

Natural Gas Utilities Asset Management Plan 2025 to 2034

Updated Asset Management Plan for Natural Gas Utilities

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Prepared by:

Katarina Bohaichuk, P.Eng.
Team Lead - Facilities Integrity

Reviewed by:

Approved by:

James Ferguson, P.Eng.
Manager, Integrity Business
Development/Technology

Laith Alfaqih, PhD, PE, CRL, MIAM, SDRM
Senior Principal

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Acronyms / Abbreviations

Acronym / Abbreviation	Full Name
AG	Above Grade
AIM TF	Asset and Integrity Management Task Force
AMP	Asset Management Plan
BG	Below Grade
CGA	Canadian Gas Association
CP	Cathodic Protection
CSA	Canadian Standards Association
DSIMP	Distribution System Integrity Management Program
EVC	Electronic Volume Corrector
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System
HP	High Pressure
ILI	In-Line-Inspection
IP	Intermediate Pressure
KM	Kilometers
KPI	Key Performance Indicator
LE	Life Expectancy
LP	Low Pressure
LOS	Level of Service
MDPE	Medium Density Polyethylene
MIP	Medium Intermediate Pressure
MOP	Maximum Operating Pressure
NG	Natural Gas
NPS	Nominal Pipe Size
PE	Polyethylene
psig	Pound per square inch gauge
ORCGA	Ontario Regional Common Ground Alliance
SOP	Standard Operating Procedure
TCP	TransCanada Pipelines, now known as TC Energy
TSSA	Technical Standard and Safety Authority
UK	Utilities Kingston
XHP	Extra High Pressure



Glossary

Term	Definition
Downtime	Any expected or unexpected shutdown of specific assets
Level of Service	A concept used to measure the quality of a service crucial for development infrastructure management plans
Lifecycle Activities	Activities undertaken with respect to a municipal infrastructure asset over its service life, including constructing, maintaining, renewing, operating and decommissioning, and all engineering and design work associated with those activities (O. Reg 588/17)
Low Pressure (GIS table)	Includes linear inventory for TCP, IP, MIP, and LP pressure ratings
LP (pressure rating)	Pressure downstream of the service meter, not regulated
Gas Main	UK type designation for TCP, XHP, HP, IP, MIP, LP (pressure)
Performance Measures	A process of quantifying and assessing the effectiveness of the system
Outages	See Downtime above



1 Introduction

For over 150 years, Utilities Kingston (UK) has provided the Kingston community with safe and reliable utility services. UK is an asset management corporation responsible for ensuring that the City's Gas, Water, Wastewater, and Electric Utilities are operated and maintained effectively, efficiently, safely, and reliably. These goals are reflected in the UK Mission, Vision, and Values:

- Mission: Our mission is to manage, operate, and maintain community infrastructure to deliver safe, reliable services and a personal customer experience.
- Vision: Our vision is to advance the unique multi-utility model to benefit our customers and build better communities.
- Values: Our values are safety, integrity, innovation, and reliability.

As an Asset Management System is formalized, adopted, improved, and entrenched in the organization, it is expected to provide:

- Strong governance and accountability;
- Sustainable decision-making;
- Enhanced customer service;
- Effective risk management; and
- Improved financial efficiency.

UK identifies Asset Management, including Natural Gas Asset Management, as a corporate priority and it has been an essential function of UK since its inception. As part of its services, UK aims to provide safe and reliable gas distribution to nearly 16,000 customers.

The Natural Gas Asset Management Plan is intended to meet the requirements of Ontario Regulation 588/17 Asset Management Planning for Municipal Infrastructure. As regulated and as part of its continuous improvement, the Plan shall be reviewed and updated as necessary at least every five years.



2 State of Local Infrastructure – Natural Gas Utility

As required by the Ontario Regulation 588/17, the following sections address:

- a summary of the assets;
- the replacement costs of the assets;
- the average age of the assets;
- the information available on the condition of the assets; and
- a description of the approach to assessing the condition of the assets (assessment methodologies).

2.1 Asset Inventory

The Kingston Natural Gas (NG) Distribution system serves nearly 16,000 customers in Central Kingston, Ontario and is comprised of both linear and non-linear assets, specified in **Subsections 2.1.1 and 2.1.2**. The inventory information is obtained from the City of Kingston's administered Enterprise Geographic Information System (GIS).

The major NG assets are regulating stations and the extra-high pressure (XHP) / high-pressure (HP) pipeline system. UK receives NG products from TransCanada Pipelines (TCP), now known as TC Energy. The NG enters the Kingston Gas Distribution system at the City Gate located between Unity Road and Perth Road in the City of Kingston.

From the City Gate regulating station, the product is transported via two parallel XHP/HP main lines of diameters NPS 8 and NPS 12 along Perth Road. The two mainlines, Queen Line and City Line, split their trajectory before crossing Highway 401. From there, the two mainlines travel to 10 other regulating stations and transport products to customers via HP and intermediate pressure (IP) pipelines. The IP lines transport product directly to customers via service lines. The 10 regulating stations further reduce the gas pressure to a non-regulated pressure of 55 psig for distribution throughout the system.

The XHP/HP steel pipe system is 27 km in length and IP system comprises 232 km of steel and polyethylene pipe. The service system is 231 km in length.

2.1.1 Linear Assets

UK Linear Assets include all NG distribution mains and service pipelines. **Table 1** and **Figure 1** provide information on pipe size range, Maximum Operating Pressure (MOP), and length of pipe by pressure class.



Table 1: Summary of Natural Gas Linear Assets by Pressure Class¹

Pressure Class	Pipe Size (in)	MOP (psig)	Typical Operating Pressure (psig)	Length (km)
XHP	4 to 12	475	425	16.00
HP	2 to 8	375	325	11.119
MIP/IP	1/2 to 8	60	55	232.49
SERVICES	3/4 to 8	60	55	231.30

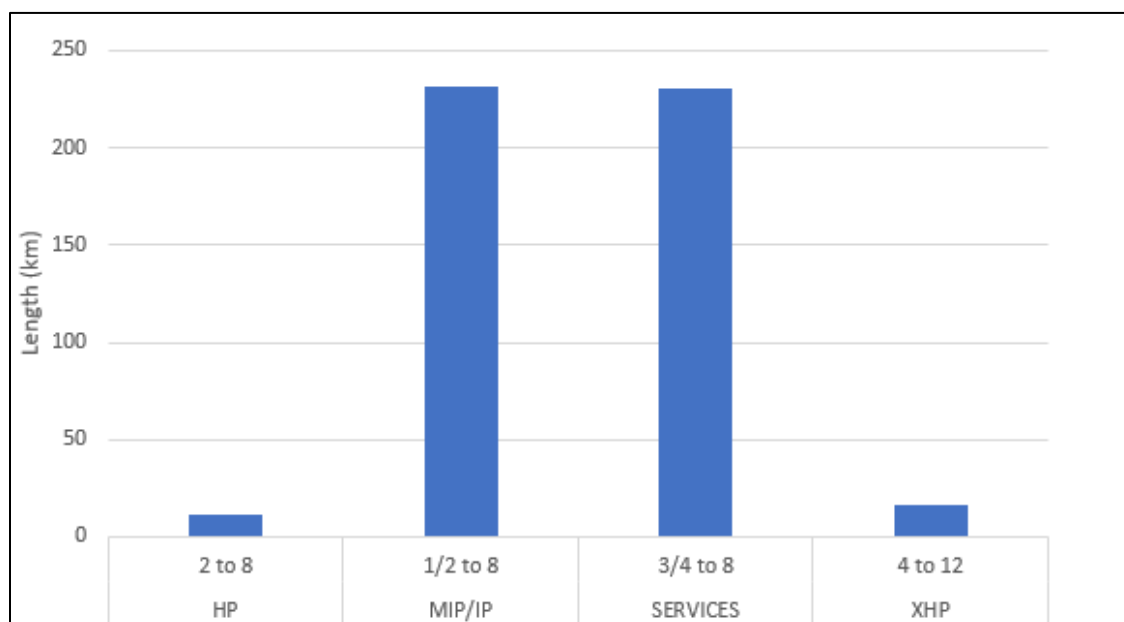


Figure 1: Summary of Linear Assets by Pressure Class²

Table 2 and **Figure 2** summarize the length of NG Linear Assets by material, with approximately 94 km of pipe made of steel, and 396 km pipe made of polyethylene (PE). The PE pipe represents approximately 80.7% of NG linear infrastructure while steel pipe represents approximately 19.2%.

In addition, **Table 2** and **Figure 2** summarize the distribution of the NG Linear Assets length by decades of installation. The majority (59%) of the steel pipe was installed from the 1950's to 1980's and the majority (81%) of the PE pipe was installed post 1980's to current date. The date of installation of approximately 12 km of steel pipe, and 76 km of PE pipe is not known.

¹ Source data: Gas_Mains_High_Pressure.xls, Gas_Mains_Low_Pressure.xls, Gas_Services.xls., with corrections from UK

² Source data: Gas_Mains_High_Pressure.xls, Gas_Mains_Low_Pressure.xls, Gas_Services.xls., with corrections from UK



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The total length of black iron pipe is approximately 0.3 km and it is mostly installed in the 1960's and 1970's. From the data available, 0.14 km of this type of pipe has unknown date of installation.

Table 2: All Natural Gas Linear Assets – Installation Date and Materials³

Decade of Installation	Length of Steel Pipe (km)	Length of PE Pipe (km)	Length of Black Iron (km)
1950's	10.23	0.00	-
1960's	16.73	0.30	0.16
1970's	10.53	0.18	0.01
1980's	17.81	57.35	-
1990's	6.98	139.89	-
2000's	15.28	59.03	-
2010's	3.72	53.74	-
2020's	1.31	9.53	-
Unknown	11.66	76.20	0.14
Subtotal	94.25	396.22	0.31
% Steel/PE	19.2%	80.7%	<0.1%
Total	490.9 km		

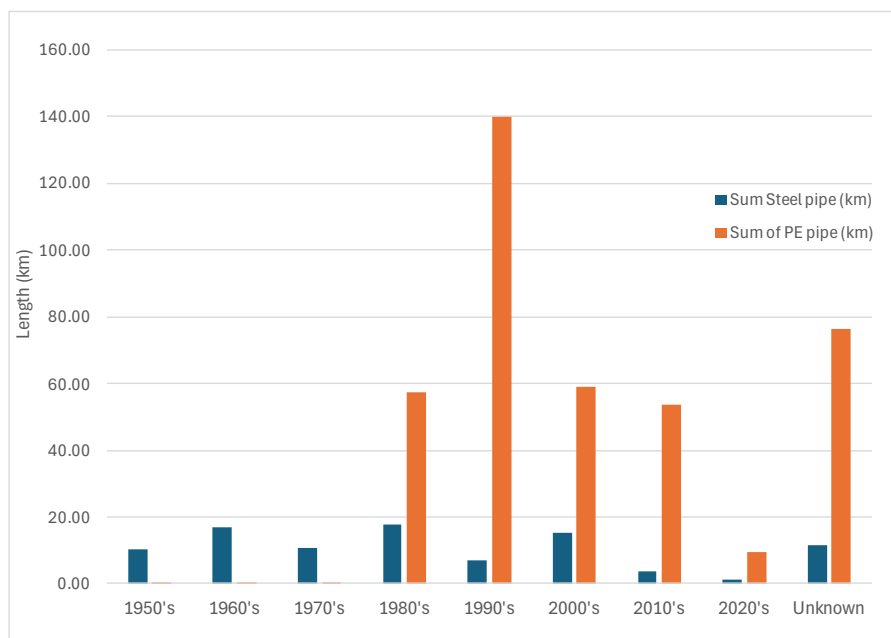


Figure 2: Summary of Natural Gas Linear Assets – Installation Date and Materials⁴

³ Source data: Gas_Mains_High_Pressure.xls, Gas_Mains_Low_Pressure.xls, Gas_Services.xls. No copper remaining in system as per UK.

⁴ Source data: Gas_Mains_High_Pressure.xls, Gas_Mains_Low_Pressure.xls, Gas_Services.xls.



The material information on the Linear Assets is generally complete in the GIS Asset Inventory; however, approximately 12% of the steel pipe and 19% of the PE pipe have an unknown year of installation.

2.1.2 Non-Linear Assets

Table 3 includes a summary of the non-linear assets grouped by asset category including total quantity of each item by size:

- Regulating Stations – eleven regulating stations, including 10 that serve as a transition from the XHP and HP pipelines to the intermediate pressure distribution piping network.
- Valves - serve as connectors between HP, IP, and service lines, and includes mainline valves, grasshopper valves which are assumed to be located above grade (AG) and excess flow valves and curb stops or shut-off valves which are assumed to be located below grade (BG).
- Meters – per UK records, there are 15,776 meter services to end customers.
- Cathodic Protection (CP) assets - include test points, anodes, locate stations, and insulators. The number of anodes (60) is likely to represent the anodes installed recently.

Table 3: Summary of Natural Gas Non- Linear Assets ^{5,6,7,8}

Group	Asset Description	Sizes (in)	Number of the Assets
Valves	Service Valves- including Excess Flow Valves and Shut-off (curb stop) Valves	1/2 to 8	2,745
	Grasshopper Valves	2 to 6	4
	Mainline Valves	1 1/4 to 12	1,401
Commercial - Meters	Intelis 250	n/a	1,085
	Intelis 425	n/a	324
	D800	n/a	357
	1.5M TCI	n/a	226
	3M TCI	n/a	175
	5M PTZ (AA)	n/a	38
	7M PTZ(AA)	n/a	18
	11M PTZ (AA)	n/a	4

⁵ Source data: Gas_Node.xls, Gas_Valve.xls, Gas_Station.xls., with corrections from UK

⁶ GIS data for Pipe fittings such as tees, elbows, transitions, junctions, reducers are available but not included in the analysis.

⁷ GIS files are not structured by above and below grades, the summary of non-linear assets reflect the structure presented in GIS files.

⁸ Meters are not represented in GIS files; it was assumed that 'Service Tees' are associated with each of the Customer Meters. UK has provided an updated number of meters.



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Group	Asset Description	Sizes (in)	Number of the Assets
Residential - Meters	Intelis 250	n/a	13,367
	Intelis 425	n/a	124
	D800	n/a	45
	1.5M TCI	n/a	7
	3M TCI	n/a	6
Regulating Stations	No.1 City Gate	n/a	1
	No.2 Railway St	n/a	1
	No.3 Division/Weller	n/a	1
	No.4 Dalton Ave	n/a	1
	No.5 John Counter	n/a	1
	No.6 Division St	n/a	1
	No.7 Elliot Ave	n/a	1
	No.8 Sir John A. MacDonald	n/a	1
	No.9 Novelis	n/a	1
	No.10 P4W	n/a	1
	No.11 JCB	n/a	1
Cathodic Protection			
	Locate Stations	n/a	70
	Cathodic Test Points	n/a	271
	Anodes	n/a	60
	Insulators	n/a	24

2.2 Replacement Costs

This section of the report summarizes the replacement costs for the Natural Gas utilities asset classes.

The Main Line Pipe system has the highest replacement value in the portfolio (69%) as shown in **Figure 3**. The remainder of the assets correspond to 31% of the value associated with the total portfolio of assets. The replacement monetary values can be found in **Table 4 through Table 7**.



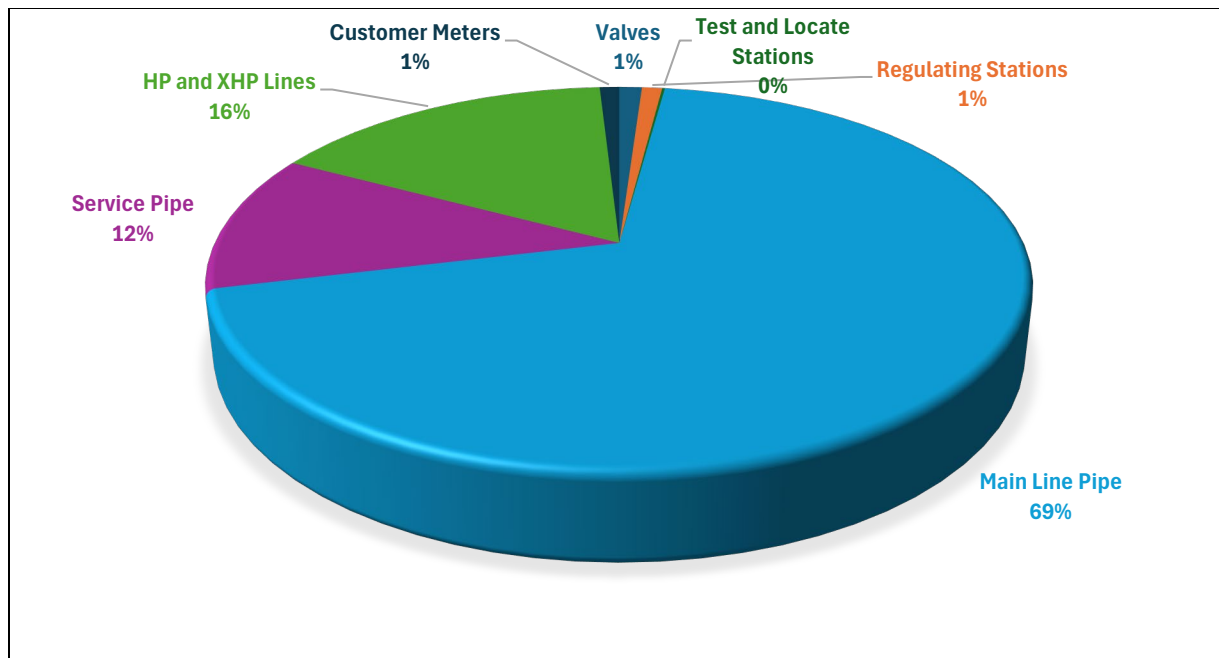


Figure 3: Asset Replacement Value for Natural Gas Assets,⁹

As per the 2024 AMP, replacement costs were based on the most recently available data sources and include the most-recent rates seen in the open market tender results¹⁰. It was noted in the 2024 AMP that cost data for some items such as regulating stations and high-pressure piping were based on certain assumptions and historic rates as available¹¹.

Further information on Linear and Non-Linear Assets replacement cost is provided in **Sub-sections 2.2.1 and 2.2.2**.

2.2.1 Linear Assets¹²

Table 4 summarizes the total replacement cost of each linear asset class in UK's gas services distribution inventory for 2024 as well for 2025. Note that the asset replacement cost in 2025 represents a 2% increase for linear assets when compared with 2024.

⁹ Source data: Gas_Node.xls, Gas_Valve.xls, Gas_Station.xls. Customer meter data provided by UK.

¹⁰ Market data used in 2024 AMP for asset replacement cost not available

¹¹ Asset replacement value for historical rates not available

¹² Some of the linear and non-linear replacement values are missing from the 2024 AMP. This information is unknown and requires market research. Assumed values have been used and noted in the appropriate tables in this section.



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Table 4: Summary of Linear Assets Replacement Cost¹³

Type of Asset	Number of assets	Length of Pipe (km)	2024 Cost of Replacement of each Asset	2025 Cost of Replacement of each Asset
Main Line Pipe (MIP, IP and TCP)		232.5	\$463,718,123	\$472,992,485
Service Pipe ¹⁴	15,896		\$78,035,210	\$79,595,914
Main HP and XHP Lines ¹⁵		27.1	\$109,333,415	\$111,520,083
Total			\$651,086,748	\$664,108,483

Table 5 provides a detailed breakdown of the replacement cost valuations for Linear Assets infrastructure in 2024.

Table 5: Detailed Linear Assets Replacement Value Summary in 2024¹⁶

Linear	Type of Asset	No of Assets/ Quantity (each)	Length of Pipe/ Quantity(m)	Unit Rate	2024 Total Cost of Asset
Service Pipe only (no Tee Off service)	1/2"	12,177		\$4,600	\$56,014,200
	3/4"	883		\$5,200	\$4,591,600
	1"	500		\$5,500	\$2,750,000
	1 1/4"	1,834		\$5,900	\$10,820,600
	1 1/2"	3		\$6,500 ¹⁷	\$19,500
	2"	430		\$6,500	\$2,795,000
	3"	16		\$12,500	\$200,000
	4"	21		\$15,000	\$315,000
	6"	8		\$28,000	\$224,000
	8"	1		\$30,000	\$30,000
	Unknown	23		\$11,970 ¹⁸	\$275,310
	Subtotal	15,896			\$78,035,210

Table continues on next page

¹³Source data: 2024 AMP, "GA2 - AMP asset calculations & rough work for 2024_ok.xls".

¹⁴ Service pipe count does not include Tee Off Service length count that adds additional 10.4 km.

¹⁵ The count for steel pipes is only the high-pressure system, and was used as it aligns with 2024 AMP count for linear assets table.

¹⁶ Source data: 2024 AMP, 2024 AMP, "GA2 - AMP asset calculations & rough work for 2024_ok.xls".

¹⁷ assumed \$ value per unit as value of next highest diameter asset.

¹⁸ assumed \$ value as an average of all units' rates.



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Linear	Type of Asset	No of Assets/ Quantity (each)	Length of Pipe/ Quantity(m)	Unit Rate	2024 Total Cost of Asset
IP Mains Pipe					
	1/2"	2	11.8	\$1,500	\$17,664
	3/4"	1	2.5	\$1,500	\$3,804
	1"	8	167.8	\$1,500	\$251,651
	1 1/4"	247	13,441.0	\$1,600	\$21,505,520
	2"	2,724	154,118.9	\$1,800	\$277,414,051
	3"	184	12,537.8	\$2,250	\$28,210,050
	4"	520	29,653.4	\$2,250	\$66,720,150
	6"	296	15,222.9	\$2,700	\$41,101,830
	8"	237	7,244.6	\$3,900	\$28,254,011
	12"	10	9.1	\$4,500 ¹⁹	\$40,912
	Unknown	13	84.5	\$2,350	\$198,481
	Subtotal	4,242	232,494.3		\$463,718,123
HP (City Line)	2"	5	909.1	\$3,000	\$2,727,271
	3"	1	7.0	\$3,000	\$20,982
	6"	50	153.0	\$3,300	\$505,022
	8"	80	10,050.6	\$3,900	\$39,197,391
	Subtotal	136	11,119.7		\$42,450,666
XHP (Queen Line)	4"	11	1,069.5	\$3,000	\$3,208,516
	6"	2	16.8	\$3,300	\$55,487
	8"	16	5,822.2	\$3,900	\$22,706,689
	12"	10	9,091.6	\$4,500	\$40,912,056
	Subtotal	39	16,000.1		\$66,882,749
Liner Assets	Total				\$651,086,748

¹⁹ assumed \$ value per unit as similar value of 12" XHP Line



2.2.2 Non-Linear Assets^{20,21}

Table 6 summarizes the total replacement cost for each non-linear asset in UK's gas services distribution inventory for 2024 as well as for 2025. Note that the asset replacement costs in 2025 represents a 4% increase for non-linear assets when compared to 2024.

Table 6: Summary of Non-Linear Assets Replacement Cost

Type of Asset	No of Assets	2024 Estimated Asset Replacement Cost	2025 Estimated Asset Replacement Cost
Valves	4,150	\$7,012,125	\$7,292,610
Regulating Stations	11	\$6,279,000	\$6,530,160
Test and Locate Stations	341	\$824,500	\$857,480
Customer Meters	15,776	\$6,324,756	\$6,577,746
Total		\$20,440,381	\$21,257,996

Table 7 provides a detailed breakdown of the replacement costs of the Non-Linear Assets/ Facilities in 2024.

Table 7: Detailed Non-Linear Assets Replacement Value Summary - 2024²²

Non-Linear	Type of Asset	Number of Assets	2024 Cost of Replacement of Each Asset	2024 Total Cost of Asset
Above Grade (Main Line Shut-off Valves Grasshopper Valves)				
(IP, MIP)	2"	1	\$15,000	\$15,000
(IP, MIP)	4"	2	\$18,000	\$36,000
(IP, MIP)	6"	1	\$20,000	\$20,000
	Subtotal	4		\$71,000
Below Grade Service Shut-off Valves (curb stops) and Excess Flow Valves	1/2"	1295	\$1,200	\$1,554,000
	3/4"	414	\$1,300	\$538,200

²⁰ Some of the linear and non-linear replacement values are missing from the 2024 AMP. This information is unknown and requires market research. Assumed values have been used and noted in the appropriate tables in this section.

²¹ Estimated current value is unknown, UK estimated the estimated replacement cost based on historical values.

²² Source: 2024 AMP; "2024 AMP, "GA2 - AMP asset calculations & rough work for 2024_ok.xls", with corrections from UK. Commercial and Residential Meter data is provided by UK.



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Non-Linear	Type of Asset	Number of Assets	2024 Cost of Replacement of Each Asset	2024 Total Cost of Asset
	1"	150	\$1,500	\$225,000
	1 1/4"	615	\$1,500	\$922,500
	1 1/2"	3	\$1,800 ²³	\$5,400
	2"	188	\$1,800	\$338,400
	3"	8	\$3,000	\$24,000
	4"	4	\$3,500	\$14,000
	6"	2	\$4,375	\$8,750
	8"	1	\$4,375 ²⁴	\$4,375
	Unknowns	65	\$1,800	\$117,000
	Subtotal	2745		\$3,751,625
Main Line Valves / Gate Valves	1 1/4"	68	\$1,500	\$102,000
	2"	1025	\$1,800	\$1,845,000
	3"	45	\$3,000	\$135,000
	4"	128	\$3,500	\$448,000
	6"	88	\$4,000	\$352,000
	8"	36	\$6,500	\$234,000
	12"	7	\$8,500	\$59,500
	Unknowns	4	\$3,500	\$14,000
	Subtotal	1401		\$3,189,500
Total Valves		4150		\$7,012,125
Regulating Stations	Gate Station No.1	1	\$2,500,000	\$2,500,000
	Railway St No.6	1	\$1,250,000	\$1,250,000
	District St No.3- No.11	9	\$281,000	\$2,529,000
	Subtotal	11		\$6,279,000
Test and Locate Stations	Test Stations	271	\$2,500	\$677,500
	Locate Stations	70	\$2,100	\$147,000
	Subtotal	341		\$824,500
Commercial - Meters	Intelis 425	1085	\$300	\$325,500
	Intelis 425	324	\$485	\$157,140
	D800	357	\$1,663	\$593,691
	1.5M TCI	226	\$2,102	\$475,052

²³ Assumed similar value as 2" Below Grade Service Valve.

²⁴ Assumed similar value as 6" Below Grade Service Valve



Non-Linear	Type of Asset	Number of Assets	2024 Cost of Replacement of Each Asset	2024 Total Cost of Asset
	3M TCI	175	\$2,324	\$406,700
	5M PTZ (AA)	38	\$3,044	\$115,672
	7M PTZ(AA)	18	\$3,430	\$61,740
	11M PTZ (AA)	4	\$3,882	\$15,528
Residential - Meters	Intelis 250	13,367	\$300	\$4,010,100
	Intelis 425	124	\$485	\$60,140
	D800	45	\$1,663	\$74,835
	1.5M TCI	7	\$2,102	\$14,714
	3M TCI	6	\$2,324	\$13,944
	Subtotal	15,776		\$ 6,324,756
Non-Linear Total				\$ 20,440,381

The replacement costs for Regulating Stations #1 and #6 include significant uncertainty due to the insufficient comparable cost information available for large regulating stations of similar nature since they are replaced infrequently.

2.3 Asset Age and Condition Assessment

The average asset age and condition information is directly related to the remaining life of the asset, which is key for developing capital projects and maintenance programs. Understanding the remaining service life of individual assets enables the development of long-term capital planning for asset replacement, prioritization of investments, evaluation of life-cycle decisions, and refinement of UK's maintenance programs. In alignment with Ontario Regulations 588/17, this section addresses the age and condition of Linear and Non-Linear Assets within UK's NG Utility system.

2.3.1 Asset Age Assessment

2.3.1.1 Linear Assets Age

Table 8 and **Figure 4** summarize the life expectancy (LE) of each asset material category, the length of assets currently past their LE, and those that will reach the end of their service life in the next five and ten years. The LE of each asset category is primarily obtained from GIS data.

There are approximately 21 km of steel pipes which are currently past their LE, and 33 km of steel pipe with up to 10 years of remaining life, based on a 60-year life cycle. Additionally, there are approximately 0.3 km of PE pipe which is past due for replacement, and 0.5 km of PE pipe with up to 10 years of remaining life based on a 60-year life cycle.



Replacement rates presently are approximately 1.0 km / year which is much less than the ‘break-even’ replacement rate which corresponds to 3.75 km per year.²⁵

Table 8: Linear Asset Age and Life Expectancy (LE)²⁶

Asset	LE ²⁷	Past LE Current (km)	LE in Next 5 Years (km) ²⁸	LE in Next 10 Years (km) ²⁹
Gas Steel	60 years	20.9	27.0	32.6
Gas PE	60 years	0.26	0.3	0.47

Figure 4 shows a graphical representation the gas main age life expectancy by steel /PE asset type.

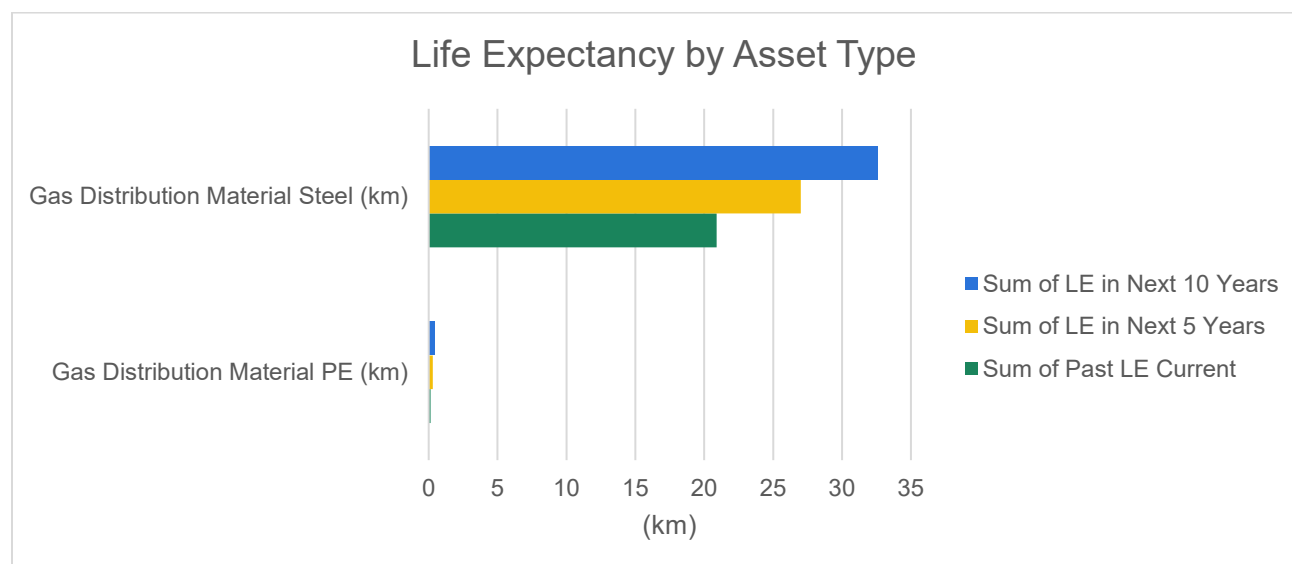


Figure 4: Average Life Expectancy by Asset Type³⁰

As previously noted, the majority of steel pipe was installed from the 1950's to 1980's and most of the PE pipe was installed post 1980's to current date. The date of installation of approximately 12 km of steel pipe, and 76 km of PE pipe is not known. For more information refer to **Section 2.1.1** of this document.

²⁵ Source: 2024 NG AMP for replacement rate/km and the assumption of 1km/year

²⁶ Source data: Gas_Mains_High_Pressure.xls, Gas_Mains_Low_Pressure.xls, Gas_Services.xls

²⁷ Source: 2024 AMP

²⁸ Next 5 years contains the cumulative total beyond LE.

²⁹ Next 10 years contains the cumulative total beyond LE.

³⁰ Source data: Gas_Mains_High_Pressure.xls, Gas_Mains_Low_Pressure.xls, Gas_Services.xls



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As determined by industry standards and anticipated material performance, the estimated useful life of NG Linear Assets is approximately 60 years. However, it is important to note that the life-expectancy may vary considerably based on, but not limited to:

- in situ conditions such as, but not limited to temperature, soil pH, soil conductivity;
- material properties and installation practices; and
- third-party damage.

The factors above can significantly influence the useful life of the pipelines.

The steel mains require more maintenance due to the continual need for adequate CP; however, the steel mains can last longer than PE lines which lose strength over time with the rate of deterioration being a function of residual stresses and ground temperature. The medium density PE pipe used within UK's NG pipe network is a relatively new material and the overall lifespan is still being understood industry wide.

Table 9 and **Figure 5** provide the age distribution and percentage of expected life for the NG Linear Assets. The actual installation years are not documented in the GIS Asset Inventory for many linear assets; as a result, the age distribution is presented per decade. Approximately 18% of the gas system pipe length has unknown age.

Table 9: Natural Gas Linear Assets Age Distribution and Percentage of Expected Useful Life³¹

Decade of Installation	Steel pipe (km)	PE pipe (km)	Average Remaining Life (%)
1950's	10.23	0.00	-11.9%
1960's	16.73	0.30	-1.4%
1970's	10.53	0.18	16.5%
1980's	17.81	57.35	35.4%
1990's	6.98	139.89	47.4%
2000's	15.28	59.03	66.4%
2010's	3.72	53.74	81.5%
2020's	1.31	9.53	94.6%
Unknown	11.66	76.2	
Total km	94.25	396.22	
% Main Steel/PE pipe	19.2%	80.8%	
Exceed lifetime expectation	7.75%	0.06%	
Total Mains (km's)	490.9		

³¹ Source data: Gas_Mains_High_Pressure.xls, Gas_Mains_Low_Pressure.xls, Gas_Services.xls.



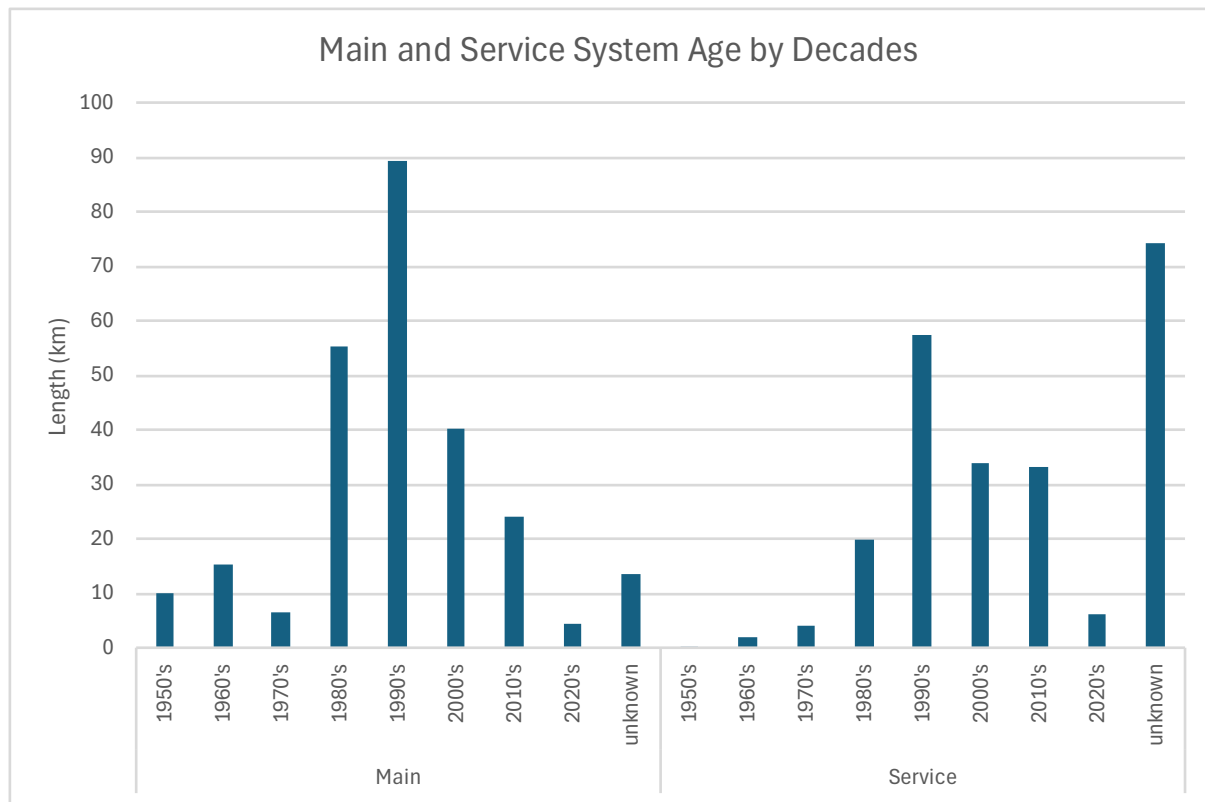


Figure 5: Gas Main: HP and Low Pressure (GIS table) and Service Age by Decades³²

Figure 5 shows both the main pipe system and the service pipe system length in kilometers (km) by decade of installation. It is noted that the number of pipes with unknown year of installation in the service system is 32% for PE pipe as compared to 6% for steel pipe.

³² Source data: Gas_Mains_High_Pressure.xls, Gas_Mains_Low_Pressure.xls, Gas_Services.xls



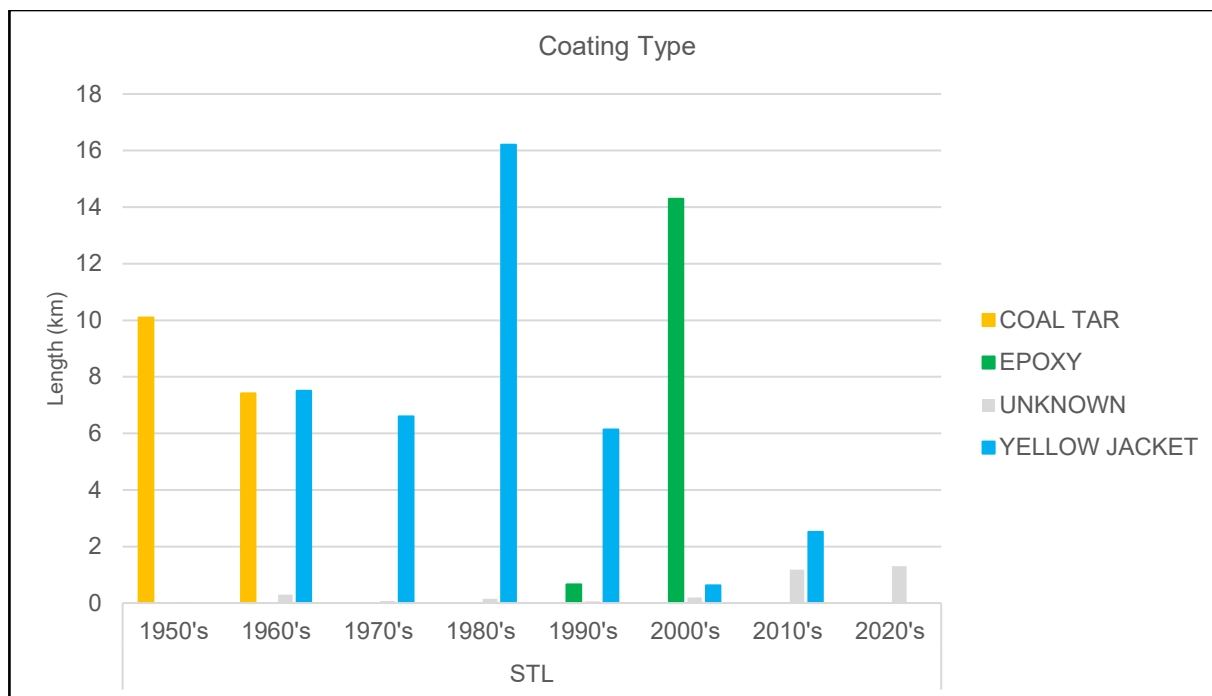


Figure 6: Gas Main and Service Steel Pipe Coating³³

Figure 6 summarizes the type of coating used on the steel pipe assets. There are 17.5 km of various pipe diameter with coal tar coating built in the 1950's-1960's. Also, 3 km of the steel pipe coating is unknown.

2.3.1.2 Non-Linear Assets Age^{34,35}

Table 10 and **Figure 7** indicate the age profile of non-linear assets and upgrades. They provide the average number of consumed years since installation, the percentage of average remaining life, and the percentage of assets with unknown age. The average life expectancy for non-linear assets was assumed at 50 years with the exception of customer meters with an assumed average life expectancy of 15 years³⁶. The life expectancy for test and locate stations was not provided in the source indicated table, thus was not updated in **Table 10**.

As presented in **Table 10**, and in alignment with available GIS data, the valves are grouped by mains, service and grasshoppers.

³³ Source data: Gas_Mains_High_Pressure.xls, Gas_Mains_Low_Pressure.xls, Gas_Services.xls

³⁴ The source of age of the regulating stations was not available, the number are maintained from the 2024 AMP

³⁵ The life expectancy for test and locate stations is unknown, the data shown in the table is summarized from previous 2024 AMP report

³⁶ The average life expectancy of 50 years was deduced from the 2024 AMP Table 4.3.2. The life expectancy of customer meters was provided by UK as 15 years.



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Table 10: Natural Gas Non-Linear Assets Age and Life Remaining³⁷

Non - Linear Asset	Average Age to 2025 (years)	Average Life Remaining (%)	Unknown Age (%)
Main Valve	29	42	20
Service - curb stop only	32	36	
Grasshopper Valves	43	15	
Test and Locate Stations	14.5	-	81
Customer Meters	5.5	-	13
Regulating station- City Gate	10	80	89
Regulating station- Railway St.	40	10	
Regulating station- District (typical)	5-15	67-88	

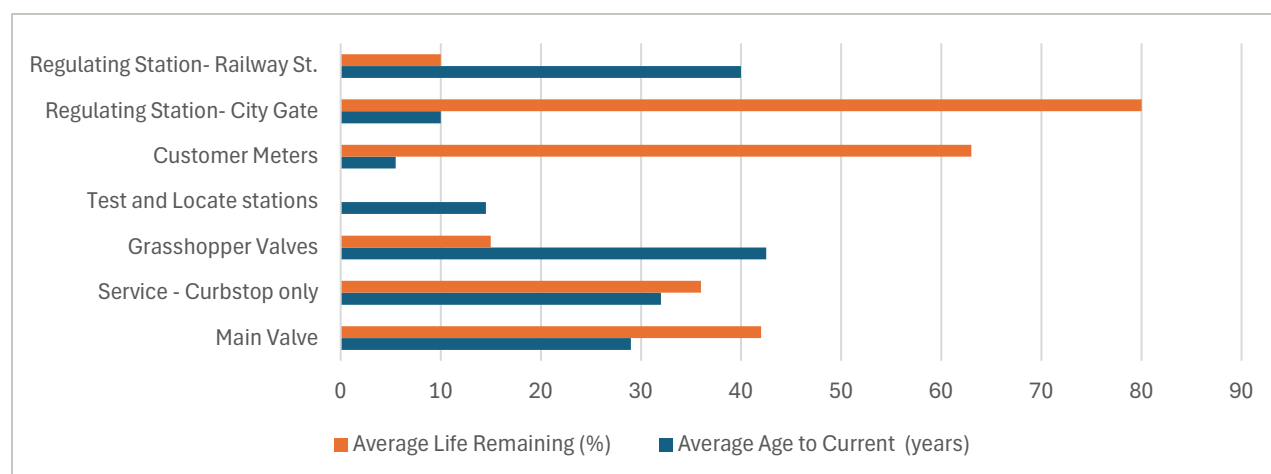


Figure 7: Natural Gas Non- Linear Assets Age and Life Remaining ³⁸

As part of current UK practices, the non-linear assets are often replaced when the adjacent linear infrastructure is replaced on a life cycle basis. Regulating stations of all sizes are treated separately and have been replaced or upgraded as dictated by the ability of the infrastructure to meet the utility's operational needs.

Note: Railway St. Regulating Station has the lowest average remaining life of 10%. The age was calculated assuming a life expectancy of 50 years from 1984 when the Station was likely built.

³⁷ Source data: Gas_Node.xls, Gas_Valve.xls, Gas_Station.xls, 2024 AMP Table 4.3.2

³⁸ Source data: Gas_Node.xls, Gas_Valve.xls, Gas_Station.xls, 2024 AMP Table 4.3.2



2.3.2 Asset Condition Assessment

Asset condition assessments were generated based on interviews and reviews of the major assets by UK Operational staff. **Table 11** defines the asset criticality grades and the conditions scores used in the assessment. Assets were criticality graded as high, moderate and low (A, B, and C, respectively) and the asset condition was scored from <2.0 to ≥ 4, with ≥4 assigned to excellent condition.

Table 11: Criticality Grade and Condition Scoring³⁹

Criticality Grade	Description
A	Highly Critical: significant facility and/or substantial consequence of failure
B	Moderately Critical: moderately sized facilities with moderate consequence of failure
C	Low Criticality: Small or very small facilities, often with redundancy or minimal consequence of failure
Condition Score	Description
≥4.0	Excellent condition
3.5-4.0	Good condition
3.0-3.5	Satisfactory condition
2.0-3.0	Poor condition

2.3.2.1 Linear Asset Condition Assessment and Methodology⁴⁰

Several condition assessment parameters are tracked relating to the condition of distribution gas mains and services, including but not limited to asset age, CP, and leak history.

The methodology used to track these parameters are the Leak Surveys and CP Surveys. See **Section 2.3.2.3** for the description of these methodologies.

As mentioned in **Section 2.3.1.1**, there are 17.5 km of various pipe diameters with coal tar coating built in 1950's-1960's. The Medium Density Polyethylene (MDPE) linear assets comprise of 81% of the distribution network and are among the most recently installed gas assets, post 1980's. For the MDPE piping, age is a primary indicator of condition. In addition to the asset age, incidents are tracked to help identify systemic material or installation issues.

³⁹ Source: 2024 AMP.

⁴⁰ The year of construction for the regulated stations is an estimate, gathered from various sources through the AMP reports.



To better understand the condition of the high-pressure linear assets, consideration has been given to in-line-inspection (ILI) methods; however, both the City and Queens lines are not currently constructed to facilitate this type of inspection. Alterations to both lines would be required to implement ILI technologies.

2.3.2.2 Non-Linear Asset Condition Assessment and Methodology

The condition assessment information for the non-linear infrastructure is based on interviews with UK Operations staff. Routine maintenance is performed on the stations in accordance with UK Standard Operating Procedures as required by the Safety Regulations.

The District Regulating Stations are relatively new additions to the NG Distribution system with most of them installed within the past 10-20 years, except the No.2 Railway St. Station that was installed in 1984. The installation dates were deduced from the '2024 AMP Table 4.3.2 Summary of Non-Linear Asset Age and Remaining Life'.

Table 12 shows the results of the condition assessment. The regulating stations No.1 City Gate and No.10 P4W were ranked by UK with the highest condition score of four (4). The table also include the estimated year of construction for the regulating stations as well as any stations with history of upgrades.

Table 12: Regulating Station Condition Assessment Summary

Asset Class	Asset Name	Condition Scores⁴¹	Constructed⁴²	Upgrades⁴³
Regulating Stations	No.1 City Gate	4.0	2015	Some upgrades are planned, such as an upgraded odorant tank
	No.2 Railway St	2.5	1985	Some upgrades conducted, some planned
	No.3 Division/Weller	3.0	2010-2020	
	No.4 Dalton Ave	3.5	2010-2020	
	No.5 John Counter	3.5	2010	
	No.6 Division St	3.5	2010-2020	Some upgrades conducted, some planned
	No.7 Elliot Ave	3.5	2010-2020	
	No.8 Sir John A. MacDonald	3.5	2010-2020	
	No.9 Novelis	3.5	2014	
	No.10 P4W	4.0	2023	
	No.11 JCB	4.0 ⁴⁴	2023 ⁴⁵	

⁴¹ Source: 2024 AMP.

⁴² Source data: 2024 AMP Table 4.3.2 Summary of Non-Linear Asset Age and Remaining Life, and Gas_Regulating_Station.xls

⁴³ Qualitative assessment based on review of historical capital replacements. Data Source: 'E3_2019 - 2022 & 2023-40 Capital Plan 2018 v.17- FINAL.xlsx'

⁴⁴ Assumed excellent condition as station was recently built

⁴⁵ Source: UK communication



The criticality scores are primarily attributed to an asset's redundancy in the system. The assets which are required to be in operation for the NG Distribution System to operate are assigned the highest criticality score. Conversely, the assets which can be temporarily taken off service without negatively impacting the level of service provided to customers are assigned a lower criticality score.

City Gate Station #1 includes redundancy within its design in accordance with Gas Safety Codes; however, the station itself has no back-up; therefore, a Criticality score of A was assigned to the station. All regulating stations in UK NG Distribution system rely on supply from City Gate; thus, if City Gate Station #1 is shut down, levels of service to all customers would be compromised, and the incident would trigger a safety critical incident response until the station returns to operation.

Railway Regulating Station #2 is the largest regulating station to feed the Intermediate Pressure Network. During the heating season, November to March, the capacity offered by this station is essential to maintain sufficient system pressure and NG supply. However, during the lower system demand, the Railway Regulating Station #2 could be taken offline without consequence; therefore, a Criticality Grade of B has been assigned to the station.

District Regulating Station #8, located at Sir John A MacDonald Boulevard and Johnson Street, has a Criticality Grade of B because its flow rate exceeds the flow of other District Regulating Stations. The condition assessment for this station included physical observations of the internal surfaces which has shown some metal loss within the body of the regulator. The location of the metal loss and wear pattern appears to be consistent with scour caused by high flow rates. While the installation of District Regulating Station #10 in 2023 helps to reduce the overloading, due to the relatively higher criticality and low asset condition score, Sir John A. MacDonald Station #8 should be considered for remediation.

The remaining District Regulating Stations (Division/Weller Station #3, Dalton Ave Station #4, John Counter Station #5, Division St. Station #6, Elliot Ave Station #7, Novelis Station #9, P4W Station #10, and JCB Station #11) have been assigned a Criticality Grade of C, as they have full redundancy in the system and can be turned off for maintenance purposes without compromising system performance.

2.3.2.3 Condition Assessment Methodologies

The following sections contain information about the various condition assessment methodologies utilized on the NG Distribution assets.

2.3.2.3.1 GIS Based Data Gathering System

Figure 8 is a screenshot of UK's GIS interface that shows the various fields that can be captured within the system and various other information relating to asset condition, including visual condition assessment determined through survey results and leak history, as described in the next sections.



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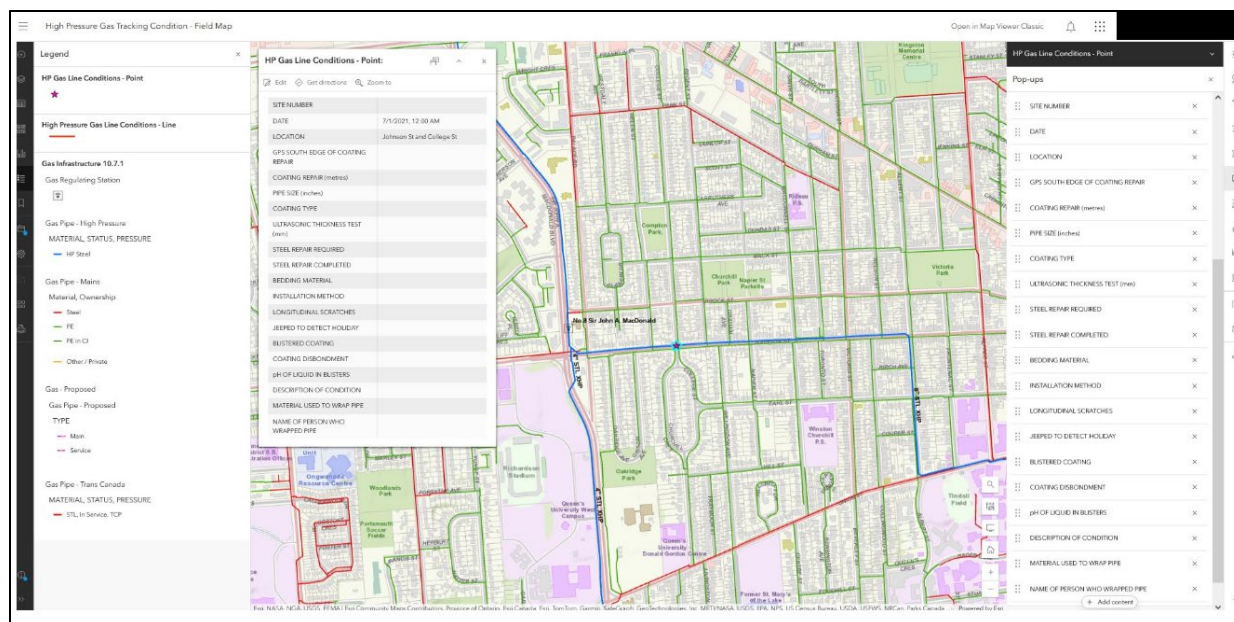


Figure 8: GIS Based Data Gathering System

UK's Natural Gas System Operational Plan and Standard Operating Procedures outline eleven procedures to inspect, test, and monitor the distribution system. These procedures are shown in **Table 13** and some of these are detailed in the next sections.

Table 13: Natural Gas System Operational Plan and Standard Operating Procedures⁴⁶

Natural Gas System Operational Plan and Standard Operating Procedures	
1. Leak Survey	GD-01-07
2. Damage Survey	GD-01-08
3. Mains Testing	GD-02-04
4. Valve Maintenance	GD-03-02
5. Service Cleaning and Testing	GD-04-02
6. Meters Light and inspect	GD-05-07
7. Corrosion Coating Repair	GD-11-02
8. Corrosion Cathodic Survey	GD-11-03
9. Regulator Stations Maintenance Inspections	GR-01-01
10. Alarm Response	GR-01-03
11. Pressure Relief Valves Operations Checks	GR-03-01

⁴⁶ Source: Distribution System Integrity Management Program.pdf.



2.3.2.3.2 *Leak Survey*

As a control response to the potential hazards, a leak survey is performed at regular intervals in accordance with the GG-01-07 Leakage Survey Program. The procedure summarizes and describes the leak detection elements, methods, and frequency. The program is held annually or event driven, except the IP Mains and service/distribution pipe system that is systematically surveyed every 5 years.

In compliance with UK standard practice, all XHP and HP assets are surveyed annually in addition to 20% of the distribution system as well as any special zones, new construction projects, events, etc. In the last two years (2023 and 2024), new installations, distribution system Zones 2 and 6, commercial Zone 1, and all XHP/HP lines including TCP to Railroad St. Station and TCP to Queen's University as well from Sir John A McDonald Blvd. to Division St underwent leak surveys. Service valves and tees corresponding to the survey locations were also surveyed. A laser spectroscopy instrument was used to conduct the leakage surveys, as well as a Gazoscan Remote Methane Detector was utilized on non-passable areas of the XHP line. Supplementary instrumentation, such as Combustible Gas Indicators, Odorators, and Ethane Identifiers were available and utilized as required. In 2024, a total of 64 km of distribution lines were surveyed and all (27km) of XHP/HP lines. According to the GTel report, 0.06 below grade leakage per km (or 6.8 leaks per 100 km) were found and reported back to the Operator for the distribution system and 0 below grade leaks for the XHP/HP system.

All identified leaks are reported and the records kept on file record. Repair work is performed within a specific timeline depending on the severity of the leak and its subsequent leak classification (A, B, or C), as prescribed by the Program.

2.3.2.3.3 *Cathodic Protection*

The CP system is a passive system relying on sacrificial anodes distributed throughout the network of steel mains to ensure that the pipelines are protected. The current system relies on direct measurement of the pipe-to-soil potential difference at each test station, performed on an annual basis. These measurements are reviewed and areas which need additional protection have additional anodes installed.

2.4 Maturity and Moving Forward

2.4.1 Asset Inventory and Replacement Cost Maturity

The Linear Assets inventory information is available through the City of Kingston's GIS with varying levels of detail. The inventory is well structured by main lines that are HP, IP, and LP as well as service pipes. The inventory has detailed information on asset attributes, such as geographical location, pipe ID, diameter size, type of material, type of pressure system, coating, and year of installation. For some 1950's pipes, the year of replacement was added in the Comments column. The NG leak incident information stored has a geographical representation mapped to the GIS inventory.



Linear Assets have a good data inventory in terms of location, type and size of assets. Only 0.1% of the assets are missing diameter size. Some areas for improvement were identified below:

- Pipe coating is missing for 3 km of steel pipes in the GIS inventory.
- The NG leak incident information is stored in GIS inventory, but it does not tie with the pipe ID in the GIS inventory.
- Overall, the liner assets inventory is considered to meet the minimum maturity level requirements as per the IIMM (NAMS, 2011) guidelines (refer to **Table 14: Current Maturity of Asset Inventory and Valuation**).

Linear Assets replacement costs were determined by UK in the 2024 AMP. HP and IP system replacement costs were assessed by pipe length in meters, while the Gas Service system valuation was switched from a per meter basis to a per service basis in better alignment with industry pricing. A minimum cost replacement per length of each pipe was completed by UK, with some 1 ¼" and 12" pipe diameters missing the cost replacement. Per **Section 2.2.1**, it is concluded that the 2025 value of the Linear assets is approximatively \$664 million.

Overall, the Linear Assets valuation has sufficient information to meet the 'Minimum' criteria. The replacement cost for applicable asset age/life is considered to meet the criteria for Core Maturity level.

The Non- Linear Assets inventory information is available through the City of Kingston's GIS. Similar to the Linear Assets, the Non- Linear Assets are also included in the GIS inventory with varying levels of detail. The inventory is structured by stations, valves, and nodes. The non- linear assets inventory has detailed information on asset attributes, such as northing and easting geographical location, asset ID, type of service, valve diameter size, type of valves or other fittings, and year of installation.

Valves are divided by types such as main valves, service valves, and grasshoppers. The type of valve is classified in the GIS. Valves are mainly classified as Excess Flow and Curb Stop and some of the valves are associated with type of pipe pressure (e.g., HP/TCP, IP).

The Non-linear Assets inventory was noted to have some limited information summarized below:

- Major equipment within a regulating station such as boilers and heaters, some of which is risk ranked the highest score, is not represented in the GIS inventory.
- The valve inventory is relatively complete, with 1% of valve diameter sizes unknown, of which, four (4) are main valves. Only four (4) grasshopper valves are present in the GIS inventory. Some grasshopper valves appear to not be represented.
- CP assets - including test points, anodes, locate stations, and insulators are present in the inventory. However, the ground beds are missing and the number of anodes is likely to represent only those that are recently installed.



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Considering these factors, the overall non-linear asset inventory is in a minimal state as per the IIMM (NAMS, 2011) guidelines (refer to **Table 14: Current Maturity of Asset Inventory and Valuation**). Some assets such as Test and Locate Stations are at a core maturity level.

Non-Linear assets replacement costs – valves, stations, test and locate systems - were evaluated as individual assets. The replacement cost value conducted by UK provides a detailed breakdown of the replacement costs of the assets in a structure that could not be exactly related with the GIS inventory. For example, valves were divided between above and below grade valves with Curb Stops considered as below grade valves and Line Shut-off Valves (Grasshopper) considered as above grade valves. When UK's valve characterization was compared with the GIS inventory, the above grade /below grade category was not present in the GIS inventory. Therefore, the number of valves could not be compared. The GIS Inventory also listed 4,150 valves while the 2024 AMP listed 3,529 valves. **Section 2.2.2** details a best fit in terms of valve characterization and number of valves.

The replacement costs for Regulating Stations #1 and #6 include significant uncertainty, due to the insufficient comparable cost information available for large regulating stations of similar nature, since they are replaced infrequently. It is noted that the Non-Linear Assets were valued in year 2025 to approximately \$14.7 million.

Some Non-Linear Assets have insufficient information to complete the valuation for all applicable asset age/life. Therefore, it is concluded that not all the Non-Linear Assets meet the Core Maturity level.

Table 14: Current Maturity of Asset Inventory and Valuation

Maturity Level ⁴⁷	Description	Status of Current Plan
Minimum	Basic physical information recorded in a spreadsheet or similar (e.g. location, size, type), but may be based on broad assumptions or not complete.	Currently meeting the Minimum Maturity Level
Core	Sufficient information to complete asset valuation – as for 'minimum' plus replacement cost and asset age/life. Asset hierarchy, asset identification and asset attribute systems documented.	Majority of the Linear assets meet the Core Maturity. Short-Term Target: advance maturity of non-linear assets
Intermediate	A reliable register of physical and financial attributes recorded in an information system with data analysis and reporting functionality. Systematic and documented data collection process in place. High level of confidence in critical asset data.	
Advanced	Information on work history type and cost, condition, performance, etc. recorded at asset component level. Systematic and fully optimized data collection program. Complete database for critical assets; minimal assumptions for non-critical assets	

⁴⁷ Levels defined in 2024 AMP



2.4.2 Asset Age and Condition Assessment Maturity

To summarize, the condition of the Linear Assets is assessed based on the installation date, leak surveys, CP surveys, and the asset's life expectancy. The LE of NG Linear Assets is estimated taking into consideration the pipe material (steel, PE), while an average LE is assumed for Non-Linear Assets. Additionally, for assets with missing installation dates, the LE should be further estimated based on other available data and/ or through the best judgement of UK staff.

Considering these factors, the overall asset inventory is in a minimal state per the IIMM (NAMS, 2011) guidelines (refer to **Table 14** in the section above). Likewise, the maturity of the Facilities condition assessment can be considered at a Minimum Maturity level.

Stantec recommends the following actions regarding the asset inventory:

1. Include all condition assessment attributes of assets in the inventory such as coating condition, pipe accessibility, proximity to other utilities, over pressurization, over utilization, third party damage, geotechnical, and capability to line locate.
2. Include assets such as boilers and heaters in the GIS data that are ranked high in criticality for further tracking of the maintenance timelines.
3. Update and correct information missing in GIS (e.g., PE lines have coating, customer meters and installation dates missing) using other available data sources. A complete list of CP assets should be included in the inventory for tracking and recording evidence of inspection and maintenance.
4. Include the pipe steel and valve material grades and wall thickness in the asset inventory for further assessing the condition of the underground assets.
5. Valves should be updated to indicate whether they are above or below grade. Historically, opportunity for valve maintenance was used as a measure of pipe replacements, however, a record of the valve's latest maintenance should be kept.
6. The LE of the assets should be studied and added to the inventory.
7. Conduct a formal condition assessment for the linear assets and major equipment installed at non-linear asset sites, including the City Gate and Railway Stations.
8. The capacity of the main and intermediate stations should be monitored and upgraded to avoid overutilization.



3 Levels of Service

3.1 Current Level of Service

The Ontario Regulation 588/17 requires a description of the current Level of Service (LOS) for all asset categories. In the case of non-core assets such as the NG Distribution System, the LOS is based on qualitative descriptions and quantitative defined metrics.

The LOS indicates the quality of service provided and it is helpful to guide UK in their management of infrastructure to meet specific service quality targets. This version of the AMP, in addition to the number of leaks as the primary indicator of the LOS, considers other risk, sustainability, growth and reliability metrics. **Table 15** below summarizes the performance and reliability metrics for LOS of below grade assets.

3.1.1 Performance and Reliability

Table 15: Performance and Reliability

Key Performance Indicator	Past Period (2018-2022) <i>Average per Year</i>	Current Period (2023-2024) ⁴⁸ <i>Average per Year</i>	Target (2025 to 2034)	Notes
Unplanned Downtime/ Outages that Affect Active Customers ⁴⁹	18	12	<12	Unplanned outages due to line strikes
Planned Downtime/ Outages that Affect Active Customers ⁵⁰	4	Unknown	<5	Outages due to planned repairs

3.1.1.1 Current Level of Service Metrics – Downtime Related to Unplanned Line Strikes

Downtime related to unplanned line strikes is tracked as an indicator of both operational performance within the utility and overall infrastructure health. An increased number of line strikes may be correlated to higher amounts of unplanned, reactive work or a reduction in safety and quality of work being undertaken on the system.

⁴⁸ Source data: UK - CP Data for 2021 due March 31 with Comments, GasLeaks_BelowGrade.xlsx.

⁴⁹ Recent Downtime/ Outages that Affect Active Customers- data not available. Downtime that affects active customers was made available for 2018-2021 only

⁵⁰ Recent Downtime/ Outages that Affect Active Customers- data not available. Downtime that affects active customers was made available for 2018-2021 only



Figure 9 and **Table 16** show a summary of the 2023-2024 third-party damage (unplanned line strikes) recorded for the assets with or without release of the gas product.

Table 16: Gas Damage/Release Incidents from 2023-2024 due to Third-Party Damage⁵¹

Year	No. of Gas Incidents	Above Grade	Below Grade	Damage with Gas Release (Underground)	Cause
2023	12	2	10	8	Third party damage
2024	12	0	12	12	Third party damage

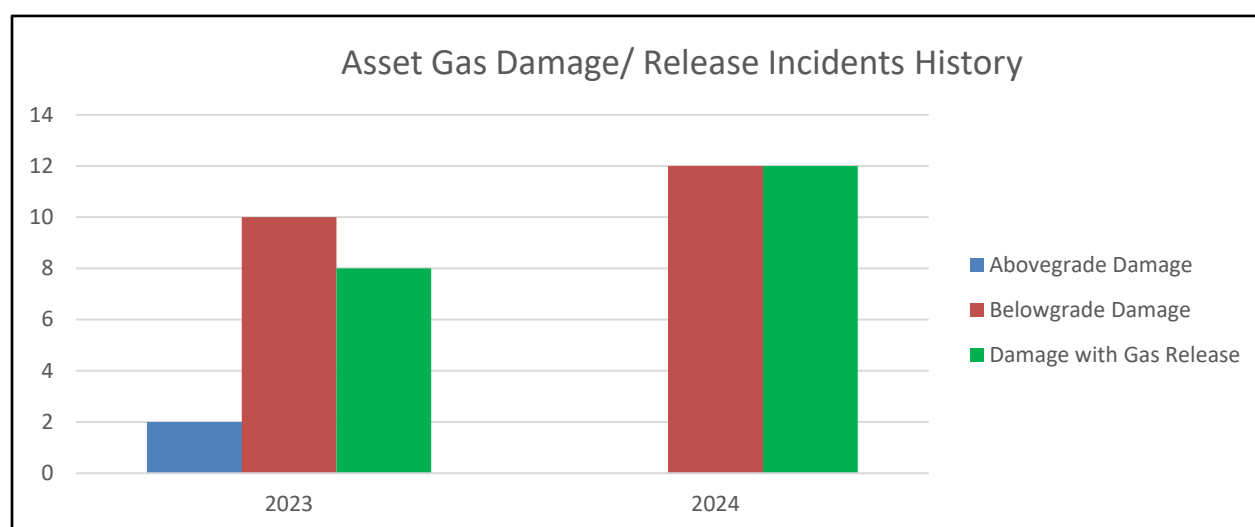


Figure 9: Gas Asset Third-Party Damage/ Release Incidents⁵²

3.1.1.2 Current Level of Service Metrics – Downtime Related to Planned Repairs⁵³

UK tracks the number of outages due to planned repairs as both an indicator of infrastructure health as well as quality and reliability of service delivery to customers. UK aims to continually reduce the number of outages resulting from planned work to maximize system uptime.

According to ORCGA statistics published for 2019-2021, 2-5 outage/year occur due to planned repairs in the gas distribution pipe system.⁵⁴ Outage data for planned repairs in 2023-2024 was not available at the time of preparing this report.

⁵¹ Source data: Gas Pipeline Incident Spreadsheet.xls.

⁵² Source data: Gas Pipeline Incident Spreadsheet.xls.

⁵³ Source: The GIS data available for downtime due to planned repairs.

⁵⁴ Source: UK – CP Data for 2021 due March 31 with Comments



3.1.2 Risk Management

3.1.2.1 Current Level of Service Metrics: Number of Leaks

Leak data is tracked as a prime indicator of infrastructure health with the yearly goal of reducing occurrences of leaks and increasing monitoring to reduce duration of leaks. Leaks tracked in these key performance indicators (KPIs) do not necessarily result in system downtime and are often located via annual leak surveys and subsequent repaired without service interruption. **Table 17** presents a summary of below-grade leak performance by primary cause.

Table 17: Risk Management

Key Performance Indicator	Past Period (2018-2022) Average per Year	Current Period (2023-2024) ⁵⁵ Average per Year	Target (2025 to 2034)
Number of Leaks: Mains and Services due to Excavation Damage	6	11	10
Number of Leaks: Mains and Services due to Materials or Welds	1.4	1.5	1.5

Figure 10 and **Figure 11** address the number of below grade leaks per year over defined periods of time observed in UK's distribution network. The leak data addressed in **Figure 10** and **Figure 11** present the number of below grade leaks of pipelines surveyed between 2018-2024 by material pipe and by cause of the leak.

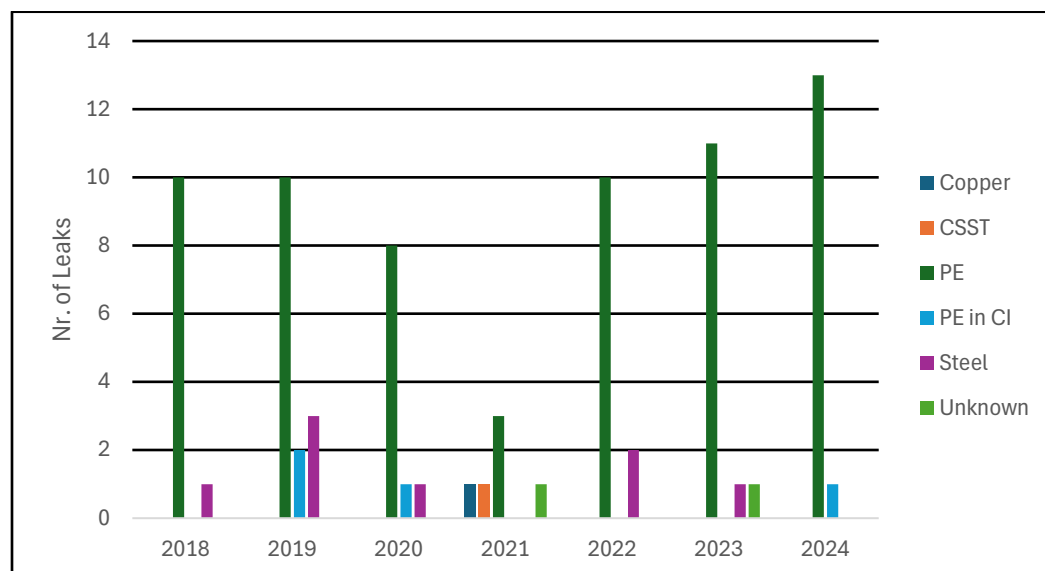


Figure 10: 2018-2024 Below Grade Leak by Material⁵⁶

⁵⁵ Source data: UK - CP Data for 2021 due March 31 with Comments, GasLeaks_BelowGrade.xlsx.

⁵⁶ Source data: 'GasLeaks_BelowGrade.xls'.



It is noted that the major cause of below grade leaks is excavation damage followed by material and welds. There was an increase in the number of leaks from an average of 11 below grade leaks per year in 2018-2022 to 13 leaks in 2023 and 14 leaks in 2024.

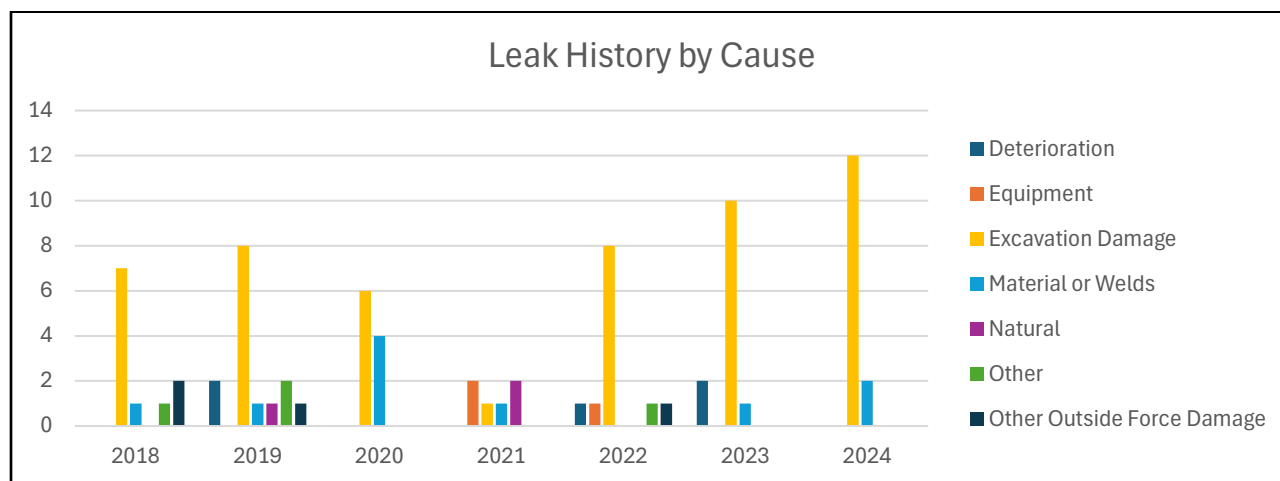


Figure 11: Below Grade Leak since 2018 to Date by Cause⁵⁷

Pipes made of PE material are most prone to leaks when located underground due to excavation damage.

3.1.3 Current Asset Performance

Asset performance of the NG System at UK is presently addressed by the hydraulic conveyance of an asset relative to its maximum capacity, with the intention to indicate remaining capacity in the asset system.

The following sections address the relative capacity of the Linear Assets including the high-pressure and intermediate networks, as well as the non-linear regulating station assets, and represent the current performance of NG assets in accordance with the Ontario Regulation 588/17.

3.1.3.1 Linear Assets

The current performance of the Linear Assets is inferred by comparing the upstream pressure to the downstream pressure for the given asset, using data obtained through pressure monitoring programs. The performance of the assets is further measured by using knowledge of pipeline system capacity and comparison of the mentioned pressure data points.

Figure 12 illustrates the industry standard curve used to determine utilized capacity and performance of linear assets. It should be noted that as a system approaches its maximum capacity, the pressure ratio decreases steeply in a non-linear fashion. The shape of the curve suggests that for pressure drop ratios

⁵⁷ Source data: Gas Pipeline Incident Spreadsheet.xls.



less than 0.5, the risk of exceeding available capacity would increase sharply. To manage the risk, it is suggested that a pressure drop ratio of 0.5 be used as a limit to trigger the capacity upgrades, which corresponds to approximately 80% of a pipeline system's utilized capacity.

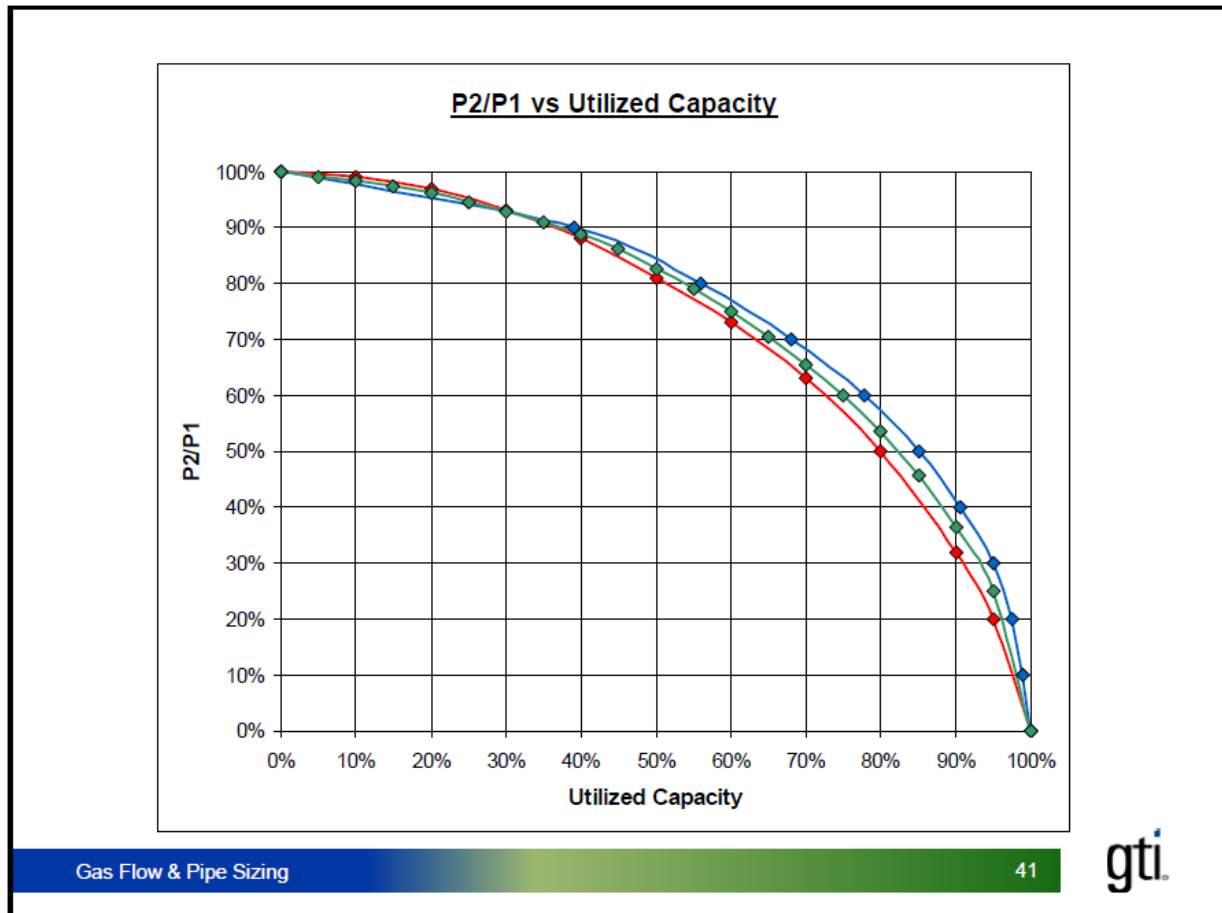


Figure 12: Pressure Drop vs Utilized Capacity⁵⁸

3.1.3.2 High Pressure Pipeline System

Instantaneous pressure and flow data from 2024 was analyzed, and a graphical representation of the high-pressure pipe system, for City Line and Queen's Line, is shown in **Figure 13** and **Figure 14**, respectively.

As presented in **Figure 13**, City Line pressures includes data from pressure sensors located at the most upstream location (City Gate City Outgoing Line Pressure (CityGate_AIPT11) and the most downstream locations on the pipeline (Railway St. Incoming Gas Pressure (RAILRTU.PT01)). The outlier datapoints appear within the data set as a brief drop in pressure. These anomalies in the data are generated when

⁵⁸ Source: 2024 AMP



sections of the pipeline containing the sensor have been subject to maintenance work/procedures. The data anomalies have been excluded from the analysis.

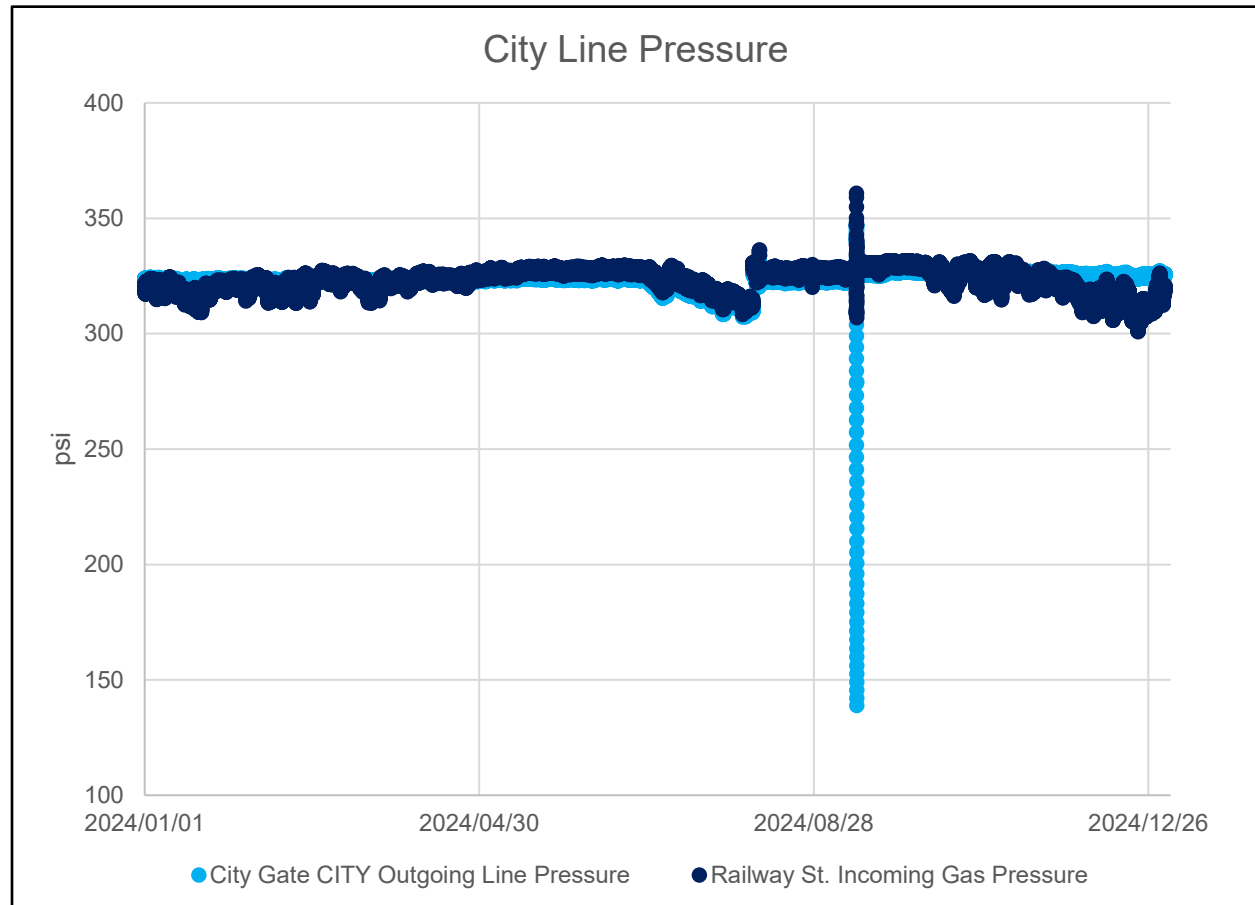


Figure 13: City Line Input and Output Pressure⁵⁹

As presented in **Figure 14**, Queen's Line pressures include data collected from the sensors installed at the most upstream location (City Gate Queen's Line Pressure (CityGate_AIPT06) and the most downstream location (CHP High Pressure Incoming (CHPGAS.HPIN)). A few of the extraneous data points above and below the trendline are believed to be caused by readings taken at the time when the power plant downstream switches instantaneously off. The system quickly compensates this brief imbalance, but a reading per on/off event shows in the data. These data anomalies have been also excluded from the analysis.

⁵⁹ Source data: 3.a,b,c Citygate.xlsx, 3.a,b,c Railway.xlsx, 3.a,b,c CHP.xlsx.



Natural Gas Utilities Asset Management Plans 2025 to 2034

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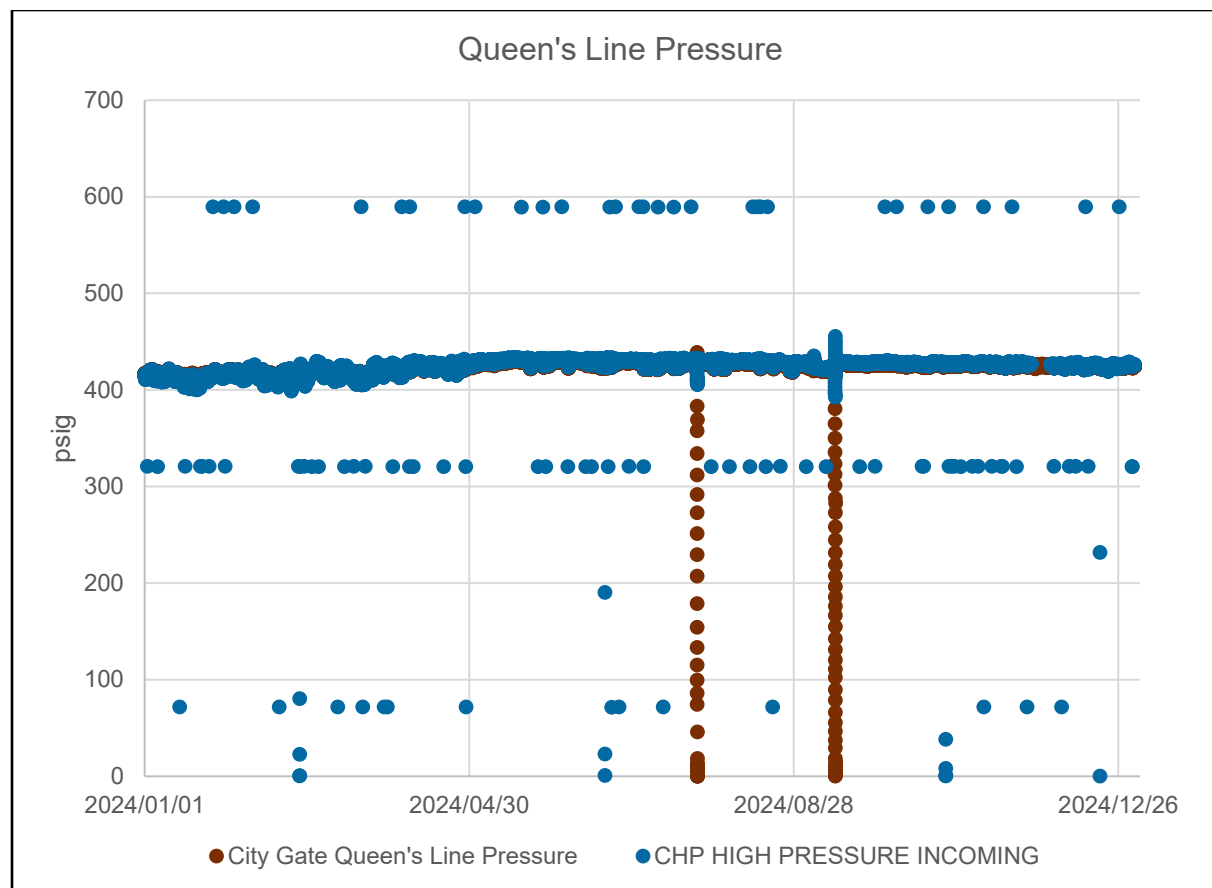


Figure 14: Queen's Line Input and Output Pressure

Table 18 summarizes the current asset performance for this asset class and shows roughly a 25% utilization of the City Line in 2024.

Table 18: Actual Capacity of Regulated High-Pressure Linear Assets

Linear Asset	P1 ⁶⁰ (psig)	P2 (psig)	P2/P1	Flow Rate (m3/h)	Utilized Capacity (%)
City Line	324	309 ⁶¹	0.95	14,364	25
Queen's Line	424	398 ⁶²	0.94	16,420	100

It should be noted that the minimum acceptable downstream pressure for the Queen's Line is 400 psi due to the sales agreement in place with Queen's University. Therefore, with this constraint, the Queen's Line

⁶⁰ P1 taken as average outgoing pressure from City Gate

⁶¹ P2 taken from minimum pressure reading during demand period on January 20-21, 2024. Flow rate taken from City Gate City Line at corresponding timeframe.

⁶² P2 taken from minimum pressure reading during demand period on February 24, 2024. Flow rate taken from City Gate Queen's Line corresponding timeframe.



is at 100% of its available capacity. If it is assumed that the minimum acceptable downstream stream pressure for the City Line is 60 psi, this line may be assessed to be utilized at ~30% of its available capacity.

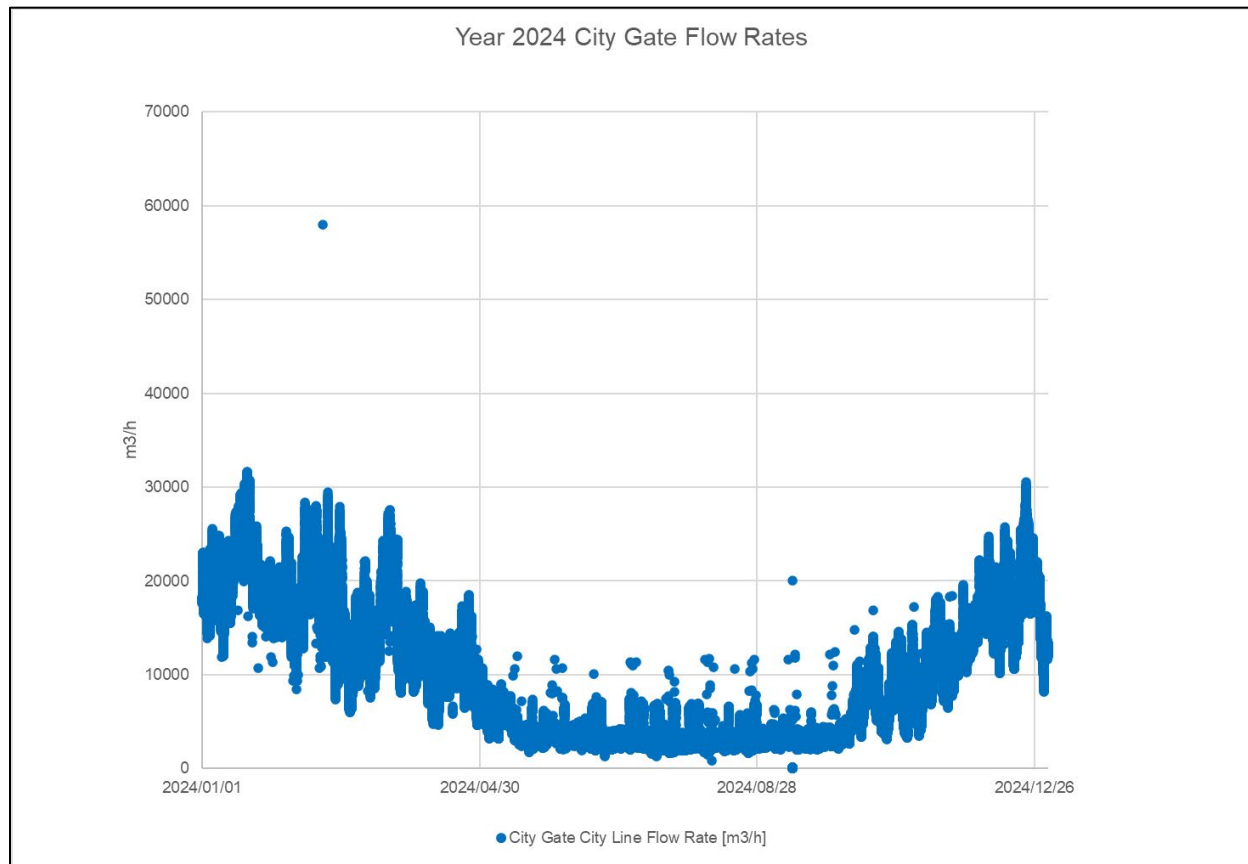


Figure 15: Summation of City Gate City Line and City Gate Queen's Line Daily Flow Rates⁶³

Flow rate data received taken in 2024 from City Gate City Line and Queen's Line in general do not exceed the City Gate peak historical flow rates⁶⁴ of 40,000 m³/h from 2014 and 2016. Assuming that the February 2024 flowrate of 58,000 m³/h is a reading error, the peak 2024 flowrate is 31,580 cubic meters per hour, as per the **Figure 15**.

3.1.3.3 Intermediate Pressure Network

Four (4) large volume meters are selected for measuring pressures at the far end of the intermediate pressure systems. These are 1000 King W., 7 Earl St., 8 River St, and 100 Portsmouth Ave.

⁶³ Source data: 3.a,b,c Citygate.xlsx.

⁶⁴ Historical flow rate data is taken from the 2024 AMP.



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Downstream pressure within the Intermediate Pressure network is the limiting factor in available system capacity and is a highly critical performance indicator. This data informs UK about excess capacity available to connect new customers without investing in capital expansion projects. To gather this data, Electronic Volume Corrector (EVC) meters are utilized. The EVC meters use real-time pressure data to perform the volumetric metering calculations. The program began collecting this data at specific locations in November 2020.

Figure 16 shows a map of the Intermediate Pressure Monitoring Locations.



Figure 16: Map of Intermediate Pressure Monitoring Locations⁶⁵

Table 19 recaps the data provided in the 2024 AMP and summarizes the upstream and downstream pressures at the end of Intermediate Pressure network.

⁶⁵ Data Source:2024 AMP.



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Table 19: Meters Capacity for End of Intermediate Pressure Assets⁶⁶

Linear Asset	P1 (psig)	P2 (psig)	P2/P1	Utilized Capacity (%)
1000 King St. W.	48.8	34.4	0.70	65
7 Earl St.	48.8	36.5	0.75	55
8 River St.	50	41.6	0.83	50
100 Portsmouth Ave.	48.8	33.5	0.69	65

Recent capacity pressure data received from partial readings taken in 2024-2025 show the minimum and maximum pressure recorded daily. The maximum and minimum pressures incoming into the volume meters was analyzed based on the recent 2024 data. The pressure was made available at the locations '8 River St.' and '7 Earl St.' and '1000 King St. W' and is presented in **Table 20**.

Table 20: Volume Meters Capacity for Intermediate Pressure Assets based on Pressure – 2024⁶⁷

Non- Linear Asset	P1 ⁶⁸ (MOP) (psig)	P2 (Min. Pressure Incoming) (psig)	P2/P1	Utilized Capacity (%)
1000 King St. W.	60	41.1	0.69	65
7 Earl St. In	60	39.9	0.67	65
8 River St. In	60	43.7	0.73	60

It is concluded that in recent (2024) statistics the volume capacity of the volume meters is maximized, and the pressure capacity of the volume meters is at 60-65% utilization. The minimum service pressures of these meters were not provided, so the utilization based on service constraints cannot be reported.

⁶⁶ Data Source: 2024 AMP, Table 3.1.1.1. It is assumed these pressures are representative of the capacity at end-2023.

⁶⁷ Data Source: Natural Gas - Spare Capacity.zip. It is assumed the data provided is in absolute pressure

⁶⁸ Pressure data from upstream regulating district stations not made available. It is assumed that the outlet pressure of the regulating stations is MOP pressure.



3.1.3.4 Non-Linear Assets/ Facilities

Figure 17 provides expected NG flow rates at the different pressure regulating stations.

When gas is received into the UK NG System, the flow is divided at City Gate Regulating Station #1 into two high-pressure distribution mains. The expected flow rates for these two lines are included in the figures below.

The City Line was originally installed in 1958, and its primary purpose is to feed Regulating Station No. #2 Railway St. and customers on the east side of the distribution system, based on demand and the resulting relative pressures within the related intermediate pressure network. The Queen's Line was installed in 2006 in order to provide high-pressure and high-volume gas supply to the Queen's University Combined Heat and Power Plant.

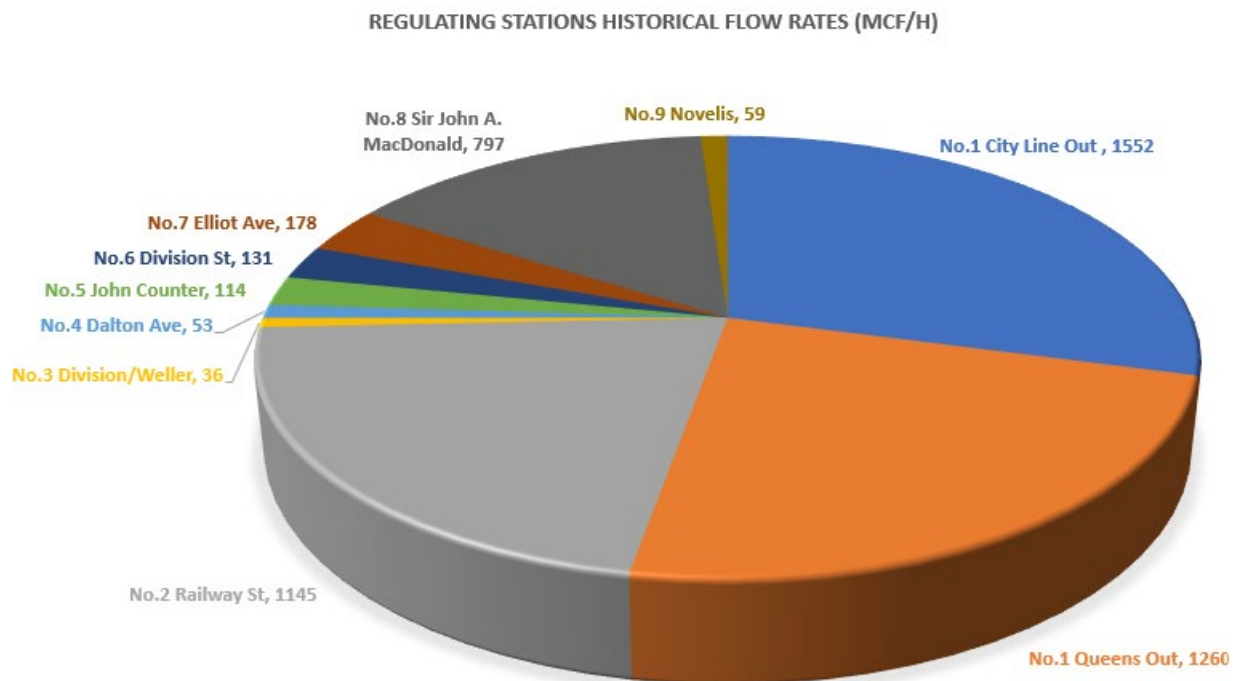


Figure 17: Gas Model Rates at High and Intermediate Pressure Regulating Stations (Mcfh)⁶⁹

⁶⁹ Data Source: GA2 - District Station Report_ok.xls.



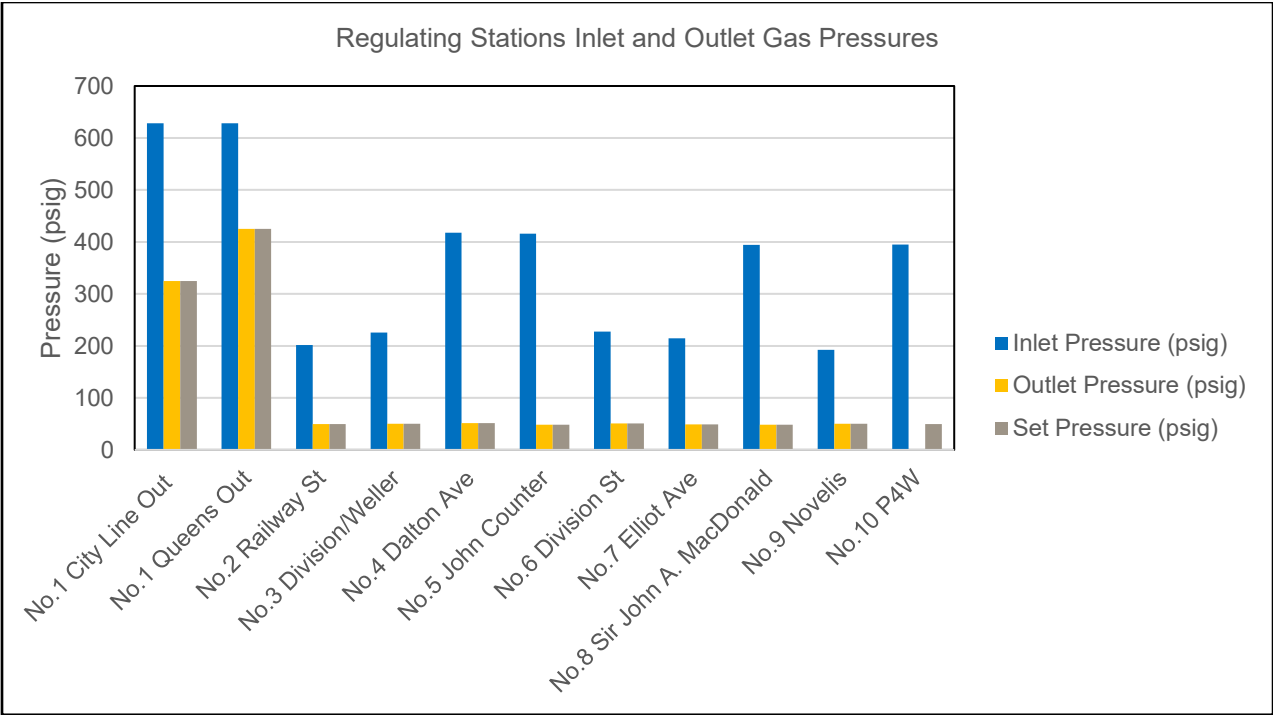


Figure 18: Historical Regulating Stations Inlet and Outlet Pressure⁷⁰

The second level in gas distribution is the transition from the high-pressure lines to the intermediate pressure distribution piping network. At the transition locations, metering data is not available because these stations are not equipped with meters. Instead, flow rate estimates provided by hydraulic modelling software can be utilized. The pressures for each of these intermediate regulating stations is also presented in **Figure 18** above.

Table 21 refers to historical gas flow rates capacity while **Table 22** provides information on current (2024) gas capacity utilization, which is used to measure the performance capacity of the assets.

⁷⁰ Data Source: GA2 - District Station Report_ok.xls.



Table 21: Historical Regulating Station Capacity Utilization⁷¹

Station	Estimated Flow Rate (Sm ³ /hr)	Capacity (Sm ³ /hr)	% Utilized
No.2 Railway St	18,661	40,000	47%
No.3 Division/Weller	588	6,800	9%
No.4 Dalton Ave	867	8,500	10%
No.5 John Counter	1,864	8,500	22%
No.6 Division St	2,141	6,800	31%
No.7 Elliot Ave	2,903	6,800	43%
No.8 Sir John A. MacDonald	12,977	8,500	153%

In conclusion, based on the historical provided data (GA2 - District Station Report), the Non-Linear system has some level of surplus capacity which varies depending on the Station, except for the No. 8 Sir John A. MacDonald Station that shows as over utilized. More recent data was not made available for No.8 Sir John A. MacDonald, however, it is expected that since the installation of the No. 10 P4W Regulating Station and associated P4W line, the utilization of No.8 Sir John A. MacDonald Station will have reduced.

Table 22: Current Regulating Station Capacity Utilization using SCADA data for 2024

Station	Maximum Flow Rate (Sm ³ /hr) ⁷²	Stated Capacity (Sm ³ /hr) ⁷³	% Utilized
No. 1 City Gate City Line	16,615	50,000	68%
No. 1 City Gate Queens Line	17,608 ⁷⁴		

3.2 Proposed Levels of Service

In general, UK is not proposing any significant changes or enhancements to its current lifecycle activities or existing operational service levels over the next 10 years. This decision reflects a balanced approach to service delivery, financial sustainability, and risk management. The current levels of service are considered both achievable and appropriate within UK's existing financial and operational capacity.

Several factors support the decision to maintain existing service levels. The operating budget, funded through stable and predictable revenue sources, is sufficient to support ongoing maintenance and operations. The current service levels align with community expectations and have proven to be both

⁷¹ Data Source: 2024 AMP, Table 3.2.1. It is assumed that this data is representative of the capacity at end-2023.

⁷² Data Source: 3.a,b,c Citygate_CV.xls.

⁷³ Data Source: 2024 AMP, Table 3.2.1

⁷⁴ Excluding unrealistically high datapoints that are assumed to be data errors.



effective and affordable. Furthermore, the condition of existing assets and the associated risks are being actively managed through planned maintenance and renewal activities.

A number of new KPIs, outlined in **Table 23** have been added to allow the municipality to better predict future growth-related infrastructure needs, increase resilience and align with the City's and UK sustainability objectives.

3.2.1 Performance and Reliability

Table 23: Performance and Reliability (Proposed)

Key Performance Indicator	Past Period (2018-2022) <i>Average per Year</i>	Current Period (2023-2024) ⁷⁵ <i>Average per Year</i>	Target (2025 to 2034)	Notes
Unplanned Downtime/ Outages that Affect Active Customers ⁷⁶	18	12	Good: < 10, Acceptable: 10-18, Unacceptable: > 18	Unplanned outages due to line strikes
Planned Downtime/ Outages that Affect Active Customers ⁷⁷	4	Unknown	Good: < 3, Acceptable: 3-5, Unacceptable: > 5	Outages due to planned repairs
NEW Below Grade Leaks per 100km per year	Unknown	6.8 ⁷⁸	<31 ⁷⁹	

3.2.1.1 Proposed Level of Service – Downtime Due to Planned Repairs

UK proposes to maintain the existing level of service with respect to downtime/outages related to planned repairs. Further data related to downtime needs to be gathered and tracked to establish an appropriate target metric and funding required.

⁷⁵ Source data: UK - CP Data for 2021 due March 31 with Comments, GasLeaks_BelowGrade.xlsx.

⁷⁶ Recent Downtime/ Outages that Affect Active Customers- data not available. Downtime that affects active customers was made available for 2018-2021 only

⁷⁷ Recent Downtime/ Outages that Affect Active Customers- data not available. Downtime that affects active customers was made available for 2018-2021 only

⁷⁸ Data Source: 2024 GTel Leakage Survey Report

⁷⁹ Based on estimated US national average of 0.5 leaks per mile of pipeline reported in Cheptonui, F.; Riddick, S.N.; Hodshire, A.L.; Mbua, M.; Smits, K.M.; Zimmerle, D.J. Estimating the Below-Ground Leak Rate of a Natural Gas Pipeline Using Above-Ground Downwind Measurements: The ESCAPE1 Model. Sensors 2023, 23, 8417. And reference Weller, Z.D.; Hamburg, S.P.; Von Fischer, J.C. A National Estimate of Methane Leakage from Pipeline Mains in Natural Gas Local Distribution Systems. Environ. Sci. Technol. 2020, 54, 8958–8967.



3.2.1.2 Proposed Level of Service – Below Grade Leak Rates per 100 km

UK proposes to add a new KPI to track the number of below grade leaks per 100 km, with a target of less than 31 leaks per 100 kilometers per year, which is based on US national averages.

Data will be gathered through the existing leakage survey program. The leakage survey program divides the distribution gas grid into sections and inspects based on a 5-year maximum inspection interval and annually for XHP/HP assets and selected areas of interest. It is important to note that in any given year only 20% of the distribution grid is surveyed.

It should be noted that leak rate data for above grade piping is tracked separately as it is not considered an indicator of pipeline condition. It is tracked separately as an important data set relating to the greenhouse gas (GHG) emission management and reduction.

3.2.1.3 Proposed Level of Service - Downtime Related to Line Strikes

UK proposes to maintain the existing level of service with respect to downtime/outages related to line strikes. Information on the number of line strikes is currently tracked, however, information regarding associated downtime needs to be better tracked going forward.

3.2.2 Risk Management

Table 24: Risk Management (Proposed)

Key Performance Indicator	Past Period (2018-2022) Average per Year	Current Period (2023-2024)⁸⁰ Average per Year	Upcoming Period (2025 to 2034)⁸¹	Target (2025 to 2034)
NEW Linear Assets Exceeding Life Expectancy	Unknown	IP Mains: 6% HP Mains: 27% Service Pipe: 1%	IP Mains: 6% HP Mains: 27% Service Pipe: 1%	Good: < 5%, Acceptable: 5 - 25 %, Unacceptable: > 25%
NEW Non-Linear Assets Exceeding Life Expectancy	Unknown	Unknown	Customer Meters: 50%	Good: < 5%, Acceptable: 5 - 10 %, Unacceptable: > 10%
Number of Leaks: Mains and Services due to Excavation Damage	6	11	-	Good: < 6, Acceptable: 6-12, Unacceptable: > 12
Number of Leaks: Mains and Services due to Material or Welds	1.4	1.5	-	Good: < 2, Unacceptable: > 2

⁸⁰ Source data: UK - CP Data for 2021 due March 31 with Comments, GasLeaks_BelowGrade.xlsx., Gas_Mains_High_Pressure.xlsx, Gas_Mains_Low_Pressure.xlsx, Gas_Services.xlsx

⁸¹ Source data: Gas_Mains_High_Pressure.xlsx, Gas_Mains_Low_Pressure.xlsx, Gas_Services.xls. Customer meter data provided by UK.



3.2.2.1 Proposed Level of Service – Linear Assets Exceeding Life Expectancy

UK proposes to add a new KPI to track the number of linear assets exceeding their life expectancy with the target of less than 25% of linear assets (IP Mains, HP Mains, and Service Pipes) to be exceeding their life expectancy and to maintain the 25% over the next 10 years. **Figure 19** depicts the percentage of assets exceeding their service life in the next 10-years, assuming no replacements are undertaken. Currently, 27% of the HP assets are exceeding their LE in 2025. Taking an average 2025 replacement cost of the end-of-life HP assets to be \$3,866 per meter, approximately \$2.1 million is required in 2025 to bring the HP assets within the proposed LOS target⁸². The funding required for 2025 HP Replacements can be spread and indexed over the next 10-years to meet this proposed LOS, provided UK assesses that the assets are safe for continued operations and has appropriate risk mitigations and monitoring in place. **Section 5.2** details the 10-year funding available and shows that the utility is in deficit with this proposed LOS.

Currently, 6% of IP Mains, 0.2% of HP Mains, and 33% of Service Pipes have an unknown installation date in the GIS inventory. Accurate installation dates should be obtained for these assets to ensure reliable tracking of this KPI and to support the proposed LOS.

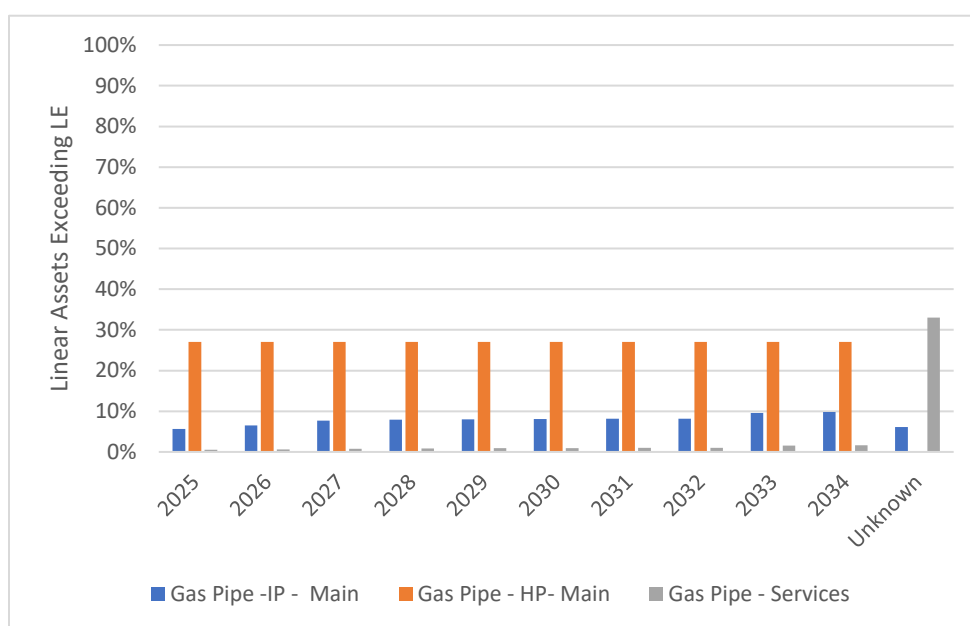


Figure 19: Linear Assets Exceeding 60-year LE

⁸² Source: 2024 AMP replacement costs, indexed to 2% for linear assets



3.2.2.2 Proposed Level of Service – Non-Linear Assets Exceeding Life Expectancy

UK proposes to add a new KPI to track the number of non-linear assets exceeding their life expectancy. This KPI currently only applies to customer meters. Further information needs to be gathered on facility assets to track a similar KPI in future revisions.

With an estimated life expectancy of 15 years, approximately 50% of the customer meters will reach their end of useful life within the next 10-year period. The 2025 replacement costs for the customer meters can be used to determine the additional funding required to keep the customer meters within the proposed LOS target. This results in an additional \$3.1 million to meet the proposed target. This cost can be spread and indexed over the next 10-years. **Section 5.2** details the 10-year funding available and shows that the utility is in deficit with this proposed LOS.

3.2.2.3 Proposed Level of Service – Leaks Due to Line Strikes and Material Failures

UK proposes to maintain the existing level of service with respect to leaks occurring from excavation damage (e.g. line strikes) and material or weld failure. Additional information related to this KPI can be found in **Section 3.1.2.1**.

3.2.3 Growth and Planning

3.2.3.1 Proposed Level of Service – Capacity Utilized

As shown in **Table 25**, UK proposes to add three new KPIs to track the capacity utilized for HP linear assets, IP linear assets and City Gate station in order to plan for growth and development in the service area, allowing for enhanced, forward looking distribution system planning. A detailed overview of the systems current capacity used to inform these KPIs is included in **Section 3.1.3**.

Table 25: Growth and Planning (Proposed)

Key Performance Indicator	2023 ⁸³	Current (2024)	Target (2025 to 2034)	Notes
NEW Capacity Utilized: HP Linear Assets	N/A	City Line: 25% Queens Line: 100%	City Line: <80% Queens Line: 100%	Based on the inlet and outlet pressures of the subject pipelines. (City Line and Queen's Line) <i>Note: Queen's Line is at 100% of its sales agreement constrained (400 psig) pipeline pressure</i>

⁸³ Data Source: 2024 AMP. It is assumed that this data is representative of the capacity at end-2023.



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Key Performance Indicator	2023 ⁸³	Current (2024)	Target (2025 to 2034)	Notes
NEW Capacity Utilized: IP Linear Assets	1000 King St. W: 65% 7 Earl St: 55% 8 River St: 50% 100 Portsmouth Ave: 65%	1000 King St. W: 65% 7 Earl St: 65% 8 River St: 60% 100 Portsmouth Ave: 65%	Good: <75% Acceptable: 75-85% Unacceptable: >85%	Based on the pressure at regulating stations and the furthest downstream meters, as represented by 1000 King St. W, 7 Earl St., 8 River St., and 100 Portsmouth Ave.
NEW Capacity Utilized: City Gate Station	N/A	68	Good: <75% Acceptable: 75-85% Unacceptable: >85%	Based on flowrate.

3.2.4 Sustainability

3.2.4.1 Proposed Level of Service – Sustainability

As shown in **Table 26**, UK proposes a new KPI to track site energy use and total greenhouse gas emissions (GHG) of key gas facilities relative to 2018 baseline values to align with climate action targets and ongoing reduction of emissions.

UK also recognizes that fugitive methane emissions can occur from the natural gas system through several pathways, including pipeline leaks, third-party damage, pressure regulation activities and venting during flaring or pipeline blowdowns. Emissions associated with these activities are difficult to measure or quantify with precision. UK is exploring the development of a fugitive emissions management program, beginning with improved monitoring and data collection to better quantify this emission contribution. Once complete, a future fugitive emissions KPI may also be considered to track progress.

Table 26: Sustainability (Proposed)

Key Performance Indicator	2023	Current (2024)	Target (2025 to 2034)	Notes
NEW Total GHG Emissions (kgCO ₂ e) from Utility Energy Usage reduction compared to 2018 baseline values (as a %) ⁸⁴	a) City Gate: n/a b) Railway: -66.6%	a) City Gate: n/a b) Railway: -75.5%	Good: < or = -50% Acceptable: >-50% to +10% Unacceptable: >+10%	The reported greenhouse gas emissions reflect only energy-related emissions from utility-supplied natural gas and electricity. Data for City Gate is currently under review by UK.

⁸⁴ Source: as provided by UK



4 Asset Management Strategy

The Asset Management Strategy for the NG Distribution Utility utilizes the following principles:

- Risk Management is a primary trigger for asset replacement or major system upgrade.
- Growth is the primary trigger for new asset construction as well as facility and system expansion/upgrades.
- Maintenance activities are related to maintaining the condition of the assets with the purpose to provide the lowest lifecycle cost.

UK's asset management strategy is based on four key categories:

1. Infrastructure Planning: focuses on addressing UK's growth-related needs, ensuring that infrastructure meets the growth-driven needs of the city
2. Risk Management: supports decision-making by evaluating the risks associated with the assets. This includes assessment of condition and criticality.
3. Lifecycle Decision-Making: helps to determine the asset interventions required based on the information obtained from infrastructure planning and risk assessments.
4. Maintenance Management: focuses on maintaining assets when there are no immediate triggers for replacement or upgrades. Maintenance management includes both preventive and reactive maintenance activities.

Together these categories ensure effective asset management and support the long-term development of the UK NG system. Each category is further discussed in the following sections.

4.1 Infrastructure Planning

The purpose of infrastructure planning is to ensure that the NG system can meet both current and future customer demands. Currently, The City of Kingston only plans to increase density of housing in the natural gas service territory, and UK has deemed that no system expansion is needed to support this level of growth.

4.1.1 Growth Estimation⁸⁵

As part of the Population, Housing and Employment Growth Analysis Study, a Technical Memorandum prepared by Watson was presented to Council on December 5, 2023, that identified low, medium and

⁸⁵ Commentary and Data sourced from: E9_Planning-Committee_Meeting-17-2024_Report-PC-24-051 _Growth-Analysis.pdf.



high population, housing and employment growth scenarios for the city to the year 2051 (Report Number 24-016).

Near-term provincial gross domestic product (GDP) growth slowed notably in 2023 and has continued to slow in 2024 due to the high cost of borrowing and persistent inflation at levels above target by the Bank of Canada. While national and provincial GDP is anticipated to rebound by 2025/2026 in response to recent and anticipated interest rate cuts by the Bank of Canada, it should be noted that macro-economic conditions across Canada and Ontario have softened within the past year. As a result, the national housing market recently started to show signs of cooling with respect to sales and price appreciation. Canada's federal government increased its immigration targets, which are now set at 500,000 new permanent residents in 2025 and 2026. Recent data indicates that a growing share of new Canadians are choosing to reside in the Kingston census metropolitan area and the City of Kingston.

Council endorsed the Medium Population, Housing and Employment Growth Scenario for the 2021-2051 time period. Based on this scenario, the city is projected to grow from 154,100 people in 2021 to 220,900 people by 2051, representing 66,800 new residents, with approximate 29,300 new housing units for the entire City of Kingston.

Currently, the city does not have enough land within the current urban boundary to accommodate the city's growth forecast to 2051. The land assessment for residential use takes into consideration a higher residential intensification target of 60% within the city's existing urban boundary (as compared to the existing intensification target of 40%).

The 29,300 new housing units anticipated in the city between 2021 and 2051 include both permanent as well as student households, with the permanent households being approximately 24,600.

The growth allocations by sub-area are as follows and are summarized in **Table 27**. The table may not represent the same number as presented above as the data throughout the gross analysis report varies.

Table 27: Growth Allocations by Sub-Area in the City of Kingston

Sub-Area	Population growth (2021-2051)	Population growth share	Housing growth (2021-2051)	Housing growth share	Employment growth (2023-2051)	Employment growth share
Kingston West	24,900	41%	10,610	39%	13,420	40%
Kingston Central	20,500	34%	10,100	37%	11,850	36%
Kingston East	14,100	23%	6,000	22%	7,640	23%
Kingston North	900	1%	270	1%	480	1%
City of Kingston	60,400	100%	26,980	100%	33,390	100%

As noted in Report Number 24-172, the actual development of any urban boundary expansion lands will depend on the outcomes of the Integrated Mobility Plan and the Water and Wastewater Master Plan and



it is likely that these lands will not be developed for a number of years until they can be supported by the necessary infrastructure.

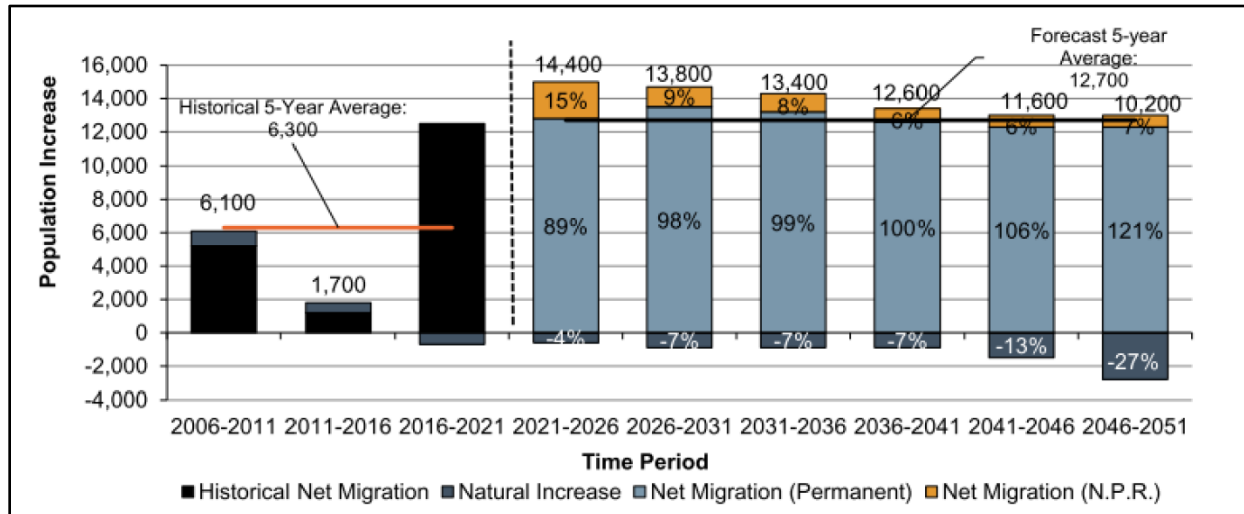


Figure 20: Kingston Census Metropolitan Area Components of Population Growth⁸⁶

Figure 20 highlights that a 100% growth is expected for the City of Kingston in the next 30 years with an 89% growth until 2026. The 5-year average forecast shows a 12,700 population increase per year.

The current number of customer meters is estimated at 16,000 that is assumed one meter per household/customer.

According to the growth study, demand is anticipated to increase more significantly in the next 5 years rather than over a 10-year horizon. This projected increase in natural gas customer demand could represent over a 100% increase in capacity requirements over the next 26 years. Accommodating this level of growth may involve urban boundary expansion, particularly in areas with proximity and access to Highway 401, where future development may include industrial uses. However, while these projections indicate potential demand, growth-related projects must be carefully evaluated in light of broader utility considerations, including Hydro infrastructure and long-term integrated energy planning. Additionally, any changes to the City's strategic direction, including updates to existing plans or the development of a new strategic growth plan, could influence how and where growth is accommodated, which in turn may affect future infrastructure investment decisions for the natural gas distribution system.

UK plans for growth through infrastructure planning studies (in progress) that will provide guidance for identifying projects, such as the potential for expansion of the gas distribution system, new regulating stations and intermediate stations, or any new high pressure and intermediate capacity pipelines that may required to meet both current and future customer demands while adhering to gas CSA Z662 standards and Ontario Regulation 588/17.

⁸⁶ Source: E9_Planning-Committee_Meeting-17-2024_Report-PC-24-051 _Growth-Analysis.pdf.



Although the natural gas demand management strategies may not have an immediate impact on the budget, they can provide long-term benefits by slowing down upgrades to the distribution system and lowering operating expenses through decreased gas usage and losses.

4.1.2 Electrification and Climate Change

A number of corporate plans and activities are currently underway or expected to be developed in the next couple of years that will have implications on UK's natural gas system, including:

- Kingston Hydro Strategic Plan (2025)
- UK's Strategic Plan (2026)
- Climate Action Leadership Plan (2025)

Strategic priorities may include:

- Reducing energy usage
- Reducing unwanted gas losses
- Renewable Natural Gas (RNG)
- Green Hydrogen production and utilization
- Integrated Energy opportunities
- Demand side management and other conservation initiatives

While population growth in the city is anticipated to grow the demand for energy and natural gas, decarbonization is expected to simultaneously reduce demand for natural gas. The net effect of these competing factors will be a key priority in upcoming years.

4.2 Risk Management

Risk management strategy is often used to prioritize capital investments and to help companies to define asset criticality and condition grades. The following sections describe UK's Risk Assessment process and methodology used to support the NG Utility Capital Plan development.

Following the 2020 Technical Standards and Safety Authority (TSSA) regulatory audit, UK updated its Risk Assessment process in 2022 to align it with the requirements of CSA Z662 Annex N. Taking in consideration data maturity, UK will continue improving its Risk Assessment process as part of the continuous improvement process as addressed within the UK NG Distribution System Integrity Management Program.



4.2.1 Risk Assessment Process

After the comparison and assessment of different risk methodologies used by various local gas distribution companies and taking into consideration the type and size of the UK organization and gas network, as well as the maturity level of current data, UK based its NG Risk Assessment methodology on an observation-based approach that would provide the best leverages of the company's strengths. The meeting-based format previously used was replaced by a staff-survey format. This new approach, that relies on Operations Lead's observation inputs, was adopted based on the success demonstrated by other local distribution companies during UK's participation in CGA Distribution Risk Management Sub-Committee of the Asset and Integrity Management Task Force (AIM TF).

The staff-survey questionnaire enabled the identification of all hazards/ potential hazards and their related risks. The assets are usually grouped into the following asset classes:

- High Pressure Distribution
- Intermediate Pressure Distribution
- Facilities: City Gate, Railway, and District Stations

UK's Risk Assessment Model follows a score-based relative ranking system. The scores are used to compare the various assets against each other.

The risk rankings are calculated for each asset class/ area as an average of all the relative rankings received from Operations. The highest risk ranked items are selected for actionable work in the coming years. A criticality threshold of 3.75 out of 5.00 is used to define the highest priority risk items to allow for a manageable number of projects to be selected for further action. The goal of the risk assessment process is to identify and mitigate the highest risks within the system. The risk assessment results are considered for integrity and asset management planning,

In addition, in the last risk assessment (2023), all items identified in the comments within the following sections were also included in the NG Capital Plan.

4.2.2 Risk Assessment Survey Results and Prioritization⁸⁷

Table 28 through Table 32 summarize the risk assessment survey results and risk prioritization. The numbers under the 'Average' column, represent the average of all the eleven independent SME's risk ranking for the same condition.

⁸⁷ Data Source: GC1 - 2023 - 2026 Capital Plan Summary Document 4stantec.docx.



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Table 28: Risk Ranking - Linear Assets, High Pressure

High Pressure (XHP & HP)	Risk Rank (1-5)											Average
Condition of the Queen's Line	5	-	4	5	4	4	3	-	4	5	2	4.00
Third Party Damage	4	5	2	4	3	3	4	-	3	4	5	3.70
Condition of the City Line	3	3	4	4	4	4	4	-	3	3	4	3.60
Cathodic Protection	2	3	3	4	3	4	3	-	5	3	3	3.30
Line Marking and Identification	3	3	3	4	2	3	1	-	2	1	5	2.70
Inoperable/Inaccessible Valves	2	1	3	3	2	3	1	-	2	4	5	2.60
Proximity to Other Utilities	4	2	2	2	2	2	1	-	3	1	3	2.20
Over Pressurization	2	2	2	3	2	2	1	-	3	2	-	2.11
Geotechnical	2	1	2	1	2	1	1	-	2	3	1	1.60
High Pressure Comments												Freq (#)
Queens Line												5
Pipeline Accessibility												2
Age of City Line												2
Third Party Damage												1
Pipeline Marking												1



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Table 29: Risk Ranking- Linear Assets Intermediate Pressure Linear

Distribution (IP/MIP Network)	Risk Rank (1-5)											Average
Steel Islands	2	5	4	4	4	4	3	4	3	3	5	3.73
Steel Services and Risers Corrosion	4	3	4	5	3	3	3	3	4	4	5	3.73
Material Degradation & Corrosion	3	3	3	5	3	3	3	3	4	-	5	3.50
Coating Issues	2	5	3	4	3	3	3	4	3	-	5	3.50
Untraceable Assets	3	4	3	3	2	3	4	4	2	2	5	3.15
Third Party Damage	4	5	2	3	2	2	4	2	2	3	4	3.00
Inoperable/Inaccessible Valves	2	2	3	4	3	3	3	2	2	3	5	2.91
Materials (issue/improper use)	2	1	4	3	3	3	2	4	1	3	5	2.82
Over Pressurization	3	2	2	2	2	3	2	2	2	2	4	2.36
Meter Sets	2	2	2	3	1	2	2	1	1	2	5	2.18
Distribution Comments												Freq (#)
Steel Island Mains												2
Steel Island Services												2
Risers												1
Compton Wilson Weller Risers												1
Materials: "Plexco" Tapping Tee Caps												1
Aging Infrastructure												1
Un-tracible Assets												1
Coating Holidays												1
Meter Protection												1
Contractor Management (materials)												1
Cathodic Protection Program - transparency & training												1
Risers in the Compton Wilson Weller area												1



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Table 30: Risk Ranking- Facility Assets City Gate

City Gate	Risk Rank (1-5)										Average
Boiler System (vacuum loss, redundancy)	5	4	5	4	4	5	4	5	5	5	4.60
Mercaptan System Building & Safety	3	4	4	3	3	3	3	3	4	4	3.40
Bypass Valves & Procedures	3	3	4	3	4	4	3	3	-	3	3.33
Grasshopper Valves	-	4	3	3	3	3	4	2	2	4	3.33
Overpressurization downstream	4	3	4	2	3	3	3	2	3	5	3.10
Regulating Runs	3	3	3	3	2	3	2	3	4	3	3.00
UG Piping at the Station	2	3	3	3	2	4	3	2	3	3	2.80
Instrumentation & Monitoring Failure	4	1	3	2	2	2	4	2	3	2	2.50
TC Incoming Line	2	-	3	3	2	2	3	1	5	1	2.44
Security (3rd Party Tampering)	4	1	2	2	2	2	2	2	4	3	2.40
Build Grounds (access/ roads)	2	1	2	2	2	2	1	2	2	2	1.80
Building Issues	2	1	2	2	2	2	1	2	2	1	1.70
City Gate Comments											Freq. (#)
Heater											5
Valve Repair											1
Mercaptan Building Roof Maintenance											1



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Table 31: Risk Ranking- Facility Assets Railway Regulating Station No 2

Railway Regulating Stn. No 2	Risk Rank (1-5)										Average
Boiler System (vacuum loss, redundancy)	4	3	5	4	3	5	-	4	5	5	4.22
Grasshopper Valves	1	5	5	4	4	4	-	3	3	5	3.78
Bypass Valves & Procedures	2	3	5	4	4	5	-	2	3	5	3.67
Building Envelope	3	3	4	4	2	2	-	4	5	4	3.67
UG piping at the Station	2	4	3	3	2	3	-	2	3	3	2.78
Security (3rd Party Tampering)	4	2	2	2	2	3	-	2	4	3	2.67
Overpressurization Downstream	4	2	2	2	2	3	-	2	3	3	2.56
Instrument. & Monitoring Failure	2	2	2	2	2	2	-	2	5	1	2.22
Regulating Runs	2	1	2	2	2	3	-	2	4	1	2.11
Railway Regulating Station Comments											Freq. (#)
Bypass Valve											3
Building Issues (walls, roof, etc.)											3
Heater											2
Relief Reg Venting Location											1
Training on Relief Operation											1



Table 32: Risk Ranking- Facility Assets District Regulating Stations

District Regulating Stations	Risk Rank (1-5)										Average
Relief Valves	3	3	3	3	3	3	-	2	5	2	3.00
UG Piping & Valves to the Station	2	2	4	4	3	3	-	1	3	4	2.89
Regulator Ice Over	2	3	3	3	2	2	-	2	5	3	2.78
Security (3rd Party Tampering)	4	3	2	2	3	3	-	1	4	2	2.67
Enclosures	2	1	3	3	3	3	-	1	4	1	2.33
Overpressurization Downstream	2	2	2	2	3	3	-	1	3	2	2.22
District Regulating Stations Comments											Freq. (#)
Risers Need to be Re-coated											1
Geotechnical Movement at RS #5											1
Palace Rd Showing Excessive Wear											1
Filter Maintenance											1
Gas Contamination											1

4.2.3 Risk Assessment Results Implementation and Moving Forward

The outcomes from the above addressed risk assessment are summarized in **Table 33**.

The investment summary includes specific linear projects until the year 2030. It is assumed that additional projects will be required until 2034 but have not yet been defined. **Table 33** addresses near term investments. Investments made further into the future will be subject to additional analysis, risk assessments, and managerial direction. Operations and Maintenance activities are not included in this table, but continuation of the existing programs is appropriate. **Section 4.5** discusses Operations and Maintenance Activities in more detail.



Table 33: Capital Investment Summary ⁸⁸

Year	Stations	IP Mains	HP Mains	Services
2025	Recoating	Fraser & Joseph	-	New as req'd
2026	Railway Design	Bath Rd & Armstrong	HP Line Survey	New as req'd
2027	Railway Rebuild	Kingscourt	-	New as req'd
2028	Palace Rd Upsizing	Raglan	HP Line Survey	New as req'd
2029	TBA	Rideau St (lower)	-	New as req'd
2030	TBA	Rideau St (upper)	HP Line Survey	New as req'd
2031	TBA	TBA	-	New as req'd
2032	TBA	TBA	HP Line Survey	New as req'd
2033	TBA	TBA	-	New as req'd
2034	TBA	TBA	HP Line Survey	New as req'd

Capital investment plans are subject to City Council approval and the project list is revisited at regular intervals to keep this approval current. This approach should be maintained going forward, with adjustments to the investment program made as new asset condition and risk information becomes available.

4.3 Integrity Management

To achieve a safe and reliable delivery/ supply of NG within the UK distribution area, UK developed a Distribution System Integrity Management Program (DSIMP) in alignment with the most current version of CSA Z662 Oil and Gas Pipeline Systems industry standard. The purpose of the DSIMP is to provide the framework for UK to collect, integrate, and analyze information related to design and construction, condition monitoring, maintenance and repair, operating conditions, failure/ damage incidents, damage/ deterioration/ manufacturing imperfections, environmental protection, and safety.

4.4 Lifecycle Decision Making

In accordance with Ontario Regulations 588/17, the following section includes a description of lifecycle activities to maintain the current Level of Service.

The infrastructure planning and risk management are used to identify assets that require new/ increased/accelerated maintenance, rehabilitation/ major upgrades or replacement. Once these assets

⁸⁸ Data Source: 2024 AMP, Communications with UK



are identified, decisions are made on how they should be addressed through the Lifecycle Decision Making process.

4.4.1 Linear Infrastructure

Lifecycle decisions relating to the Linear Assets are based on the planning and the risk assessment processes:

- An asset should typically be maintained through digging and repairs if it shows minor maintenance requirement(s) and/ or a lower risk of failure.
- The planning process identifies the need for capacity improvements, the upgrades should be prioritized within the planned timeframe, or UK may address the replacement as a separate, one-off project.
- If the assets are identified as high-risk, where maintenance activities will not be cost-effective in reducing the risk, the following should be considered:
 - Replacement of an asset and its dependents
 - Rehabilitation, with consideration to the condition of dependent assets and appropriate rehabilitation, cathodic protection, or replacement of dependent assets.

4.4.2 Non-Linear Assets/ Facilities

The Non-Linear Assets are primarily managed through maintenance and minor upgrades or coincidental with the need to replace non-linear assets (e.g. valves), rather than major upgrades/ replacements. However, if the planning processes identifies the need for a significant increase in capacity and/or significant improvement of the assets, the assets are managed through major upgrades or facility replacements.

4.5 Operations and Maintenance Management

In the absence of triggers for replacement, upgrades, or capacity increase, a routine maintenance program should be completed to ensure the NG system operates effectively.

The Gas Pipeline Systems Safety Code requires that various maintenance activities be conducted at prescribed or performance-based intervals. The Standard Operating Procedures contain a detailed response to the maintenance work that is required by both policy and by code.

Table 34 addresses maintenance intervals of the selected key components of this Plan.



Table 34: Major Maintenance Item Intervals⁸⁹

Asset Category	Maintenance Item	Frequency
Linear	Leak Survey	High Pressure: Annual Other Linear Assets: 1 in 5 years
Linear	Cathodic Protection Survey	Annual
Linear	Priority Shut-off Valves	As per SOP
Facilities	Regulator Rebuild	Annual
Facilities	Relief Valve Verification	Annual
Facilities	Odorant System	As Req'd
Facilities	Boiler Maintenance	As Req'd

All maintenance activities should be documented, tracked by asset, and accessible to UK staff.

Existing tracking methods include:

- Various tracking sheets maintained by Operations for linear infrastructure, relating to maintenance.
- The GIS Asset Inventory can track work on the Linear Infrastructure, but maintenance activities are currently tracked on individual sheets. It is recommended to track and catalog all maintenance work completed in GIS or other asset management software.

4.6 New Assets

In general, UK adds new assets through acquisition from developers (due to growth) and in-house construction (driven by growth, reassessed capacity needs, or internal risk assessments). The new assets should be documented in the Asset Inventory and incorporated into the financial summaries as required.

A recent growth study completed for the City of Kingston showed an increase in population with approximate permanent households to increase by approximately 26,980 in the next 26 years, with a respective more than double increase in the Capacity demand⁹⁰. The majority of the population growth is expected in the next 5 years and with 60% concentrated on the core and around Hwy 401, according to the statistics, see **Section 4.1.1** for details.

The current NG Distribution capacity provides for the 2024 demand. Downstream pressure at the end of Intermediate Pressure network is the limiting factor in available system capacity and will limit growth in

⁸⁹ Data Source: 2024 AMP.

⁹⁰ Data Source: According to the document "E9_Planning-Committee_Meeting-17-2024_Report-PC-24-051 _Growth-Analysis", the count of permanent households is 24,570. However, the count of Services from UK's GIS is 16,806.



NG services. The analysis conducted through 2024 considers measured pressure and flow rates and presented in this 2025 AMP shows:

- Actual Capacity of Regulated High-Pressure Assets (City Line, Queens Line) shows that the current pressure on the XHP system (Queens Line) is maximized and there is excess capacity on the City Line to deliver additional volumes to the IP system.
- Queens Line average pressure readings are at 100% of its downstream sales agreement constraint (400 psig) for pipeline pressure.
- The volume capacity of the IP regulating stations ranges from 9-153%.
- Volume capacity data from the volume meters located at the end of the Intermediate pressure system ranges from 12-66%.
- The pressure capacity of the volume meters located at the end of the Intermediate pressure system ranges from 60-65%.

Based on the 2024 data, the current system has capacity to deliver additional volumes to support the planned densification in the Central area.

4.7 Decommissioning

When an asset is no longer providing value, it should be decommissioned or repurposed as applicable. The process of formally removing an asset from service and operation includes steps like physical removal, data sanitization, decontamination, dismantling, and responsible disposal or repurposing to ensure the safety, compliance, and recovery of value at the end of an asset's lifecycle. It is a crucial, complex, and potentially costly final phase of an asset's management, requiring careful planning to address potential hazards, environmental concerns, and regulatory requirements. This process should include carrying out the necessary studies and procedures to properly decommission/ repurpose assets that are no longer required.

4.8 Maturity and Moving Forward

Linear assets have sufficient information to complete asset valuation for 'minimum' maturity level plus replacement cost for applicable asset age/life which is considered that meet the criteria Core Maturity level.

Non - Linear assets have minimum information to complete asset valuation cost for all applicable asset age/life. Some assets such as Test and Locate Stations are at a core maturity level. It was concluded that not all the non-linear assets meet the criteria Core Maturity level.



5 Financial Strategy

5.1 Overview

This section summarizes the cost and budget figures as well as projects that are planned for the next 10 years. Maintenance is not included in these totals.

5.2 Operating Costs

Figure 21 summarizes significant operating expenses from 2020 to 2035. Historically, approved budgets have adequately covered actual operating costs. The rising trend in operating budgets reflects UK's ongoing commitment to efficiently manage existing operations while preparing for future expansions. For 2024, the approved operating budget is \$5,282,481. The proposed operating budget for 2025 is \$5,841,680, marking an increase of \$559,199 (or 10.6%). An additional increase of \$417,005 (or 7.1%) is anticipated for 2026, bringing the proposed operating budget to \$6,258,685.

These increases are primarily driven by rising costs for contracted services, supplies (e.g., materials, tools, equipment, and parts), and utilities necessary to maintain current service levels. The budget also reflects the need for additional resources to support the inspection, operation, and maintenance of the City's inventory of natural gas assets, including facilities and underground infrastructure.

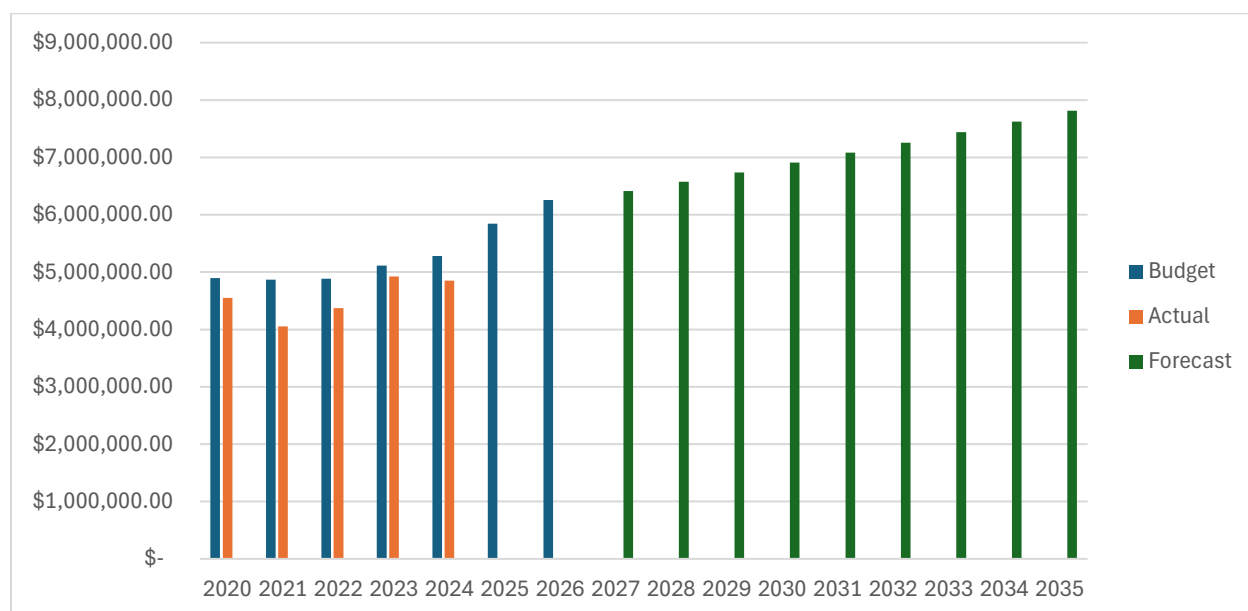


Figure 21: Significant Operating Costs for Natural Gas⁹¹

⁹¹ Source: E5-E7. Municipal Utilities Budget to Actuals - 2020-2035



5.3 Capital Cost and Budget Forecast

Existing budgets were based on the previous 2024 Asset Management Plan (AMP) and as provided by UK⁹².

Milestone projects are those items previously identified as important priorities and have been funded, such as the 2027 Railway St. Regulating Station Rebuild which is reaching end of life. Additional funds required to meet the proposed levels of service outlined in **Sections 3.2.2.1 and 3.2.2.2** have been added to the 2025-2034 Capital Plan presented in detail in **Appendix A.2**.

Table 35 and **Appendix A** summarizes the 10-year budget forecast required to continue operate the gas utility at the current levels of service, the proposed levels of services and the available capital. Based on this forecast, the gas utility infrastructure is in a deficit.

Table 35: 2025-2034 Breakdown of UK Financial Strategy for the Gas Utility

Year	UK Capital Funding Available	Funding Required for Current LOS	Funding Required for Proposed LOS	Funding Available vs. Required – Proposed LOS
2025	\$8,441,210	\$7,615,760	\$7,992,498	\$448,712
2026	\$7,630,210	\$7,617,425	\$8,060,150	-\$429,940
2027	\$7,520,892	\$ 6,992,500	\$7,451,497	\$69,395
2028	\$6,884,754	\$ 6,975,000	\$7,425,562	-\$540,808
2029	\$6,893,148	\$ 5,865,400	\$6,308,329	\$584,819
2030	\$6,335,941	\$ 5,835,400	\$6,296,007	\$39,934
2031	\$6,171,912	\$ 5,892,670	\$6,371,775	-\$199,863
2032	\$5,937,725	\$ 5,856,600	\$6,354,533	-\$416,808
2033	\$6,040,150	\$6,036,600	\$6,553,701	-\$513,551
2034	\$6,171,397	\$ 5,849,925	\$6,363,044	-\$191,647
Total	\$68,027,339	\$64,537,280	\$69,177,094	-\$1,149,755

5.4 Infrastructure Deficit

Table 35 presents the capital budget forecast and projected capital funding availability for the Gas Utility, highlighting the difference between the capital expenditures in the financial plan and the asset management projections over the 10-year period, which results in an infrastructure deficit of \$1.1 million. The funding requirements to achieve the proposed Levels of Service incorporate an assumed annual inflation rate of 3%. Financial plans are reviewed and updated annually to reflect current priorities, funding availability, and market conditions. All financing options are carefully assessed to maximize the asset management work achievable within available resources. For projects involving the replacement of

⁹² Source: E2_2025-2045 UKCapPlan W-WW-G



existing infrastructure, additional funding may be accessed from rate-based sources to ensure essential renewal proceeds. Ongoing monitoring, proactive financial planning, and the pursuit of sustainable funding strategies remain critical to managing these risks and ensuring reliable service delivery.

It should be noted that persistent underfunding increases the risk of service disruption, higher lifecycle costs, and reduced capacity to maintain desired Levels of Service. Addressing the projected 10-yr infrastructure deficit requires a focused set of lifecycle activities, including rehabilitation, upgrades, replacement, and maintenance. Deferring these activities risks accelerated asset failure, reductions in levels of service and reduced service reliability. To manage these risks, a risk-based prioritization framework will be employed to focus resources where they are most needed. Additionally, cost-effective strategies such as routine maintenance programs, the implementation of the new Enterprise Asset Management, and the use of asset condition monitoring technologies will be implemented to maintain existing levels of service while minimizing expenditures.



Appendix A – 2025-2034 Capital Plan

A.1 UK Gas 10-Year Capital Budget

	Total 2025	Total 2026	Total 2027	Total 2028	Total 2029	Total 2030	Total 2031	Total 2032	Total 2033	Total 2034	Sum of WIP	Sum of Total
General												
Business Systems												
Business Systems City Transfers	\$ 321,460.00	\$ 388,625.00	\$ 390,000.00	\$ 390,000.00	\$ 200,000.00	\$ 200,000.00	\$ 221,970.00	\$ 221,000.00	\$ 221,000.00	\$ 225,000.00	\$ 556,410.00	\$ 3,335,465.00
Business Systems UK	\$ 350,000.00	\$ 487,500.00	\$ 1,280,000.00	\$ 1,130,000.00	\$ 250,000.00	\$ 255,000.00	\$ 260,100.00	\$ 260,000.00	\$ 260,000.00	\$ 265,200.00	\$ 1,499,531.00	\$ 6,297,331.00
SCADA	\$ 100,000.00	\$ 110,000.00	\$ 40,000.00	\$ 40,000.00	\$ 10,400.00	\$ 10,400.00	\$ 10,600.00	\$ 10,600.00	\$ 10,600.00	\$ 10,600.00	\$ 120,000.00	\$ 473,200.00
Construction and Office Equipment												
City Restoration Costs	\$ 250,000.00	\$ 240,000.00	\$ 220,000.00	\$ 220,000.00	\$ 210,000.00	\$ 200,000.00	\$ 200,000.00	\$ 180,000.00	\$ 150,000.00	\$ 150,000.00		\$ 2,020,000.00
Office Equipment	\$ 17,500.00	\$ 5,000.00	\$ 7,500.00	\$ -	\$ -	\$ -	\$ -	\$ 10,000.00	\$ -	\$ -	\$ 7,500.00	\$ 47,500.00
Tools, Locating Equipment, Radios	\$ 303,800.00	\$ 253,800.00	\$ 125,000.00	\$ 120,000.00	\$ 120,000.00	\$ 125,000.00	\$ 125,000.00	\$ 100,000.00	\$ 90,000.00	\$ 100,000.00	\$ 209,334.00	\$ 1,671,934.00
Property												
Land		\$ -	\$ -	\$ -	\$ -	\$ 20,000.00	\$ -	\$ -	\$ -	\$ 10,000.00	\$ 10,000.00	\$ 40,000.00
Office Building Improvements		\$ -	\$ -	\$ -	\$ -	\$ 20,000.00	\$ -	\$ -	\$ -	\$ 20,000.00	\$ 49,615.00	\$ 89,615.00
Vehicles												
New	\$ 25,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 455,000.00	\$ 480,000.00
Upgrades	\$ 10,000.00	\$ 7,500.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 16,000.00	\$ 33,500.00
G-Pipes												
Appearance Upgrades or Replacement												
Meters	\$ 2,273,000.00	\$ 3,000,000.00	\$ 1,100,000.00	\$ 1,200,000.00	\$ 1,200,000.00	\$ 1,200,000.00	\$ 1,225,000.00	\$ 1,100,000.00	\$ 1,200,000.00	\$ 1,224,000.00		\$ 14,722,000.00
Pipe	\$ 400,000.00	\$ 200,000.00	\$ 200,000.00	\$ 225,000.00	\$ 200,000.00	\$ 200,000.00	\$ 225,000.00	\$ 200,000.00	\$ 200,000.00	\$ 225,000.00		\$ 2,275,000.00
Services	\$ 50,000.00	\$ 450,000.00	\$ 200,000.00	\$ 200,000.00	\$ 150,000.00	\$ 250,000.00	\$ 250,000.00	\$ 250,000.00	\$ 170,000.00	\$ 250,000.00		\$ 2,220,000.00
Valves	\$ 110,000.00	\$ 175,000.00	\$ 175,000.00	\$ 200,000.00	\$ 300,000.00	\$ 300,000.00	\$ 275,000.00	\$ 250,000.00	\$ 250,000.00	\$ 275,000.00		\$ 2,310,000.00
Construction												
Main Expansion IP	\$ 25,000.00	\$ 100,000.00	\$ -	\$ -	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00	\$ 75,000.00		\$ 450,000.00
Main Replacement HP	\$ 150,000.00	\$ 100,000.00	\$ 100,000.00	\$ 125,000.00	\$ 150,000.00	\$ 150,000.00	\$ 150,000.00	\$ 150,000.00	\$ 150,000.00	\$ 175,000.00		\$ 1,400,000.00
Main Replacement IP	\$ 2,600,000.00	\$ 1,500,000.00	\$ 2,500,000.00	\$ 2,500,000.00	\$ 2,800,000.00	\$ 2,600,000.00	\$ 2,600,000.00	\$ 2,600,000.00	\$ 2,600,000.00	\$ 2,600,000.00		\$ 24,900,000.00
New Services	\$ 450,000.00	\$ 200,000.00	\$ 185,000.00	\$ 185,000.00	\$ 175,000.00	\$ 175,000.00	\$ 175,000.00	\$ 175,000.00	\$ 175,000.00	\$ 185,000.00	\$ 778.00	\$ 2,080,778.00
Planning & Design	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Regulating Stations												
Construction	\$ -	\$ -	\$ 385,000.00	\$ 375,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 2,550,000.00	\$ 3,310,000.00
Equipment Upgrades or Replacement												
Building Fixtures	\$ 10,000.00	\$ 10,000.00	\$ 10,000.00	\$ 15,000.00	\$ 15,000.00	\$ 10,000.00	\$ 10,000.00	\$ 15,000.00	\$ 5,000.00	\$ 5,125.00		\$ 105,125.00
Building Structure	\$ 25,000.00	\$ 20,000.00	\$ 15,000.00	\$ 15,000.00	\$ 10,000.00	\$ 10,000.00	\$ 10,000.00	\$ -	\$ 5,000.00	\$ 20,000.00		\$ 130,000.00
Electrical Equipment	\$ 35,000.00	\$ 20,000.00	\$ 20,000.00	\$ 10,000.00	\$ 10,000.00	\$ 30,000.00	\$ 30,000.00	\$ 15,000.00	\$ 5,000.00	\$ 10,000.00		\$ 185,000.00
Mechanical Equipment	\$ 110,000.00	\$ 100,000.00	\$ 40,000.00	\$ 25,000.00	\$ 10,000.00	\$ 30,000.00	\$ 75,000.00	\$ 270,000.00	\$ 450,000.00	\$ 25,000.00		\$ 1,135,000.00
Planning & Design	\$ -	\$ 250,000.00	\$ 5,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 45,000.00	\$ -	\$ 6,000.00	\$ 306,000.00
Grand Total	\$ 7,615,760.00	\$ 7,617,425.00	\$ 6,992,500.00	\$ 6,975,000.00	\$ 5,865,400.00	\$ 5,835,400.00	\$ 5,892,670.00	\$ 5,856,600.00	\$ 6,036,600.00	\$ 5,849,925.00	\$ 5,745,168.00	\$ 70,282,448.00



Natural Gas Utilities Asset Management Plans 2025 to 2034

A.2 Proposed UK Gas 10-Year Capital Budget^{93,94}

		Total 2025	Total 2026	Total 2027	Total 2028	Total 2029	Total 2030	Total 2031	Total 2032	Total 2033	Total 2034	Sum of WIP	Sum of Total
General													
Business Systems													
	Business Systems City Transfers	\$ 321,460.00	\$ 388,625.00	\$ 390,000.00	\$ 390,000.00	\$ 200,000.00	\$ 200,000.00	\$ 221,970.00	\$ 221,000.00	\$ 221,000.00	\$ 225,000.00	\$ 556,410.00	\$ 3,335,465.00
	Business Systems UK	\$ 350,000.00	\$ 487,500.00	\$ 1,280,000.00	\$ 1,130,000.00	\$ 250,000.00	\$ 255,000.00	\$ 260,100.00	\$ 260,000.00	\$ 260,000.00	\$ 265,200.00	\$ 1,499,531.00	\$ 6,297,331.00
	SCADA	\$ 100,000.00	\$ 110,000.00	\$ 40,000.00	\$ 40,000.00	\$ 10,400.00	\$ 10,400.00	\$ 10,600.00	\$ 10,600.00	\$ 10,600.00	\$ 10,600.00	\$ 120,000.00	\$ 473,200.00
Construction and Office Equipment													
	City Restoration Costs	\$ 250,000.00	\$ 240,000.00	\$ 220,000.00	\$ 220,000.00	\$ 210,000.00	\$ 200,000.00	\$ 200,000.00	\$ 180,000.00	\$ 150,000.00	\$ 150,000.00		\$ 2,020,000.00
	Office Equipment	\$ 17,500.00	\$ 5,000.00	\$ 7,500.00	\$ -	\$ -	\$ -	\$ -	\$ 10,000.00	\$ -	\$ -	\$ 7,500.00	\$ 47,500.00
	Tools, Locating Equipment, Radios	\$ 303,800.00	\$ 253,800.00	\$ 125,000.00	\$ 120,000.00	\$ 120,000.00	\$ 125,000.00	\$ 125,000.00	\$ 100,000.00	\$ 90,000.00	\$ 100,000.00	\$ 209,334.00	\$ 1,671,934.00
Property													
	Land		\$ -	\$ -	\$ -	\$ -	\$ 20,000.00	\$ -	\$ -	\$ -	\$ 10,000.00	\$ 10,000.00	\$ 40,000.00
	Office Building Improvements		\$ -	\$ -	\$ -	\$ -	\$ 20,000.00	\$ -	\$ -	\$ -	\$ 20,000.00	\$ 49,615.00	\$ 89,615.00
Vehicles													
	New	\$ 25,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 455,000.00	\$ 480,000.00
	Upgrades	\$ 10,000.00	\$ 7,500.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 16,000.00	\$ 33,500.00
Customer Meters													
	Commercial	\$ 107,551.15	\$ 110,777.68	\$ 114,101.02	\$ 117,524.05	\$ 121,049.77	\$ 124,681.26	\$ 128,421.70	\$ 132,274.35	\$ 136,242.58	\$ 140,329.86	\$ -	\$ 1,232,953.40
	Residential	\$ 208,686.65	\$ 214,947.25	\$ 221,395.67	\$ 228,037.54	\$ 234,878.66	\$ 241,925.02	\$ 249,182.77	\$ 256,658.26	\$ 264,358.00	\$ 272,288.74	\$ -	\$ 2,392,358.57
G-Pipes													
Appurtenance Upgrades or Replacement													
	Meters	\$ 2,273,000.00	\$ 3,000,000.00	\$ 1,100,000.00	\$ 1,200,000.00	\$ 1,200,000.00	\$ 1,200,000.00	\$ 1,225,000.00	\$ 1,100,000.00	\$ 1,200,000.00	\$ 1,224,000.00		\$ 14,722,000.00
	Pipe	\$ 400,000.00	\$ 200,000.00	\$ 200,000.00	\$ 225,000.00	\$ 200,000.00	\$ 200,000.00	\$ 225,000.00	\$ 200,000.00	\$ 200,000.00	\$ 225,000.00		\$ 2,275,000.00
	Services	\$ 50,000.00	\$ 450,000.00	\$ 200,000.00	\$ 200,000.00	\$ 150,000.00	\$ 250,000.00	\$ 250,000.00	\$ 250,000.00	\$ 170,000.00	\$ 250,000.00		\$ 2,220,000.00
	Valves	\$ 110,000.00	\$ 175,000.00	\$ 175,000.00	\$ 200,000.00	\$ 300,000.00	\$ 300,000.00	\$ 275,000.00	\$ 250,000.00	\$ 250,000.00	\$ 275,000.00		\$ 2,310,000.00
Construction													
	Main Expansion IP	\$ 25,000.00	\$ 100,000.00	\$ -	\$ -	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00	\$ 75,000.00		\$ 450,000.00
	Main Replacement HP	\$ 210,500.00	\$ 217,000.00	\$ 223,500.00	\$ 230,000.00	\$ 237,000.00	\$ 244,000.00	\$ 251,500.00	\$ 259,000.00	\$ 266,500.00	\$ 275,500.00		\$ 2,414,500.00
	Main Replacement IP	\$ 2,600,000.00	\$ 1,500,000.00	\$ 2,500,000.00	\$ 2,500,000.00	\$ 2,800,000.00	\$ 2,600,000.00	\$ 2,600,000.00	\$ 2,600,000.00	\$ 2,600,000.00	\$ 2,600,000.00		\$ 24,900,000.00
	New Services	\$ 450,000.00	\$ 200,000.00	\$ 185,000.00	\$ 185,000.00	\$ 175,000.00	\$ 175,000.00	\$ 175,000.00	\$ 175,000.00	\$ 175,000.00	\$ 185,000.00	\$ 778.00	\$ 2,080,778.00
Planning & Design													
		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Regulating Stations													
Construction													
		\$ -	\$ -	\$ 385,000.00	\$ 375,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 2,550,000.00	\$ 3,310,000.00
Equipment Upgrades or Replacement													
												\$ 265,000.00	\$ 265,000.00
	Building Fixtures	\$ 10,000.00	\$ 10,000.00	\$ 10,000.00	\$ 15,000.00	\$ 15,000.00	\$ 10,000.00	\$ 10,000.00	\$ 15,000.00	\$ 5,000.00	\$ 5,125.00		\$ 105,125.00
	Building Structure	\$ 25,000.00	\$ 20,000.00	\$ 10,000.00	\$ 15,000.00	\$ 15,000.00	\$ 10,000.00	\$ 10,000.00	\$ -	\$ 5,000.00	\$ 20,000.00		\$ 130,000.00
	Electrical Equipment	\$ 35,000.00	\$ 20,000.00	\$ 20,000.00	\$ 10,000.00	\$ 10,000.00	\$ 30,000.00	\$ 30,000.00	\$ 15,000.00	\$ 5,000.00	\$ 10,000.00		\$ 185,000.00
	Mechanical Equipment	\$ 110,000.00	\$ 100,000.00	\$ 40,000.00	\$ 25,000.00	\$ 10,000.00	\$ 30,000.00	\$ 75,000.00	\$ 270,000.00	\$ 450,000.00	\$ 25,000.00		\$ 1,135,000.00
Planning & Design													
		\$ -	\$ 250,000.00	\$ 5,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 45,000.00	\$ -	\$ 6,000.00	\$ 306,000.00
Grand Total		\$ 7,992,497.80	\$ 8,060,149.93	\$ 7,451,496.68	\$ 7,425,561.58	\$ 6,308,328.43	\$ 6,296,006.28	\$ 6,371,774.47	\$ 6,354,532.61	\$ 6,553,700.58	\$ 6,363,043.60	\$ 5,745,168.00	\$ 74,922,259.97

⁹³ As outlined in **Section 3.2.2.1**, an average 2025 replacement cost of HP assets at their LE was determined to be \$3,866 per meter resulting in \$2.1 million required in 2025 to bring the HP assets within the proposed LOS target. The \$2.1 million for HP Main Replacements was spread over 10-years and indexed to 3% inflation per year.

⁹⁴ As outlined in **Section 3.2.2.2**, the replacement cost for customer meters reaching their LE in the next 10-years was determined to be \$3.1 million required to bring the customer meters within the proposed LOS target. This cost was averaged over 10-years and indexed to 3% inflation per year.





Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

Stantec Consulting Ltd.
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4
stantec.com

