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September 13, 2016

VIA ELECTRONIC FILING

Barcy McNeal
Ohio Power Siting Board
Docketing Division
180 East Broad Street, 11th Floor
Columbus, OH 43215-3716

Re: Duke Energy Ohio C314V Central Corridor Pipeline Extension Project
Case No. 16-253-GA-BTX

Dear Ms. McNeal:

Attached please find a copy of the Application for a Certificate of Environmental Compatibility and Public Need (Application) for the C314V Central Corridor Pipeline Extension Project (Project) by Duke Energy Ohio, Inc. (Duke Energy Ohio). This filing is being made in accordance with O.A.C. 4906-5-01, *et seq*., and 4906-2-01, *et seq*.

This Application is being filed electronically in accordance with O.A.C. 4906-2-02 (A) and (D). Five printed copies and ten additional electronic copies (CDs) of this filing are also being submitted to the Staff of the Ohio Power Siting Board for their use. In addition, we are providing one copy, in electronic format, of the relevant base case system data, also on CD.

The following information and notarized statement is included per the requirements of O.A.C. 4906-2-04(A)(3):

(a) Applicant:
Duke Energy Ohio, Inc.
139 East Fourth Street
Cincinnati, Ohio 45202

(b) Name and Location of the Proposed Facility:
Duke Energy Ohio C314V Central Corridor Pipeline Extension Project
Hamilton County, Ohio

(c) Authorized Representatives:

Technical:
John A. Hill, Jr., P.E.
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(d) Changes made since the filing of the preapplication notification letter:

In the preapplication notification letter filed in this docket on March 8, 2016, Duke Energy Ohio stated that the natural gas pipeline it proposed to construct would be 30 inches in diameter and about 12 miles long. Through the process of meetings with elected representatives, community leaders, and members of the public, and through the review of over 2,900 comments, Duke Energy Ohio has determined that it will reduce the size of the proposed natural gas pipeline to 20 inches, which is consistent with the pipelines already in use in southwest Ohio and operated safely by Duke Energy Ohio for decades. Concomitant with that size reduction, the operating pressure will be reduced to approximately 400 PSIG, from the originally planned 600 PSIG.

In addition, Duke Energy Ohio is filing, with this Application, a motion for waiver relating to the modifications in pipeline specifications made in response to public comments, although the Company believes that such a waiver is technically unnecessary under the provisions of the Ohio Administrative Code.

(e) Notarized statement:

The notarized statement of Charles R. Whitlock, confirming that the information contained in the Application is complete and correct to the best knowledge, information and belief of Duke Energy Ohio, is enclosed herewith.

Respectfully submitted,

/s/ Jeanne W. Kingery
Amy B. Spiller (0047277)
Deputy General Counsel
Jeanne W. Kingery (0012172) (Counsel of Record) Associate General Counsel
Duke Energy Business Services LLC
155 East Broad St, 20th Floor
Columbus, OH 43215
(614) 222-1334(telephone)
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Amy.Spiller@duke-energy.com
Jeanne.Kingery@duke-energy.com

cc: Robert Holderbaum, Ohio Power Siting Board Staff

STATE OF OHIO)
) SS:
COUNTY OF HAMILTON)

I, Charles R. Whitlock, Senior Vice President, Midwest Distribution and Gas Operations, Duke Energy Ohio, Inc. and Duke Energy Kentucky, Inc., being first duly sworn, hereby verify that the information contained in the attached certificate application is complete and accurate to the best of my knowledge, information and belief.

Charles R. Whitlock

Sworn to and subscribed before me this 9th day of September, 2016.

Notary Public

My commission expires: 11-19-2020

NOTARIAL SEAL STATE OF OHIO

Julie M. Thompson
Notary Public, State of Ohio
My Commission Expires 11-19-2020

Application for Certificate of Environmental Compatibility and Public Need

C314V Central Corridor Pipeline Extension Project

OPSB Case No. 16-0253-GA-BTX

Prepared for

DUKE ENERGY®

Submitted to

Ohio Power Siting Board

September 2016

ch2m

BEFORE THE OHIO POWER SITING BOARD

Certificate Application for Gas Pipeline Facilities

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Acronyms and Abbreviations

ALU	aquatic life use
AMSL	Above Mean Sea Level
API	American Petroleum Institute
AREMA	American Railroad Engineering and Maintenance Association
BMP	Best Management Practice
CAGIS	Cincinnati Area Geographic Information System
Certificate	Certificate of Environmental Compatibility and Public Need
CFR	Code of Federal Regulations
CGT	Columbia Gulf Transmission
CH2M	CH2M HILL, Inc.
cm	centimeter
CWA	Construction Work Area
DOE	Determination of Eligibility
DOW	Department of Wildlife
Duke Energy Ohio	Duke Energy Ohio, Inc.
FAQ	Frequently Asked Question
GIS	Geographic Information System
HDD	horizontal directional drilling
HHEI	Headwater Habitat Evaluation Index
I-	Interstate
ID	identification
LDC	Local Distribution Company
MAOP	maximum allowable operating pressure
MCFH	thousand cubic feet per hour
MSDS	Material Safety Data Sheet
N/A	not applicable
NHL	National Historic Landmarks
NGV	Natural Gas Vehicle
NOPE	Neighbors Opposing Pipeline Extension
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
O.A.C.	Ohio Administrative Code
OAI	Ohio Archaeological Inventory
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
OH-	Ohio Route
OHI	Ohio Historic Inventory
OHPO	Ohio State Historic Preservation Office
OPSB	Ohio Power Siting Board
ORAM	Ohio Rapid Assessment Method
OSHA	Occupational Safety and Health Administration
PEM	Palustrine Emergent Wetland
PFO	Palustrine Forested Wetland
PHMSA	Pipeline and Hazardous Materials Safety Administration

PHWH	Primary Headwater Habitat
Project	C314V Central Corridor Pipeline Extension Project
PSIG	pounds per square inch gauge
PSS	Palustrine Scrub-shrub Wetland
PUCO	Public Utility Company
QHEI	Qualitative Habitat Evaluation Index
ROW	right-of-way
RSS	Route Selection Study
SR	State Route
SWPPP	Storm Water Pollution Prevention Plan
T&E	Threatened and Endangered
TNW	Traditionally Navigable Waterway
UNT	unnamed tributary
US-	U.S. Route
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

4906-5-02 PROJECT SUMMARY AND APPLICANT INFORMATION

Duke Energy Ohio, Inc., (Duke Energy Ohio) operates an integrated natural gas system in southwest Ohio that includes infrastructure installed at varying points in time over the past several decades. It has safely maintained this system while meeting the ever-changing needs of its customers and adhering to increased regulatory oversight.

Duke Energy Ohio is proposing to further improve its integrated system through the C314V Central Corridor Pipeline Extension Project (Project). This Project, which is a continuation of the C314 pipeline constructed in 2003, is integral to the Company's long-term plan to retire propane-air plants and balance system supply from north to south. To more readily achieve this second objective, Duke Energy Ohio originally intended to propose a 30-inch pipeline engineered to an operating pressure of 600 PSIG. Through the process of meetings with elected representatives, community leaders, and members of the public, and through the review of over 2,900 comments, Duke Energy Ohio has determined that it will reduce the size and scope of the project to a pipeline that is consistent with the pipelines already in use in southwest Ohio and that have been operated safely by Duke Energy Ohio for decades. As a result of these reductions in the design specifications, Duke Energy Ohio anticipates achieving its long-term plan through a combination of the Project and other infrastructure modernization efforts implemented over many years to come.

This Application is the result of Duke Energy Ohio's coordination of its plans with the needs and concerns of our communities.

(A) PROJECT SUMMARY

Duke Energy Ohio is proposing to construct the Project as part of its long-term planning process to retire propane-air plants, balance system supply from north to south, and support the replacement of aging infrastructure. The proposed Project will consist of installing approximately 13 miles of new, 20-inch diameter natural gas pipeline from the southern terminus of Line C314, an existing high pressure 24-inch natural gas pipeline at a point near the intersection of Hamilton, Warren and Butler Counties (known as WW Feed Station), to a location along Line V, an existing

20-inch natural gas pipeline in the Fairfax or Norwood area (Figure 2-1 and 2-2) depending upon whether the Preferred or Alternate Route is selected, respectively.

(1) General Purpose of the Facility

The Project is intended to allow for the retirement of the propane-air facilities that are based on old technology that is expensive to maintain and impractical to repair in a permanent fashion. It will also contribute to the improvement of the north/south balance of gas in the central Hamilton County area and will support the replacement of aging infrastructure.

The original gas distribution system in Hamilton County developed from manufactured gas sites located along the Ohio River south of the city. In the 1940s, additional interstate natural gas pipeline supplies became available north of the city extending to the Lebanon Hub, a facility where several of the interstate pipelines convene. Twenty-one various gate stations were constructed to serve the area from natural gas transmission lines owned and operated by Texas Gas Transmission, Texas Eastern Transmission and ANR Pipeline, which are located to the north of the city of Cincinnati. Since Duke Energy Ohio's system was built to distribute gas from the south to the north, 50 to 60 percent of the peak design day load must be supplied through Foster Station in Kentucky.

Propane-air plants in Erlanger, Kentucky, and Cincinnati, Ohio, and the associated storage caverns, were built in the early 1960s to provide an additional peaking supply (approximately 10 percent). These propane-air plants and propane storage caverns, used to serve customers on an annual basis, are reaching the end of their useful life. The loss of supply from either Foster Station or the propane-air plants on a high demand day would result in widespread service outages, as some customers can not currently be served from feeds from the north. The cost to maintain this outdated technology and impracticability of permanent repairs lead to the conclusion that the propane-air plants should be removed from the system. Furthermore, with these plants in operation, there is the potential for a propane-air mixture to reach approximately half of the distribution system in the central Hamilton County area. This has had the effect of inhibiting growth, as certain customer operations are propane intolerant, including Natural Gas Vehicle (NGV) facilities.

Natural gas pipeline integrity testing requirements have progressively become more stringent over the years, increasing safety margins. While modern, thoroughly tested and inspected pipelines are desired, every Local Distribution Company (LDC) has natural gas pipelines of varying age. Duke Energy Ohio is actively inspecting, testing, and replacing older natural gas pipelines that were not designed to meet the current requirements. Furthermore, Duke Energy Ohio needs to inspect, test and upgrade portions of its "backbone" system that brings gas from both north and south into the central Hamilton County area. Key elements of this backbone include Line A, which runs north to south through central area neighborhoods in Hamilton County, Line V that runs east to west (Figures 2-1 and 2-2) and the various Line AM natural gas pipelines (Figure 3-1 and 3-2) that convey gas from the Foster Station to points in both Kentucky and Ohio. Line A varies in diameter (18-24 inches) and carries natural gas at a maximum pressure of 150 PSIG. Much of Line A was constructed in the 1950s and 1960s, so is also approaching the end of its useful life and will need to be upgraded. Lateral natural gas pipelines that branch from Line A provide natural gas supply to the residential and industrial customer base in the central area. Duke Energy Ohio must begin to replace aging infrastructure that has the potential to place these customers at risk of outage.

Construction of the proposed Project will allow Duke Energy Ohio to conduct the required inspections and will support replacement of Line A while continuing to supply natural gas to residential and industrial customers in the area. More broadly, pressure verification efforts have led to the need to complete integrity-related work on many of Duke Energy Ohio's older lines, including critical infrastructure (AM lines) from Foster Station extending north to Ohio River crossings at Cincinnati. Improved system redundancies provided by the proposed Project will allow Duke Energy Ohio to replace aging infrastructure while maintaining service.

The Project will also address the current vulnerability of the system to "firm" curtailment and/or shut-in (in other words, a reduction of gas deliveries due to a shortage of supply or because demand for natural gas service exceeds a natural gas pipeline's capacity), due to the excessive reliance on gas supplies that enter Duke Energy Ohio's system through a single gate station from the south (Foster Station). The proposed C314V line will convey additional flow from the Mason Station from the north, thereby reducing the required amount of flow from the Foster Station on a peak demand day.

(2) General Location, Size, and Operating Characteristics

Depending upon the final route selected, the Project will result in the installation of approximately 13 miles of new 20-inch natural gas pipeline from Duke Energy Ohio's WW Feed Station, near the intersection of Hamilton, Warren and Butler Counties, to the existing Line V that traverses between the Norwood and Fairfax areas. The Project is located entirely within Hamilton County. The initial study area for the Project route alternatives encompassed approximately 90 square miles of the central and eastern Hamilton County area. The area can be very roughly defined by Interstate 275 (I-275) to the north (although the northern tie-in is 1 mile north of I-275), the Mill Creek Valley to the west, the Little Miami River to the east, and the Duck Creek Valley (now occupied by the Norwood Lateral) to the south.

The 20-inch natural gas pipeline is planned to operate at approximately 400 PSIG. A new Highpoint Regulation Station, adjacent to the existing WW Feed Station, complete with odorization facilities and a pig launcher (pigs are devices that are inserted into natural gas pipelines to clean, inspect or maintain them without taking them out of service) would be constructed. This station will be constructed at the north end of the line to reduce pressures from the typical interstate transmission maximum allowable operating pressure of approximately 670 PSIG to an operating pressure of approximately 400 PSIG. The future Fairfax Station would further reduce the pressure at the south end of the line at the connection to the existing Line V.

(3) Suitability of Preferred and Alternate Routes

Projects of this nature and scope in Ohio require a Certificate of Environmental Compatibility and Public Need (Certificate) from the Ohio Power Siting Board (OPSB). As part of the Application process for a Certificate, a route selection study must be performed and a final report submitted to the OPSB. Among other requirements, the Application rules require the developer to evaluate "all practicable alternatives" within the applicant's defined study area and ultimately select a Preferred and Alternate Route for the OPSB's review.

Once Duke Energy Ohio had settled on the need to connect the WW Feed Station to Line V (described further in Section 4906-5-03 of this Application), a Route Selection Study (RSS) was conducted to identify and evaluate potential routes for the Project. The goal of the RSS was to identify practicable and reasonable routes, while avoiding or minimizing effects on sensitive land uses, ecological, and cultural features in the Project vicinity. Potential routes were evaluated, compared, and ranked to aid in the selection of a Preferred and an Alternate Route. The RSS is discussed in detail in Section 4906-5-04 and the RSS report is provided as Appendix 4-1 to this Application.

Because of the dense development within the Project study area, Duke Energy Ohio conducted a "constrained" RSS (that is, the RSS was "constrained," or limited, by pre-existing buildings, other utilities, and other existing land-use restrictions) and collected and evaluated data for thousands of route alternatives, collecting, sorting and displaying the data in a geographic information systems (GIS) application. The alternatives ranged from routing along existing railroads, using public road right-of-way (ROW), paralleling interstate highways and using the few open areas adjacent to existing roads on private properties. The route selection process included consulting with an independent natural gas pipeline engineering contractor to identify and analyze engineering and constructability issues and opportunities that were then included in the overall comparative evaluation that formed the RSS. Through multiple, iterative route evaluation and constructability reviews and field observations, the number of route options was reduced to 28 primary route candidates.

Selection of Top Ranking Routes

Duke Energy Ohio used a numeric-based scoring process and ranking to help evaluate the 28 primary route candidates and focus on those that would present the most feasible, constructible routes having the lowest number of overall impacts on sensitive land uses (including proximity to residences, schools, daycare facilities, hospitals, and worship centers) and the environment. Based on the route scoring and a constructability review, Duke Energy Ohio selected three primary route corridors to present during three public informational meetings to solicit input from the public. The routes presented at the public meeting, and as identified in the RSS, were Routes 27, 26, and 28. Route 28 is a combination of several routes, generally following Interstate 71 (I-71,) that individually scored well. Route 28 was introduced later in the scoring process and ultimately scored among the top ranked routes. Route 27 was identified as the "Green Route," Route 26 as the "Pink Route" and Route 28 as the "Orange Route." A description of each is provided below and they are illustrated on Figures 3-1 (aerial map) and 3-2 (topographic map) in the RSS report in Appendix 4-1.

Green Route Alternative: The 13-mile Green Route is the most western of the three routes the siting team took to the first two public information meetings. The Route begins at WW Feed Station and heads west to Conrey Road and then south to cross under I-275 near the Blue Ash Sports Center then turns west to Reed Hartman Highway. The Route travels south along the east side of Reed Hartman Highway as far as Osborne Boulevard where it crosses to the west side of Reed Hartman Highway. The Route then continues south towards Summit Park (former Blue Ash Airport), where it turns west to follow the south side of Glendale-Milford Road. At Plainfield Road, the Route switches to the north side of Glendale-Milford Road, then again to the south before reaching a Norfolk Southern railroad in Evendale. The Route heads south paralleling the railroad and Reading Road (US-42) through the communities of Evendale, Reading, Roselawn, and Golf Manor to the Norwood Station on Line V.

Pink Route Alternative: The centrally located Pink Route (the shortest of the three options) presented at the first two public information meetings begins at the WW Feed Station and follows the same alignment as the Green Route as far as the Plainfield Road/Glendale-Milford Road intersection. From the intersection the Pink Route heads south along the east side of Plainfield Road, switching to the west side on Blue Ash Golf Course property until reaching Cooper Road. From there the route heads south, somewhat parallel to Line A for short distances, heading through or near residential areas, crossing Hunt Road before paralleling the south side of Ronald Reagan Highway for a short distance. The Route heads south through additional residential area before turning west parallel to East Galbraith Road then south to parallel Ridge Road. The final leg of the Route leaves Ridge Road to head west through Losantiville Country Club then south along its western boundary until the southern tie-in to Line V at Norwood Station.

Orange Route Alternative: The 13.4-mile Orange Route (the most eastern of the three options) presented at the first two public information meetings begins at WW Feed Station and heads southwest to School Road, then south along Conrey Road. The Route heads east along Kemper Road for a short distance before turning south along Deerfield Road as it passes under I-275. The Route then turns east through mixed commercial and wooded land to I-71, which it parallels as far south as Pfeiffer Road/Glendale-Milford Road. The Route follows Glendale-Milford Road to the west before turning south along Reed Hartman Highway, following it turning east along Malsbary Road. The Route then heads south first paralleling Kenwood Road then the I&O/SORTA Railroad (outside the ROW and with several deviations) until reaching East Galbraith Road. The

Route heads east following East Galbraith Road to the Kenwood Mall area where it turns south to parallel I-71. It generally follows I-71, with numerous small deviations until Red Bank Road, which it then generally follows to the southern tie-in to Line V in the Fairfax area.

Final Selection of Preferred and Alternate Routes for the Project

Duke Energy Ohio took three route options to the public open houses where many comments were received. In the meantime, Duke Energy Ohio also conducted further detailed constructability reviews and considered additional operating scenarios. Based upon continued review, evaluation and public input Duke Energy Ohio ultimately reduced the three potential route options down to two and selected the Orange Route as the Preferred Route and the Green Route as the Alternate Route.

Duke Energy Ohio has determined that the Orange Route is the best alternative because it meets the three purposes of the Project while being one of the most favorable scoring routes, using the scoring approach that considers current, sensitive land uses, as well as the environment and technical/engineering factors. Of the three routes, the Orange Route best allows for the retirement of the propane-air facilities, improves the north/south balance of gas in the central Hamilton County area, and advances the ability to perform integrity testing on the natural gas pipeline system. Futhermore, connecting Line C314V to the Line V in the Fairfax area (*i.e.*, at the Orange Route connection) provides the most favorable flow balance both east and west on Line V. The Orange option also provides more pressure and flow towards the California Station, providing the ability to more directly offset flows from the Foster Station through natural gas pipeline AM04. With additional gas capacity provided by the Orange Route to the central Hamilton County area, it relieves the dependency on other natural gas pipelines in the area, thereby providing the ability to test and replace aging infrastructure without loss of service.

The Green Route was selected as the Alternate Route as it would also allow for retirement of the propane-air facilities and would generally improve the north/south supply balance. However, because the Green Route would connect to Line V at Norwood Station, it offers less opportunity to directly offset gas flow from the south through the California Station, and would increase the system dependency on the Norwood Station, which limits the flexibility for natural gas pipeline testing and replacement.

Although the Pink Route adequately meets the purposes of the Project, it was ultimately eliminated from the alternatives review. Pink Route was narrowly identified as the most constructable of the three routes, but it also traverses the most densly developed sections of the Project area. If selected, this route would likely result in the greatest impact to residential properties, a concern expressed repeatedly at the public meetings. Further, the termination of the Pink Route is located near the Norwood Station and similar to the Green Route, would increase dependency on the station and reduce the overall flexibility of the system to conduct necessary integrity testing.

(4) Explanation of the Project Schedule

Refer to Section 4906-5-04 (F) of this application for the proposed project schedule of major activities and milestones.

(B) APPLICANT DESCRIPTION

Duke Energy Ohio, a subsidiary of Duke Energy Corporation, is a regulated public utility primarily engaged in the transmission and distribution of electricity in portions of Ohio, and in the transportation and sale of natural gas in portions of Ohio. Duke Energy Ohio's service area covers approximately 3,000 square miles and supplies electric service to approximately 705,000 residential, commercial and industrial customers and provides natural gas services to approximately 420,000 customers in Ohio.

Duke Energy Corporation is an energy company headquartered in Charlotte, N.C. Its Regulated Utilities business unit serves 7.4 million retail electric customers in six states in the Southeast and Midwest regions of the United States, representing a population of approximately 24 million people. Duke Energy Corporation is a Fortune 125 company, traded on the New York Stock Exchange under the symbol DUK. More information about the company is available at **duke-energy.com**.

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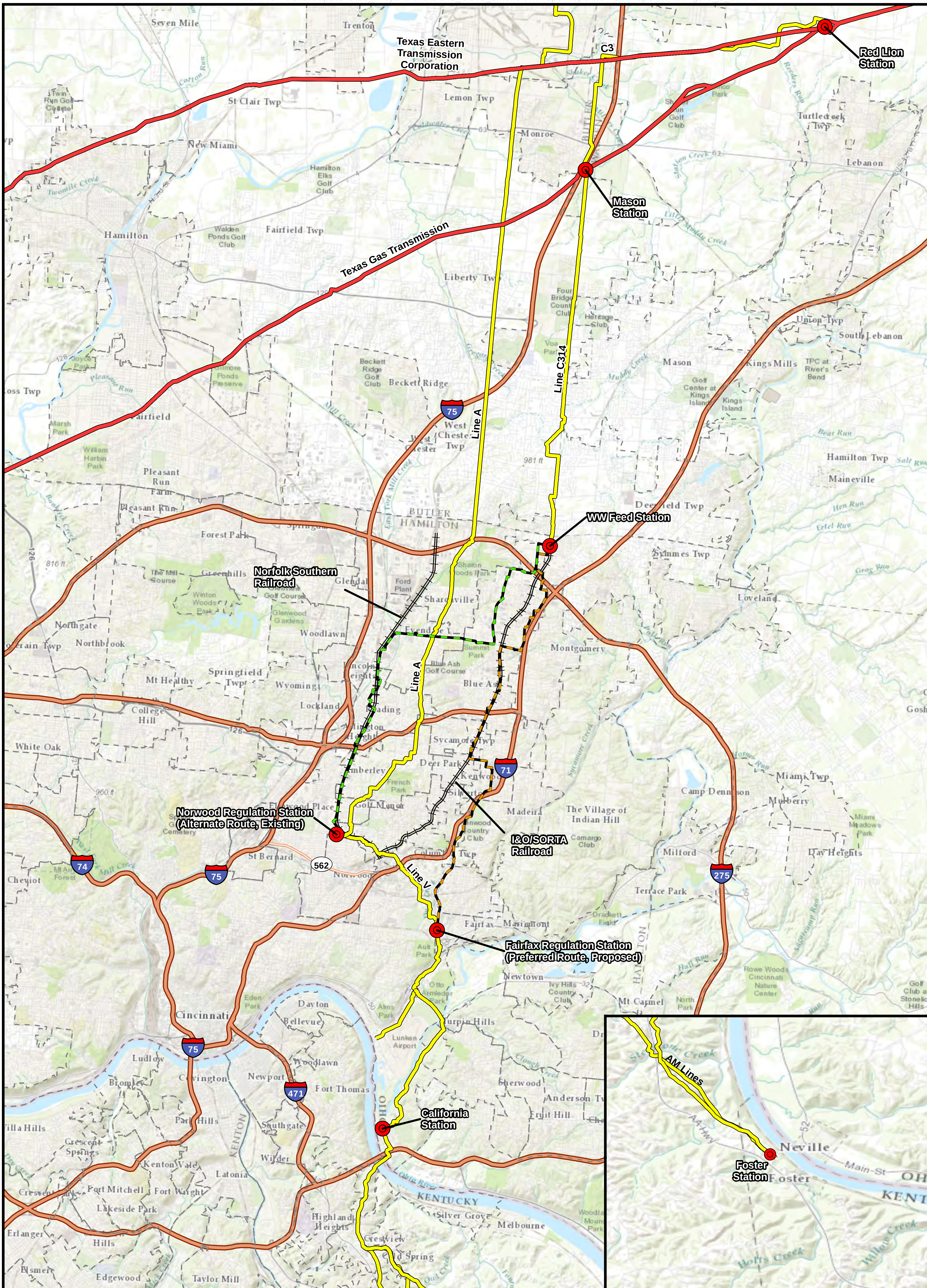

LEGEND:

- Station (Existing and Proposed)
- Preferred Route
- Alternate Route
- Existing Duke Pipelines
- Interstate Gas Transmission Lines
- Railroad
- Municipal Boundary

BASE MAP SOURCE:
USGS 7.5-minute Topographic Quadrangle
Cincinnati East 1982, Glendale 1982
Madeira 1983, Mason 1982

0 10,000 20,000
Scale in Feet

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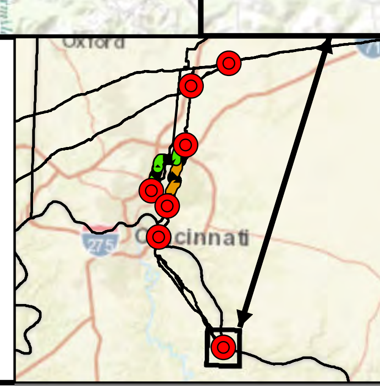

DUKE ENERGY.

C314V Central Corridor Pipeline Extension Project

FIGURE 2-1
PROJECT VICINITY MAP

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REVIEWED BY:

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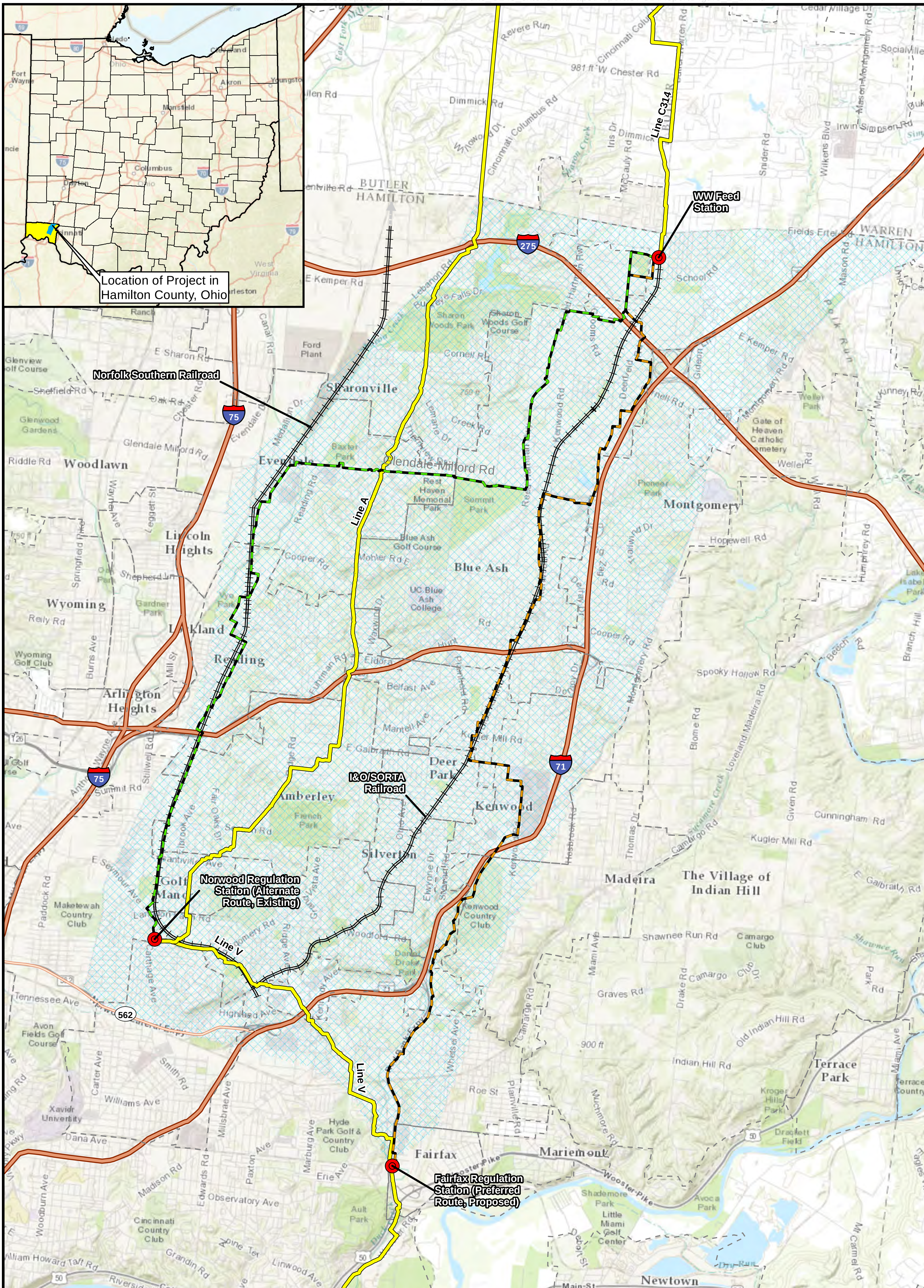

LEGEND:

- Station
- Preferred Route
- Alternate Route
- Central Corridor Pipeline Extension Study Area
- Existing Duke Pipelines
- Railroad
- Municipal Boundary

BASE MAP SOURCE:
ESRI World Topographic Map 2015

0 5,000 10,000
Scale in Feet

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DUKE ENERGY.

C314V Central Corridor Pipeline Extension Project

FIGURE 2-2
STUDY AREA OVERVIEW MAP

PN: 672247
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REVIEWED BY: JN

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4906-5-03 REVIEW OF NEED AND SCHEDULE

(A) NEED FOR PROPOSED FACILITY

(1) Purpose of the Proposed Facility

As introduced in Section 4906-5-02 of this Application, Duke Energy Ohio is proposing to construct the Project as part of its current, long-range plan to retire propane-air peaking plants, balance system supply from north to south, and support the inspection, replacement, and upgrading of aging infrastructure. The proposed Project will consist of installing approximately 13 miles of new, 20-inch diameter pipeline. The pipeline will begin at the southern terminus of Line C314, the WW Feed Station, and end in the Norwood or Fairfax areas at the existing Line V (Figures 2-1 and 2-2).

(2) System Conditions, Local Requirements, and Other Pertinent Factors

Duke Energy Ohio and its subsidiary, Duke Energy Kentucky, Inc., through an integrated system covering southwestern Ohio and northern Kentucky, supply up to 43,000 MCFH (thousand cubic feet per hour) of natural gas (daily peak hour flow) to approximately 525,000 current customers (91 percent residential customers which use approximately 50 percent by volume, 8 percent commercial that use 29 percent by volume and less than one percent industrial that use about 10 percent by volume) in the combined Ohio and Kentucky service territory. The natural gas is received into Duke Energy Ohio's system from 22 stations that connect with several interstate pipelines. All of the stations, except for a key interconnect in the south (Foster Station), are located in the northern part of Duke Energy Ohio's service territory. Despite the number of stations located in the northern part of Duke Energy Ohio's system, more than 55 percent of the Ohio customer load is served through a single station, Foster Station, located in Kentucky. The system also includes propane-air peaking plants to meet demand during peak periods as well as emergencies.

Reliability and constraint issues facing Duke Energy Ohio's natural gas system relate to system configuration limitations that prevent functional and reliable balance of supply from north-to-south and vice-versa. Constraints and reliability issues include aged propane-air peaking plants, several river crossings, a single gate station where a majority of supply is received, and pressure-limited pipeline infrastructure throughout many areas. Duke Energy Ohio's pipeline system to feed the distribution system was built from south to north, feeding from Columbia Gulf

Transmission (CGT) pipelines in southern Kentucky. Today, during peak demand, Foster Station provides up to 55 percent of the system supply from CGT into Duke Energy Ohio's service territory (Figure 3-1).

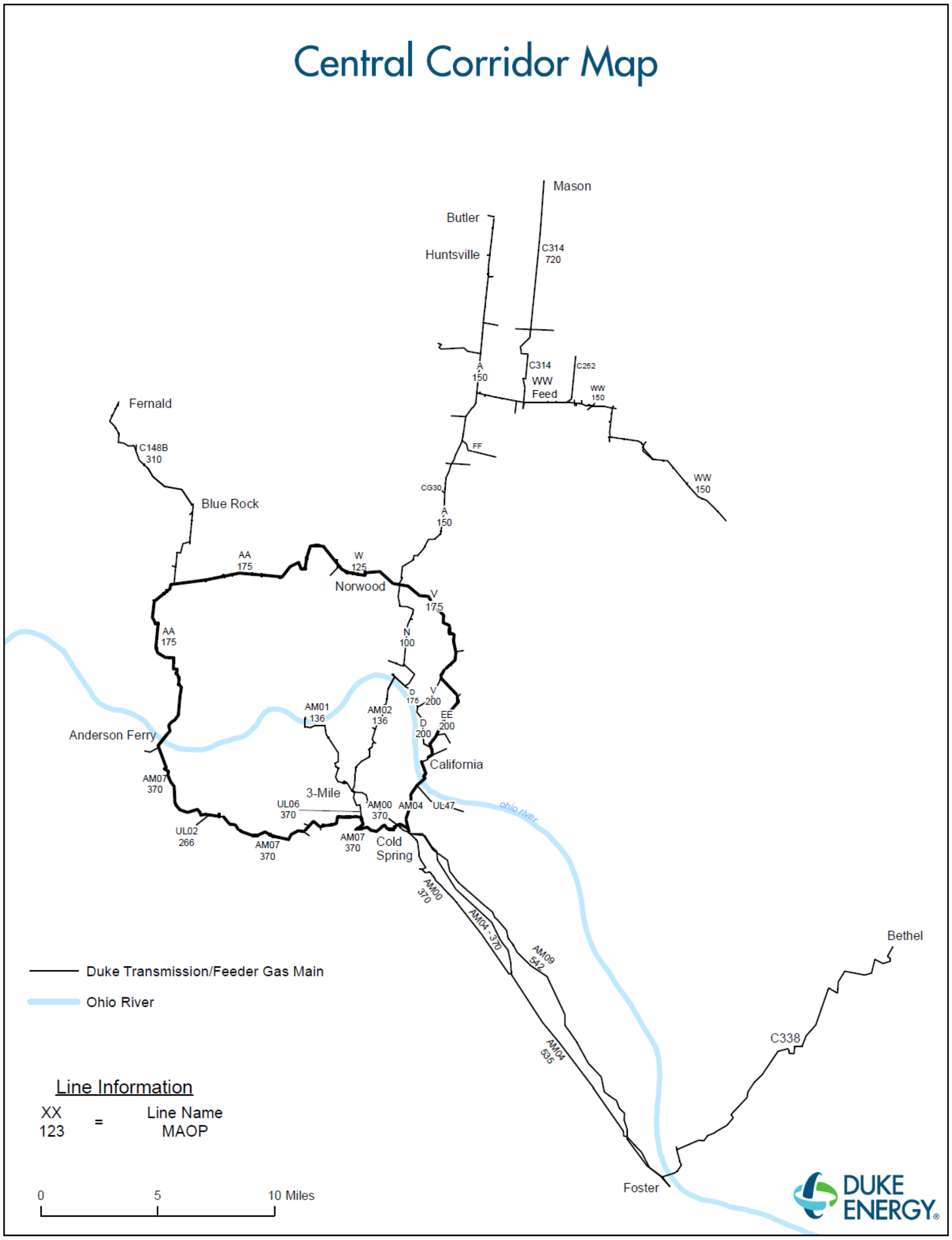


Figure 3-1: Diagram of the main pipelines and MAOPs in the Duke Energy Ohio system around southwest Ohio and northern Kentucky. Numbers represent the MAOP of each of the pipelines, which are identified with a letter (Line A, Line V, Line EE etc.).

Figure 3-1 provides an overview of the natural gas system that feeds the southwest Ohio and northern Kentucky regions, which are Duke Energy Ohio's service area and that of its subsidiary, Duke Energy Kentucky, Inc. (Duke Energy Kentucky). The propane-air peaking plants in Kentucky and Cincinnati are, as discussed throughout this Application, approaching the end of their useful lives. Figure 3-2 provides an enlarged version of the Ohio and Kentucky "high pressure loop" which illustrates the direction of typical peak day natural gas flows through the system.

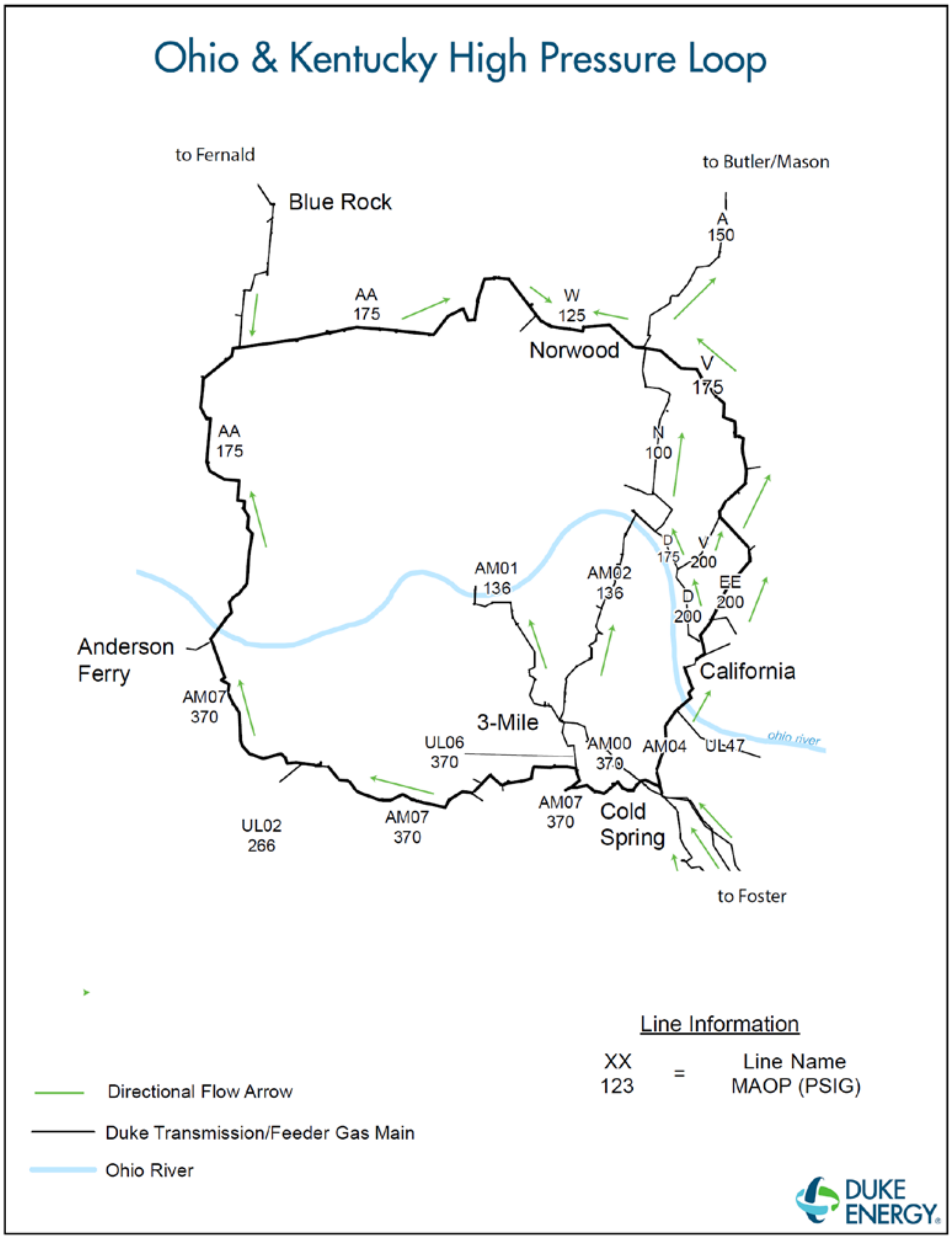


Figure 3-2: Detail view of the Ohio and Kentucky high-pressure natural gas pipeline loop, showing pipelines, peak day flow directions, stations and MAOPs.

Note that flow from the south (Foster Station to the California Station) pushes natural gas supply as far north as the Norwood Station via Line V. Natural gas is supplied from Norwood Station to Line A and Line W. The MAOP limits of existing pipelines in this area present one of the limiting factors to north-south flow. Line A has an MAOP of 150 PSIG as far north as Huntsville Station, and is often operated close to that pressure on a peak day. Line V has an MAOP of 200 PSIG, except between the Fairfax area and Norwood where this is reduced to 175 PSIG. Note that on a peak day, Foster Station also supplies natural gas to the west leg of the Ohio and Kentucky high pressure loop, flowing natural gas through the Cold Spring Station, into Line AM07, continuing across the Ohio River to the Anderson Ferry Station into Line AA.

Line C314, installed in the summer of 2003, is a 10-mile, 24-inch pipeline, with a normal operating pressure of about 600 PSIG, that brings natural gas from the north to WW Feed Station. The pipeline was designed to assist with Line A deliveries as well as to support points to the east served by Line WW. Prior to operation of Line C314, Duke Energy Ohio struggled to maintain pressures above 100 PSIG in Line A, which increased the potential for pressure drops for customers fed from Line A in the central core of Duke Energy Ohio's service area. Line A has reached maximum capacity and, without upgrades, is not capable of supplying additional natural gas to the area on peak days at its current maximum pressure. Line C314 has capacity available, as is needed in the central core area. Line C314 was designed and constructed with future expansion to the south in mind.

In the current system, there is a notable operating pressure drop from 600 PSIG to 150 PSIG where Line C314 connects with the WW Feed Station. This pressure reduction limits the capability of Line C314 pipeline to bring greater quantities of natural gas into the heart of the pipeline system from the north. An extension of Line C314 has been part of Duke Energy Ohio's long-term plans for the system, and the proposed Project will bring increased volumes and pressure of natural gas into the system from the north, eliminating some of the existing system constraints.

As originally designed and engineered, Duke Energy Ohio planned that the Project would be proposed as a 30-inch pipe with an operating pressure of 600 PSIG. However, based on the concerns and input from elected representatives, community leaders, and members of the public, Duke Energy Ohio performed further system analyses and determined that it could reduce the size and scope of the proposed Project, as discussed in this Application. The Project, now proposed as a 20-inch natural gas pipeline with an operating pressure of approximately 400 PSIG, will result in increased volumes and pressures from the north, although to a lesser degree than the original plan for the project and will not meet all the additional needs that would have been addressed by the 30-inch pipeline option, as further detailed in Section 4906-5-04(A)(1) of this Application.

(3) Load Flow Studies and Contingency Analyses

Duke Energy Ohio employs a commercially available, steady-state simulation modeling program, customized to represent its natural gas pipeline system, called Synergi. The modeling program was originally developed by Stoner Associates. It is regarded as one of the premier pipeline simulation models and is used by hundreds of natural gas and oil companies throughout the world. Simulation models portray the behavior of real-life systems and permit the testing of experimental changes to the system without the expense, time, or cost of actually testing a new pipe segment in the ground.

Synergi was used to assist Duke Energy Ohio with the development of its long-range plan. The plan identified future infrastructure needs in order to maintain the ability to provide customers with supply reliability, as well as to provide sufficient flexibility of the natural gas system to be able to recover from a wide range of shut-in (or interruption) events. Each conceived system expansion, including configuration options for peaking, was modeled to determine its ability to fulfill these long-range objectives.

Reliability was the highest priority of the model runs due to the current dependence on the aged and outdated propane-air peaking plants and a single gate station that serves over half of the system's firm (non-interruptible) customers. A system capable of reliably serving the southern segments from northern gate stations would insulate against the loss of natural gas supply to a substantial number of customers. Other attributes reflected in the modeling were demographics, regions of concentrated demand growth, and contemplated pipeline replacement or pressure changes. These attributes were used to better determine the best way to enhance the system for reliability.

When the propane-air peaking plants are in use, natural gas supplies containing the propane-air mixture can travel extensively throughout Duke Energy Ohio's piping systems due to the numerous system interconnections depending on the volumes of propane-air sent out. Figure 3-3 illustrates in red the maximum potential extent of propane-air throughout Duke Energy Ohio's distribution system when propane-air is being produced at both the Cincinnati and Kentucky facilities. Figure 3-4 illustrates in red the maximum potential extent of propane-air throughout Duke Energy Kentucky's distribution system when propane-air is being produced at the Kentucky facility (propane-air from Cincinnati does not enter Kentucky).

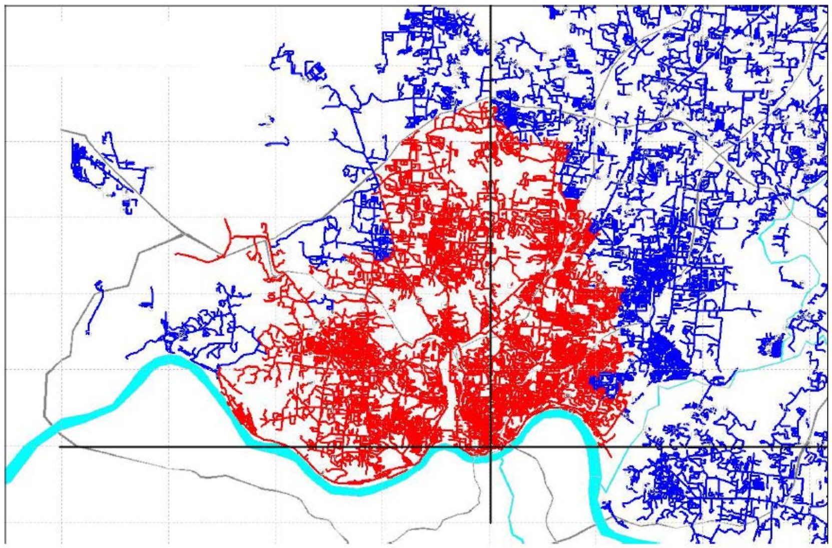


Figure 3-3: The extent of propane flow into the Ohio part of the system from the propane-air peaking plants in Kentucky and Cincinnati, at peak demand flow.

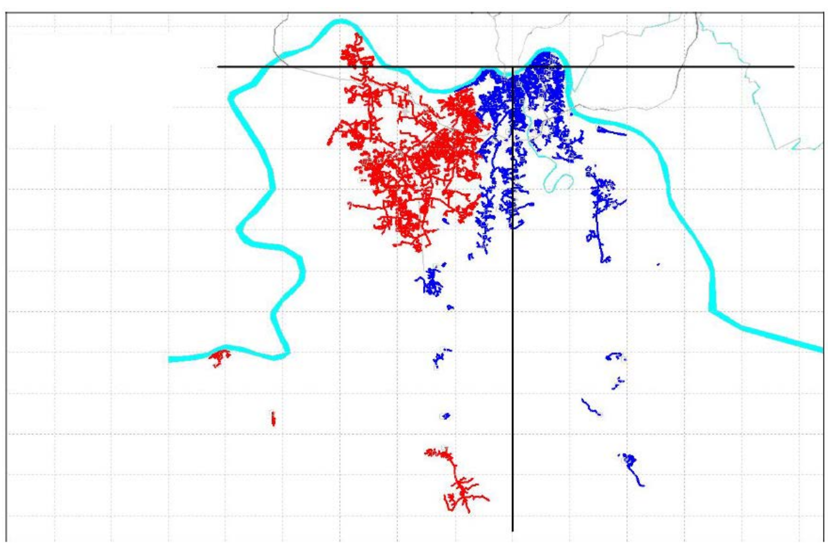


Figure 3-4: The extent of propane flow into the northern Kentucky part of the system from the Kentucky propane-air peaking plant at peak demand flow.

As Figures 3-3 and 3-4 indicate, the reach of the propane-air peaking plants is significant on peak days. Therefore, retirement of the propane-air peaking plants, necessary based on their age, will leave the system unable to serve up to approximately 50,000 customers on peak winter days. Increasing flow from the northern gate stations to compensate for propane-air augmentation is not currently possible, without the Project, due to the system capacity restrictions.

Figure 3-5 illustrates a scenario modeled at a peak demand (45,500 MCFH) where the propane-air peaking plants are no longer operational and no additional pipelines have been constructed.

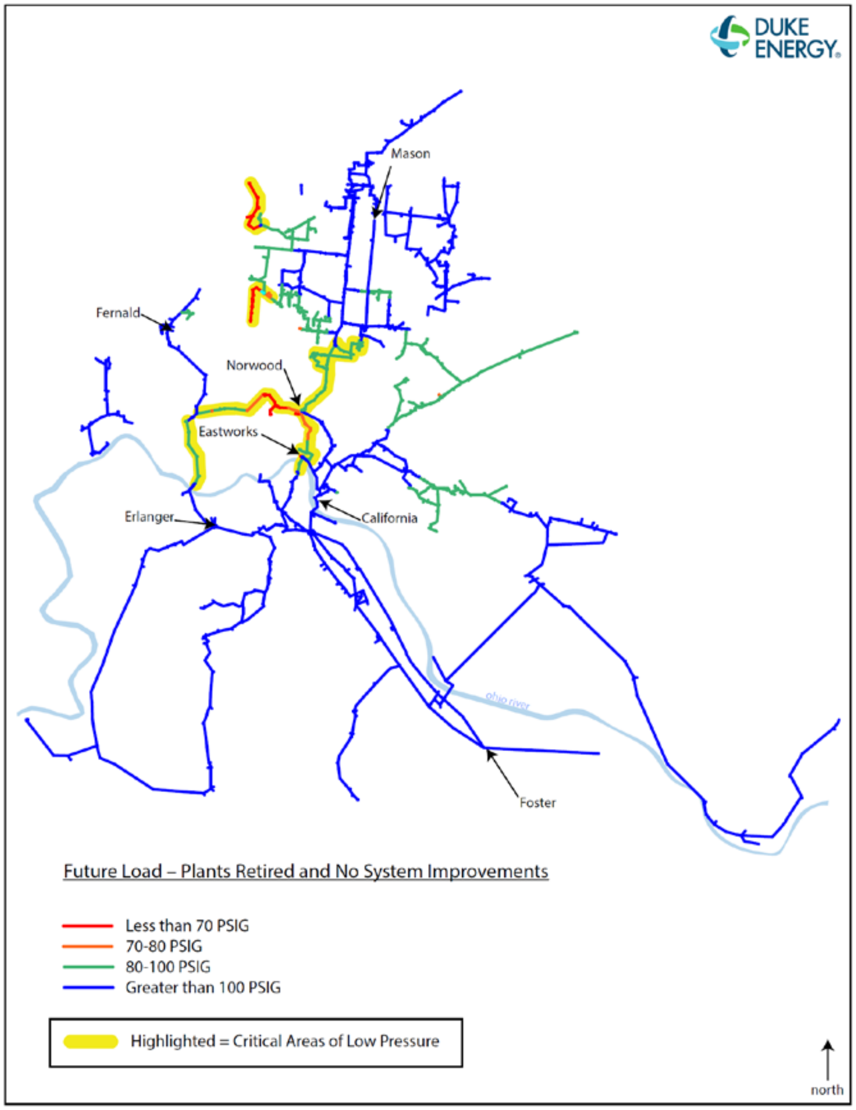


Figure 3-5: Modeled pressures in the system with the propane-air peaking plants retired and no additional pipelines constructed.

Under these circumstances, the system is unable to maintain adequate pressures in the high-pressure distribution system. In other words, there is simply not enough natural gas pressure in the system to maintain service to all customers. The system would be making demands on the Foster Station that well exceed its ability to supply natural gas to Duke Energy Ohio's customers.

Foster Flow Maximized Scenario: Duke Energy Ohio modeled a scenario where the propane-air peaking plants were retired, and a 20-inch diameter pipeline (C314V) with an operating pressure of approximately 400 PSIG had been installed between WW Feed Station and Line V, and maximum capacity was provided through Foster Station (Figure 3-6).

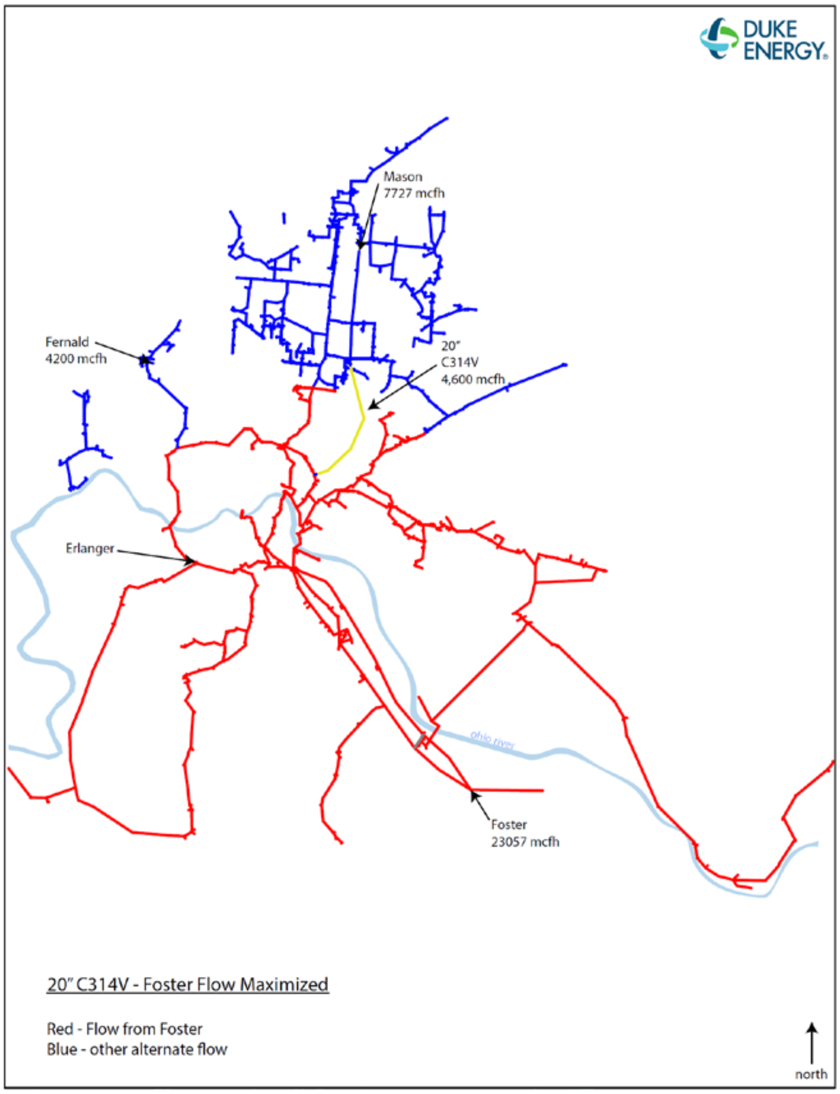


Figure 3-6: Model results showing peak shaving plants retired, flow from Foster Station maximized and proposed C314V operational.

In the Figure, natural gas supplied from the northern stations is colored blue, the natural gas provided from Foster Station is represented by red. Again, peak demand was set at 45,500 MCFH. With Foster Station at capacity, and the Fernald station in the northwestern side of the Duke Energy Ohio territory supplying an additional 1,800 MCFH for a total of 4,200 MCFH, it is necessary to flow approximately 5,000 MCFH (which is approximately 10 percent peak day flow) through the proposed C314V line in order to meet system demands. This confirmed the need for the installation of C314V and that the necessary retirement of the propane-air peaking plants could be accomplished with the capacity of a 20-inch C314V line available.

C314V Flow Maximized Scenario: Under this future-operating scenario, Duke Energy Ohio is anticipating a system load of 45,500 MCFH (Figure 3-7).

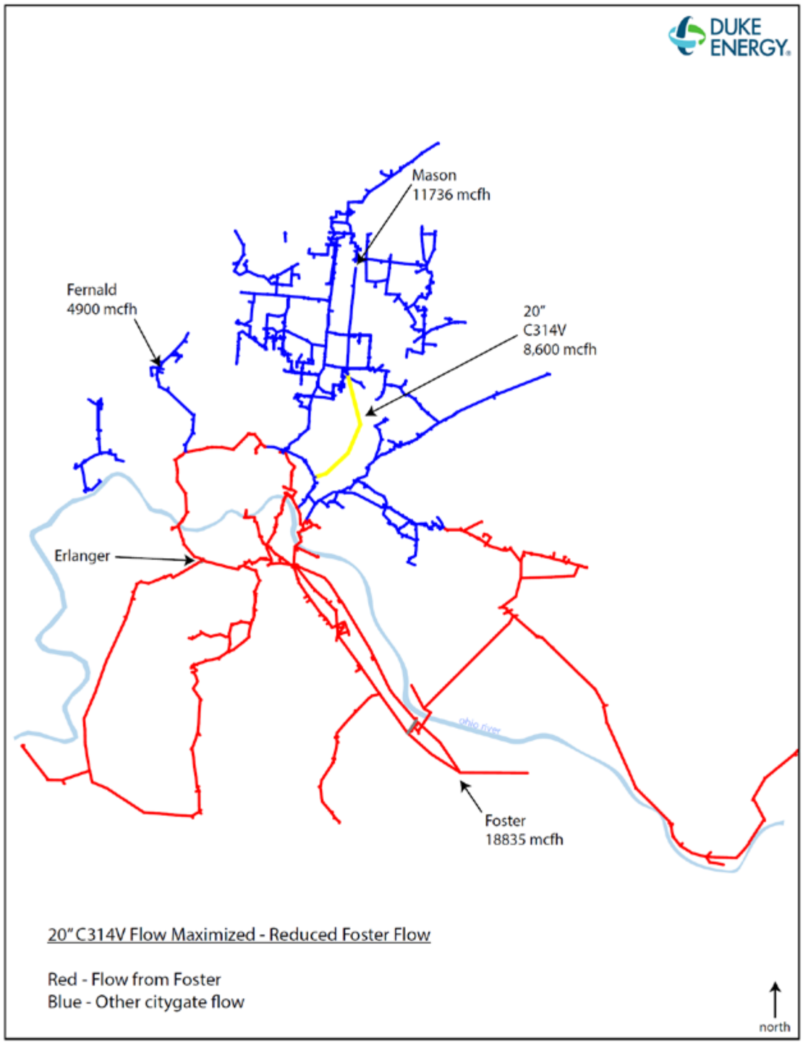


Figure 3-7: Model results showing propane-air peaking plants retired, flow through C314V maximized to show reduction in reliance on Foster Station.

The propane-air peaking plants will not be available and their output will be replaced with an additional flow of 1,800 MCFH from the Fernald South Gate Station and flow in the C314V pipeline. The north-south flow balance is improved by flowing a total of 8,600 MCFH in the C314V pipeline, reducing the area needed to be served by the Foster Station and reducing the flow demand from Foster Station to 18,800 MCFH. This modest improvement in the north-south balance can be seen in the Figure 3-6 as additional blue colored pipelines representing flow from the north.

(4) System Performance Transcription Diagrams

This Application is for a natural gas pipeline; therefore, this section is not applicable.

(5) Relevant Base Case System Data

Using Gas Synergi Version 4.7 hydraulic modeling software, the existing design peak hour was simulated with a system throughput of approximately 43,000 MCFH, propane-air peaking plants in operation and interruptible customers curtailed. The results submitted include a network map showing flows at key city gates and a data table listing pressures at nodes. The results are provided under separate cover to OPSB Staff.

(B) REGIONAL EXPANSION PLANS

Duke Energy Ohio's long-range plan identified the potential development of NGV stations in the central Hamilton County, which is dependent on propane-free natural gas supply pipelines. Because this Project will improve the pressure in the system, resulting in the ability to retire the propane-air peaking plants, the Project will enable additional growth of NGV stations in central Hamilton County.

Since the supplies from CGT received through Foster Station to the south have already been maximized, additional capacity must be obtained from interstate pipelines from the north. Duke Energy Ohio has developed a long-term capital plan to address reliability, flexibility and potential load growth. Balance of supply and the ability to accommodate growth would be accomplished with a combination of new pipelines and the reconstruction of existing pipelines.

(1) Proposed Electric Facility in Long-Term Forecast

This Application is for a natural gas pipeline; therefore, this section is not applicable.

(2) How the Proposed Facility Fits into the Most Recent Long-Term Forecast Report

(a) Reference in Long-Term Gas Forecast

This Project is one of several capital improvement projects recommended for inclusion in Duke Energy Ohio's long-range plan and was also recommended as a follow up to the original C314 project and, as such, it has been part of Duke Energy Ohio's long-term forecast for the last 10 years. However, when included in the Long-Term Gas Forecast, the intended purpose of this Project was to further improve pressures in the area and accommodate potential growth.

(C) SYSTEM ECONOMY AND RELIABILITY

This Application is for a natural gas pipeline; therefore, this section is not applicable.

(D) OPTIONS TO ELIMINATE THE NEED FOR THE PROPOSED PROJECT

This Application is for a natural gas pipeline; therefore, this section is not applicable.

(E) FACILITY SELECTION RATIONALE

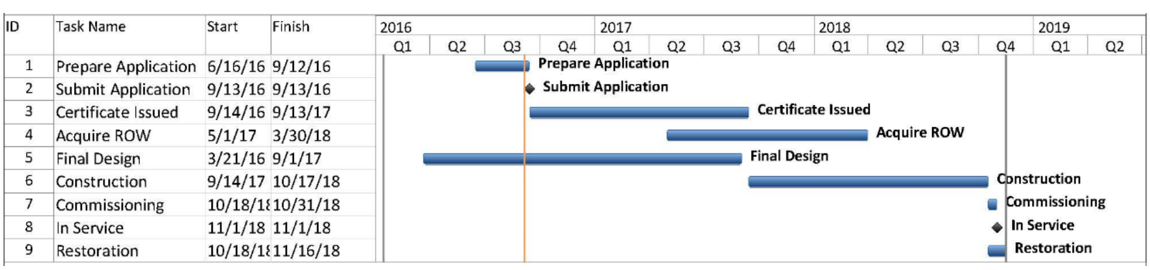
Please refer to Sections 4906-5-02 and 4906-5-04 of this application for the Project alternatives analyses.

(F) PROJECT SCHEDULE

(1) Gantt Schedule Bar Chart

The Gantt chart below presents the proposed schedule for all major activities and milestones for the Project.

Figure 3-8: Gantt chart of proposed schedule of major milestones.



ID	Task Name	Start	Finish
1	Prepare Application	6/16/16	9/12/16
2	Submit Application	9/13/16	9/13/16
3	Certificate Issued	9/14/16	9/13/17
4	Acquire ROW	5/1/17	3/30/18
5	Final Design	3/21/16	9/1/17
6	Construction	9/14/17	10/17/18
7	Commissioning	10/18/1	10/31/18
8	In Service	11/1/18	11/1/18
9	Restoration	10/18/1	11/16/18

(2) Impact of Critical Delays

The Project is proposed at this time due to the age and outdated technology of the existing pipeline system infrastructure, including, in particular, the propane-air peaking plants. As previously stated, an engineering review has concluded that the propane-air peaking plants are approaching the end of their useful life. Failure of the propane-air system or shut-in of the southern natural gas supply during periods of peak demand would result in supply vulnerability for many customers. The timing of this Project is intended to be a proactive measure and significant delays to the in-service date for the pipeline will result in increased system vulnerability and unnecessary risks to the reliability of natural gas supplies for customers. Retirement of the propane-air peaking plants is not possible without the completion of this Project to provide additional natural gas supply.

4906-5-04 ROUTE ALTERNATIVES ANALYSES

(A) BACKGROUND

This Application is specific to the Project and this Section details the route selection process Duke Energy Ohio's siting team used to identify and evaluate routes between WW Feed Station in the north and the existing Line V connection to the south (See Figure 2-1 to reference the pipelines and stations discussed in this section). This Section also describes how Duke Energy Ohio identified and evaluated a broad range of options to meet the needs and purpose of the Project (as detailed in Section 4906-5-02 of this Application). The following paragraphs summarize the process Duke Energy Ohio used to evaluate the existing natural gas system. That evaluation included generating potential solutions, and resolving those solutions down to a central area project. Once at that point, the siting team conducted a routing study to identify and evaluate potential routes, and then to identify a Preferred and Alternate Route. The three critical needs of the Project are described in Section 4906-5-02 of this Application but are repeated here for context of the siting study. Duke Energy Ohio identified the following critical near-term system needs:

- Duke Energy Ohio currently uses a series of propane-air peaking plants that temporarily supply propane gas to boost supply when natural gas demand is greatest (typically in winter) and during other emergency situations. The equipment at these facilities, built in the mid-20th century, is nearing the end of its useful life and needs to be taken out of service. This is one of the primary goals of the Project. In addition, the propane supplemented natural gas needs to be removed from the Duke Energy Ohio natural gas delivery system as it creates difficulties for natural gas vehicles and modern natural gas handling equipment at the end users' facilities.
- The Duke Energy Ohio system relies very heavily on natural gas supplies via its Foster Station (*i.e.*, from the south). An interruption of supply from this one station would potentially mean up to 50 percent of Duke Energy Ohio's customers would be without natural gas for the duration of the interruption, as well as for the period of time needed for service restoration. Easing reliance on Foster Station is an essential part of the proposed Project. Over time, Duke Energy Ohio has been able to address the reliance on

Foster Station incrementally through a series of system upgrades and new construction. This Project, as a continuation of these upgrades, helps further reduce reliance on Foster Station to below 50 percent, an important milestone as this provides sufficient backup should one of the feeds to Foster Station from the south be interrupted.

- Duke Energy Ohio's natural gas system in the central core of the city is aging and needs to be replaced and upgraded. Continuous replacement of infrastructure is part of Duke Energy Ohio's plan to modernize the natural gas system over the next few decades. This will help Duke Energy Ohio to continue providing a safe and reliable natural gas supply to customers.

To expand on the issue related to aging infrastructure, Duke Energy Ohio operates over 700 miles of high-pressure natural gas pipelines to bring natural gas to the central core of the Hamilton County area, and to then distribute that natural gas via "laterals," or smaller diameter pipelines. One of the main backbones of that system is known as Line A. Line A is a large diameter (18-24-inch) pipeline that feeds natural gas both from the north (from ANR and Texas Gas pipelines) and from the south (from Norwood Station). Depending on the pressure balance, natural gas can be fed from either direction to supply customer needs. Refer to Figure 2-1 and 2-2 for the locations of Line A, Line V, and the stations.

One of the limits to this pipeline backbone is the MAOP of Line A. It is limited to 150 PSIG and regularly operates within a few pounds of that in the peak winter season. Furthermore, Line A was built in the 1940, 1950s, and 1960s and does not meet today's stricter construction, inspection and testing standards. Duke Energy Ohio needs to be able to inspect and if needed replace Line A over the coming years. Line V is the other essential element of the backbone for central Hamilton County. Line V is a 20-inch natural gas pipeline that feeds Norwood Station, then Line A with natural gas from the south. The proposed Project is critical in providing the required capacity to allow these existing aged pipelines to be taken out of service temporarily for such upgrades and improvements.

(1) Discussion of Alternative Projects

Duke Energy Ohio evaluated a wide variety of solutions to these system issues, including the no action alternative, replacing existing pipelines, and new construction. A brief summary of these alternative scenarios follows:

No Action, Construction or Replacement: Duke Energy Ohio considered the possibility of making no improvements and simply continuing maintenance of the existing infrastructure. Although this option is the least expensive and least disruptive in the short-term, maintenance costs and the risk of failure of the aging propane-air plants, equipment and the overall pipeline system will rise. Secondly, failure to adequately test and upgrade pipelines in the system will likely result in non-compliance with state and Federal pipeline safety requirements. Third, over-dependence and risk of a failure from the Foster Station supply point in the south would remain. In short, the system would quickly reach the inability to meet demand in southwest Ohio, resulting in an unacceptable risk of failure and outage. An important part of Duke Energy Ohio's role is to anticipate and plan for future energy needs in the area. This Project addresses the current system risks and some future energy needs of our customers.

Replacement in Place: Replacement of the existing "backbone" specifically Line A, extending from Line WW toward Line V was considered. Due to the limited backup throughput capacity of the pipeline system (*e.g.*, looping), taking Line A out of service would result in interruptions to customers during the peak winter season, an unacceptable situation for natural gas customers and Duke Energy Ohio. A review of the current status of residential and commercial development around the existing pipelines extending from the north to or near Line V indicated there is not enough existing ROW width to install a replacement pipeline of a size that can meet the capacity needs of the Project. In order to meet the needs of this Project, replacement of Line A in its entirety would be necessary. This would require the installation of another 20-inch pipeline adjacent to Line A, before Line A could be taken out of service.

System Modeling Study: A variety of system improvements were modeled to gauge their effectiveness at resolving the three identified critical needs. Three western and one eastern scenario beyond the I-275 loop and three central options within the I-275 loop were modeled in the study. No routing or similar analysis was included at the initial planning stages or during this modeling step.

In general, the western options did not allow for retirement of the propane-air plants, nor did they improve reliability to the extent that inspection and replacement work could be conducted as needed in the central core area.

The Eastern options are able to bring a significant supply of additional natural gas from northern suppliers and would contribute to retirement of the propane-air plants, but this would come at the cost of social and environmental impacts as well as the greater economic costs of a 36-inch high-pressure pipeline, up to three times longer than any of the other options. This option would also require at least one additional large diameter, high-pressure pipeline into the central core of the city, further increasing impacts. Furthermore, this option would not completely resolve the issue of replacement of aging central core natural gas infrastructure. These options beyond the I-275 loop were rejected by Duke Energy Ohio as they did not meet the purpose and needs of the Project.

The series of projects in the central core area were considered by Duke Energy Ohio to offer the greatest potential for resolving the three critical aims of the Project. This series of projects included an extension of Line C314 from WW Feed Station to the existing Line V to the south. Line C314 was constructed in 2003 and is a 24-inch, high-pressure pipeline that brings natural gas south from the interstate system toward Central Hamilton County's core. Prior to Line C314's completion, the system in the central area was struggling to maintain sufficient pressures to support existing customers. Duke Energy Ohio also identified a need to extend Line C314 further south as part of a future upgrade. Based on the most recent system modeling, Duke Energy Ohio concluded that an extension further south through the central corridor remains the best option to minimize overall Project impacts and meet customer needs well into the future. Unlike Duke Energy Ohio's southern supply point (Foster Station), the current C314 pipeline has additional capacity to bring natural gas into Hamilton County and was built with such a purpose in-mind.

The proposed Project will allow Duke Energy Ohio to eliminate the propane-air plants and reduce reliance on the Foster Station supply point. The proposed Project and other long-range plans will improve the balance and variability (*i.e.*, reliability) in natural gas supply for southwest Ohio customers. Therefore, Duke Energy Ohio selected an option to connect the southern end of the C314 pipeline at WW Feed Station to the existing Line V pipeline near Norwood Station. The Project was named C314V Central Corridor Pipeline Extension Project.

Pipeline Diameter and Pressure Needs: Duke Energy Ohio evaluated several pipeline diameters and pressures to determine the optimum balance of supply into Duke Energy Ohio's distribution system. Initially, Duke Energy Ohio selected a 30-inch diameter pipeline engineered to an operating pressure of 600 PSIG. This size and pressure combination was considered for the following reasons:

- Immediate ability to retire the propane-air plants
- Reduction to 35 percent from 55 percent reliance on Foster Station supply point and Line A and the ability to handle interruptions during the winter peak demand days
- Maintain target pressures in the central service area
- Significantly increase safety and reliability and the ability to fully inspect, service, and if necessary replace and/or reduce pressures on existing pipelines without the potential for interruptions
- Apparent initial availability of a well suited existing corridor – I&O/SORTA Railroad that connects to the southern terminus of the original Line C314 all the way south to Line V. Duke Energy Ohio has easement rights along the railroad and it was initially believed the railroad line had the capacity to accommodate the Project. The eventual elimination of this routing option, except for a portion along Blue Ash Road, is discussed further below.

(B) CENTRAL CORRIDOR PIPELINE EXTENSION PROJECT ROUTE SELECTION STUDY

Following selection of the Central Corridor Pipeline Extension Project scenario and identification of the initial required basic size/pressure combination that would meet the Project purpose, Duke Energy Ohio's siting team began the route selection process intended to find and evaluate viable routes between WW Feed Station and Line V. Most linear routing studies begin by looking for existing corridors to parallel or site within. Therefore, the potential availability of space within the I&O/SORTA Railroad ROW was initially considered and evaluated as a primary option.

Duke Energy Ohio maintains a legacy agreement with I&O/SORTA, originally negotiated with the I&O/SORTA Railroad, that allows for development of electric and natural gas pipeline and distribution infrastructure within the railroad ROW. This agreement was primarily established to simplify new electric and crossings of the railroad line rather than to accommodate parallel development. It is also worth noting that much of the available space within the ROW was already developed with overhead electric transmission and distribution poles prior to the easement agreement.

The railroad option was thoroughly evaluated, as there initially appeared to be sufficient physical space for the proposed pipeline along the railroad ROW for long sections along the northern half of the route, with only scattered short sections where space narrowed forcing deviations away from the ROW. The southern half of the railroad route was constrained by a difficult combination of steep slopes and existing residential developments but was still explored as an option. The siting team conducted pedestrian, windshield and helicopter observations of the railroad ROW. These observations noted the proximity of structures to the railroad tracks and identified possible deviations away from the railroad where space appeared inadequate. In addition, the presence and location of existing utilities was observed and recorded.

Continued evaluation of the railroad ROW identified many structures that had been built either within the railroad ROW or immediately adjacent, which would preclude pipeline development. In addition, as previously mentioned terrain became increasingly difficult towards the southern end of the Project and presented no room for a natural gas pipeline installation.

In parallel, Duke Energy Ohio consulted with a specialized railroad consultant regarding the applicability of specific guidelines and standards for pipeline construction in proximity to active railroads. Based on that review, it was concluded that the American Railroad Engineering and Maintenance Association (AREMA) Guidelines were applicable to the Project, even though the I&O/SORTA track was defined as low-volume, low-speed. The Duke Energy Ohio siting team reviewed these guidelines for siting-focused limitations and identified the following:

- Longitudinal pipelines should be located as far as possible from any track.
- They must not be located parallel within 25-feet from the centerline of any track.

Although short stretches of the railroad ROW might have been suitable for the Project, due to observations and the AREMA guidelines the final determination was that unfortunately the railroad line did not present a viable route for its entirety from north to south. Furthermore, use of the railroad ROW is not compatible with I&O/SORTA Railroad's current use and future light rail plans. The siting team refocused on identification of other candidate routes that were practical through the study area. The railroad ROW option was therefore eliminated from practical consideration. Elimination of the railroad ROW option did not altogether preclude all parallel options outside of the 25-foot AREMA limitation. Several options that used various sections that paralleled the railroad were considered, particularly a section along Blue Ash Road.

(C) ROUTE SELECTION STUDY

The Duke Energy Ohio siting team initiated an RSS, which included selection of a study area, collection of pertinent data, placement of route options, and an objective comparison of the routes before bringing the most favorable options before the public in a series of open houses. The RSS is included at the end of this Section as Appendix 4-1 and the findings are briefly summarized in the following paragraphs. The RSS ended with the recommendation of three routes/corridors to take to the public open houses required as part of the Application process. Comments from the public open houses and additional studies in response to the public comments were subsequently conducted and are documented in this Section.

The RSS report includes a description of the study area with corresponding maps, identification of route alternatives evaluated, siting criteria, evaluation and scoring process, and the rationale for selecting the three routes/corridors that were taken to the public open houses. The selection of the Preferred and Alternate Routes from the three options is also presented in this Section. The Applicant's consultant, CH2M, HILL, Inc. (CH2M) assisted Duke Energy Ohio with the RSS, forming a combined Duke Energy Ohio Siting team. For details on specific RSS information refer to the full RSS report in Appendix 4-1.

(1) Study Area Description and Rationale

For this Project, there were several current land use features such as transportation corridors (*e.g.*, Interstates-71 and I-75), high-density residential, industrial, and commercial developments, and large forested land areas present that naturally served to both limit the size of the study area and offer opportunities for potential route corridors. Therefore, the western Project boundary was generally defined by I-75, the eastern by I-71 and Montgomery Road, and the southern by the Line V tie-in (although note the eastern Project boundary was extended later in the study as additional options were evaluated). Routes outside this general area would not provide the necessary support for infrastructure upgrades (see the earlier description of the Project's critical needs), although subsequent expansion of the study area did encompass the areas of Madeira and Indian Hill.

(2) Study Area Map

Figure 1-1 of the RSS (Appendix 4-1) illustrates the approximate boundary of the study area for the Project. Note that this boundary was extended out to the east to include route options through Madeira and Indian Hill.

(3) Map of Study Area, Routes, and Sites Evaluated

Figure 1-3 of the RSS (Appendix 4-1) illustrates the route selection constraints and the initial route segments proposed prior to detailed scoring. Figures 2-1 through 2-9 (Appendix 4-1) show the 28 routes scored in detail. Figures 3-1 and 3-2 (Appendix 4-1) show the routes as presented at the three public information meetings.

(4) Siting Criteria

The term siting criteria collectively refers to geographic characteristics that affect or can be affected by construction of a pipeline. An "attribute" or "opportunity" is a criterion that is a positive for pipeline placement; for example, an existing wide ROW is typically considered an attribute, or opportunity (*i.e.*, a "better" place to construct a pipeline). A "constraint" is a criterion representing a less positive location for a pipeline (*i.e.*, a "worse" place to construct a pipeline). A residential area is considered a constraint. There are typically many constraints and fewer opportunities when conducting routing studies, particularly in heavily developed areas. The goal is to make maximum use of the opportunities and minimize the constraints, recognizing that constraints cannot be avoided altogether.

Complicating things further, locations may exhibit both attributes and constraints. For example, there might be residences located adjacent to an existing pipeline corridor, or there may be an open, undeveloped area (an attribute) that hosts high quality forested wetlands and endangered species (both significant constraints). Therefore, when considering routes for development, the siting team has to find a way to account for and balance a large and often contradictory set of attributes and constraints. Ultimately, siting involves comparing options to each other and making a decision as to which one, on balance, represents the more favorable option. It is perfectly possible that no option may be regarded as "good" by an outside observer, but the critical metric is how the options compare to the others in the study.

The siting team developed a list of siting criteria that were relevant to pipeline development and could be measured and mapped. These measurable criteria are termed quantitative. An example of a quantitative criterion is the number of residences within 1,000 feet of the Project. A list and description of all quantitative siting criteria utilized in the study is presented in subsection 2.2.1 of the RSS report (Appendix 4-1). The quantitative siting criteria consist of various constraint and attribute data such as locations of individual residences, property boundaries, institutional land uses, forested land, wetlands, streams, existing infrastructure, roads and other land use features.

The Duke Energy Ohio Siting Team used the quantitative siting criteria to compare the routes numerically to one another. The criteria were collected under three broad headings: land use/cultural, ecology, and technical. Multiple individual criteria were collected under these broad headings (Table 4-1). The siting criteria were selected based on their relevance to the Project, the study area, and the availability and quality of the data sets. Similar data has been used effectively on many previous projects and typically evolves based on changes in regulations, the nature of the study area, and new data availability. Table 4-1 also indicates a brief statement regarding the rationale for or relevance of using specific criteria.

TABLE 4-1
Siting Constraints and Opportunities

Criteria	Source	Rationale
Linear feet of woodlots crossed	Digitized from 2015 aerial photograph	Constraint: If the ROW crosses a wooded area, the trees within the ROW must be cleared permanently - Required to report on by OPSB and potential loss of habitat, screening and visual effects for residents, as well as a cost for clearing. Avoid or minimize.
Linear feet of NWI wooded wetlands	U.S. Fish and Wildlife Service	Constraint: Wooded wetlands (or PFO) within 100 feet would require clearing. PFO is considered more sensitive than non-PFO wetland. PFO does trigger a greater level of permitting and mitigation. Avoid or minimize.
Linear feet of NWI non-wooded wetlands	U.S. Fish and Wildlife Service	Constraint: Impacts to wetlands trigger additional permitting cost and schedule issues. Agencies seek to avoid, minimize, or lastly, mitigate for impacts to wetlands. Avoid or minimize.

TABLE 4-1
Siting Constraints and Opportunities

Criteria	Source	Rationale
Number of Streams Crossed	USGS	Constraint: Stream crossings are a sensitivity for pipeline projects, and may require clearing riparian vegetation, horizontal boring beneath, open-cut; scrutinized by OPSB as well as potentially increasing the permitting requirements for the Project. Avoid or minimize.
Linear feet of endangered, threatened, or protected species crossed and number of endangered, threatened, or protected species within 1,000 feet	ODNR, Division of Wildlife	Constraint: T&E Species and Habitat are reviewed by the USFWS, ODNR, and OPSB. It is better to avoid known locations in the siting study. Often potential habitat extends over a wide area, or information can be dated. Avoid and maximize distance from.
Linear feet of managed areas crossed and Number of managed areas within 1,000 feet		
Number of National Register of Historic Places (NRHP) locations within 1,000 feet	Ohio Historic Preservation Office	Constraint: Potential view shed impacts. Avoid where possible.
Number of Cemeteries within 100 feet		Constraint: Potential view shed impacts. Avoid where possible.
Number of residences within 100 feet	CAGIS (Cincinnati Area GIS) & Aerial Photography	Constraint: Residences and residential areas are avoided where possible, and being further away from residences is preferred. A lower number of properties crossed is preferred for public impact considerations, schedule, and cost.
Number of residences between 100 and 1,000 feet		
Number of Residential Parcels Within 1,000 feet		
Number of institutional land uses within 1,000 feet (Schools, Hospitals, Churches)	Environmental Sciences Research Institute	Constraint: Potential viewshed impacts and required reporting by OPSB. Aim is to avoid and maximize distance from.
Number of sensitive land uses within 1,000 feet (Airports, Parks, preserves, golf courses, conservation sites)	Environmental Sciences Research Institute	Constraint: Potential viewshed impacts and required reporting by OPSB.
Number of road crossings	CAGIS	Constraint: Road crossing permits during construction
Linear feet of pavement crossed	Digitized from 2015 Aerial	Constraint: Follows existing disturbed corridor and limits fragmentation of property
Number of railroad crossings	CAGIS	Constraint: Railroad crossing require a permit and often involve additional engineering measures. Minimize number of crossings.

TABLE 4-1
Siting Constraints and Opportunities

Criteria	Source	Rationale
Linear feet of segment paralleling existing electric line ROW	Duke Energy Ohio	Attribute: Follows existing disturbed corridor and limits fragmentation of property. Maximize this where possible.
Linear feet of segment paralleling existing natural gas line ROW		Constraint: In this Project this was a constraint, because if insufficient space to safely allow for construction, and the existing line would likely have to be taken out of service.
Length of route (in feet)	Developed from GIS Data	Constraint: The shorter the length, the less to potentially impact sensitive land uses and less cost. Shorter is better.
Linear feet of slope >15 percent	CAGIS (Cincinnati Area GIS)	Constraint: Steep slopes present construction difficulty, are a problem with stormwater erosion, and can present long-term engineering problems. It is better to avoid steep slopes if possible. Maximize gentle slopes minimize steep slopes
Linear Feet of Segment Paralleling Roads	CAGIS (Cincinnati Area GIS)	Attribute: Follows existing disturbed corridor and limits fragmentation of property, and provides good construction access
Linear Feet of Segment Paralleling Railroads	CAGIS (Cincinnati Area GIS)	Attribute: This was regarded as an attribute as using existing corridors typically results in lower impacts to other land uses.
Parcels Crossed by 50-feet ROW	CAGIS (Cincinnati Area GIS)	Constraint: A lower number of properties crossed is preferred for schedule, cost, and public impact considerations.
Linear feet requiring specialized resource-intensive engineering and construction techniques	CAGIS (Cincinnati Area CIS), Duke Energy Ohio	Constraint: These areas require additional considerations to mitigate risk.
Linear feet affected by AREMA regulations	Developed from GIS Data	Constraint: These guidelines require additional considerations for construction and ROW maintenance. This constraint captures those areas that both parallel railroad and are affected by AREMA guidelines.

Using the evaluation criteria, preliminary route centerlines were identified by the siting team.

(5) Siting Process for Preferred and Alternate Routes

The Duke Energy Ohio Siting Team placed preliminary centerlines based on the constraint mapping, review of aerial photography, topographic maps, and the collected attribute and constraint data. The intent when placing these centerlines was, to the extent possible, to avoid residences, sensitive land uses, existing structures, wetlands, forested areas, and, where practical, to follow existing corridors or use undeveloped land. Terrain was important as steep slopes are present in the area and can affect pipeline stability and longevity, so were avoided to the extent practical. Duke Energy Ohio's technical preferences included:

- Maintain a minimum of 15 feet of separation between structures and centerline of the pipeline.
- Where routes follow Interstate Highways, they must be outside Ohio Department of Transportation (ODOT) ROW by a minimum of 10 feet.
- On other roads in the area, try to remain outside the road ROW and away from existing water and sewer lines except where crossing.
    - When crossing a road ROW, crossings are to be perpendicular to the extent feasible.
- Terrain with a slope over 25 percent was considered to need additional engineering and environmental controls for construction, with a preference to avoid where possible.

The siting team explored the potential of using the available ROWs and areas adjacent to existing ROW's through the area, I-71, I-75, Norfolk Southern Railroad (near I-75 and not as congested as the I&O/SORTA Railroad corridor), sections of the original I&O/SORTA Railroad (outside the ROW and where possible – see previous detailed discussion of the railroad option), and adjacent to roads throughout the area.

Generally, the siting team attempted to avoid residential areas as much as practical, preferring commercial/industrial areas, and open areas such as golf courses and parklands where present. Some residential areas were unavoidable, so when encountered, the siting team favored properties with deeper setbacks from the road to maximize separation between the pipeline and the residence. The siting team also recognized that residential back yards are typically considered more private than front yards, and as such they were avoided wherever possible. The size of buildings and the need for parking and shipping/receiving space in commercial and industrial areas created potential space for the pipeline to be routed through these areas and the team considered that space for several candidate routes.

(6) Route Descriptions and Rationale for Selection

The resulting candidate routes were assigned lettered nodes at turning points and segment intersections for descriptive purposes. After the candidate routes were identified and mapped, the siting team conducted an additional windshield survey of the area and routes were refined and adjusted. Through the process, over 100 route segments were identified, resulting in thousands of possible unique route combinations. Maps showing the extensive set of preliminary route options are included as Figure 2-1 through Figure 2-9 in the attached RSS (Appendix 4-1).

As an additional verification step at this stage, Duke Energy Ohio retained a natural gas pipeline engineering consultant (Willbros Group Inc.) to review the candidate routes primarily for constructability and to propose additional practical routes for consideration. Based on the constructability review, some route segments were adjusted and several additional routes were added. Additional routes added included the route through the center of the Project study area and potential routes though Madeira and Indian Hill. In addition, from this evaluation, some of the initial route segments were modified or rejected due to significant constructability challenges.

The routes from the RSS and the constructability review ultimately resolved into several main corridors. Summary descriptions of these route groups are provided below. For brevity, these are not intended as detailed descriptions. Each route is identified on the figures provided in the RSS and all figure references given below in the option descriptions also apply to the RSS in Appendix 4-1.

- **Western Route Options:** Six western routes were identified, 7 (Figure 2-2), 8 (Figure 2-3), 10 (Figure 2-3), 11 (Figure 2-4), 17 (Figure 2-6), and 18 (Figure 2-8). All use a common route from Glendale-Milford Road to the southern tie-in with existing Line V. From Glendale-Milford Road the line parallels the eastern side of a Norfolk Southern two-track railroad through industrial areas before crossing US-42. The route then passes along 3rd Street through residential land before generally following a railroad (with several small route diversions) through industrial/commercial land use to the southern terminus. Three main options were identified to connect the routes from Glendale Milford Road to the northern tie-in point. These include:
    - Routes east along Glendale-Milford Road then north along Reed Hartman Highway, east along Glendale-Milford Road then north along the railroad with several small route diversions.
    - Routes east along Cornell Road (further north than Reed Hartman Highway) then north along Reed Hartman Highway, east along Glendale-Milford Road then north along the railroad with several small route diversions.

- **Central Railroad Options:** Two options (Routes 5 and 6) were identified that parallel the I&O/SORTA Railroad through the center of the Project area (Figure 2-2 in the RSS (Appendix 4-1)). As discussed earlier, review of these routes in their entirety indicated they were non-constructible based on AREMA guidelines and space constraints. Nevertheless, they were retained for comparative scoring and methodology continuity purposes. Route 5 was developed outside the existing railroad ROW and Route 6 was developed inside the existing railroad ROW.

- **Central Option:** One route (Route 25) was identified through the central portion of the study area that did not utilize significant portions of the railroad or interstate ROW (also shown on Figure 2-8, Appendix 4-1). This option utilized sections of residential roads and highways, and passed through residential and industrial neighborhoods. This route leaves WW Feed Station at the north end, passes through an open area adjacent to the Summit Woods office Park before turning west then south to follow Reed Hartman Highway for a short stretch. The route leaves Reed Hartman Highway just to the north of Creek Road where it passes through an area of mixed commercial and residential land use before heading west along Glendale-Milford Road and south along Plainfield Road. After a short westward turn onto Cooper Road the route heads south through mixed wooded and residential area before heading west to parallel State Route 126 (SR-126; Ronald Reagan Cross County Highway). The route then passes through additional mixed residential and commercial area before paralleling East Galbraith Road, then Ridge Avenue to the south. The route also passes through Losantiville Country Club before reaching the southern tie in.

- **Central/Railroad & I-71 Combinations**: Thirteen of the initial 25 routes scored use a combination of I-71 and the central railroad. These are identified in the following figures (in the RSS in Appendix 4-1) and include Routes 2 (Figure 2-1), 4 (Figure 2-2), 9 (Figure 2-3), 12 (Figure 2-4), 13 (Figure 2-5), 14 (Figure 2-4), 15 (Figure 2-5), 16 (Figure 2-6), 19 (Figure 2-7), 20 (Figure 2-7), 21 (Figure 2-7), 22 (Figure 2-8), and 24 (Figure 2-8). The northern portions of combined I-71/Railroad routes use three main corridors to get from WW Feed Station to the vicinity of Glendale-Milford Road. These are Reed-Hartman Highway, I-71, and the Railroad. From this point south, the non-I-71 options follow the railroad with jogs away, or Kenwood Road. At East Galbraith Road, an east-west connector links the I-71 options with those along the Railroad and Kenwood Road. South of Galbraith the Kenwood Road option joins the I-71

Routes after passing along the western edge of Kenwood Mall. The railroad option continues south until it reaches Section Road where it follows Plainfield Road to the south, Woodford Road to the west then Kennedy Avenue and Highland Road to the southern termination point.

- **I-71 Options:** Two options were identified that paralleled the I-71 corridor (Figure 2-1, Appendix 4-1). These include Route 1 and Route 3. Although other routes use portions of the I-71 corridor (outside the ROW), Routes 1 and 3 are the only two routes that follow I-71 for the majority of the length of the Project. Route 1 follows the east side of the Interstate, while Route 3 follows the western side. Route 23 was identified east of I-71 through the communities of Loveland, Madeira, and Indian Hill. This was the longest of the route options and while it minimized the number of dense residential areas affected, there was a significant acreage of woodland impact and a large number of stream crossings.

Duke Energy Ohio investigated the potential of occupying the ROW along I-71, which included discussions with ODOT regarding existing regulations and policies. As that investigation confirmed, ODOT generally does not allow “longitudinal” placement of utilities in ROW for several reasons, including maintenance access, potential road expansions, public safety related to moving traffic, and utility construction and repair activities within interstate ROW. Duke Energy Ohio therefore looked for opportunities to parallel I-71 without actually placing the pipeline within ODOT ROW.

Scoring and Ranking of Routes

The siting team collected quantitative data, for various criteria along all the evaluated routes. In other words, the team counted occurrences of the various criteria along each route. The result is a huge raw data table (forest area, streams crossed, residences within 1,000 feet, wetland area crossed*, etc*.). It becomes a challenge to easily compare and rank routes with so much raw data. When looking at large numbers of criteria and many route options, siting studies often use scoring; that is, turning the raw data into a number that represents if it is “better” or “worse” than the other routes allowing for a comparative analysis between candidate routes. Scoring numbers are used for several practical reasons, and there is no magic to them. Scores simply translate what we might typically express through descriptions such as “better,” or “worse.”

For example, consider the constraint “acres of woodland cleared.” Each route candidate will pass through a different acreage of woodland. The minimum might be 0.25 acre; the maximum might be 10 acres. So the range of "impacts to woodland" is 0.25 to 10 acres. This can be translated into a "score" with the route with minimum impact being 1 and maximum impact being 9. The same minimum/maximum and range calculation is used to develop scores for every criterion such that they are all scored between 1 (which is "better") and 9 (which is "worse"). A score of 1 is much better then 9, a score of 2 is a little worse than 1. So the score reflects how much better or worse one route is to the rest according to each criterion. The scores for all the attributes can then be added up to come up with a combined route score. "Better" and "worse" can be subjective, but in this case better simply means there is less of a constraint or more of an attribute. Worse means there are higher numbers of constraints counted, and lower numbers of attributes.

Based on the data collected and route scores, the routes were ranked first by individual category (*i.e.*, Land Use/Cultural, Ecological, and Technical) then overall. Table 3-1 shows the 28 routes sorted by overall score. The scores by category are also shown. These routes are also presented as a graphic bar chart in Figure 3-3 (Appendix 4-1). The graph illustrates that the scored routes ranged in overall score from 55 to 188. The top ten routes scored from 65 to 84 and, in ascending order, are Routes 3, 17, 27, 24, 10, 28, 15, 26, 1, and 9.

- Route 3 is the lowest (*i.e.*, most favorable) scoring route and follows the west side of I-71 for most of its length then transitions to the eastern side at Kenwood Country Club then leaves I-71 at Red Bank Road, following that to the southern tie-in.
- A large group of routes scored in the 90s to low 100s (4, 5, 8, 16, 25, 21, 7, 12). The most poorly scoring routes included 2, 22, 13, 20, 18, and 11. Route 11 had the highest numeric score by a wide margin (indicating it scored poorly according to the criteria) and is a western route that uses Cornell Road to head west then returns along Section Road. Route 18 is similar to Route 11 but makes the westward connection along Glendale-Milford Road rather than Cornell Road. Routes 2, 13, 20 and 22 are all combinations of I-71 and Blue Ash Road, some with the southern connection along Plainfield, Woodford, and Kennedy Roads.

Selection of Top Ranking Routes

Duke Energy Ohio used the numeric siting study and ranking to help evaluate and filter the 28 routes and focus on those that would present the most feasible routes while also having relatively low overall impacts. Based on the route scoring and a constructability review, Duke Energy Ohio selected three primary route corridors to present during the public information meeting to solicit public input as the top scoring quartile of routes fell into these corridors. These were Routes 27, 26, and 28. Route 28 is a combination of several routes generally following I-71 that individually scored well, was introduced later in the scoring process, and ultimately scored among the top routes. Route 27 was identified as the "Green Route," Route 26 as the "Pink Route" and Route 28 as the "Orange Route." A description of each is provided below and they are illustrated on Figures 3-1 (aerial map) and 3-2 (topographic map) in the RSS (Appendix 4-1). Note these are the routes as they appeared at the first two public information meetings. The routes were adjusted before the third meeting, after review of initial public comments.

Green Route Alternative: The Green Route is the most western of the three routes the siting team took to the first two public information meetings. The Route begins at WW Feed Station and heads west to Conrey Road and then south to cross under I-275 near the Blue Ash Sports Center then turns west to Reed Hartman Highway. The Route travels south along the east side of Reed Hartman Highway as far as Osborne Boulevard where it crosses to the west side of Reed Hartman Highway. The Route then continues south towards Summit Park (former Blue Ash Airport), where it turns west to follow the south side of Glendale-Milford Road. At Plainfield Road, the Route switches to the north side of Glendale-Milford Road, then again to the south before reaching a Norfolk Southern railroad in Evendale. The Route heads south paralleling the railroad and Reading Road (US-42) through the communities of Evendale, Reading, Roselawn, and Golf Manor to the Norwood Station on Line V.

Pink Route Alternative: The Pink Route presented at the first two public information meetings begins at the WW Feed Station and follows the same alignment as the Green Route as far as the Plainfield Road/Glendale-Milford Road intersection. From the intersection the Pink Route heads south along the east side of Plainfield Road, switching to the west side on Blue Ash Golf Course property until reaching Cooper Road. From there the route heads south, somewhat parallel to Line A for short distances, heading behind the University of Cincinnati Raymond Walter's campus and through residential areas, crossing Hunt Road before paralleling the south side of Ronald Reagan Highway for a short distance. The Route heads south through additional residential area before turning west parallel to East Galbraith Road then south to parallel Ridge Road. The final leg of the Route leaves Ridge Road to head west through Losantiville Country Club then south along its western boundary until the southern tie-in to Line V at Norwood Station.

Orange Route Alternative: The Orange Route presented at the first two public information meetings begins at WW Feed Station and heads southwest to School Road, then south along Conrey Road. The Route heads east along Kemper Road for a short distance before turning south along Deerfield Road as it passes under I-275. The Route then turns east through mixed commercial and wooded land to I-71, which it parallels as far south as Pfeiffer Road/Glendale-Milford Road. The Route follows Glendale-Milford Road to the west before turning south along Reed Hartman Highway, following it turning east along Malsbary Road. The Route then heads south first paralleling Kenwood Road then the I&O/SORTA Railroad (outside the ROW and with several deviations) until reaching East Galbraith Road. The Route heads east following East Galbraith Road to the Kenwood Mall area where it turns south to parallel I-71. It generally follows I-71 with numerous small deviations until Red Bank Road, which it then generally follows to the southern tie-in to Line V in the Fairfax area.

The entire siting process, methodology, and results are described in further detail in the RSS report in Appendix 4-1.

(D) COMPARISON TABLE OF ROUTES, ROUTE SEGMENTS, AND SITE

Table 3-1 of the RSS report (Appendix 4-1) provides details of score results for the route alternatives presented at the Public Meetings. These tables include the individual category scores (ecological, cultural resources, land use, and technical) for each route alternative and the corresponding relative rank of each.

(E) PUBLIC INVOLVEMENT AND ADDITIONAL STUDIES

Duke Energy Ohio Project Webpage: Duke Energy Ohio developed an informational web page for the Project at: http://www.duke-energy.com/ohio/natural-gas/central-corridor.asp

This web page provides background information on the Project: need, scope (maps, letters to residents, questionnaires), construction sequencing, expected schedule, and information about public meetings and other announcements. The web page also provides e-mail and phone contact information if there are any questions that the public may have about the Project. Project information in the form of answers are also posted on the webpage in response to Frequently Asked Questions (FAQs).

Public Relations Team: Duke Energy Ohio has and will continue to proactively engage with local officials and residents of the communities during the Project planning process. A public involvement team comprised of Duke Energy Ohio employees and consultants was assigned to facilitate and implement the following tasks to help capture and respond to public input:

- Answering project hotline (513-287-2130) Monday through Friday from 8:30 a.m. – 4:30 p.m., with voice mail option after hours, and responding to customer questions.

- Front-line response and forwarding of customer inquiries that come in via the project e-mail address: CentCorridorpipeline@duke-energy.com.

- Developing, logging, and maintaining a dynamic customer comment database detailing each hotline call, project e-mail, OPSB docket filing, etc. and how each was handled.

- Maintaining hard copies of all public input received via e-mail and the OPSB docket.

- Creating and maintaining a master list of questions, sorted by topic of concern, that have been received from the public, obtaining answers, and responding back to the customer. This FAQ list is also posted and updated periodically on the project website.

- Research and writing of special information/updates to be posted on the project website, http://www.duke-energy.com/ohio/natural-gas/central-corridor.asp.

- Scheduling field survey visits with stakeholders as needed.

Initial Meetings with Local Government Officials: Between February 3, 2016, and February 19, 2016, representatives from Duke Energy Ohio met with officials of 12 potentially affected communities (Sycamore Township, Madeira, Fairfax, Amberley Village, Columbia Township, Norwood, Golf Manor, Blue Ash, Silverton, Deer Park, Sharonville, Reading) to discuss the upcoming pipeline Project. Project details such as the need for the pipeline, size, pressure, and the approximate time line of the Application and construction duration were discussed. Additionally, a map of three potential routes was reviewed.

First and Second Public Informational Meeting: The first Public Information Meeting for the Project was held on March 22, 2016, at the Sycamore Township Community Center at 11580 Deerfield Road near the north-central zone of the Project area. Duke Energy Ohio displayed poster boards of the three proposed routes in addition to blue colored possible engineering re-routes for each alternative routing corridor. In addition, several GIS mapping stations were set up and available to members of the public so that they could identify their properties and to suggest alternatives and have comments recorded. Comment cards were also available at all the stations. Safety, ROW, siting, real estate, construction/engineering experts, and OPSB Staff were on hand to answer questions. Approximately 50 members of the public attended this open house. Comments generally included concern over Project need, size, scope, safety, and potential routing close to residential areas, particularly on private property in back-yards.

A second open house was held at Pleasant Ridge Montessori 5945 Montgomery Road, near the south-central zone of the Project area, on March 23, 2016 with the same format as the first open house. Approximately 70 members of the public attended, and there were similar comments received focusing on Project need, size, scope, safety, and routing close to residential areas.

Meeting with Blue Wing Terrace and Blue Ash Residents (April 20th): Duke Energy Ohio representatives were requested to attend a meeting by Blue Ash Councilman Marc Sirkin to be held at the Blue Ash Municipal Center at 4343 Cooper Road on April 20, 2016. The purpose of the meeting was to answer concerns and questions from Blue Ash residents regarding the Project. Duke Energy Ohio accepted this request, initially providing a summary of the Project as given at the first two public meetings but the meeting quickly moved into addressing the numerous questions from the Blue Ash residents for the remainder of the meeting. The questions were focused on the central route option presented at the public meeting (which is proposed to be routed through Blue Ash, in addition to other communities) and on the size and pressure of the proposed pipeline, pipeline safety, construction activities, and routing concerns. Duke Energy Ohio encouraged the attendees at this meeting to also make their concerns known to the OPSB with comments that could be filed directly to the Public Utility Company (PUCO) docket for the Project. Duke Energy Ohio provided brochure information not only on the Project but also the OPSB public involvement and approval processes.

Route Adjustments Between Public Information Meetings 2 and 3: Following the initial Public Information Meetings, the comments received were reviewed, and additional review of the three candidate routes, constructability analyses, and engineering adjustments were conducted. Based on the review and comments, the routes were refined and in some cases minor re-routes were made. These were made for several reasons; a lower impact alternative was identified, there were significant engineering issues to resolve (often existing infrastructure or insufficient clearance), or there were encroaching structures. Changes to the Green and Orange Routes are described below as they ultimately became the Preferred and Alternate Routes in the Application. Similar adjustments were made to the Pink Route, but are not described here as the option was eliminated.

The changes along the Orange Route from the alignment shown at the first two public information meetings to the routes presented at the third public meeting and as included in this Application include:

1. The route north of School Road has been realigned to head due south after the first bend and runs between the former Green Bay Packing facility instead of following the west edge of the facility.

2. Originally, the Orange Route turned and followed East Kemper Road at the intersection with Conrey Road. The adjusted route continues to run south along Conrey Road and across the parking lot between two large commercial buildings before rejoining the original route on Deerfield Road.

3. There is a small realignment at the I-275 crossing where the route follows the edge of Robert J. Schuler Sports Complex field for 275 feet before making the road crossing and joining back up with the original route.

4. There is a realignment along the portion of pipeline that parallels I-71 approximately 500 feet past Ashfield Drive. The adjusted route turns west within a commercial complex and joins up with Deerfield Road which it parallels, and then follows Creek Road west, Millington Court south, and then skirts the west edge of the Pavilion Medical Associates property south to the intersection of I-71 and Glendale-Milford Road. It crosses Glendale-Milford Road and runs westward through the Crowne Plaza parking lot before joining back up with and paralleling Glendale-Milford Road on the south side.

5. Approximately 400 feet west of Kenwood Road, the adjusted route deviates from the original route and runs south parallel to the railroad tracks before joining back up with

the original alignment 400 feet east of the eastern extent of Malsbary Road, and continuing south along the tracks.

6. Just north of Ohio Route 126 (OH-126) there is a minor revision, with the route deviating from Blue Ash Road, heading west along Ellman Avenue and south along Floral Avenue.

7. About 750 feet north of the intersection of Blue Ash Road and East Galbraith Road, the route crosses to the east side of Blue Ash Road and then parallels it, turning eastward at East Galbraith Road and paralleling it on the north side instead of the south.

8. Instead of running along the east side of the Kenwood Towne Center property, the route follows the west and south borders of Jewish Hospital and then parallels Kenwood Road along the west border of the Kenwood Towne Center property to just north of I-71 before crossing to the south side approximately 1,000 feet northeast of the previous crossing.

9. The pipeline route no longer crosses Duck Creek north of the I-71/Red Bank Expressway interchange but instead parallels Stewart Avenue until it rejoins the original alignment just south of Madison Road.

10. The adjusted route remains on the east side of Red Bank Road whereas the previous alignment saw the route cross to the west side of the road just south of the I&O/SORTA Railroad line for approximately 1,650 feet before crossing again and resuming its course back on the east side.

11. The adjusted route extends south along Red Bank Road beyond the end of the original route and then in between the commercial buildings surrounding Fair Lane. The current terminus extends approximately 2,000 feet beyond that of the original one.

The changes along the Green Route from the alignment shown at the first two public information routes to the routes presented at the third public meeting and in this Application include:

1. The crossing at I-275 has been moved approximately 134 feet to the southeast, follows the edge of the tree line rather than cutting across the grass areas and paved areas within the ODOT property on Grooms Road. The adjusted alignment crosses Grooms Road approximately 155 feet north of the previous alignment at the ODOT property entrance.

2. The previous alignment followed the east side of Reed Hartman Highway, the adjusted alignment crosses to the west side of the Reed Hartman Highway south of the entrance to the P&G facility at 11511 Reed Hartman Highway. The adjusted alignment crosses back to the east side of Reed Hartman Highway approximately 200 feet south of Cornell Road. Both alignments follow the east side of Reed Hartman Highway until the south side of Osborne Boulevard. The previous alignment crosses the highway at this point, the adjusted alignment remains on the east side of the Reed Hartman Highway until Creek Road where it crosses to the west side of the highway.

3. The adjusted alignment deviates from the previous alignment to the east of Wyscarver Road where it remains on the north side of Glendale-Milford Road as opposed to crossing to the south as the previous alignment. The adjusted alignment crosses Glendale Milford Road approximately 300 feet west of Cunningham Drive.

4. To the north of the Alu Chem Inc. property the adjusted alignment leaves the rail corridor, the previous alignment is adjacent and follows the Alu Chem Inc. property line approximately 450 feet to the east. The adjusted alignment follows the business driveway to the south and southwest for approximately 1,500 feet and crosses the rail corridor where it follows the west side of Pleasant Street. The adjusted alignment follows Pleasant Street to Market Street and remains on the west side of the pavement. The adjusted alignment turns east at East Mechanic Street where it rejoins the previous alignment to the west of 3rd Street. The previous alignment diagonally crossed the City of Reading property at the southern terminus of 3rd Street, the new alignment follows the property lines and moves to the west further to the south to minimize impact on the City of Reading property and rejoins the previous alignment adjacent to the Norfolk Southern rail line.

5. The current alignment remains on the east side of the Norfolk Southern rail line until Losantiville Road where it crosses the rail corridor and rejoins the original alignment.

Third Public Informational Meeting: Based upon route adjustments following the detailed engineering/constructability review, the public's interest in the Project and associated public comments from and after the first two meetings, numerous questions to the phone and e-mail hotlines, and the need for additional time to respond to public comments as they affected Project design, Duke Energy Ohio decided to conduct a third open house. The open house was conducted at the Cooper Creek Event Center at 4040 Cooper Road in Blue Ash, Ohio, on June 15, 2016. This location was selected as it is central to the Project area and had the capacity to handle the expected number of guests.

Approximately 550 members of the public attended. The main concerns expressed by the public at this meeting centered on natural gas pipeline safety related to recent high pressure large diameter natural gas pipeline incidents in other parts of the country and questions over pipeline size and pressure, with doubts that a pipeline of the proposed design was required. Concerns were also expressed over pipeline routing through residential and near other sensitive areas like hospitals, churches, schools, and daycare facilities. In addition, related comments were received that suggested increasing the weight should be given to land use factors in the siting analysis thereby weighting to further avoid routing near potentially sensitive residential and institutional land-uses.

Duke Energy Ohio Meeting with the Hamilton County Commissioners: Duke Energy Ohio representatives met with the Hamilton County Commissioners and local elected officials on June 27, 2016, at the Sharonville convention center, to explain the need for the Project and to answer questions from elected officials in the Project area, including the County Commissioners. More than 250 members of the public also attended this meeting but were given instructions by the County Commissioners that they would not have opportunity to ask questions or otherwise intervene in the proceedings. Duke Energy Ohio executives Jim Henning, John Hill and Gary Hebbeler presented information on Duke Energy Ohio, the need for the Project, the siting process, and on the topics of natural gas pipeline safety and construction methodology. Questions from local elected officials (including Blue Ash, Amberley Village, Golf Manor, Reading, Sharonville, and Evendale) were predominantly concerned with safety, size, the need for a pipeline, and the routing process.

Duke Energy Ohio provided answers to the elected officials, after which several questions were asked by the Commissioners. Duke Energy Ohio commented that the Project has to connect WW Feed Station to Line V as there is a need for additional natural gas supply in the Central Hamilton County, and that there are limited realistic routes available to do that. All options would have to pass through some residential and other sensitive areas to get the natural gas to where it is needed. The Commissioners commented that they would remain engaged in the process on behalf of the public, and would intervene as an interested party in the Ohio Power Siting Board Application process. Commissioner Portune closed the meeting by asking that Duke Energy Ohio to: pause the process, stop sending out survey permission letters, and re-evaluate Project options, including the need for a pipeline. Duke Energy Ohio agreed to stop sending letters during the pause and expressed it was taking a fresh look at pipeline diameters and pressures to confirm the minimum needs to achieve the stated needs of the Project.

Consideration of Heavier Weighting of Land-Use Factors: In response to public concerns over possible land-use impacts, Duke Energy Ohio evaluated the effect of applying more emphasis, or weighting, to land use factors. Increased weighting of land-use factors, relative to the technical and ecological factors, does not significantly change the route score rankings (even when land use is factored at three times as important as technical and ecological factors). It does promote routes that have some ROW adjacent to interstate (*i.e.*, with no residences within) in a few places, but does not change the limitations associated with those routes. The Pink and Orange Routes fare slightly worse, while the Green Route remains the second ranked option. The siting team concluded that if such weighting had been used it would not have changed the routes selected.

Additional Review and Analysis of Eastern Options Beyond the I-275 Loop: Some comments from the public questioned why Duke Energy Ohio did not include an "eastern" option in the routing study. In fact, eastern options were considered at multiple stages in both the initial planning phases and during the first constructability review of the initial routes prior to scoring and ranking. In both cases, eastern routes, although apparently attractive based on the less dense residential development, are significantly longer (ultimately resulting in similar or larger impact totals compared to the central routes) and would require at least one additional lateral to achieve the basic three Project needs. These three needs are each built upon Duke Energy Ohio's charge to deliver safe and reliable natural gas supply to southwest Ohio, as discussed previously in Section A of this Section and in Section 4906-5-02 of the Application.

Eastern routes initially were rejected for basic needs reasons prior to detailed scoring. However, to further respond to comments raised at the public meetings and by local representatives, the Duke Energy Ohio siting team re-visited the eastern option in more detail and collected similar data to the route options scored and ranked in the siting study. It is important to note that this evaluation did not include the additional needed lateral routing impacts. The following general observations were made:

- The eastern routes are up to 3 times longer than the central routes.
- Eastern routes as a group have substantially more ecological issues – predominantly tree clearing and stream crossings with some additional wetland impacts.
- Total land use impacts are generally comparable to or greater than the central routes even though the land-use density is lower. In other words, greater routing lengths but lower development densities ultimately resulted in equal or greater overall land-use impacts.
- Generally lower engineering and constructability challenges as a result of less build-out densities, with some exceptions through denser development "bottle-neck'" areas such as Milford, Eastgate, Newtown, and Anderson Township.

Note, however, that the preliminary routing analysis of these eastern routes does not include the routing impact of at least one additional high-pressure lateral that would have to be constructed across to the central route area to achieve the Project goals. One lateral would likely come from WW Feed Station down into Blue Ash to connect with Line A along the general alignment of Route 26 with the need and location for any additional laterals to be determined. There is therefore no advantage to eastern routes from a siting perspective as they would result in greater overall Project impact.

Based upon further analysis of eastern route alternatives beyond the I-275 loop, Duke Energy Ohio is confident that even the best eastern routes are not better route options, as compared to central routes, in terms meeting Project needs and minimizing overall Project routing impacts. Although not specifically addressed in the analysis, it should also be noted that an eastern alternative would result in significantly increased costs. In addition, an eastern route alternative for this Project would directly benefit Central Hamilton County customers while placing the majority of the routing, easement, and construction impact burden on customers beyond the I-275 loop who would derive less direct benefit from the Project. For all the reasons discussed a

Project though the central area offers the best solution to address the Project need and that is why it is being proposed by Duke Energy Ohio.

Selection of Pipeline Size and Pressure

After close review of the pipeline design and construction needs and listening to concerns raised during the public meetings, Duke Energy Ohio is modifying its preference for a 30-inch diameter pipeline down to a 20-inch diameter pipeline, which is designed to operate at a pressure of approximately 400 PSIG. The 20-inch diameter pipeline is more constructible from an engineering standpoint, within the highly developed nature of the Project area. The 20-inch diameter pipeline will meet the primary purpose of the Project by increasing the natural gas flow through the central corridor, thereby allowing the retirement of the propane-air plants. It will also allow for an improved north/south balance of natural gas supply, and will support the replacement of aging infrastructure. The disadvantage of the 20-inch pipeline is that it will not provide the natural gas throughput to significantly change the north/south supply balance that a 30-inch diameter pipeline could, nor does it allow for future growth within the City. Note that moving to the 20-inch, approximately 400 PSIG option will require upgrades of existing lines in the future throughout the central Hamilton County area, some of which would not be required by the 30-inch, 600 PSIG option.

Final Selection of Preferred and Alternate Routes for the Project

Duke Energy Ohio took three constructible pipeline options to the public open houses where many comments were received. In parallel, Duke Energy Ohio conducted further detailed constructability reviews, and weighed the operational characteristics of each. Based on these reviews, Duke Energy Ohio selected the Orange Route as the Preferred Route and the Green Route as the Alternate Route. As indicated in the routing study, the Orange and Green Routes were similar in overall land use and ecology impacts. Although the Orange Route is within 1,000-feet of more residences than the Green Route, the Orange Route directly affects less residential land. Only 1,871 linear feet of pipeline would be located on residential land under the Orange Route scenario, compared to 3,516 linear feet for the Green Route. This is largely because residential land use along the Green Route is in older, denser communities, leaving fewer options for avoiding direct impacts to residential properties. However, Duke Energy Ohio considered both options constructible, hence their selection as the Preferred and Alternate Routes.

Duke Energy Ohio selected the Orange Route as the Preferred Route because it best meets the three purposes of the Project while being one of best scoring routes. It allows for the retirement of the propane-air plants, improves the north/south balance of natural gas in the central/southern Hamilton County area, and supports the replacement of aging infrastructure. Furthermore, connecting Line C314V to Line V in the Fairfax (*i.e.*, at the Orange Route connection) area provides the most favorable flow balance both east and west on Line V, allowing additional flow to replace the propane-air plants. The Orange Route option also provides more pressure and flow towards the California Station, providing the ability to more directly offset flows from the Foster Station through pipeline AM04. And with the additional natural gas capacity provided by the Orange Route, it relieves the dependency on other pipelines in the area.

The Green Route was selected as the Alternate Route as it would also allow for retirement of the propane-air plants and would generally improve the north/south supply balance. However, because the Green Route would connect to the Line V to the west of or at the Norwood Station, it offers less opportunity to directly offset natural gas flow from the south through the California Station and would increase the system dependency on Norwood Station, which limits the flexibility for pipeline replacement. Further, although the Green Route takes advantage of a more industrial corridor, the number of residences within 100 feet of the Route (198 residences) is greater than those for the Orange Route (157 residences), due to older, more densely developed communities.

Although the Pink Route adequately meets the purposes of the Project, it was ultimately eliminated from consideration as the Preferred or Alternate Route. The Pink Route was narrowly identified as the most constructible of the three routes, but it also traverses the most densely developed sections of the Project area. If selected, this route would likely result in the greatest impact to residential properties, a concern expressed repeatedly at the public meetings. Further, the termination of the Pink Route is located near the Norwood Station and similar to the Green Route would increase dependency on the station and reduce the overall flexibility of the system to conduct necessary testing.

DUKE ENERGY

FIGURE 4-1
CONSTRAINT MAP SHOWING CANDIDATE ROUTES
C314V Central Corridor Pipeline Extension Project

ch2m:

APPENDIX 4-1

Route Selection Study Report

Route Selection Study
C314-V Central Corridor Pipeline Extension Project

Prepared for

DUKE ENERGY®

May 2016

Prepared by

ch2m

Contents

Acronyms and Abbreviations

Application	Application for Certificate of Environmental Compatibility and Public Need
AREMA	American Railroad Engineering and Maintenance Association
Certificate	Certificate of Environmental Compatibility and Public Need
GIS	Geographic information system
I&O	Indiana and Ohio Railroad
NHD	National Hydrography Dataset
NWI	National Wetland Inventory
OHI	Ohio Historical Inventory
OPSB	Ohio Power Siting Board
Project	C314V Central Corridor Extension Project
PSIG	Pounds per Square Inch
PUCO	Public Utilities Commission of Ohio
ROW	Right-of-Way
RSS	Route Selection Study
SORTA	Southwest Ohio Transit Authority

1 Introduction and Project Overview

1.1 Nature and Purpose of the Project

Duke Energy Ohio is proposing to construct the Project as part of its long-term planning process to retire propane-air plants, balance system supply from north to south, and support the replacement of aging infrastructure. The proposed Project will consist of installing approximately 13 miles of new, 20-inch diameter natural gas pipeline from the southern terminus of Line C314, an existing high pressure 24-inch natural gas pipeline at a point near the intersection of Hamilton, Warren and Butler Counties (known as WW Feed Station), to a location along Line V, an existing 20-inch natural gas pipeline in the Fairfax or Norwood area (Figure 1-1).

Projects of this nature and scope in Ohio require a Certificate of Environmental Compatibility and Public Need (Certificate) from the Ohio Power Siting Board (OPSB), which is part of the Public Utilities Commission of Ohio (PUCO). As part of the Application process for a Certificate, a route selection study (RSS) is required (this document), with the results reported to the OPSB. Among other requirements, the Application rules require the developer to evaluate “all practicable alternatives” within the applicant’s defined study area and ultimately select a preferred and alternate route for the OPSB’s review (this document and Chapter 4906-5-04 of the Application). The purpose of this report is to help meet this RSS requirement, and with the addition of the Application to describe the selection of a Preferred and Alternate Route.

The study area for the Project largely consists of dense residential, industrial, and institutional land use, parklands, interstate highways and railroad corridor. These land uses combined with a general lack of undeveloped land and some challenging terrain offer limited, or constrained routing opportunities. Where there is high-density development and build-out, the remaining opportunities are limited to residential front and back yards, road right-of-way (ROW), and remaining open spaces on commercial and industrial lots; where linear infrastructure exists (existing rail, highway, wire transmission, pipeline transmission), these opportunities were explored in detail. Routing in dense development has to also account for existing electrical, sewer, water, fiber optic, natural gas, telephone, and traffic signal facilities all buried in potential pathways. When exploring routing options adjacent to existing facilities, parallel routing can also become more difficult due to additional construction challenges. The existing buried infrastructure, most notably water and sewer lines, are typically installed under roadways, limiting opportunities for additional buried infrastructure under the roads themselves.

Based on the restricted built-out nature of the study area, Duke Energy Ohio conducted a "constrained" siting study and evaluated multiple opportunities. The opportunities ranged from routing along an existing railroad, using road ROW, paralleling interstate highways, and using the few open areas adjacent to existing roads within private properties. One aspect of the route selection analysis included consulting an engineering contractor to analyze opportunities from a heavily weighted constructability viewpoint and then including those routes in the overall comparative evaluation.

1.2 Summary of the Siting Process

To comply with the OPSB requirements and to assist Duke Energy Ohio with selection of a viable route for construction and operation of the gas pipeline, CH2M used a proven siting process that has resulted in the successful siting of many gas pipeline and electric overhead transmission projects across Ohio and other states. To be effective, a siting narrows the search from a very large number of possibilities down to a manageable set of viable alternatives, using an efficient and defensible methodology. Core siting principles and goals remain the same across many projects but there are unique elements to each project related to geography and land use, environmental and socioeconomic setting, the project's construction requirements, the political climate, regulatory requirements, and the schedule needs of the project. These unique elements influence the siting criteria selected for the RSS. Most projects must contend with a suite of competing commercial, technical, environmental, and land use criteria, requiring a comprehensive, relevant, and effective siting study design. That design should use appropriate data at the appropriate scale to enable the siting team to focus quickly on those areas and corridors with the greatest potential for success. It must also be transparent and effectively communicated.

A siting process helps guide the siting team to use the appropriate methods to achieve the aims of the project. The process, which is illustrated on Figure 1-2, consists of three groups of steps.

1. **Scoping and Delineation of a focused study area:** The first step in a RSS is to develop a focused study area in which to collect detailed constraint and opportunity data. This can be done using raster-based corridors, or through use of geographic features and professional judgment. For this project, there were several land use features such as transportation corridors (e.g., Interstates 71 and 75), high-density residential, industrial and commercial developments, and large forested land areas present that naturally served to both limit the size of the study area and offer opportunities for potential route corridors.
2. **Collection and mapping of "constraint" and "opportunity" data and identification of potential route candidates:** Constraint and opportunity data are collected under three broad headings; land

use/cultural, and technical (engineering/constructability). Multiple individual criteria are collected under these broad headings and are mapped within the focused study area using Geographic Information Systems (GIS). The siting criteria are selected based on their relevance to the project, the study area, and the availability and quality of a data set. Once collected and mapped, the data are used to guide placement of potential routes. These are refined through site visits and review with the siting team.

3. **Scoring and ranking routes:** Once the routes are refined, the siting team establishes a set of metrics through which to score and rank the route candidates.

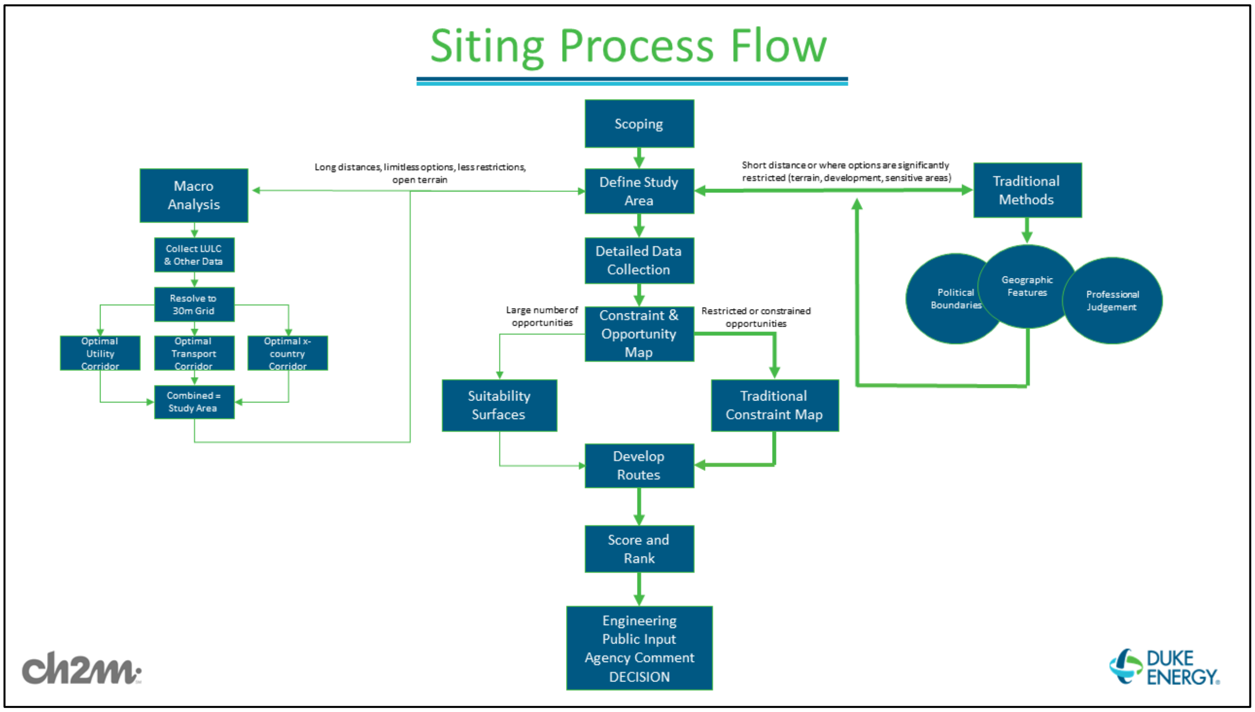
The process flow (Figure 1-2) allows for re-evaluation of routes, corridors, and data at any point in the process. For example, if in step 2 described above, the number of corridor options proves insufficient, or the process identified the same broad corridor, the project requirements can be “loosened” to increase the number of route candidates. In the same way, information received from public informational meetings can be introduced into the process and incorporated into the outcome.

For this pipeline siting study, the urban nature of the study area produced a variety of physical barriers and limitations. The majority of the acreage within the study was actually unavailable for pipeline development. Therefore, it was appropriate to use “traditional” methods to define the study area, and an assessment of macro land-use and engineering limitations to identify initially some possible route corridors. These physically “possible” locations were then further refined and a series of “candidate” routes was developed, then refined, and scored and ranked. One of the most critical evaluations performed during the candidate route evaluation stage was the assessment of the viability of the existing railroad ROW that runs generally north-south through the center of the project area.

1.3 Study Area Characteristics

A fold out map of the study area of this RSS including constraints is included as Figure 1-3. The study area for the project encompasses approximately 90 square miles of the eastern and northeastern Cincinnati Metropolitan Area. The area can be very roughly defined by Interstate 275 (I-275) to the north (although the northern tie-in is 1 mile north of I-275), the Mill Creek Valley to the west, the Little Miami River to the east, and the Duck Creek Valley (now occupied by the Norwood Lateral) to the south. Additional route opportunities were also considered outside of the Study Area including routes through Madeira and Indian Hill that were identified by the engineering contractor as part of the heavily weighted constructability analysis.

FIGURE 1-2
Siting Process Flow



From the broad, flat Mill Creek and Little Miami River valleys, terrain rises steeply from approximately 480 feet to more than 800 feet above mean sea level. This creates some steep valley sides and incised tributary valleys, which account for the majority of the undeveloped land in the study area. Steep slopes in the area have a history of instability, making development in those locations impractical. The Mill Creek, Little Miami, and Duck Creek River valleys link up and trace the former course of the Ohio River prior to the most recent glaciation. The remnant valley is wide and relatively flat; it is also an important source of groundwater, these features helped spur the development of the Mill Creek Valley with light and heavy industries and the supporting distribution, infrastructure, and domicile networks. The river valleys also offer pathways for rail and major highways to the north and northeast. The area between the valleys is very densely developed with residential areas, commercial and industrial land uses.

The northern endpoint for the project is the existing terminus for the C-314 (WW Feed Station) pipeline located within a fenced gravel pad in an industrial area about a mile north of I-275. A railroad (operated by the Indiana and Ohio Railroad, but is owned by SORTA – the SORTA\I&O Railroad) runs north to south, adjacent to the east of the station and continues south-southwest into the community of Norwood where is joins an east-west railroad. The southern termination point for the Project is the existing Duke Energy Ohio Line V that runs east to west from the intersection of Varelman Avenue and Cartage Avenue in the west to I-71 and Ridge Avenue in the east. The southern terminus was selected as a variable end point, i.e. the Project could connect anywhere along its length within the study area, as Line V will need to be upgraded in the near future irrespective of the Project.

The study area is developed with several prominent north-to-south trending highways and railroads, which include I-75 and a Norfolk Southern rail track to the west, I-71 to the east, State Route 42 in the center and the I&O/SORTA railroad that runs from the north to the southwest. Intersections with I-71 and Reed Hartman Highway lie about a mile to the southeast and southwest, respectively.

I-71 provides a prominent north-south corridor through the study area a mile to the east of the northern tie-in. Development adjacent to I-71 includes a mix of dense industrial, commercial, and residential land uses. A large pocket of industrial/commercial development is located in the southwest corner of the intersection of I-275 and I-71 along with dense residential development in the southeast corner. Johnson Nature Preserve (an urban park owned by the City of Montgomery) lies just southeast of the intersection of I-71 and I-275.

Dense residential development continues on the eastern side of I-71 unbroken for about 4.5 miles until it reaches the City of Kenwood. Here land use is predominantly retail and commercial, with Kenwood Mall located on the west side of I-71 and a mix of office and commercial business on the east side of the Interstate. The west side of I-71 from I-275 south to Kenwood includes about one mile of commercial and industrial development which gives way to dense residential developments for the remainder of the way south to Kenwood.

Generally, the land use east of I-71 is residential, right up to edge of the interstate ROW in many places, with pockets of retail and office development. Terrain to the south becomes increasingly steep, resulting in a “greener” appearance to the landscape as much of the steep land is not suitable for development and has been left as woodland. Communities to the east of I-71 include Montgomery, Indian Hill, and Madeira and Kenwood. South of Kenwood the terrain on either side of I-71 becomes increasingly steep, making development outside the Interstate ROW very difficult. Often the highway and the on/off ramps either are in cuts or located on steep embankments. Kenwood Country Club is located on the east side of I-71 adjacent to the south of Kenwood Mall and is located on an elevated plateau above the highway and an auto dealership, located within a cut below highway elevation. South of this are areas of mixed residential and commercial/industrial land use. There are few, if any, open and undeveloped areas. In addition to the almost fully developed nature of the I-71 corridor, a system of noise attenuation barriers/walls is present along both sides of the highway for much of its length. Residential back yards are located all the way up to the barriers in many locations.

I-75 effectively marks the western limit of the study area presented in this RSS and runs north south along the highly industrial Mill Creek Valley. The Mill Creek valley has an extensive gravel aquifer. The valley has been the location of much of Cincinnati's heavy industry for many years. I-75 crosses I-275 approximately four miles west of the northern project tie-in. Land uses between the tie-in and I-75 include Sharon Wood State Park, residential development, and increasingly industrial development close to I-75. Heavy industry and warehouse land use dominates the eastern side of I-75 from I-275 in the north until the Lincoln Heights/Reading area about four miles to the south. South of Reading, both sides of the interstate are very densely developed with mixed commercial, industrial, and residential land uses and several rail sidings. The dense development, along with the presence of the Mill Creek, makes routing in this area a challenge. While there is often more physical room to place routes through industrial areas, the Mill Creek valley has a long history of contaminated sites and those already undergoing remediation. Potential for existing contamination must be taken into consideration when evaluating possible new buried pipeline routes.

East-west major divided highways through there area include I-275, Ronald Reagan Cross County Highway (SR-126) and the Norwood Lateral (SR-562). SR-126 is a four-lane, limited access highway that connects I-71 and the town of Montgomery to I-75 and points to the west. It offers some limited opportunities to connect potential north-south pipeline routes along its largely residential land uses. It passes through Blue Ash where there is a large area of commercial and industrial development. Additional industrial development is present where SR-126 crosses I-75. SR-562 also joins I-71 and I-75 but effectively defines the southern boundary of the project study area. SR-562 passes through the communities of Norwood and the northern portion of Saint Bernard. The entire length of SR-126 is developed with dominantly industrial and commercial land uses.

Non-divided highways and major roads that cross the study area east to west include (not a comprehensive list), listing north to south; Kemper Road, Cornell Road, Glendale-Milford Road, Cooper Road, Galbraith Road and Montgomery Road.

The termination point for the original C-314 pipeline (which is the northern tie in point for this project at WW Feed Station) is located adjacent to a short abandoned section of a railroad ROW. The rail line becomes active as the I&O/SORTA Railroad just south of the tie-in point. The I&O/SORTA Railroad line runs south for 1,600 feet before gently curving to the southwest. Land use along the railroad north of I-275 is a mix of medium density industrial and warehousing, with many of the buildings built right up to the edge of the tracks (for loading and unloading when they actively used rail transport), limiting available space for further development. The railroad line passes under I-275 before passing adjacent to a ball field (on the west side) and a small lake, Carter Lake, on the east side. The line continues through a mix of commercial and residential areas, most notably the City of Blue Ash where there is an increased density of commercial land use. In the city of Blue Ash, the railroad line passes behind a strip mall, close to residential back yards before passing through a corridor that is made up of the railroad, Blue Ash Road, gravel and asphalt parking and a residential service road. The rail line passes under SR-126 then through increasingly dense residential areas as it passes through older suburbs of the city (Rossmoyne, Silverton, Deer Park, and Kennedy Heights). South of SR-126 the terrain becomes a little steeper with residential development right up the edge of the railroad easement and occasional drop-offs and embankments adjacent to the railroad ROW.

The study area includes multiple City of Cincinnati districts and small cities, towns and communities. Most of these have long since grown together into an indistinguishable urban/suburban landscape, but they nevertheless maintain their jurisdiction identities. The non-city of Cincinnati communities in the study area include; Sharonville, Blue Ash, Evendale, Montgomery, Kenwood, Dillonvale, Arlington Heights, Reading, Deer Park, Amberley Village, Silverton, Golf Manor, Norwood, Madeira Fairfax, Columbia Township, and Sycamore Township. City of Cincinnati neighborhoods include Pleasant Ridge, Kennedy Heights, Bond Hill, Madisonville, and Roselawn.

Based on the nature of the project and the characteristics of the Project area, the siting team developed the siting steps detailed in the next section of this report.

2 Siting Study Steps

2.1 Developing a Focused Study Area

For this Project, there were several current land use features such as transportation corridors (e.g., Interstates 71 and 75), high-density residential, industrial, and commercial developments, and large forested land areas present that naturally served to both limit the size of the study area and offer opportunities for potential route corridors. Therefore, the western project boundary was generally I-75, the eastern by I-71 and Montgomery Road, and the southern by the Line V tie-in.

2.2 Data Collection and Constraint Map Preparation

Prior to placing candidate routes, it is necessary to prepare a constraint/opportunity map. That map guides the placement of routes to locations that are more compatible with the project and away from less compatible locations. A copy of the constraint map is provided as Figure 1-3. Constraints represent those features on the landscape that we seek to avoid (e.g. wetlands, residential areas), opportunities are those features that we seek to site along or close to (e.g. existing utility ROW, undeveloped areas). The steps involved in constraint map development include; selection of a basemap (typically aerial photographs and/or USGS 7.5-minute topographic quadrangle maps); selection of opportunity and constraint data, and collection and mapping of that data.

2.2.1 Siting Constraint and Opportunity Data

CH2M and Duke Energy Ohio used a set of evaluation criteria to compare the routes numerically to one another. The criteria are collected under three broad headings; land use/cultural, and technical. Multiple individual criteria were collected under these broad headings (Table 2-1). The siting criteria were selected based on their relevance to the Project, the study area, and the availability and quality of the data sets. Similar data has been used successfully on many previous projects, and typically evolves based on changes in regulations, the nature of the study area, and new data availability. Table 2-1 provides the type of data, its source and a comment on why it is relevant when siting a pipeline. It is important to note that what is important often depends on one's perspective or area of interest. The siting team tried to select criteria that allowed comparison of route options based on their anticipated impact/effect on the land use, aesthetics, ecology and cultural resources of the area. The routes have to be technically feasible so technical criteria are considered. An additional qualitative review of the scoring and ranking is conducted by the siting team in a follow-on step, and includes public and agency input.

TABLE 2-1
Siting Constraints and Opportunities

Criteria	Source	Rationale
Linear feet of woodlots crossed	Digitized from 2015 aerial photograph	Constraint: If the ROW crosses a wooded area, the trees within the ROW must be cleared permanently - Required to report on by OPSB and potential loss of habitat, screening and visual effects for residents, as well as a cost for clearing. Avoid or minimize.
Linear feet of NWI wooded wetlands	U.S. Fish and Wildlife Service	Constraint: Wooded wetlands (or PFO) within 100 feet would require clearing. PFO is considered more sensitive than non-PFO wetland. PFO does trigger a greater level of permitting and mitigation. Avoid or minimize.
Linear feet of NWI non-wooded wetlands	U.S. Fish and Wildlife Service	Constraint: Impacts to wetlands trigger additional permitting cost and schedule issues. Agencies seek to avoid, minimize, or lastly, mitigate for impacts to wetlands. Avoid or minimize.
Number of Streams Crossed	USGS	Constraint: Stream crossings are a sensitivity for pipeline projects, and may require clearing riparian vegetation, horizontal boring beneath, open-cut; scrutinized by OPSB as well as potentially increasing the permitting requirements for the Project. Avoid or minimize.
Linear feet of endangered, threatened, or protected species crossed and number of endangered, threatened, or protected species within 1,000 feet	ODNR, Division of Wildlife	Constraint: T&E Species and Habitat are reviewed by the USFWS, ODNR, and OPSB. It is better to avoid known locations in the siting study. Often potential habitat extends over a wide area, or information can be dated. Avoid and maximize distance from.
Linear feet of managed areas crossed and Number of managed areas within 1,000 feet		
Number of National Register of Historic Places (NRHP) locations within 1,000 feet	Ohio Historic Preservation Office	Constraint: Potential view shed impacts. Avoid where possible.
Number of Cemeteries within 100 feet		Constraint: Potential view shed impacts. Avoid where possible.
Number of residences within 100 feet	CAGIS (Cincinnati Area GIS) & Aerial Photography	Constraint: Residences and residential areas are avoided where possible, and being further away from residences is preferred. A lower number of properties crossed is preferred for public impact considerations, schedule, and cost.
Number of residences between 100 and 1,000 feet		
Number of Residential Parcels Within 1,000 feet		
Number of institutional land uses within 1,000 feet (Schools, Hospitals, Churches)	Environmental Sciences Research Institute	Constraint: Potential viewshed impacts and required reporting by OPSB. Aim is to avoid and maximize distance from.
Number of sensitive land uses within 1,000 feet (Airports, Parks, preserves, golf courses, conservation sites)	Environmental Sciences Research Institute	Constraint: Potential viewshed impacts and required reporting by OPSB.

TABLE 2-1
Siting Constraints and Opportunities

Criteria	Source	Rationale
Number of road crossings	CAGIS	Constraint: Road crossing permits during construction
Linear feet of pavement crossed	Digitized from 2015 Aerial	Constraint: Follows existing disturbed corridor and limits fragmentation of property
Number of railroad crossings	CAGIS	Constraint: Railroad crossing require a permit and often involve additional engineering measures. Minimize number of crossings.
Linear feet of segment paralleling existing electric line ROW	Duke Energy Ohio	Attribute: Follows existing disturbed corridor and limits fragmentation of property. Maximize this where possible.
Linear feet of segment paralleling existing natural gas line ROW		Constraint: In this Project this was a constraint, because if insufficient space to safely allow for construction, and the existing line would likely have to be taken out of service.
Length of route (in feet)	Developed from GIS Data	Constraint: The shorter the length, the less to potentially impact sensitive land uses and less cost. Shorter is better.
Linear feet of slope >15 percent	CAGIS (Cincinnati Area GIS)	Constraint: Steep slopes present construction difficulty, are a problem with stormwater erosion, and can present long-term engineering problems. It is better to avoid steep slopes if possible. Maximize gentle slopes minimize steep slopes
Linear Feet of Segment Paralleling Roads	CAGIS (Cincinnati Area GIS)	Attribute: Follows existing disturbed corridor and limits fragmentation of property, and provides good construction access
Linear Feet of Segment Paralleling Railroads	CAGIS (Cincinnati Area GIS)	Attribute: This was regarded as an attribute as using existing corridors typically results in lower impacts to other land uses.
Parcels Crossed by 50-feet ROW	CAGIS (Cincinnati Area GIS)	Constraint: A lower number of properties crossed is preferred for schedule, cost, and public impact considerations.
Linear feet requiring specialized resource-intensive engineering and construction techniques	CAGIS (Cincinnati Area CIS), Duke Energy Ohio	Constraint: These areas require additional considerations to mitigate risk.
Linear feet affected by AREMA regulations	Developed from GIS Data	Constraint: These guidelines require additional considerations for construction and ROW maintenance. This constraint captures those areas that both parallel railroad and are affected by AREMA guidelines.

The evaluation criteria include both attribute and constraint data. Attribute data represents possible features that would promote the development of a gas transmission line, whereas, constraint data correspond to areas that would limit the development of a gas transmission line (i.e. residential areas). Using the evaluation criteria, preliminary route centerlines were identified by the siting team.

2.2.2 Placement of Initial Centerlines

Consideration of the I&O/SORTA Railroad Corridor

From the beginning of the project, Duke Energy Ohio recognized routing though the project area would present challenges. Therefore, the ability to use space within the I&O/SORTA railroad ROW was initially considered and evaluated as a possible option. Duke Energy Ohio maintains a legacy agreement with SORTA, originally negotiated with the I&O Railroad, that allows for development of electric and gas transmission and distribution infrastructure within the ROW. This agreement was primarily established to simplify new electric and crossings of the rail line rather than parallel development. Much of the available space within the ROW was already developed with overhead electric transmission and distribution poles prior to the agreement.

Initial studies on the railroad option suggested that there was sufficient physical space along the railroad ROW for long sections of new pipeline with only scattered locations where available space narrowed. The team conducted a helicopter survey along the railroad and followed up with a windshield survey at publically accessible locations. Observations made during the initial windshield surveys included assessing the proximity of structures to the railroad tracks and identifying possible diversions away from the railroad where space appeared to be too confined. The windshield survey also highlighted some of the terrain challenges particularly towards the southern end of the project. In addition, the presence and location of existing utilities was observed and recorded. Two routes were identified and scored that paralleled the railroad (these are described later in this section).

The siting team produced a GIS layer that identified locations where the known railroad ROW provided sufficient physical space for the pipeline trench (initial thoughts were that the project needed 15 feet between the tracks and the edge of the trench and 15 feet between the edge of the trench and the closest structure).

As the railroad option was further evaluated, Duke Energy Ohio consulted with a specialized railroad consultant regarding the applicability of specific construction guidelines and standards for pipeline construction within and close to active railroads. Based on that review, it was concluded that the AREMA Guidelines were applicable to the project even though the track was defined as low volume low speed. Section 5.1 of the American Railroad Engineering and Maintenance Association (AREMA) Guidelines specifies requirements for natural gas pipelines in the vicinity or railroads.

The Duke Energy Ohio siting team reviewed these guidelines for siting focused limitations and identified the following:

- Longitudinal pipelines should be located as far as possible from any track.
- They must not be located parallel within 25-feet from the centerline of any track.

The siting team modified the GIS layer based on the AREMA limitations by re-identifying possible construction opportunities within the railroad ROW using existing railroad, the railroad ROW as indicated on scanned ROW maps, existing adjacent structures, and the "non-construction" exclusion of 25 feet from railroad centerline. Based on these layers, the siting team was able to identify those areas of railroad ROW where construction of the pipeline was theoretically "possible". The results indicated there were actually few locations where the project could be located within the railroad ROW. In addition to the AREMA guidelines, additional challenges to using the railroad in light of AREMA were identified, these included:

- Variation of the historical railroad ROW along its length. In some locations, the width is not well defined or recorded and there are many potential encroachments. Resolving uncertain ROW boundaries has the potential to have significant schedule impacts even for those areas that do appear to have sufficient room for the project.

- The ROW is much too narrow in places, with insufficient clearance between the edge of the active tracks and adjacent structures. Where there is sufficient space it is often occupied by existing utilities.

- The southern portion of the railroad enters some challenging terrain, with narrow row and steep sides. With buildings and other utilities almost adjacent, there is simply no room for the pipeline.

Although short stretches of the railroad ROW may be suitable for the project, the final determination was that unfortunately the rail line does not present a viable route from north to south. To utilize the railroad corridor, Duke Energy Ohio would have to purchase the railroad corridor along with any existing contracts, and this option is not compatible with I&O's current use and SORTAs possible future light rail plans. The siting team refocused on additional identification of candidate routes that were practical through the study area.

Placement of Candidate Route Centerlines

Preliminary centerlines were placed based on the constraint mapping, review of aerial photography, topographic maps, and the collected attribute and constraint data. The intent when placing these centerlines was to avoid residences, sensitive land uses, existing structures, wetlands, forested areas, and, where practical, to follow existing developed corridors such as roads and existing transmission/ distribution lines. Terrain was also an important factor as steep slopes were avoided to the extent practical. Duke Energy Ohio's technical preferences included:

- Structures were to have a minimum of 15 feet separation distance from the centerline of the pipeline.
- Where routes follow Interstate Highways, they must be outside Ohio Department of Transportation (ODOT) ROW by a minimum of 10 feet.
- On other roads in the area, try to remain outside the road ROW and away from existing water and sewer lines except where crossing.
  - When crossing a road ROW, crossings are to be perpendicular to the extent feasible.
- Terrain with a slope over 25 percent was considered to need additional engineering and environmental controls for construction, with a preference to avoid where possible.

The siting team explored using the available ROW's and areas adjacent to existing ROW's through the area, I-71, I-75, Norfolk Southern Railroad (near I-75 and not as congested as the I&O Railroad corridor), sections of the original I&O Railroad (outside the ROW and where possible), and adjacent to roads throughout the area. Generally, the siting team attempted to avoid residences as practical, preferring commercial/industrial areas, and open areas such as golf courses and parklands where these land use conditions were encountered. Some residential areas were unavoidable when placing potential routes, so when encountered, the siting team attempted to place the route through properties where the residence with deeper set back from the road is able to allow as much room as possible between the pipeline easement and the residence. The siting team also recognized that residential back yards are typically considered more to be private-spaces compared to front yards, and as such they were avoided wherever possible. The size of buildings and the need for parking and shipping/receiving space in commercial and industrial areas created potential space for the pipeline to be routed through these areas and the team utilized that space for several candidate routes.

The resulting candidate routes were assigned numbered nodes at turning points and segment intersections for descriptive purposes. After the candidate routes were identified and mapped, the siting team conducted an additional windshield survey of the area and routes were refined and adjusted. Through the process over 100 route segments were identified, resulting in over 75,000 possible route combinations. A map showing the extensive set of preliminary route options is included as Figure 2-1 through Figure 2-9.

As an additional step at this stage, Duke Energy Ohio retained an engineering consultant to separately review the candidate routes for constructability and to propose additional possible routes for consideration. Because of that constructability review, some of the route segments were adjusted and several additional routes were added to the evaluation. In addition, from this evaluation, some of the initial route alternatives ended up being not considered due to the challenges discovered through this process. This secondary review/opinion was deemed necessary due to the congested nature of the project area and the associated engineering and constructability challenges discussed previously.

The routes ultimately resolved themselves into several main corridors. Summary descriptions of these route groups are provided below. For brevity, these are not intended as detailed descriptions. Each route is identified on the figures provided.

- **Western Route Options:** Six western routes were identified, 7 (Figure 2-2), 8 (Figure 2-3), 10 (Figure 2-3), 11 (Figure 2-4), 17 (Figure 2-6), and 18 (Figure 2-8). All use a common route from Glendale-Milford Road to the southern tie-in with existing Line V. From Glendale-Milford Road the line parallels the eastern side of a two-track railroad through industrial areas before crossing US 42. The route then passes along 3rd Street through residential land before generally following a railroad (with several small route diversions) through industrial/commercial land use to the southern terminus. Three main options were identified to connect the routes from Glendale Milford Road to the northern tie-in point. These include:

  - Routes east along Glendale Milford Road then north along Reed Hartman Highway, east along Glendale-Milford Road then north along the railroad with several small route diversions.

  - Routes east along Cornell Road (further north than Reed Hartman Highway) then north along Reed Hartman Highway, east along Glendale Milford Road then north along the railroad with several small route diversions.

- **Central Railroad Options:** Two options (Routes 5 and 6) were identified that parallel the I&O/SORTA Railroad through the center of the Project area (Figure 2-2). As discussed earlier, review of these routes indicated they were likely non-constructible based on AREMA guidelines and space constraints. Nevertheless, they were retained for comparative scoring purposes. Route 5 was developed outside the existing railroad ROW and Route 6 was developed inside the existing railroad ROW. These route options were ranked and scored even though the routes were not feasible to construct.

- **Central Option:** One route (Route 25) was identified through the central portion of the study area that did not utilize significant portions of the railroad or Interstate ROW (also shown on Figure 2-8). This option utilized sections of residential roads and highways, and passed through residential and industrial neighborhoods. This route leaves WW Feed Station at the north end, passes through an open area adjacent to the Summit Woods office Park before turning west then south to follow Reed Hartman Highway for a short stretch. The route leaves Reed Hartman Highway just to the north of Creek Road where it passes through an area of mixed commercial and residential land use before heading west along Glendale-Milford Road and south along Plainfield Road. After a short westward turn onto Cooper Road the route heads south through mixed wooded and residential area before heading west to parallel SR-126 (Ronald Reagan Cross County Highway). The route then passes through additional mixed residential and commercial area before paralleling East Galbraith Road, then Ridge Avenue to the south. The route also passes adjacent to Losantiville Country Club before reaching the southern tie in.

- **Central/Railroad & I-71 Combinations**: Thirteen of the initial 25 routes scored use a combination of I-71 and the central railroad. These are identified in the following figures and include Routes 2 (Figure 2-1), 4 (Figure 2-2), 9 (Figure 2-3), 12 (Figure 2-4), 13 (Figure 2-5), 14 (Figure 2-4), 15 (Figure 2-5), 16 (Figure 2-6), 19 (Figure 2-7), 20 (Figure 2-7), 21 (Figure 2-7), 22 (Figure 2-8), and 24 (Figure 2-8). The northern portions of combined I-71/Railroad routes use three main corridors to get from WW Feed Station to the vicinity of Glendale-Milford Road. These are Reed-Hartman Highway, I-71, and the Railroad. From this point south, the non-I-71 options follow the railroad with jogs away, or Kenwood Road. At East Galbraith Road, an east-west connector links the I-71 options with those along the Railroad and Kenwood Road. South of Galbraith the Kenwood Road option joins the I-71 Routes after passing along the western edge of Kenwood Mall. The railroad option continues south until it reaches Section Road where it follows Plainfield Road to the south, Woodford Road to the west then Kennedy Avenue and Highland Road to the southern termination point.

- **I-71 Options:** Two options were identified that paralleled the I-71 corridor (Figure 2-1). These include Route 1 and Route 3. Although other routes use portions of the I-71 corridor (outside the ROW), Routes 1 and 3 are the only two routes that follow I-71 for the majority of the length of the project. Route 1 follows the east side of the Interstate, while Route 3 follows the western side. Route 23 was identified east of I-71 through the communities of Loveland, Madeira, and Indian Hill. This was the longest of the route options and while it exhibited a low to moderate land use score and had a low number of dense residential areas affected (comparable number to the other well scoring routes), there was a significant acreage of woodland impact, a large number of stream crossings, numerous slopes, and the route was the longest of all routes.

3 Scoring and Ranking Routes

Once the routes were established, they were evaluated according to the attributes and constraints identified earlier. Raw data for each segment was collected, quantified, and then normalized to a dimensionless parameter (a "score") according to its suitability. Lower scores indicate "better," higher indicate "worse."

Normalizing the data into a score is one way to directly compare the constraints. It also allows the data categories to be weighted if desired. The following formula, which is easily incorporated into a spreadsheet or geographic information system (GIS) attribute data table, was used to normalize the raw data:

Normalized Score = ((Xij – Min Valuej) / Range) *100

where: i = x^{th} value in constraint (or the observed value to convert to a score)

j = constraint

This formula takes an observation for a route, for example residences within 100 feet and compares it to all the other residence observations for the other routes. It assigns a scale of 0-100 to the range of the data and converts every data point to its relative score within that range. So if the range of observations for residences is from a minimum of 25 to a maximum of 350, the range is 325 (350-25). If our observation is 45 it is converted into a score by: ((45-25)/325)* 100. The raw count of 25 residences is converted to a residence score of 6.15/100.

This normalizing method means there is no "bunching" of the data and avoids one constraint category being unintentionally influential. Essentially, it uses the data from the project to establish the range so the routes can be compared to one another. Having the best score does not mean a route is "good" or "bad" according to any external standard, it just means it is comparatively "better" or "worse" than the other routes evaluated for the project according to the data collected. It is a way to sort the huge volumes of relevant and useful data collected and guide the siting team in their decision making.

Ecological constraints, such as woodlots, National Wetlands Inventory, and stream riparian zones were calculated within 50-feet to account for potential construction impacts and clearing of trees. Residences and Ohio Historical Inventory (OHI) structures were considered out to 1,000 feet from the centerlines to reflect potential construction related impacts. The various technical constraints and attributes were measured either as feet or miles paralleling existing infrastructure or as a count for centerline crossings. The following is a summary of the evaluation and results.

3.1 Discussion of Ecological Constraints

Ecological features and constraints mapped included woodlots, streams, wetlands, threatened and endangered species, protected species, and managed areas. Woodlots were primarily concentrated on steep slopes, golf courses and other parkland and recreational spaces in the project area. Sharon Woods State Park, located just south of I-275 and between I-71 and I-75, contains a recreational lake, gold course, walking trails, and streams. Given the urban setting, there were few significant other ecological constraints and most confined to parks and recreational areas. Woodlots crossed by the candidate routes ranged from a low of 9,176 feet for Route 19 (which follows the railroad for more than half of its length) to the maximum of 56,563 feet for Route 23, the eastern route. Generally, as a group the western routes cross the least amount of woodlots. Railroad routes generally had low woodlot impacts, while the Routes following I-71 tended to have high woodlot impacts. Wetlands were not a significant factor in differentiating the routes. Only one NWI wetland was identified near Route 23.

The number of streams crossed ranged from three for the railroad routes (Routes 5 and 6) to 21 for Route 11. Generally, routes that followed the railroad tended to cross less streams. Route 23 and the I-71 Routes also had a relatively large number of stream crossings. Managed areas crossed ranged from zero for many of the routes to 6,462 for Route 11, a western route. Several of the western routes fared poorly according to this metric, as did Route 23.

Combined Ecological Scores: Once normalized and combined, scores for the ecological constraints ranged from the most favorable of 9 for Route 10, to the least favorable score of 64 for Route 11. Four out of the six western routes were in the bottom half of the rankings. Those western routes that used Cornell Road fared poorly. Routes that used the railroad tended to be in the top half of the ecological ranking.

3.2 Discussion of Cultural and Land Use Criteria

Cultural criteria identified with respect to the candidate routes included two NRHP structures and one cemetery. The siting study included categories for OHI structures and archaeological sites, but no occurrences for these other categories were found. Recorded cultural resources data should be treated with caution at the siting phase of a project because the data are only available for locations where studies have been conducted. A lack of data might simply mean there has never been a study conducted in that location. For these reasons cultural resources as a constraint is assigned a fairly low weight in the overall scoring of the project. Although it is recognized that cultural resources are important, it is the quality and availability of reliable data that requires careful consideration.

Given the highly developed nature of the Project area, land use was a significant factor in comparing the route candidates. One of the primary constraints (i.e. land uses to avoid) was residences. The number of residences within 100 feet of the routes varies from a minimum of 118 for Route 24 (a route close to I-71) to 510 for Route 11 (a western route option). The pattern is repeated for residences between 100-1,000 feet where there were 2,257 residences identified for Route 3, (an I-71 route) and 5,978 for Route 5. When residential parcels are considered, Route 17 has the least within 1,000 feet (2,277), while Route 5 has the greatest at 5,978. Broadly, western routes, I-71 Routes, and the far eastern routes tended to have the fewest number of residences within 1,000 feet of the routes, while the central routes tended to have the greatest number.

Institutional land uses were avoided to the extent practical when placing routes, so there are surprisingly few identified within 1,000 feet of any of the routes. The route with the least number (6) in this category was Route 25, a western route through residential and commercial areas (this route avoids the major roads). In general, the western routes and routes along I-71 tended to have fewer occurrences in this category. The central/railroad routes all tended to have the most occurrences in this category, not surprising given the built-up nature of the central area.

Sensitive land uses included golf courses, parks, and recreational areas and ranged from a minimum of 31 for Routes 28 and 15, to 58 for Route 23. As a group, the western routes appeared to rank poorly in this land use category.

Combined Land Use and Cultural Score: Once the criteria were combined and scored, the most favorable routes overall in terms of land use were Routes 1 and 3, both I-71 Routes. Routes 15, 17, 25 and 27 also scored well. These are a combination of I-71 Routes (1 and 3), a western route (17), and a central route (25). The most poorly scoring routes in terms of combined land use and cultural included Route 11 (western route that returns to the southeast of the project area for the southern tie-in), and routes that use Blue Ash Road/I&O/SORTA Railroad.

3.3 Discussion of Technical Criteria

Technical criteria considered for the Project included road crossings, rail crossings, paved area crossed, proportion of route requiring special engineering techniques, and length paralleling road, rail, electric, and gas ROW.

Road crossings for a pipeline project can be disruptive to businesses, residents and to temporary traffic flow, therefore it is desirable to avoid and minimize them. The number of road crossings ranged from 34 for Route 1, to 81 for Route 20. Route 20 is a central route, which is routed along and across many streets. Generally, routes that followed established corridors, notably I-71 and the railroad routes tended to cross fewer streets than those routed through residential areas, and the western routes.

Paralleling roads in road ROW was regarded by Duke Energy Ohio as a negative criterion because of the disruption to traffic and existing water and sewer infrastructure, additional permitting during construction, and the need to disrupt traffic again potentially whenever maintenance is required. The length of road paralleled by the route alternatives ranged from 3,377 feet for Route 23, to 12,564 feet for Route 11. Generally, routes that used Blue Ash Road in the center of the Project area scored most poorly, along with Route 11 which is a western route that uses road ROW to head east in the northern portion of the study area and return in the southern part of the study area. The better scoring routes included the central route (Route 25) that uses space between residential neighborhoods, the far eastern Route 23, and Routes 5 and 6, the I-71 routes that are outside I-71 ROW.

Pavement crossing is a negative issue in terms of engineering because hard surfaces have to be excavated at greater level of effort, and there is an additional cost in terms of materials and effort to replace the hard surface (asphalt and concrete). The amount of hard surface crossed by the routes ranged from a minimum of 1,556 feet for Route 28, to 17,517 for Route 7. Route 28 is located away from other linear corridors and use non-road space between residential neighborhoods. The railroad routes and I-71 routes also scored well in this category, as well as Route 23, the far eastern route. The railroad route with diversions (Route 5) scored poorly, as it required significantly more length along roads and parking lots.

Railroad crossing require additional engineering and have to comply with depth, casing and other specific requirements, so minimizing these is desirable when considering routing options. The number of crossings ranged from 1 for Routes 25 and 28, to 19 for Route 10. Route 10 is a western option that uses the I&O/SORTA Railroad corridor before heading west and crossing the Norfolk Southern railroad several times. Not surprisingly, all the railroad routes score relatively poorly in terms of rail crossings. Central routes and the I-71 corridors generally have the fewest crossings.

Paralleling railroad refers to some portion of the proposed route being within railroad ROW. This triggers a suite of additional engineering requirements. Duke Energy Ohio therefore preferred to minimize the amount of rail ROW used for the project. Railroads are present through the center of the Project area (the I&O/SORTA Railroad) and the western edge of the Project (Contrail railroad). Linear feet within rail ROW ranged from a minimum of 50 feet for Routes 25 and 28, to 33,613 feet for Route 6. Route 6 is located within I&O/SORTA ROW. All but two of the routes (Routes 5 and 6) parallel less than 5,000 feet of rail ROW. Route 5, although close to the I&O/SORTA railroad, does leave ROW to divert away where there are space constraints so the length of ROW is 12,168 feet.

Duke Energy Ohio regarded closely paralleling existing transmission (within 15 feet) as a negative engineering issue due to the additional protection measures required to prevent induced current issues in the pipeline. Due to the congested nature of the project area a factor that would usually be considered a positive in a RSS was a negative instead. The length paralleling electric transmission ranged from a minimum of 2,246 feet for Route 23 to 9,039 feet for Route 7. The majority of routes fell into the 4,500 to 6,000-foot range. The western routes generally paralleled the most transmission line because there is a transmission line oriented north to south along the western edge of the study area. Residential/non-interstate and railroad routes generally followed the least transmission.

Duke Energy Ohio regarded closely following existing natural gas transmission (within 15 feet) as a negative due to construction and reliability concerns; therefore, there was a desire to minimize the length of existing natural gas line that the proposed routes paralleled. Due to the congested nature of the project area, a factor that would usually be considered a positive in a RSS was a negative instead. The length paralleled ranged from a minimum of 875 feet for Route 6 (a I&O/SORTA route), to 8,170 feet for Route 18 (a western route). The routes that followed the most existing natural gas pipeline were the central routes and several of the western routes. The eastern, I-71 and I&O/SORTA routes tended to parallel the least gas transmission lines.

Slope is a concern in terms of general construction, pipeline installation and longevity due to slope failure, storm water control, and maintenance activities; therefore, there is a desire to minimize construction on steep slopes. The siting team measured the length of each route that crossed slopes greater than 15%. The length of route crossing steep slopes ranged from a minimum of 7,720 feet for Route 21, to more than 35,000 feet for Route 23 (the far eastern route). Generally, those routes that used the southeastern portion of the study area fared poorly in this category, because the steepest terrain is located in that area. These routes include 2, 11, 14, and 18; a combination of I-71 routes; and those western routes that head back to the east at the southern end. Routes that used the central part of the study area, including the I&O/SORTA routes tended to score better in this category.

The number of property parcels crossed by the 50-foot ROW of each proposed route candidate ranged from 295 for Route 28, to 707 for Route 20. Generally, routes that passed through the central and southeast part of the study area crossed through the most parcels. These included Routes 12, 13, 19, 20, 21, and 22, all combinations of central and I-71 routes. The least parcels were crossed by the eastern route where lots are larger, and several western routes (excluding those that tie in the southeast portion of the project area.

Duke Energy Ohio evaluated each route with respect to the need for additional engineering difficulties that were not addressed in the other factors. This catchall metric combined terrain for construction methods, existing infrastructure, additional clearances, and local permits. The siting team evaluated the criteria to verify these additional criteria were not already addressed. This ranged from 15,561 feet for Route 6, to 38,242 feet for Route 23. Terrain is clearly an issue for Route 23 more than any other route. The I&O/SORTA routes (5 and 6) score relatively well in this category because although there are challenges, terrain is less of a factor and the AREMA issues are captured in a separate metric. AREMA guidelines affect only railroad routes, therefore those that use more rail ROW are most adversely impacted. These include Route 5, 6, then 19, 20, 21, 9, and 16. All of these follow the I&O/SORTA railroad for some of their length.

Combined Technical Score: Once all of the technical sub-criteria were scored and combined, they were ranked. Engineering scores ranged from 14 to 62. A lower score is most favorable. Routes 25 and 28 scored most favorable followed by 1, 3, and 24. This group of routes does score significantly better than the rest of the routes and comprise the central routes and combinations of I-71, railroad, and Kenwood Road routes. The most poorly scoring routes included several western routes and routes that used the railroad and Blue Ash Road (Routes 19 and 20).

3.4 Ranking and Selection of Routes

Based on the data collected and route scores, the routes were ranked first by individual category (i.e. Land Use/Cultural, Ecological, and Technical) then overall. Table 3-1 shows the 28 routes sorted by overall score. The scores by category are also shown. These routes are also presented as a graphic bar chart in

Figure 3-3. The graph illustrates that the routes ranged in overall score from 55 to 188. The top ten routes scored under between 55 and 84 and included Routes 3, 17,27, 24, 10, 28, 15, 26, 1, and 9.

- Route 3 is the best overall scoring route and follows the west side of I-71 for most of its length then transitions to the eastern side then leaves I-71 at Red Bank Road, following that to the southern tie-in. This route has quite a number of backyard impacts as it follows I-71 but scores well as much of the scoring corridor is I-71 easement.

- Routes 17 and 27 are essentially the same route that uses Reed Hartman Highway to Glendale-Milford Road, then south along the western edge of the study area through industrial land uses.

- Route 24 follows I-71 to the Blue Ash area, then Kenwood Road/Towne Road until rejoining I-71 to the southern tie-in.

- Route 10 is a western route, heading south close to the I&O/SORTA railroad then west along Glendale-Milford Road before heading south along a combination of Norfolk Southern Railroad, Reading Road and through industrial areas to the southern tie-in.

- Route 28 began as an attempt to use the I-71 ROW but because of the lack of space between residences, the sound walls and the interstate, this option jogged away from I-71 to pass along Blue Ash Road and Reed Hartman Highway before returning to parallel I-71 where there is more room at its southern end.

- Route 15 is a combination central and I-71 route. It uses Reed Hartman Highway, Kenwood Road, I-71 and finally Red Bank Road to join Line V in the Fairfax area.

- Route 26 is a central route using a combination of Reed Hartman Highway, Cooper Road, Glendale Milford Road, Cross County Highway, Galbraith Road, Ridge Avenue and cross-country stretches to tie in at the western side of the southern tie-in.

- Route 1 is a route that follows the I-71 corridor all the way south to Red Bank Road before to connect to Line V in the Fairfax area.

- Route 9 is another central and I-71 combination route. It follows Deerfield Road to Blue Ash Road before following I-71 then Red Bank Road to the Fairfax area tie-in to Line V.

A large group of routes scored in the 90s to low 100s (4, 5, 8, 16, 25, 21, 7, 12). The most poorly scoring routes included 2, 22, 13, 20, 18, and 11. Route 11 was the lowest scoring by a wide margin and is a western route that uses Cornell Road to head west then returns along Section Road. Route 18 is similar to Route 11 but makes the westward connection along Glendale Milford Road rather than Cornell Road. Routes 2, 13, 20 and 22 are all combinations of I-71 and Blue Ash Road, some with the southern connection along Plainfield, Woodford, and Kennedy Roads.

Selection of Top Ranking Routes

Duke Energy Ohio used the numeric siting study and ranking to help evaluate the 28 routes and focus on those that would present the most feasible routes having the least number of overall impacts. Based on the route scoring and a constructability review, Duke Energy Ohio selected three primary route corridors to present during the public information meeting to solicit public input. These were Routes 17, 26, and 28. Route 28 is a combination of several routes generally following I-71 that individually scored well, eliminated many of the constructability issues identified along those other I-71 routes, was introduced later in the scoring process, and ultimately scored among the top routes. Route 17 was identified as the "Green Route," Route 26 as the "Pink Route" and Route 28 as the "Orange Route." A description of each is provided below and they are illustrated on Figures 3-1 (aerial map) and 3-2 (topographic map).

Green Route Alternative: The Green Route is the most western of the three routes the siting team took to the first two public information meetings. The Route begins at WW Feed Station and heads west to Conrey Road and then south to cross under I-275 near the Blue Ash Sports Center then turns west to Reed Hartman Highway. The Route travels south along the east side of Reed Hartman Highway as far as Osborne Boulevard where it crosses to the west side of Reed Hartman Highway. The Route then continues south towards Summit Park (former Blue Ash Airport), where it turns west to follow the south side of Glendale-Milford Road. At Plainfield Road, the Route switches to the north side of Glendale-Milford Road, then again to the south before reaching a Norfolk Southern railroad in Evendale. The Route heads south paralleling the railroad and Reading Road (US-42) through the communities of Evendale, Reading, Roselawn, and Golf Manor to the Norwood Station on Line V.

Pink Route Alternative: The Pink Route presented at the first two public information meetings begins at the WW Feed Station and follows the same alignment as the Green Route as far as the Plainfield Road/Glendale-Milford Road intersection. From the intersection the Pink Route heads south along the east side of Plainfield Road, switching to the west side on Blue Ash Golf Course property until reaching Cooper Road. From there the route heads south, somewhat parallel to Line A for short distances, heading behind the University of Cincinnati Raymond Walter's campus and through residential areas, crossing Hunt Road before paralleling the south side of Ronald Reagan Highway for a short distance. The Route heads south through additional residential area before turning west parallel to East Galbraith Road then south to parallel Ridge Road. The final leg of the Route leaves Ridge Road to head west through Losantiville Country Club then south along its western boundary until the southern tie-in to Line V at Norwood Station.

Orange Route Alternative: The Orange Route presented at the first two public information meetings begins at WW Feed Station and heads southwest to School Road, then south along Conrey Road. The Route heads east along Kemper Road for a short distance before turning south along Deerfield Road as it passes under I-275. The Route then turns east through mixed commercial and wooded land to I-71, which it parallels as far south as Pfeiffer Road/Glendale-Milford Road. The Route follows Glendale-Milford Road to the west before turning south along Reed Hartman Highway, following it turning east along Malsbary Road. The Route then heads south first paralleling Kenwood Road then the I&O/SORTA Railroad (outside the ROW and with several deviations) until reaching East Galbraith Road. The Route heads east following East Galbraith Road to the Kenwood Mall area where it turns south to parallel I-71. It generally follows I-71 with numerous small deviations until Red Bank Road which it generally follows to the southern tie-in to Line V in the Fairfax area).

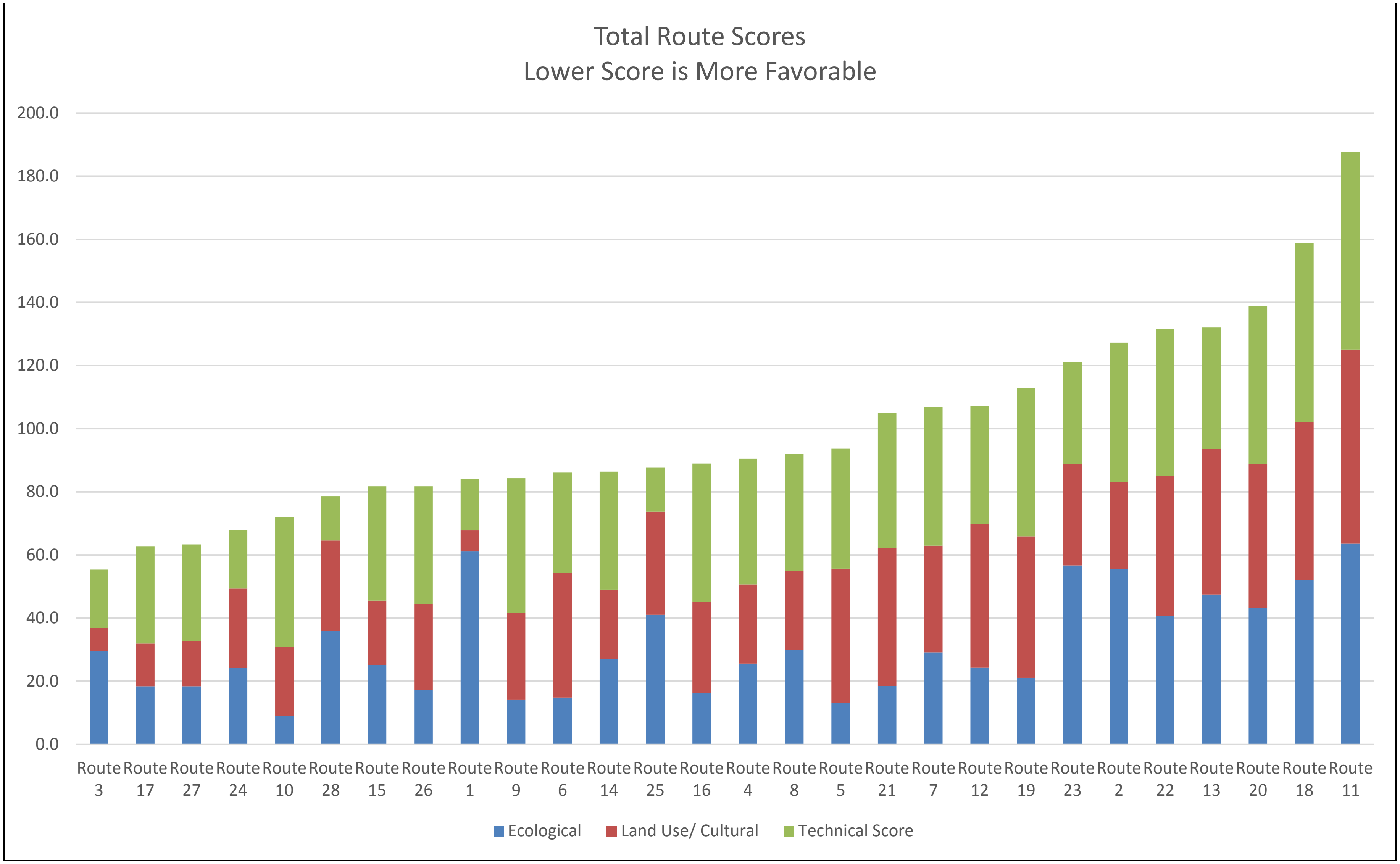
TABLE 3-1
Route Scoring and Ranking Table

Routes	Ecological Score	Ecological Rank	Land Use/ Cultural Score	Land Use/Cultural Rank	Technical Score	Technical Rank	Total Score	Final Rank
Route 3	29.6	17	7.2	2	18.5	4	55.3	1
Route 17	18.4	7	13.6	3	30.7	6	62.6	2
Route 27	18.4	7	14.3	4	30.7	6	63.4	3
Route 24	24.2	11	25.2	9	18.5	5	67.8	4
Route 10	9.0	1	21.8	6	41.1	18	72.0	5
Route 28	35.9	19	28.7	14	14.0	2	78.5	6
Route 15	25.1	13	20.4	5	36.2	10	81.7	7
Route 26	17.3	6	27.2	11	37.2	12	81.8	8
Route 1	61.1	27	6.7	1	16.3	3	84.1	9
Route 9	14.2	3	27.4	12	42.7	19	84.3	10
Route 6	14.8	4	39.5	19	31.8	8	86.1	11
Route 14	27.1	15	21.9	7	37.4	13	86.4	12
Route 25	41.0	21	32.7	17	13.9	1	87.6	13
Route 16	16.2	5	28.9	15	43.8	21	89.0	14
Route 4	25.6	14	25.1	8	39.8	17	90.5	15
Route 8	29.8	18	25.2	10	37.0	11	92.1	16
Route 5	13.2	2	42.5	20	38.0	15	93.7	17
Route 21	18.5	9	43.6	21	42.8	20	104.9	18
Route 7	29.2	16	33.8	18	43.9	22	106.9	19
Route 12	24.3	12	45.5	24	37.5	14	107.3	20

TABLE 3-1
Route Scoring and Ranking Table

Routes	Ecological Score	Ecological Rank	Land Use/ Cultural Score	Land Use/Cultural Rank	Technical Score	Technical Rank	Total Score	Final Rank
Route 19	21.1	10	44.8	23	46.9	25	112.8	21
Route 23	56.7	26	32.2	16	32.2	9	121.1	22
Route 2	55.6	25	27.5	13	44.1	23	127.3	23
Route 22	40.7	20	44.5	22	46.5	24	131.7	24
Route 13	47.5	23	46.1	26	38.5	16	132.0	25
Route 20	43.2	22	45.7	25	50.0	26	138.9	26
Route 18	52.1	24	49.9	27	56.8	27	158.8	27
Route 11	63.6	28	61.6	28	62.5	28	187.6	28

FIGURE 3-3
Final Scores C-314V Pipeline Project (lower scores are more favorable)



4 Conclusion and Next Steps

Duke Energy Ohio is proposing to construct the C314V Central Corridor Extension Project as part of its Gas System Master Plan to enhance the reliability, flexibility, and integrity of the natural gas system, and to increase the diversity of gas supply to its customers. The challenge of connecting WW Feed Station to the existing Line V is considerable, given the almost completely built-up nature of the north-central Cincinnati metropolitan area. The Duke Energy Ohio siting team considered (in varying degrees of analysis) over 75,000 route combinations and compared them according to 25 different siting criteria that encompassed ecological, land use and technical considerations. The team conducted numerous windshield surveys, two helicopter surveys, a constructability review, and a detailed evaluation or railroad construction (AREMA) guidelines to identify and evaluate potential route options. This reduced the number of routes that were evaluated in detail to 28. These routes were then scored and ranked according to the siting criteria. The siting team used the results to select three top-ranked routes, plus several potential engineering adjustments to present at two public informational meetings. Based on the results of these meetings, Duke Energy Ohio will select a Preferred and an Alternate Route to present in the Ohio Power Siting Board Application. The process of the selection of a final Preferred and Alternate Route will build upon this RSS and be described further in the body of the OPSB Application (Chapter 4906-5-04).