5. GAS PIPELINE ENGINEERING AND OPERATIONAL DESIGN

This section provides details of the design of the gas pipeline that would supply the IGCC Power Station at the West Range Site as such details are known as of the date this Application. To the extent that changes in design details would be subject to review by the Minnesota Public Utilities Commission, the Applicant will submit information regarding such changes and seek a permit amendment, if required, as provided under Minn. R. 4415.0185. As discussed in Section 2, the gas pipeline that would serve the East Range is not the subject of this Application, so detailed information on that pipeline is not included. Also, as noted earlier, the West Range pipeline may be constructed and owned by local municipalities or others.

The West Range proposed gas pipeline route is shown in Figures 5.0-1 and 5.0-2.

Figure 5.0-1
West Range Natural Gas Pipeline Route-North Segment

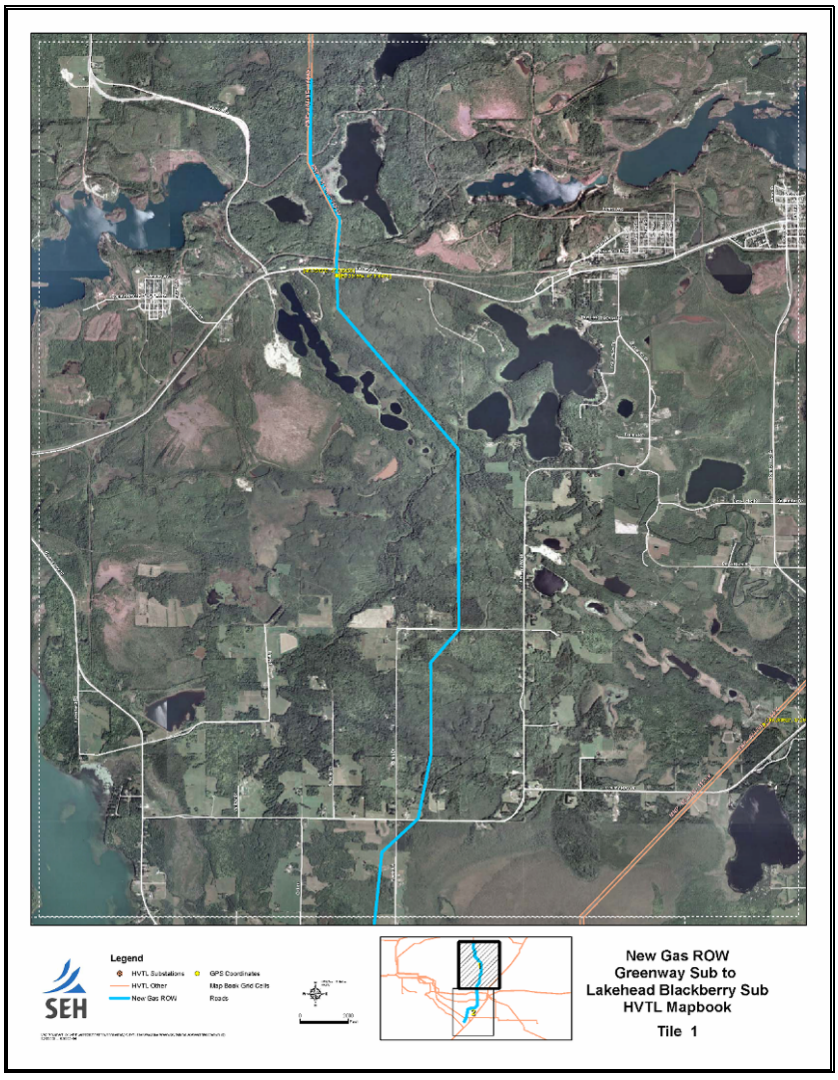
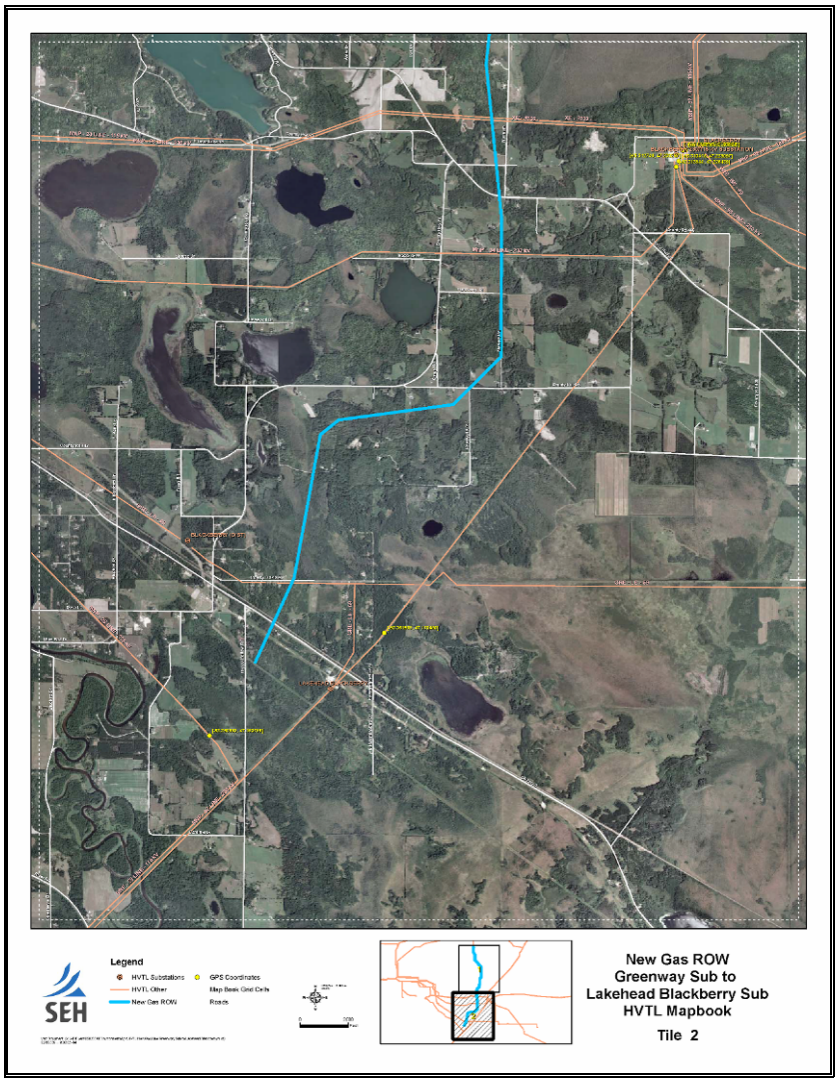


Figure 5.0-2
West Range Natural Gas Pipeline Route-South Segment



5.1 PIPELINE DESIGN SPECIFICATIONS

Pipeline design specifications for 16, 20 and 24 inch diameter pipelines are provided in Table 5.0-1 in accordance with Minn. R. 4415.0120, subp. 1.

Table 5.0-1
Natural Gas Pipeline Design Specifications

Nominal Pipe Size (Inches)	**16 OD**	**20 OD**	**24 OD**
Pipe type	**API 5L, PSL-2, ERW**		
Nominal wall thickness (inches)	0.280	0.312	0.375
Pipe Design Factor	The entire length of the pipeline ia being designed to a Class 3 location design factor of 0.50.		
Longitudinal or seam joint	1.00		
Class location and requirements	The entire length of the pipeline will be considered Class 3 for design and operation purposes		
Specified minimum yield strength (pounds per square inch gauge)	60,000	65,000	65,000
Tensile strength (pounds per square inch gauge)	75,000	80,000	80,000

5.2 OPERATING PRESSURE

The normal and maximum allowable operating pressures for the pipeline are provided in Table 5.0-2.

Table 5.0-2
Natural Gas Pipeline Design Specifications

Nominal Pipe Size (Inches)	**16 OD**	**20 OD**	**24 OD**
Normal Operating Pressure	The normal operating pressure will depend on the status of the GLG lines and the usage requirements of the IGCC Power Station.		
Maximum allowable operating pressure (pounds per square inch gauge)	1050	1014	1016

5.3 ASSOCIATED FACILITIES

Launcher and receiver facilities will be located at each end of the pipeline to allow for cleaning and internal inspection of the pipeline using intelligent pig technology. The only other associated facilities on the right-of-way beside markers required by the DOT will be cathodic protection facilities. These will consist of a rectifier and ground bed whose location will be determined by actual measurement of pipe to soil potentials along the route after the pipeline is installed.

5.4 PRODUCT DESCRIPTION AND CAPACITY INFORMATION

The only product carried in the pipeline will be sweet processed natural gas that is in compliance with the tariff filed by GLG. Material safety data sheets (MSDS) for natural gas and odorant additive are included Appendix 4.

The planned minimum and maximum design capacities of the pipeline are as follows:

A. Planned minimum design capacity – 0 million cubic feet of natural gas per day (0 Mcfd)
B. Maximum design capacity – 210 million cubic feet of natural gas per day (105 Mcfd per Phase)

5.5 LAND REQUIREMENTS

The Applicant or owner will negotiate with landowners for easements to install the pipeline on each individual tract that the route would cross. Generally, the easement terms would allow the operator the perpetual right to construct, maintain, operate, repair, replace abandon and/or remove the pipeline and related appurtenances. It would allow the grantee necessary ingress and egress to accomplish those purposes. The grantor would agree to not build any building in the easement or remove any cover from over the pipeline without the consent of the grantee. Compensation would be determined based on the value of the land at the time the easement is acquired. Landowners will be compensated for any crop damages or other merchantable item losses incurred due to construction activity.

Estimates of land use requirements are provided as follows:

- Permanent right-of-way length, average width, and estimated acreage:

  The total right-of-way length is approximately 13.2 miles. The permanent right-of-way width will be 70 feet. Estimated acreage within the permanent right-of-way is 112 acres.

- Temporary right-of-way (workspace) length, estimated width, and estimated acreage:

  An additional 30 feet of temporary workspace will be acquired along the pipeline route. Estimated additional acreage within the temporary right-of-way is 48 acres. It is anticipated that this space may not be fully utilized but would give construction crews approximately 100 feet of right-of-way for workspace if needed. Localized conditions such as roads, railroads and water body crossings may require additional temporary workspace to complete the installation. When deemed necessary, permission to use temporary workspace will be obtained from landowners adjacent to the permanent right-of-way.

- Estimated range of minimum trench or ditch dimensions including bottom width, top width, depth, and volume of excavation:

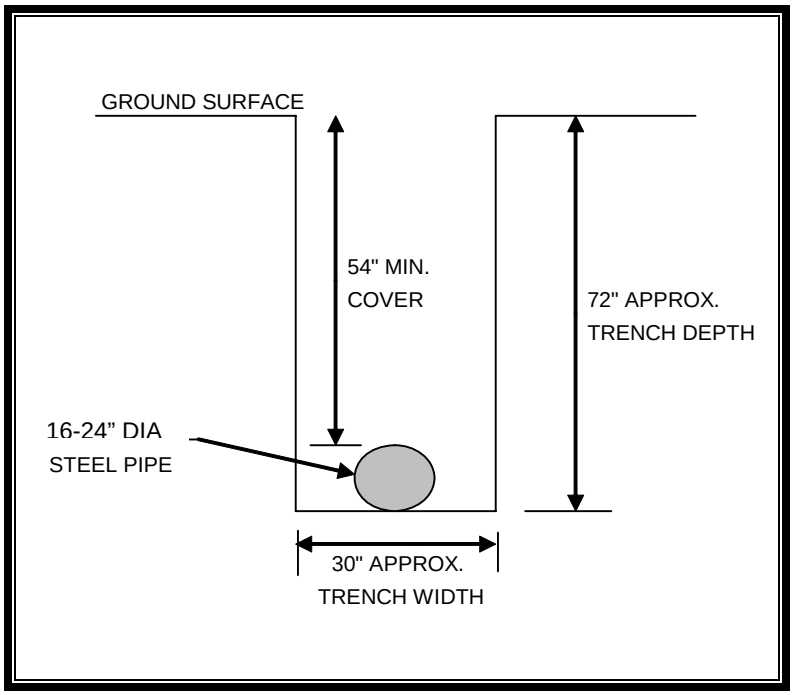
  a. Estimated trench bottom width - 30 inches

b. Estimated trench depth - 72 inches
c. Estimated trench top width - 30 inches
d. Estimated excavation – 40,000 cubic yards

- Minimum depth of cover for state and federal requirements: 54 inches

A typical cross-section for the open trench section of the proposed gas pipeline is shown in Figure 5.5-1.

Figure 5.5-1
Typical Section-Gas Pipeline Open Trench Installation



- Rights-of-way sharing or paralleling: type of facility in the right-of-way, and the estimated length, width, and acreage of the right-of-way:

The proposed pipeline route easements will parallel existing electric transmission ROW for 1.3 miles, existing gas pipeline ROW for 0.9 miles, and proposed electric transmission ROW for 4.2 miles (see Figures 5.0-1 and 5.0-2).

5.6 GAS PIPELINE CONSTRUCTION

The first step in construction of a pipeline is to prepare the Right-of-Way (ROW). The centerline of the pipeline and points of intersection tangents (PI's) will be established by a survey. Staking will be at a maximum of 400-foot intervals. A construction ROW up to 100 feet wide would be cleared. Aboveground vegetation and obstacles would only be cleared as necessary to allow safe and efficient use of construction equipment.

Storage areas up to several acres may be required for storing equipment, pipe, and other materials and would be acquired through negotiations with affected landowners.

When encountered along a ROW, fences would be adequately braced before any opening to the fence is made. Locking gates or appropriate fencing would be installed when construction in the area has been completed. Any damage to fences, gates and cattle guards would be restored to the original condition or replaced. Access and livestock control would be employed during construction to limit impact to the use of the land.

Clearing of the ROW would follow accepted industry practices and sound construction guidelines. In areas where timbering is required, trees would be cut in uniform length and stacked along the ROW based on the owner's preferences. The profile of stumps left from timbering would be as low as possible, and the removal of stumps would be limited to only that necessitated by pipeline installation. Debris created from preparation of the ROW would be disposed of using approved methods during restoration.

After the construction area has been cleared of obstacles and prior to trenching, the area would be graded as necessary to create a relatively flat work surface for the passage of heavy equipment and vehicles for subsequent construction activities. Minimal grading would be required on most of the ROW where the terrain is flat to gently sloping. In particularly difficult terrain, additional construction ROW may be required. Grading and cut-and-fill excavation would be performed to minimize effects on natural drainage and slope stability. On steep terrain or in wet areas where the ROW must be graded at two elevations (i.e., two-toning) or where diversion dams must be built to facilitate construction, the areas would be restored upon completion of construction to original conditions. Excavation and grading would only be undertaken where necessary to increase stability and decrease the gradient of unstable slopes.

The State of Minnesota requires a 54 inch minimum depth of cover in certain areas as detailed in Minn. Stat. § 116I.06, subds. 1, 2, and 3. Specifications will provide for a minimum of 54 inches of ground cover for this proposed pipeline unless waived by the landowner, or to accommodate special construction needs. Federal minimum cover requirements range from 18 inches to 48 inches depending on the circumstances encountered. For most of the proposed route it is anticipated that requirements will call for at least 48 inches of cover over the pipeline.

Most trenching would be performed using a bucket-wheel ditching machine. Conventional tracked backhoes would be used where ground conditions are unsuitable for a ditching machine and if a deeper or wider trench is required. Trench dimensions will comply with applicable land use and regulatory requirements. In wet marshy areas, draglines and clamshells are used to do the ditching. To insure the pipe is buried at the proper depth, the trench will be drained or pumped dry where practicable, or concrete coated pipe is set on weights to overcome any buoyant force. Where the pipe crosses highway or road ditches, the trench or boring is excavated deep enough to provide a minimum of 54 inches of cover over the pipe. All surfaced road crossings will be installed via directional drilling so that traffic flow will not be interrupted. Directional drilling may be used where the natural gas pipeline crosses lakes, rivers and/or streams.

In areas where there is a need to separate top and subsoil, a two-pass trenching process will be used. The first pass would remove topsoil and the second pass would remove subsoil, with soils from each of the excavations being placed in separate banks. This technique will allow for proper

restoration of the soil during the backfilling process. Spoil banks will contain gaps to prevent storm runoff water from backing up or flooding. The Applicant will be required to notify the Commissioner of Agriculture if burial of the natural gas pipeline will impact cultivated agricultural land (as that term is defined in Minn. Stat. § 116.01, subd. 4). The Commisioner may participate and advise the MPUC as to whether to grant a permit for the project and the best options for mitigating adverse impacts to agricultural lands if the permit is granted. The Department of Agriculture would be the lead agency on the development of any agricultural mitigation plan required for such project (this provision also applies to HVTL route permit applications.

The operation of stringing involves the placement of pipe, from a pipe storage facility or from the pipe mill, along the ROW. Pipe will be loaded onto trucks, transported to the ROW, and unloaded by trucks equipped with booms rigged to handle pipe. The pipe would be strung either prior to or after ditching.

After the joints of pipe are strung along the trench and before the sections of pipe are joined together, individual sections of the pipe are bent to allow for uniform fit of the pipeline with the varying contours of the bottom of the trench and to accommodate changes in the route direction. A track-mounted, hydraulic pipe-bending machine is normally used for this purpose when using the size of pipe proposed for this project. The number of degrees of deflection that is allowed in a field bend is limited. Bends required that are greater than that allowed in the field are factory fabricated.

Installation of the pipe, following the bending, commences with internally swabbing the pipe, and aligning the bevels for welding. The weld material is deposited after the proper spacing and alignment of the bevels is accomplished. The line up clamps are held until enough of the weld is completed to assure weld integrity.

A critical phase of pipeline construction is the welding process. Welding is the joining of the individual sections of pipe to form the pipeline, and must be performed by a qualified welder in accordance with welding procedures that meet strict code requirements. Welders must be tested periodically to maintain the rigorous qualifications for certification of pipeline welding.

Every weld will be inspected by radiographic examination to ensure the quality and integrity of the weld. Radiographic examination is a nondestructive method of inspecting the inner structure of welds to determine if any defects are present. Defects would be repaired or removed as outlined in API 1104, which is incorporated by reference in 49 C.F.R. 192.

After welding, the girth weld and the pipe adjacent to the weld must be protected from corrosion. When the field coating or wrapping of the weld is completed, the pipeline is ready to be lowered into the trench. Special side boom tractors spread out along the pipeline simultaneously lift the line and move it over the open trench. The welded string of pipe is then lowered into the trench. An electronic holiday detector is used to monitor the coating during this operation to assure the coating is not damaged.

After the pipe has been lowered into the ditch, the trench will be backfilled. The operation must be performed in a manner that prevents damage to both the pipe and pipe coating from equipment or backfill material. Excess backfill material will be bermed over the ditch centerline to permit

natural settling. Where the ditching process was used to separate top and subsoil, backfill is also installed by placing the subsoil into the trench prior to placement of the topsoil to maintain the soil segregation.

After backfilling, the pipeline will be tested to ensure that the system is capable of withstanding the operating pressure for which it was designed. In this process, the pipeline is filled with water at a pressure equal to 1.5 times the design pressure and is maintained for a minimum of eight (8) hours. Water availability and terrain conditions will determine test lengths, and test water will be disposed of pursuant to permit requirements.

The final phase of pipeline construction involves clean up and restoration of the ROW. Removal and disposal of construction debris and any surplus materials will be a part of the clean up. Restoration of the ROW surface involves smoothing by chisel plow or disc harrows or other equipment, and stabilizing when necessary. In non-cropland, the ROW will be re-vegetated according to agreement with the landowner or appropriate government agency.

5.7 GAS PIPELINE OPERATION AND MAINTENANCE

The pipeline is regulated by the Minnesota Office of Pipeline Safety (MOPS). All facilities proposed for the pipeline project will be designed, operated and maintained in accordance with DOT Minimum Federal Safety Standards in Title 49 of the C.F.R., Part 192. These regulations are meant to ensure adequate protection to the public from failures of natural gas pipelines and related facilities. Part 192 defines and specifies the minimum standards for operating and maintaining pipeline facilities, including the establishment of an Emergency Plan which will provide written procedures to minimize hazards in the event of a gas pipeline emergency. Key elements of the plan include procedures for:

- Receiving, identifying, and classifying emergency events – gas leakage, fires, explosions and natural disasters.
- Establishing and maintaining communications with local fire, police and public officials, and coordinating emergency responses.
- Making personnel, equipment, tools and materials available at the scene of an emergency.
- Priority protection of people, followed by protection of property.
- Emergency shutdown of the system and safely restoring service.

The safety standards specified in Part 192 require each pipeline operator to:

- Develop an emergency plan, working with local fire departments and other agencies to identify personnel to be contacted, equipment to be mobilized, and procedures to be followed to respond to a hazardous condition caused by the pipeline or associated facilities.
- Establish and maintain a liaison with the appropriate fire, police and public officials in order to coordinate mutual assistance when responding to emergencies.
- Establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a natural gas pipeline emergency and report it to appropriate public officials.

Before placing the pipeline in service, the operator must prepare a procedure manual for operation and maintenance of the proposed new pipeline.

Pipeline facilities will be operated and maintained in compliance with MOPS regulations. The Applicant or its operator will become a member of the Gopher State Excavators One-Call system that is vital in helping to prevent damage to underground pipelines by excavators and others engaged in construction activities. Semi-annual inspections of the pipeline right-of-way will be conducted for gas leak detection, and cathodic protection surveys would be conducted annually.

5.8 GAS PIPELINE COST ESTIMATE

The estimated construction cost of the proposed West Range pipeline is $10.2 million.