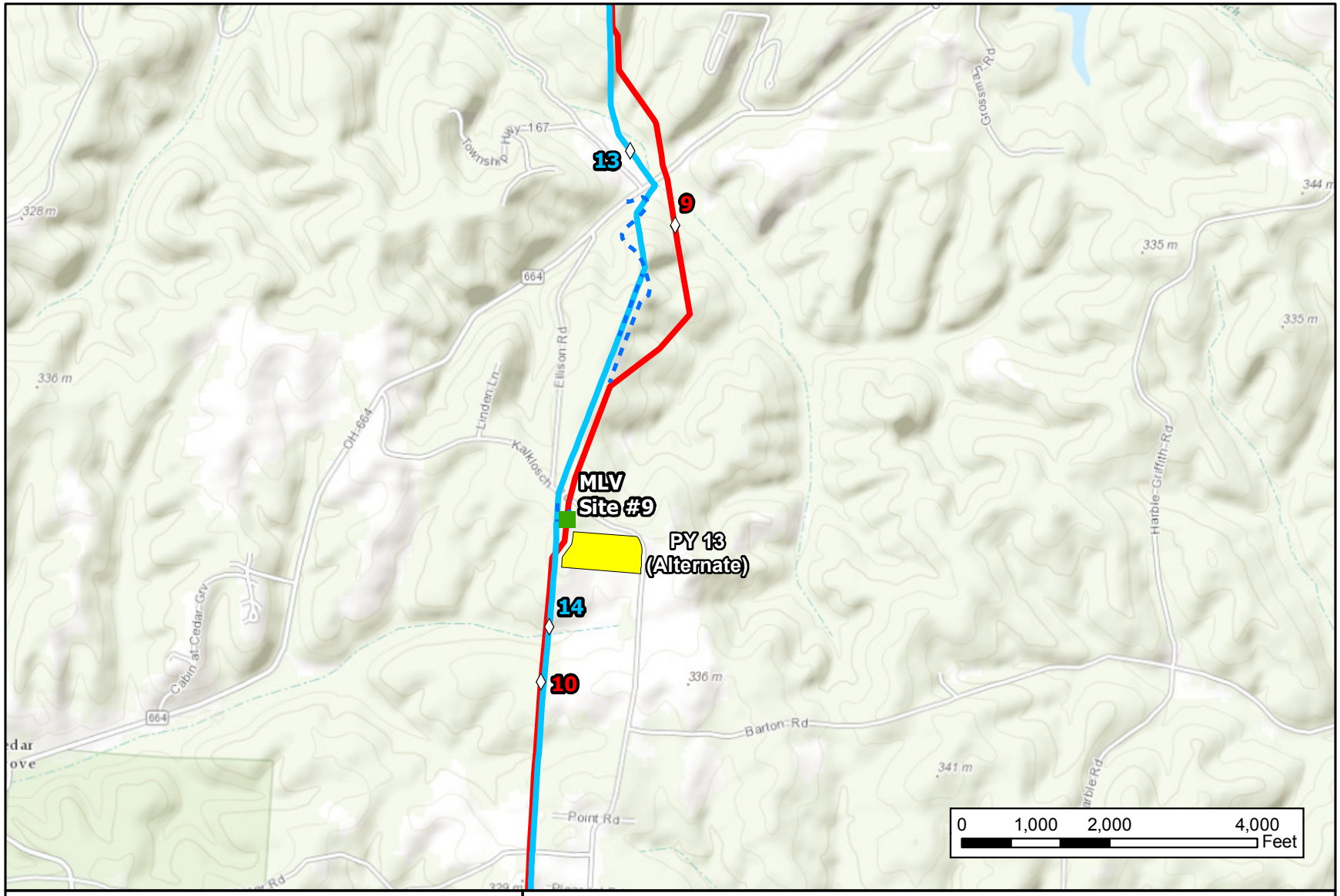
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-52
Leach XPress
Project Overview



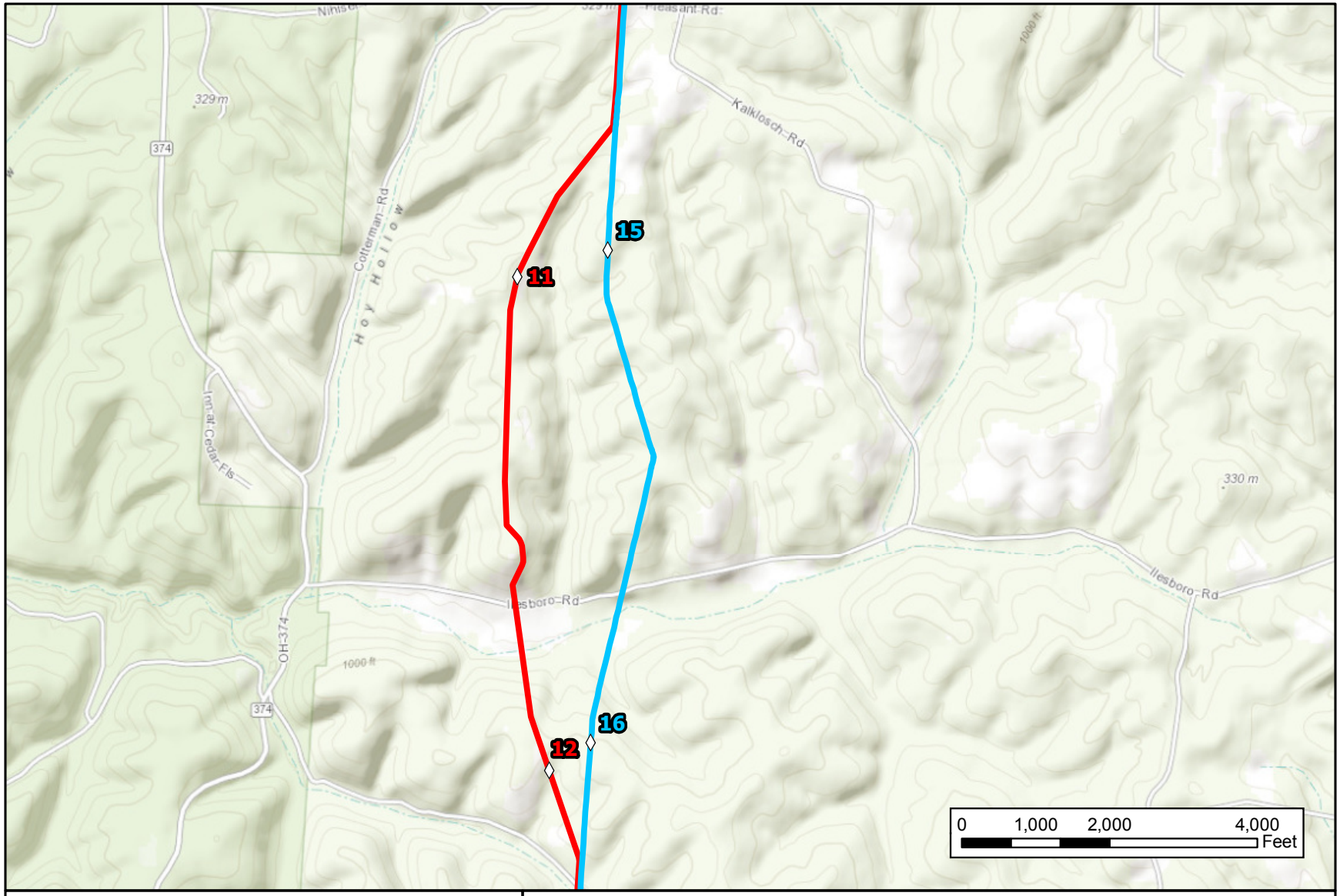
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-53
Leach XPress
Project Overview



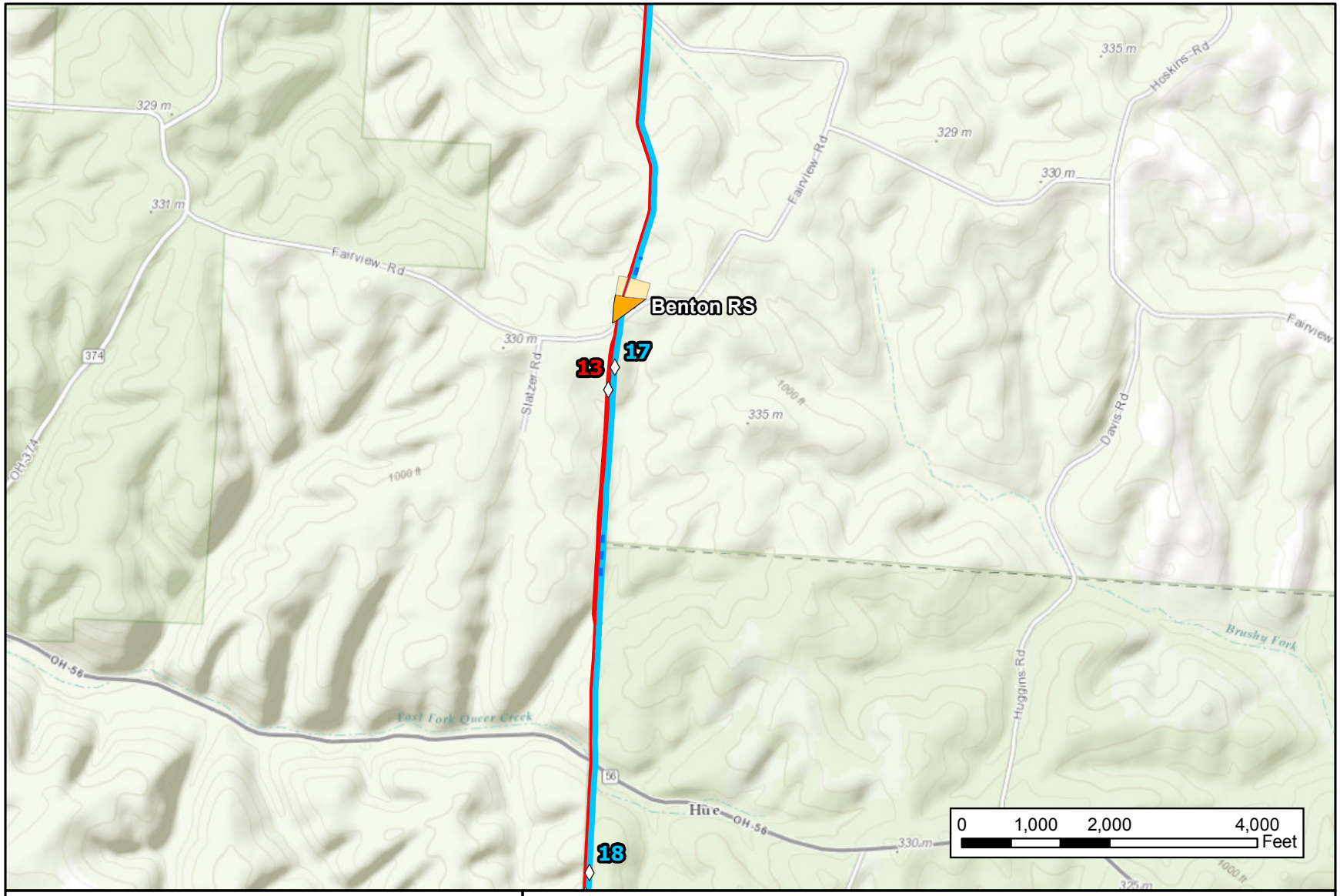
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-54
Leach XPress
Project Overview



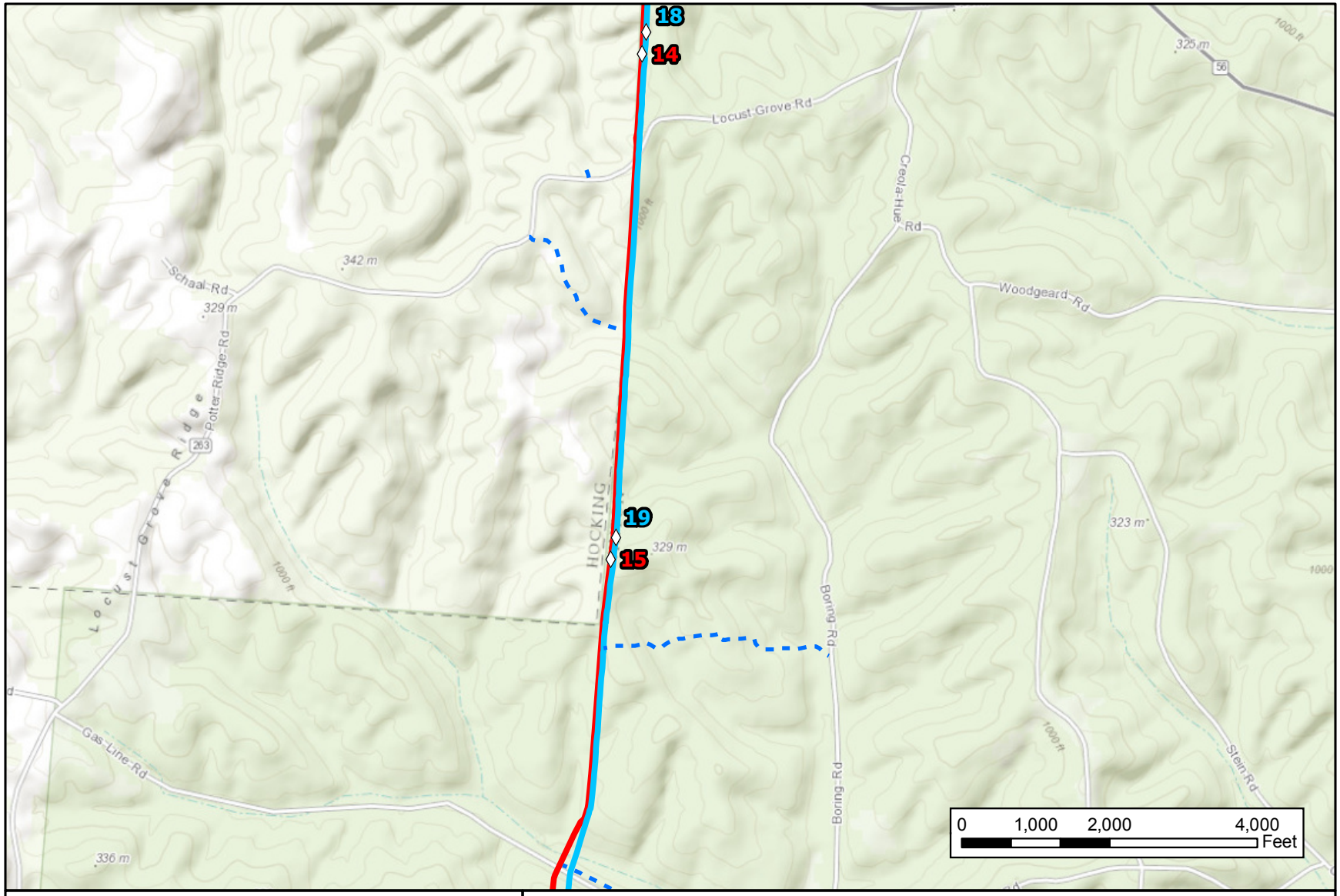
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-55
Leach XPress
Project Overview



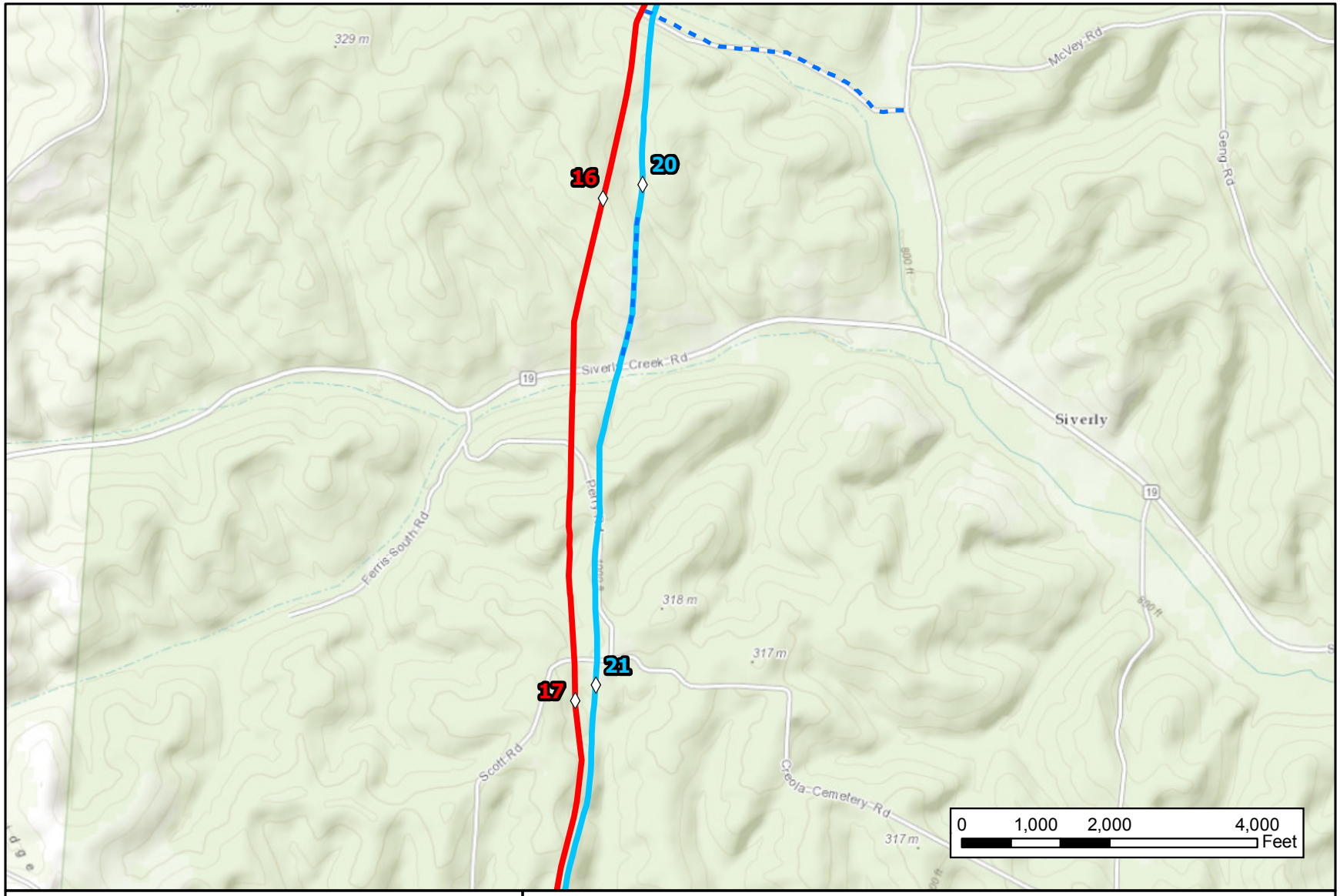
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-56
Leach XPress
Project Overview



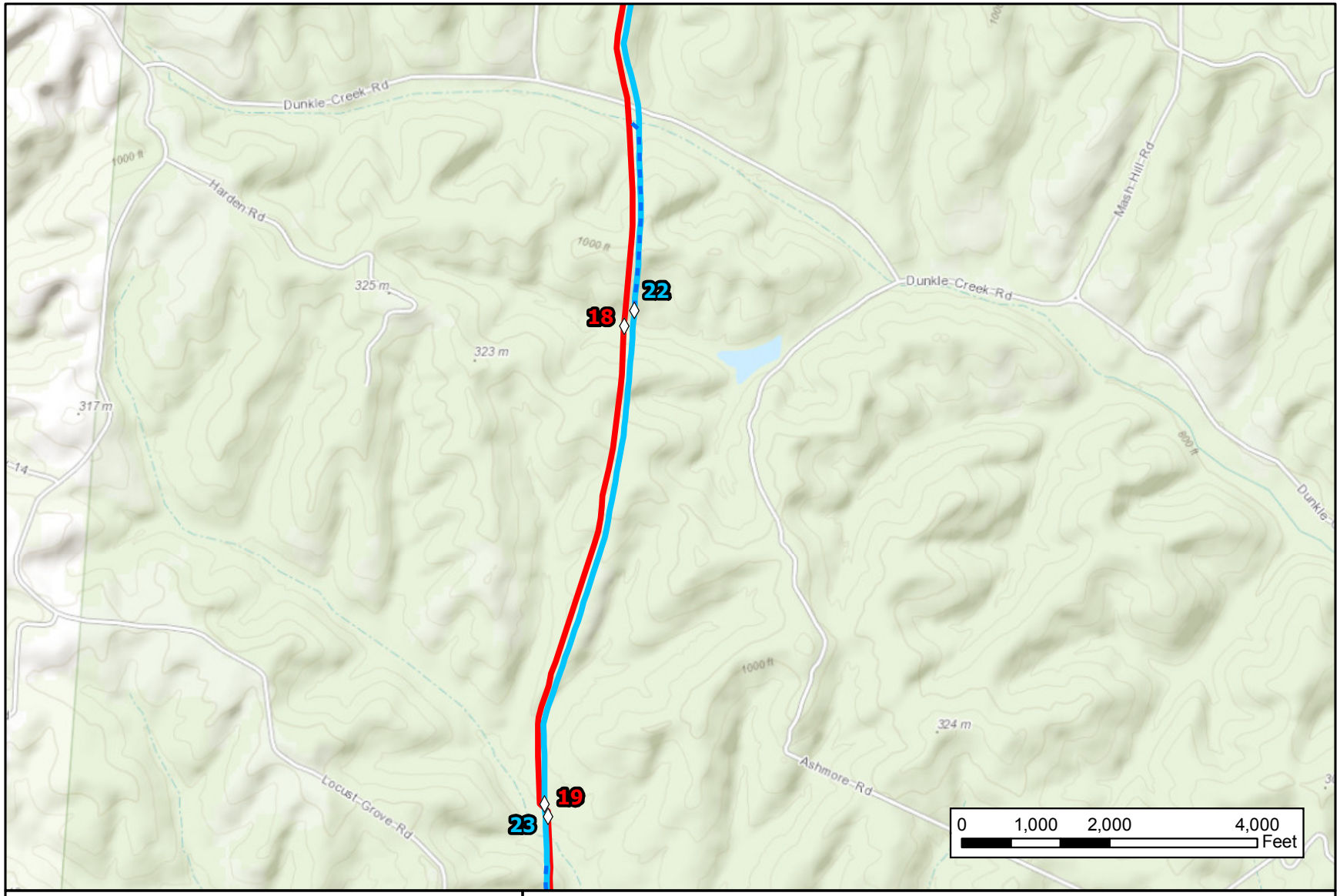
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-57
Leach XPress
Project Overview



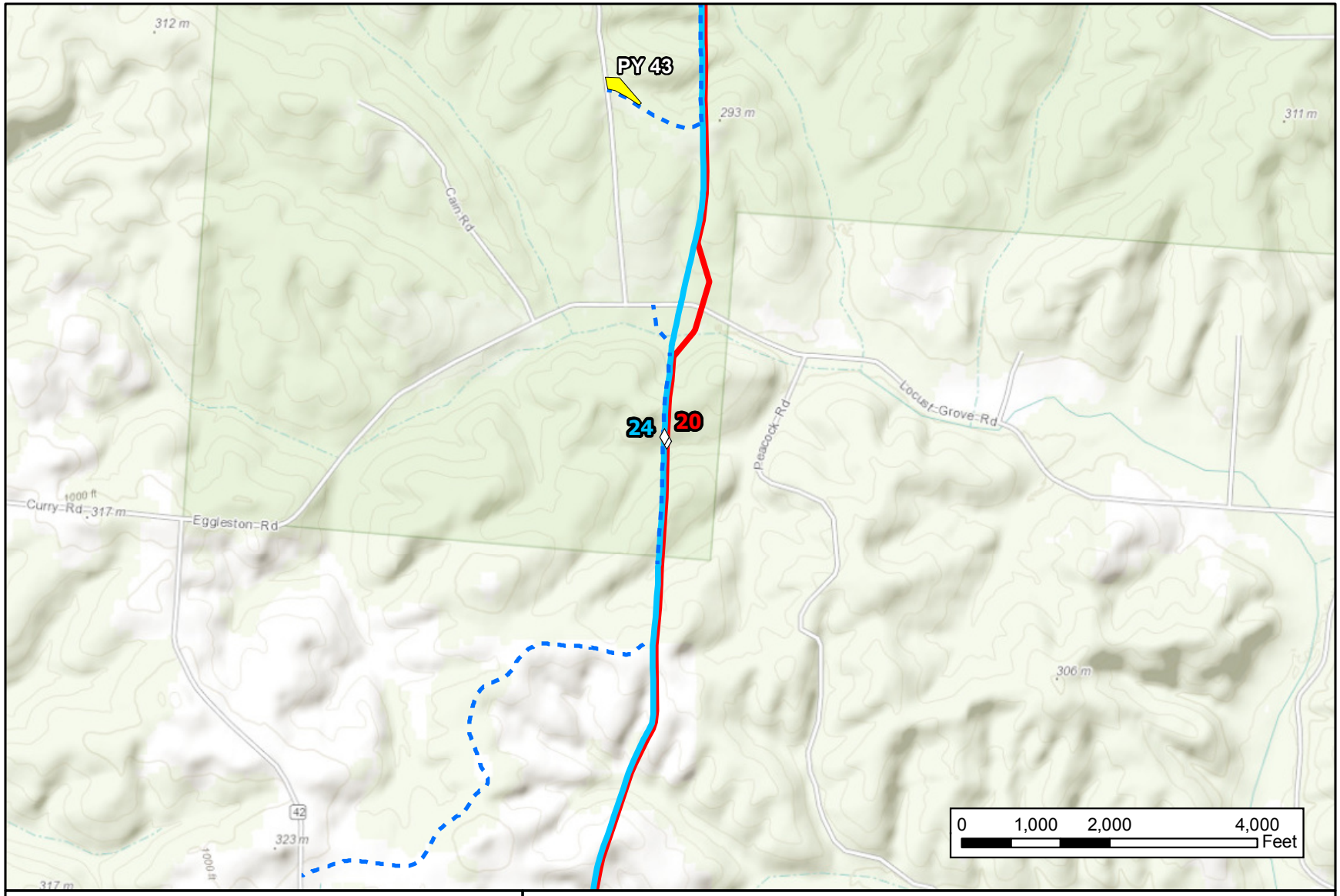
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-58
Leach XPress
Project Overview



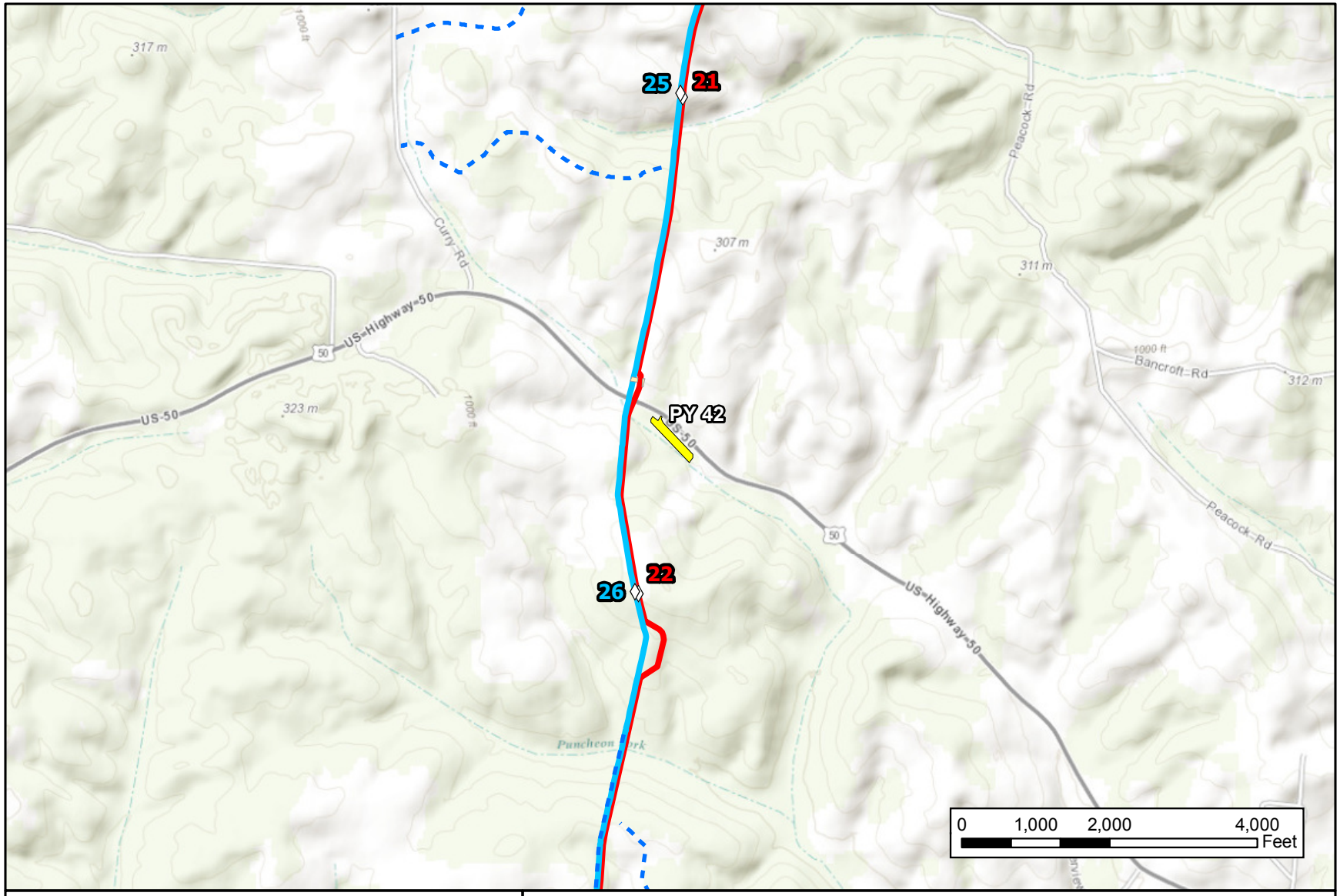
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-59
Leach XPress
Project Overview



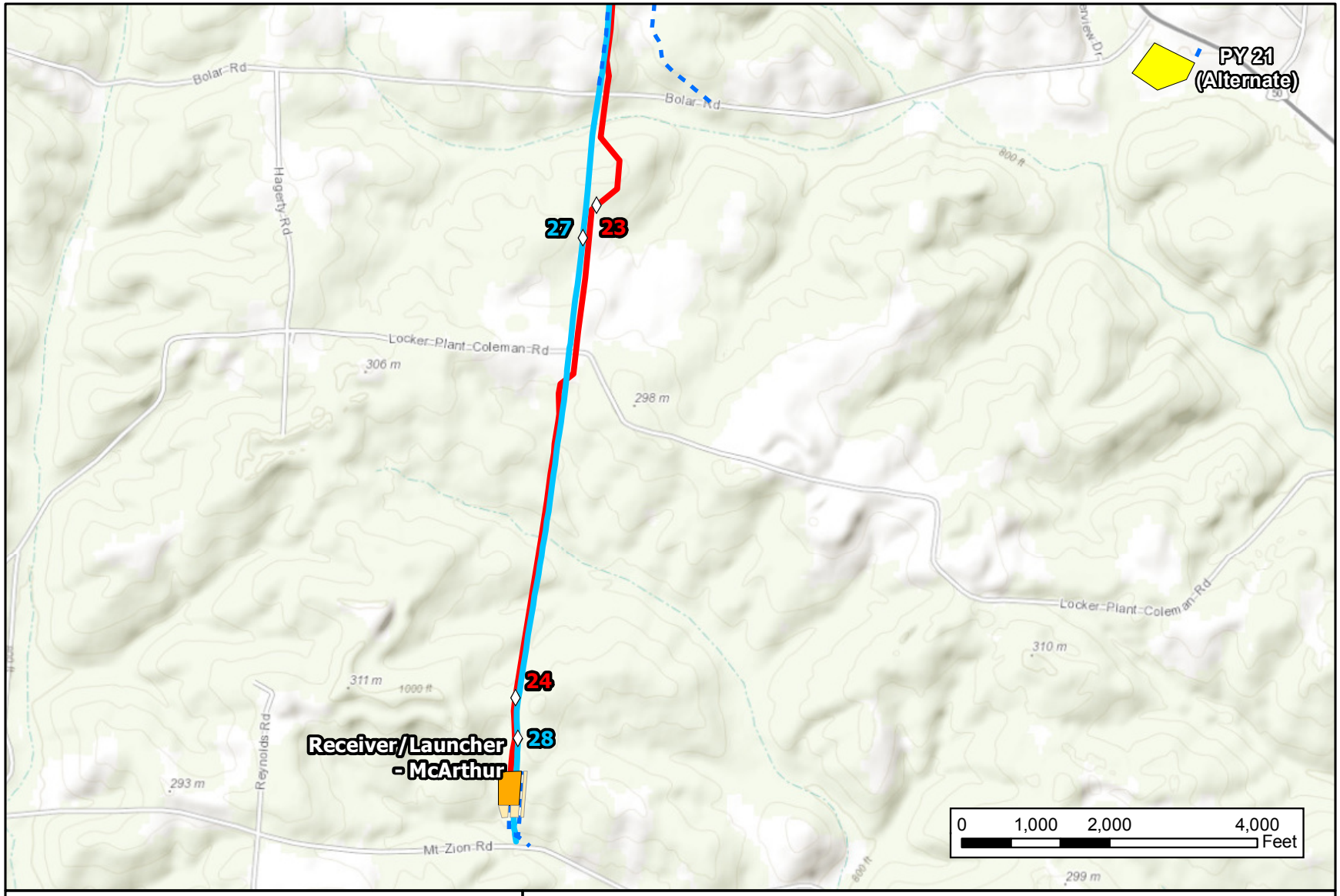
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-60
Leach XPress
Project Overview



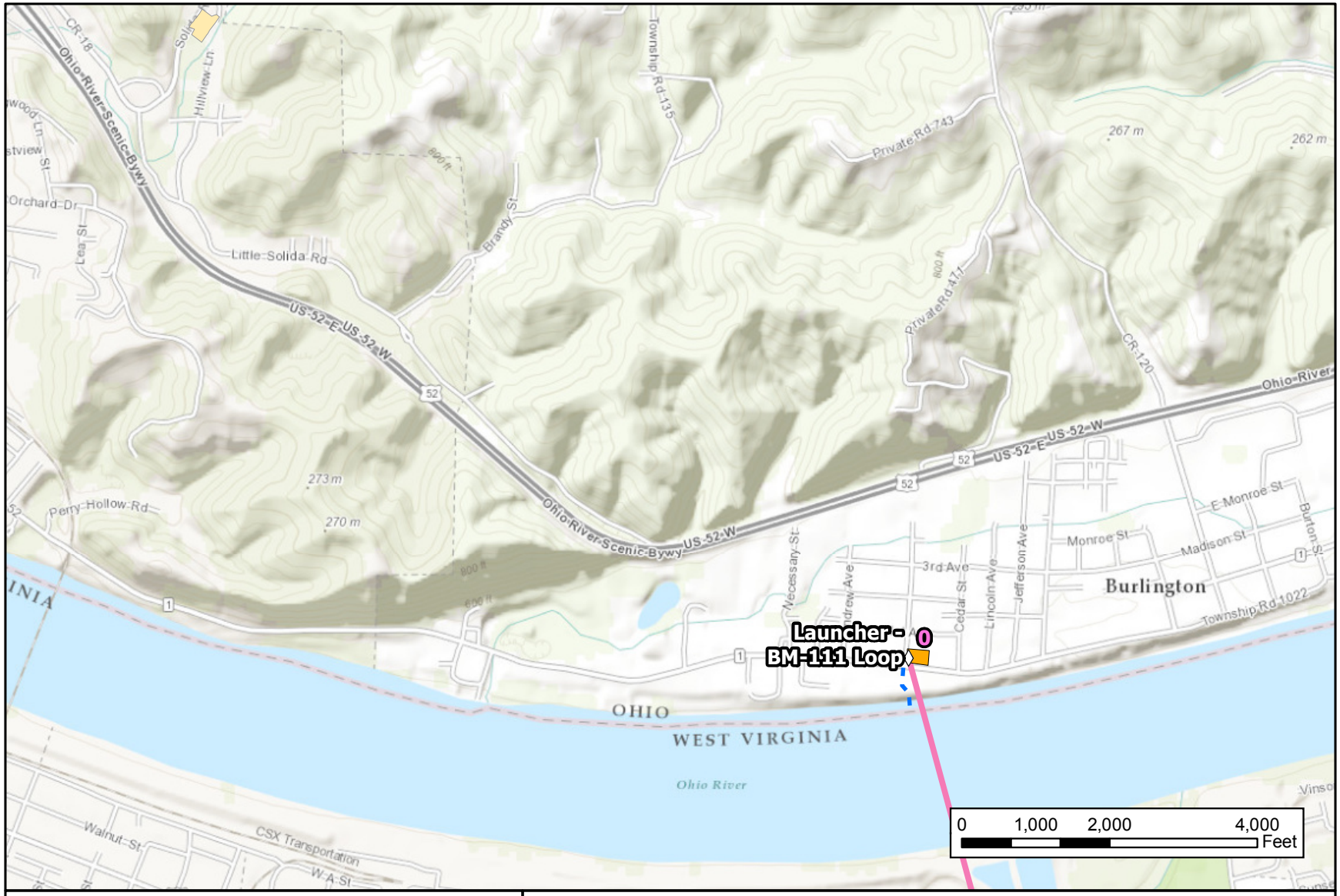
LEX
LEX1
R-801 Loop
R-801 Loop
R-501 Abandonment
Main line Valve
Access Road
Suction Line
Permanent Site Facility
Temporary Workspace
Pipe Yards
Milepost

Appendix B-61
Leach XPress
Project Overview



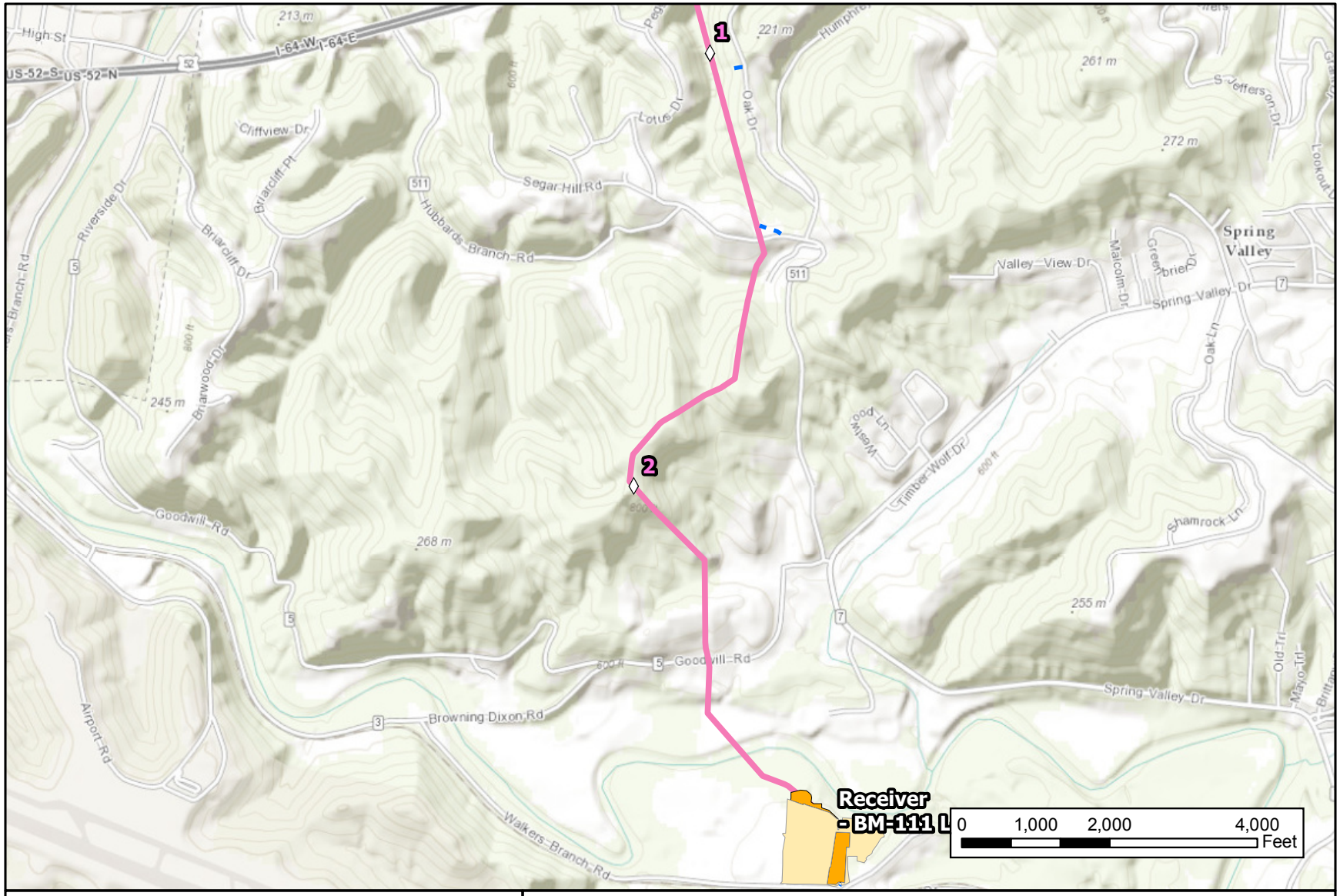
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-62
Leach XPress
Project Overview



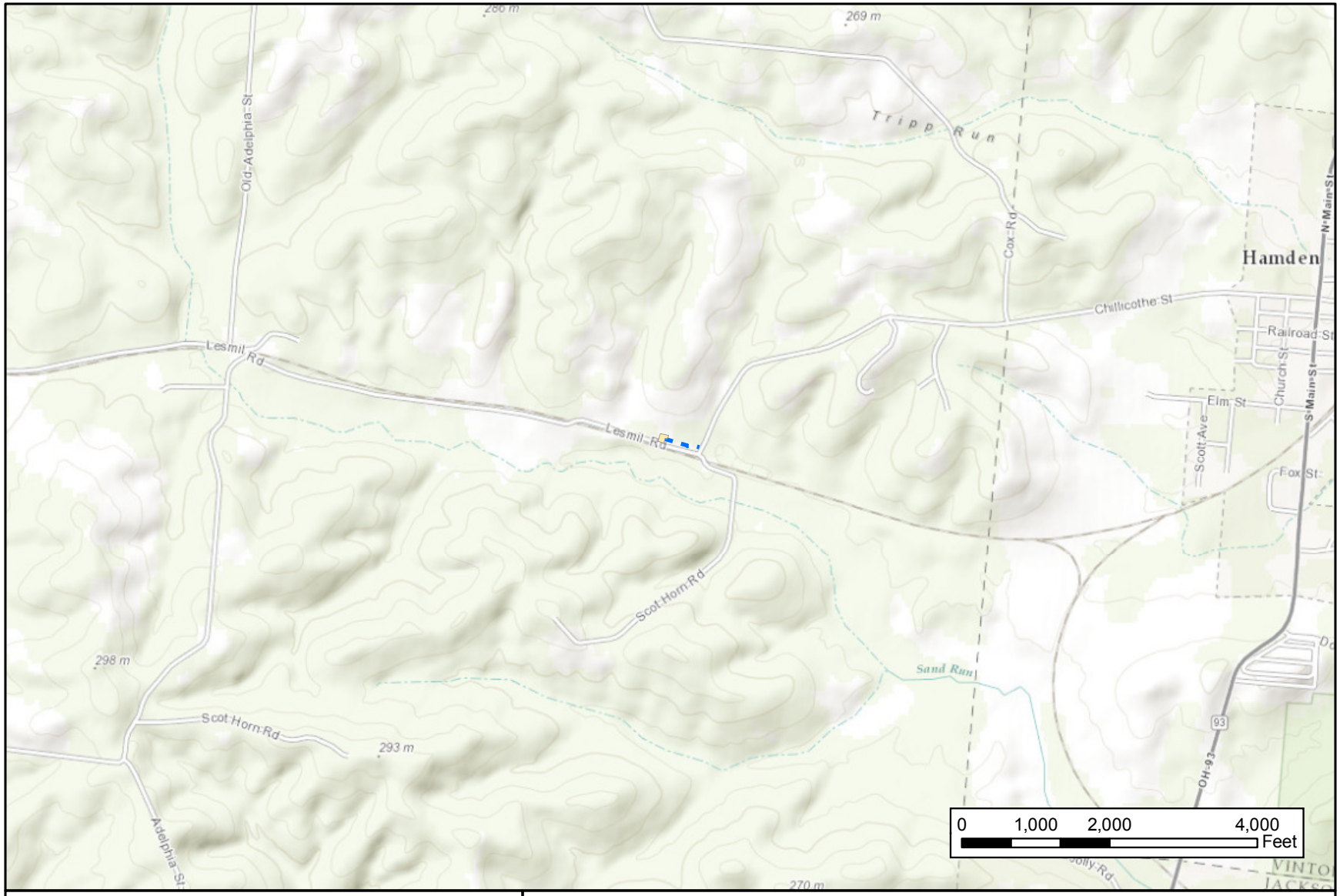
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-63
Leach XPress
Project Overview



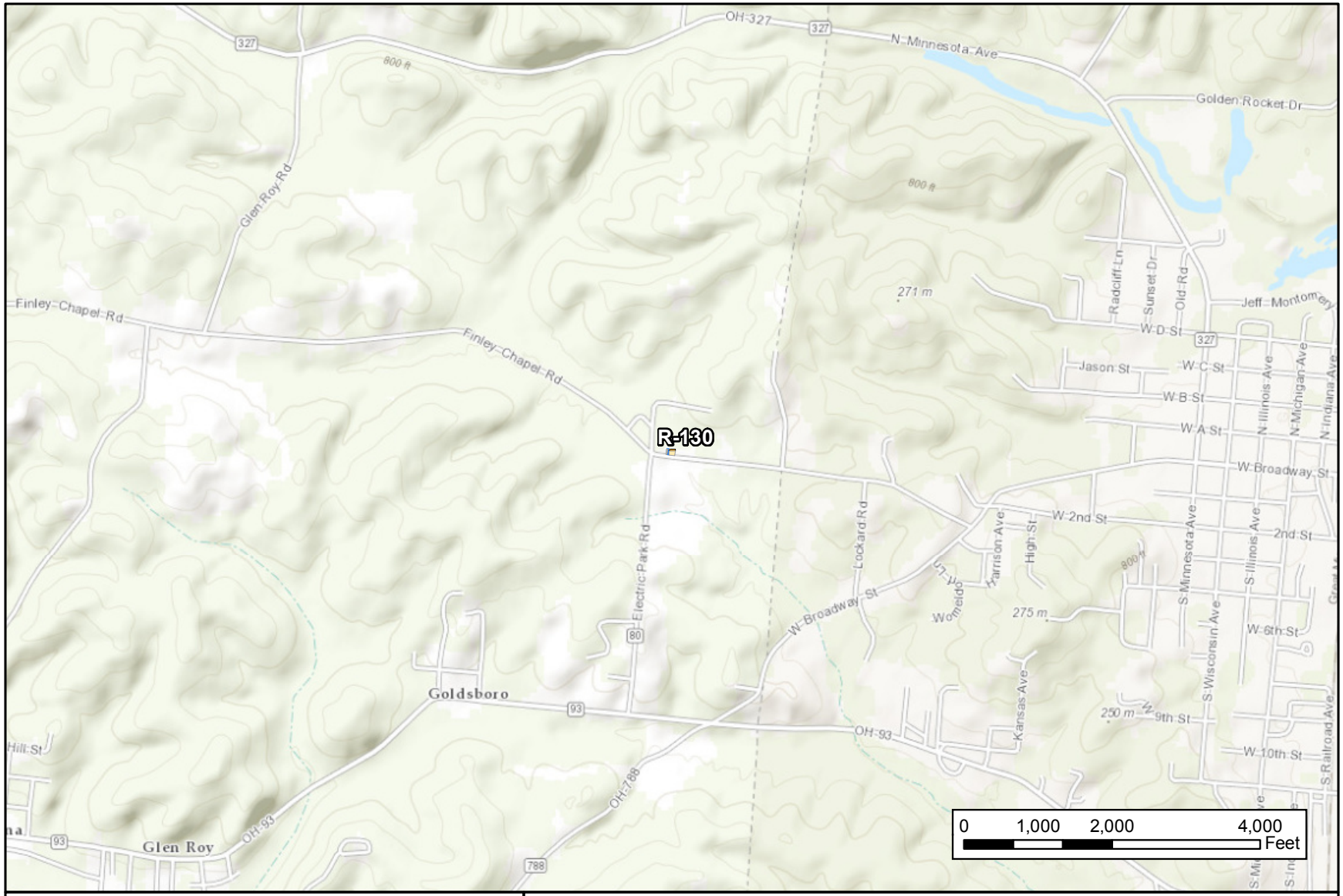
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-64
Leach XPress
Project Overview



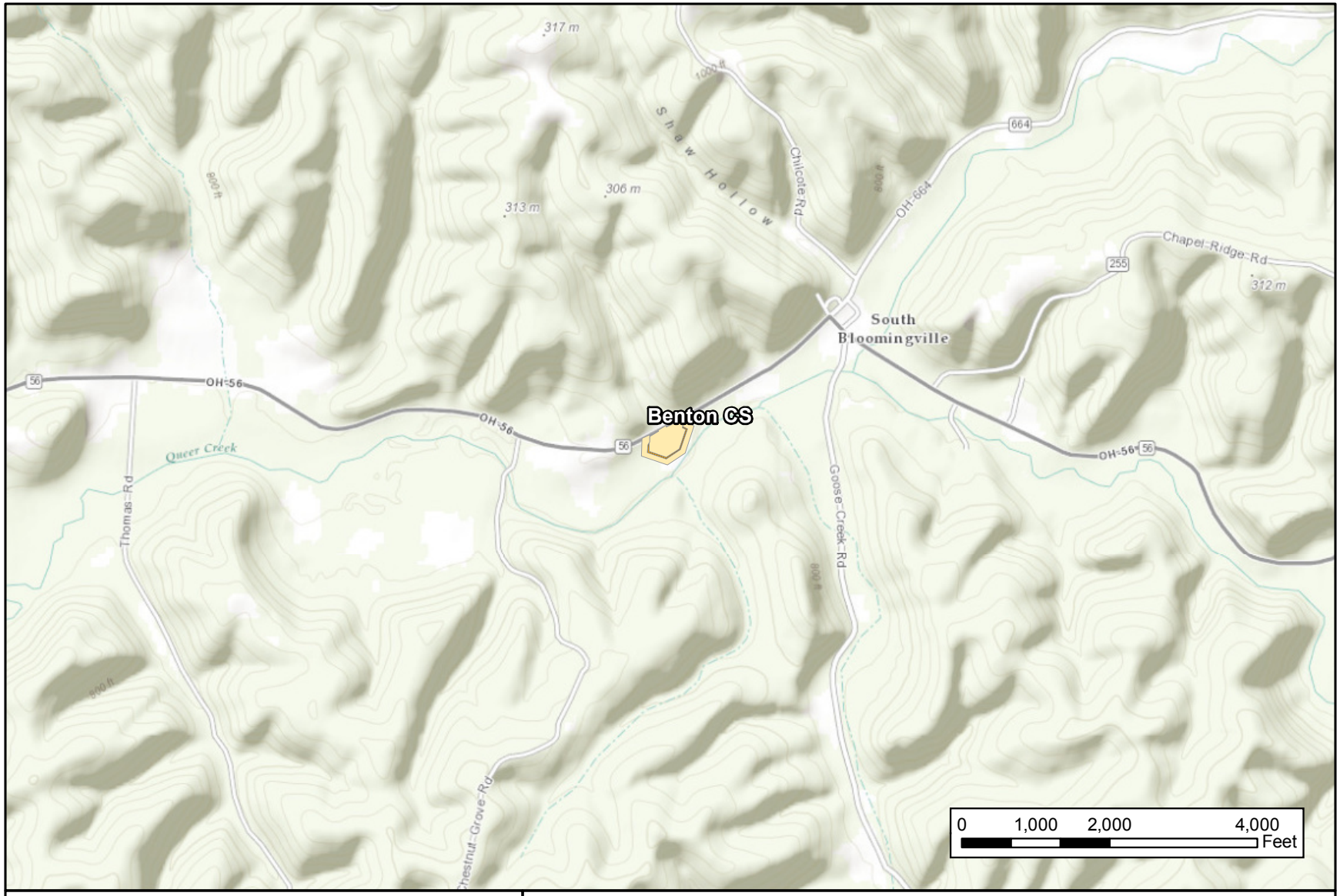
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-65
Leach XPress
Project Overview



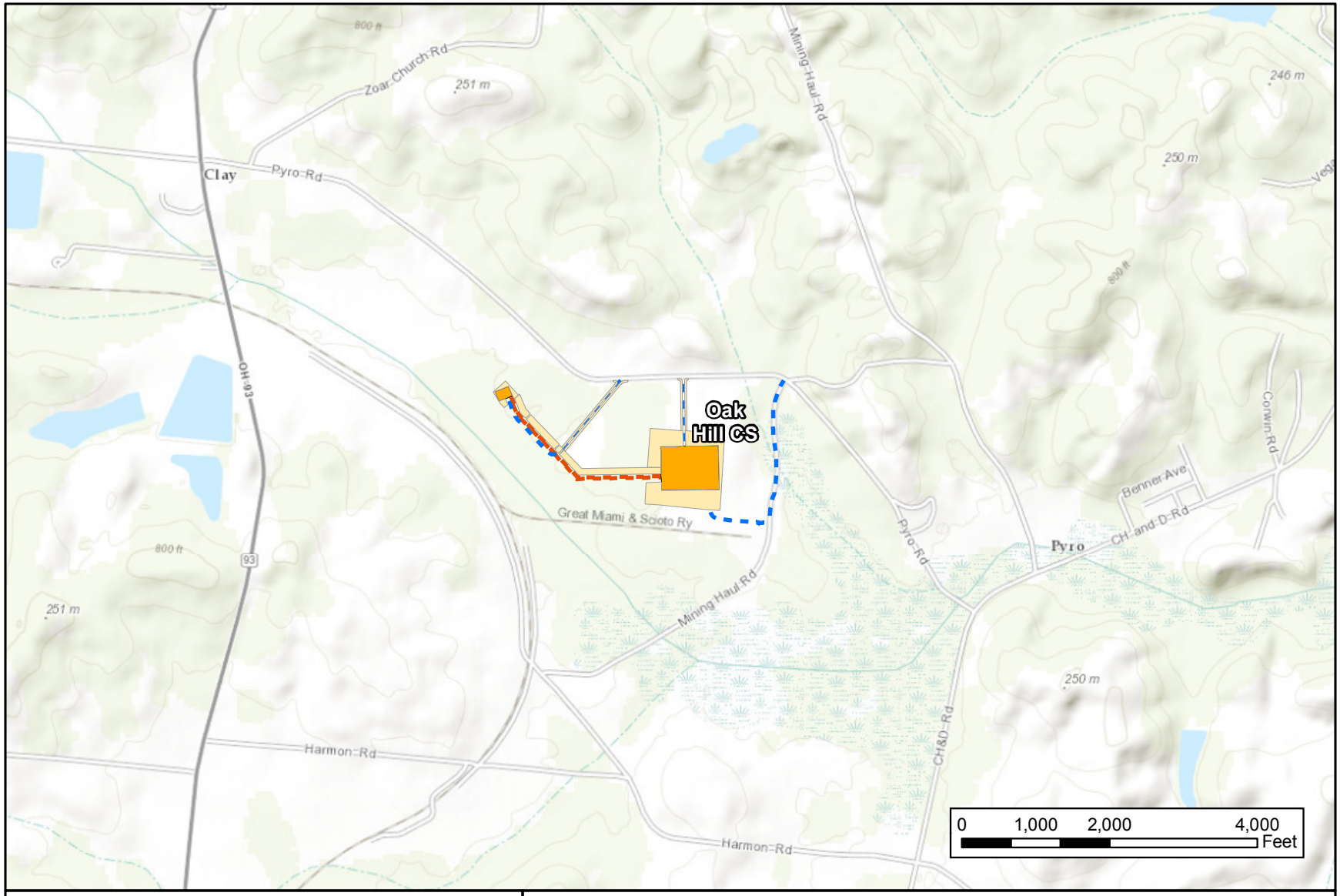
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-66
Leach XPress
Project Overview



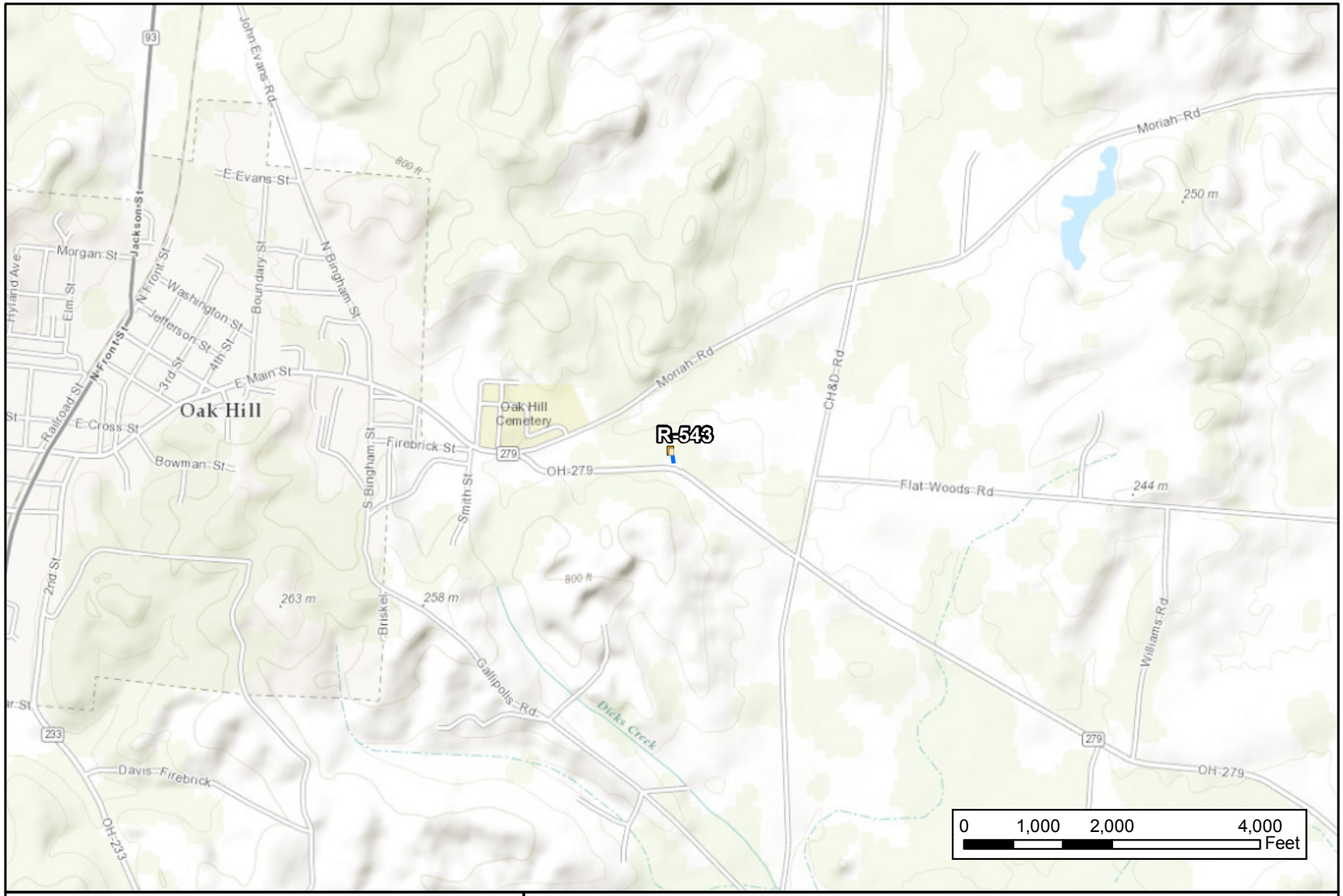
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-67
Leach XPress
Project Overview



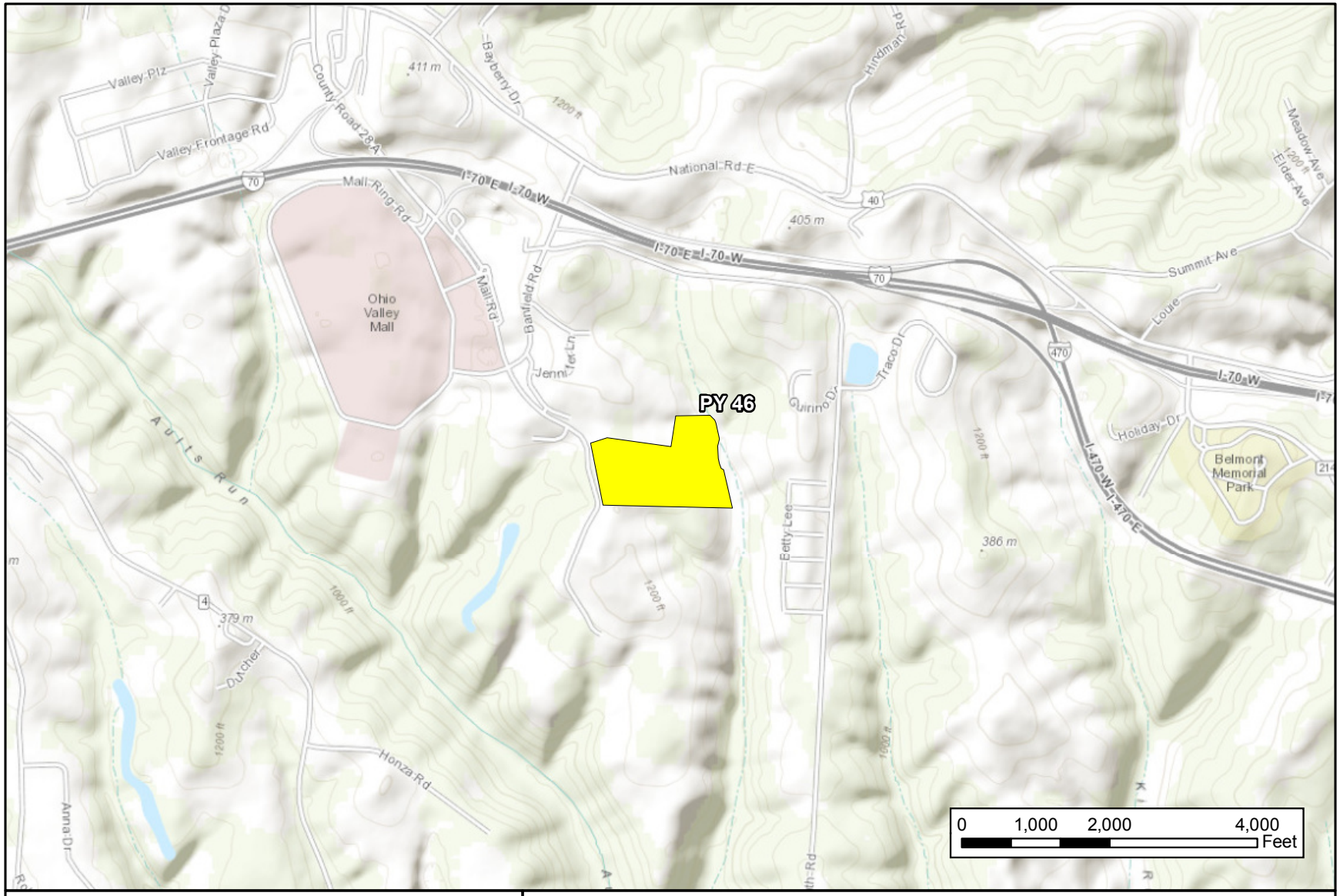
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-68
Leach XPress
Project Overview



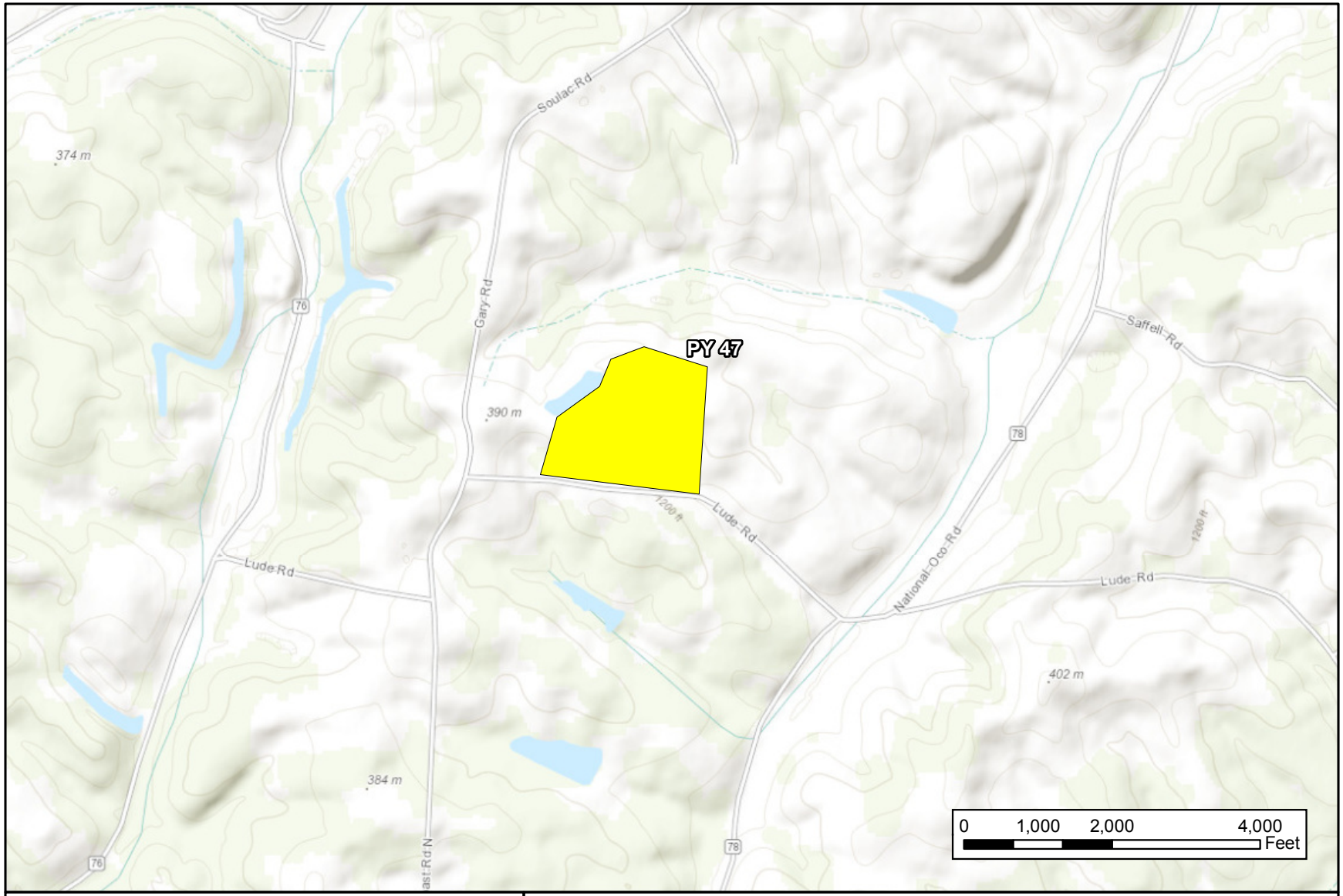
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-69
Leach XPress
Project Overview



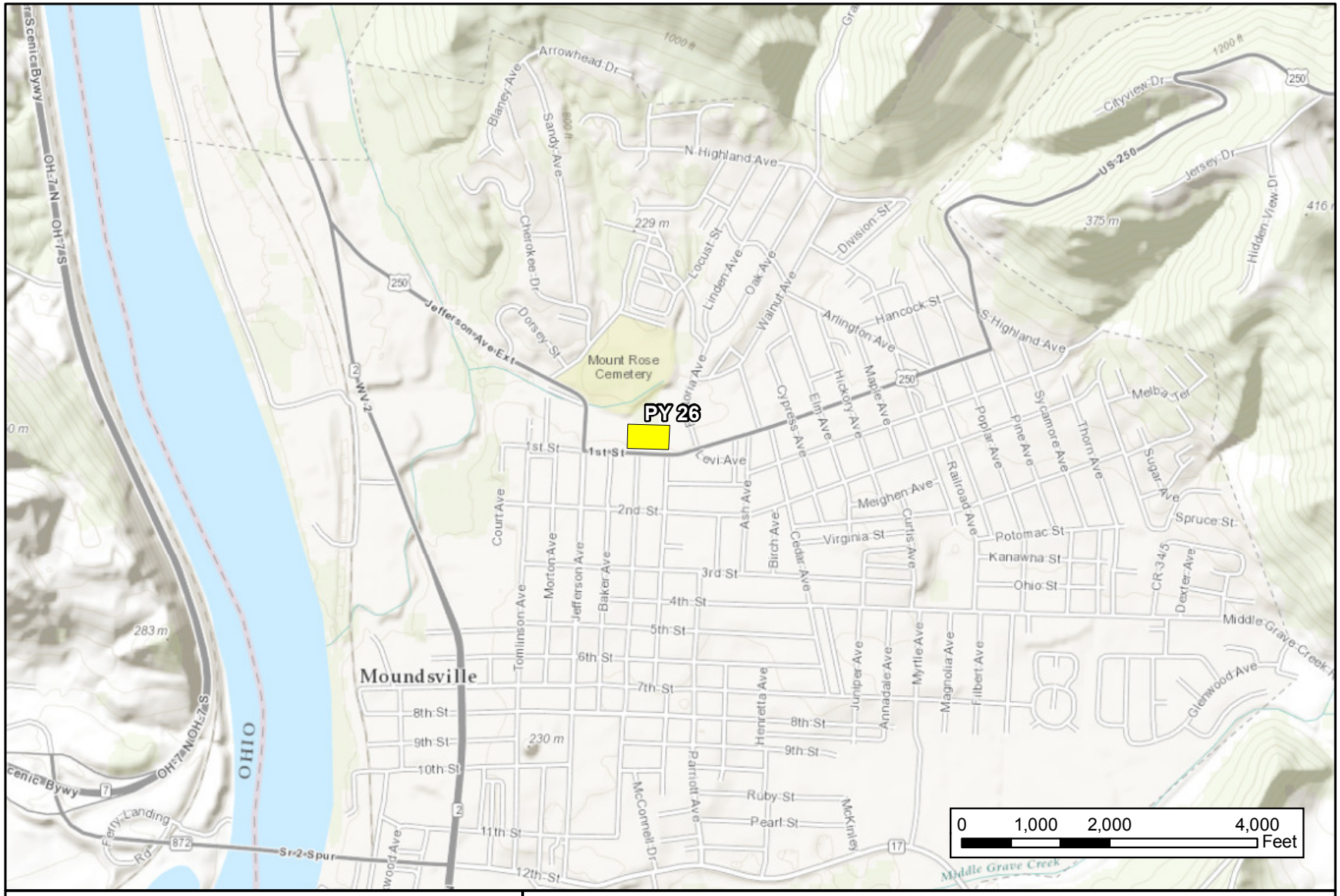
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-70
Leach XPress
Project Overview



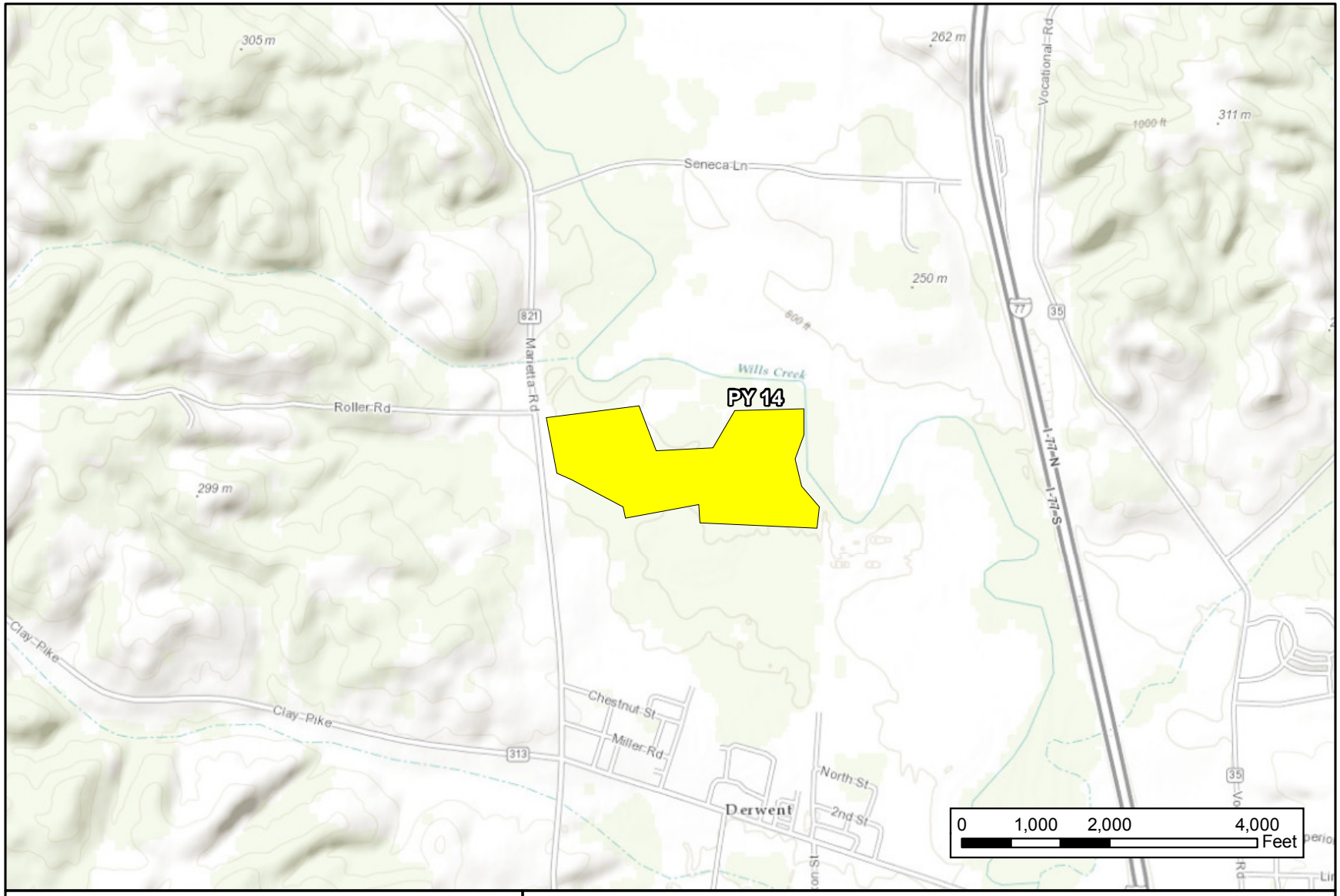
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-71
Leach XPress
Project Overview



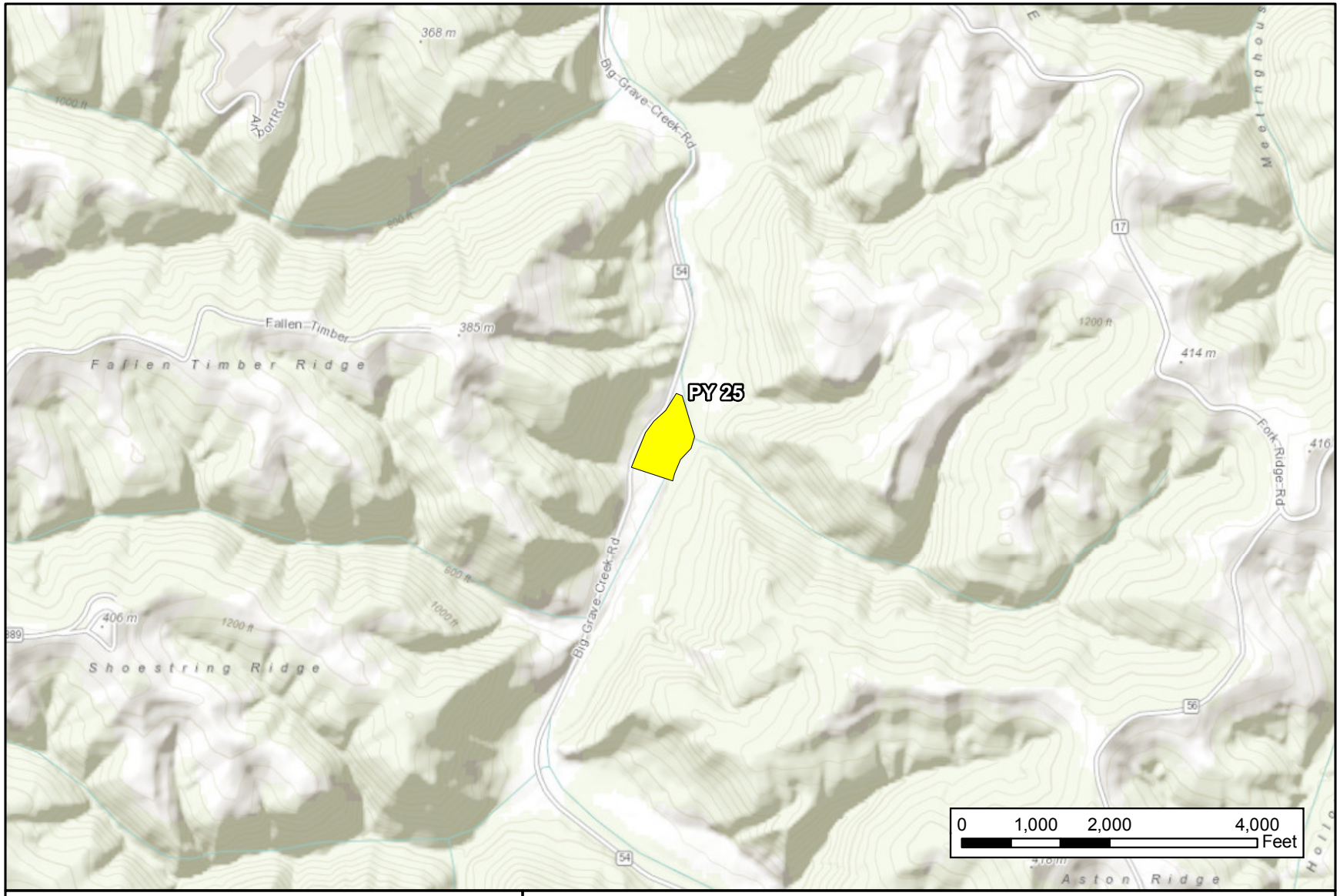
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-72
Leach XPress
Project Overview



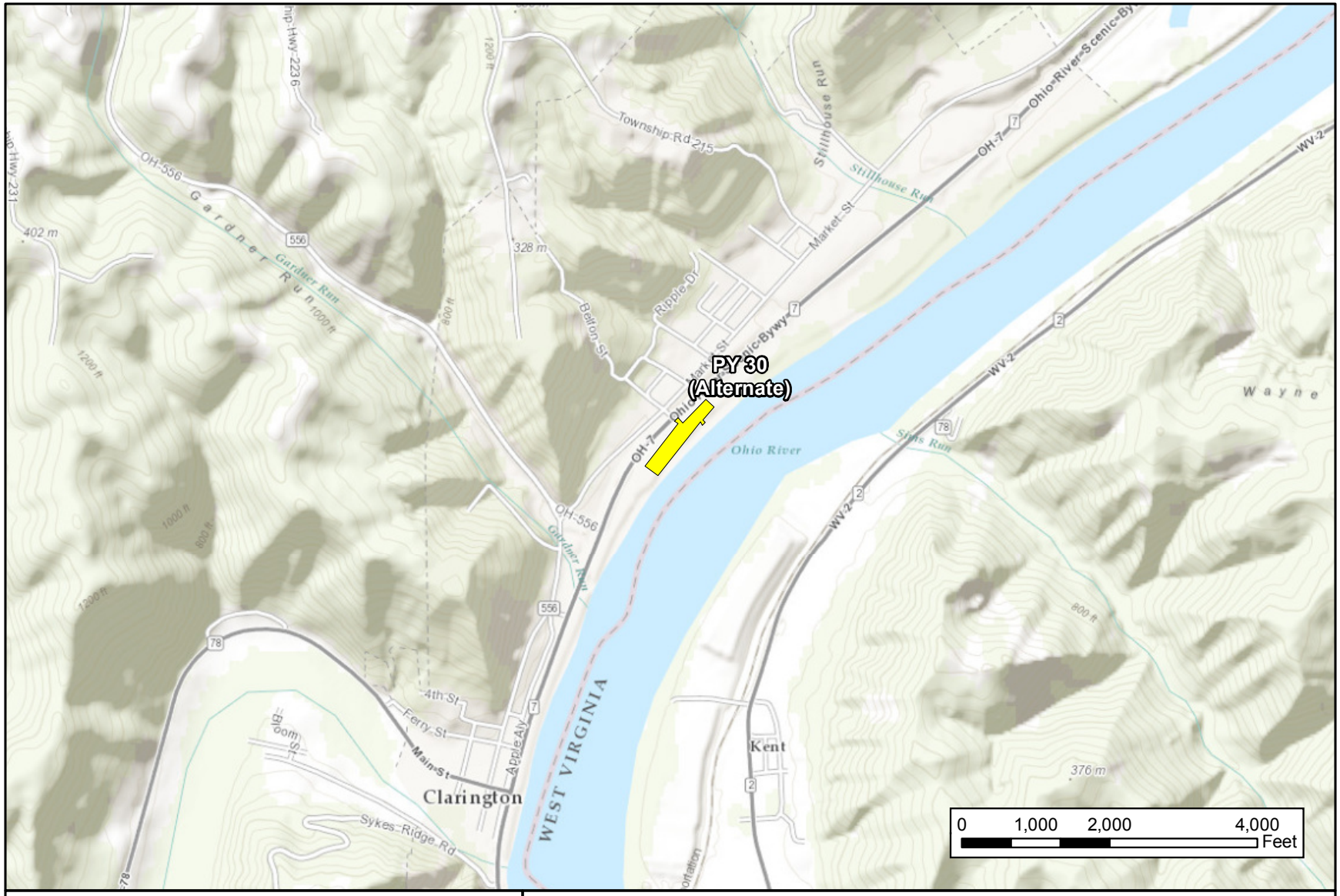
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-73
Leach XPress
Project Overview



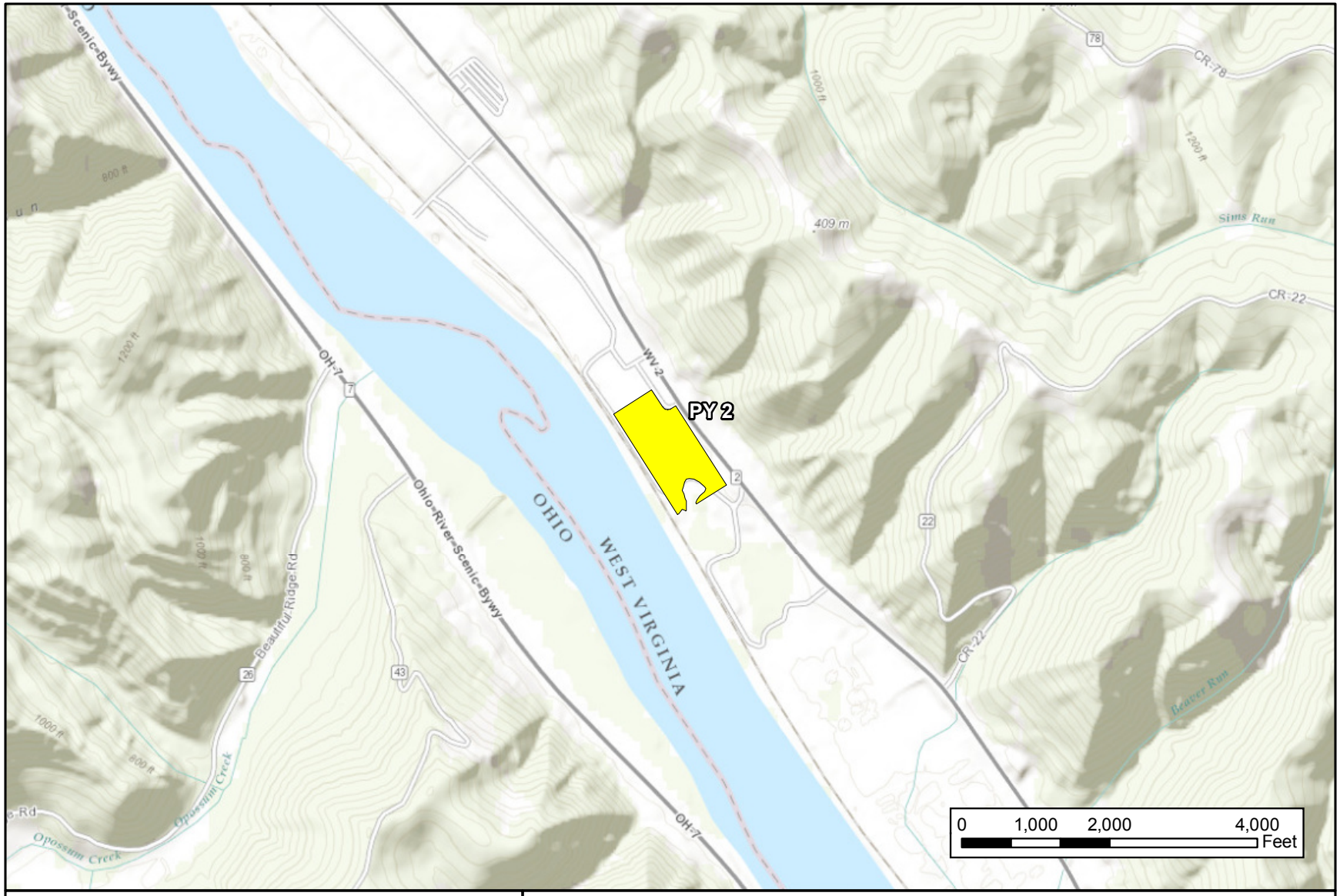
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-74
Leach XPress
Project Overview



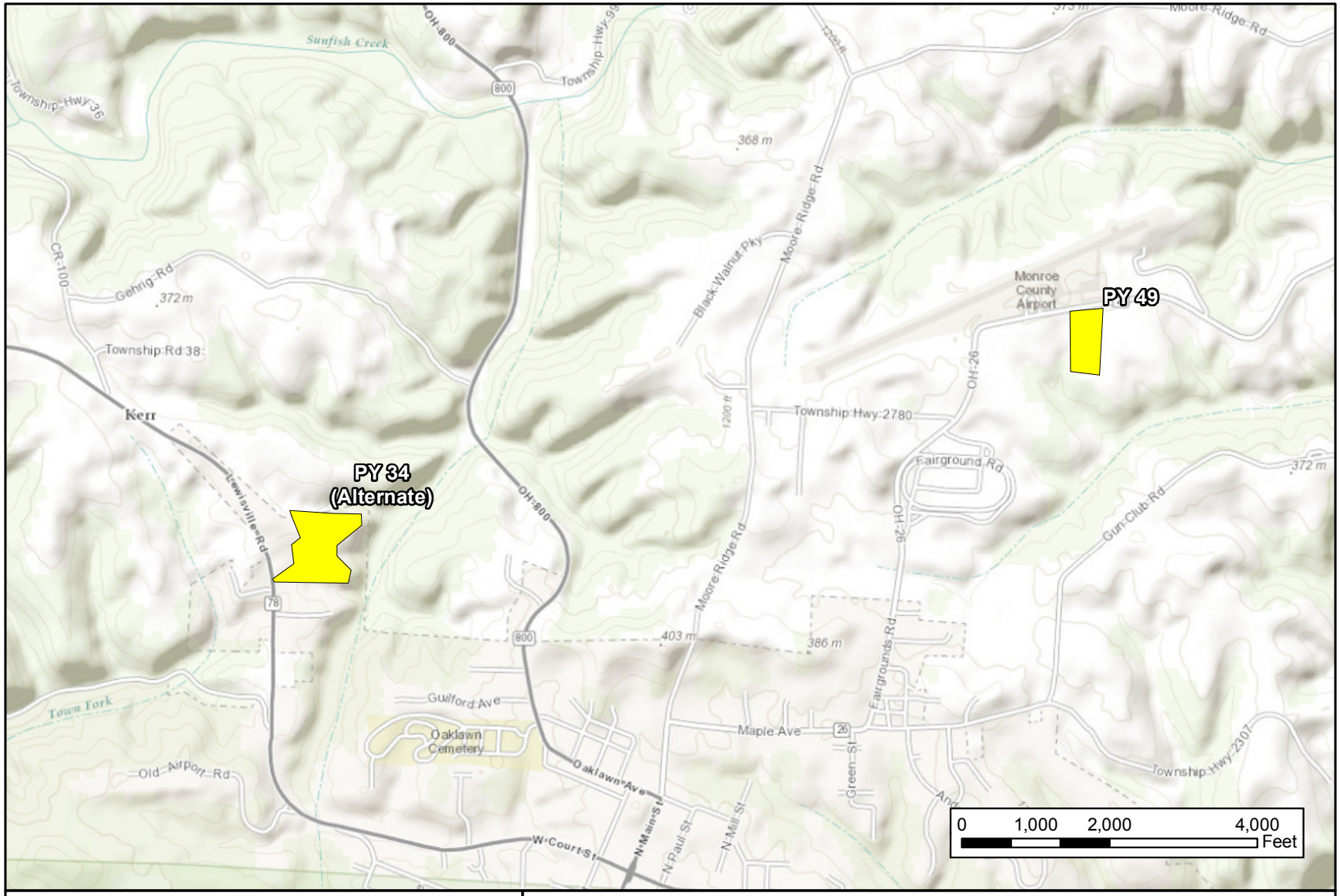
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-75
Leach XPress
Project Overview



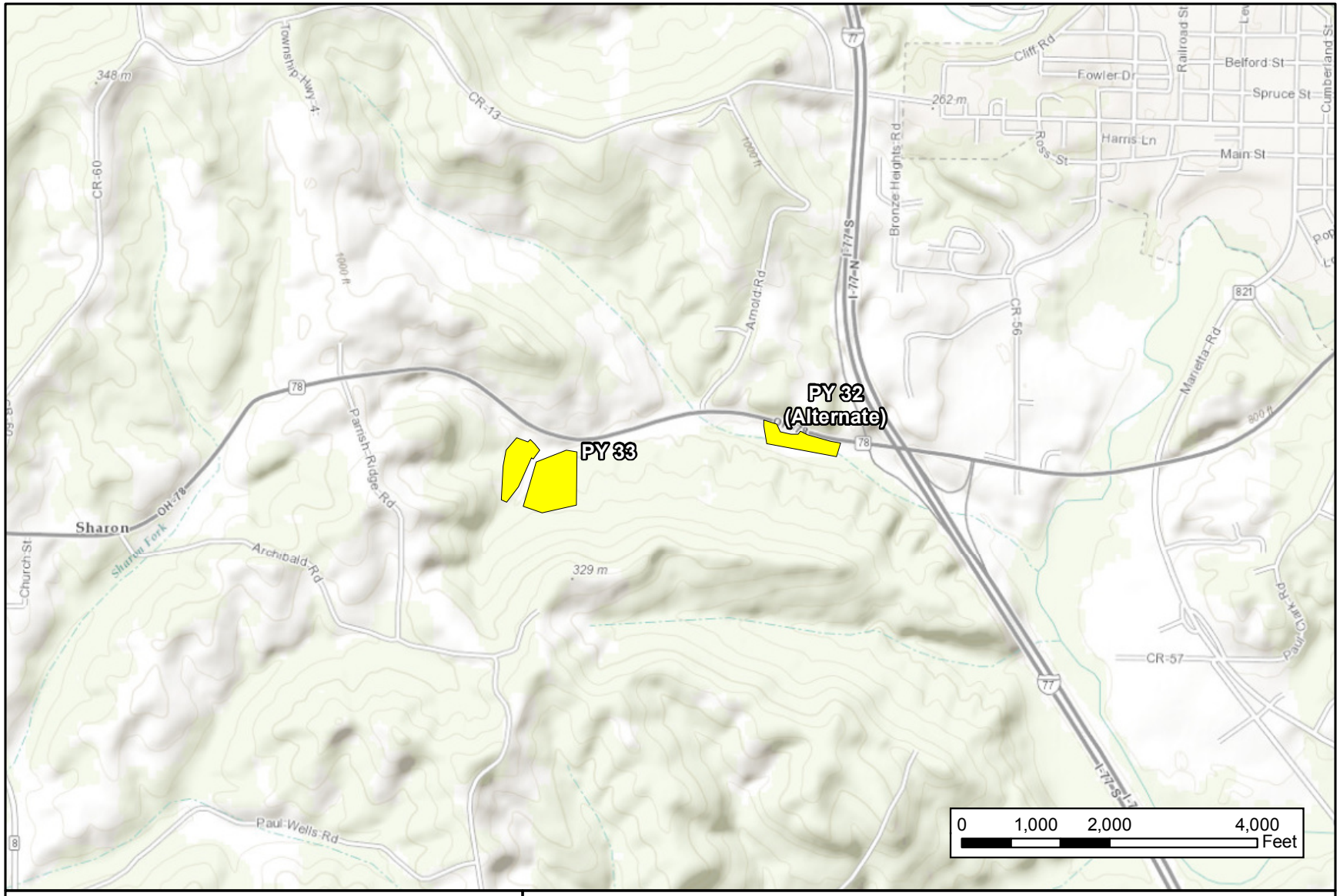
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-76
Leach XPress
Project Overview



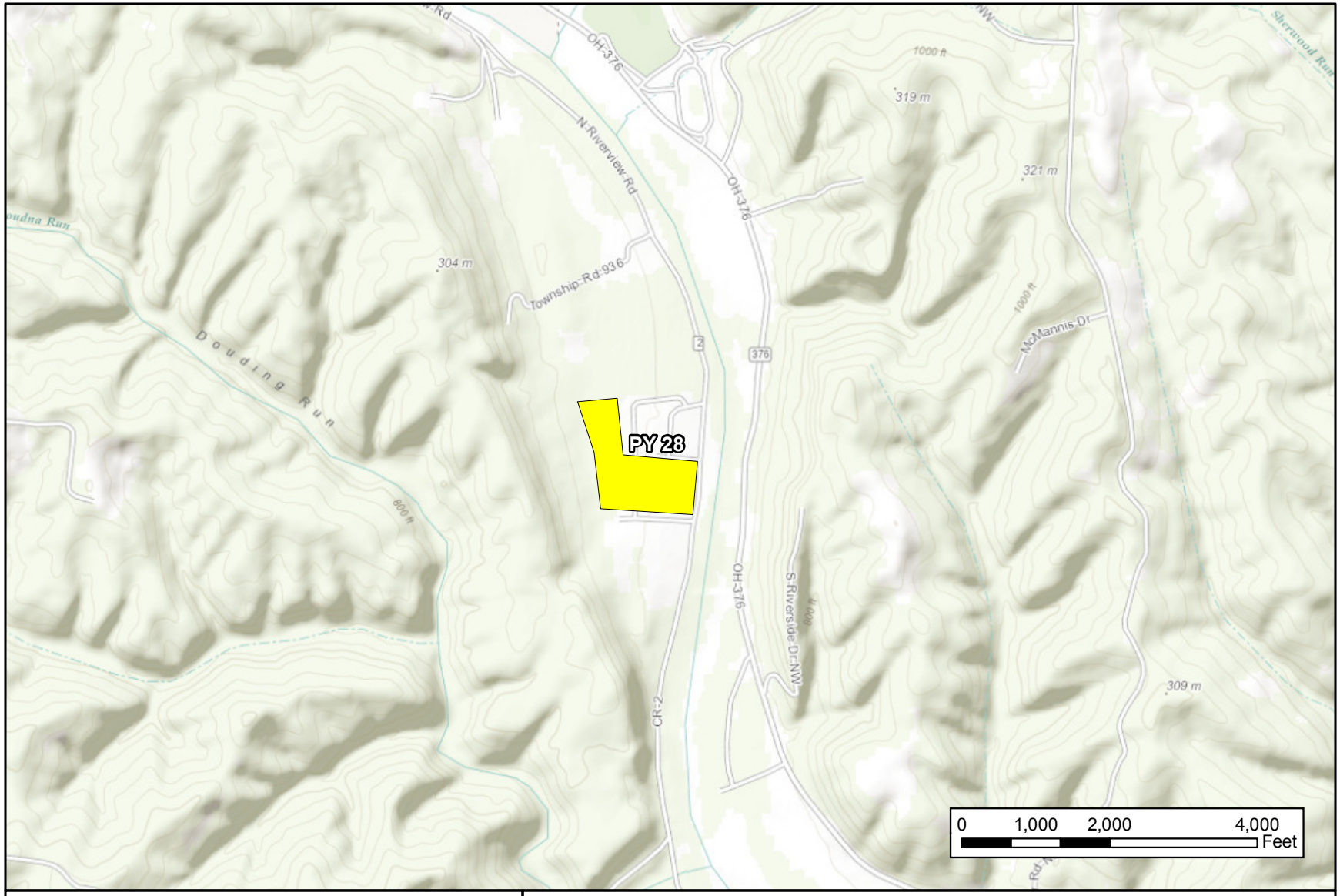
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-77
Leach XPress
Project Overview



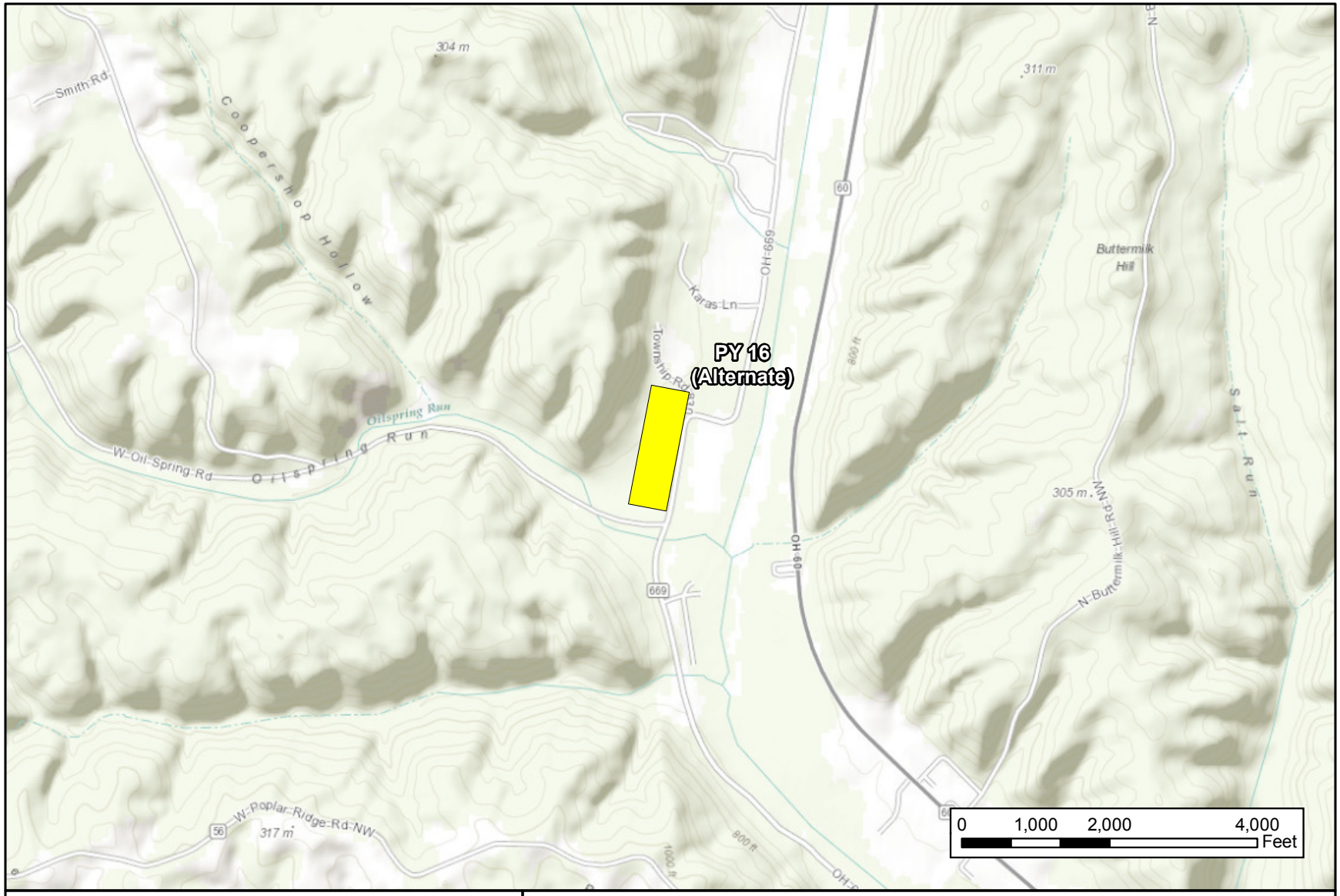
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-78
Leach XPress
Project Overview



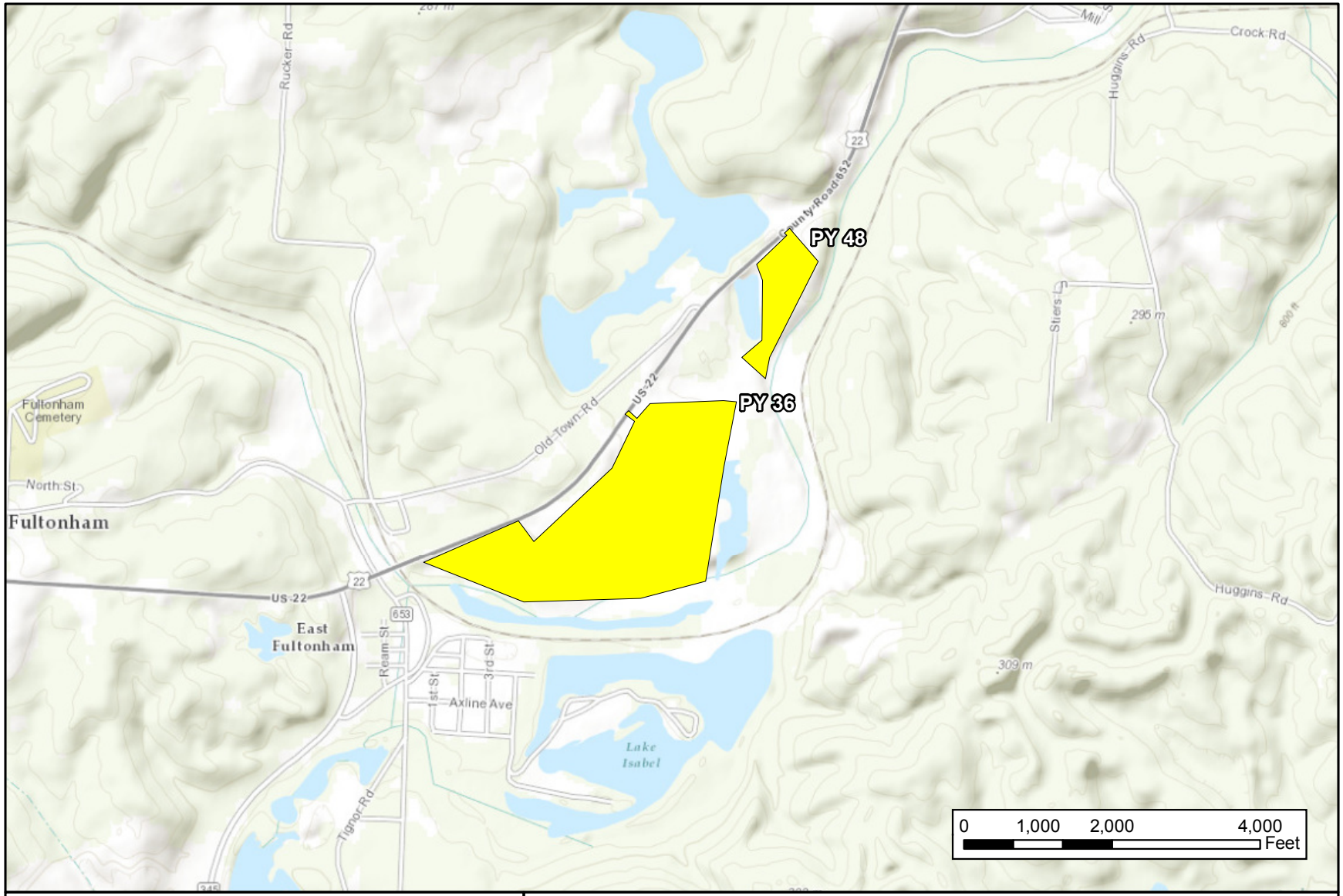
LEX
LEX1
R-801 Loop
R-801 Loop
R-501 Abandonment
Main line Valve
Access Road
Suction Line
Permanent Site Facility
Temporary Workspace
Pipe Yards
Milepost

Appendix B-79
Leach XPress
Project Overview



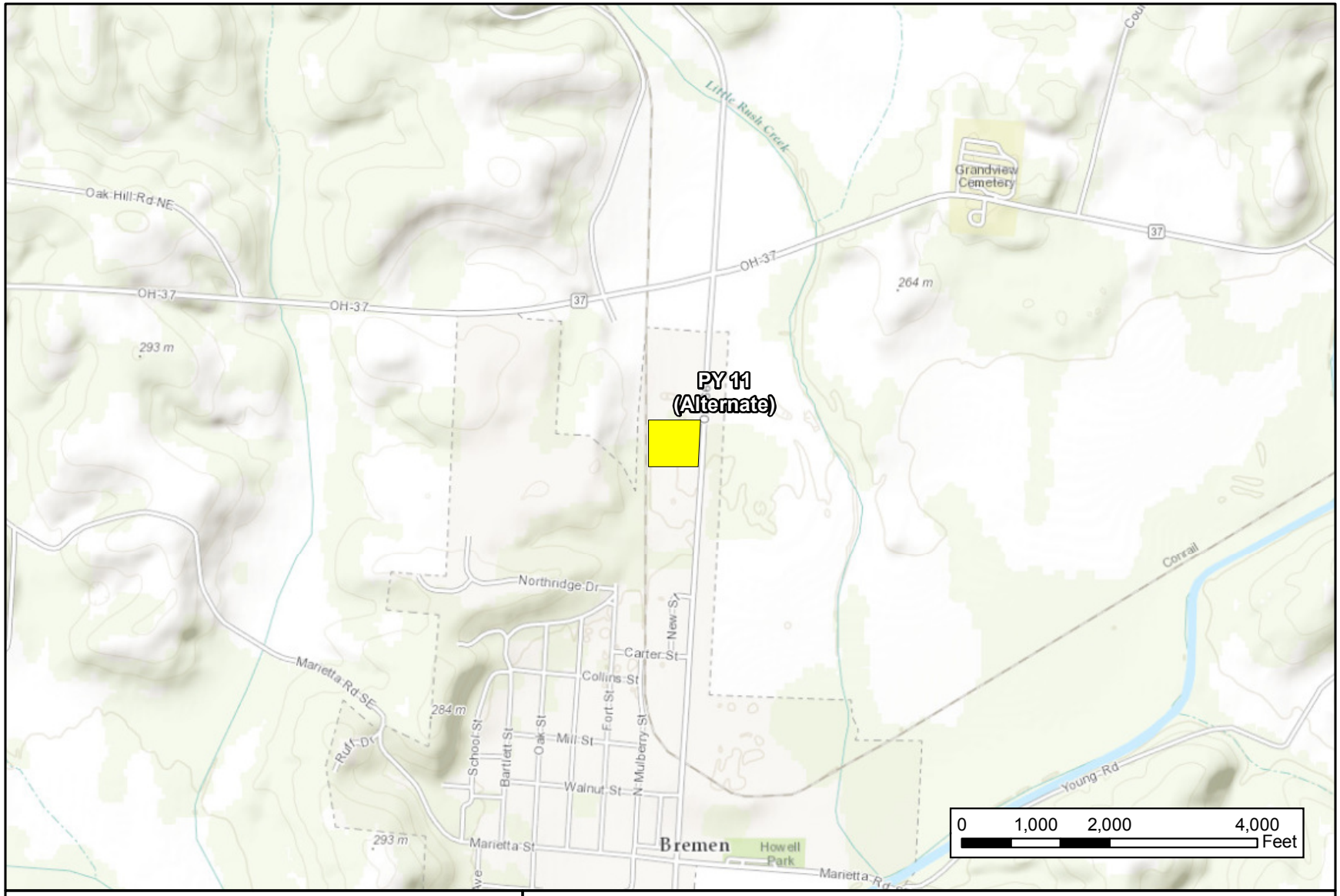
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-80
Leach XPress
Project Overview



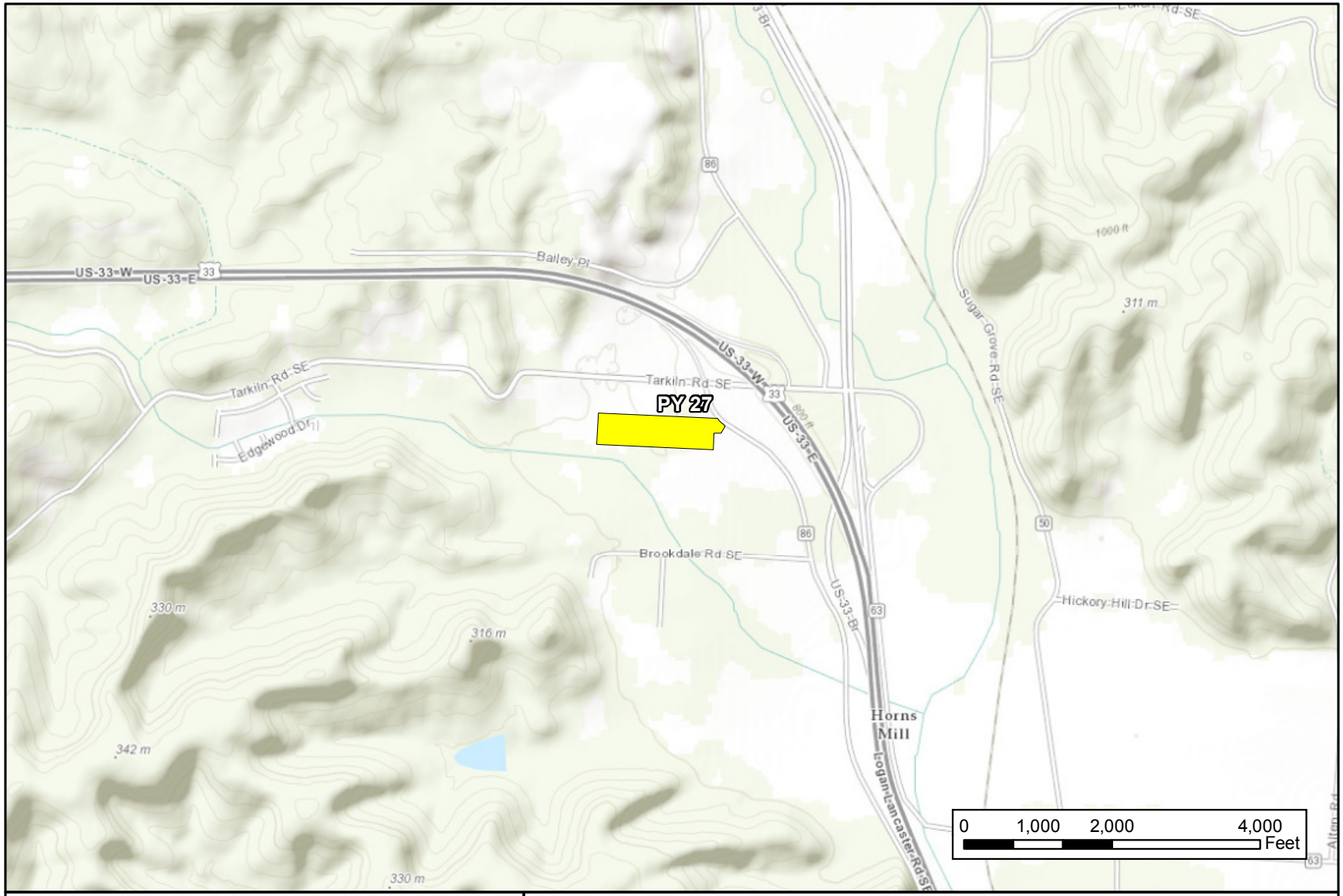
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-81
Leach XPress
Project Overview



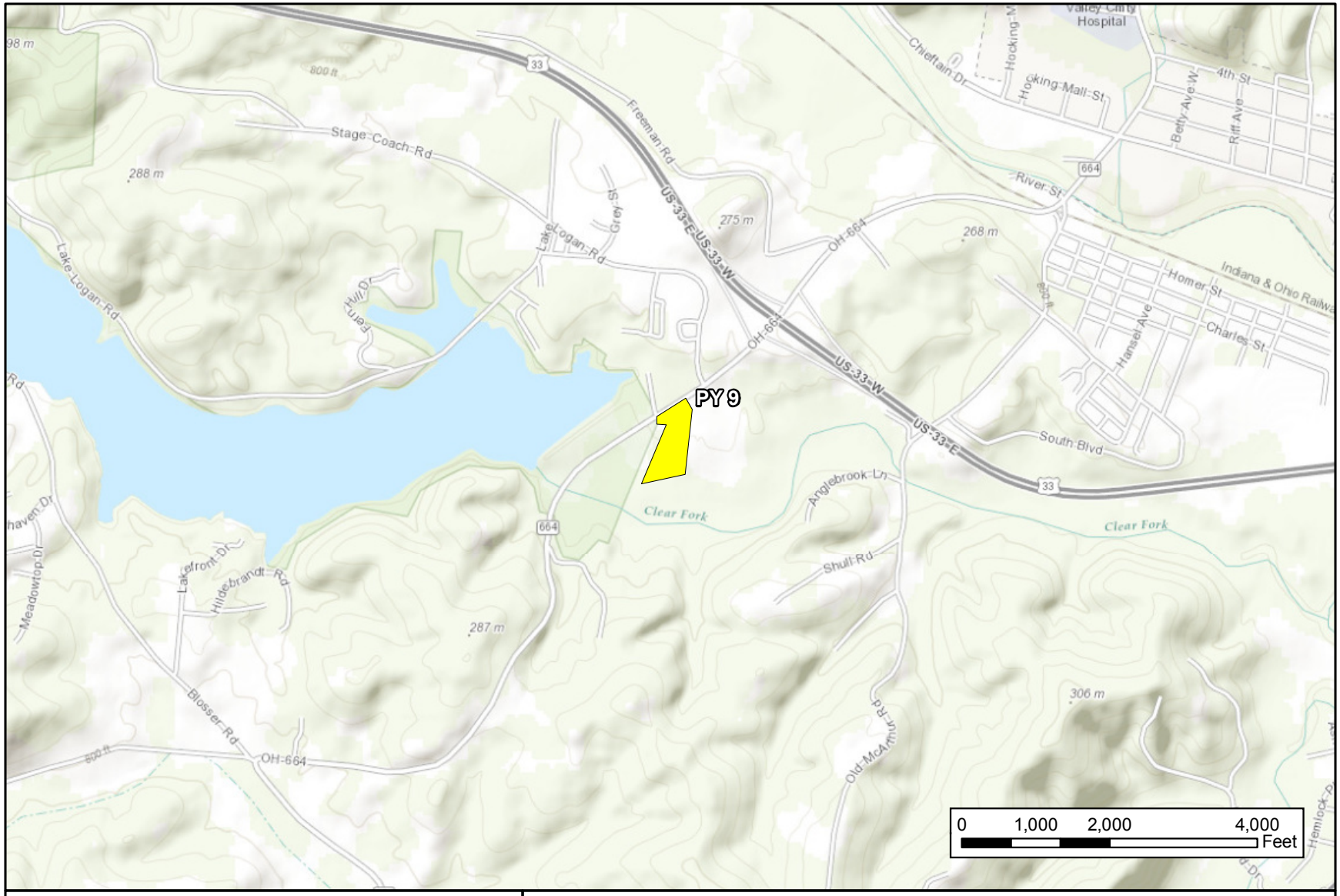
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-82
Leach XPress
Project Overview



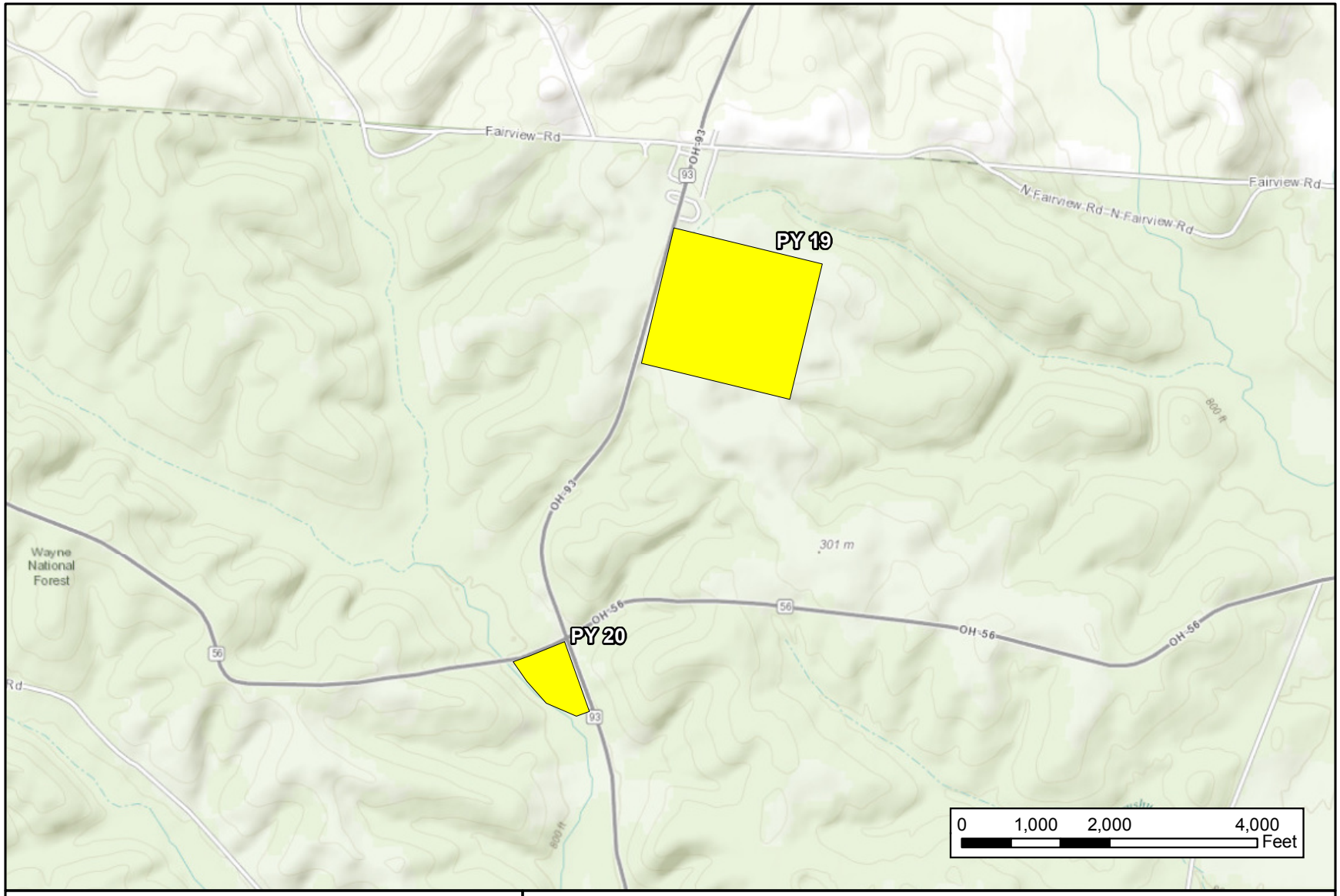
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-83
Leach XPress
Project Overview



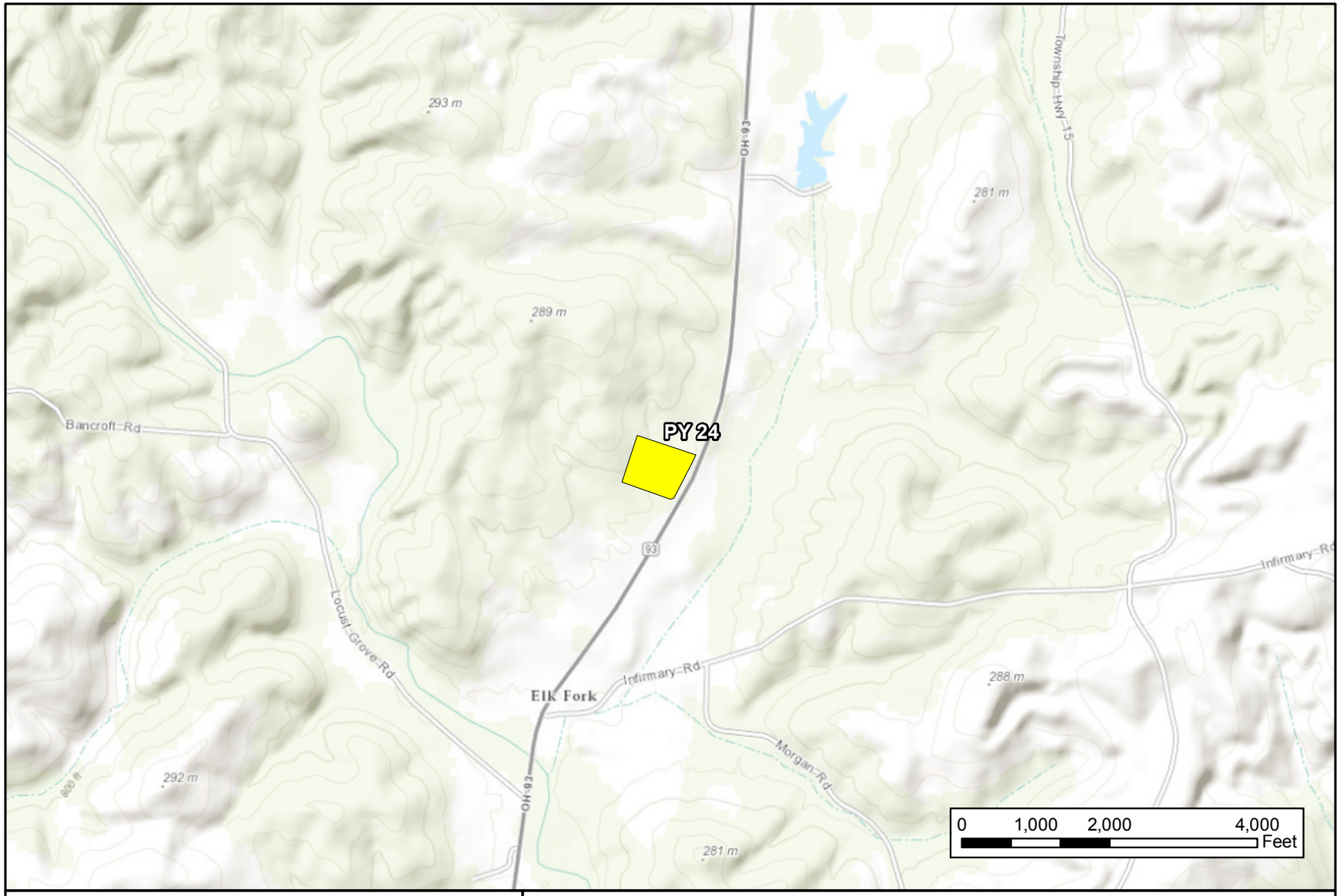
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-84
Leach XPress
Project Overview



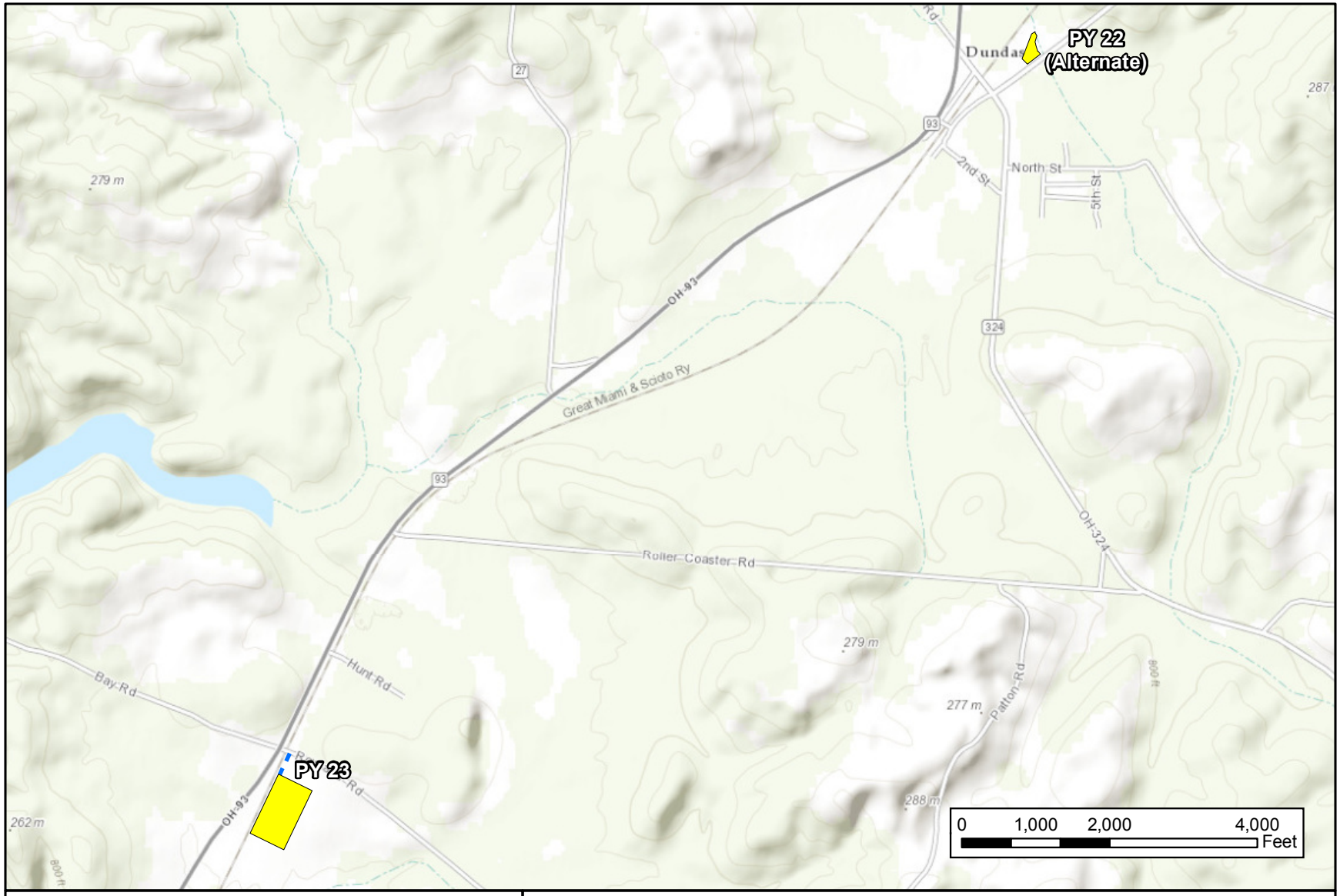
LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-85
Leach XPress
Project Overview



LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

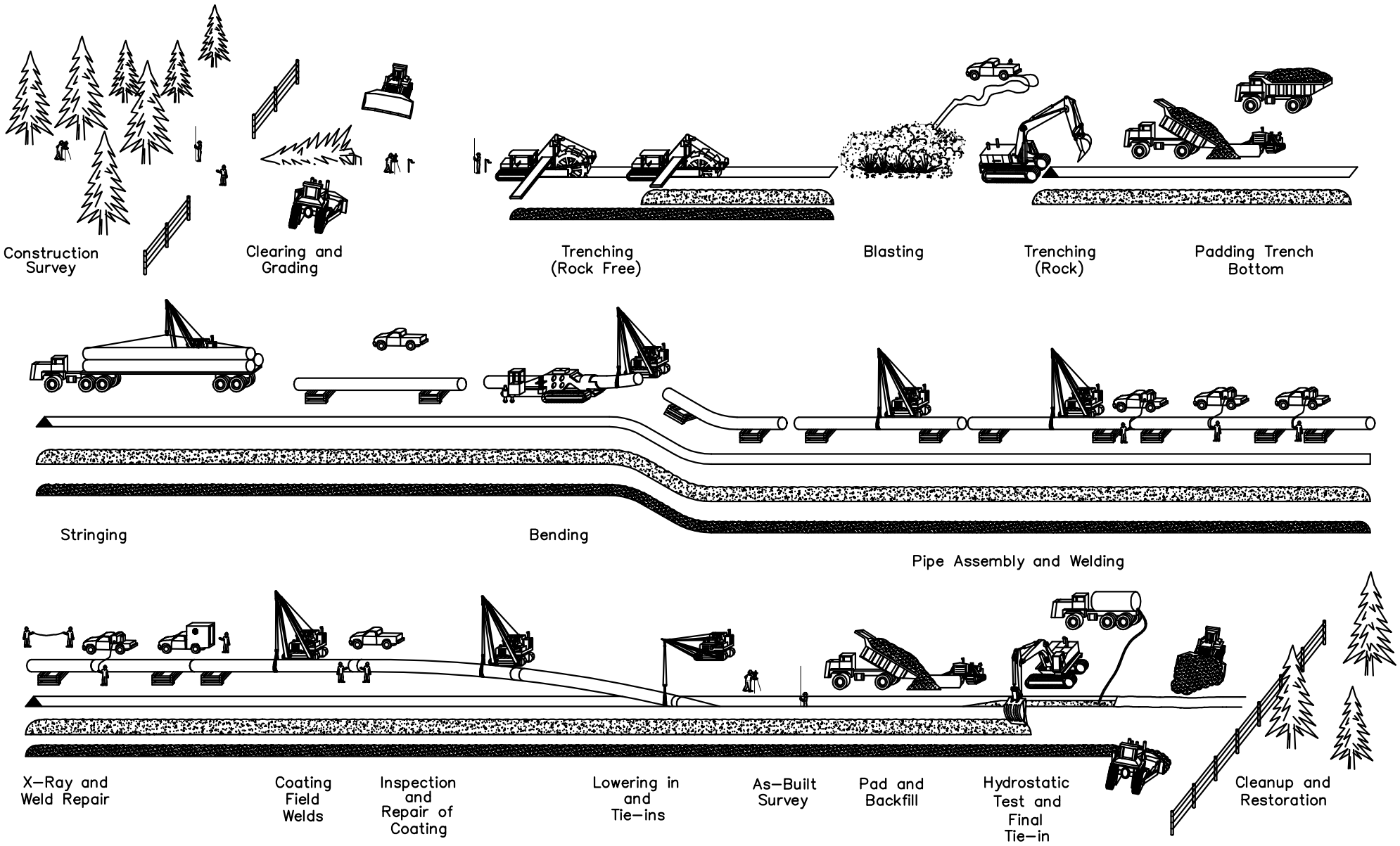
Appendix B-86
Leach XPress
Project Overview



LEX	Access Road
LEX1	Suction Line
R-801 Loop	Permanent Site Facility
R-801 Loop	Temporary Workspace
R-501 Abandonment	Pipe Yards
Main line Valve	Milepost

Appendix B-87
Leach XPress
Project Overview

APPENDIX C
Typical Construction Standards



Appendix C-1

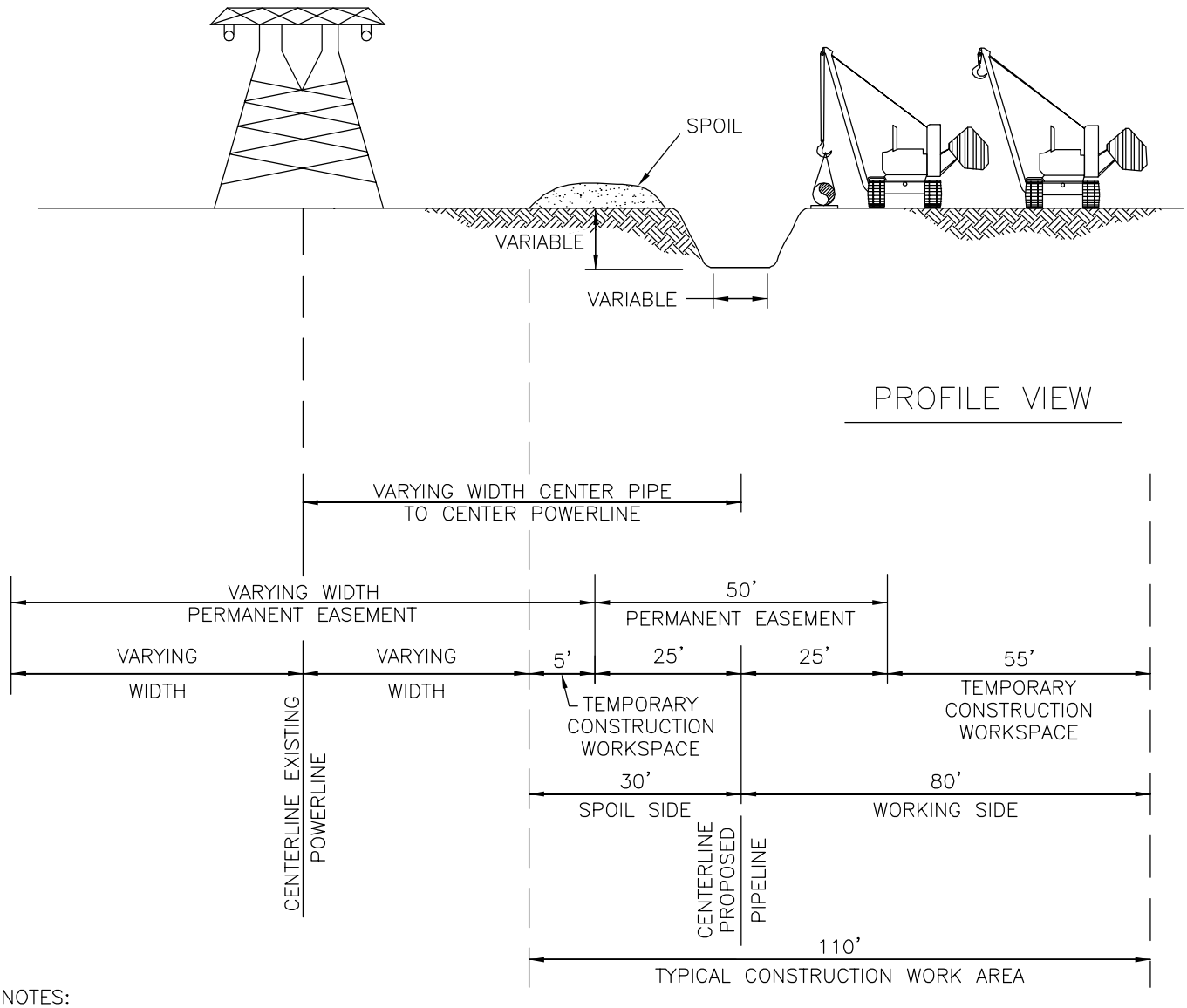
LEACH XPRESS

TYPICAL

PIPELINE CONSTRUCTION SEQUENCE

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	FIGURE 1-1
APPROVED BY	SHEET 1 OF 1	

TYPICAL PARALLELING CONFIGURATION WITH POWERLINE



NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 110 FEET.

PRELIMINARY

Appendix C-2

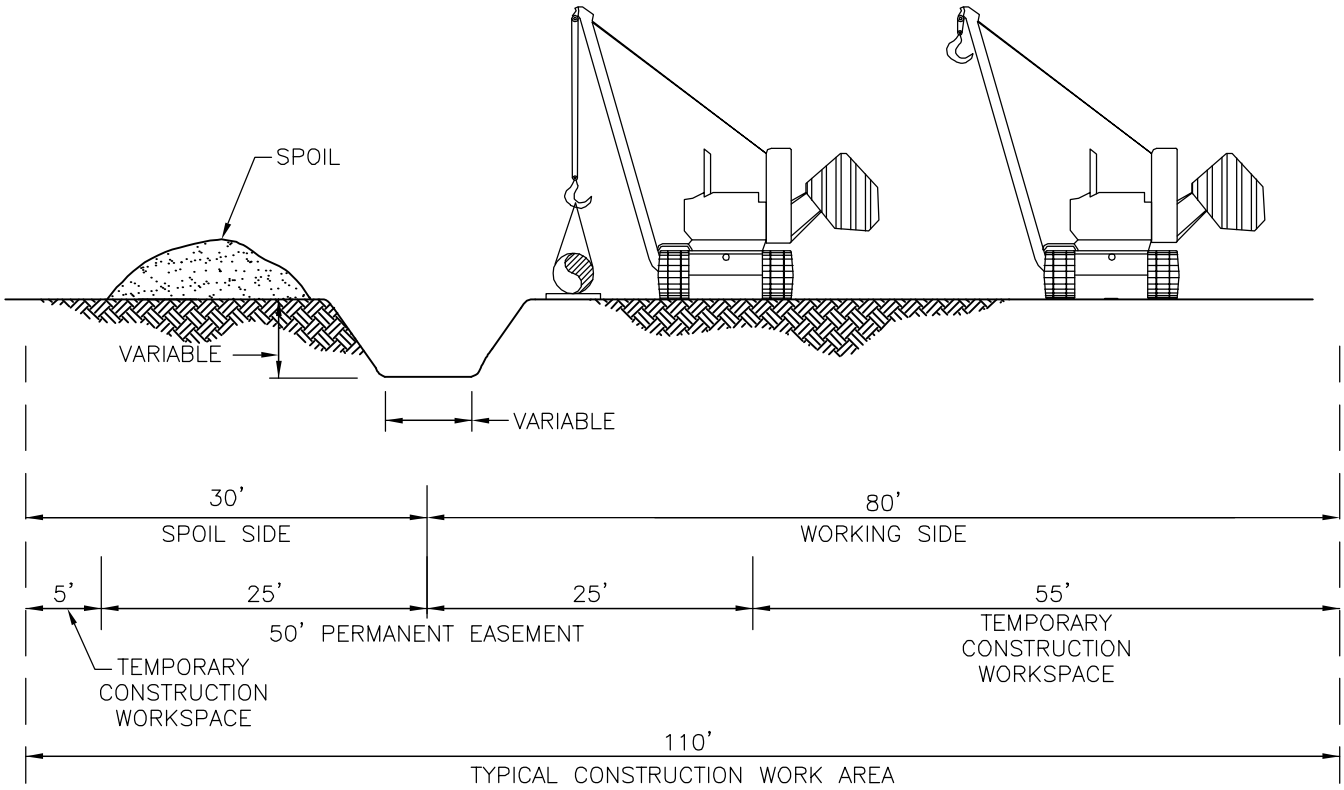
File No.:

TYPICAL PARALLELING CONFIGURATION WITH POWERLINE

LEACH XPRESS PROJECT

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 1
APPROVED BY	SHEET 1 of 1	

TYPICAL GREENFIELD WORKSPACE



PLAN/PROFILE VIEW

NOTES:

1. USE FOR 14-INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE-SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 110 FEET.

PRELIMINARY

Appendix C-3

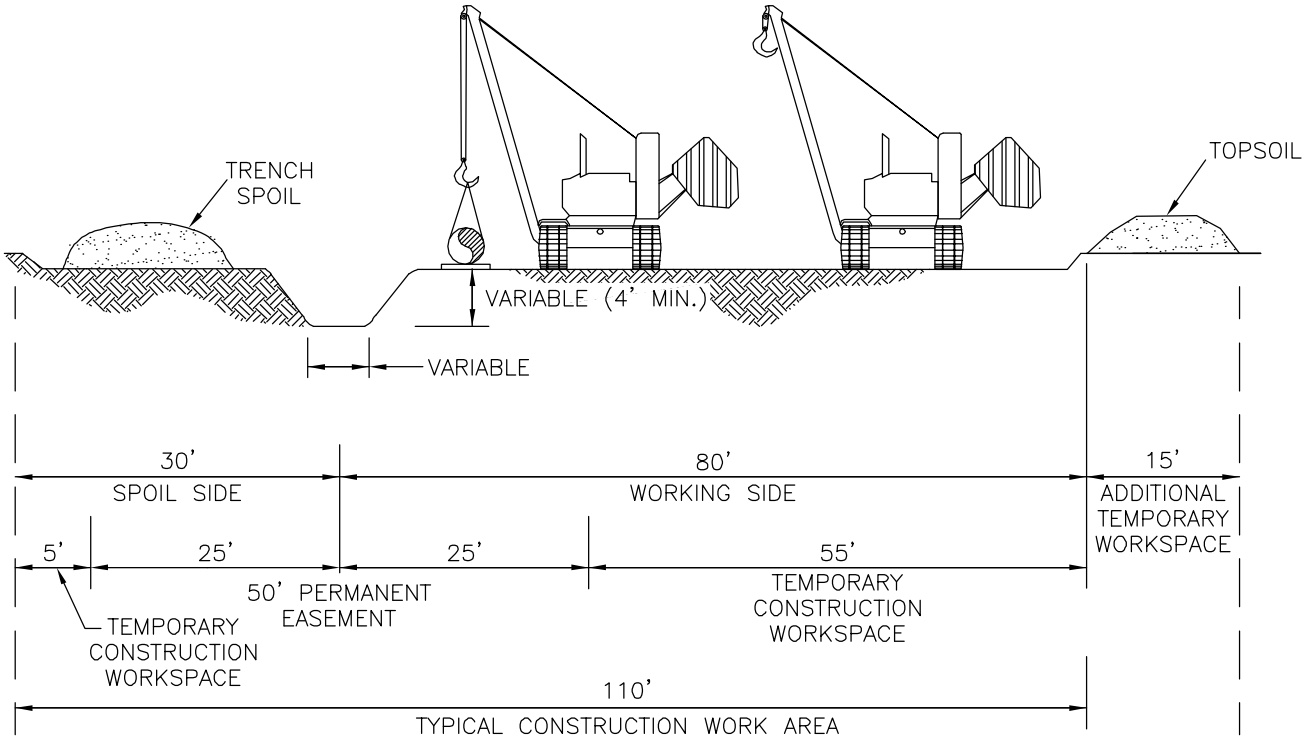
TYPICAL GREENFIELD WORKSPACE

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 2
APPROVED BY	SHEET 1 of 1	

TYPICAL AGRICULTURAL WORKSPACE



PLAN/PROFILE VIEW

NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 110 FEET.
4. OTHER CONFIGURATIONS OF TOPSOIL AND SUBSOIL ARE ACCEPTABLE PROVIDED THEY ARE KEPT SEPARATE.
5. UP TO 12 INCHES OF TOPSOIL REMOVED.
6. TOPSOIL AND SUBSOIL PILES WILL BE ADEQUATELY PROTECTED FROM EROSION AND SEDIMENTATION BY USE OF SEDIMENT FILTER DEVICES OR MULCH.

PRELIMINARY

Appendix C-4

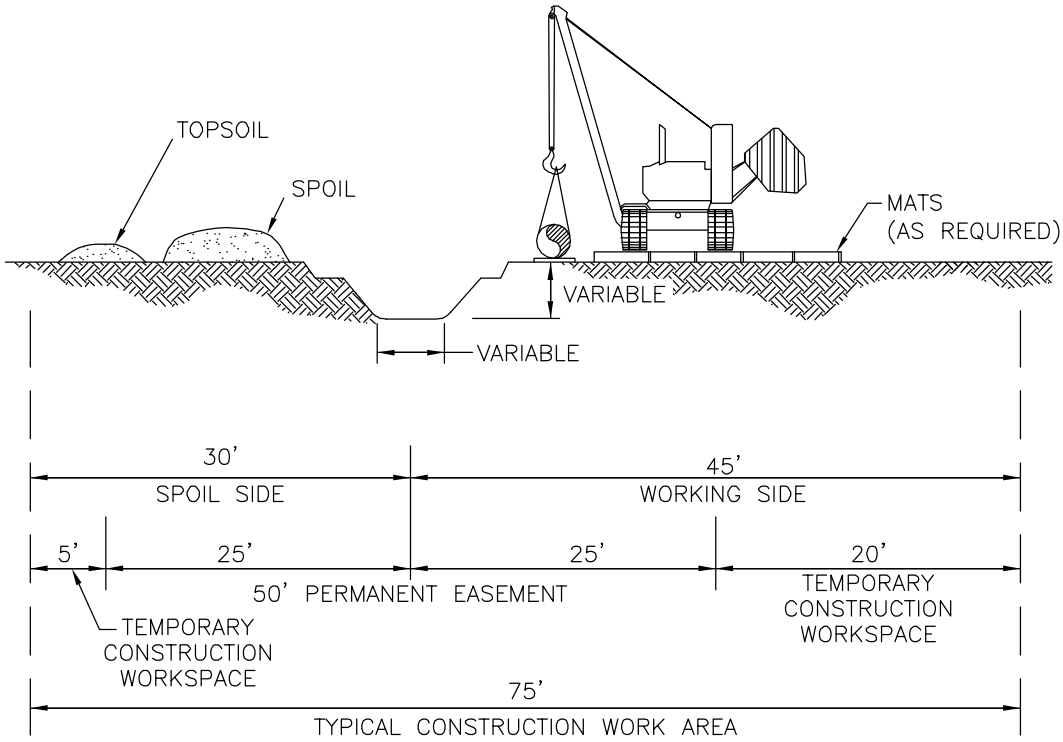
TYPICAL AGRICULTURAL WORKSPACE

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 3
APPROVED BY	SHEET 1 of 1	

TYPICAL WETLAND CROSSING



PLAN/PROFILE VIEW

NOTES:

1. IN WETLAND AREAS WHICH CONTAIN NO STANDING WATER OR IF SOILS ARE SATURATED OR FROZEN, TOPSOIL (TOP 12 INCHES) AND SUBSOIL WILL BE STOCKPILED SEPARATELY WITHIN THE WETLAND CONSTRUCTION WORK AREA.
2. WETLANDS WITH STANDING WATER, SATURATED OR FROZEN SOIL, OPERATE EQUIPMENT PER REQUIREMENTS IN SECTION III.B–2. (ECS)
3. A SEDIMENT FILTER DEVICE WILL BE PLACED ACROSS THE WORK AREA AT THE WETLAND'S EDGE, IMMEDIATELY UPSLOPE OF THE WETLAND BOUNDARY.
4. A SEDIMENT FILTER DEVICE WILL BE PLACED AT THE EDGE OF THE WORK AREA AND AROUND SOIL AND SUBSOIL PILES AS NECESSARY.

PRELIMINARY

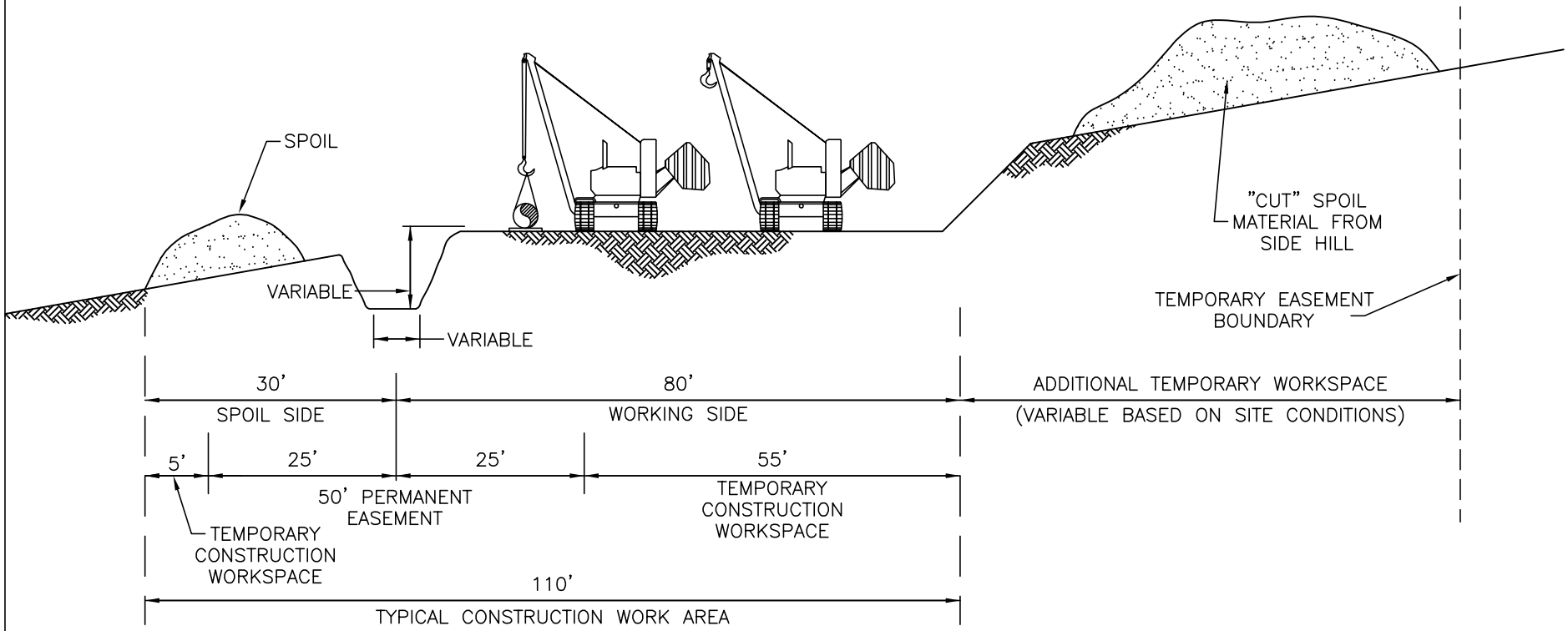
Appendix C-5

File No.:

TYPICAL WETLAND CROSSING

LEACH XPRESS PROPJECT

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 4
APPROVED BY	SHEET 1 of 1	



PROFILE

NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 110 FEET.

PRELIMINARY

Appendix C-6

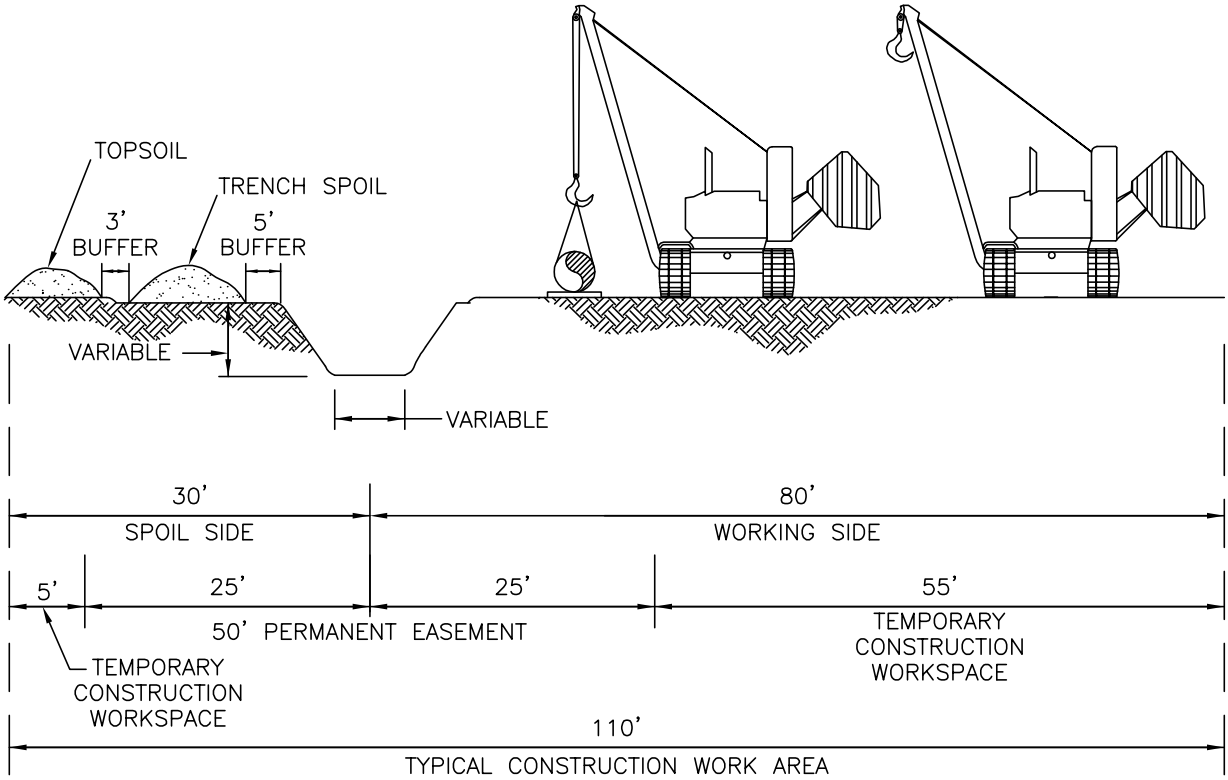
TYPICAL SIDE SLOPE CONSTRUCTION WORKSPACE

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 5
APPROVED BY	SHEET 1 OF 1	

TYPICAL GREENFIELD WORKSPACE
DITCH AND SPOIL SIDE TOP SOIL SALVAGE



PLAN/PROFILE VIEW

NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 110 FEET.

PRELIMINARY

Appendix C-7

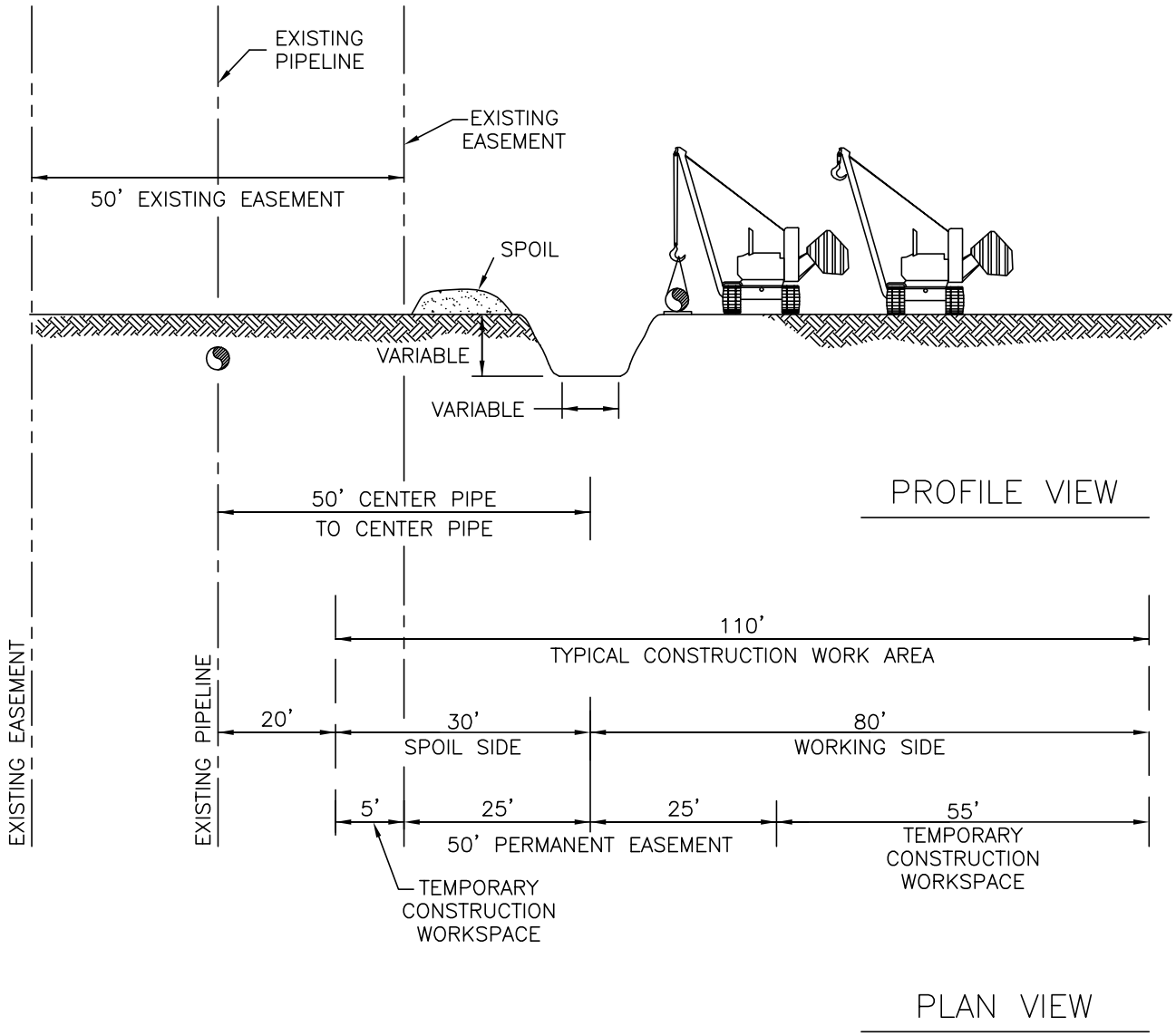
TYPICAL GREENFIELD WORKSPACE DITCH AND SPOIL SIDE TOP SOIL SALVAGE

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 6
APPROVED BY	SHEET 1 of 1	

TYPICAL CONFIGURATION FOR PARALLELING TO EXISTING PIPELINES



NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 110 FEET.

PRELIMINARY

Appendix C-8

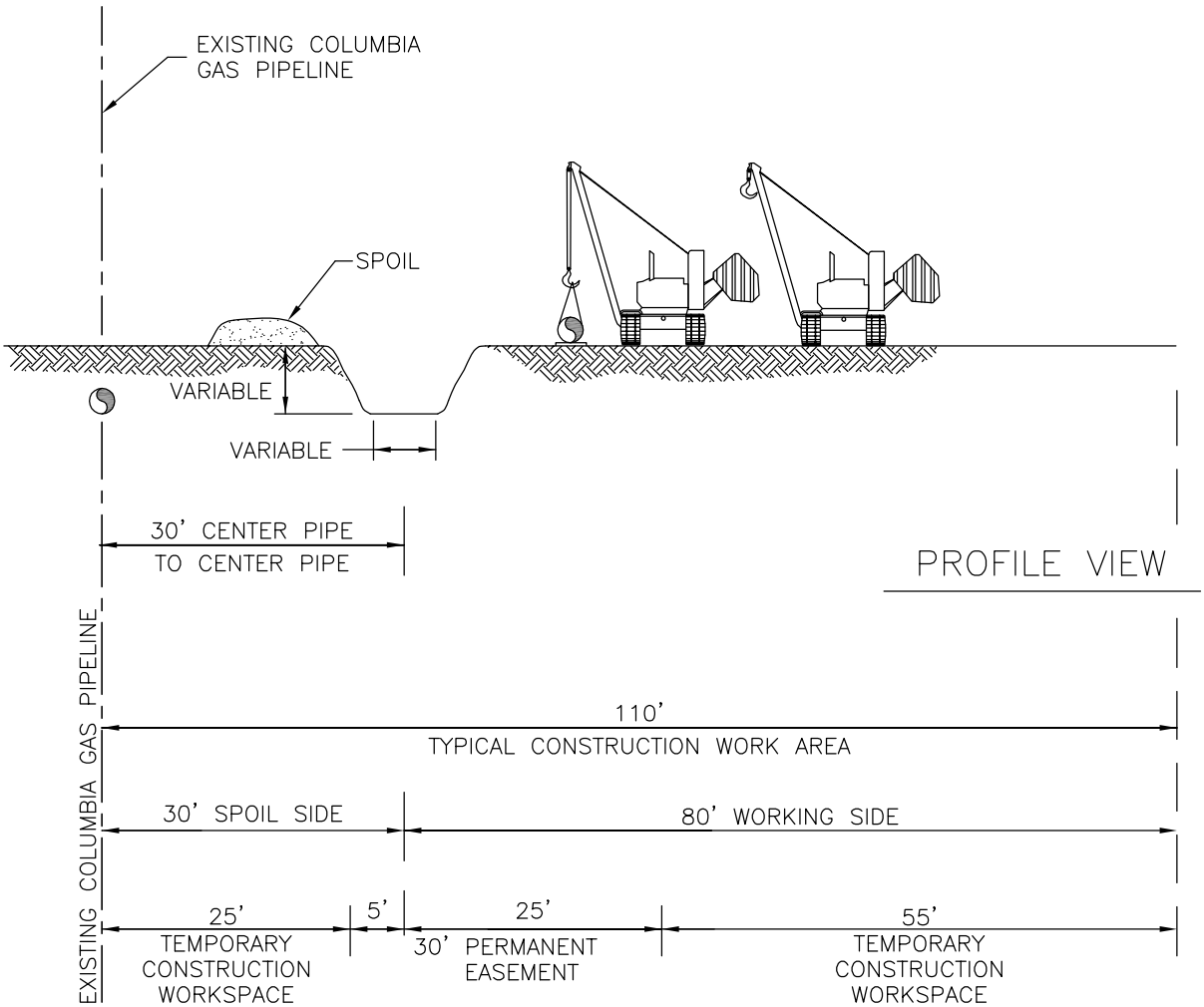
TYPICAL CONFIGURATION FOR PARALLELING TO EXISTING PIPELINES

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 7
APPROVED BY	SHEET 1 of 1	

TYPICAL CONFIGURATION FOR CO-LOCATING WITH EXISTING COLUMBIA PIPELINES - 30' EASEMENT



PLAN VIEW

NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 110 FEET.

PRELIMINARY

Appendix C-9

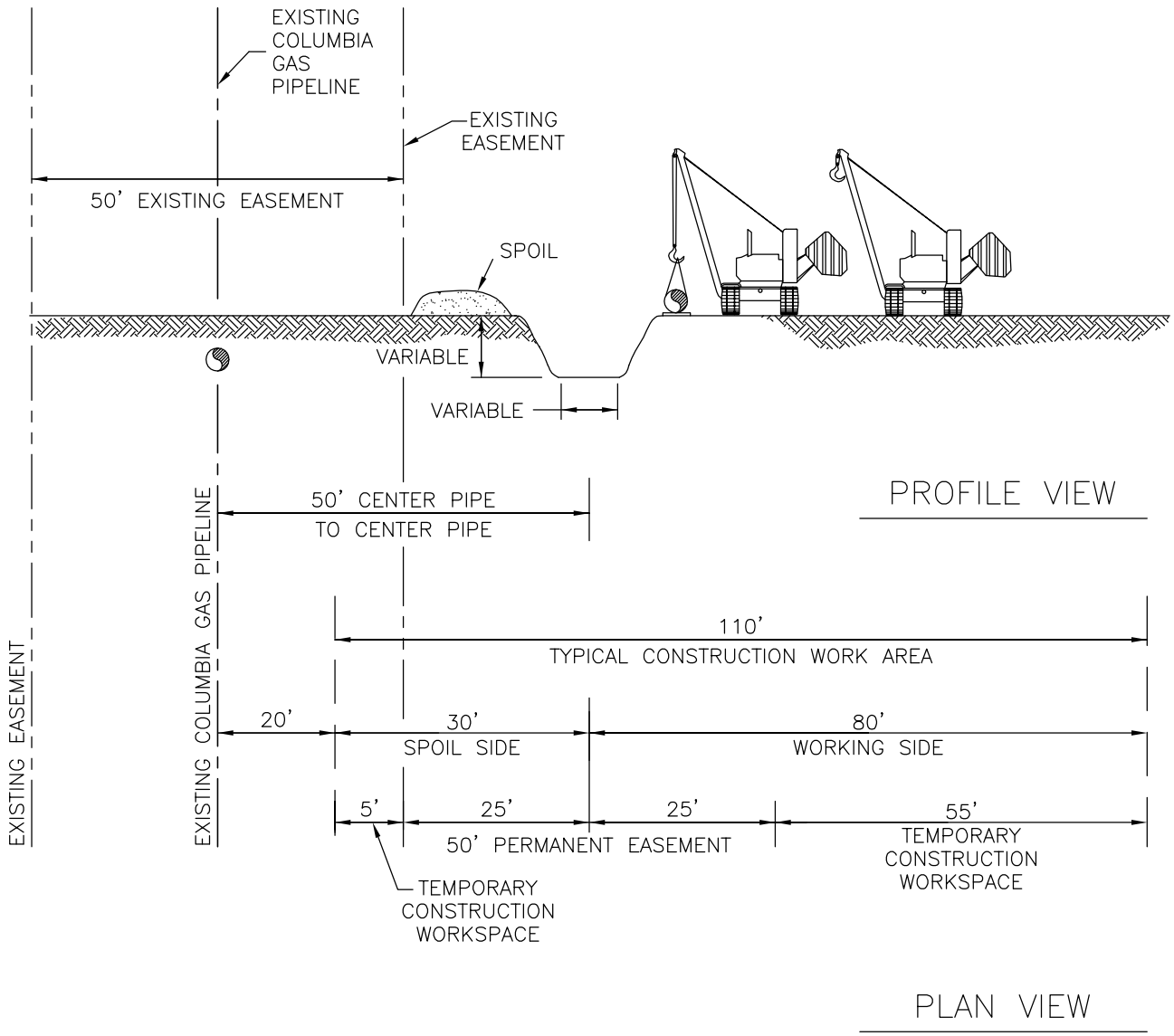
TYPICAL CONFIGURATION FOR CO-LOCATING WITH EXISTING COLUMBIA PIPELINES - 30' EASEMENT

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 8A
APPROVED BY	SHEET 1 of 1	

TYPICAL CONFIGURATION FOR PARALLELING TO EXISTING COLUMBIA PIPELINES - 50' EASEMENT



NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 110 FEET.

PRELIMINARY

Appendix C-10

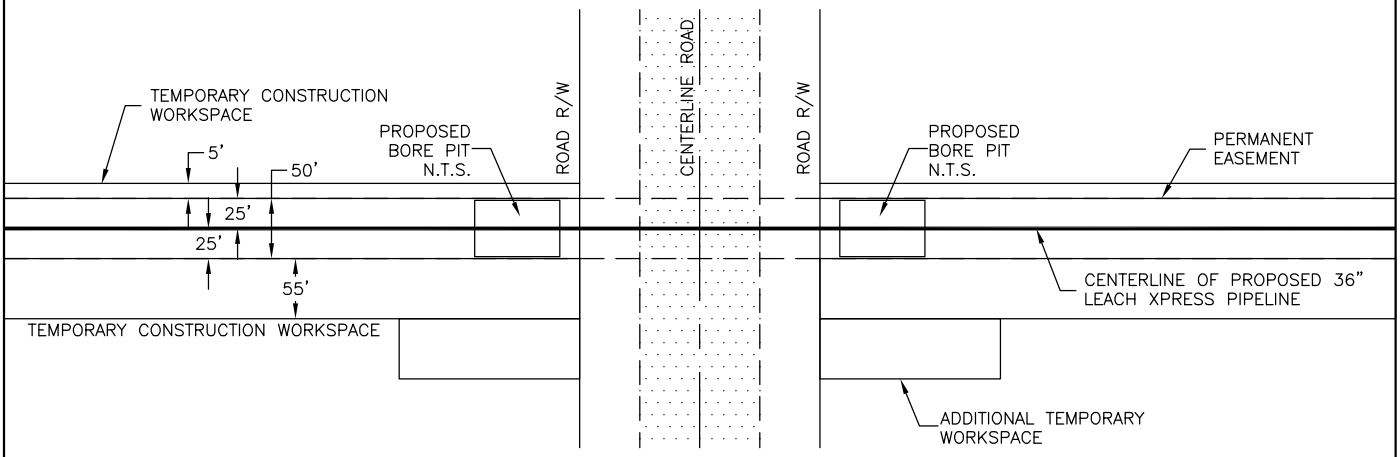
TYPICAL CONFIGURATION FOR PARALLELING TO EXISTING COLUMBIA PIPELINES - 50' EASEMENT

LEACH XPRESS PROJECT

File No.:

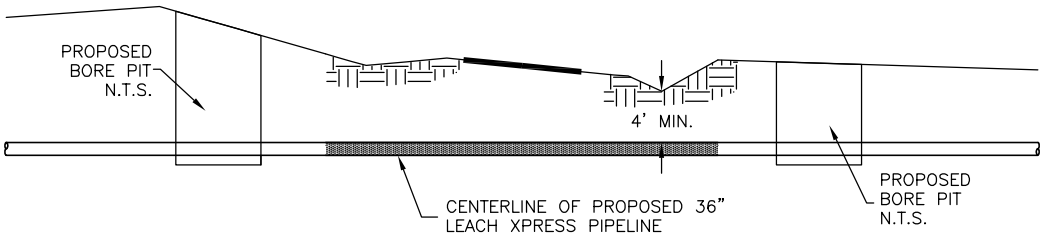
DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 8B
APPROVED BY	SHEET 1 of 1	

TYPICAL BORED ROAD CROSSING



PLAN VIEW

N.T.S.



PROFILE VIEW

N.T.S.

NOTES:

1. CONSTRUCTION WORK AREA WILL TYPICALLY BE 160 FEET WIDE.

PRELIMINARY

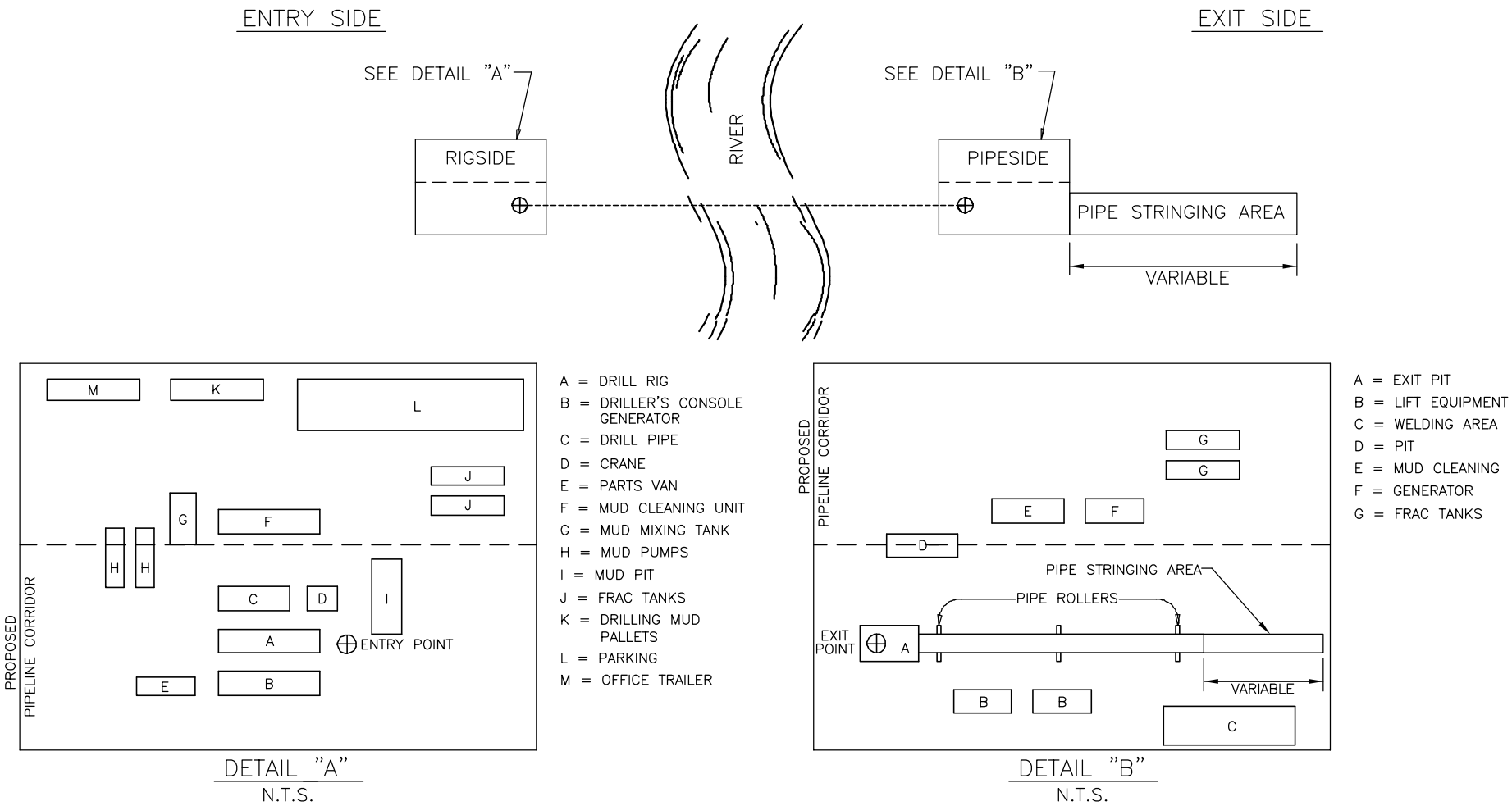
Appendix C-11

TYPICAL BORED ROAD CROSSING

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 9
APPROVED BY	SHEET 1 of 1	



PRELIMINARY

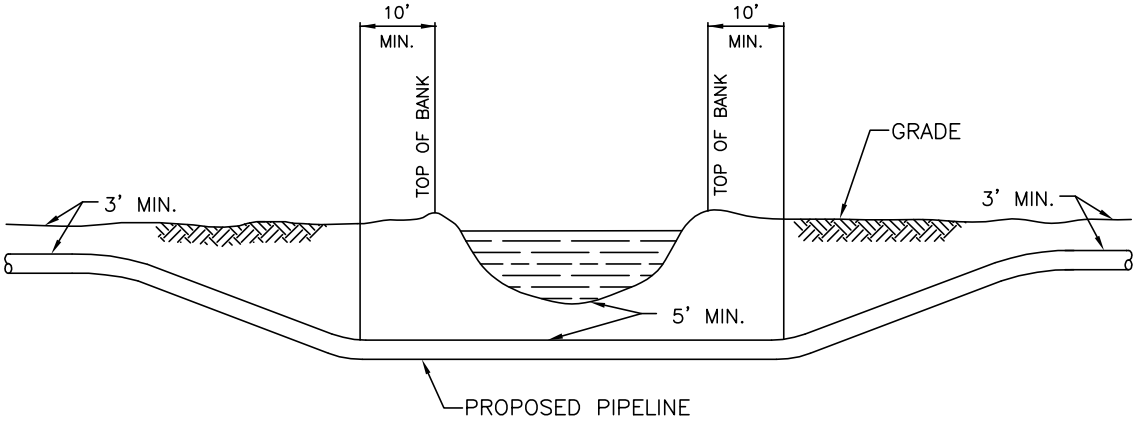
Appendix C-12

TYPICAL HDD CONFIGURATION

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 10
APPROVED BY	SHEET 1 OF 1	



TYPICAL WATERBODY CROSSING

PRELIMINARY

Appendix C-13

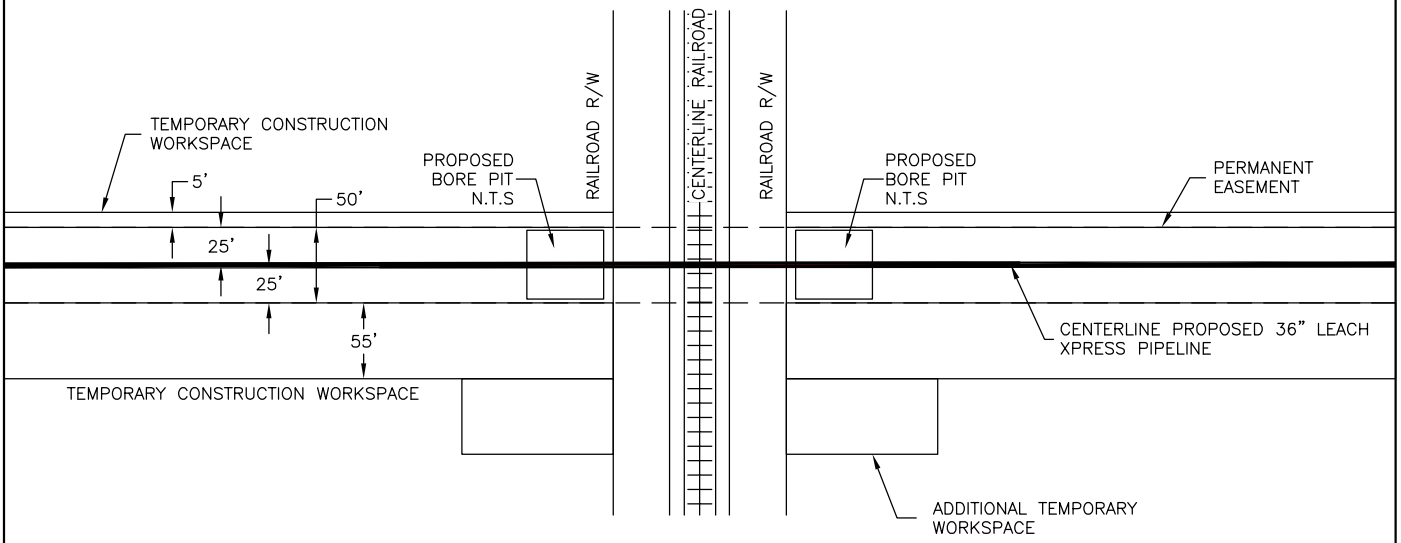
TYPICAL WATERBODY CROSSING

LEACH XPRESS PROJECT

File No.:

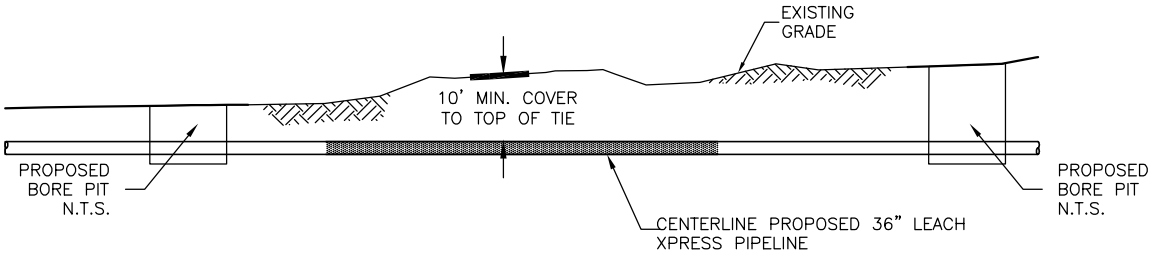
DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 11
APPROVED BY	SHEET 1 OF 1	

TYPICAL BORED RAILROAD CROSSING



PLAN VIEW

N.T.S.



PROFILE VIEW

N.T.S.

NOTES:

1. CONSTRUCTION WORK AREA WILL TYPICALLY BE 160 FEET WIDE.

PRELIMINARY

Appendix C-14

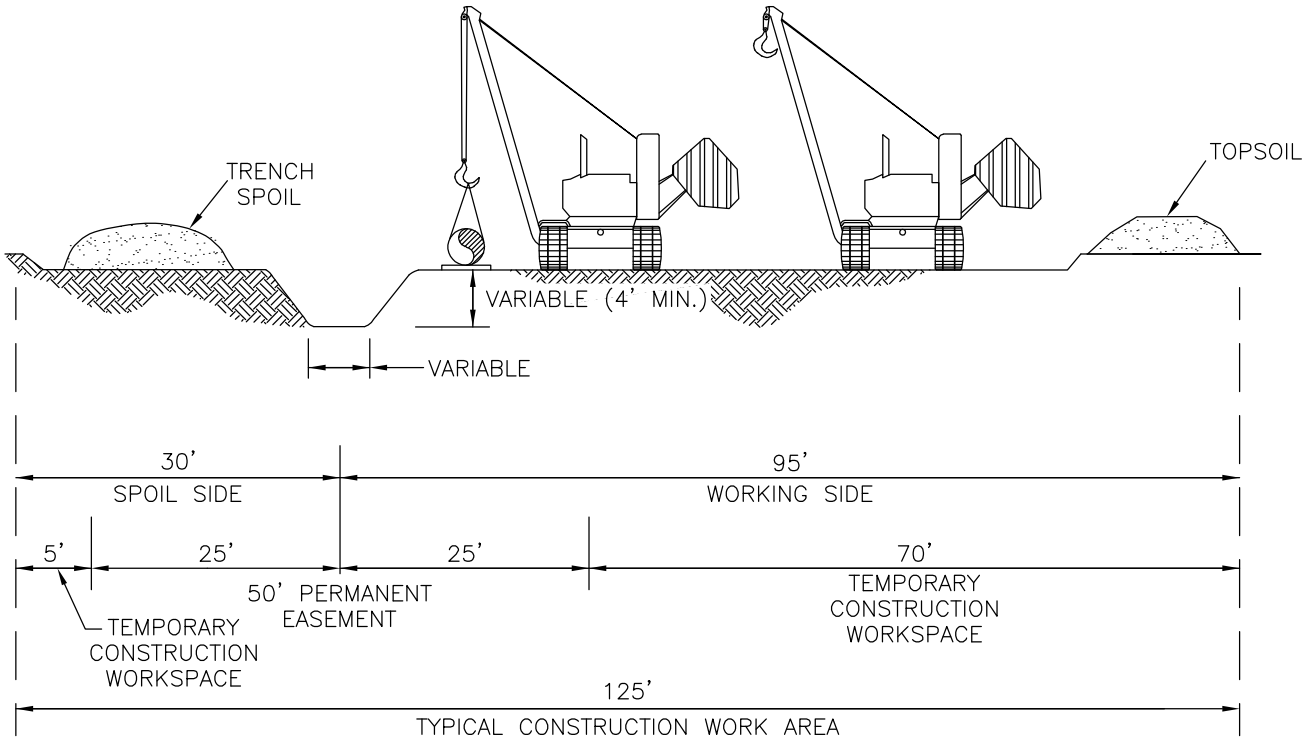
TYPICAL BORED RAILROAD CROSSING

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 12
APPROVED BY	SHEET 1 of 1	

TYPICAL STEEP SLOPE WORKSPACE - LEX MP 0.00-38.98



PLAN/PROFILE VIEW

NOTES:

1. USE FOR 14-INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE-SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 125 FEET.
4. OTHER CONFIGURATIONS OF TOPSOIL AND SUBSOIL ARE ACCEPTABLE PROVIDED THEY ARE KEPT SEPARATE.
5. UP TO 12 INCHES OF TOPSOIL REMOVED.
6. TOPSOIL AND SUBSOIL PILES WILL BE ADEQUATELY PROTECTED FROM EROSION AND SEDIMENTATION BY USE OF SEDIMENT FILTER DEVICES OR MULCH.
7. A TYPICAL CORRIDOR WIDTH OF 125 FEET IN UPLANDS IS REQUIRED FOR LEX FROM MP 0.00 TO MP 39.98, AS ADDITIONAL SPACE WILL BE NEEDED TO PROVIDE FOR SAFE AND EFFICIENT CONSTRUCTION OF THE PIPELINE THROUGH HILLY TERRAIN AND STEEP SLOPE CONDITIONS.

PRELIMINARY

Appendix C-15

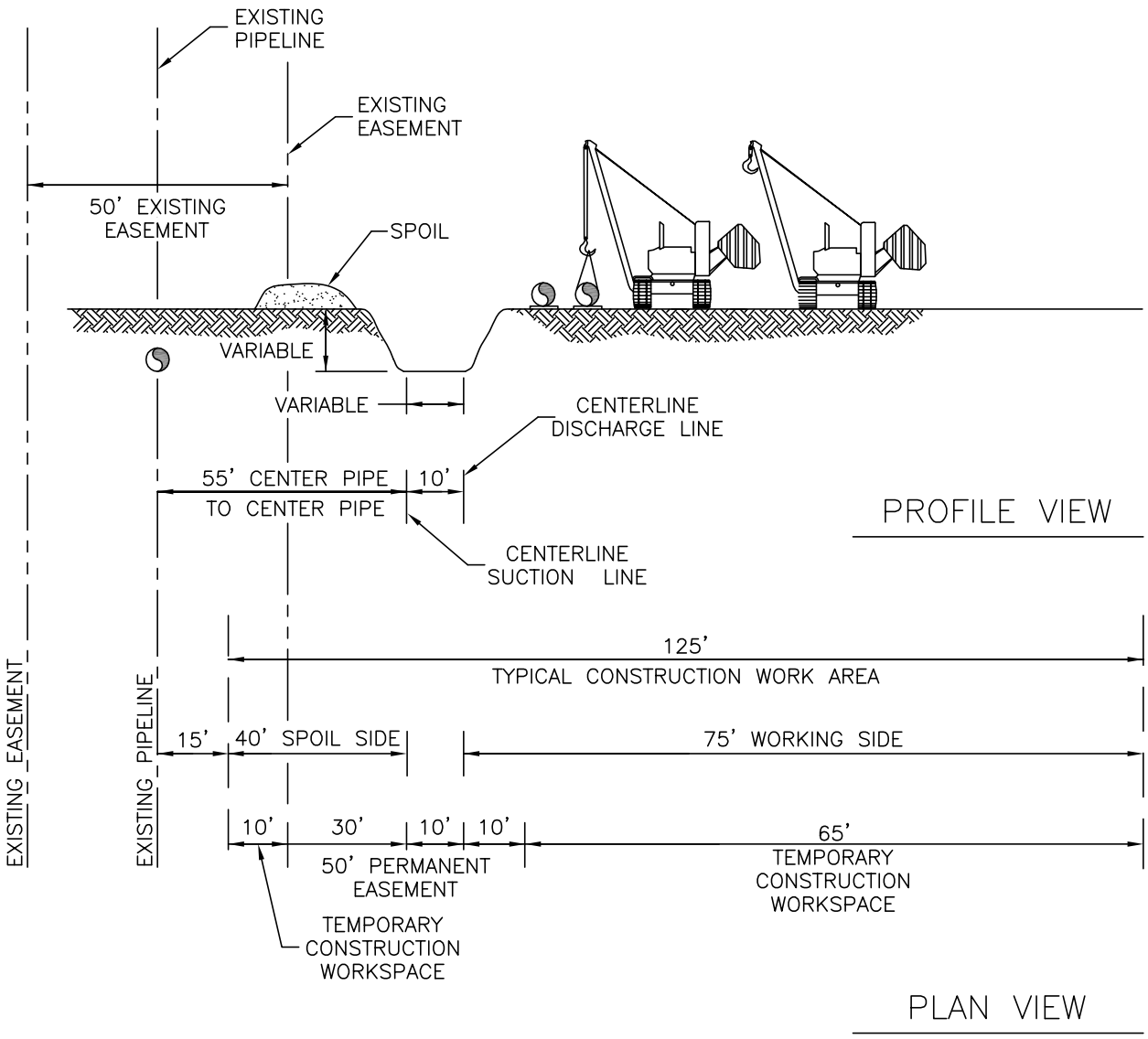
TYPICAL STEEP SLOPE WORKSPACE - LEX MP 0.00-38.98

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 13
APPROVED BY	SHEET 1 of 1	

TYPICAL SUCTION AND DISCHARGE LINE WORKSPACE



NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 125 FEET.

PRELIMINARY

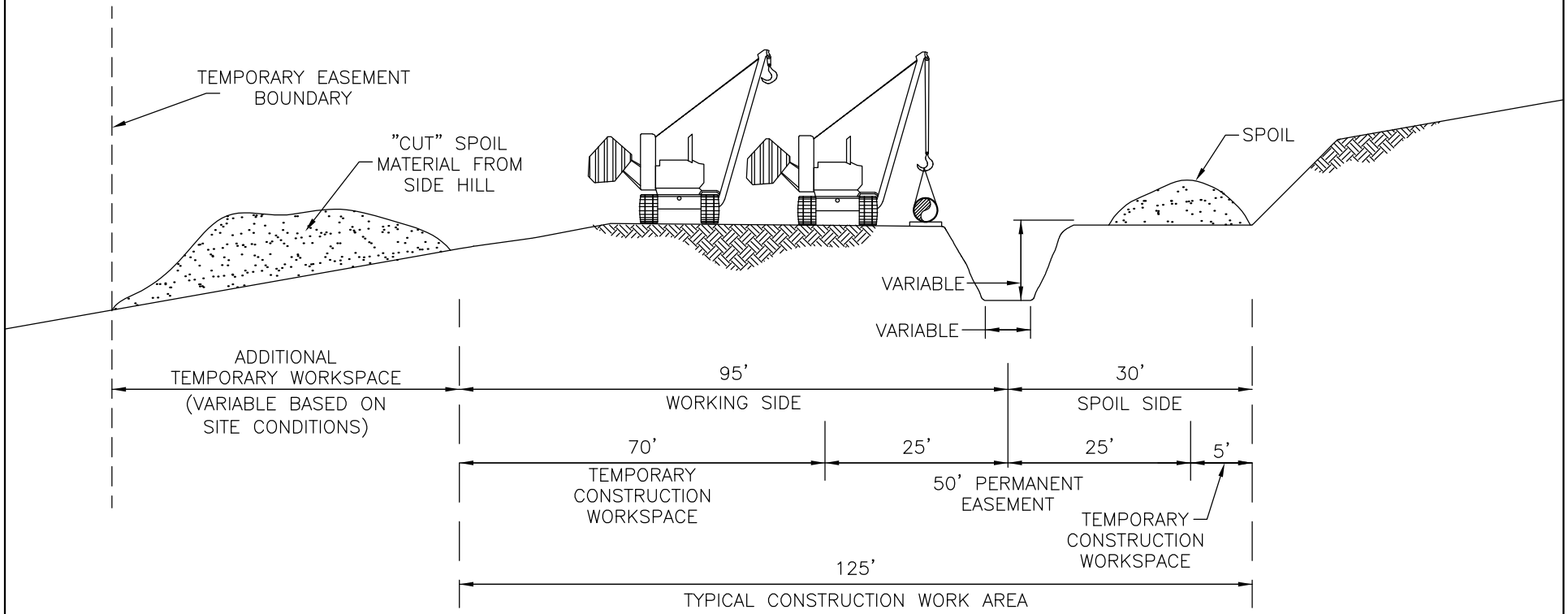
Appendix C-16

TYPICAL SUCTION AND DISCHARGE LINE WORKSPACE

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 14
APPROVED BY	SHEET 1 of 1	



PROFILE

NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 110 FEET.
4. A TYPICAL CORRIDOR WIDTH OF 125 FEET IN UPLANDS IS REQUIRED FOR LEX FROM MP 0.00 TO MP 39.98, AS ADDITIONAL SPACE WILL BE NEEDED TO PROVIDE FOR SAFE AND EFFICIENT CONSTRUCTION OF THE PIPELINE THROUGH HILLY TERRAIN AND STEEP SLOPE CONDITIONS.

PRELIMINARY

Appendix C-17

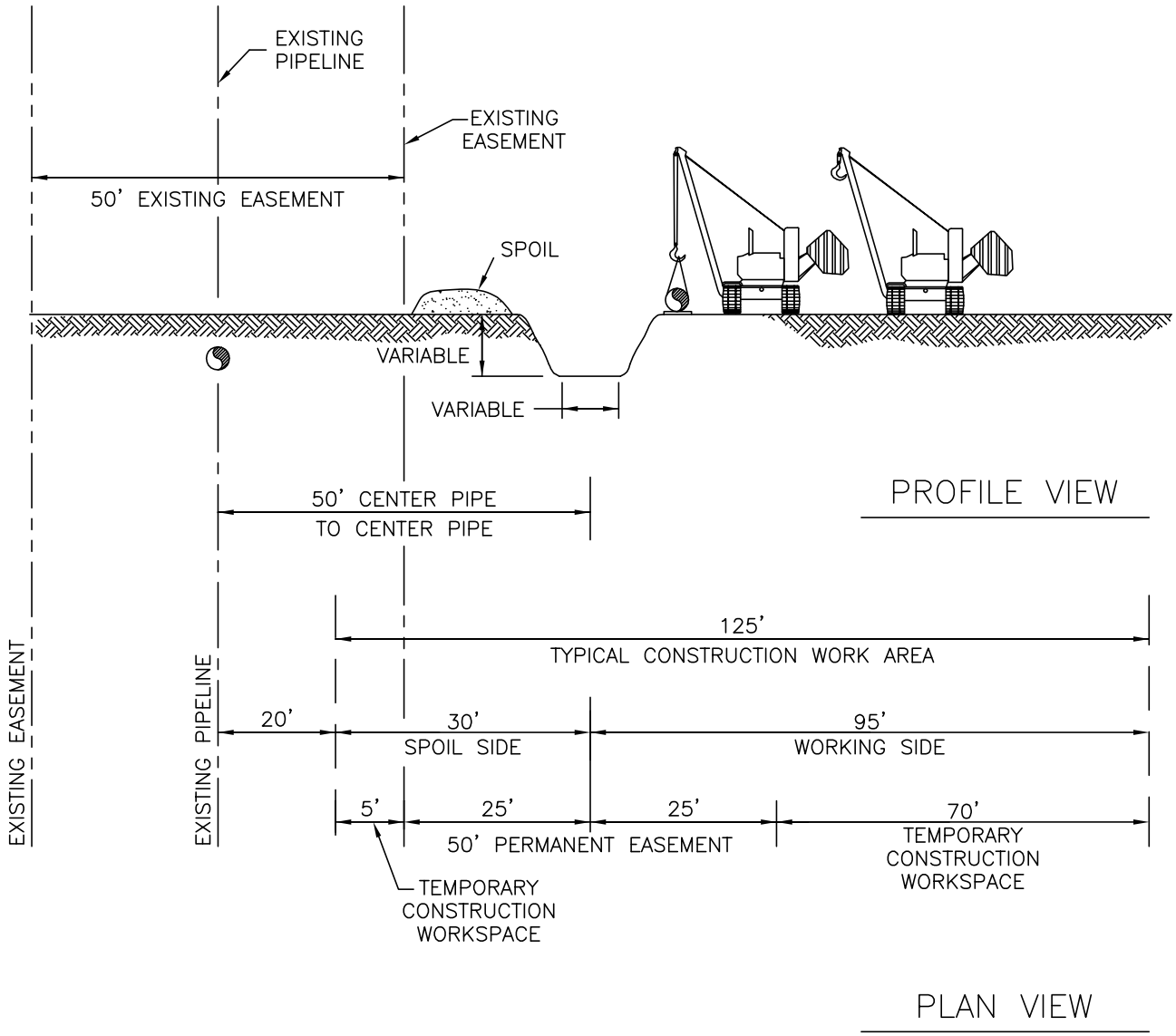
TYPICAL STEEP SLOPE WITH SIDE SLOPE WORKSPACE- LEX MP 0.00-38.98

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 15
APPROVED BY	SHEET 1 OF 1	

TYPICAL CONFIGURATION FOR PARALLELING TO EXISTING PIPELINES - LEX MP 0.00-38.98



NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 125 FEET.

PRELIMINARY

Appendix C-18

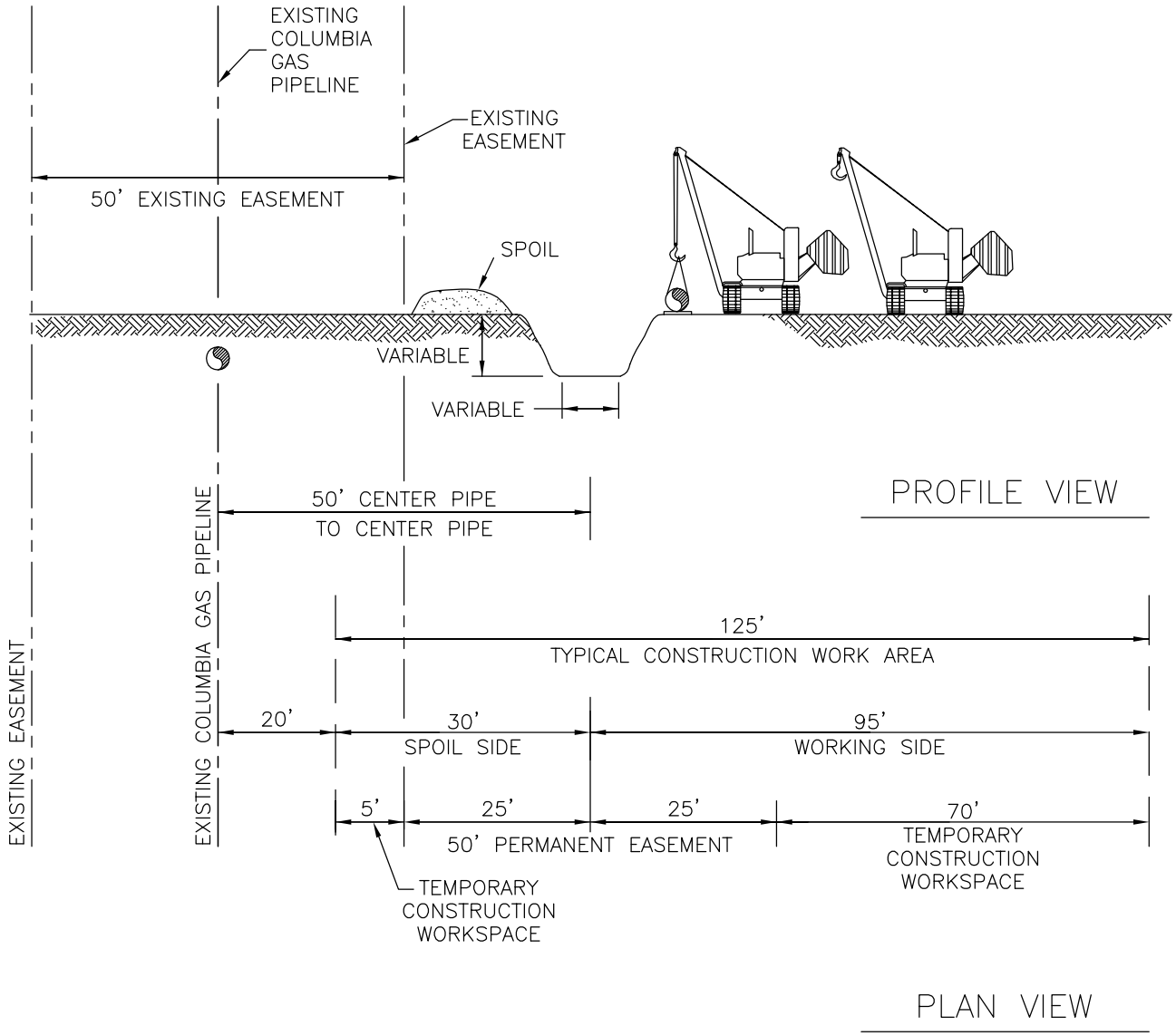
TYPICAL CONFIGURATION FOR PARALLELING TO EXISTING PIPELINES - LEX MP 0.00-38.98

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 16
APPROVED BY	SHEET 1 of 1	

TYPICAL CONFIGURATION FOR PARALLELING TO EXISTING COLUMBIA PIPELINES - LEX MP 0.00-38.98



NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 125 FEET.

PRELIMINARY

Appendix C-19

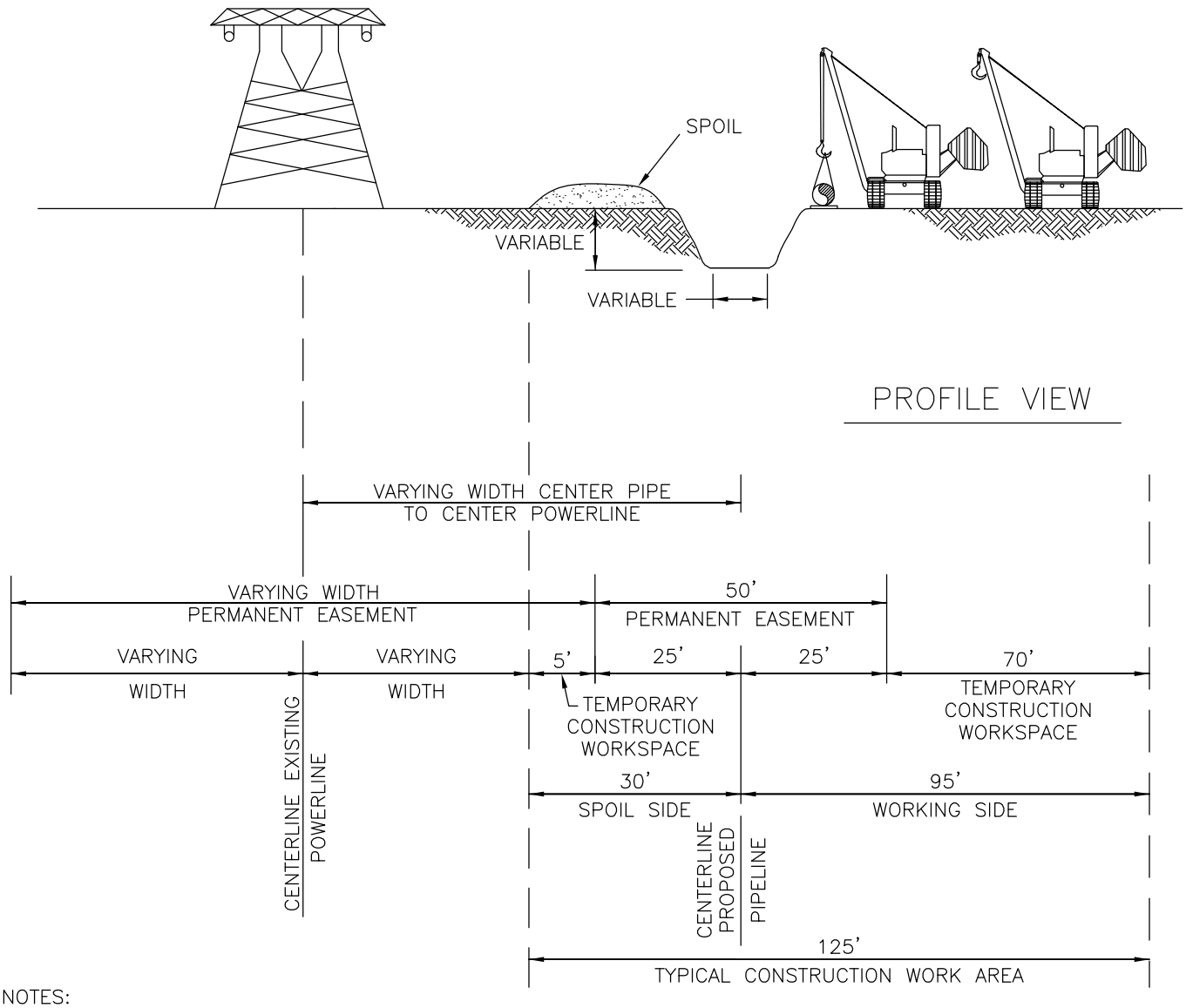
TYPICAL CONFIGURATION FOR PARALLELING TO EXISTING COLUMBIA PIPELINES - LEX MP 0.00-38.98

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 17
APPROVED BY	SHEET 1 of 1	

TYPICAL PARALLELING CONFIGURATION WITH POWERLINE - LEX MP 0.00-38.98



NOTES:

1. USE FOR 14–INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE–SPECIFIC TERRAIN FEAUTURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION WORK AREA WILL BE 125 FEET.

PRELIMINARY

Appendix C-20

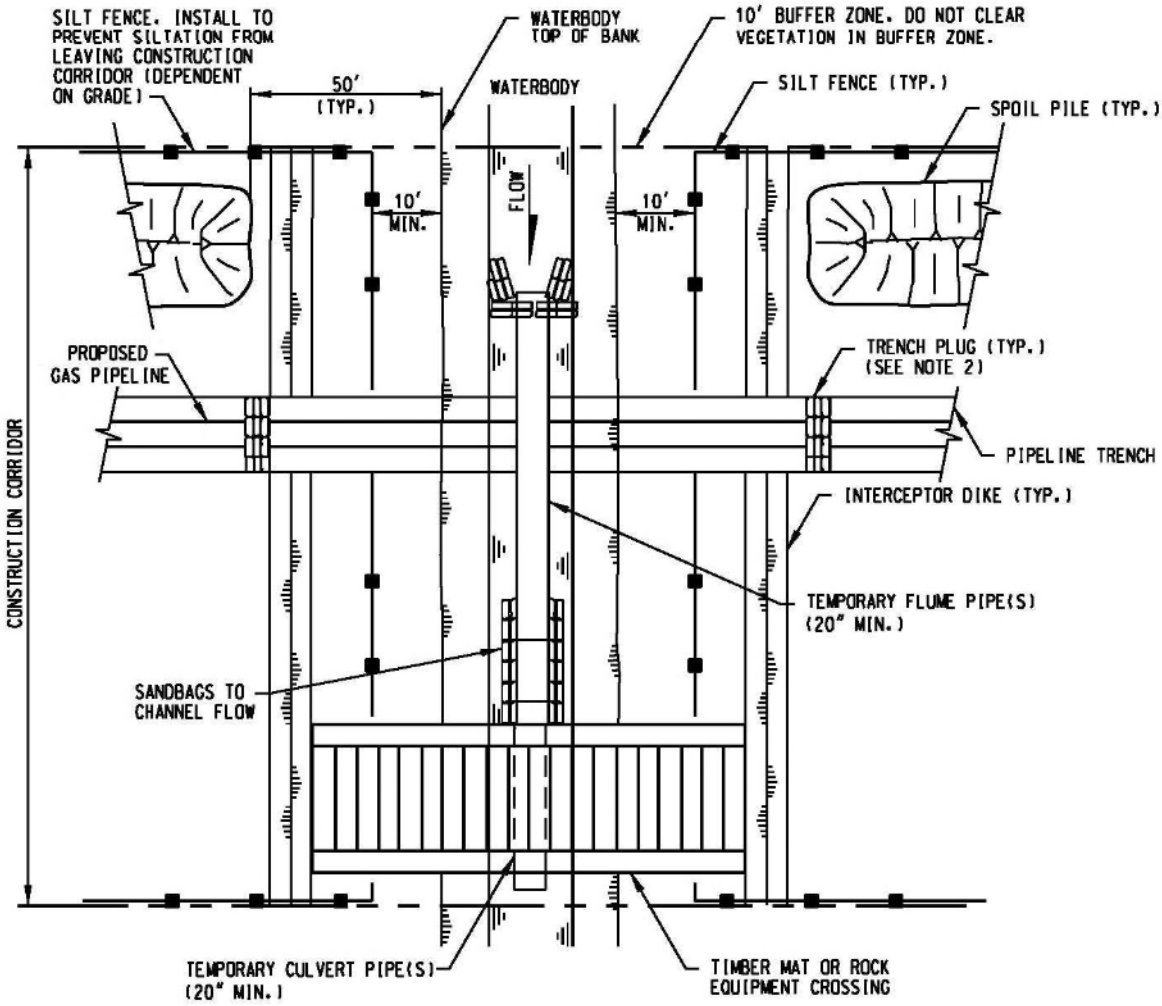
TYPICAL PARALLELING CONFIGURATION WITH POWERLINE - LEX MP 0.00-38.98

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 18
APPROVED BY	SHEET 1 of 1	

TYPICAL FLUMED CROSSING METHOD



1. SILT FENCE AND INTERCEPTOR DIKE TO BE REMOVED ACROSS PIPELINE TRENCH DURING CONSTRUCTION OF PIPELINE. SILT FENCE AND INTERCEPTOR DIKES TO BE REPLACED AFTER BACKFILL OF TRENCH.
2. USE HARD OR SOFT PLUGS PRIOR TO PIPE INSTALLATION. INSTALL PERMANENT TRENCH PLUGS AFTER PIPE INSTALLATION AND PRIOR TO BACKFILLING PIPELINE TRENCH.

PRELIMINARY

Appendix C-21

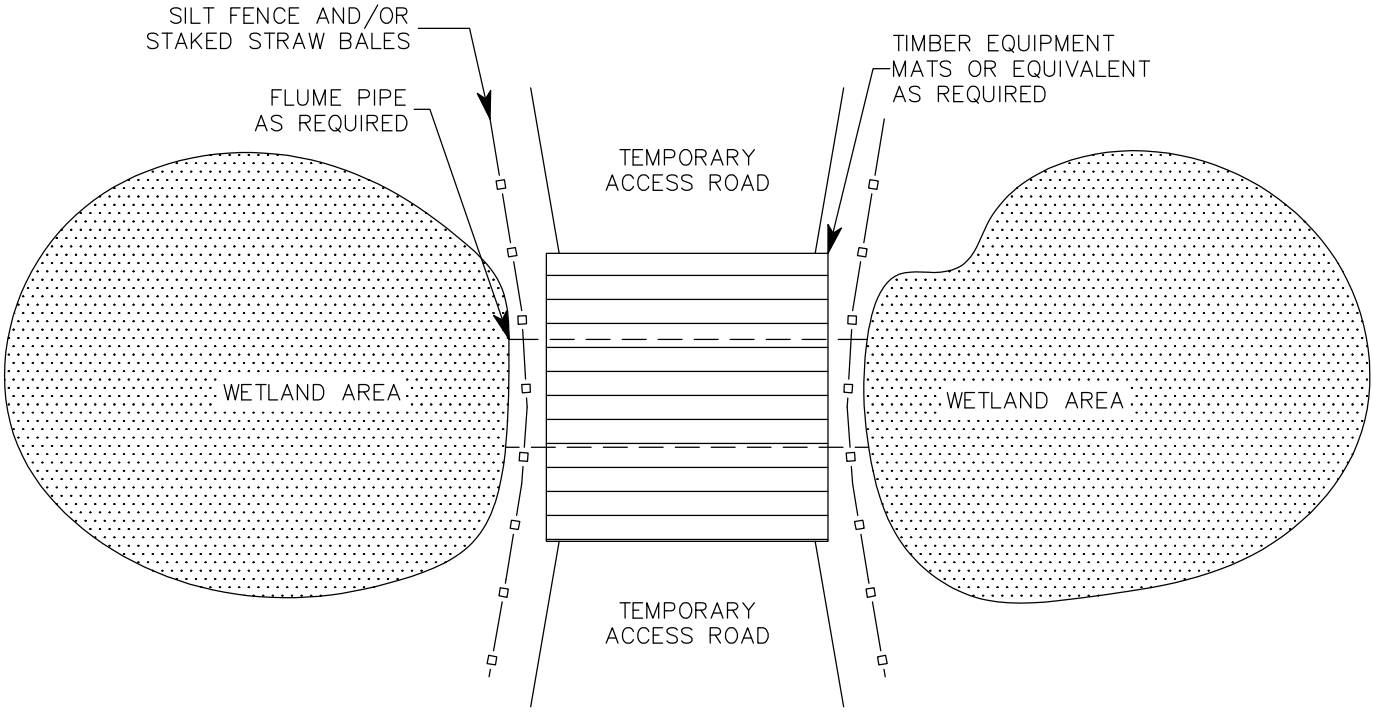
TYPICAL FLUMED CROSSING METHOD

LEACH XPRESS PROJECT

File No.:

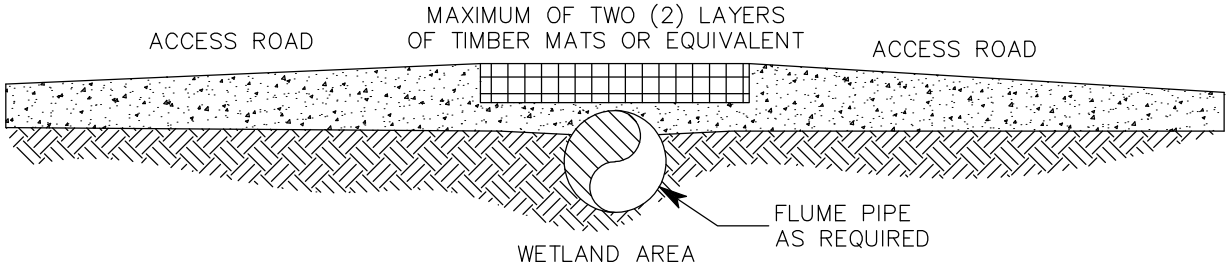
DRAWN BY	DATE		DWG. NO.
CHECKED BY	SCALE	N.T.S.	TYPICAL 19
APPROVED BY	SHEET	1 of 1	

TYPICAL CONSTRUCTION WETLANDS ACCESS ROAD



PLAN VIEW

N.T.S.



PROFILE VIEW

N.T.S.

PRELIMINARY

Appendix C-22

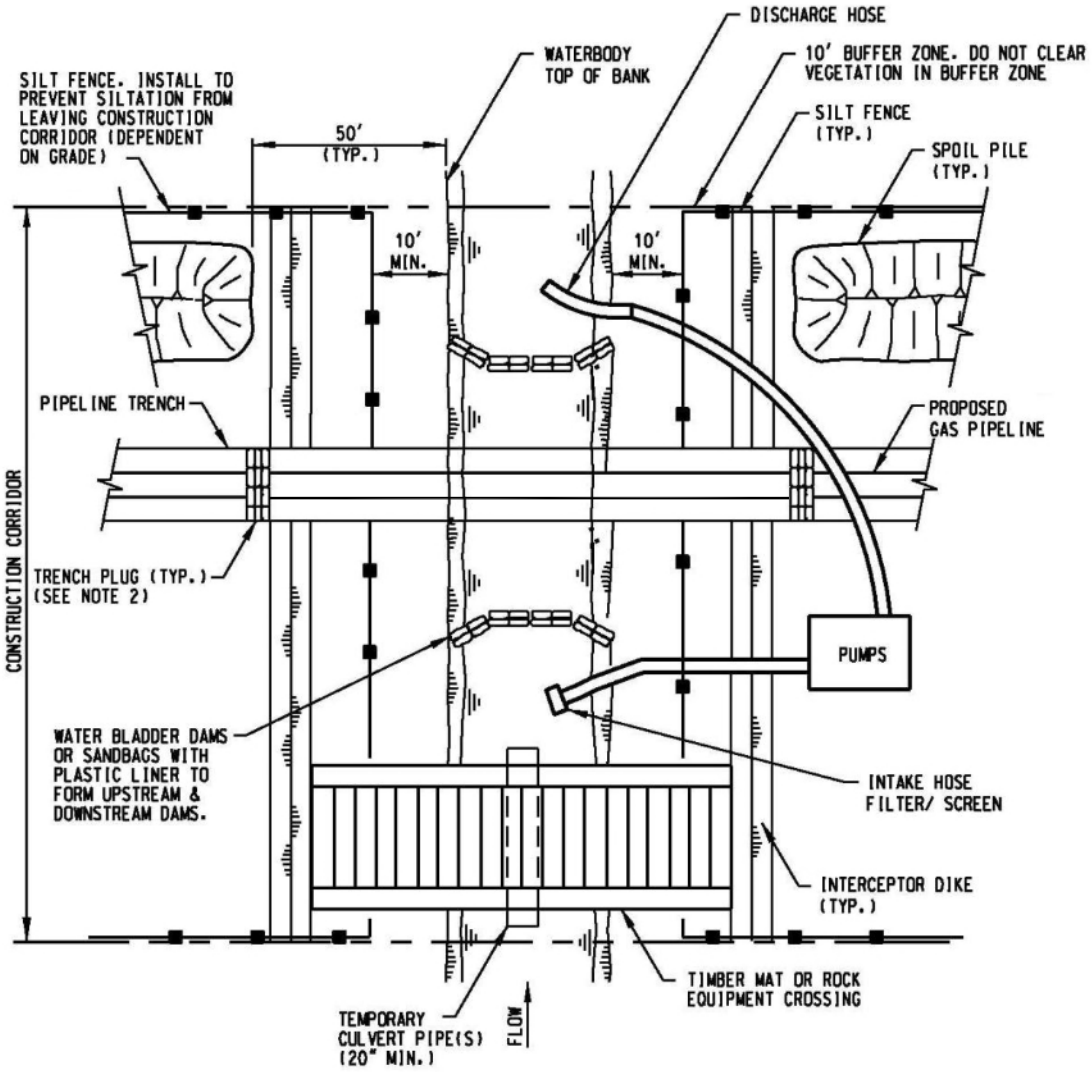
File No.:

TYPICAL CONSTRUCTION WETLANDS ACCESS ROAD

LEACH XPRESS PROJECT

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 20
APPROVED BY	SHEET 1 of 1	

TYPICAL DAM AND PUMP CROSSING METHOD



1. SILT FENCE AND INTERCEPTOR DIKE TO BE REMOVED ACROSS PIPELINE TRENCH DURING CONSTRUCTION OF PIPELINE. SILT FENCE AND INTERCEPTOR DIKES TO BE REPLACED AFTER BACKFILL OF TRENCH.

2. USE HARD OR SOFT PLUGS PRIOR TO PIPE INSTALLATION. INSTALL PERMANENT TRENCH PLUGS AFTER PIPE INSTALLATION AND PRIOR TO BACKFILLING PIPELINE TRENCH.

PRELIMINARY

Appendix C-23

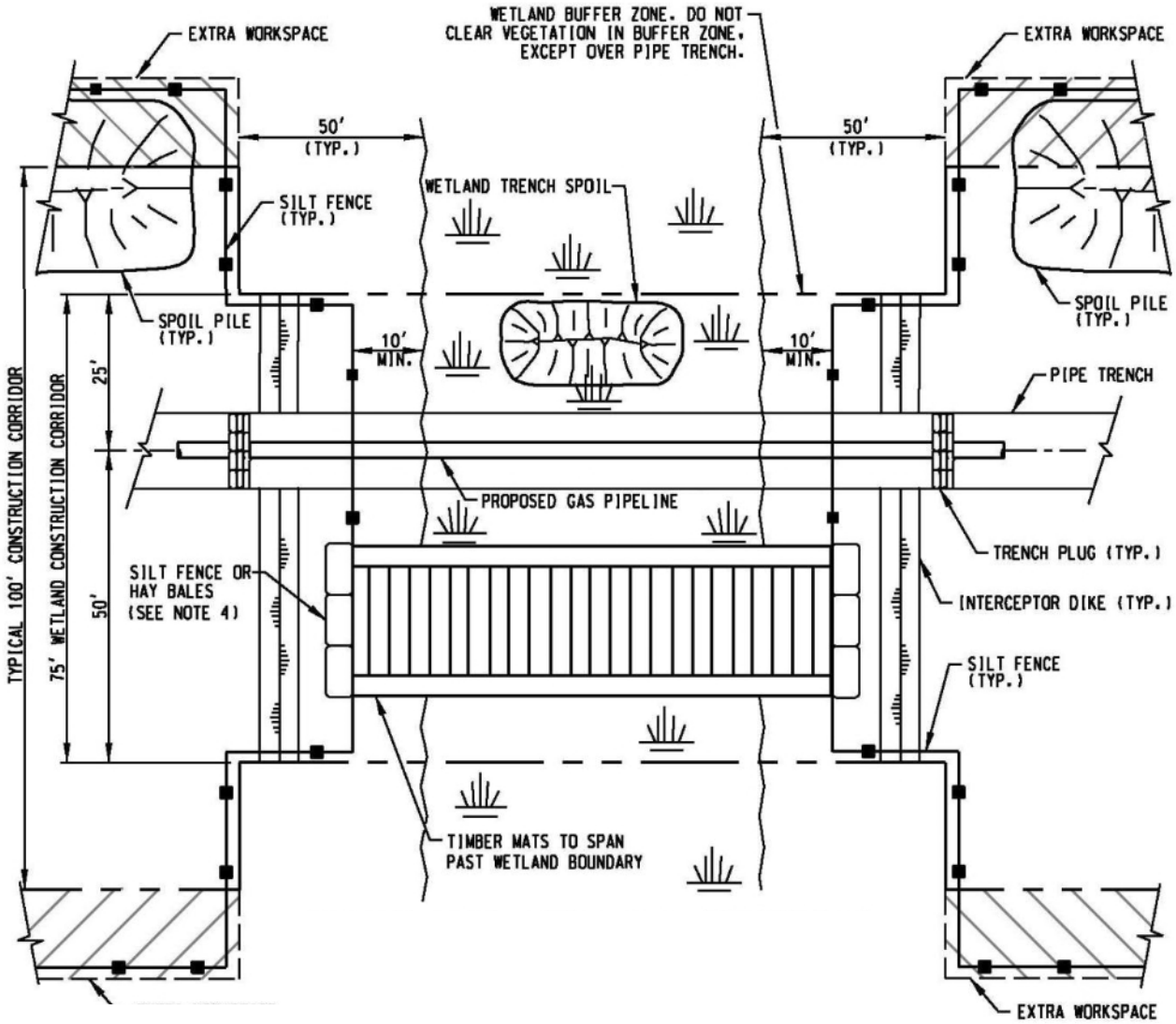
TYPICAL DAM AND PUMP CROSSING METHOD

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE		DWG. NO.
CHECKED BY	SCALE	N.T.S.	TYPICAL 21
APPROVED BY	SHEET	1 of 1	

TYPICAL SATURATED WETLAND CROSSING



NOTE:

1. INSTALL PERMANENT INTERCEPTOR DIKES AT THE BASE OF ALL SLOPES ADJACENT TO THE WETLAND.
2. CONTRACTOR SHALL POSTPONE GRADING OF WORK AREA ADJACENT TO WETLAND UNTIL STAGING AREA IS PREPARED AND WORK IN THE WETLAND IS READY TO COMMENCE.
3. SILT FENCE OR HAY BALES SHALL BE PLACED IN THE GAP AT THE TIMBER MATS BY THE END OF EACH DAY OR PRIOR TO APPROACHING RAIN TO PREVENT SEDIMENT FLOW INTO WETLAND.
4. USE ADDITIONAL TIMBER MAT LAYERS TO RAISE CROSSING ABOVE GRADE WHERE POOR SOIL CONDITIONS EXIST.
5. SILT FENCE AND INTERCEPTOR DIKE TO BE REMOVED ACROSS PIPE TRENCH AND DURING CONSTRUCTION OF PIPELINE. SILT FENCE AND INTERCEPTOR DIKE TO BE REPLACED AFTER BACKFILL OF TRENCH.

PRELIMINARY

Appendix C-24

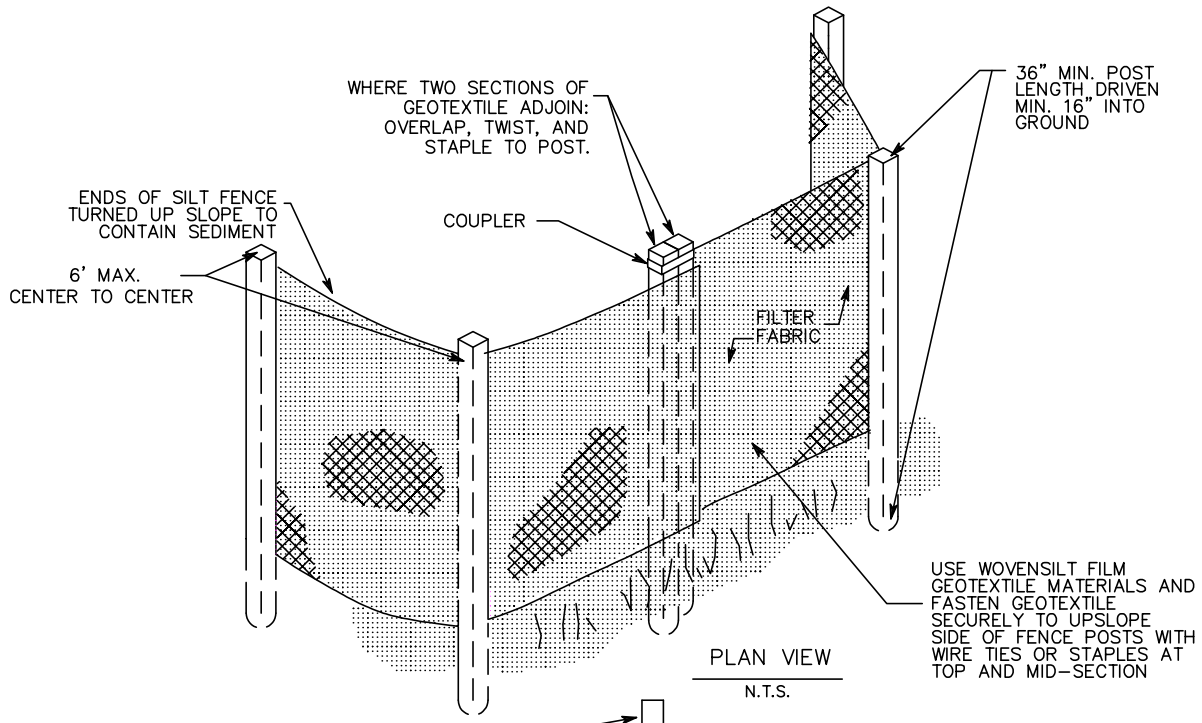
TYPICAL SATURATED WETLAND CROSSING

LEACH XPRESS PROJECT

File No.:

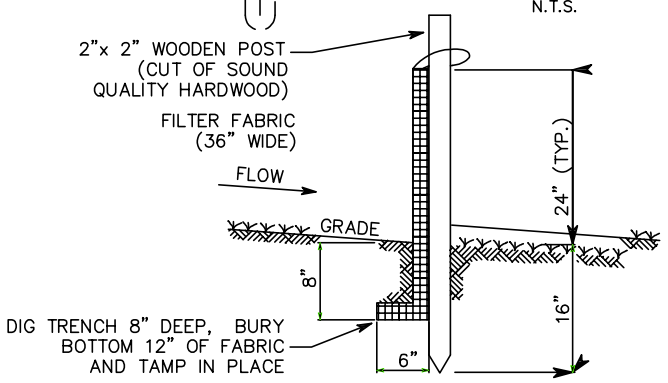
DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 22
APPROVED BY	SHEET 1 of 1	

TYPICAL CONSTRUCTION SILT FENCE



PLAN VIEW

N.T.S.



PROFILE VIEW

N.T.S.

INSTALLATION REQUIREMENTS:

- WHEN USING SILT FENCE, PLACE IT:
  - BETWEEN DISTURBED AREAS AND DOWN-SLOPE ENVIRONMENTAL RESOURCE AREAS
  - AT THE BASE OF ALL SLOPES NEXT TO WETLANDS, WATERBODIES, AND ROAD CROSSINGS
  - AT THE INLET AND OUTLET OF OPEN DRAINAGE STRUCTURES
  - EXTEND BOTH ENDS OF THE SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SILT FENCE.
- USE SANDBAGS OR BACKFILLING TO KEY IN THE BOTTOM OF THE FABRIC WHERE IT IS NOT FEASIBLE TO TRENCH IT IN (LEDGES, ROCKY SOIL, LARGE ROOTS, ETC.)

MAINTENANCE REQUIREMENTS:

- INSPECT SILT FENCE:
  - DAILY IN AREAS OF ACTIVE CONSTRUCTION
  - WEEKLY IN AREAS WITH NO CONSTRUCTION
  - WITHIN 24 HOURS FOLLOWING EACH MAJOR STORM EVENT
- REPAIR OR REPLACE SILT FENCE IF GEOTEXTILE IS TORN OR UNDERMINING OF THE SILT FENCE OCCURS
- REMOVE ACCUMULATED SEDIMENTS TO AN UPLAND AREA WHEN BULGES DEVELOP IN SILT FENCE OR WHEN SEDEMENT REACHES 25% OF FENCE HEIGHT.

PRELIMINARY

Appendix C-25

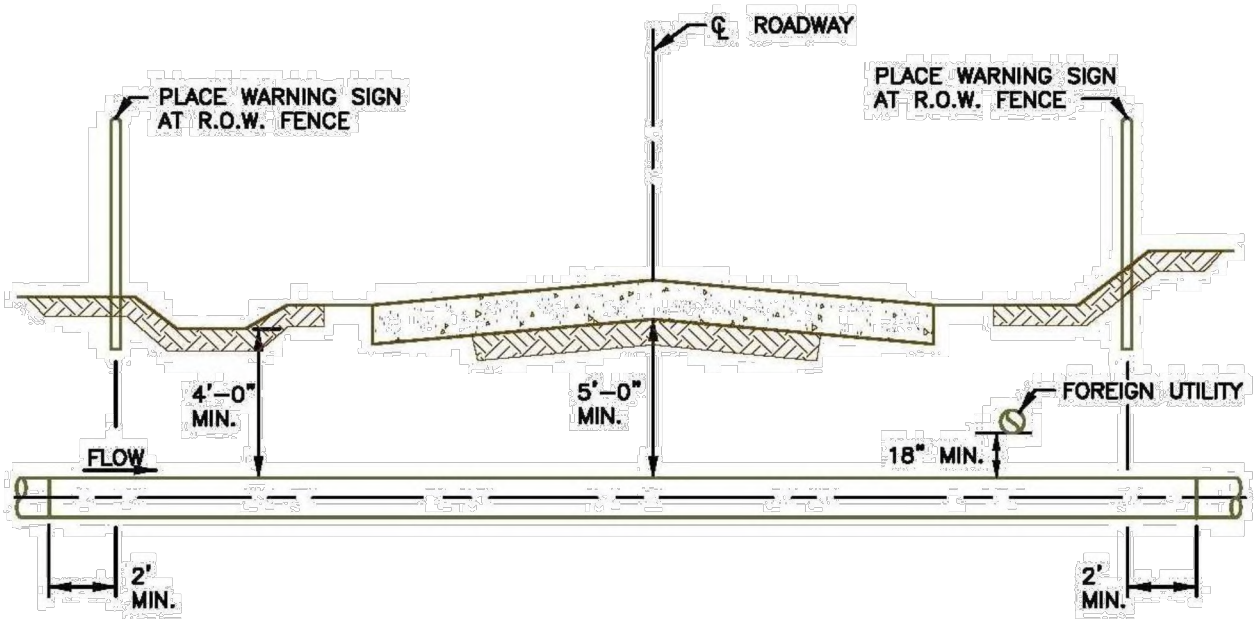
File No.:

TYPICAL CONSTRUCTION SILT FENCE

LEACH XPRESS PROJECT

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 23
APPROVED BY	SHEET 1 of 1	

TYPICAL OPEN-CUT ROAD CROSSING



NOTES:

1. CONTRACTOR SHALL INSTALL THE HEAVY WALL STEEL PIPE, BACKFILL AND REPLACE ROAD SURFACE IN ACCORDANCE WITH PERMIT ISSUED BY THE GOVERNMENT BODY HAVING JURISDICTION AND/OR IN ACCORDANCE WITH THE SPECIFICATIONS, WHICHEVER IS THE MOST STRINGENT.

2. THE PIPELINE SHALL CROSS AS NEAR TO RIGHT ANGLE AS POSSIBLE AND ECONOMICALLY PRACTICAL.

3. THE HEAVY WALL STEEL PIPE SHALL BE INSTALLED FROM THE R.O.W. LIMIT TO THE RIGHT–OF–WAY LIMIT AND EXTEND A MINIMUM OF 2 FEET BEYOND THE R.O.W. LIMITS.

4. THE HEAVY WALL STEEL PIPE WITHIN THE RIGHT–OF–WAY LIMITS SHALL BE FULLY EXTENDED DURING INSTALLATION.

5. ANY OPEN CUT TRENCH SHALL BE IN ACCORDANCE WITH STATE OR COUNTY SPECIFICATIONS AS DEFINED IN THE SPECIFICATION AND STANDARD. THE TRENCH SHALL BE BACKFILLED IN 8" LIFTS AND COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY THE PROCTOR COMPACTION TEST (ASTM D698).

6. AS AN ALTERNATE, AND WHEN APPROVED BY ENGINEER, CONCRETE SLURRY (200PSI CONCRETE) MAY BE USED AS BACKFILL MATERIAL ABOVE THE PIPE.

7. REPLACE SUB–GRADE AND ROAD SURFACE MATERIAL WITH EQUAL OR GREATER THICKNESS AND WITH EQUAL OR GREATER MATERIAL AND SPECIFICATIONS TO PROVIDE A SMOOTH AND CONTINUOUS ROAD SURFACE.

PRELIMINARY

Appendix C-26

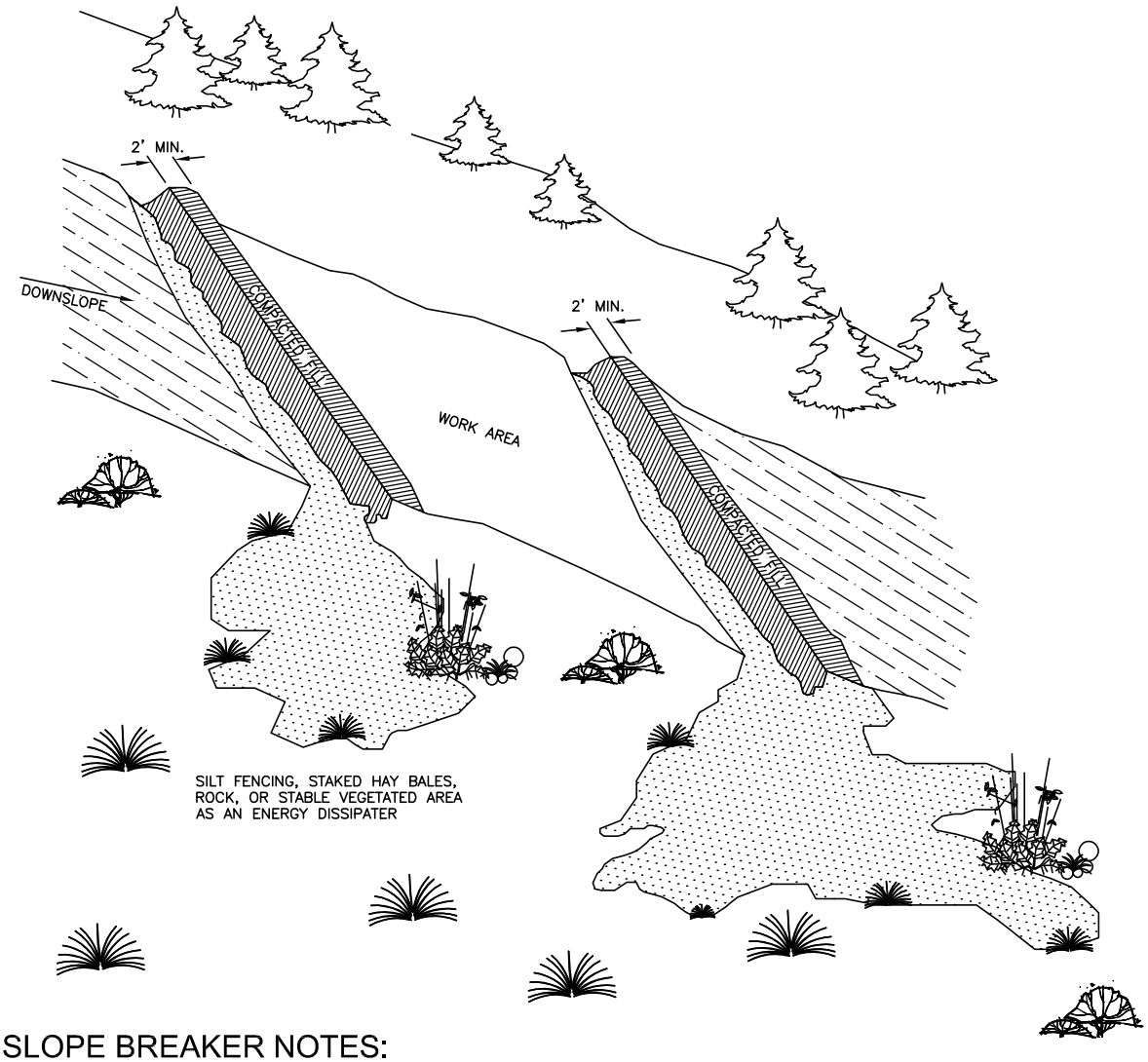
TYPICAL OPEN-CUT ROAD CROSSING

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 24
APPROVED BY	SHEET 1 of 1	

TYPICAL SLOPE BREAKER - TEMPORARY AND PERMANENT



SLOPE BREAKER NOTES:

1. SLOPE BREAKERS SHALL BE CONSTRUCTED OF COMPACTED NATIVE SOIL AND INSTALLED AT LOCATIONS AS SHOWN ON THE CONSTRUCTION DRAWINGS OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTION.
2. SLOPE BREAKER SHALL BE CREATED AS SHOWN OR OTHER PATTERN AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR TO DIRECT THE WATER OFF THE WORK AREA.
3. THE SLOPE BREAKER SHALL BE 18" DEEP (AS MEASURED FROM THE TROUGH TO THE TOP OF THE SLOPE BREAKER) THE TROUGH WILL BE A MINIMUM OF 5' WIDE ACROSS THE WIDTH OF THE WORK AREA.
4. THE OUTLET OF THE SLOPE BREAKER MUST FREELY DISCHARGE ALL RUNOFF OFF THE DISTURBED WORK AREA. INTO A STABLE WELL VEGETATED AREA OR INTO AN ENERGY DISSIPATER.
5. WHERE SLOPE BREAKERS EXTEND BEYOND THE EDGE OF THE CONSTRUCTION WORK AREA TO DIRECT RUNOFF INTO STABLE, WELL VEGETATED AREAS THESE LOCATIONS MUST BE APPROVED BY THE ENVIRONMENTAL INSPECTOR.

SLOPE (%)	SPACING (FEET)
5–15	300
>15–30	200
>30	100

PRELIMINARY

Appendix C-27

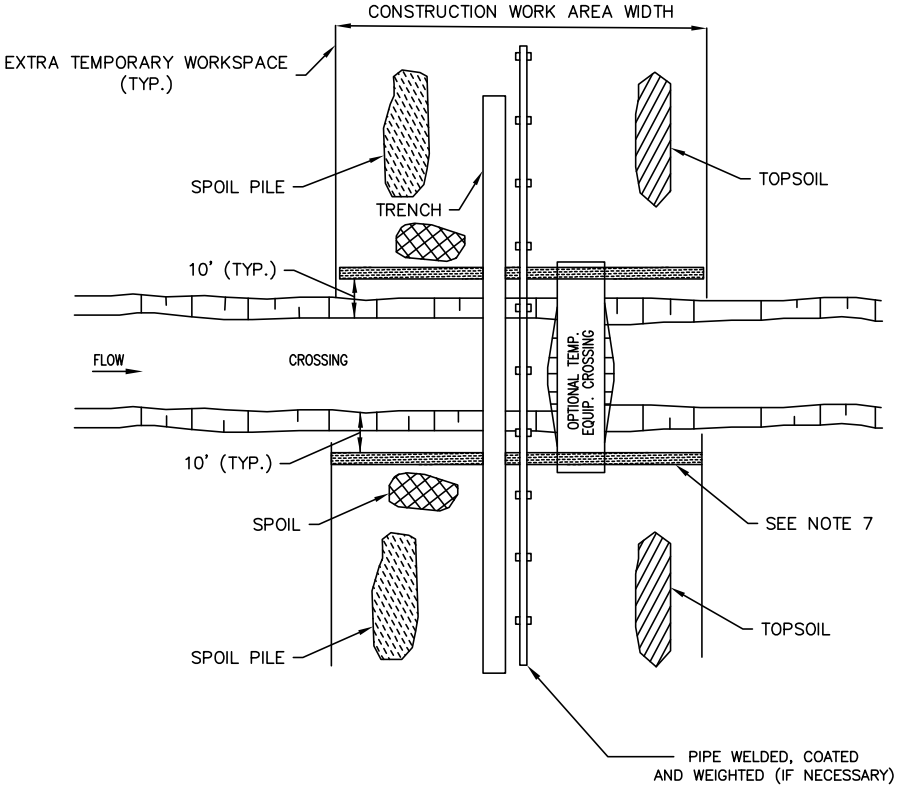
File No.:

TYPICAL SLOPE BREAKER - TEMPORARY AND PERMANENT

LEACH XPRESS PROJECT

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 25
APPROVED BY	SHEET 1 of 1	

TYPICAL WATER CROSSING - OPEN CUT NO FLOW



PLAN VIEW
N.T.S.

NOTES:

1. THIS METHOD APPLIES TO CROSSINGS WHERE NO FLOWING WATER IS PRESENT AT THE TIME OF CROSSING.
2. CONTRACTOR MAY MAINLINE TRENCH THROUGH THE CROSSING OR UP TO BOTH SIDES OF THE CROSSING, STRING, WELD, COAT AND WEIGHT (IF NECESSARY). USING THE MAINLINE CREW WITH THE PIPE SKIDDED OVER THE CROSSING.
3. NO REFUELING OF MOBILE EQUIPMENT OR CONCRETE COATING ACTIVITIES WITHIN 100 FEET OF CROSSING
4. IN AGRICULTURAL LAND, STRIP TOPSOIL FROM SPOIL, STORAGE AREA, STOCKPILE TOPSOIL AND SPOIL SEPARATELY, TOPSOIL AND SPOIL WILL NOT BE STOCKPILED IN THE CROSSING CHANNEL AND WILL BE PLACED IN A MINIMUM OF 10 FEET FROM CROSSING BANKS WITHIN THE CONSTRUCTION WORK AREA.
5. RESTORE CROSSING CHANNEL TO PRE-CONSTRUCTION PROFILE AND SUBSTRATE
6. RESTORE CROSSING BANK TO APPROXIMATE ORIGINAL CONDITION AND STABILIZE AS REQUIRED. STABILIZE CROSSING BANKS; INSTALL TEMPORARY SEDIMENT BARRIERS WITHIN 24 HOURS OF COMPLETING THE CROSSING
7. AS DIRECTED BY THE PIPELINE DIRECTOR, EROSION CONTROL MEASURES SHALL BE INSTALLED ACROSS THE WORK AREA FOLLOWING CLEARING AND GRADING AND MAINTAINED UNTIL CONSTRUCTION OF THE CROSSING EROSION CONTROL MEASURES SHALL RE REINSTALLED IMMEDIATELY FOLLOWING BACKFILLING OF TRENCH AND STABILIZATION OF BANKS, BARRIERS MAY BE TEMPORARY REMOVED TO ALLOW CONSTRUCTION ACTIVITIES BUT MUST BE REPLACED AT THE END OF EACH WORK DAY.

PRELIMINARY

Appendix C-28

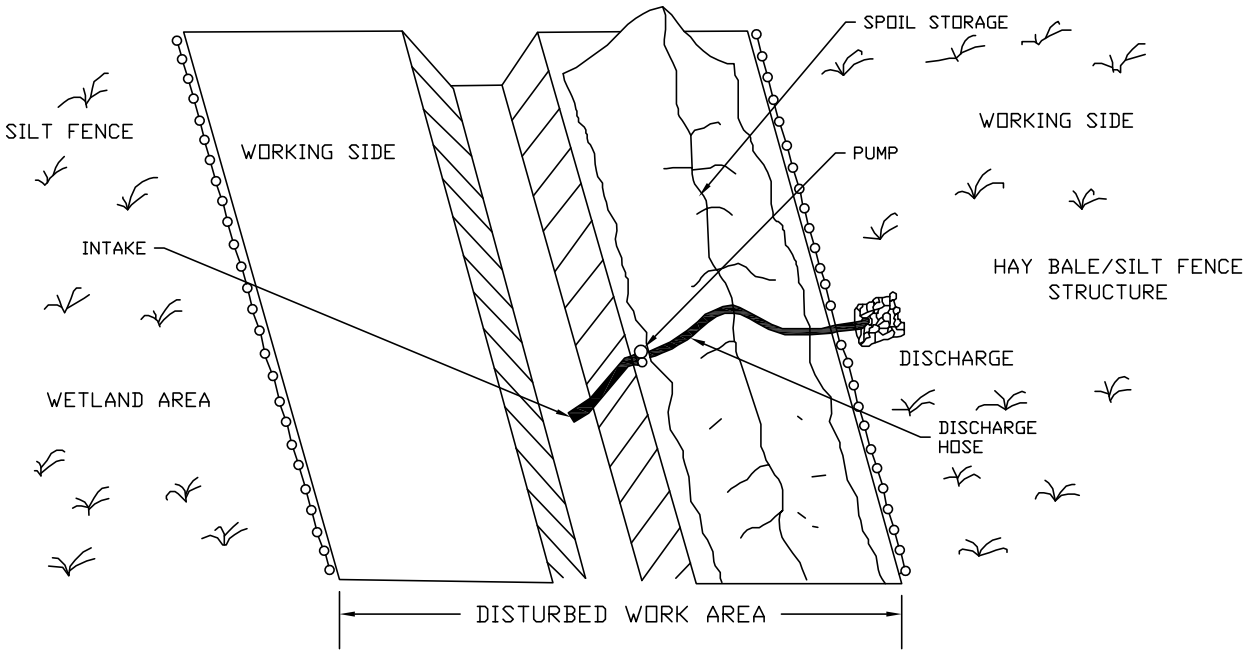
TYPICAL WATER CROSSING - OPEN CUT NO FLOW

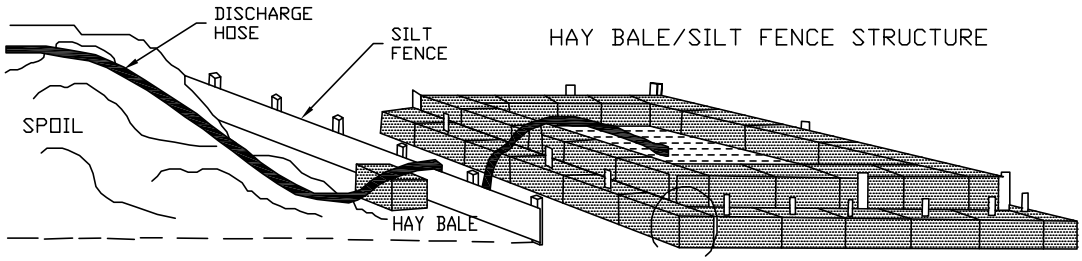
LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 26
APPROVED BY	SHEET 1 of 1	

EROSION CONTROL AND SEDIMENT FILTRATION MEASURES





PRELIMINARY

Appendix C-29

EROSION CONTROL AND SEDIMENT FILTRATION MEASURES

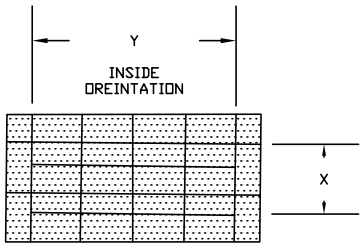
FOR DEWATERING THE PIPELINE TRENCH AN ROADBORES WITHIN WETLANDS AND SPARSELY VEGETATED AREAS - EXHIBIT 1

File No.:

LEACH XPRESS PROJECT

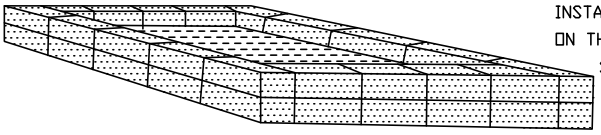
DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 27
APPROVED BY	SHEET 1 of 1	

EROSION CONTROL AND SEDIMENT FILTRATION MEASURES



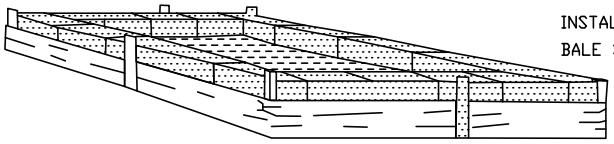
STEP 1

ARRANGE THE STRAW BALES TO THE X AND Y DIMENSIONS (INSIDE) AS SPECIFIED BASED ON THE FLOW RATE OF THE PUMP TO BE USED FOR DEWATERING. ANCHOR STRAW BALES PER TYPICAL 30.



STEP 2

INSTALL ANOTHER LAYER OF STRAW BALES ON THE OUTER EDGE AS SHOWN. DIG IN STARW BALES PER TYPICAL 30.

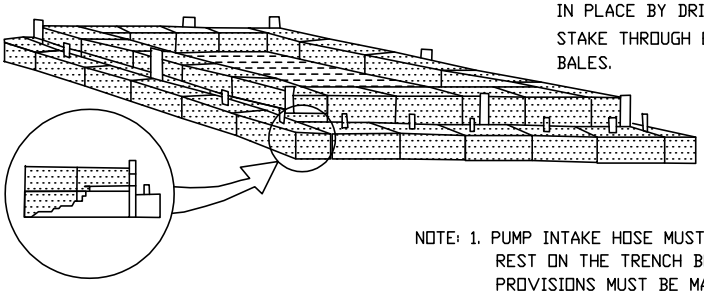


STEP 3

INSTALL SILT FENCE ALL AROUND THE STRAW BALE STRUCTURE AS SHOWN IN TYPICAL 31.

STEP 4

INSTALL ANOTHER LAYER OF STRAW BALES ON THE OUTSIDE OF THE SILT FENCE AND SECURE IN PLACE BY DRIVING A REBAR OR WOODEN STAKE THROUGH EACH OF THE OUTER STRAW BALES.



NOTE: 1. PUMP INTAKE HOSE MUST BE SECURED AND NOT BE ALLOWED TO REST ON THE TRENCH BOTTOM THROUGHOUT DEWATERING. PROVISIONS MUST BE MADE TO ELEVATE THE INLET HOSE TO AT LEAST ONE FOOT ABOVE THE BOTTOM UNTIL BOTTOM DEWATERING IS NECESSARY.

2. WHEN SILT FENCE STAKES CANNOT BE DRIVEN INTO GROUND, LINE THE BOTTOM AND EXTERIOR OF STRAW BALES WITH GEOTEXTILE FABRIC.

PRELIMINARY

Appendix C-30

EROSION CONTROL AND SEDIMENT FILTRATION MEASURES

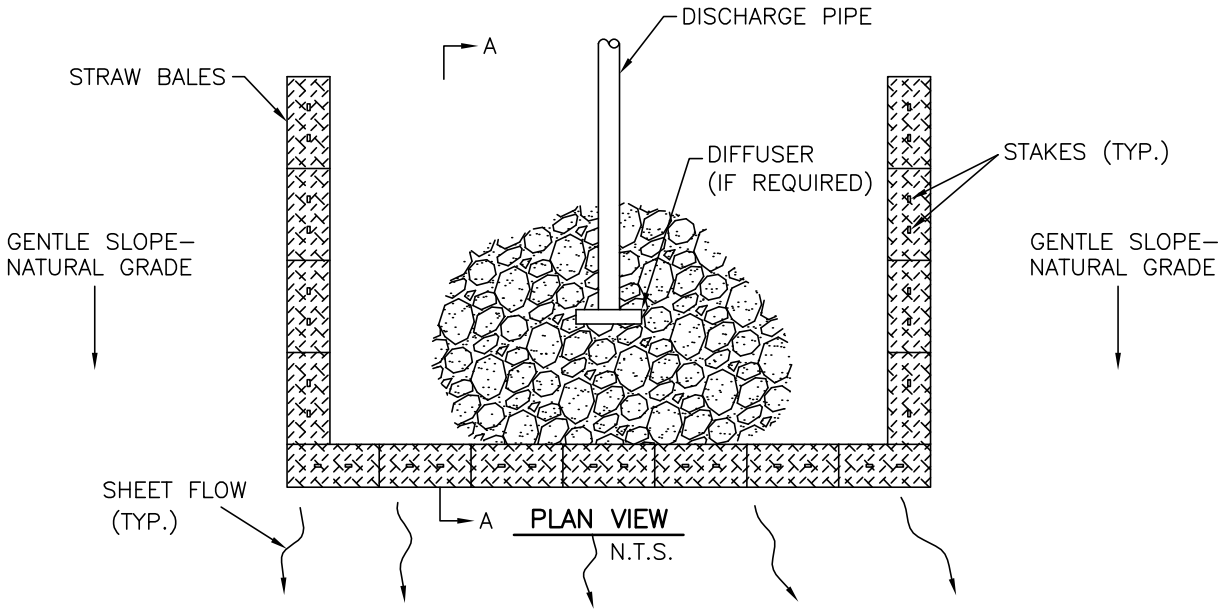
FOR DEWATERING THE PIPELINE TRENCH AN ROADBORES WITHIN WETLANDS AND SPARSELY VEGETATED AREAS - EXHIBIT 2

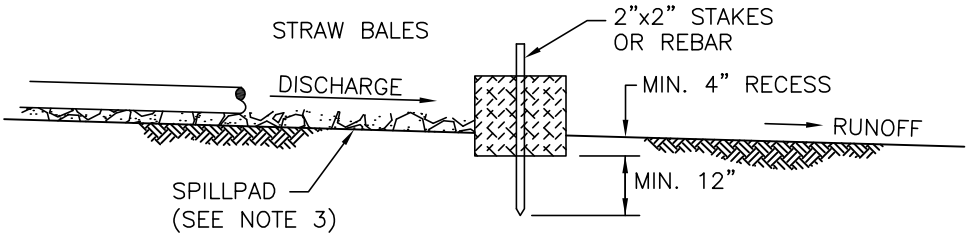
File No.:

LEACH XPRESS PROJECT

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL28
APPROVED BY	SHEET 1 of 1	

TYPICAL STRAW BALE DEWATERING STRUCTURE (SMALL VOLUME)





SECTION A–A
N.T.S.

NOTES:

1. INSTALL A STRAW BALE DEWATERING STRUCTURE WHEREVER IT IS NECESSARY AND AS DIRECTED BY THE COMPANY'S INSPECTOR TO PREVENT THE FLOW OF HEAVILY SILT LADEN WATER INTO WATER BODIES OR WETLANDS.
2. DISCHARGE SITE SHALL BE WELL VEGETATED AND THE TOPOGRAPHY OF THE SITE SUCH THAT WATER WILL FLOW INTO THE DEWATERING STRUCTURE AND AWAY FROM ANY WORK AREAS. THE AREA DOWN SLOPE FROM THE DEWATERING SITE MUST BE REASONABLY PLANE OR STABILIZED BY VEGETATION OR OTHER MEANS TO ALLOW THE FILTERED WATER TO CONTINUE AS SHEET FLOW.
3. DIRECT THE PUMPED WATER INTO A STABLE SPILL PAD CONSTRUCTED OF STRAW BALES, ROCK FILL, WEIGHTED TIMBERS OR WOVEN GEOTEXTILE STAKED TO THE GROUND SURFACE (SUCH AS MIRAFI 600X, TERRAFIX 400W) OR A COMPANY APPROVED EQUIVALENT. FORCE THE DISCHARGE WATER BEYOND THE SPILL PAD INTO SHEET FLOW USING STRAW BALES AND NATURAL TOPOGRAPHY. ANCHOR STRAW BALES SECURELY IN PLACE WITH TWO WOODEN STAKES OR REBAR. ENTRENCH ("KEY") STRAW BALES INTO THE GROUND TO A DEPTH OF 4".
4. DISCHARGE RATES SHALL BE SUCH THAT WATER WILL NOT OVERFLOW THE TOP OF THE STRUCTURE.
5. MANUFACTURED FILTER BAGS ARE A SUITABLE ALTERNATIVE TO STRAW BALE STRUCTURES FOR TRENCH DEWATERING. FILTER BAGS SHALL BE INSTALLED AS SPECIFIED BY THE MANUFACTURER. DISPOSE OF FULL FILTER BAGS AT AN APPROVED OFF–SITE FACILITY.
6. INSTALL AN ENERGY DISSIPATOR IF THE DISCHARGE VELOCITY MAY ERODE THE SOIL.

PRELIMINARY

Appendix C-31

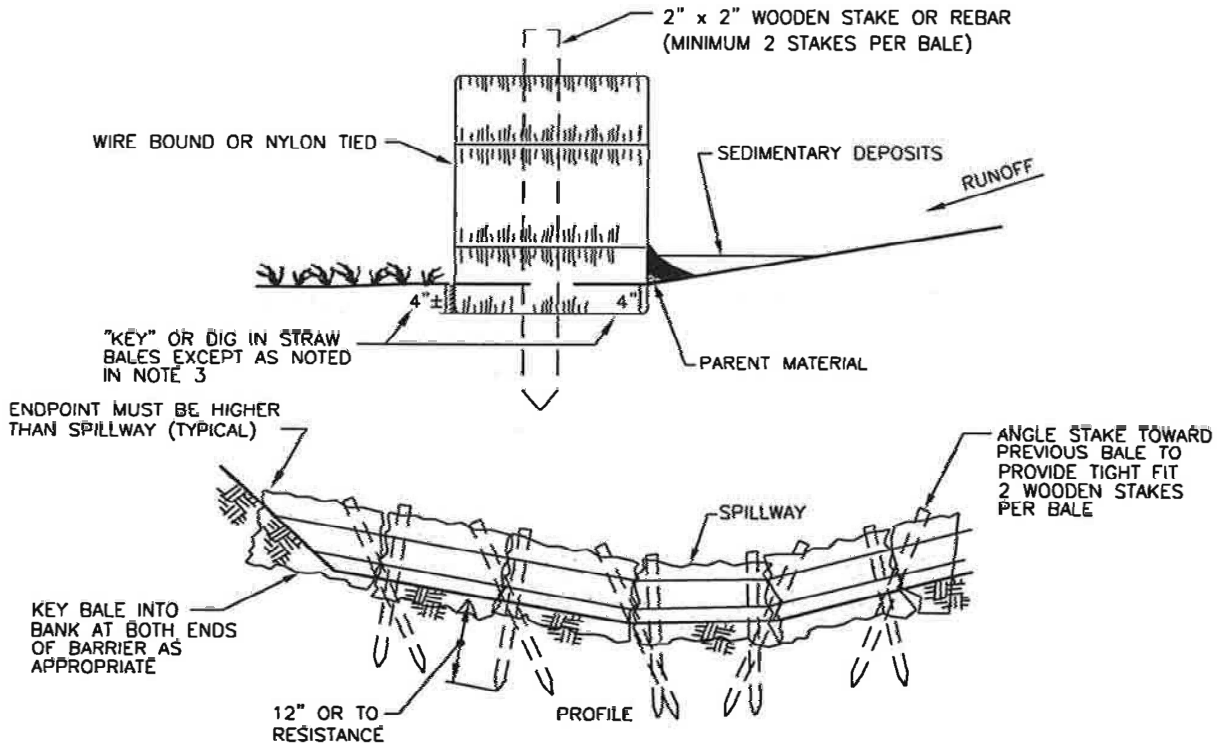
File No.:

TYPICAL STRAW BALE DEWATERING STRUCTURE (SMALL VOLUME)

LEACH XPRESS PROJECT

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 29
APPROVED BY	SHEET 1 of 1	

STRAW BALE SEDIMENT BARRIER



NOTE:

1. STRAW BALE SEDIMENT BARRIERS MAY BE INSTALLED AT THE FOLLOWING LOCATIONS
   - THE BASE OF ALL SLOPES ABOVE ROADS, SPRINGS, WETLANDS, IMPOUNDMENTS AND STREAMS
   - THE DOWNSLOPE EDGE WHERE ANY OF THE ABOVE-MENTIONED LOCATIONS ARE ADJACENT TO
   - THE WORK AREA;
   - BETWEEN TOPSOIL/SPOIL STOCKPILES AND STREAMS OR WETLANDS AS NEEDED:
   - ALONE THE WORK AREA BOUNDARIES IN WETLAND CONSTRUCTION;
   - ACROSS CONSTRUCTION WORK AREA AT ALL WATER BODY CROSSINGS;
   - AS SPECIFIED IN THE SPILL PREVENTION, CONTAINMENT, AND COUNTERMEASURE PLAN;
   - AS DIRECTED BY THE COLUMBIA INSPECTOR
2. STRAW BALE SEDIMENT BARRIERS SHALL CONSIST OF A ROW OF STRAW BALES, PLACED ON THE FIBER-CUT EDGE (TIES NOT IN CONTACT WITH THE GROUND). BALES SHALL BE TIGHTLY ABUTTED TO ONE ANOTHER. THE BARRIER SHALL BE ONE BALE HIGH. ONLY CERTIFIED "NOXIOUS WEED-FREE" STRAW SHALL BE USED WHENEVER POSSIBLE.
3. ENTRENCH ("KEY") STRAW BALES INTO THE GROUND TO A DEPTH OF 4" EXCEPT IN FROZEN, STURATED,
   OR EXTREMELY ROCKY SOILS. PLACE PARENT MATERIAL ON UPSTREAM SIDE OF STRAW BALES TO PREVENT UNDERMINING.
4. WALK ON STRAW BALES TO INSURE ADEQUATE BALE-TO-SOIL CONTACT.
5. ANCHOR STRAW BALES SECURELY IN PLACE WITH TWO WOODEN OR STEEL REBAR STAKES DRIVEN THROUGH THE TOPS OF THE BALE. THE STAKES SHALL PENETRATE THE GROUND AT A DISTANCE OF 12" UNLESS ROCK OR AN IMPERMEABLE LAYER IS ENCOUNTERED:
   - THE FIRST, CENTER AND END BALES OF THE BARRIER SHALL HAVE STAKES DRIVEN
   - VERTICALLY THROUGH THE BALE;
   - BALES, OTHER THAN THOSE LOCATED AT THE ENDS OR CENTER OF THE BARRIER, SHALL HAVE THE
   - FIRST STAKE DRIVEN THROUGH THE TIP OF THE BALE AT AN ANGLE SO THAT THE STAKE PASSES
   - THROUGH THE PREVIOUS PLACED BALE IN ORDER TO PROVIDE TIGHT CONTACT BETWEEN BALES. THE
   - SECOND STAKE SHALL BE DRIVEN VERTICALLY THROUGH THE TOP OF THE BALE.
6. TIES TO BE IN HORIZONTAL POSITION.

PRELIMINARY

Appendix C-32

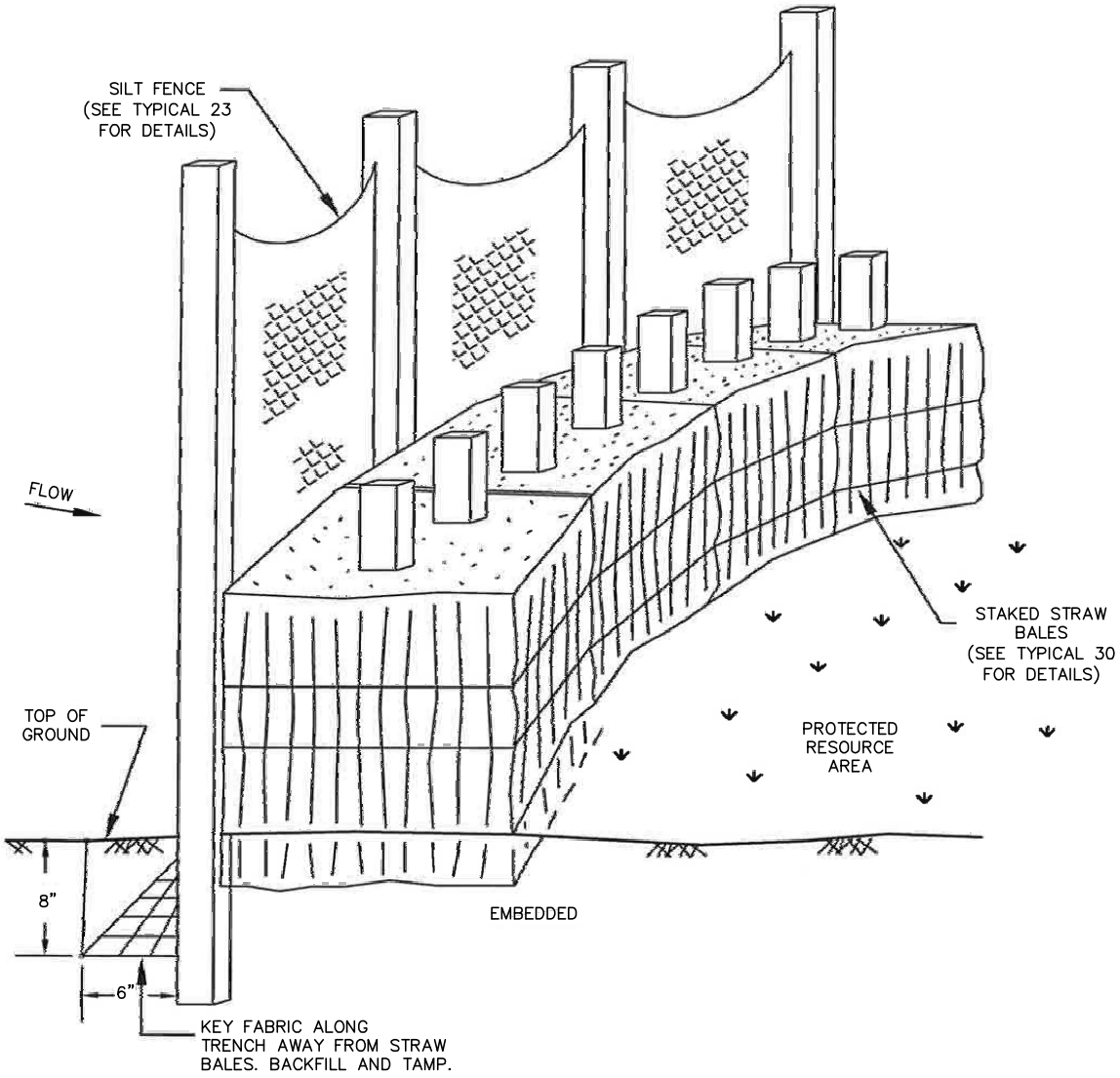
STRAW BALE SEDIMENT BARRIER

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL30
APPROVED BY	SHEET 1 of 1	

TYPICAL STRAW BALE AND SILT FENCE



NOTE:

1. WHERE EXTREMELY ERODIBLE SOIL CONDITIONS EXIST AND AT THE DIRECTION OF THE INSPECTOR. A COMBINED STRAW BALE AND SILT FENCE SEDIMENT CONTROL BARRIER SHALL BE INSTALLED. FOR INSTALLATION CONDITIONS AND INSTRUCTIONS SEE: TYPICAL 23 AND TYPICAL 30

PRELIMINARY

Appendix C-33

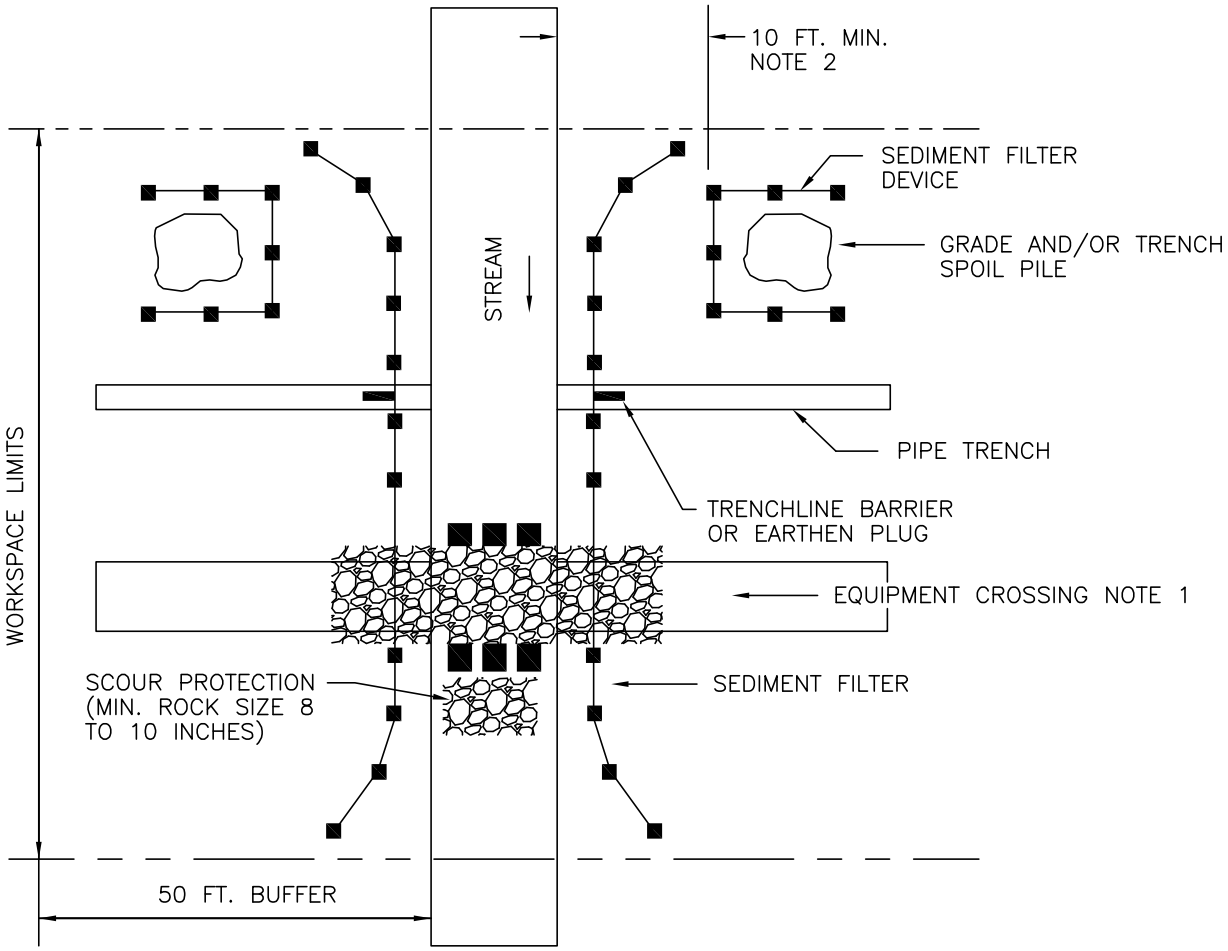
TYPICAL STRAW BALE AND SILT FENCE

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 31
APPROVED BY	SHEET 1 of 1	

TYPICAL WATER CROSSING - OPEN CUT WITH FLOW



NOTES:

1. EQUIPMENT CROSSINGS ARE TO BE PREPARED AS ILLUSTRATED IN TYPICAL 20.
2. GRADE AND TRENCH SPOIL WILL BE STOCKPILED AT LEAST 10 FEET FROM THE WATERS' EDGE.

PRELIMINARY

Appendix C-34

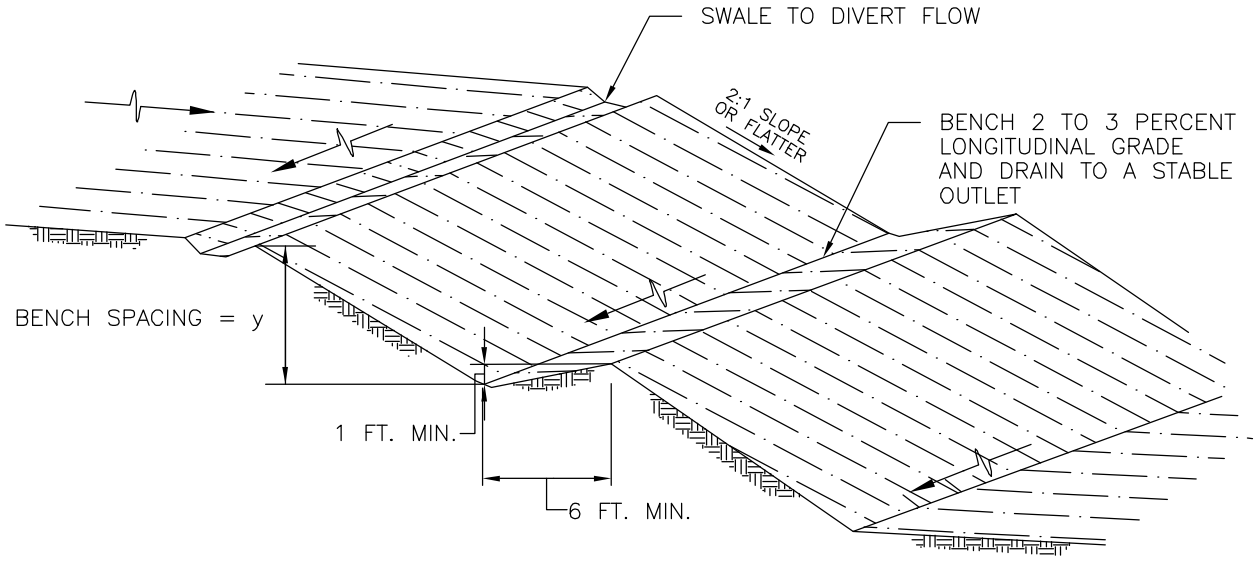
TYPICAL WATER CROSSING -
OPEN CUT WITH FLOW

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 32
APPROVED BY	SHEET 1 of 1	

TYPICAL BENCHING



SLOPE	y (MAX.)
2:1	20 FT
3:1	30 FT
4:1	40 FT

CONSTRUCTION SPECIFICATIONS:

1. USE FILL MATERIAL FREE OF BRUSH, RUBBISH, ROCKS, LOGS, STUMPS, BUILDING DEBRIS, AND OTHER OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.
2. DO NOT INCORPORATE FROZEN, SOFT, MUCKY, OR HIGHLY COMPRESSIBLE MATERIALS INTO FILL SLOPES OR STRUCTURAL FILLS. DO NOT PLACE FILL ON A FROZEN FOUNDATION.
3. PLACE ALL FILL IN LOOSE LIFTS NOT TO EXCEED 8 INCHES AND THEN COMPACT.
4. COMPACT ALL FILLS AS REQUIRED TO REDUCE EROSION, SLIPPAGE, SETTLEMENT, OR OTHER RELATED PROBLEMS. COMPACT FILL INTENDED TO SUPPORT STRUCTURES, CONDUITS, ETC., IN ACCORDANCE WITH LOCAL REQUIREMENTS OR CODES.

PRELIMINARY

Appendix C-35

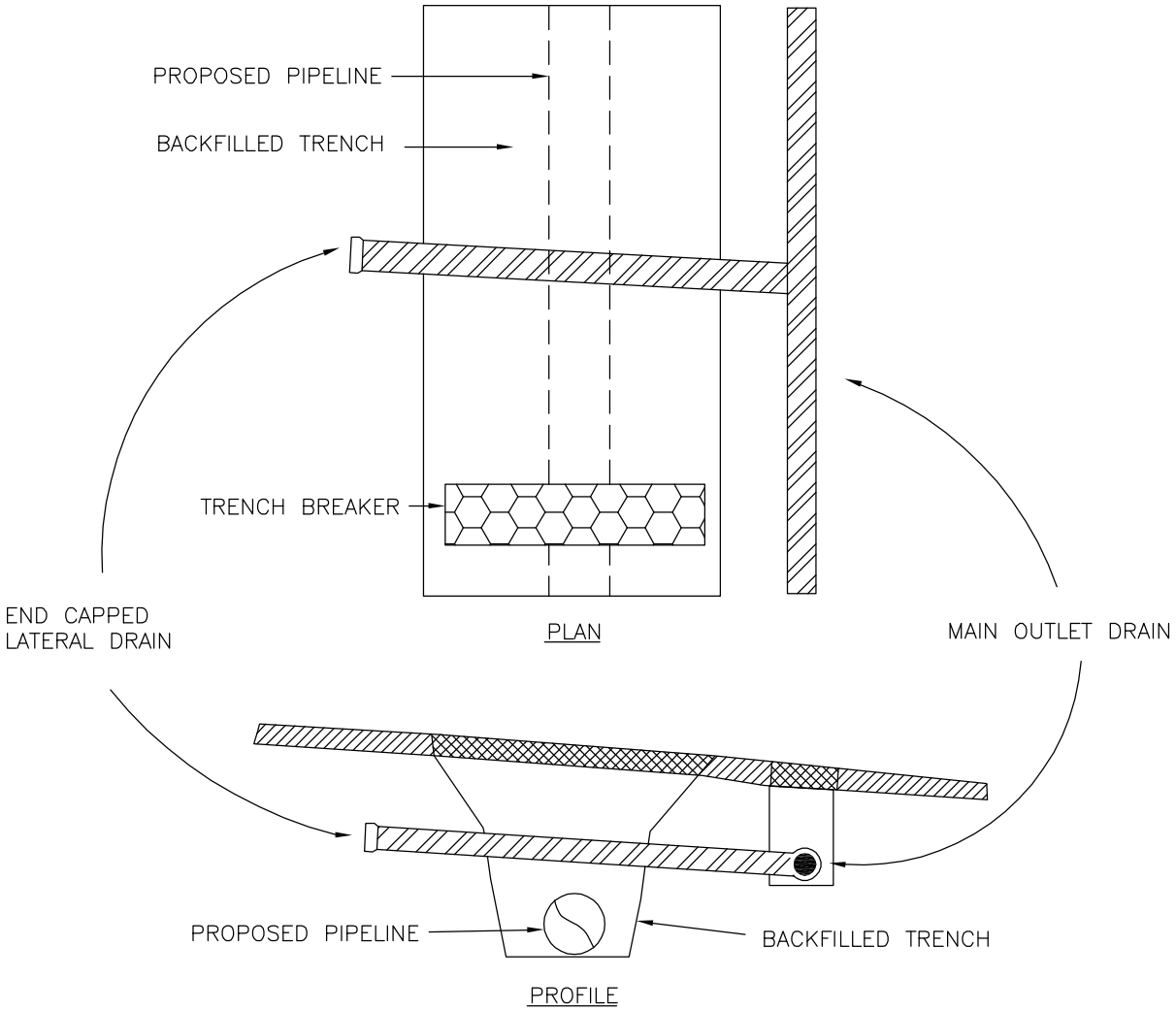
TYPICAL BENCHING

LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE		DWG. NO.
CHECKED BY	SCALE	N.T.S.	TYPICAL 33
APPROVED BY	SHEET	1 of 1	

TYPICAL FRENCH DRAIN
(INTERCEPT DRAIN CROSS-TRENCH)



NOTES:

1. TRENCH BREAKERS PREVENT GULLY EROSION WHILE THE TRENCH IS OPEN AND HELP TO INHIBIT WATER PIPING ALONG THE PIPELINE AFTER BACKFILLING.
2. INTERCEPT DRAINS RECEIVE SOIL MOISTURE DRAINING NATURALLY FROM THE UNDISTURBED SOIL PROFILE INTO THE DISTURBED BACKFILL SOIL WITHIN THE TRENCH. THE INTERCEPT DRAIN LINES HELP PREVENT SATURATED SOIL CONDITIONS ALONG THE PIPELINE.
3. INSTALL INTERCEPTOR DRAINS AT INTERVALS AS NEEDED TO REDUCE DRAINAGE THROUGH TRENCH BACKFILL.
4. USE FILL MATERIAL FREE OF BRUSH, RUBBISH, ROCKS, LOGS, STUMPS, BUILDING DEBRIS, AND OTHER OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.

PRELIMINARY

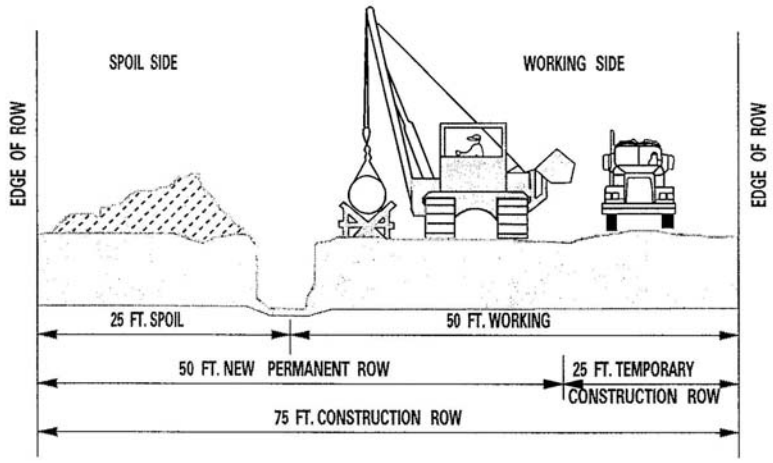
Appendix C-36

TYPICAL FRENCH DRAIN
(INTERCEPT DRAIN CROSS-TRENCH)

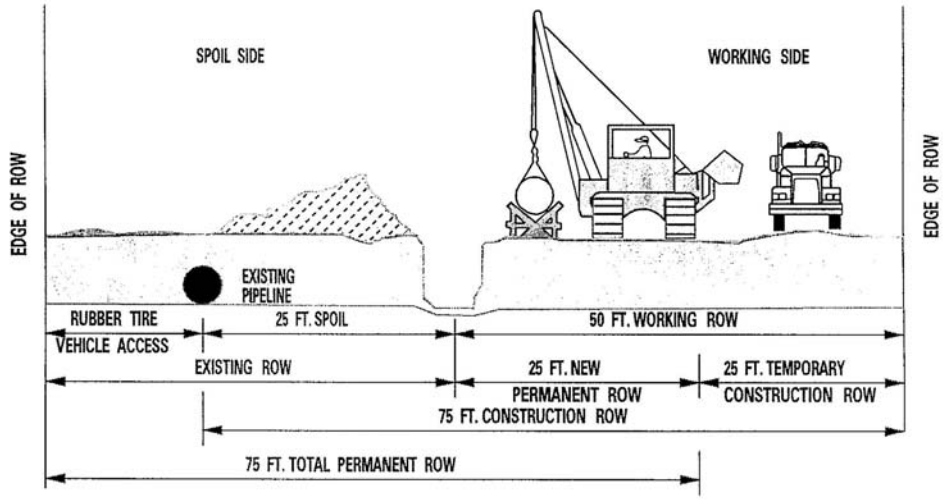
LEACH XPRESS PROJECT

File No.:

DRAWN BY	DATE	DWG. NO.
CHECKED BY	SCALE N.T.S.	TYPICAL 34
APPROVED BY	SHEET 1 of 1	



NEW ROW

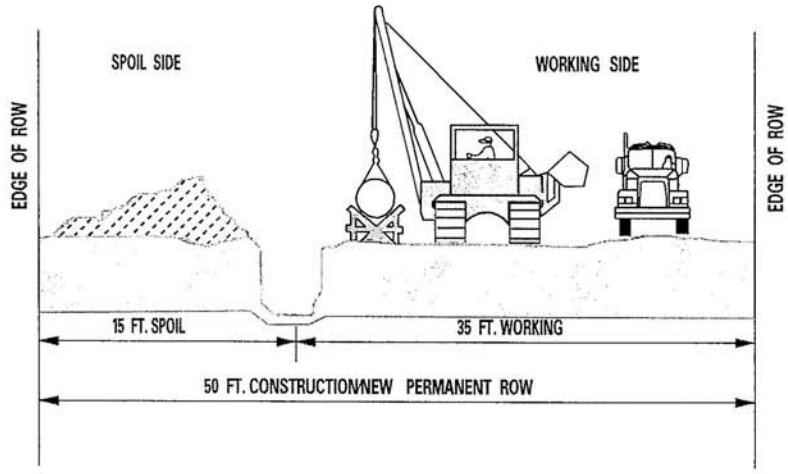


PARALLEL TO EXISTING ROW

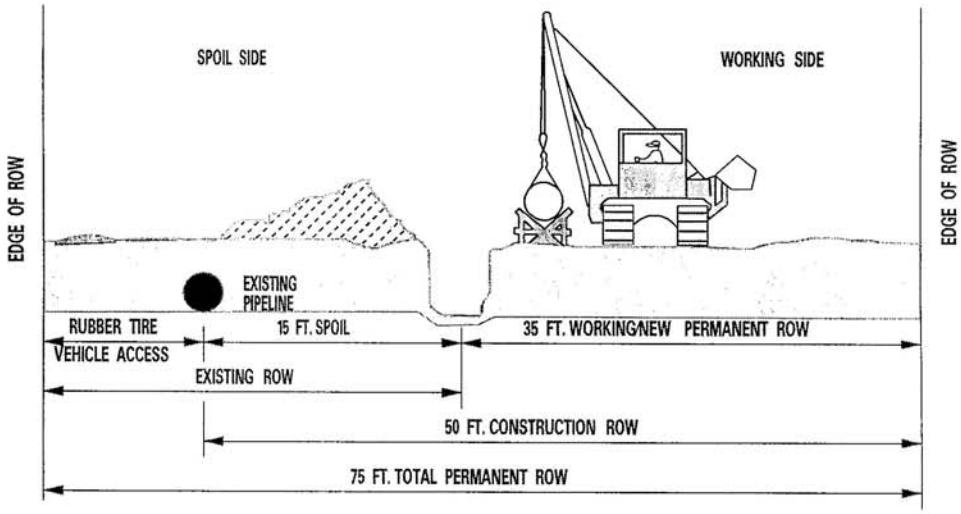
NOTES:
1. USE FOR 14-INCH OR GREATER DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE-SPECIFIC TERRAIN FEATURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION ROW WILL BE 75 FEET.

NOT TO SCALE

Appendix C-37	**TYPICAL 75 FT. CONSTRUCTION RIGHT-OF-WAY**	



NEW ROW

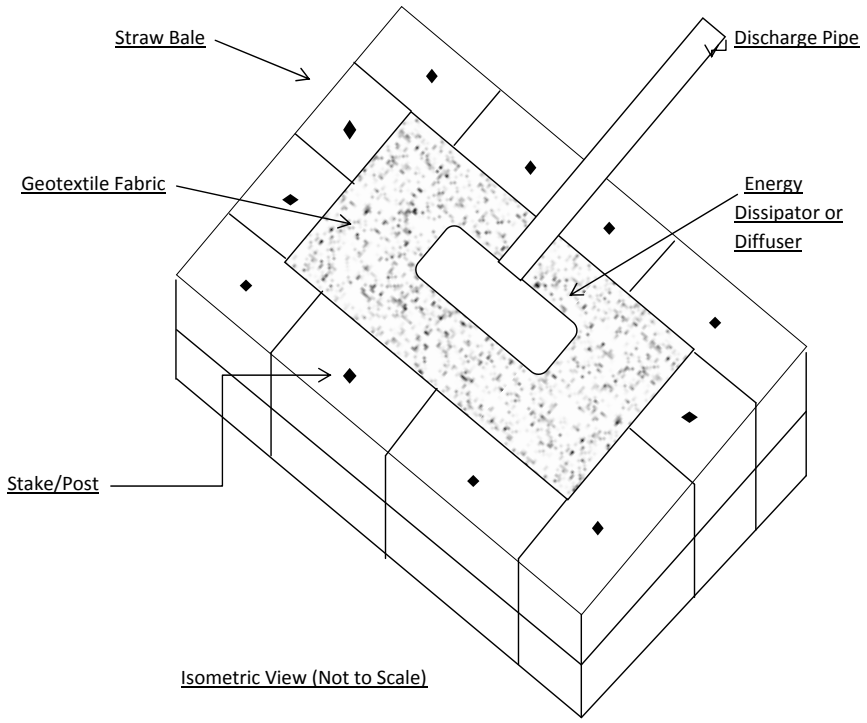


PARALLEL TO EXISTING ROW

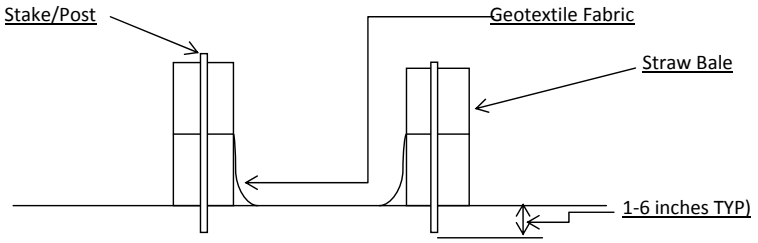
NOTES:
1. USE FOR 12-INCH OR LESS DIAMETER PIPELINE.
2. THE DIMENSIONS SHOWN ON THIS FIGURE ARE TYPICAL.
3. VARIATIONS FOR STAGING AREAS MAY BE NECESSARY DUE TO SITE-SPECIFIC TERRAIN FEATURES; HOWEVER, UNLESS OTHERWISE INDICATED IN COLUMBIA'S ENVIRONMENTAL MANAGEMENT & CONSTRUCTION PLANS, THE MAXIMUM WIDTH OF CONSTRUCTION ROW WILL BE 50 FEET.

NOT TO SCALE

Appendix C-38	TYPICAL 50 FT. CONSTRUCTION RIGHT-OF-WAY	



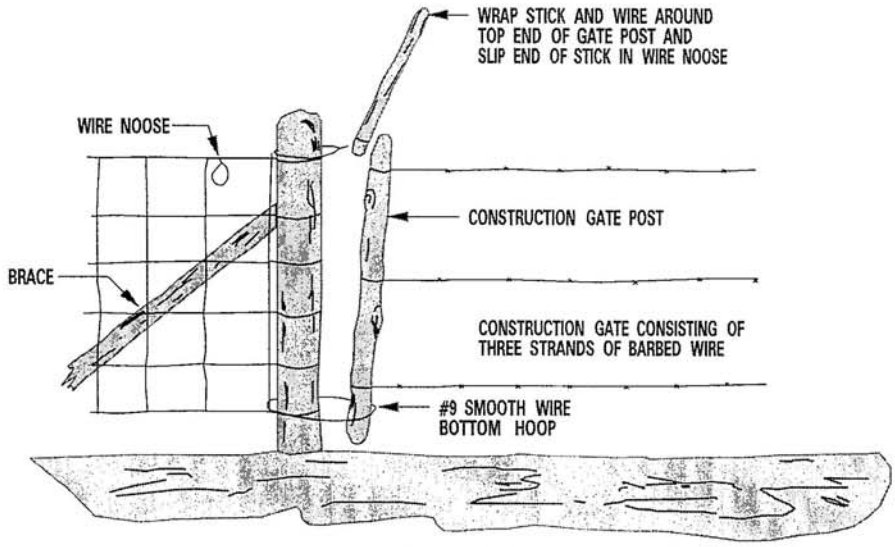
Isometric View (Not to Scale)



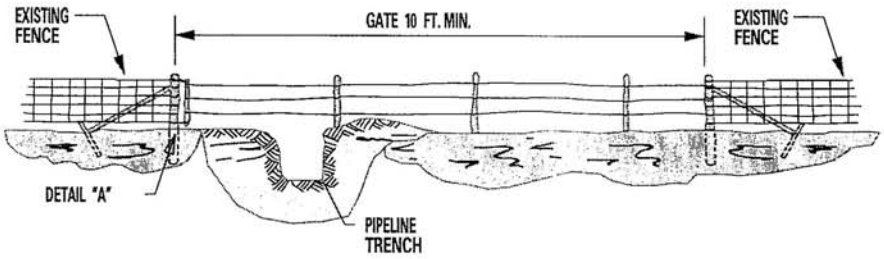
Profile View (Not to Scale)

NOT TO SCALE

Appendix C-39	**Hydrostatic Test Dewatering Pit**	



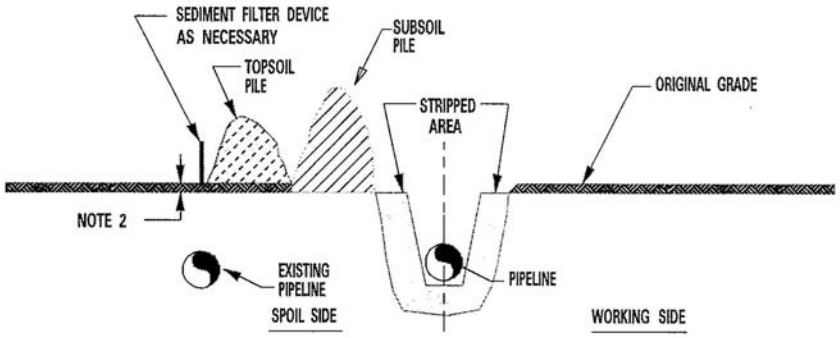
DETAIL "A"



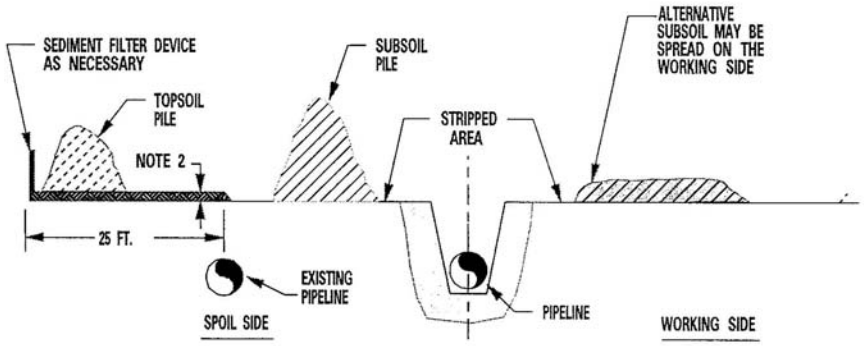
NOTES:
1. IF EXISTING FENCE POSTS ARE STEEL "T" BAR TYPE, THEN REMOVE THE STEEL "T" BAR POST ON BOTH SIDES OF THE GATE OPENING AND REPLACE WITH TEMPORARY WOODEN POSTS, BRACED AS SHOWN.
2. SUITABLE SUBSTITUTES FOR THE STICK AND WIRE GATE FASTENER ARE PERMISSIBLE.

NOT TO SCALE

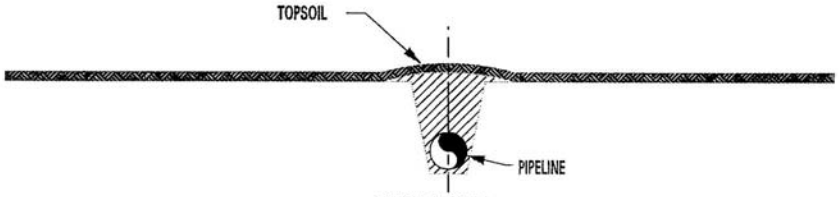
Appendix C-40	**TEMPORARY CONSTRUCTION GATE**	



TRENCHLINE AND SPOIL SIDE METHOD



ENTIRE CONSTRUCTION ROW METHOD



REPLACED

NOTES:
1. OTHER CONFIGURATIONS OF TOPSOIL AND SUBSOIL ARE ACCEPTABLE PROVIDED THEY ARE KEPT SEPARATE.
2. UP TO 12 INCHES OF TOPSOIL REMOVED.
3. TOPSOIL AND SUBSOIL PILES WILL BE ADEQUATELY PROTECTED FROM EROSION AND SEDIMENTATION BY USE OF SEDIMENT FILTER DEVICES OR MULCH.

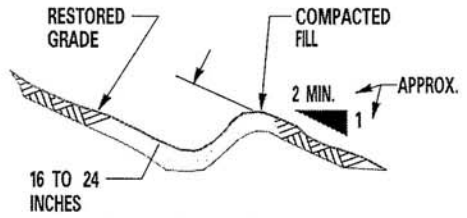
NOT TO SCALE

Appendix C-41	TYPICAL TOPSOIL CONSERVATION	

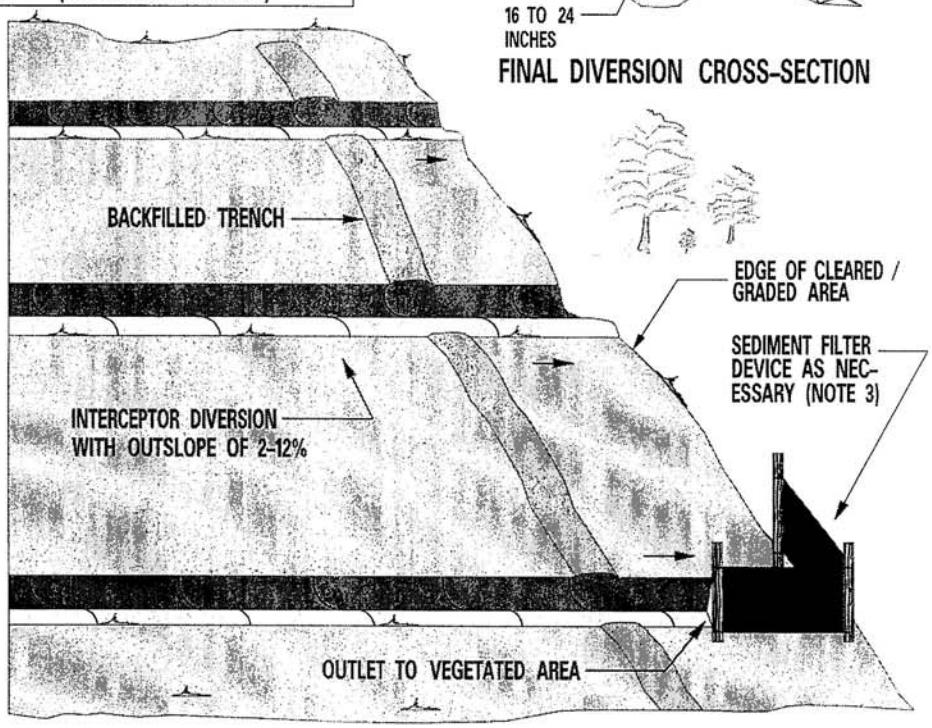
NOTE 1

SLOPE	SPACING
< 5%	NONE
5–15%	300 FEET
15–30%	200 FEET
>30+%	100 FEET

INTERCEPTOR SPACING (MINIMUM REQUIRED)



FINAL DIVERSION CROSS-SECTION



NOTES:
1. SPACING USED FOR BOTH TEMPORARY AND FINAL INTERCEPTOR DIVERSIONS.
2. TEMPORARY INTERCEPTOR DIVERSIONS WILL BE MAINTAINED DURING THE CONSTRUCTION PHASE UNTIL FINAL INTERCEPTOR DIVERSIONS ARE INSTALLED.
3. IF EXISTING GROUND COVER IS SPARSE, SECURE SEDIMENT FILTER DEVICE IN OUTLET.
4. THE DIVERSION MAY BE EXTENDED UP TO 5 FEET OFF THE ROW, IF NECESSARY, TO PROVIDE AN ADEQUATE OUTLET.
5. DIVERSION OUTLETS WILL ALTERNATE FROM SIDE TO SIDE WHENEVER POSSIBLE.

NOT TO SCALE

INTERCEPTOR DIVERSIONS / SLOPE BREAKERS

INTERCEPTOR DIVERSIONS /SLOPE BREAKERS

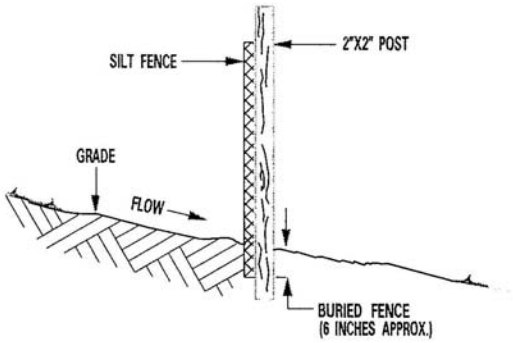
Interceptor diversions are the most common and effective device used for erosion control on construction ROW. During construction, temporary diversions are installed to control water on the graded ROW. During restoration final diversions are installed to protect the ROW from erosion until the vegetation reestablishes on the disturbed areas.

Temporary diversions are generally made by building a curb 8 to 14 inches high across the ROW. The curbs are shaped to allow passage of construction equipment and inspector vehicles. The diversion should have a gradient of 2%– 12%, and must drain either into the trench or off the ROW. Where water is directed off the ROW, the outlet will be protected by a sediment filter device or heavy vegetation. Temporary diversions may be broken down by construction equipment during the workday, but will be restored by the end of each day. Temporary diversions will be spaced along the ROW in accordance with Figure 6A. The actual number of temporary diversions may vary from that of final diversions because the construction ROW's artificial grade may reduce the slope. Temporary diverisons may be conctructed out of silt fence, staked hay or straw bales or sand bags with the Environmental Inspectors approval. Position the outfall of each temporary slope breaker to prevent sediment discharge into wetland, waterbodies, or other sensitive areas.

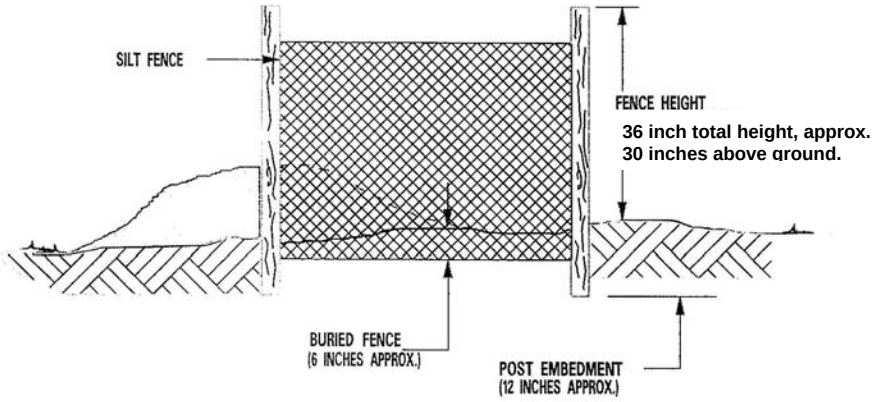
Final diversions typically consist of a curb 16 to 24 inches high below a shallow swale. The curb is constructed of compacted earth fill with side slopes of 2:1 or flatter to allow passage of maintenance equipment. The diversions should extend across the entire ROW and drain water with a 2% to 12% gradient. The outlets of final diversions are stabilized with sediment filter devices, rock, brush, or heavy vegetation. Final diversions will be spaced along the ROW in accordance with Figure 6A (or as shown on the Environmental Construction Drawings), and will tie into existing diversions where present. In places where final grade creates side slopes or slopes which break in more than one direction, diversion installation may need to vary to create an outslope of 2% to 12% which will carry water off the ROW.

Alternative diversion construction may be used in areas where an earthen diversion is impractical. In these instances, temporary diversions may be constructed with sediment filter devices as noted above.

Appendix C-43	**INTERCEPTOR DIVERSIONS**	



SIDE VIEW



FRONT VIEW

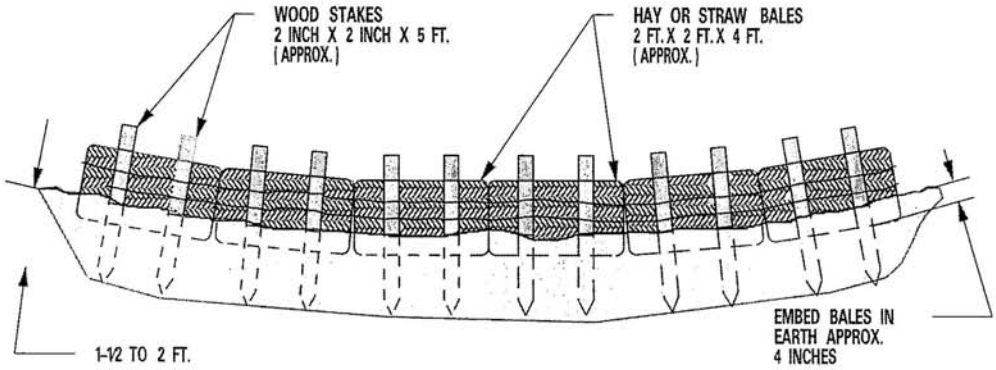
NOTE: SILT FENCE CAN ALSO BE INSTALLED (USING THE SAME SPECIFICATIONS AS PRESENTED ABOVE) IN OTHER SITUATIONS FOR EROSION AND SEDIMENTATION CONTROL.

SEDIMENT FILTER DEVICE SILT FENCING

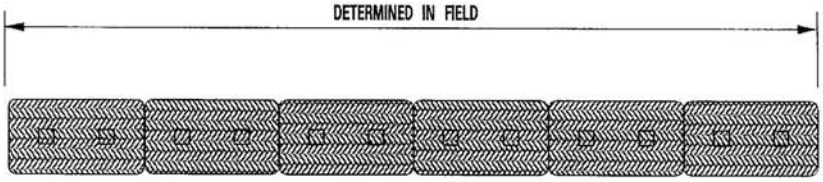
Stakes should be spaced 8 feet apart.

NOT TO SCALE

Appendix C-44	SEDIMENT FILTER DEVICE SILT FENCING	



SIDE VIEW



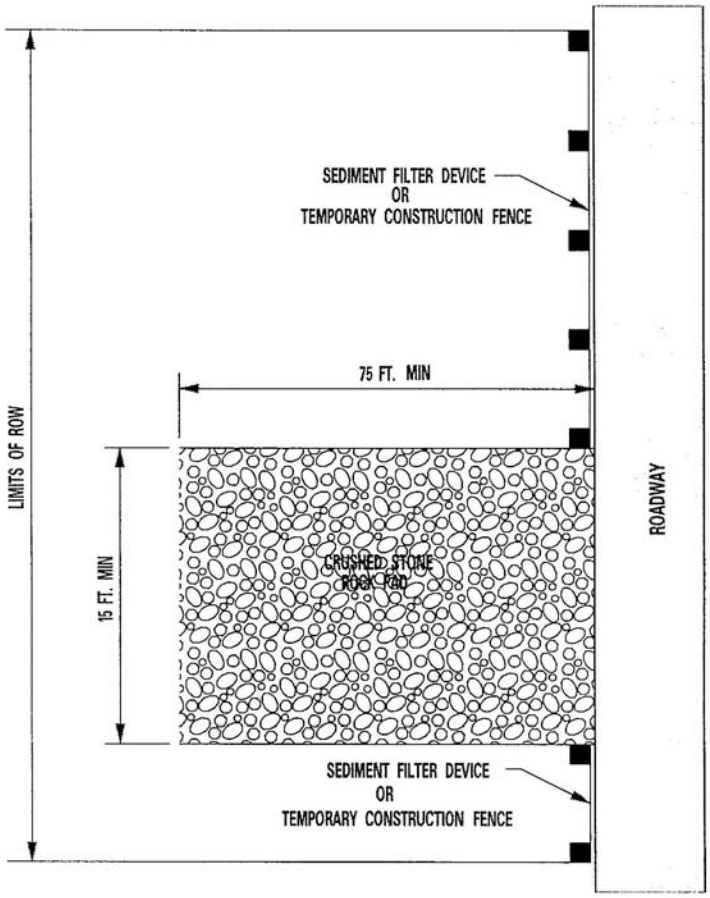
TOP VIEW

NOTES:

1. IF BALES ARE TO BE PLACED ON TOP OF HEAVY VEGITATION, EMBEDDING THE BALES MAY NOT BE NECESSARY.
2. REBAR (3 /8" TO 3 /4" DIAMETER) CAN BE SUBSTITUTED FOR WOOD STAKES.

NOT TO SCALE

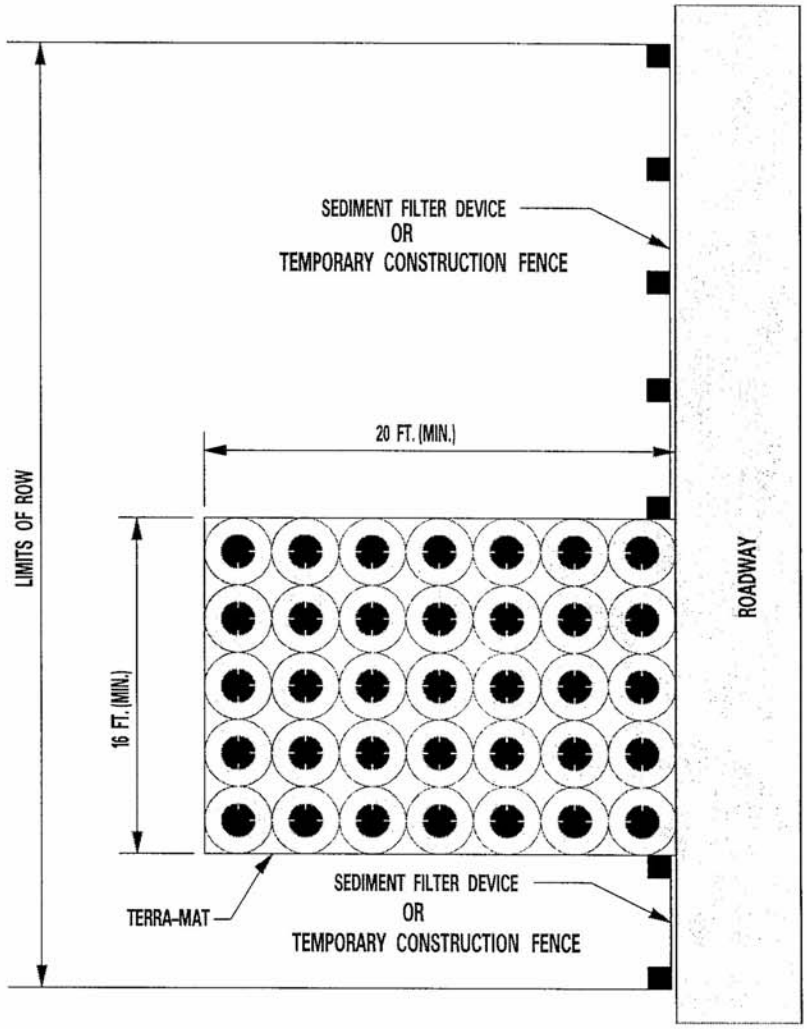
Appendix C-45	SEDIMENT FILTER DEVICE STAKED BALES	



NOTES:
1. CRUSHED STONE SIZE WILL BE AASHTO NUMBER 1 COARSE AGGREGATE OR EQUIV. (4 INCH DIAMETER MINIMUM.)
2. ROCK PAD WILL BE AT LEAST 6 INCHES THICK.
3. THE ROAD ENTRANCE SHOULD HAVE A GEOTEXTILE FABRIC BENEATH THE ROCK PAD. (SEE SECTION II.E)
4. IF ROCK PAD BECOMES COVERED WITH MUD SO AS TO BECOME INEFFECTIVE, ADDITIONAL STONE WILL BE ADDED.
5. ALL STONE AND FABRIC MUST BE REMOVED DURING ROW RESTORATION.
6. THE ROCK PAD MAY BE ENLARGED TO INCLUDE A TURNING RADIUS.

NOT TO SCALE

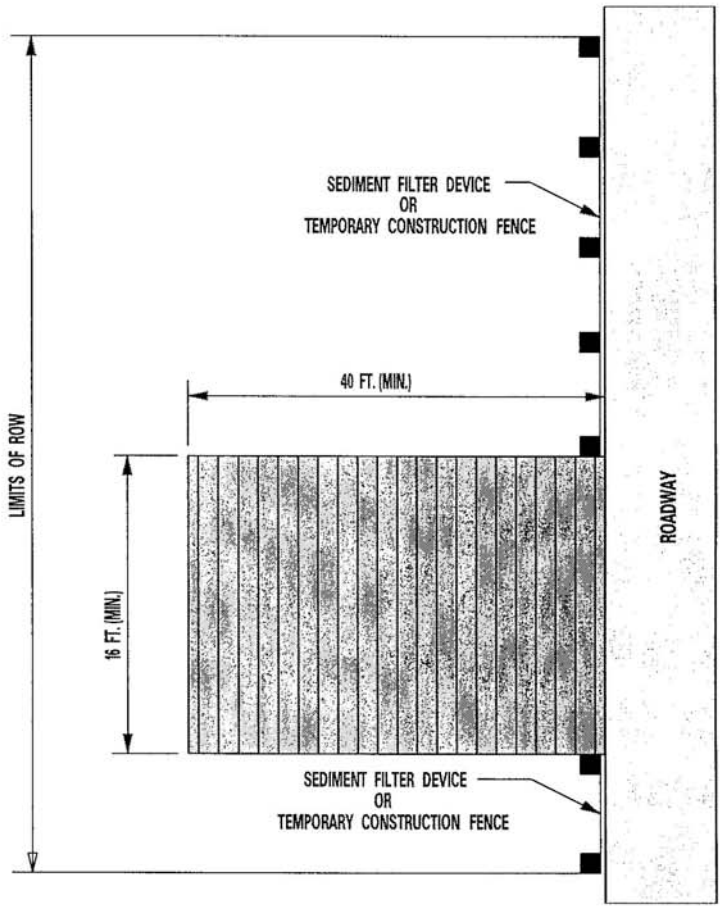
Appendix C-46	**TEMPORARY ROAD ENTRANCE ROCK PADS**	



NOTES:
1. TERRA-MATS ARE CONSTRUCTED BY OVERLAPPING TIRES AND INTERCONNECTED CABLE.
2. TERRA-MATS WILL BE UNDERLAIN WITH GEOTEXTILE FABRIC.
3. TERRA-MATS SHOULD BE MAINTAINED SO AS NOT TO ALLOW EXCESS MUD TO ACCUMULATE.

NOT TO SCALE

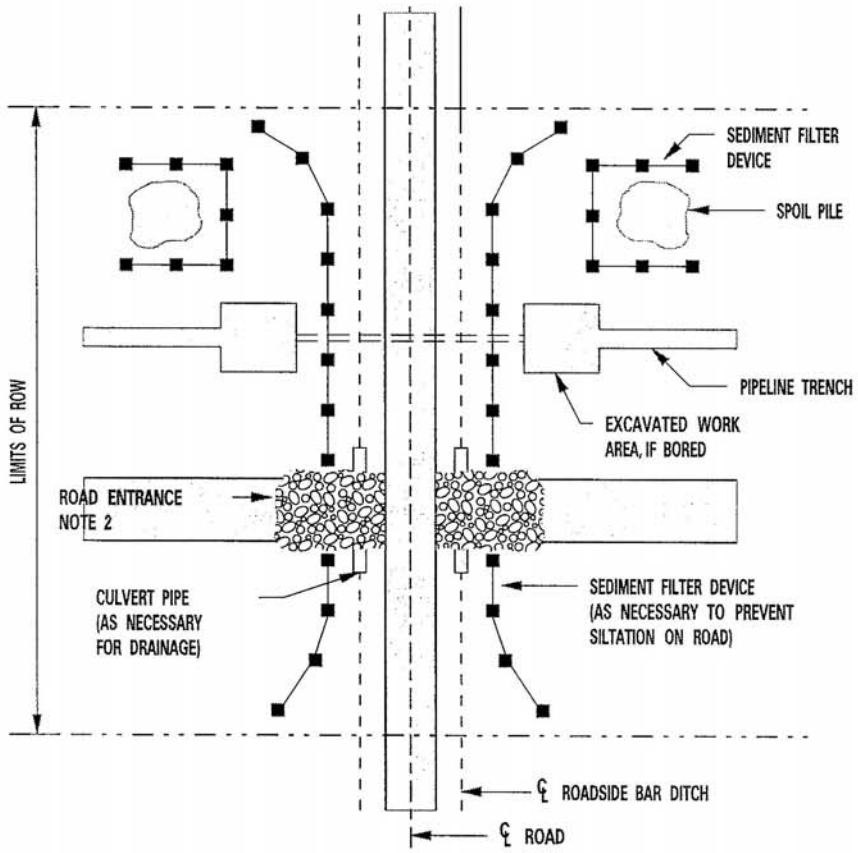
Appendix C-47	TEMPORARY ROAD ENTRANCE TERRA-MATS	



NOTES:
1. BOARD ROADS TO BE USED IN WETLANDS AND ROADWAY ENTRANCES FOR TEMPORARY ACCESS ROADS.
2. BOARD ROADS ARE CONSTRUCTED BY LAYERING A BASE OF THE INTERLOCKING MATS PARALLEL TO THE ROAD IN A STAGGERED MANNER. OTHER METHODS OF BOARD ROAD CONSTRUCTION MAY BE USED IF APPROVED BY THE EM & CP PREPARER.
3. BOARD ROADS WILL BE UNDERLAIN WITH GEOTEXTILE FABRIC.

NOT TO SCALE

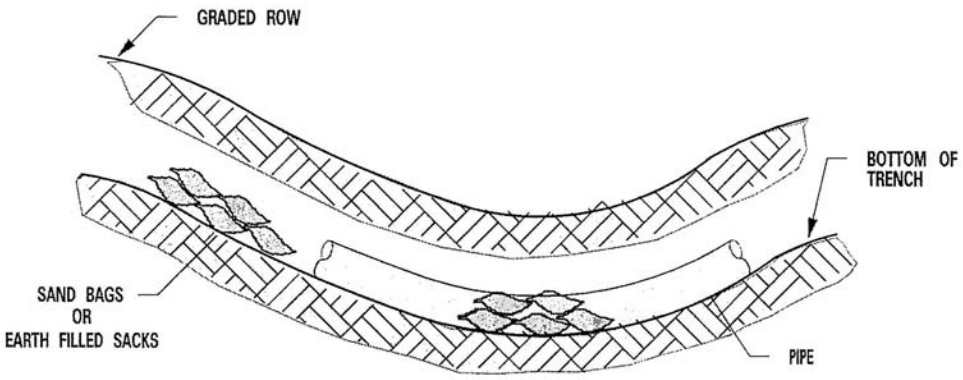
Appendix C-48	**TEMPORARY ROAD ENTRANCE BOARD ROAD**	



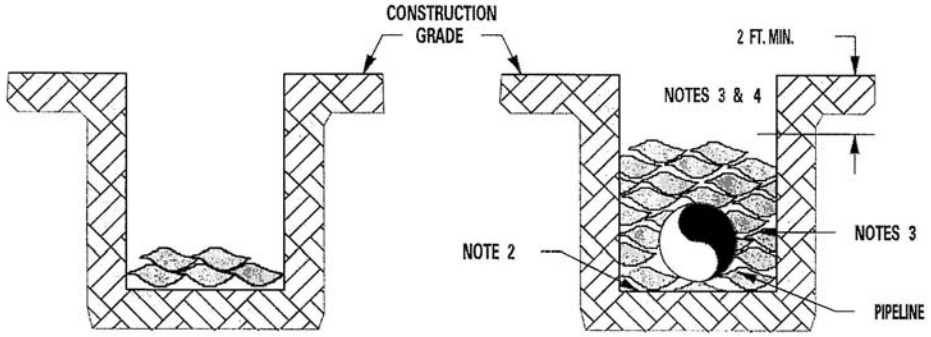
NOTES:
1. SIMILAR PROCEDURES WILL BE USED AT RAILROAD CROSSINGS.
2. REFER TO FIGURES 9, 10, AND 11 FOR TYPES OF ROAD ENTRANCES.

NOT TO SCALE

Appendix C-49	TYPICAL EROSION CONTROL MEASURES AT ROAD CROSSINGS	



SIDE VIEW



BEFORE PIPE INSTALLATION
BREAKER

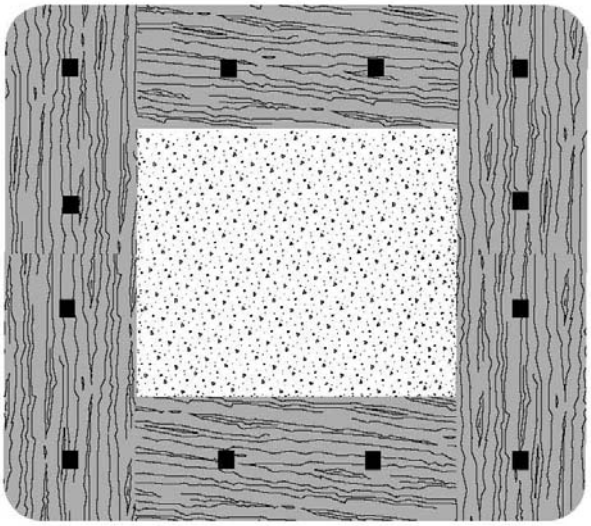
AFTER PIPE INSTALLATION
BARRIER

FRONT VIEW

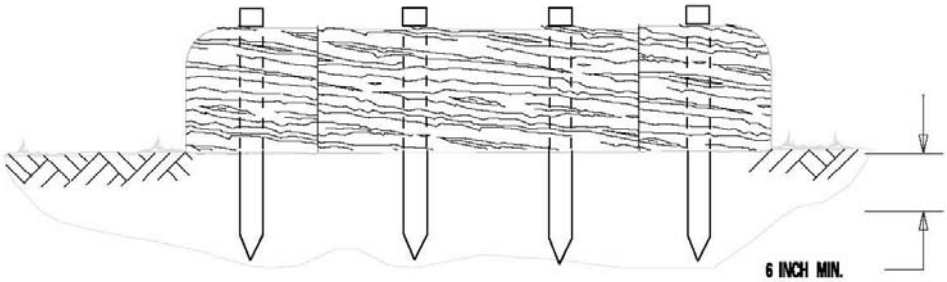
NOTES:
1. INSTALL AT EVERY SECOND INTERCEPTOR DIVERSION PROMPTLY AS TRENCH IS COMPLETED. (SEE FIGURE 6A)
2. PRIOR TO LOWERING IN, REMOVE ALL DECOMPOSED MATERIAL AND ROCKS.
3. INSTALL SACKS TO TOP OF TRENCH ON STEEP GRADES THAT ARE NOT USED FOR FARMING.
4. TOP OF TRENCHLINE BARRIER WILL BE BELOW PLOW DEPTH IN AGRICULTURAL LAND.
5. DOUBLE STAKED HAY /STRAW BALES MAY BE SUBSTITUTED FOR SAND BAGS (EARTH FILLED SACKS) AS TEMPORARY BREAKERS WHERE APPROPRIATE.

NOT TO SCALE

Appendix C-50	**TRENCHLINE BARRIERS AND BREAKERS**	



PLAN VIEW



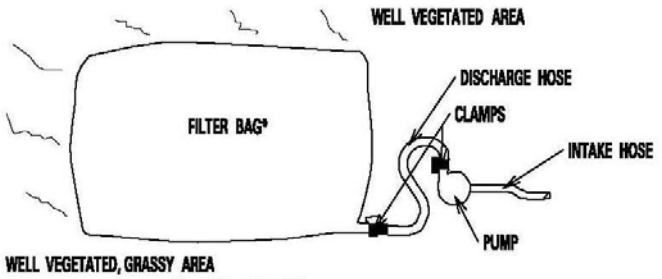
SIDE VIEW

NOTES:

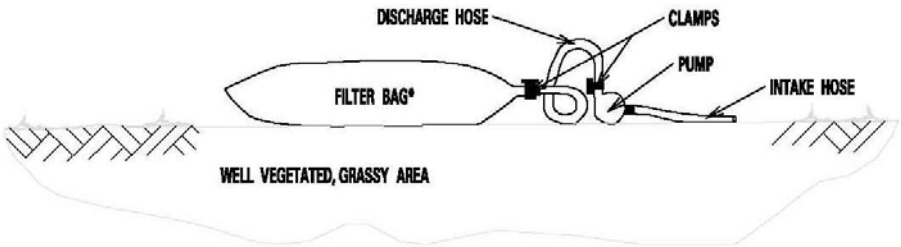
1. INSTALL BALES AS SHOWN. IF ADDITIONAL STORAGE VOLUME IS NECESSARY, SECURE ADDITIONAL BALES ON TOP OF INITIAL BOTTOM LAYER AND/OR BY INCREASING THE NUMBER BALES IN BOTTOM LAYER.
2. SECURE EACH BALE & EACH LAYER OF BALES USING EITHER TWO REBARS OR TWO WOODEN STAKES PER BALE.
3. PLACE A 5 TO 6 INCH DEEP LAYER OF 3/4 TO 1.0 INCH CLEAN STONE OR STRAW ON GROUND INSIDE BALES.
4. THE SEDIMENT TRAP WILL NOT BE GREATER THAN TWO BALES IN HEIGHT FOR SIX-BALE BOTTOM CONSTRUCTION WITHOUT ADDITIONAL REINFORCEMENT OF TRAP WALLS.
5. A FILTER BAG MAY ALSO BE UTILIZED INSIDE THE TRAP TO HELP FILTER THE DISCHARGE.

NOT TO SCALE

Appendix C-51	**SEDIMENT TRAP**	



PLAN VIEW



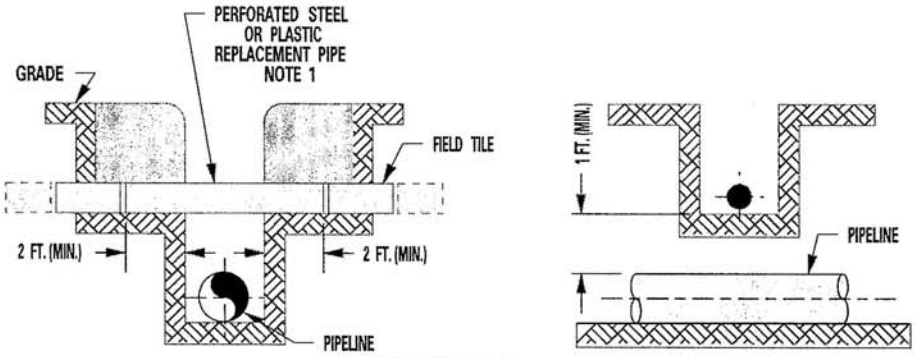
SIDE VIEW

NOTES:

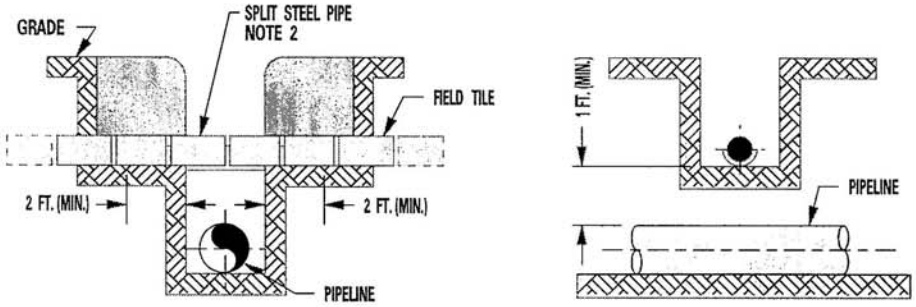
1. FILTER BAGS SHALL BE MADE FROM NON-WOVEN GEOTEXTILE MATERIAL SEWN WITH HIGH STRENGTH, DOUBLE STITCHED "J" TYPE SEAMS. THEY SHALL BE CAPABLE OF TRAPPING PARTICLES LARGER THAN 150 MICRONS.
2. BAGS MUST BE PLACED WITHIN THE PERMITTED AREA IF ACCESSING THE BAG WITH MACHINERY IS REQUIRED FOR DISPOSAL PURPOSES. FILTER BAGS SHALL BE REPLACED WHEN THEY BECOME 1/2 FULL OF SEDIMENT. SPARE BAGS SHALL BE KEPT AVAILABLE FOR REPLACEMENT OF THOSE THAT HAVE FAILED OR ARE FILLED.
3. BAGS SHOULD BE LOCATED IN WELL-VEGETATED (GRASSY) AREAS, AND DISCHARGE ONTO STABLE, EROSION RESISTANT AREAS. WHERE THIS IS NOT POSSIBLE, A GEOTEXTILE FLOW PATH CAN BE PROVIDED OR ALLOW DISCHARGE FROM BAG TO FLOW THROUGH A SERIES OF SEDIMENT LOGS ETC... BAGS CAN BE USED INSIDE SEDIMENT TRAPS (FIGURE 14A).
4. BAGS SHALL NOT BE PLACED ON SLOPES GREATER THAN 5%.
5. THE PUMP DISCHARGE HOSE SHALL BE INSERTED INTO THE BAGS IN THE MANNER SPECIFIED BY THE MANUFACTURER AND SECURELY CLAMPED. DO NOT ALTER OR CUT BAGS.

NOT TO SCALE

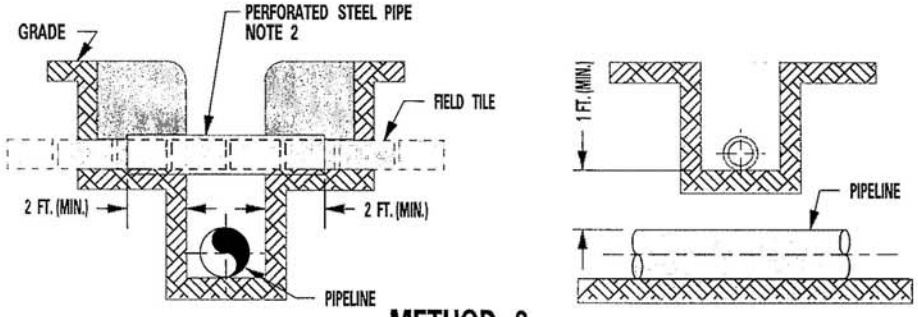
Appendix C-52	**FILTER BAG (DIRT BAG)**	



METHOD 1



METHOD 2

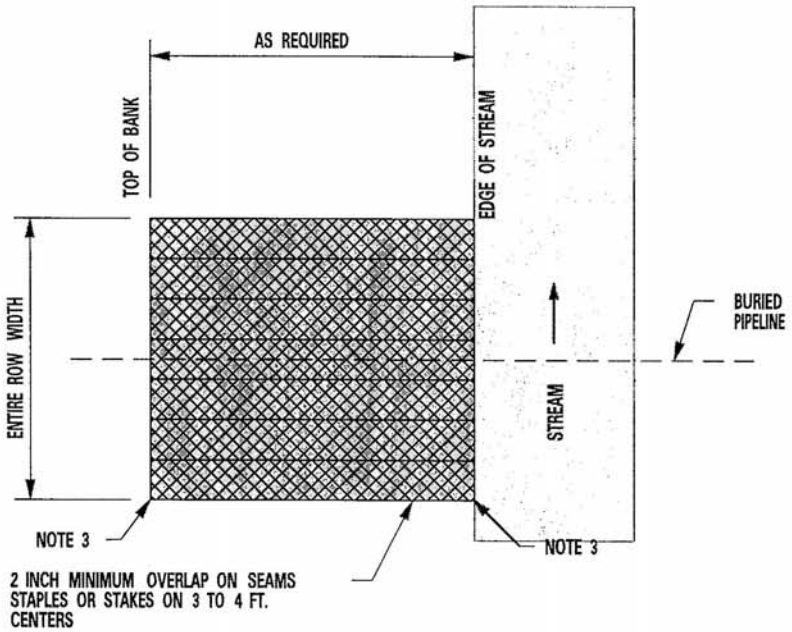


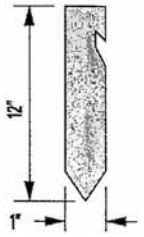
METHOD 3

NOTES:
1. REPLACEMENT PIPE TO BE AS NEAR AS POSSIBLE TO THE DIAMETER OF THE FIELD TILE.
2. STEEL CARRIER PIPE TO HAVE INSIDE DIAMETER AS NEAR AS POSSIBLE THE OUTSIDE DIAMETER OF THE FIELD TILE.
3. MAINTAIN ORIGINAL FLOW LINE OF FIELD TILE IN ALL METHODS.

NOT TO SCALE

Appendix C-53	**FIELD TILE REPLACEMENT METHODS**	



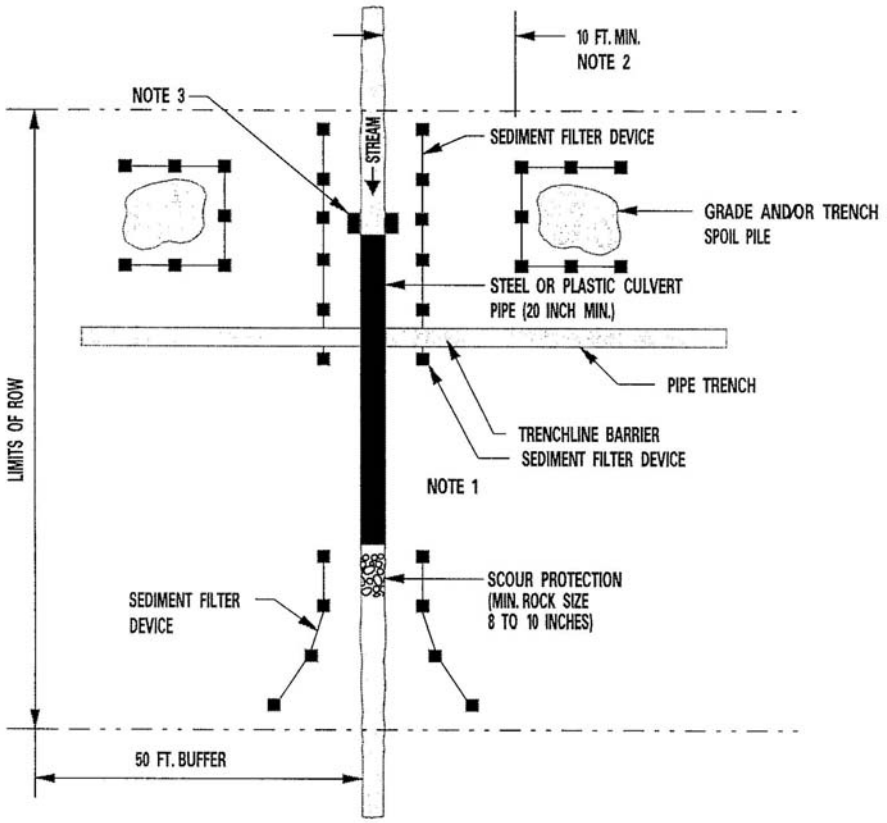


WOODEN STAKES

NOTES:
1. INSTALL JUTE NETTING DURING RESTORATION.
2. LIME, FERTILIZE, SEED AND MULCH AREA TO BE JUTE NETTED.
3. TRENCH IN AND BURY UPHILL AND UPSTREAM EDGE OF JUTE NETTING.
4. AN INTERCEPTOR DIVERSION WILL BE INSTALLED IMMEDIATELY ABOVE JUTE NETTING ON SLOPED BANKS.
5. ON SHORT BANKS (LESS THAN 10'), JUTE NETTING CAN BE PERPENDICULAR TO BANK SLOPE.
6. INSTALL ON STEEP SLOPES OR ON THE BANKS OF FLOWING STREAMS, OR IN UPLAND AREAS.

NOT TO SCALE

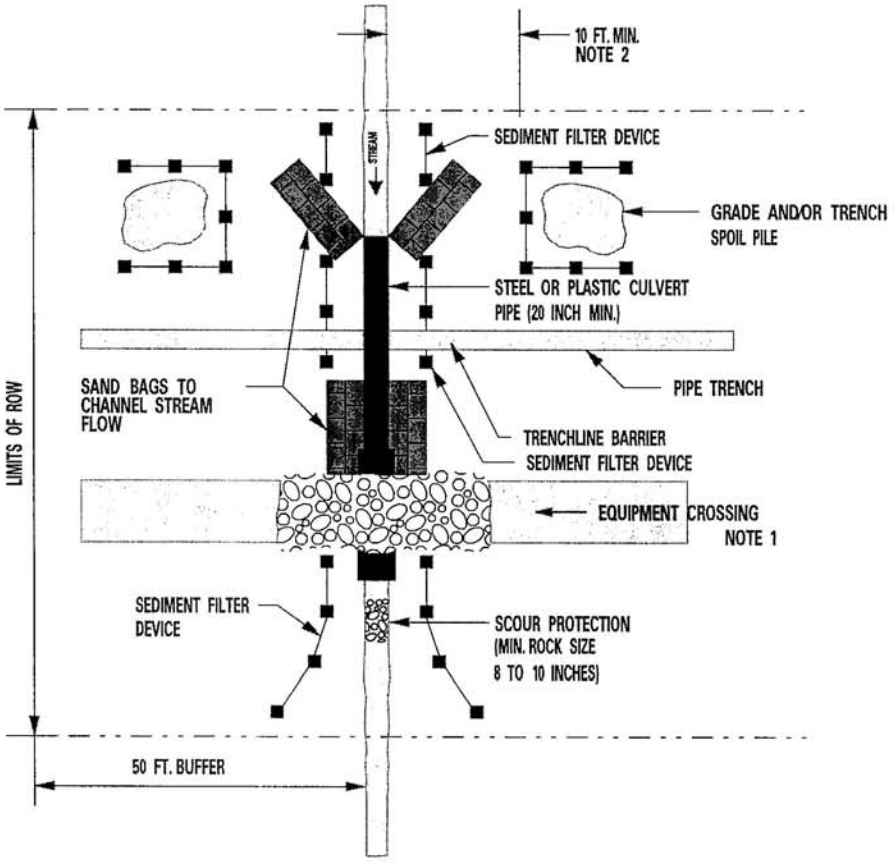
Appendix C-54	EROSION CONTROL BLANKET	



NOTES:
1. EQUIPMENT CROSSINGS ARE TO BE PREPARED AS ILLUSTRATED IN FIGURES 21 & 22 IF NEEDED.
2. GRADE AND TRENCH SPOIL WILL BE STOCKPILED AT LEAST 10 FEET FROM THE WATER'S EDGE, TOPOGRAPHY PERMITTING.
3. SAND BAGS OR EARTH FILLED SACKS WILL BE PLACED AT UPSTREAM END OF CULVERT TO CHANNEL FLOW.

NOT TO SCALE

Appendix C-55	**TYPICAL STREAM CROSSING INTERMITTENT STREAMS**	

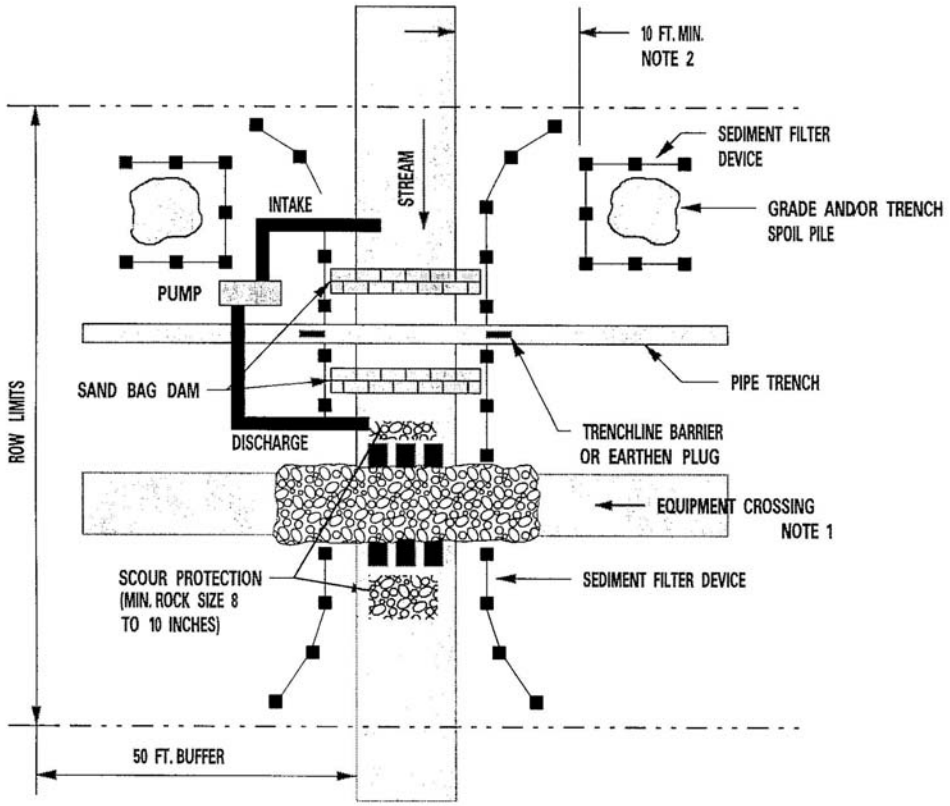


NOTES:

1. EQUIPMENT CROSSINGS ARE TO BE PREPARED AS ILLUSTRATED IN FIGURES 21 & 22.
2. GRADE AND TRENCH SPOIL WILL BE STOCKPILED AT LEAST 10 FEET FROM THE WATER'S EDGE.
3. INSTALL FLUME PIPE AFTER BLASTING (IF NECESSARY), BUT BEFORE TRENCHING.
4. PROPERLY ALIGN FLUME PIPE(S) TO PREVENT BANK EROSION OR STREAM BED SCOUR.
5. COMPLETE STREAMBED AND BANK STABILIZATION BEFORE RETURNING FLOW TO THE WATERBODY CHANNEL.

NOT TO SCALE

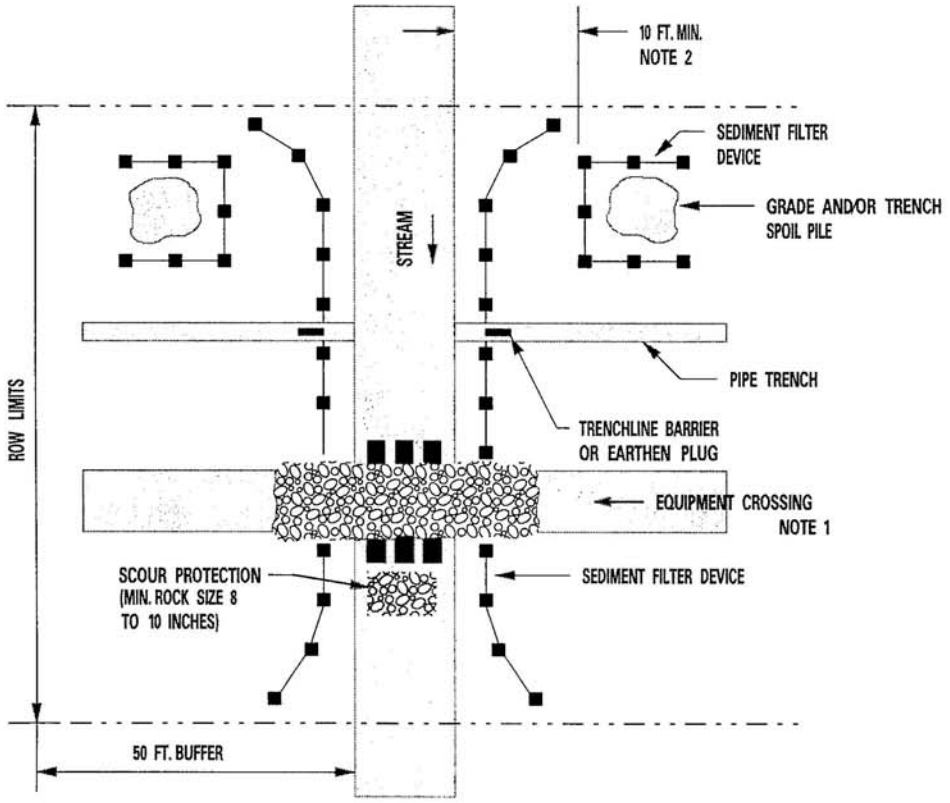
Appendix C-56	**TYPICAL STREAM CROSSING DRY-DITCH**	



NOTES:
1. EQUIPMENT CROSSINGS ARE TO BE INSTALLED AS ILLUSTRATED IN FIGURES 21 OR 22.
2. GRADE AND TRENCH SPOIL WILL BE STOCKPILED AT LEAST 10 FEET FROM THE WATERS' EDGE, TOPOGRAPHY PERMITTING.
3. PUMP INTAKES WILL BE SCREENED. PREVENT STREAMBED SCOUR AT DISCHARGE.
4. SUFFICIENT PUMP CAPACITY WILL BE USED TO MAINTAIN STREAM FLOW AT ALL TIMES UNTIL BACKFILL AND REMOVAL OF SANDBAG DAM.
5. BACKUP PUMPS (AS SAME NUMBER AND CAPACITY AS ACTIVE PUMPS) WILL BE READILY AVAILABLE IN WORKING CONDITION ON SITE AT CROSSING.
6. CONSTRUCT DAMS WITH MATERIAL THAT PREVENT SEDIMENT AND OTHER POLLUTANTS FROM ENTERING THE WATERBODY.
7. MONITOR THE DAM AND PUMPS TO ENSURE PROPER OPERATIONS THROUGHOUT THE WATERBODY CROSSING.

NOT TO SCALE

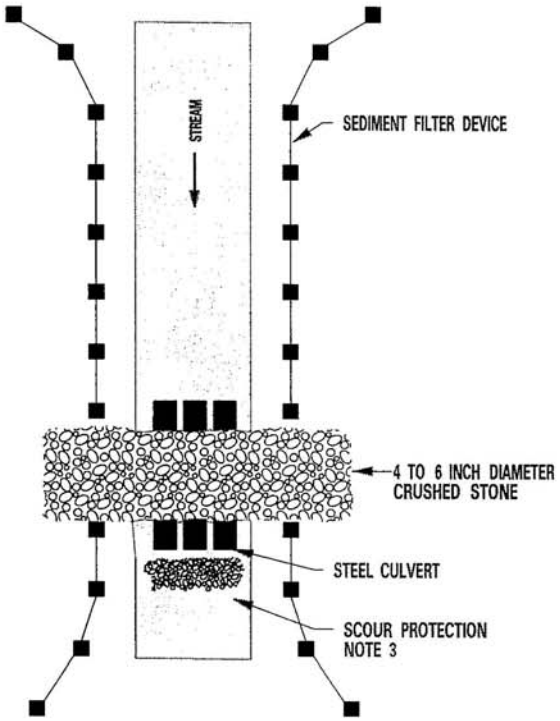
Appendix C-57	**TYPICAL STREAM CROSSING DAM AND PUMP**	



NOTES:
1. EQUIPMENT CROSSINGS ARE TO BE PREPARED AS ILLUSTRATED IN FIGURES 21 & 22.
2. GRADE AND TRENCH SPOIL WILL BE STOCKPILED AT LEAST 10 FEET FROM THE WATERS' EDGE.

NOT TO SCALE

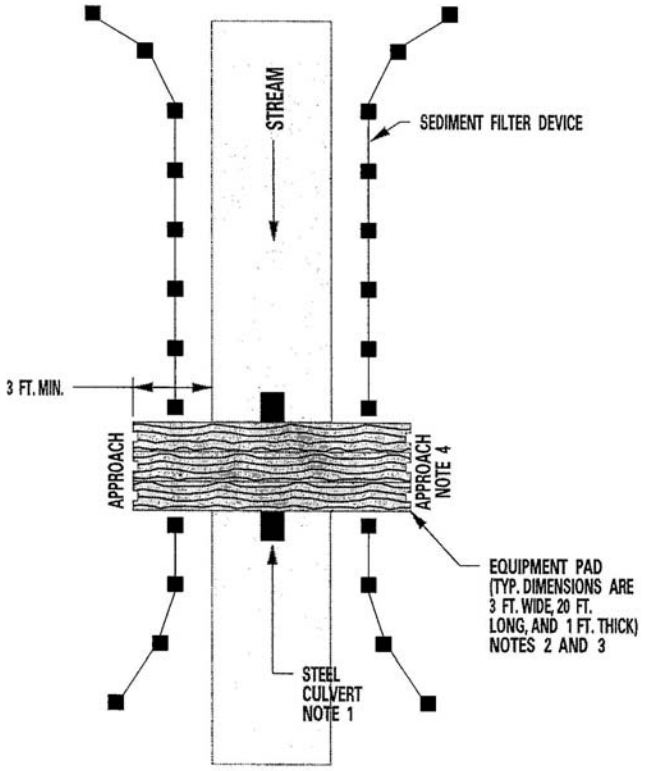
Appendix C-58	TYPICAL STREAM CROSSING WET-DITCH	



NOTES:
1. MINIMUM CONTOURING OF THE BOTTOM NECESSARY TO LAY THE CULVERTS LEVEL MAY BE DONE.
2. USE AS MANY CULVERTS AS REQUIRED TO SPAN ENTIRE STREAM BED. (CULVERTS SHALL BE PLACED SIDE BY SIDE.)
3. STONES WILL BE PLACED AT THE OUTLET OF ALL CULVERTS TO PROVIDE SCOUR PROTECTION IN THE EXISTING CHANNELS. MINIMUM ROCK SIZE: 8 TO 10 INCHES.
4. MINIMUM CULVERT DIAMETER 20 INCHES .
5. MAINTAIN ROCK AS NOT TO ALLOW MUD TO ENTER THE STREAM.
6. ALIGN CULVERTS TO PREVENT BANK EROSION.

NOT TO SCALE

Appendix C-59	**TEMPORARY EQUIPMENT CROSSING CULVERT AND STONE**	

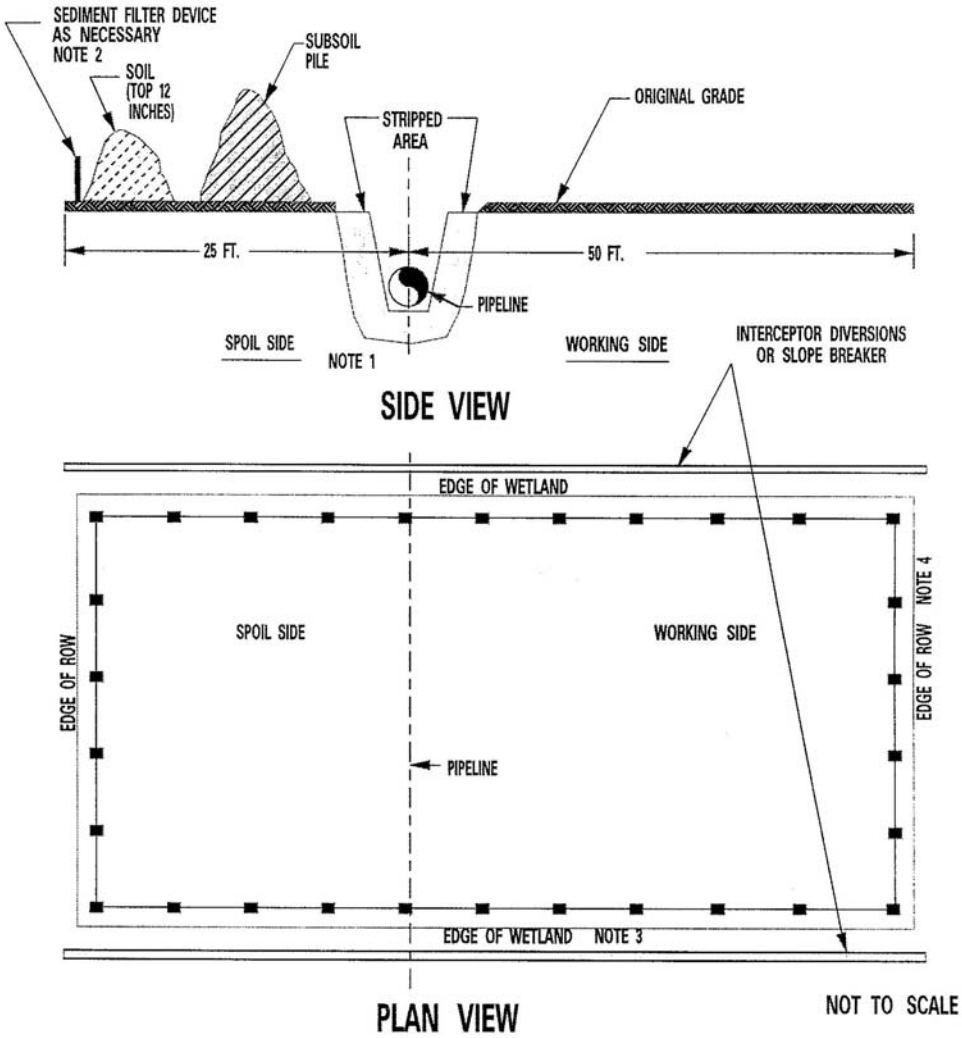


NOTES:

1. CULVERT PIPE UTILIZED IF ADDITIONAL SUPPORT IS REQUIRED. ALIGN CULVERT TO PREVENT SCOUR OR BANK EROSION.
2. ADDITIONAL PADS CAN BE PUT SIDE BY SIDE IF EXTRA WIDTH IS REQUIRED.
3. EQUIPMENT PAD TYPICALLY CONSTRUCTED OF HARD-WOOD; MUST ACCOMMODATE THE LARGEST EQUIPMENT USED.
4. RAMP APPROACHES CAN EITHER BE GRADED OR DUG INTO GROUND. IF NECESSARY, CRUSHED STONE WILL BE USED TO RAMP UP TO THE EQUIPMENT PADS.
5. MINIMUM CULVERT DIAMETER 20 INCHES.
6. MAINTAIN PADS SO AS NOT TO ALLOW MUD TO ENTER THE STREAM

NOT TO SCALE

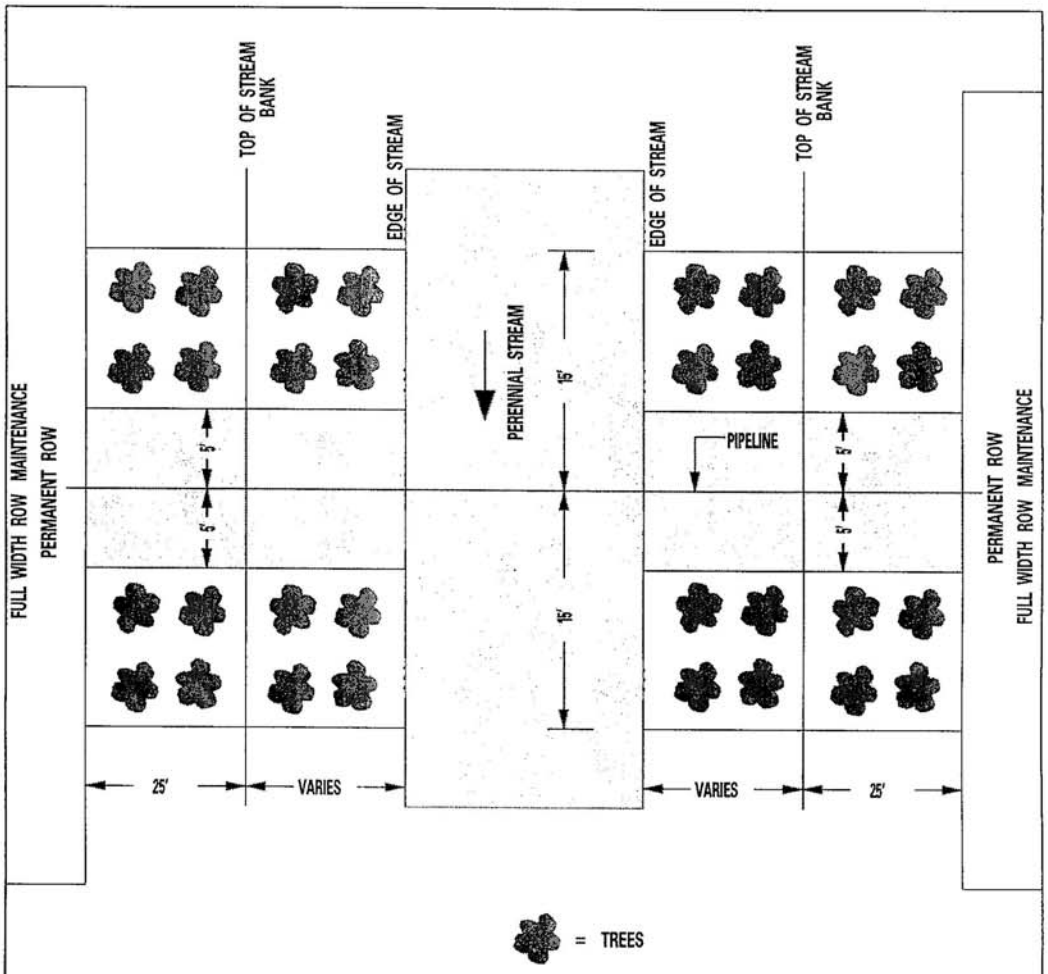
Appendix C-60	**TEMPORARY EQUIPMENT CROSSING EQUIPMENT PADS**	



NOTES:

1. IN WETLAND AREAS WHICH CONTAIN NO STANDING WATER OR IF SOILS ARE SATURATED OR FROZEN, TOPSOIL (TOP 12 INCHES) AND SUBSOIL WILL BE STOCKPILED SEPARATELY WITHIN THE WETLAND CONSTRUCTION ROW.
2. WETLANDS WITH STANDING WATER, SATURATED OR FROZEN SOIL, OPERATE EQUIPMENT PER REQUIREMENTS IN SECTION III.B-2. (ECS)
3. A SEDIMENT FILTER DEVICE WILL BE PLACED ACROSS THE ROW AT THE WETLAND'S EDGE, IMMEDIATELY UPSLOPE OF THE WETLAND BOUNDARY.
4. A SEDIMENT FILTER DEVICE WILL BE PLACED AT THE EDGE OF THE ROW AND AROUND SOIL AND SUBSOIL PILES AS NECESSARY.

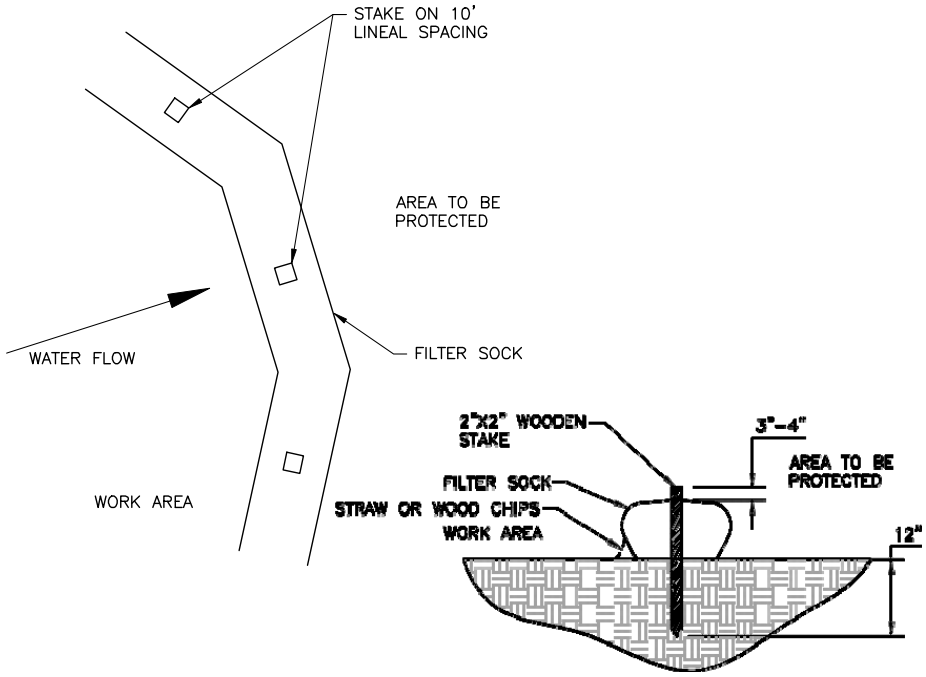
Appendix C-61	**TYPICAL WETLAND CROSSING**	



NOTES:
1. FULL WIDTH ROW MAINTENANCE PRACTICES WITHIN 25 FEET OF PERENNIAL STREAMBANKS ARE PROHIBITED.
2. A CORRIDOR UP TO 10 FEET WIDE CENTERED ON THE PIPELINE OR APPURTENANCES MAY BE MAINTAINED IN A HERBACEOUS STATE.
3. TREES LOCATED WITHIN 15 FEET OF THE PIPELINE AND GREATER THAN 15 FEET TALL MAY BE SELECTIVELY CUT AND REMOVED FROM THE ROW.

NOT TO SCALE

Appendix C-62	**ROW MAINTENANCE PERENNIAL STREAMS**	



NOTES:

1. COMPOST FILTER SOCK TO BE FILTREXX SILTSOXX OR APPROVED EQUIVALENT.
2. 8", 12", 18", AND 24" COMPOST FILTER SOCK TO BE USED. SEE PLAN SHEET FOR SIZES AND LOCATIONS.
3. ACCUMULATED SEDIMENT SHALL BE REMOVED AND DISPOSED OF WHEN IT REACHES ½ THE ABOVE GROUND HEIGHT OF THE COMPOST FILTER SOCK.
4. COMPOST FILTER SOCK SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. DAMAGED COMPOST FILTER SOCK SHALL BE REPAIRED ACCORDING TO MANUFACTURER'S SPECIFICATIONS.

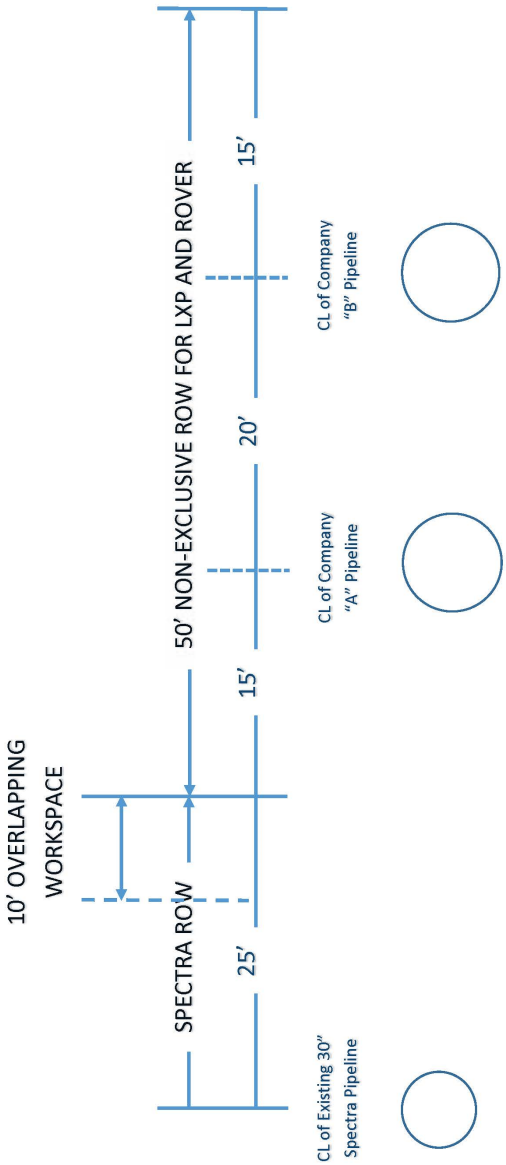
NOT TO SCALE

Appendix C-63	TYPICAL COMPOST FILTER SOCK	

Columbia Gas Transmission, LLC

Leach XPress Project

Leach XPress Pipeline / Rover Pipeline Typical ROW Cross Section



Appendix C-64	TYPICAL ROW CROSS SECTION FOR COLLOCATION SEGMENTS	NOT TO SCALE

APPENDIX D
Access Roads Associated with the Leach XPress Project

APPENDIX D
Access Roads Associated with the Leach XPress Project

Access Road ID	Milepost	Proposed Use	Existing Use	Upgrade Requirements[a]	Approx. Length (feet)	Approx. Width (feet)[b]
LEX						
TAR-166	0.6	Temporary	Existing field road	Grading and gravel	482	15
TAR-145	1.7	Temporary	Existing field road	Grading and gravel	1,318	25
TAR-146	2.1	Temporary	Existing field road	Grading and gravel	4,994	25
TAR-147	3.6	Temporary	Existing field road	Grading, gravel, and tree clearing	1,651	25
TAR-148	5.1	Temporary	Existing field road	Grading, gravel, and tree clearing	4,331	25
TAR-149	6.5	Temporary	Existing field road	Grading and gravel	6,447	25
TAR-122	8.6, RR-1	Temporary	Existing gravel and dirt road	None	1,736	14
TAR-123	10.3	Temporary	Existing field road	Grading, widening, and gravel	870	20
TAR-124	11.3	Temporary	Existing gravel and dirt road	Grading and gravel	563	20
TAR-125	14.1, RR-2	Temporary	Existing gravel and dirt road	None	3,971	25
PAR-72	17.1, RR-3	Permanent	Existing gravel road	Grading, widening, and gravel	2,570	25
PAR-175	17.4	Permanent	Open land / Forested land	Clearing, grading, and gravel	843	10
TAR-70	18.0	Temporary	Forested land / Existing paved road	Clearing, grading, and gravel	1,275	25
TAR-75	19.1	Temporary	Existing gravel drive	Grading and widening	218	25
TAR-13	21.1	Temporary	Open land	Grading and gravel	660	25
TAR-HDD-1	21.2	Temporary	Open land / Forested land	Clearing, grading, and gravel	518	25
TAR-126	21.3	Temporary	Open land / Existing dirt road	Grading, clearing, and gravel	964	25
TAR-14	21.4	Temporary	Open land / Existing dirt road	Grading and gravel	2,488	25
TAR-168	24.3	Temporary	Existing gravel road	None	1,285	10
TAR-169	24.6	Temporary	Existing gravel road	None	2,601	15
TAR-HDD-2	25.2, RR-5	Temporary	Open land / Forested land	Clearing, grading, and gravel	258	25
TAR-156	25.8, RR-5	Temporary	Existing dirt road / Open land	Grading, clearing, and gravel	741	10
TAR-156A	25.8, RR-5	Temporary	Existing dirt road / Open land	Grading, clearing, and gravel	89	10
TAR-HDD-3	25.8, RR-5	Temporary	Forested land / Open land	Clearing, grading, and gravel	379	25
TAR-167	26.9, RR-5	Temporary	Existing field road / Forested land	Clearing, grading, and gravel	6,413	25
TAR-27	28.6	Temporary	Existing field road	Grading and gravel	334	16
TAR-38	31.1	Temporary	Existing dirt and gravel road	None	3,512	25
TAR-63	34.8	Temporary	Existing dirt road	Grading, clearing, and gravel	943	25
TAR-39	38.9	Temporary	Existing field road	Grading	2,167	10
TAR-62	45.1	Temporary	Existing dirt road	None	235	25
TAR-2	46.2	Temporary	Existing dirt road / Forest / Open land	Clearing and grading	1,539	25

APPENDIX D
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Access Road ID	Milepost	Proposed Use	Existing Use	Upgrade Requirements[a]	Approx. Length (feet)	Approx. Width (feet)[b]
TAR-40	48.9	Temporary	Existing dirt road	None	883	10
TAR-41	49.5	Temporary	Existing dirt road	Widening and gravel	2,271	10
PAR-176	49.8	Permanent	Forested land	Clearing, grading, and gravel	16	10
TAR-32	51.6	Temporary	Existing field road	None	915	10
TAR-20	59.4	Temporary	Existing field road	Clearing	1,199	10
TAR-33	64.5	Temporary	Existing dirt road	Widening and gravel	433	15
TAR-60	65.9	Temporary	Open land / Existing dirt road	Widening and gravel	1,652	25
TAR-16	66.9	Temporary	Existing dirt road	Widening	318	25
TAR-128	66.9	Temporary	Open land	Grading and gravel	119	25
TAR-59	67.3	Temporary	Open land / Existing dirt road	Gravel	2,275	15
TAR-74	68.8	Temporary	Open land / Existing dirt road	Gravel	1,691	15
TAR-73	74.3	Temporary	Existing dirt road	Widening and gravel	1,482	25
TAR-71	74.6	Temporary	Existing dirt road	Widening and gravel	1,879	25
TAR-34	76.8	Temporary	Existing dirt road	Widening and gravel	721	15
PAR-177	83.2	Permanent	Open land	Grading and gravel	7	10
TAR-42	85.3	Temporary	Existing dirt road	None	1,952	10
TAR-44	87.1	Temporary	Open land / Existing field road	None	926	10
TAR-30	87.5	Temporary	Open land / Existing field road	Grading	2,052	15
TAR-15	89.4	Temporary	Forested land / Open land	Clearing, grading, and gravel	573	25
TAR-HDD-4	89.4	Temporary	Open land / Forested land	Clearing, grading, and gravel	913	25
TAR-19	89.7	Temporary	Existing dirt road	Widening and gravel	806	25
TAR-18	89.8	Temporary	Existing dirt road / Open land	Grading and gravel	1,464	25
TAR-57	102.3	Temporary	Existing dirt road / Open land	Widening and gravel	993	25
TAR-58	103.3	Temporary	Existing field road	Widening and gravel	2,834	25
TAR-76	104.7	Temporary	Open land	Grading, clearing, and gravel	301	25
TAR-43	105.5	Temporary	Existing dirt road	Gravel	331	10
TAR-3	109.7	Temporary	Existing dirt road	Clearing, widening, and gravel	939	10
TAR-22	110.1	Temporary	Forested land	Clearing and gravel	129	10
TAR-28	110.5	Temporary	Existing dirt road	None	1,698	10
TAR-23	111.7	Temporary	Existing gravel and dirt road	Clearing, grading, and gravel	1,571	10
TAR-56	113.7	Temporary	Open land / Existing dirt road	Grading and gravel	1,865	25
TAR-24	115.7	Temporary	Existing dirt road	Gravel	1,791	15
TAR-25	116.5	Temporary	Existing dirt and gravel road	Widening and gravel	2,526	10
TAR-26	116.7	Temporary	Open land / Existing gravel road	Gravel	702	15

APPENDIX D
Access Roads Associated with the Leach XPress Project

Access Road ID	Milepost	Proposed Use	Existing Use	Upgrade Requirements[a]	Approx. Length (feet)	Approx. Width (feet)[b]
PAR-178	116.7	Permanent	Open land	Grading and gravel	17	10
TAR-5	117.7	Temporary	Open land / Existing dirt road	Widening and gravel	2,069	25
TAR-172	119.6	Temporary	Existing field road	Widening and gravel	1,990	15
TAR-171	119.8	Temporary	Existing field road	Widening and gravel	1,672	15
TAR-17	119.9	Temporary	Open land / Existing dirt road	Grading, clearing, widening, and gravel	3,513	15
TAR-HDD-5	120.0	Temporary	Open land	Clearing, grading and gravel	661	25
TAR-10	120.1	Temporary	Forested land / Open land	Clearing and gravel	303	25
TAR-66	122.5	Temporary	Open land	Grading and gravel	720	25
TAR-21	125.7	Temporary	Existing paved drive and dirt road	None	537	25
TAR-164	129.4	Temporary	Open land / Existing dirt road	Grading, widening, and gravel	1,295	10
TAR-52	130.2	Temporary	Existing dirt road	Grading, widening, and gravel	1,483	15
TAR-51	130.8	Temporary	Existing gravel road	None	66	10
TAR-HDD-6	130.8	Temporary	Open land	Clearing, grading and gravel	388	10
TAR-165	131.2	Temporary	Existing gravel road	None	1,465	10
R-801 Loop						
TAR-53	0.6	Temporary	Existing gravel road	None	2.201	25
TAR-49	2.3	Temporary	Existing gravel road	Widening and gravel	554	25
TAR-48	4.2	Temporary	Existing field road	Grading, widening, and gravel	1,246	25
TAR-133	5.5	Temporary	Forested land	Clearing, grading, and gravel	123	25
TAR-47	5.9	Temporary	Existing field road	Grading and gravel	2,097	25
TAR-50	6.2	Temporary	Existing field road	Grading and gravel	1,293	25
TAR-8	7.7	Temporary	Existing dirt road	Widening and gravel	1,203	25
TAR-134	9.4	Temporary	Existing gravel road / Open land	Widening and gravel	2,442	25
PAR-179	14.2	Permanent	Forested land	Clearing, grading, and gravel	139	10
TAR-46	14.5	Temporary	Existing dirt road / Forested land	Gravel	1,468	25
TAR-77	15.2	Temporary	Open land / Existing dirt road	Grading and gravel	2,545	25
TAR-68	15.6	Temporary	Existing field road	Widening and gravel	3,003	25
TAR-135	19.3	Temporary	Existing field road	Grading and gravel	1,112	25
TAR-136	20.4	Temporary	Existing field road	Grading and gravel	5,413	25
TAR-137	21.1	Temporary	Existing dirt road / Field road / Forested land	Clearing, grading, and gravel	3,250	25
TAR-138	22.5	Temporary	Existing field road	Grading and gravel	1,743	25
TAR-160	22.8	Temporary (Pipe Yard 21)	Open land	Grading and gravel	223	25

APPENDIX D
Access Roads Associated with the Leach XPress Project

Access Road ID	Milepost	Proposed Use	Existing Use	Upgrade Requirements[a]	Approx. Length (feet)	Approx. Width (feet)[b]
TAR-161	24.1	Temporary (Pipe Yard 23)	Open land / Existing gravel drive	Grading and gravel	248	25
BM-111 Loop						
TAR-139	0.0	Temporary	Driveway / open land	Grading and gravel	248	25
TAR-162	1.0	Temporary	Forested land	Clearing, grading, and gravel	166	25
TAR-140	1.4	Temporary	Existing dirt road	Grading and gravel	255	25
R-501 Abandonment						
TAR-80	0.9	Temporary	Open land / existing dirt road	Gravel	204	25
TAR-81	1.0	Temporary	Existing gravel road	Gravel	263	25
TAR-151	1.9	Temporary	Open land	Grading	1,542	25
TAR-152	2.1	Temporary	Open land / Existing dirt road	Grading	2,554	25
TAR-153	2.1	Temporary	Open land	Grading	4,523	25
TAR-82	3.1	Temporary	Open land	Grading and gravel	520	25
TAR-83	3.2	Temporary	Open land	Grading and gravel	1,329	25
TAR-154	3.3	Temporary	Open land	Grading	133	25
TAR-84	3.3	Temporary	Existing driveway	None	336	25
TAR-85	3.4	Temporary - Walking Path	Open land	None	187	5
TAR-86	3.5	Temporary	Open land / Existing gravel road	Gravel	207	25
TAR-87	3.5	Temporary - Walking Path	Open land	None	385	5
TAR-88	4.1	Temporary – Walking Path	Open land	None	72	5
TAR-89	4.1	Temporary – Walking Path	Open land	None	3	5
TAR-90	4.2	Temporary – Walking Path	Open land	None	813	5
TAR-93	6.5	Temporary	Existing dirt road / Open land	Clearing, grading, and gravel	590	25
TAR-94	8.0	Temporary – Walking Path	Open land	None	322	5
TAR-95	8.1	Temporary	Existing field road	Widening and grading	1,965	25
TAR-96	8.1	Temporary – Walking Path	Open land	None	538	5
TAR-97	8.2	Temporary- Walking Path	Open land	None	448	5
TAR-98	8.9	Temporary	Existing dirt / Field road	Widening and grading	1,282	25
TAR-99	8.9	Temporary- Walking Path	Open land	None	292	5
TAR-101	9.2	Temporary- Walking Path	Open land	None	562	5
TAR-104	9.7	Temporary	Open land / Forested land	Clearing, grading, and gravel	712	25
TAR-105	11.9	Temporary	Open land	Gravel	524	25
TAR-155	12.0	Temporary	Open land	Gravel	995	25
TAR-107	13.3	Temporary- Walking Path	Open land	None	696	5
TAR-108	13.8	Temporary- Walking Path	Open land	None	194	5

APPENDIX D
Access Roads Associated with the Leach XPress Project

Access Road ID	Milepost	Proposed Use	Existing Use	Upgrade Requirements[a]	Approx. Length (feet)	Approx. Width (feet)[b]
TAR-109	16.8	Temporary	Open land	Gravel	247	25
TAR-177	17.3	Temporary	Open land	Gravel	472	18
TAR-111	20.1	Temporary	Open land	Gravel	1,538	25
TAR-112	21.6	Temporary	Existing field road / Open land	Grading and gravel	2,042	25
TAR-178	23.1	Temporary	Open land	Gravel	1,310	25
TAR-113	23.8	Temporary	Open land	Gravel	457	20
TAR-173	23.8	Temporary	Open land	Grading and gravel	2,212	25
TAR-174	26.3	Temporary	Open land	Grading and gravel	2,165	25
Aboveground Facilities						
LEX						
PAR-F-2	0.0	Permanent (LEX launcher facility)	Existing gravel road	None	139	29
PAR-MLV-1	3.1	Permanent (MLV Site #1)	Open land	Grade and gravel	161	10
PAR-F-3	7.6, RR-1	Permanent (Lone Oak CS)	Existing property access	Grade, gravel, and trim trees	441	24
PAR-MLV-2	18.5, RR-4	Permanent (MLV Site #2)	Agricultural land	Grading and gravel	292	20
PAR-MLV-3	31.7	Permanent (MLV Site #3)	Open land	Grading and gravel	76	10
PAR-MLV-4	49.3	Permanent (MLV Site #4)	Open land	Grading and gravel	192	10
PAR-F-5	57.2	Permanent (Summerfield CS)	Existing farm road (Town Hwy 209)	Grade and gravel	3,421	16
PAR-127	65.6	Permanent (MLV Site #5)	Existing dirt road	Grading and gravel	838	20
PAR-MLV-6	84.3	Permanent (MLV Site #6)	Open land	Grading and gravel	132	10
PAR-MLV-7	104.2	Permanent (MLV Site #7)	Open land	Grading and gravel	165	10
PAR-MLV-8	122.0	Permanent (MLV Site #8)	Forested land	Clearing, grading, and gravel	391	10
LEX1						
PAR-F-21	0.0	Permanent (K-260 RS)	Existing field road / forested land	Clearing, grading and gravel	2,241	20
PAR-F-27	0.0	Permanent (K-260 RS) (tie-in valve)	Forested land	Clearing, grading and gravel	211	16
PAR-F-26	0.0	Permament (K-260 RS)	Existing driveway / Forested land	Clearing, grading and gravel	1,253	18
PAR-F-22	0.3	Permanent (K-260 RS)	Existing field road	Grading and gravel	4,169	20
PAR-F-6	1.2	Permanent (LEX1 receiver facility)	Open land	Grading and gravel	956	25
R-801 Loop						
PAR-F-8	0.0	Permanent (R-System RS)	Existing driveway / existing farm road	Grading and gravel	557	8
PAR-F-28	0.05	Permanent (R-System RS tie-in facility)	Open land	Grading and gravel	385	16
PAR-F-29	0.06	Permanent (R-System RS)	Existing driveway / existing farm road	None	798	20

APPENDIX D
Access Roads Associated with the Leach XPress Project

Access Road ID	Milepost	Proposed Use	Existing Use	Upgrade Requirements[a]	Approx. Length (feet)	Approx. Width (feet)[b]
PAR-MLV-9	9.7	Permanent (MLV Site #9)	Existing gravel road / Forested land	Grading and gravel	178	10
PAR-F-19	12.8	Permanent (Benton RS)	Open land	Gravel	12	25
PAR-F-20	24.2	Permanent (McArthur RS)	Forested land	Clearing, grading, and gravel	686	20
PAR-F-11	24.2	Permanent (McArthur RS)	Existing dirt road / Forested land	Clearing, grading, and gravel	541	20
BM-111 Loop						
PAR-F-24	2.85	Permanent (Ceredo CS)	Existing gravel road	Gravel	37	20
Existing Columbia Pipeline System						
PAR-F-14	51.5 [d]	Permanent (Oak Hill CS)	Agricultural land	Grading and gravel	712	24
PAR-F-25	0.0 [d]	Permanent (Crawford CD regulator valve facility)	Open land	Grading and gravel	46	16
TAR-F-15	51.5 [c]	Temporary (Oak Hill CS)	Existing farm road (Mining Haul Rd) / Agricultural land	Existing – grading New –grading and gravel	2,174	20-60
PAR-F-16	51.5 [c]	Permanent (Oak Hill CS)	Agricultural land / Forested land	Clearing, grading, and gravel	1,849	16
PAR-F-12	34.7 [c]	Permanent (R-486 OS)	Agricultural land	Grading and gravel	370	20
PAR-F-13	37.1 [c]	Permanent (R-130 OS)	Existing driveway / Open land	Grading and gravel	63	16
TAR-F-17	53.7 [c]	Temporary (R-543 OS)	Existing gravel road	None	123	20

[a] All temporary access roads will be utilized during the construction phase only and returned to pre-construction conditions following Project completion. Any upgrade requirements listed for permanent access roads reflect the permanent disposition of the road, as needed to maintain access during operation of the Project facilities.

[b] Approximate width corresponds to the average width of the proposed access road; however, an expanded width across short distances may be required in specific locations to accommodate safe turning areas for construction equipment.

[c] Milepost is associated with Columbia's existing Line R-501.

APPENDIX E
Site-Specific Deviations from the FERC Plan and Procedures

APPENDIX E
Site-Specific Deviations from the FERC Plan and Procedures

Workspace ID	Milepost	Justification
LEX		
Construction corridor	0.0-131.3	Necessary to provide for safe and efficient construction of the pipeline through hilly terrain, steep slope conditions, and shallow bedrock.
ATWS-1,815	1.7	Necessary to provide for safe and efficient construction of the pipeline through hilly terrain, steep slope conditions, and shallow bedrock.
ATWS-1,816	1.8	ATWS is necessary to accommodate additional construction equipment and placement of excavated soils outside of the waterbody.
ATWS-2,128	8.3, RR-1	ATWS is necessary to accommodate additional construction equipment and placement of excavated soils outside of the waterbody.
ATWS-49	9.7	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-1,178	21.1	ATWS is necessary to accommodate staging of prefabricated section of pipe for HDD.
ATWS-94	21.1	ATWS is necessary to accommodate additional construction equipment.
ATWS-1,301	21.2	ATWS is necessary to accommodate additional vehicle/equipment parking.
ATWS-1,302	21.3	ATWS is necessary to accommodate equipment to withdraw water for hydrostatic testing.
ATWS-1,303	21.3	ATWS is necessary to accommodate equipment to withdraw water for hydrostatic testing
ATWS-105	25.2	ATWS is necessary to accommodate additional construction equipment.
ATWS-106	25.79, RR-5	ATWS is necessary to accommodate additional construction equipment and for spoil storage due to extreme slopes
ATWS-2,084	25.87, RR-5	ATWS is necessary to accommodate additional construction equipment HDD
ATWS-145	30.4	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-1,769	36.3	ATWS is needed for additional construction equipment and placement of excavated soils.
ATWS-1,065	36.5	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-262	42.8	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-342	50.9	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils outside of the waterbody.
ATWS-2163	50.9, RR-6	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing
ATWS-364	54.1	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-2106	54.8, RR-7	ATWS is needed to segregate the topsoil.
ATWS-369	56.1	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-390	61.9	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-422	66.9	ATWS is necessary to accommodate additional construction equipment.
ATWS-1,417	66.9	ATWS is necessary to accommodate equipment to withdraw water for hydrostatic testing.
ATWS-423	67.3	ATWS is necessary to accommodate additional construction equipment.
ATWS-508	77.3	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils outside of the waterbody.
ATWS-681	89.8	ATWS is necessary to accommodate staging of prefabricated section of pipe for HDD.
ATWS-1,530	104.7	ATWS is needed for additional construction equipment and placement of excavated soils.
ATWS-740	107.7	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-741	107.7	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-1,532	107.7	ATWS is needed for additional construction equipment and placement of excavated soils.

APPENDIX E Site-Specific Deviations from the FERC Plan and Procedures		
Workspace ID	**Milepost**	**Justification**
ATWS-1,537	108.9	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-747	108.9	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-764	111.4	ATWS is needed to accommodate additional construction equipment necessary to facilitate major PI and for placement of excavated soils outside of the waterbody.
ATWS-772	112.3	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-773	112.3	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-806	118.8	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-813	119.6	ATWS is necessary to accommodate additional construction equipment.
ATWS-1,579	120.0	ATWS is necessary to accommodate equipment to withdraw water for hydrostatic testing and HDD.
ATWS-814	120.1	ATWS is necessary to accommodate additional construction equipment.
ATWS-837	124.5	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils outside of the waterbody.
ATWS-838	124.5	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils outside of the waterbody.
ATWS-2,031	129.9	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-859	130.2	ATWS is necessary to accommodate additional construction equipment.
LEX1		
Construction corridor	0.0-1.2	Necessary to provide for safe and efficient construction of the pipeline through hilly terrain and steep slope conditions.
R-801 Loop		Necessary to provide for safe and efficient construction of the pipeline through hilly terrain, steep slope conditions, and shallow bedrock.
Construction corridor	0.0-24.2	Necessary to provide for safe and efficient construction of the pipeline through hilly terrain, steep slope conditions, and shallow bedrock.
ATWS-884	3.4	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-890	6.7	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
ATWS-897	8.9	ATWS is needed to accommodate additional construction equipment necessary to facilitate road crossing and for placement of excavated soils.
BM-111 Loop		
Construction corridor	0.0-2.8	Necessary to provide for safe and efficient construction of the pipeline through hilly terrain, steep slope conditions, and shallow bedrock.
ATWS-1050	1.0	ATWS is necessary to accommodate additional construction equipment.
ATWS-1,181	1.1	Necessary to provide for safe and efficient construction of the pipeline through steep slope conditions.
ATWS-1730	1.4	ATWS is necessary to accommodate staging of prefabricated section of pipe for HDD.

APPENDIX F
Geologic Formations Crossed by the Leach XPress Project

APPENDIX F
Geologic Formations Crossed by the Leach XPress Project

Geologic Formation/ Unit	Facility	Begin MP	End MP	Period/Era	Primary Lithology	Secondary Lithology	Description
Dunkard Group	LEX	2.0	21.3	Permian, Pennsylvanian	Sandstone	Siltstone	Non-marine cyclic sequences of sandstone, siltstone, shale, limestone, and coal.
		21.6	25.2				
		26.0, RR-5	38.7				
		38.8	40.6				
		40.7	41.4				
		41.5	41.8				
		42.0	43.9				
		44.0	45.0				
		45.1	48.0				
		48.1	48.3				
		48.4	48.5				
		48.5	48.7				
		48.9	49.2				
		49.3	49.3				
		49.6	49.7				
		49.8	49.8				
		50.1	50.2				
		50.4	50.5				
		51.8	51.9				
		51.9	52.0				
		52.1	52.2				
		52.7	52.8				
		54.4	54.5				
		57.4	57.4				
		73.9	74.0				
		74.9	75.0				
		75.2	75.2				
		75.8	75.9				
		76.2	76.3				
		77.0	77.1				
		77.3	77.4				
		77.9	78.0				
		78.3	78.4				
	Mainline Valve 1	3.1	3.1				

APPENDIX F
Geologic Formations Crossed by the Leach XPress Project

Geologic Formation/ Unit	Facility	Begin MP	End MP	Period/Era	Primary Lithology	Secondary Lithology	Description
	Mainline Valve 2	18.6, RR-4	18.6, RR-4				
Dunkard Group	Mainline Valve 3	31.7	31.7	Permian, Pennsylvanian	Sandstone	Siltstone	Non-marine cyclic sequences of sandstone, siltstone, shale, limestone, and coal.
	Mainline Valve 4	49.3	49.3				
	Lone Oak CS	7.4	7.4				
Monongahlea Group	LEX	0.0	0.0	Pennsylvanian	Sandstone	Siltstone	Black, red, gray, and green shale, siltstone, and mudstone
		1.6	2.0				
		21.3	21.6				
		25.2	25.6, RR-5				
		25.6, RR-5	26.0, RR-5				
		38.7	38.8				
		40.6	40.7				
		41.4	41.5				
		41.8	42.0				
		43.9	44.0				
		45.0	45.1				
		48.0	48.1				
		48.3	48.4				
		48.5	48.5				
		48.7	48.9				
		49.2	49.3				
		49.3	49.6				
		49.7	49.8				
		49.8	50.1				
		50.2	50.4				
		50.5	50.8, RR-6				
		51.0, RR-6	51.2				
		51.3	51.8				
		51.9	51.9				
		52.0	52.1				
		52.2	52.4				
		52.5	52.7				
		52.8	54.4				
		54.5	55.3, RR-7				
		55.5, RR-7	57.4				

APPENDIX F
Geologic Formations Crossed by the Leach XPress Project

Geologic Formation/ Unit	Facility	Begin MP	End MP	Period/Era	Primary Lithology	Secondary Lithology	Description
		57.4	57.8				
		58.2	58.7				
Monongahlea Group	LEX	58.8	59.0	Pennsylvanian	Sandstone	Siltstone	Black, red, gray, and green shale, siltstone, and mudstone
		59.2	59.5				
		60.0	60.1				
		60.5	61.1				
		62.4	62.5				
		62.5	63.2				
		63.4	63.5				
		64.1	64.2				
		64.5	64.6				
		68.0	68.2				
		71.3	73.9				
		74.0	74.9				
		75.0	75.2				
		75.2	75.8				
		75.9	76.2				
		76.3	77.0				
		77.1	77.3				
		77.4	77.9				
		78.0	78.3				
		78.4	79.1				
		83.0	83.1				
		84.0	86.0				
		86.3	86.5				
		87.0	87.2				
		88.4	88.4				
		88.7	89.0				
		90.2	90.3				
		90.4	90.8				
		90.9	91.3				
		91.7	91.8				
		92.4	92.5				
		92.6	92.6				

APPENDIX F
Geologic Formations Crossed by the Leach XPress Project

Geologic Formation/ Unit	Facility	Begin MP	End MP	Period/Era	Primary Lithology	Secondary Lithology	Description
		93.4	93.6				
	Summerfield CS	57.1	57.1				
	Mainline Valve 6	84.3	84.3				
Monongahlea Group	LEX launcher	0.0	0.0	Pennsylvanian	Sandstone	Siltstone	Black, red, gray, and green shale, siltstone, and mudstone
Conemaugh Group	LEX	50.8, RR-6	50.9, RR-6	Pennsylvanian	Siltstone	Shale	Black, red, gray, and green shale, siltstone, and mudstone.
		51.2	51.3				
		52.4	52.5				
		55.3, RR-7	55.5, RR-7				
		57.8	58.2				
		58.7	58.8				
		59.0	59.2				
		59.5	60.0				
		60.1	60.5				
		61.1	62.4				
		62.5	62.5				
		63.2	63.4				
		63.5	64.1				
		64.2	64.5				
		64.6	68.0				
		68.2	71.3				
		79.1	83.0				
		83.1	84.0				
		86.0	86.3				
		86.5	87.0				
		87.2	88.4				
		88.4	88.7				
		89.0	90.2				
		90.3	90.4				
		90.8	90.9				
		91.3	91.7				
		91.8	92.4				
		92.5	92.6				
		92.6	93.4				

APPENDIX F
Geologic Formations Crossed by the Leach XPress Project

Geologic Formation/ Unit	Facility	Begin MP	End MP	Period/Era	Primary Lithology	Secondary Lithology	Description
		93.6	98.2				
		98.4	99.9				
		100.3	101.9				
		102.1	102.6				
Conemaugh Group	LEX	103.1	105.4	Pennsylvanian	Siltstone	Shale	Black, red, gray, and green shale, siltstone, and mudstone.
		105.4	105.9				
		105.9	106.2				
		106.3	106.6				
		106.7	107.1				
		107.3	109.4				
		111.2	111.3				
	BM-111 Loop	0.8	2.6				
	Mainline Valve 5	65.6	65.6				
	Mainline Valve 7	104.2	104.2				
Allegheny and Pottsville Groups, Undivided	LEX	98.2	98.4	Pennsylvanian	Shale	Siltstone	Gray, olive, and greenish shale, siltstone, and underclay. Locally contains marine fossils.
		99.9	100.3				
		101.9	102.1				
		102.6	103.1				
		105.4	105.4				
		105.9	105.9				
		106.2	106.3				
		106.6	106.7				
		107.1	107.3				
		109.4	111.2				
		111.3	117.4				
		117.5	117.6				
		117.7	117.9				
		118.4	118.6				
		119.3	119.6				
		119.7	119.8				
		120.3	121.1				
		121.6	121.8				
	R-801 Loop	1.8	1.8				
		3.8	4.0				

APPENDIX F
Geologic Formations Crossed by the Leach XPress Project

Geologic Formation/ Unit	Facility	Begin MP	End MP	Period/Era	Primary Lithology	Secondary Lithology	Description
Allegheny and Pottsville Groups, Undivided		4.4	4.5	Pennsylvanian	Shale	Siltstone	Gray, olive, and greenish shale, siltstone, and underclay. Locally contains marine fossils.
		6.0	6.4				
		8.1	8.2				
		9.4	11.5				
		11.8	12.1				
		12.3	13.3				
		13.5	13.6				
		13.8	15.5				
		15.6	16.3				
		16.4	19.7				
		19.7	24.2				
	BM-111 Loop	0.0	0.1				
	Benton Regulator Station	12.8	12.8				
	RS-1286 Regulator Station	21.6	21.6				
	McArthur Regulator Station	24.2	24.2				
	BM-111 Loop Launcher	0.0	0.0				
	Oak Hill Compressor Station	51.50 [a]	51.50 [a]				
	Mainline Valve 9	9.7	10.7				
	R-130 Odorization Site	37.08 [a]	37.08 [a]				
	R-300 / R-500 Odorization Site	88.02 [a]	88.02 [a]				
	R-486 Odorization Site	34.72 [a]	34.72 [a]				
	R-543 Odorization Site	53.68 [a]	53.68 [a]				
Black Hand Sandstone Member of Cuyahoga Formation	LEX	121.2	121.5	Mississippian	Sandstone	Conglomerate	Yellow-gray to white sandstone and conglomerate that grades laterally into shale and siltstone.
		122.0	123.7				
		124.0	124.2				
		124.4	124.6				
		125.1	125.3				
		126.1	126.1				
		127.0	127.1				
		127.6	128.2				
		129.1	129.2				

APPENDIX F
Geologic Formations Crossed by the Leach XPress Project

Geologic Formation/ Unit	Facility	Begin MP	End MP	Period/Era	Primary Lithology	Secondary Lithology	Description
		129.7	131.3				
	LEX1	0.6	1.2				
	R-801 Loop	0.0	0.5				
		0.7	1.0				
		1.1	1.7				
		2.0	2.4				
Black Hand Sandstone Member of Cuyahoga Formation		3.1	3.6	Mississippian	Sandstone	Conglomerate	Yellow-gray to white sandstone and conglomerate that grades laterally into shale and siltstone.
		4.8	4.9				
		5.0	5.2				
		6.7	6.8				
		7.6	7.7				
		8.6	9.0				
	R-System RS	0.0	0.0				
	LEX1 receiver	1.2	1.2				
	Crawford CS	0.00 [a]	0.00 [a]				
	Benton CS	5.19 [b]	5.19 [b]				
Maxville Limestone; Rushville, Logan, and Cuyhoga Formations, Undivided	LEX	117.4	117.5	Mississippian	Shale	Siltstone	Gray, yellow, brown shale, siltstone, and sandstone.
		117.6	117.7				
		117.9	118.4				
		118.6	119.3				
		119.6	119.7				
		119.8	120.3				
		121.1	121.2				
		121.5	121.6				
		121.8	122.0				
		123.7	124.0				
		124.2	124.4				
		124.6	125.1				
		125.3	126.1				
		126.1	127.0				
		127.1	127.6				
		128.2	129.1				
		129.2	129.7				
	LEX1	0.0	0.6				

APPENDIX F
Geologic Formations Crossed by the Leach XPress Project

Geologic Formation/ Unit	Facility	Begin MP	End MP	Period/Era	Primary Lithology	Secondary Lithology	Description
	R-801 Loop	0.5	0.7				
		1.0	1.1				
		1.7	1.8				
		1.8	2.0				
		2.4	3.1				
		3.6	3.8				
		4.0	4.4				
Maxville Limestone; Rushville, Logan, and Cuyhoga Formations, Undivided		4.5	4.8	Mississippian	Shale	Siltstone	Gray, yellow, brown shale, siltstone, and sandstone.
		4.9	5.0				
		5.2	6.0				
		6.4	6.7				
		6.8	7.6				
		7.7	8.1				
		8.2	8.6				
		9.0	9.4				
		11.5	11.8				
		12.1	12.3				
		13.3	13.5				
		13.6	13.8				
		15.5	15.6				
		16.3	16.4				
		19.7	19.7				
	K-260 RS	0.0	0.0				
	Mainline Valve 8	122.0	122.0				
Quaternary Alluvium	LEX	25.6, RR-5	25.6, RR-5	Quaternary	Alluvium	N/A	Alluvial deposits of sand, gravel, silt, and clay.
	BM-111 Loop	0.1	0.8				
		2.6	2.9				
	Ceredo CS	2.9	2.9				
Greene Formation	LEX	0.6	0.6	Permian	Sandstone	Shale	Cyclic sequences of sandstone, shale, red beds, thin limestone, and thin, impure coal.
		0.8	1.1				
Washington Formation	LEX	0.5	0.6	Permian	Sandstone	Shale	Sequences of sandstone, red shale, limestone, and coal.
		0.6	0.8				
		1.1	1.2				

APPENDIX F
Geologic Formations Crossed by the Leach XPress Project

Geologic Formation/ Unit	Facility	Begin MP	End MP	Period/Era	Primary Lithology	Secondary Lithology	Description
Waynesburg Formation	LEX	0.0 1.2	0.5 1.6	Permian and Pennsylvanian	Sandstone	Shale	Sequences of sandstone, shale, limestone, and coal.

[a] Milepost is associated with Columbia's existing Line R-501.
[b] Milepost is associated with Columbia's existing Line R-515.
Source: USGS, 2005a-g.

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
LEX		
Marshall County, WV		
0.0	0.0	126
Approximate Percent of Pipeline Crossing Length		*0.01%*
Greene County, PA		
0.6	0.6	205
0.6	0.7	185
Approximate Percent of Pipeline Crossing Length		*0.05%*
Marshall County, WV		
2.1	2.1	76
2.1	2.2	326
2.2	2.2	87
2.2	2.3	183
2.4	2.4	127
2.4	2.5	324
2.5	2.5	184
2.6	2.7	399
2.7	2.9	801
2.9	3.0	536
3.0	3.1	661
3.1	3.2	338
3.2	3.2	299
3.2	3.3	333
3.3	3.4	630
3.4	3.4	123
3.5	3.5	128
3.5	3.5	138
3.5	3.6	481
3.6	3.7	555
3.7	3.8	140
3.8	3.8	50
3.8	3.8	128
3.8	3.8	189
3.9	4.0	543
4.0	4.0	73
4.0	4.1	120
4.1	4.1	184
4.1	4.1	169
4.1	4.2	155
4.2	4.2	355
4.3	4.4	792
4.4	4.4	204
4.4	4.5	370
4.5	4.5	119

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
4.5	4.5	44
4.5	4.6	347
4.6	4.7	210
4.7	4.7	228
4.7	4.7	153
4.8	4.8	148
4.8	4.8	199
4.9	5.0	701
5.0	5.1	199
5.1	5.1	120
5.1	5.3	864
5.3	5.3	140
5.3	5.4	150
5.4	5.4	50
5.4	5.4	128
5.4	5.5	291
5.5	5.5	155
5.5	5.5	196
5.5	5.6	208
5.6	5.6	111
5.6	5.6	191
5.6	5.7	110
5.7	5.8	553
5.8	5.8	121
6.0	6.0	156
6.1	6.1	132
6.1	6.2	122
6.2	6.2	165
6.2	6.2	189
6.3	6.4	361
6.4	6.5	260
6.5	6.5	316
6.5	6.6	214
6.6	6.6	44
6.6	6.6	306
6.6	6.8	877
6.8	6.9	520
7.0	7.0	123
7.0	7.1	98
7.1	7.1	281
7.1	7.2	376
7.2	7.3	730
7.3	7.3	50
7.3	7.4	338
7.4	7.4	207

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
7.4	7.5	161
7.5	7.5	161
7.5	7.6	104
7.6	7.7	904
7.7	7.7	23
7.8	7.8	198
7.9	7.9	72
8.0	8.0	67
8.0	8.0	174
8.0	8.1	290
8.2	8.2	442
8.3	8.3	26
8.3	8.4	161
8.4	8.4	323
8.5	8.5	177
8.6	8.6	208
8.6	8.7	336
8.6	8.7	233
8.7	8.7	79
8.7	8.7	94
8.7	8.8	189
8.7	8.9	372
8.8	9.0	208
9.0	9.0	28
9.0	9.1	313
9.1	9.1	101
9.1	9.2	103
9.2	9.2	54
9.2	9.2	136
9.2	9.3	184
9.7	9.8	518
9.8	9.9	281
9.9	10.0	461
10.0	10.0	396
10.0	10.1	498
10.1	10.2	214
10.2	10.2	76
10.2	10.2	153
10.2	10.3	427
10.3	10.4	474
10.6	10.6	46
10.6	10.6	112
10.6	10.6	42
10.6	10.6	108
10.7	10.8	436

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
10.8	10.9	436
10.9	11.0	268
11.0	11.0	187
11.1	11.1	194
11.2	11.3	268
11.3	11.3	251
11.3	11.4	163
11.4	11.5	453
11.5	11.6	131
11.6	11.6	112
11.6	11.6	204
11.6	11.6	65
11.6	11.7	148
11.8	11.8	66
11.8	11.8	95
11.8	11.8	254
11.8	11.9	99
11.9	11.9	278
12.0	12.0	10
12.0	12.0	316
12.1	12.1	196
12.1	12.1	100
12.1	12.2	297
12.2	12.3	709
12.3	12.4	228
12.4	12.4	339
12.4	12.5	129
12.5	12.5	261
12.8	12.8	180
12.8	12.8	31
12.9	12.9	157
12.9	12.9	207
12.9	13.0	341
13.0	13.0	123
13.0	13.1	217
13.1	13.1	151
13.1	13.1	86
13.1	13.1	60
13.1	13.1	179
13.1	13.2	67
13.2	13.2	162
13.2	13.3	64
13.3	13.3	123
13.3	13.3	117
13.4	13.4	198

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
13.4	13.4	102
13.5	13.5	160
13.7	13.7	174
13.7	13.7	52
13.7	13.7	199
13.7	13.8	208
13.8	13.8	341
13.9	13.9	80
14.0	14.0	147
14.1	14.1 (RR-2)	108
14.1 (RR-2)	14.2 (RR-2)	213
14.2 (RR-2)	14.2 (RR-2)	216
14.3 (RR-2)	14.4 (RR-2)	468
14.5 (RR-2)	14.5 (RR-2)	132
14.6 (RR-2)	14.6 (RR-2)	165
14.6 (RR-2)	14.6 (RR-2)	47
14.6 (RR-2)	14.8 (RR-2)	943
14.8 (RR-2)	14.8 (RR-2)	87
14.8 (RR-2)	14.8 (RR-2)	111
14.8 (RR-2)	14.8 (RR-2)	87
14.8 (RR-2)	14.9 (RR-2)	389
14.9 (RR-2)	15.0 (RR-2)	566
15.0 (RR-2)	15.2 (RR-2)	939
15.8 (RR-2)	15.8 (RR-2)	110
15.8 (RR-2)	15.8 (RR-2)	52
15.8 (RR-2)	15.1	267
15.1	15.1	88
15.1	15.2	94
15.2	15.2	222
15.3	15.4	128
15.4	15.4	126
15.4	15.5	442
15.5	15.5	163
15.6	15.6	117
15.6	15.6	150
15.6	15.6	77
15.6	15.7	224
15.7	15.7	117
15.8	15.8	261
15.8	15.8	100
15.8	15.9	134
15.9	15.9	331
16.3	16.3	144
16.3	16.3	110
16.3	16.3	80

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
16.3	16.4	301
16.4	16.4	127
16.4	16.5	285
16.5	16.5	112
16.5	16.6	277
16.6	16.6	310
16.6	16.7 (RR-3)	264
16.7 (RR-3)	16.7 (RR-3)	134
16.7 (RR-3)	16.7 (RR-3)	134
17.1 (RR-3)	17.2	264
17.2	17.2	441
17.3	17.3	93
17.3	17.3	326
17.3	17.4	108
17.4	17.4	99
17.4	17.4	86
17.4	17.4	181
17.4	17.4	29
17.5	17.5	79
17.5	17.6	562
17.6	17.7	282
17.7	17.7	76
17.7	17.7	167
17.7	17.7	61
17.7	17.8	199
17.8	17.8	94
17.8	17.9	642
17.9	17.9	65
17.9	18.0	127
18.0	18.0	109
18.0	18.0	86
18.0	18.0	170
18.0	18.2	879
18.2	18.2	82
18.2	18.2	108
18.2	18.3	270
18.3	18.3	227
18.3	18.4	163
18.4	18.4	66
18.4	18.4	132
18.4 (RR-4)	18.5 (RR-4)	233
18.5 (RR-4)	18.5 (RR-4)	260
18.5 (RR-4)	18.6 (RR-4)	79
18.6 (RR-4)	18.6 (RR-4)	85
18.6 (RR-4)	18.6 (RR-4)	112

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
18.6 (RR-4)	18.7	658
18.8	18.8	90
18.8	18.8	137
18.8	18.9	230
18.9	19.0	630
19.0	19.0	73
19.0	19.0	90
19.0	19.0	205
19.0	19.1	41
19.1	19.1	137
19.1	19.1	283
19.2	19.3	233
19.3	19.3	46
19.3	19.3	127
19.3	19.3	188
19.3	19.4	247
19.4	19.5	468
19.5	19.6	730
19.6	19.7	283
19.7	19.7	396
19.7	19.8	230
19.8	19.8	265
19.8	19.9	116
19.9	20.0	554
20.0	20.0	91
20.0	20.1	559
20.1	20.2	364
20.2	20.2	383
20.2	20.4	637
20.4	20.5	956
20.6	20.8	836
20.8	20.9	420
20.9	21.0	531
21.3	21.3	118
21.6	21.7	920
21.7	21.8	58
21.8	21.8	350
21.8	21.9	180
21.9	21.9	228
21.9	22.0	620
22.0	22.1	316
22.1	22.1	406
22.1	22.3	909
22.3	22.3	104
22.3	22.4	162

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
22.4	22.5	454
22.5	22.5	218
22.5	22.5	164
22.5	22.5	57
22.5	22.6	482
22.6	22.6	31
22.6	22.7	225
22.7	22.8	601
22.8	22.8	180
22.8	22.9	172
22.9	22.9	127
22.9	23.0	445
23.0	23.0	137
23.0	23.2	1,004
23.4	23.5	599
23.5	23.6	240
23.6	23.6	169
23.6	23.6	15
23.6	23.7	564
23.7	23.7	92
23.7	23.8	234
23.8	23.8	82
23.8	23.8	59
23.8	24.0	691
24.0	24.1	649
24.1	24.1	118
24.1	24.2	91
24.2	24.3	631
24.3	24.4	442
24.4	24.4	106
24.4	24.4	113
24.4	24.4	97
24.4	24.5	554
24.5	24.6	541
24.6	24.7	255
24.7	24.7	250
24.9	24.9	77
25.0	25.0	163
25.0	25.0	32
25.0	25.1	318
Approximate Percent of Pipeline Crossing Length		*10%*
Monroe County, OH		
25.8 (RR-5)	25.9 (RR-5)	421
25.9 (RR-5)	25.9 (RR-5)	144
26.0 (RR-5)	26.1 (RR-5)	735

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
26.1 (RR-5)	26.3 (RR-5)	953
26.3 (RR-5)	26.3 (RR-5)	215
26.3 (RR-5)	26.4 (RR-5)	224
26.4 (RR-5)	26.5 (RR-5)	631
26.5 (RR-5)	26.6 (RR-5)	503
26.6 (RR-5)	26.8 (RR-5)	1,288
26.8 (RR-5)	27.0 (RR-5)	595
27.0 (RR-5)	27.0 (RR-5)	319
27.0 (RR-5)	27.0	1,158
27.0	27.0	64
27.0	27.1	270
27.1	27.2	457
27.2	27.2	143
27.2	27.2	111
27.2	27.3	227
27.3	27.4	597
27.4	27.4	86
27.4	27.4	280
27.4	27.5	225
27.5	27.6	512
27.6	27.6	116
27.6	27.6	158
27.6	27.7	181
27.7	27.7	136
27.7	27.7	70
27.7	27.8	296
27.8	27.8	90
27.8	27.8	59
27.8	27.8	106
27.8	27.9	187
27.9	27.9	152
27.9	27.9	65
27.9	27.9	90
27.9	28.0	366
28.0	28.1	642
28.1	28.2	191
28.2	28.3	554
28.3	28.5	1,216
28.5	28.6	182
28.6	28.6	85
28.6	28.7	147
28.7	28.7	164
28.7	28.7	240
28.7	28.8	628
28.8	28.9	336

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
28.9	28.9	139
28.9	29.0	403
29.0	29.1	367
29.1	29.1	36
29.1	29.1	254
29.1	29.3	644
29.3	29.3	93
29.3	29.4	477
29.4	29.4	114
29.4	29.4	152
29.4	29.4	88
29.4	29.5	288
29.5	29.5	96
29.5	29.5	61
29.5	29.7	779
29.7	29.7	206
29.7	29.7	132
29.7	29.8	391
29.8	29.8	219
29.8	29.9	370
29.9	29.9	120
29.9	30.0	143
30.0	30.1	474
30.1	30.1	92
30.1	30.2	429
30.2	30.2	133
30.2	30.4	978
30.4	30.4	221
30.5	30.5	411
30.7	30.7	137
30.7	30.8	584
30.8	31.0	728
31.0	31.0	330
31.0	31.1	229
31.1	31.1	296
31.1	31.2	181
31.2	31.2	232
31.2	31.3	209
31.3	31.3	456
31.3	31.4	153
31.4	31.4	179
31.4	31.5	160
31.5	31.5	177
31.5	31.5	307
31.5	31.6	145

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
31.6	31.6	187
31.6	31.7	209
31.7	31.7	185
31.7	31.7	102
31.7	31.8	170
31.8	31.8	172
31.8	31.9	170
31.9	31.9	474
31.9	32.0	534
32.0	32.1	475
32.1	32.2	377
32.2	32.3	136
32.3	32.3	167
32.3	32.4	200
32.4	32.4	239
32.4	32.5	721
32.5	32.6	364
32.6	32.7	369
32.7	32.8	620
32.8	32.9	558
32.9	32.9	122
32.9	33.0	99
33.0	33.1	790
33.1	33.1	71
33.1	33.2	173
33.2	33.2	137
33.2	33.2	83
33.2	33.2	134
33.2	33.3	140
33.3	33.3	350
33.3	33.4	167
33.4	33.4	115
33.5	33.6	437
33.6	33.6	74
33.6	33.6	205
33.6	33.7	395
33.7	33.7	144
33.7	33.7	87
33.7	34.1	2,099
34.1	34.2	213
34.2	34.2	291
34.2	34.2	17
34.3	34.3	224
34.3	34.4	253
34.4	34.4	95

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
34.4	34.4	50
34.4	34.4	96
34.4	34.5	351
34.5	34.5	129
34.5	34.6	204
34.6	34.6	169
34.6	34.7	153
34.7	34.7	260
34.7	34.7	139
34.8	34.8	127
34.8	34.9	349
34.9	34.9	50
34.9	34.9	251
34.9	34.9	91
34.9	35.0	81
35.0	35.0	112
35.0	35.1	457
35.1	35.1	111
35.1	35.2	115
35.2	35.2	305
35.3	35.3	111
35.3	35.3	172
35.3	35.4	250
35.4	35.4	224
35.4	35.5	538
35.5	35.6	467
35.6	35.7	300
35.7	35.7	256
35.7	35.8	138
35.8	35.8	395
35.8	35.9	380
35.9	36.0	670
36.0	36.0	80
36.0	36.1	91
36.1	36.1	147
36.1	36.1	146
36.1	36.2	341
36.2	36.2	115
36.2	36.3	271
36.3	36.4	620
36.4	36.4	101
36.4	36.4	94
36.4	36.4	76
36.5	36.5	133
36.5	36.6	190

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
36.6	36.6	163
36.6	36.6	274
36.6	36.7	165
36.7	36.7	180
36.7	36.7	193
36.7	36.8	54
36.8	36.9	654
36.9	36.9	105
36.9	37.0	330
37.0	37.0	188
37.0	37.1	391
37.1	37.1	217
37.1	37.2	295
37.2	37.3	387
37.3	37.3	228
37.3	37.3	128
37.3	37.5	951
37.5	37.6	189
37.6	37.6	224
37.6	37.6	264
37.6	37.8	589
37.8	37.8	143
37.8	37.8	294
37.8	37.9	366
37.9	38.0	381
38.0	38.0	112
38.0	38.0	172
38.0	38.1	313
38.1	38.1	149
38.1	38.2	175
38.2	38.2	179
38.2	38.2	90
38.2	38.3	224
38.3	38.3	207
38.3	38.4	349
38.4	38.4	234
38.4	38.4	238
38.4	38.5	327
38.5	38.6	487
38.6	38.6	239
38.6	38.7	232
38.7	38.7	111
38.7	38.7	112
38.7	38.8	233
38.8	38.8	262

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
38.8	38.9	364
38.9	38.9	213
38.9	39.0	399
39.0	39.1	274
39.1	39.2	494
39.2	39.2	127
39.2	39.2	3
39.2	39.2	276
39.2	39.3	247
39.3	39.3	44
39.3	39.3	107
39.3	39.3	81
39.3	39.3	122
39.3	39.4	123
39.4	39.5	492
39.5	39.6	281
39.6	39.6	142
39.6	39.6	197
39.6	39.7	242
39.7	39.7	203
39.7	39.7	86
39.7	39.8	437
39.8	39.8	194
39.8	39.9	127
39.9	39.9	121
39.9	39.9	301
39.9	40.0	102
40.0	40.1	972
40.1	40.3	586
40.3	40.4	709
40.4	40.5	434
40.5	40.6	215
40.6	40.6	177
40.6	40.6	3
40.6	40.6	59
40.6	40.6	200
40.6	40.7	146
40.7	40.7	205
40.7	40.8	226
40.8	40.9	374
40.9	40.9	356
40.9	41.1	696
41.1	41.1	146
41.1	41.1	76
41.1	41.1	74

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
41.1	41.2	246
41.2	41.2	369
41.2	41.4	784
41.4	41.4	124
41.4	41.5	263
41.5	41.5	154
41.5	41.6	322
41.6	41.6	115
41.6	41.7	234
41.7	41.7	173
41.7	41.7	71
41.7	41.7	241
41.7	41.8	75
41.8	41.8	74
41.8	41.9	502
41.9	41.9	112
41.9	41.9	241
41.9	42.0	310
42.0	42.0	64
42.0	42.0	163
42.0	42.1	294
42.1	42.2	373
42.2	42.3	492
42.3	42.3	319
42.3	42.5	1,077
42.5	42.5	48
42.5	42.6	49
42.6	42.6	515
42.6	42.7	172
42.7	42.7	138
42.7	42.7	205
42.7	42.8	40
42.8	42.8	122
42.8	42.8	50
42.8	42.9	496
42.9	42.9	202
42.9	42.9	150
42.9	43.0	182
43.0	43.0	177
43.0	43.0	101
43.0	43.1	391
43.1	43.2	620
43.2	43.2	24
43.2	43.3	138
43.3	43.3	484

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
43.3	43.4	492
43.4	43.4	11
43.4	43.5	126
43.5	43.5	53
43.5	43.5	131
43.5	43.5	168
43.5	43.6	224
43.6	43.6	63
43.6	43.6	268
43.6	43.7	481
43.7	43.8	444
43.8	43.8	110
43.8	43.9	259
43.9	43.9	120
43.9	43.9	218
43.9	44.0	214
44.0	44.0	55
44.0	44.0	118
44.0	44.1	104
44.1	44.1	200
44.1	44.2	753
44.2	44.3	345
44.3	44.4	406
44.4	44.4	151
44.4	44.5	167
44.5	44.5	76
44.5	44.5	153
44.5	44.5	161
44.5	44.5	84
44.5	44.6	552
44.6	44.7	85
44.7	44.7	349
44.7	44.8	127
44.8	44.9	670
44.9	44.9	99
44.9	44.9	245
44.9	45.0	454
45.0	45.1	278
45.1	45.1	186
45.2	45.2	202
45.2	45.3	279
45.3	45.4	655
45.4	45.4	54
45.4	45.4	214
45.4	45.5	213

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
45.5	45.5	4
45.5	45.5	98
45.5	45.6	635
45.6	45.7	206
45.7	45.8	918
45.8	45.9	161
45.9	45.9	282
45.9	45.9	137
45.9	45.9	50
45.9	46.0	75
46.0	46.0	169
46.0	46.0	154
46.0	46.1	455
46.1	46.2	300
46.2	46.2	124
46.2	46.3	376
46.3	46.3	103
46.3	46.3	163
46.3	46.4	248
46.4	46.4	191
46.4	46.5	464
46.5	46.8	1,496
46.8	46.8	314
46.8	46.9	461
46.9	47.0	438
47.0	47.1	397
47.1	47.1	184
47.1	47.2	386
47.2	47.2	167
47.2	47.3	289
47.3	47.3	141
47.3	47.3	164
47.3	47.4	145
47.4	47.4	94
47.4	47.4	347
47.4	47.5	103
47.5	47.5	209
47.5	47.5	294
47.5	47.6	148
47.6	47.7	538
47.7	47.8	687
47.8	47.8	212
47.8	48.0	709
48.0	48.0	161
48.0	48.1	574

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
48.1	48.2	242
48.2	48.2	374
48.2	48.3	168
48.3	48.3	349
48.3	48.4	127
48.4	48.5	301
48.5	48.5	90
48.5	48.6	796
48.6	48.7	354
48.7	48.8	446
48.9	48.9	213
49.0	49.1	231
49.1	49.1	41
49.1	49.1	356
49.1	49.2	247
49.3	49.3	175
49.3	49.4	229
49.5	49.5	172
49.6	49.6	206
49.6	49.7	147
49.7	49.7	106
49.7	49.7	78
49.7	49.8	697
49.8	49.9	162
49.9	49.9	379
50.1	50.1	162
50.1	50.1	138
50.1	50.2	166
50.2	50.2	15
50.2	50.2	359
50.2	50.3	182
50.3	50.3	66
50.3	50.3	156
50.4	50.5	216
50.5	50.5	114
50.5	50.5	72
50.5	**50.6**	**547**
50.6	50.7 (RR-6)	90
50.7 (RR-6)	50.7 (RR-6)	165
50.7 (RR-6)	50.8 (RR-6)	148
50.8 (RR-6)	50.9 (RR-6)	143
51.5	51.6	402
51.6	51.6	275
51.6	51.6	156
51.6	51.6	23

APPENDIX G Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]		
Approximate Start (MP)	**Approximate End (MP)**	**Length Crossed by Centerline (feet)**
51.6	51.7	105
51.8	51.8	66
51.8	51.9	141
51.9	52.0	858
52.0	52.1	307
52.1	52.1	220
52.1	52.2	337
52.2	52.2	27
52.2	52.3	379
52.5	52.5	196
52.5	52.5	121
52.6	52.6	96
52.6	52.8	989
52.9	52.9	116
52.9	53.0	485
53.0	53.1	125
53.1	53.1	338
53.1	53.1	34
53.1	53.1	55
53.1	53.1	10
Approximate Percent of Pipeline Crossing Length		*15%*
Noble County, OH		
53.1	53.2	119
53.2	53.2	84
53.2	53.2	106
53.2	53.3	452
53.4	53.4	196
53.4	53.4	6
53.4	53.5	192
53.5	53.5	164
53.5	53.5	200
53.6	53.8	1,344
53.8	53.8	120
53.8	53.9	397
53.9	54.0	574
54.0	54.2	729
54.2	**54.4**	**1,352**
54.4	54.5 (RR-7)	474
54.5 (RR-7)	55.1 (RR-7)	2,998
55.1 (RR-7)	55.1 (RR-7)	171
55.1 (RR-7)	55.2 (RR-7)	616
55.2 (RR-7)	55.2 (RR-7)	136
55.5 (RR-7)	55.6 (RR-7)	309
55.6 (RR-7)	55.6 (RR-7)	264
55.6 (RR-7)	55.6 (RR-7)	246

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
55.6 (RR-7)	55.7 (RR-7)	293
55.7 (RR-7)	55.8 (RR-7)	688
55.9 (RR-7)	56.0 (RR-7)	561
56.0 (RR-7)	55.9	308
55.9	55.9	390
57.1	57.3	716
57.4	57.4	229
57.4	57.5	384
57.6	57.7	318
58.0	58.0	241
58.0	58.0	95
58.2	58.3	524
58.3	58.3	291
58.3	58.4	689
58.4	58.5	232
58.5	58.7	1,316
58.9	59.1	893
59.2	59.4	701
59.4	59.5	553
60.7	60.9	949
62.0	62.2	978
63.5	63.6	219
63.6	63.7	635
64.6	64.6	141
64.8	64.9	563
65.0	65.0	16
65.0	65.0	196
65.0	65.0	118
65.0	65.1	201
65.1	65.1	222
65.1	65.2	581
65.2	65.3	135
65.3	65.3	76
65.3	65.3	244
65.3	65.4	301
65.5	65.6	331
65.7	65.7	451
65.8	65.8	255
66.1	66.2	158
66.2	66.3	811
66.3	66.5	1,090
66.5	66.6	274
66.6	66.6	303
66.6	66.6	56
66.6	66.8	842

APPENDIX G Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]		
Approximate Start (MP)	**Approximate End (MP)**	**Length Crossed by Centerline (feet)**
66.8	66.8	241
67.1	67.1	115
67.1	67.2	586
67.4	67.5	454
67.5	67.6	508
67.6	67.7	299
67.7	67.7	203
68.0	68.1	797
68.2	68.2	134
68.3	68.4	272
68.6	68.6	199
68.7	68.7	358
69.2	69.3	522
69.4	69.4	159
69.4	69.5	361
70.4	70.6	797
70.6	70.6	125
70.7	70.7	72
71.0	71.4	1,923
71.4	71.5	149
71.7	71.9	944
72.0	72.1	779
72.2	72.5	1,722
72.6	72.9	1,329
73.3	73.3	206
73.6	73.7	609
73.8	73.9	347
74.0	74.3	1,585
74.3	74.4	331
74.4	74.5	756
74.5	74.6	452
74.6	75.0	2,171
75.0	75.0	240
75.3	75.4	426
75.4	75.6	861
76.0	76.2	934
Approximate Percent of Pipeline Crossing Length		*6%*
Muskingum County, OH		
76.2	76.2	54
76.2	76.3	485
76.3	76.4	76
76.4	76.5	517
76.5	76.5	476
76.5	76.6	205
76.6	76.7	447

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
76.7	76.7	432
76.7	76.8	177
76.8	77.1	1,454
77.1	77.3	1,057
77.4	77.5	782
77.6	77.8	1,203
77.8	78.0	671
78.0	78.1	344
78.1	78.2	398
78.2	78.2	83
78.2	78.2	136
78.2	78.3	448
78.3	78.4	315
78.4	78.4	161
78.4	78.5	351
78.5	78.8	1,679
78.8	79.0	903
79.0	79.0	259
79.0	79.1	632
79.1	79.2	414
81.6	81.6	122
81.6	81.6	149
81.9	81.9	88
82.2	82.2	272
83.0	83.1	130
83.1	83.2	570
83.2	83.2	231
84.0	84.0	207
Approximate Percent of Pipeline Crossing Length		*2%*
Morgan County, OH		
85.0	85.1	710
85.1	85.2	289
85.2	85.3	429
85.3	85.5	1270
85.5	85.7	778
86.3	86.4	325
86.4	86.5	284
86.6	86.6	34
86.9	86.9	180
86.9	86.9	81
87.1	87.1	147
87.2	87.3	266
87.3	87.4	330
87.5	87.5	185
87.6	87.7	220

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
87.9	87.9	93
88.0	88.0	161
88.2	88.2	172
88.4	88.5	207
88.9	89.0	434
89.0	89.0	168
89.2	89.3	557
90.1	90.1	374
90.1	90.3	1,072
90.3	90.4	521
90.4	90.7	1,153
90.8	91.0	1,046
91.1	91.1	223
91.1	91.2	398
91.3	91.3	305
91.5	91.6	472
91.7	91.8	202
91.8	91.9	179
92.0	92.1	308
92.2	92.2	152
92.4	92.4	129
92.7	92.7	246
92.7	92.7	79
92.7	92.9	996
92.9	92.9	104
93.0	93.1	476
93.1	93.2	400
93.2	93.2	161
93.2	93.2	92
93.2	93.3	702
93.5	93.5	156
93.6	93.7	219
93.7	93.8	847
93.9	94.0	617
94.1	94.1	159
94.2	94.2	172
94.6	94.6	172
94.6	94.8	781
94.8	94.9	240
94.9	95.0	771
95.2	95.2	329
95.4	95.5	303
95.5	95.6	513
95.8	95.8	437
95.9	95.9	148

APPENDIX G Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]		
Approximate Start (MP)	**Approximate End (MP)**	**Length Crossed by Centerline (feet)**
96.0	96.0	313
96.2	96.2	155
96.3	96.3	290
96.6	96.6	150
96.6	96.8	970
96.8	96.8	202
96.9	97.0	457
97.0	97.1	328
97.1	97.1	241
97.1	97.3	754
97.4	97.4	91
Approximate Percent of Pipeline Crossing Length		*3%*
Perry County, OH		
97.5	97.5	139
97.6	97.6	47
97.7	97.7	126
97.7	97.8	670
97.8	97.9	136
97.9	97.9	88
97.9	98.0	573
98.0	98.1	362
98.1	98.1	107
98.1	98.1	170
98.1	98.2	555
98.2	98.3	128
98.3	98.3	144
98.4	98.4	146
98.4	98.4	360
99.4	99.5	772
99.6	99.7	219
99.7	99.7	241
100.1	100.2	306
100.4	100.5	135
100.5	100.5	212
100.5	100.6	313
100.6	100.6	174
100.6	100.7	345
100.8	100.8	159
101.3	101.4	140
101.5	101.7	928
101.8	102.0	541
102.0	102.2	865
102.2	102.3	75
102.4	102.5	42
102.5	102.7	463

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
103.0	103.1	199
103.3	103.5	760
103.5	103.5	147
103.5	103.5	38
103.5	103.6	376
103.6	103.6	176
103.8	103.9	96
104.3	104.4	230
104.5	104.5	166
104.5	104.7	883
104.7	104.7	97
105.0	105.2	464
105.1	105.2	32
105.1	105.2	181
105.2	105.3	622
105.3	105.4	229
105.3	105.4	203
105.4	105.5	241
105.4	105.5	225
105.5	105.5	111
105.5	105.6	257
105.5	105.7	397
105.6	105.7	365
105.7	105.8	283
105.7	105.8	262
105.8	105.9	182
105.8	105.9	426
105.9	106.0	183
105.9	106.0	263
106.0	106.1	208
106.0	106.1	238
106.1	106.2	622
106.2	106.3	445
106.3	106.5	1,131
106.5	106.6	317
106.7	106.7	120
106.7	106.8	182
106.7	106.8	161
106.7	106.9	293
106.8	106.9	498
106.9	107.0	80
106.9	107.1	642
107.0	107.1	206
107.1	107.2	155
107.1	107.3	634

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
107.2	107.3	57
107.2	107.3	90
107.3	107.4	327
107.3	107.4	200
107.7	108.1	1,714
108.1	108.2	421
108.2	108.3	37
108.2	108.3	160
108.2	108.3	283
108.3	108.3	63
108.3	108.5	891
108.5	108.5	88
108.5	108.6	244
108.5	108.6	79
108.6	108.6	83
108.6	108.6	67
108.6	108.7	501
108.7	108.9	646
109.0	109.1	199
109.1	109.1	71
109.1	109.2	119
109.1	109.2	78
109.1	109.2	339
109.2	109.3	347
109.3	109.4	339
109.3	109.4	285
110.1	110.3	774
110.2	110.4	586
110.5	110.6	464
110.6	110.6	128
110.7	110.8	163
110.8	110.9	390
110.8	110.9	304
112.1	112.3	504
112.3	112.4	394
112.3	112.5	506
112.4	112.7	1,303
113.1	113.2	605
113.6	114.1	2,266
114.0	114.3	977
114.3	114.4	485
114.4	114.5	394
114.5	114.6	436
114.6	114.7	247
114.6	115.2	2,690

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
115.1	115.2	160
115.1	115.3	779
115.3	115.4	286
115.3	115.4	184
116.0	116.3	1,418
116.2	116.4	624
116.4	116.5	360
116.6	117.0	1,862
117.1	117.4	1,283
117.5	117.7	457
117.7	117.9	814
117.8	117.9	202
117.9	118.0	171
Approximate Percent of Pipeline Crossing Length		*6%*
Fairfield County, OH		
118.2	118.3	131
118.3	118.6	1,297
118.7	118.8	218
119.1	119.4	1,212
119.3	119.6	1,158
119.7	119.8	231
119.8	119.9	48
Approximate Percent of Pipeline Crossing Length		*0.5%*
Hocking County, OH		
119.8	119.9	151
120.2	120.3	502
120.3	120.7	1,787
120.6	120.7	6
120.6	120.7	45
120.6	120.9	990
120.8	121.1	1,002
121.0	121.3	1,212
121.3	121.4	75
121.3	121.4	276
121.4	121.5	303
121.5	121.6	470
121.8	122.0	352
122.0	122.1	137
123.7	123.9	710
123.8	123.9	183
123.9	124.0	601
124.1	124.2	358
124.2	124.3	337
124.2	124.4	705

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
124.5	124.7	803
124.7	124.8	493
124.8	125.0	840
124.9	125.0	376
125.0	125.1	545
125.2	125.4	816
125.4	125.4	168
125.4	125.5	333
Approximate Percent of Pipeline Crossing Length		*2%*
Fairfield County, OH		
125.8	125.9	292
126.2	126.3	374
126.4	126.5	160
126.7	127.0	1,625
127.1	127.2	264
127.3	127.4	88
127.4	127.5	321
127.5	127.6	229
127.6	127.7	447
128.1	128.2	488
128.2	128.4	963
128.4	128.5	268
128.4	128.5	386
128.5	128.6	162
128.5	128.6	128
128.5	128.6	134
128.6	128.8	1,035
128.8	128.9	425
128.8	128.9	106
128.9	128.9	197
128.9	129.0	182
129.0	129.1	381
129.2	129.3	395
129.3	129.4	198
Approximate Percent of Pipeline Crossing Length		*1%*
Hocking County, OH		
129.3	129.5	406
129.4	129.6	542
129.5	129.6	478
129.6	129.7	91
129.6	129.7	311
129.7	129.8	240
129.7	129.8	201
129.8	129.9	275

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
129.9	130.0	580
130.0	130.1	98
130.0	130.1	97
130.0	130.1	324
130.1	130.2	166
130.1	130.2	203
130.2	130.3	510
130.3	130.3	47
130.3	130.4	278
130.3	130.4	219
130.4	130.4	168
130.4	130.5	117
130.4	130.5	126
130.4	130.6	339
Approximate Percent of Pipeline Crossing Length		*0.7%*
LEX1		
Fairfield County, OH		
0.0	0.0	207
0.0	0.1	339
0.2	0.3	345
0.5	0.6	361
0.6	0.7	369
Approximate Percent of Pipeline Crossing Length		*0.2%*
R-801 Loop		
Hocking County, OH		
0.2	0.3	170
0.3	0.3	157
0.3	0.6	1,450
0.6	0.6	301
0.6	0.8	863
0.8	0.9	411
0.9	1.0	497
1.7	1.8	346
1.8	2.0	1,190
2.0	2.1	662
2.4	2.6	1,003
2.6	2.7	377
2.7	2.8	594
2.8	2.8	76
2.8	2.8	126
2.8	2.9	107
2.9	3.0	580

APPENDIX G Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]		
Approximate Start (MP)	**Approximate End (MP)**	**Length Crossed by Centerline (feet)**
3.0	3.0	16
3.0	3.0	353
3.0	3.1	439
3.1	3.3	959
3.5	3.7	621
3.7	3.8	640
3.8	3.8	161
3.8	4.0	988
4.0	4.2	814
4.2	4.2	250
4.2	4.4	1,200
4.4	4.5	277
4.5	4.8	1,838
4.9	5.2	1,580
5.5	5.6	245
5.7	5.9	614
6.0	6.0	143
6.1	6.2	96
6.2	6.5	1,458
6.9	7.0	242
7.1	7.2	420
7.8	7.8	57
7.8	7.8	24
7.9	8.0	272
8.1	8.7	3,170
9.3	9.4	370
9.4	9.5	533
9.5	9.5	216
9.5	9.7	1,345
9.7	9.8	322
9.8	9.9	733
9.9	10.1	668
10.1	10.2	543
10.2	10.4	1,428
10.4	10.6	983
10.6	11.5	4,828
11.5	11.7	672
11.8	11.9	560
11.9	12.0	528
12.3	12.3	146
12.5	12.7	646
12.8	13.0	649
Approximate Percent of Pipeline Crossing Length		*5%*
Vinton County, OH		
13.4	13.4	265

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
Hocking County, OH		
13.4	13.5	147
Approximate Percent of Pipeline Crossing Length		*0.02%*
Vinton County, OH		
13.5	13.7	1,403
13.7	14.1	2,069
14.2	14.3	351
14.3	14.7	2,363
14.8	14.9	307
14.9	15.1	1,014
15.1	15.1	38
15.1	15.6	2,117
15.6	15.6	206
15.6	15.7	330
15.7	15.7	104
15.7	15.8	196
15.8	16.0	1,177
16.0	16.0	226
16.0	16.3	1,537
16.4	16.4	286
16.4	16.5	173
16.5	16.5	287
16.5	16.6	339
16.6	16.6	300
16.6	16.9	1,296
16.9	16.9	223
16.9	17.3	1,912
17.3	17.4	720
17.4	17.6	673
17.7	17.8	758
17.8	17.9	402
17.9	17.9	135
17.9	18.1	882
18.1	18.1	258
18.1	18.2	373
18.2	18.2	142
18.2	18.6	1,835
18.6	18.6	261
18.6	18.7	475
18.7	19.0	1,326
19.0	19.0	52
19.1	19.1	218
19.1	19.1	103
19.1	19.3	1,002
19.3	19.5	774

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
19.5	19.5	220
19.5	19.6	323
19.6	19.6	349
19.8	19.9	484
19.9	20.0	541
20.0	20.1	422
20.1	20.1	133
20.1	20.2	249
20.2	20.4	1,152
20.4	20.5	415
20.5	20.6	914
20.6	20.7	465
20.7	20.8	306
20.8	20.9	330
20.9	20.9	327
20.9	21.0	213
21.0	21.0	457
21.0	21.1	309
21.1	21.2	560
21.2	21.3	330
21.3	21.7	2,444
21.7	21.8	159
21.8	21.8	383
21.8	22.0	731
22.0	22.1	690
22.1	22.3	848
22.3	22.3	259
22.4	22.5	478
22.5	22.5	270
22.5	22.6	190
22.6	22.6	266
22.6	22.6	232
22.6	22.7	185
22.7	22.7	102
22.7	22.8	431
22.8	22.9	293
22.9	22.9	107
22.9	22.9	301
22.9	23.0	432
23.0	23.0	121
23.0	23.1	158
23.1	23.2	396
23.2	23.3	522
23.3	23.3	409
23.3	23.4	177

APPENDIX G
Areas of Shallow Depth to Bedrock Crossed by the Leach XPress Project[a]

Approximate Start (MP)	Approximate End (MP)	Length Crossed by Centerline (feet)
23.4	23.4	454
23.4	23.6	739
23.6	23.6	150
23.6	23.9	1,740
23.9	24.0	98
24.0	24.0	364
24.0	24.2	647
24.2	24.2	50
Approximate Percent of Pipeline Crossing Length		*6%*
BM-111 Loop		
Wayne County, WV		
0.7	0.8	115
0.8	0.8	181
0.8	1.1	1,115
1.1	1.3	1,086
1.3	1.3	415
1.3	1.4	503
1.4	1.5	87
1.5	1.5	144
1.5	1.6	427
1.6	1.7	480
1.7	1.8	426
1.8	2.1	1,413
2.1	2.1	190
2.1	2.2	553
2.3	2.3	294
2.3	2.4	200
Approximate Percent of Pipeline Crossing Length		*0.9%*

[a] Soils with shallow depth to bedrock are considered to be those with consolidated rock 60 inches or less from the surface, which represents areas that have potential to introduce rock to topsoil.