Schedule C

Excerpts from EGNB
2000 Construction Application

5.1.1 Project Construction Activities

The following is a description of typical pipeline construction activities. Specific environmental protection measures and standard construction specifications are included in the Environmental Protection Plan (See Exhibit H).

Pipeline construction will generally be completed by several crews each performing a specific function to maximize construction progress. In urban areas, construction progress will be slower and will generally be completed by one or two smaller crews that are trained to perform numerous functions simultaneously. Each crew is monitored by an inspector.

Prior to the entry of the contractor's work force on any private property, an EGNB representative will contact each landowner to discuss specific concerns regarding the project. The EGNB representative will verify property details on items such as water well locations, access requirements, and current or future land use.

Discussions with landowners are recorded and the measures agreed to are communicated to the contractor for implementation. The EGNB representative is responsible for being the main contact for the landowner during the construction period.

All utilities (e.g., hydroelectrical lines) and underground facilities (e.g., storage tanks) are located to ensure proper measures are implemented to avoid damage.

5.1.1.1 Route Preparation

Asphalt and aggregate material along the public road allowance will be stripped from over the pipeline trench and workspace to allow for subsequent pipeline construction. Stumps and large rocks removed will be windrowed, buried with landowner permission, or disposed of at approved landfill sites.

5.1.1.2 Trench Excavation

Using a hoe excavator or trenching machine, the contractor will excavate a trench to a depth sufficient to provide a minimum of approximately 0.9 metres of cover over the pipe. The maximum width of the trench will be approximately 0.9 metres.

5.1.1.3 Watercourse Crossings

Trenching across watercourses will be accomplished using one of the following methods:

- horizontal directional drilling (HDD) – HDD involves drilling or boring underneath the watercourse;
- dry crossing – dry crossings are completed by trenching in "the dry" by diverting/isolating the watercourse from the construction zone; or by
- wet crossing – wet crossings are completed by trenching through an open, running watercourse.

The width, depth, and flow of the watercourse, environmental sensitivities, cost, adjacent land use, and soil conditions all influence the choice of crossing method. Prior to construction, designs and drawings will be prepared by EGNB for each watercourse crossing.

5.1.1.4 Pipeline Construction in Wet Areas

Where pipeline construction is required in wet areas and a high watertable causes the pipe to float, special construction methods may be required, including:

- use of concrete saddle weights; or
- use of other weighting measures to overcome pipe buoyancy.

5.1.1.5 Road and Railway Crossings

At railway crossings, EGNB will install the pipe inside a casing pipe, if required by the authority having jurisdiction. Open cut road crossings may be required where ground conditions or other site specific requirements make boring impracticable. In these situations, traffic access will be maintained.

The contractor will install safety barricades, road plates, temporary walkways, signs, and/or flashers, and use flagpersons around any excavation across or along a road allowance that is left overnight or for an extended period of time. Traffic control measures will be required when constructing within urban areas.

5.1.1.6 Pipe Installation

Pipe sections will be delivered to the site with a yellow jacket coating applied prior to shipment. The field welded joints will be coated.

The length of the pipe will be tested with an approved "Haliday detector" to locate any flaws in the coating and all detected flaws will be re-coated. The pipe will be re-tested to ensure there are no coating breaks prior to installation. Pipe will be lowered into the trench using approved slings and mechanical equipment.

At road and watercourse crossings, pipe will be welded in sections, installed with a small specialized crew, and then tied-in to adjacent sections of pipe. In areas of steep slopes, ditch breakers may be installed to prevent migration of water along the trenchline that could wash out the backfill material or cause trench failure.

5.1.1.7 Pipeline Cleaning, Testing and Commissioning

Once the pipeline is complete, the pipeline is cleaned, if required, with internal devices known as "pigs". After cleaning, the pipeline is tested to ensure its integrity for the intended service and maximum operating pressure, using either air or water.

All hydrostatic and air testing will be completed in accordance with the CAN / CSA Z662-96. Water is normally obtained from municipal water supplies. A Professional Engineer

is responsible for the hydrostatic testing and ensures that testing is conducted in such a manner as to protect the safety of people and property in the vicinity of the pipeline.

All necessary permits will be obtained from government authorities for the withdrawal of water for hydrostatic testing purposes. Water is disposed of only at approved locations and in accordance with regulatory requirements.

5.1.1.8 Restoration / Reclamation Activities

Trenches will be backfilled to ground surface using excavated soil and compacted sufficiently not to permit sinkage. The trench will be graded, and re-vegetated, or re-paved.

Where applicable, clean-up crews will reinstate to original conditions and restore sensitive areas such as steep slopes, ditch banks and watercourse crossings.

Re-vegetation of disturbed areas will be conducted as quickly as possible following disturbance to minimize soil erosion.

Reclamation activities at watercourse crossings may include hydroseeding, re-vegetation with shrub species (e.g., willow), and/or the use of rip-rap, jute matting or other erosion control material to stabilize disturbed areas and limit soil erosion until re-vegetation has been successful.

Inspection staff will be used to enforce all EGNB restoration requirements, construction specifications and any conditions imposed by regulatory authorities. Inspectors experienced in pipeline construction or with special knowledge and skills will be hired by EGNB to complete this task.

5.1.2 Project Operation and Maintenance Activities

EGNB will operate and maintain the pipeline in a manner that will provide safe and dependable gas distribution and protect the health and safety of the public, employees, landowners and nearby residents. The pipeline and associated facilities are designed for a life span in excess of 20 years. The actual life of the pipeline could continue for much longer if required for gas distribution service.

Prior to operational startup, EGNB will develop and provide to the Board, policy manuals for the operation and maintenance of project facilities. These policies will include pipeline maintenance, compliance with applicable permits, handling of hazardous materials and waste disposal as well as an Emergency Procedures Manual.

5.1.3 Routine Operation and Maintenance

The pipeline will be operated and maintained by EGNB in accordance with standard procedures designed to ensure the integrity of the pipeline system. The pipeline will be monitored by EGNB and required maintenance will be handled by qualified personnel.

Road allowance maintenance will be carried out in accordance with proper environmental practice, and incorporate protection measures identified in the EGNB Environmental Protection Plan (Exhibit H). Pipeline valves and surface facilities will be properly secured and protected to prevent tampering by unauthorized parties.

5.1.4 Operational Safety and System Integrity

Pipeline safety and reliability is achieved primarily through prudent design, construction, and maintenance practices, and through properly trained personnel. Environmental and safety training will be given to appropriate EGNB employees and the contractor workforce. The level of training will be commensurate with the type of duties of the personnel.

Education and vigilance are the main tools used by pipeline operators to mitigate against third party damage and encroachment. EGNB will incorporate the following features in its operating and maintenance plans, and will install pipe with dimensional and toughness properties designed to resist deformation and penetration:

- regular monitoring of the distribution system;
- extensive direct contact with landowners, contractors, and regulatory authorities;
- "call-before-you-dig" programs and easement pipeline warning markers;
- monitoring of pipeline pressures, shut-off valves;
- routine leak detection surveys;
- application of extruded polyethylene (Yellow Jacket) coating to the external pipe surface to protect against galvanic corrosion;

- installation of a cathodic protection system as secondary protection; and
- installation of sectionalization valves to allow the isolation of pipeline segments for maintenance activities and controlled releases.

In the case of the proposed system, the most potentially damaging malfunction would involve third party damage to the pipeline. However, because the severity of the rupture would be dependent on a number of factors, including the size, location, and timing of the release, the task of predicting the magnitude of effects becomes problematic. Compliance with applicable codes, regulations and standards, and implementation of appropriate pipeline protection measures will minimize the likelihood of a pipeline failure. Further, development of an Emergency Procedures Manual to deal with a variety of malfunction scenarios will limit the impacts for such malfunctions.

5.1.5 Waste Management

Construction activities may result in the generation of both liquid and solid wastes. Liquid wastes may include petroleum oils and lubricants, sewage, and gray water generated by construction crews. Solid waste may include materials such as brush, cables, rock, temporary fencing and bridge material, signs, containers and spent welding rods. EGNB will dispose of all waste material in a manner that complies with local and provincial standards. Materials that can be reused or recycled will be taken to appropriate facilities.

Operational activities may produce natural gas (methane) emissions during system blowdown and system purging, when required. As well, fugitive emissions including methane will result from the operation of metering and regulating stations. Carbon monoxide, carbon dioxide, particulate, and noise emissions will also occur from the operation of maintenance vehicles and equipment.

Liquid wastes that are typically produced during pipeline operations include waste methanol, ethylene, and spent solvent, used for maintenance of the pipeline. Other sources of liquid wastes typical for pipelines include spent oils, greases, and fuels from vehicle maintenance.

These wastes are considered hazardous and will be collected and disposed of in accordance with applicable local and provincial regulatory requirements.

5.3 Design Specifications

All materials used in the distribution system shall conform to the requirements listed below. All components of piping systems shall be approved by EGNB and selected in accordance with good engineering practice to withstand the operating conditions and test pressures to which they will be subjected. For test procedures see Section 5.6.

Steel, copper and polyethylene are used in the distribution system. Copper is to be used strictly for service settlement loops.

5.3.1 Steel Pipe Specifications

Steel pipe shall meet the requirements outlined in this section.

5.3.1.1 Specifications

For pipe sizes from nominal pipe size 1 to nominal pipe size 16, the specifications from Table 5.3.1 shall apply. Pipe sizes over nominal pipe size 16 shall be specifically designed to meet the requirements of the intended pipeline.

Table 5.3.1
Specification of Steel Pipes (CSA Z245.1)

Nominal Pipe Size	Pipe Specifications	SMYS (MPa)	Wall Thick. (mm)	Outside Diam. (mm)	Weight (kg/m)	Mill Test (kPa)
1[1]	CSA Z245.1 CAT. 1 GRADE 290	290	3.4	33.4	2.5	20,700
1¼[1]	CSA Z245.1 CAT. 1 GRADE 290	290	3.6	42.2	3.4	20,700
2[1]	CSA Z245.1 CAT. 1 GRADE 290	290	3.9	60.3	5.4	20,700
3	CSA Z245.1 CAT. 1 GRADE 290	290	4.8	88.9	9.9	18,690
3[2]	CSA Z245.1 CAT. 1 GRADE 290	290	4.0	88.9	8.3	15,520
4[3]	CSA Z245.1 CAT. 1 GRADE 290	290	4.8	114.3	12.7	14,580
4[2]	CSA Z245.1 CAT. 1 GRADE 290	290	4.0	114.3	10.8	12,070
6[2]	CSA Z245.1 CAT. 1 GRADE 290	290	4.8	168.3	19.2	12,350
8[2]	CSA Z245.1 CAT. 1 GRADE 290	290	4.8	219.1	25.1	9,450
12[2,4]	CSA Z245.1 CAT. 1 GRADE 290	290	6.4	323.9	49.7	9,660
16[2,4,5]	CSA Z245.1 CAT. 1 GRADE 290	290	6.4	406.4	62.5	7,720

[1]Note: Grade 172 MPa may be used where Grade 290 MPa pipe is not available.

[2]Note: This thin wall pipe can be used for distribution pressures up to and including 1200 kPa. It may also be used for extra high pressure lines if the design is based on future location classification and operating pressures permit.

[3]Note: Shall be used for rail crossings.

[4]Note: Consultation to determine if Category II pipe is required.

[5]Note: Can only be used up to and including Class 3 locations.

5.3.1.2 Services

5.3.1.2.1 Steel Service Lines nominal pipe size ¾ to nominal pipe size 2

Pipe shall be standard wall, CSA Z245.1, at least Grade 172 continuous weld, with a specified minimum yield strength 172 MPa, and meet the dimensional requirements in Table 5.3.1.2.1.

Table 5.3.1.2.1
Steel Service Lines Nominal Pipe Size ¾ To Nominal Pipe Size 2

Pipe Size (NPS)	Outside Diameter (mm)	Wall Thickness (mm)	Internal Diameter (mm)
¾	26.7	2.9	20.9
1	33.4	3.4	26.7
1¼	42.2	3.6	35.1
2	60.3	3.9	52.5

5.3.1.2.2 Steel Service Lines Nominal Pipe Size 3 and Larger

Pipe shall be CSA Z245.1, Grade 290, electric resistance weld pipe (ERW), with a specified minimum yield strength 290 MPa and meet the dimensional requirements of Table 5.3.1.2.2.

Table 5.3.1.2.2
Steel Service Lines Nominal Pipe Size 3 and Larger

Pipe Size (NPS)	Outside Diameter (mm)	Wall Thickness (mm)	Internal Diameter (mm)
3	88.9	4.0	80.9
4	114.3	4.0	106.4
6	168.3	4.8	158.7
8	219.1	4.8	209.5
12	323.9	6.4	311.2

Notes: Bare pipe (uncoated) shall not be used below ground.

Coated pipe shall not be used above ground for installations such as roof top headers.

5.3.2 Polyethylene Pipe Specifications

Polyethylene pipe used for pipelines or services shall be certified by CSA or other recognized testing authority testing to CSA Standards.

Polyethylene pipe and tubing shall conform to CAN3-B137.

5.3.2.1 Pipelines

Table 5.3.2.1 lists the sizes of polyethylene pipe that may be used for pipelines.

Table 5.3.2.1
Polyethylene Pipe Specifications for Pipelines[1]

Pipe Size (NPS)	SDR	Outside Diameter (mm)			Wall Thickness (mm)		Weight (kg/m)
		Min.	Max.	Avg.	Min.	Max.	
1¼	10	42.0	42.3	42.15	4.22	4.88	0.5
2	11	60.2	60.5	60.35	5.48	6.14	0.9
3	11	88.7	89.1	89.90	8.08	9.04	2.1
4	11	114.1	114.5	114.30	10.38	11.62	3.4
6	11	168.0	168.6	168.30	15.28	17.10	7.4
8	13.5	218.8	219.4	219.10	16.23	18.19	10.3

[1]Note: For calculations, use the average outside diameter and minimum wall thickness, unless otherwise required.

5.3.2.2 Services

Table 5.3.2.2 shows the sizes of polyethylene tubing and pipe up to nominal pipe size 1. For larger sizes see Table 5.3.2.1.

Table 5.3.2.2
Polyethylene Pipe Specifications for Services[1]

Pipe Size (NTS/NPS)	Outside Diameters (mm)			Wall Thickness (mm)			
	Minimum	Maximum	Average	Lining Service		Direct Burial	
NTS ½	15.8	16.0	15.9	2.28	2.44	2.28	2.44
NPS 1	33.3	33.5	33.4	-	-	3.04	3.7

[1]Note: For calculations use the average outside diameter and minimum wall thickness, unless otherwise required.

5.3.3 Copper Tubing Specifications

Copper tubing for service settlement loops, when used, shall be nominal tube size 3/8, 12.7 mm outside diameter, coated Type L copper, 0.88 mm wall thickness, manufactured in accordance with ASTM Specification B-88 - Seamless Copper Water Tube and Material Specifications Manual 2.6.

5.4 Flow Calculations

The maximum internal pressure of a pipeline system determines the ultimate capacity of that pipeline system. Capacity is a function of the difference between the inlet (maximum) and the discharge (minimum) pressures in the system. Specifically, the pipeline capacity is related by the function:

$$Pin2 - Pout2 = RxLxQ2$$

Where,

Pin = inlet pressure
Pout = outlet pressure
R = resistance of the pipe
L = length of the pipe
Q = the quantity of gas flowing

This relationship shows that the quantity of the gas, or flowrate, is dependent on the pressure differential in the pipe. The resistance of the pipe is primarily dependent on the diameter and material of the pipe. Therefore, for a given size of pipe, more gas can flow at higher pressures and at larger pressure differentials. The relationship described above is critical because the cost of the pipeline is directly related to its size.