REPORT
34347-5.2.2

CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
(URBANDALE/KELLAM LANDS)
LEITRIM DEVELOPMENT AREA

Prepared for Urbandale Corporation
by IBI Group

October 2016

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

LIST OF FIGURES

LIST OF APPENDICES

Table of Contents (continued)

1 INTRODUCTION

1.1 Purpose

The purpose of this report is to provide a review of the adequacy of public services needed to support development of the Urbandale/Kellam Lands (OPA 76 Expansion Area 9b). The specific public services reviewed by this report include the major municipal infrastructure of water supply, wastewater disposal and collection and treatment of stormwater runoff. This report will also include a Sedimentation and Erosion Control Plan. A review of traffic components will be the subject of separate reports.

The property owners, Urbandale Corporation, wish to proceed with the urban development of the subject lands in accordance with the policies set out by the Planning Department of the City of Ottawa. Part of the Plan of Subdivision process for the City includes provision of several documents in support of new developments. The Conceptual Site Servicing Study, including sections on Stormwater Management and Erosion and Sedimentation Control, is one of those documents.

This report was also prepared in accordance with the November 2009 Development Servicing Study Checklist by the City. The check list is included in **Appendix A**. It is intended to be a quick reference for location within this report of items included on the list.

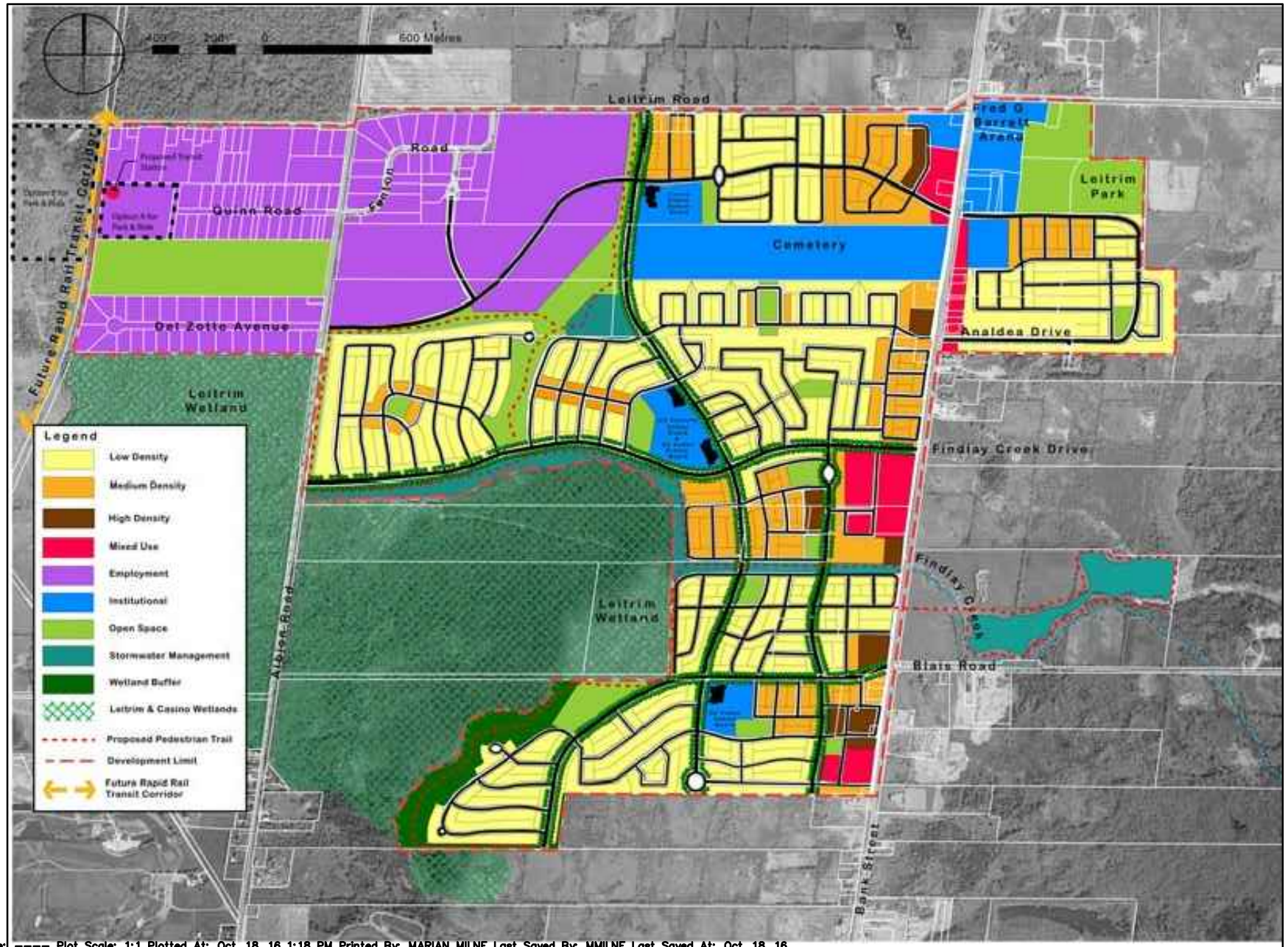
1.2 Background

Development in the Leitrim Development Area began in 2002. To assist with a planned and logical development approach for this area, the City of Ottawa in 2005, completed the Leitrim Community Design Plan (CDP). The CDP identified a preferred development concept and also included technical support documents which, among other items, addressed the requirements of water supply, wastewater disposal and management of stormwater runoff. The 2007 Final Serviceability Report confirmed a strategy to provide the necessary municipal infrastructure to support the Leitrim Development Area (LDA). The original LDA, as defined in the 2005 CDP, is included in **Figure 1.1**. The LDA covered an area of about 520 ha. The Urbandale/Kellam Lands were not included in the original CDP limits.

In 2012, the City of Ottawa expanded its urban envelope under OPA 76. Part of that expansion included an 87 ha expansion in Leitrim including OPA 76 Expansion Areas 8a, 9a and 9b. These lands were not included in the original LDA or CDP. The Urbandale/Kellam property covers about 29 ha and forms OPA 76 Expansion Area 9b which is located east of Bank Street. **Figure 1.2** shows the original CDP plus the three expansion areas in Leitrim and the Urbandale/Kellam property. To support that expansion, the new land owners are updated the 2007 Serviceability Report. The 2016 Final Updated Serviceability Report proposes a revised approach for the provision of major municipal infrastructure including changes needed to support the 2012 expansion areas, including the subject site.

1.3 Previous Studies

1. **Addendum to Leitrim Development Area Stormwater Management Environmental Study Report and Pre-Design (CCL/IBI Group, 2005)** The July 2005 Addendum, considered one of the supporting technical documents of the 2005 CDP, identified the criteria and details of the overall SWM strategy for the LDA. The report recommended two off-line SWM facilities be constructed to treat urban runoff. One of those facilities, the



J:\34347-KellamProperty\5.9 Drawings\59civil\current\Conceptual Site Servicing Study Figures\FIGURE 1.1.dwg Layout Name: FIGURE 1.1

Plot Style: ---- Plot Scale: 1:1 Plotted At: Oct. 18, 16 1:18 PM Printed By: MARIAN MILNE Last Saved By: MMILNE Last Saved At: Oct. 18, 16

IBI

Scale

Project Title

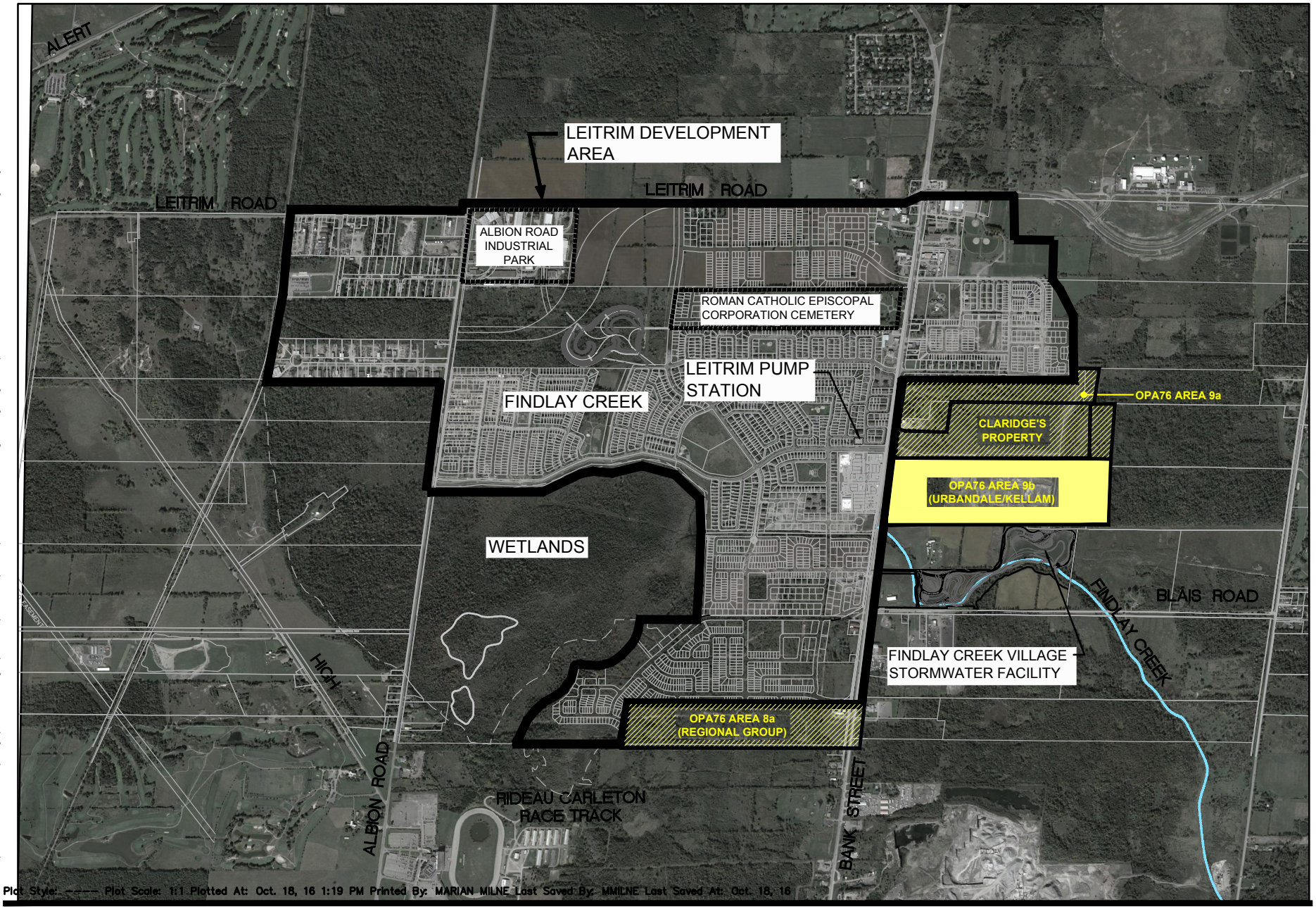
CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
URBANDALE/KELLAM LANDS
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title

2005
LEITRIM COMMUNITY
DESIGN PLAN

Sheet No.

FIGURE 1.1



J:\34347-KellamProperty\5.9 Drawings\59civil\current\Conceptual Site Servicing Study Figures\FIGURE 1.2 LOCATION PLAN.dwg Layout Name: FIGURE 1.2

Plot Style: ----- Plot Scale: 1:1 Plotted At: Oct. 18, 16 1:19 PM Printed By: MARIAN MILNE Last Saved By: MMILNE Last Saved At: Oct. 18, 16

IBI

Scale

Project Title

CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
URBANDALE/KELLAM LANDS
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title

OPA 76
AREAS 8a, 9a and 9b
LOCATION PLAN

Sheet No.

FIGURE 1.2

Findlay Creek Village Stormwater Facility, was commissioned in 2006. A recommended expansion to that facility will provide for runoff treatment from the subject site.

2. **Leitrim Development Area 2007 Final Serviceability Report** The report was prepared to further develop the recommendations in the 2005 CDP to a higher level of refinement. The report provided recommendations for the major infrastructure, including water supply, wastewater disposal and stormwater treatment for the LDA. Of significance to the subject site is a recommended 375 mm diameter sanitary sub-trunk sewer to service the original 2005 CDP lands east of Bank Street. That sub-trunk sewer was constructed in 2010 and bisects the subject site.
3. **Environmental Management Plan for the Urban Expansion Land Areas 9a and 9b, Ottawa Ontario (Golder Associates, April 20, 2016)** The main objectives of this report were to identify and assess the natural features present on the Site and in the surrounding landscape, and develop options for future development that are consistent with provincial and municipal goals, objectives and policies. The report was approved by the City and the Conservation Authority in May, 2016.
4. **2016 Final Updated Serviceability Report (Class EA OPA 76 Areas 8a, 9a & 9b) Leitrim Development Area (IBI Group, September 2016)** The report is the update to the above referenced 2007 Final Serviceability Report. The updated report was needed to review the impacts on existing major infrastructure by developing an additional 87 ha in the LDA. In 2012, under OPA 76, the City of Ottawa increased its urban envelope by over 900 ha including expansion areas 8a, 9a and 9b in the LDA. The subject site is included in OPA 76 Expansion Area 9b. The report is to be presented to City of Ottawa Planning Committee for final approval in October 2016. The design of the subject site is proposed to be developed as per the final report recommendations.

   The Urbandale/Kellam Lands are proposed to be developed in accordance with the recommendations of these higher level reports. The more specific details of the development will follow and form part of the final engineering design of the property.

1.4 Subject Property

The current draft plan of subdivision for the Urbandale/Kellam Lands is shown on **Figure 1.3**. The property covers a total area of about 29 ha and is bounded by the OPA 76 Expansion Lands 9a to the north, Bank Street to the west, rural lands and the Findlay Creek Village Stormwater Facility to the south and rural lands to the east.

Besides some employment uses fronting Bank Street, the proposed land use for the subject property will include a residential mix of single family units, townhouses and stacked units. The draft plan also provides land for a neighbourhood park and a school.

1.5 Phasing

The subject property is proposed to be designed in one phase. Coordination will be required with other landowners in OPA 76 Expansion Area 9a for both water supply and sanitary sewer outlets. Construction phasing will be determined by market conditions.

1.6 Existing Infrastructure

Figure 1.4 shows the location of existing major municipal infrastructure in the vicinity of the subject site. In 2001, the City of Ottawa completed a sanitary pumping station which was designed to service all the developable lands within the LDA and in 2006 the Findlay Creek Village Stormwater Facility, which is a stormwater management facility that will provide

DRAFT PLAN OF SUBDIVISION OF
PART OF LOT 19
CONCESSION 5 (RIDEAU FRONT)
Geographic Township of Gloucester
CITY OF OTTAWA
Prepared by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 1250

Metric
DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :
The boundaries of the lands to be subdivided and their relationship to adjoining lands have been accurately and correctly shown.

Date — Edward M. Lancaster, ONTARIO LAND SURVEYOR

OWNER'S CERTIFICATE

This is to certify that I am the owner of the lands to be subdivided and that this plan was prepared in accordance with my instructions.

Date — Mary Jarvis, Authorized Signing Officer, Urbandale Corporation
I have the authority to bind the corporation

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51-17 OF THE PLANNING ACT
(a) see plan
(b) see plan
(c) see plan
(d) residential housing, mixed use, institutional, park land and open space
(e) see plan
(f) see plan
(g) see plan
(h) City of Ottawa
(i) see soils report
(j) see plan
(k) sanitary, storm sewers, municipal water, bell, hydro, cable and gas to be available
(l) see plan

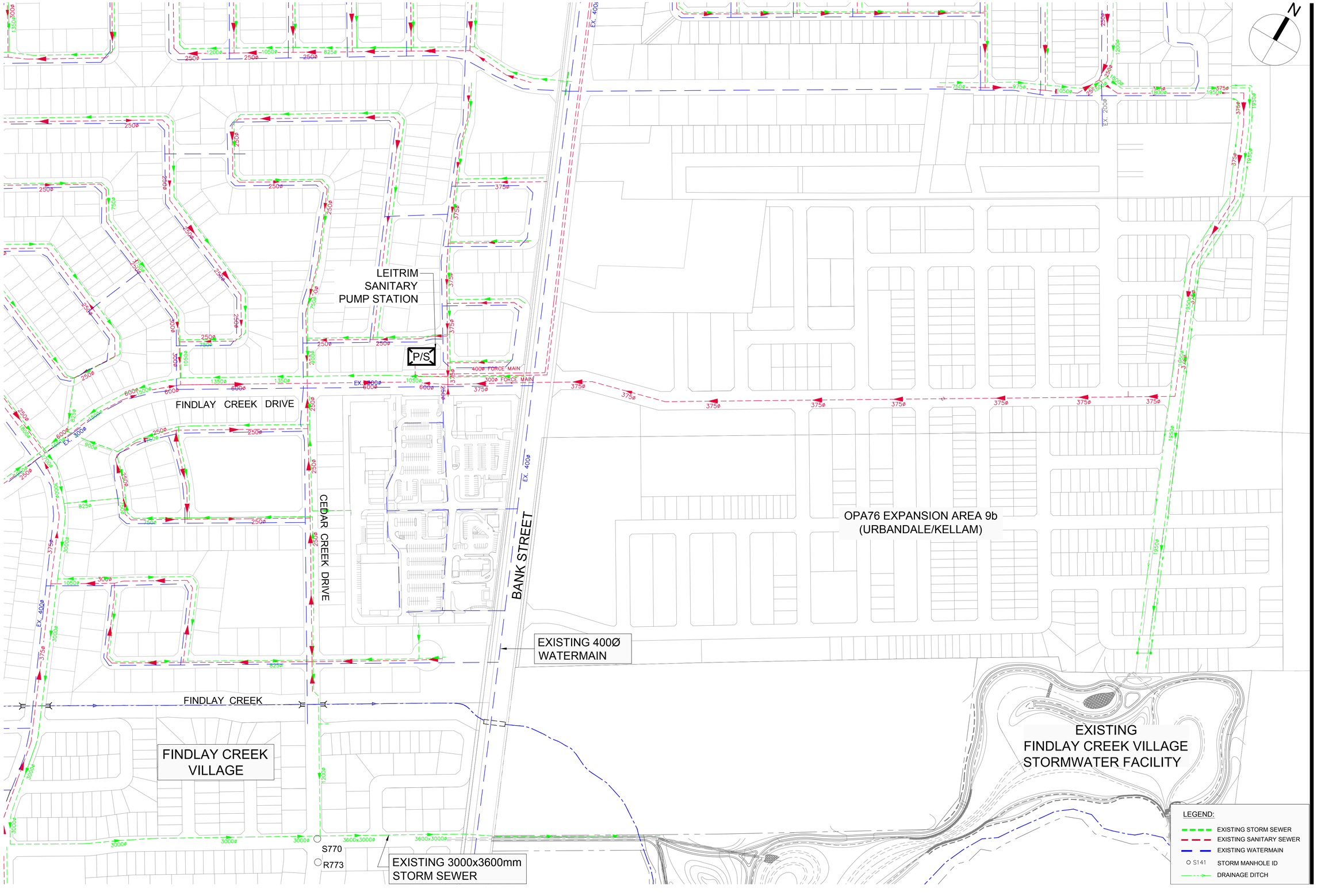
ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

Scale: N.T.S.

Project Title: CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
URBANDALE/KELLAM LANDS
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title: DRAFT PLAN OF SUBDIVISION

Sheet No.: FIGURE 1.3



J:\34347-KellamProperty\5.9 Drawings\59civil\current\Conceptual Site Servicing Study Figures\FIGURE 1.4 EXISTING MUNICIPAL INFRASTRUCTURE.dwg Layout Name: FIGURE 1.4 Plot Style: ---- Plot Scale: 1:2.5849 Plotted At: 10/18/2016 1:21 PM
Last Saved By: mmilne Last Saved At: Oct. 18, 16

IBI

Scale N.T.S.

Project Title
CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
URBANDALE/KELLAM LANDS
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title
EXISTING MUNICIPAL
INFRASTRUCTURE

Sheet No.
FIGURE 1.4

treatment for a large portion of the LDA, was also constructed. Those two facilities will provide both the wastewater outlet for the subject property as well as the treatment requirements of runoff from the site. Besides the Leitrim Sanitary Pump Station, adjacent developments east of Bank Street also included construction of a 375 mm diameter sanitary sewer to which wastewater flows from the subject site are proposed to be routed. The earlier developments also included construction of a 1950/2100 mm diameter trunk storm sewer which outlets to the existing stormwater facility.

As noted previously, a 375 mm diameter sanitary sub-trunk sewer, which bisects the OPA 76 Expansion Area 9a north of the subject site, was constructed in 2010 to service the Sundance Village (Claridge Homes) and Findlay by the Park (Lemay Homes) developments located north of the 9a lands. That sewer, which is called the Bank Street East Sub-Trunk Sewer in the 2016 Final Updated Serviceability Report, will also be the wastewater outlet for the subject site.

There is an existing 400 mm diameter watermain located in Bank Street and a 200 mm diameter watermain in Rotary Way in the Findlay by the Park development located north of the subject site. Connections to both these watermains will be needed to help provide a reliable water supply for the subject site.

Development of both the Sundance Village and Findlay by the Park neighbourhoods included construction of a 1950 mm diameter storm sewer which bisects the eastern portion of the subject site and the 9a lands. That sewer, which will be partially re-routed in the north east of the subject lands and the remainder of the sewer will provide a minor storm runoff outlet for the subject site.

The Findlay Creek Village Stormwater Facility located south of the subject site was commissioned in 2006. As per the recommendation of the 2016 Final Updated Serviceability Report, an expansion to that facility is required to provide stormwater treatment for the OPA 76 expansion lands which includes the subject property.

1.7 Pre-Consultation

There was a pre-consultation meeting held with the City on January 7, 2013. Attached in **Appendix B** are notes of that meeting prepared by the City. Among other items the meeting discussed the following items:

- Plan layout rationale
- Park requirements
- Roadway designs and alignments
- Consideration of existing adjacent developments
- Environmental report
- School sites
- Housing mix
- Serviceability report update
- Geotechnical
- Development Changes
- Plan Design

1.8 Existing Topography

Under existing conditions, the subject site is comprised of brush land. A gravel access road is located on the existing eastern trunk sewer alignment with ditches located on either side of the road which is located on the eastern side of the subject site. The site topography consists of a higher ridge at 94.50 m which splits the rural drainage southwest and east. The ridge is located approximately 180 m east of Bank Street. The land west of the ridge is drains south toward Findlay Creek between elevations 94.50 m and 92.00 m. The land west of ridge drains east from 94.50 m to 89.00 m toward the existing eastern cell of the Findlay Creek Village Stormwater Facility. The existing topography and general drainage patterns are presented on **Figure 1.5**.

Once developed, the intent will be to maintain the existing drainage pattern. For reference, a copy of Figure 8.1 Macro Grading and Drainage Plan from the 2016 Final Updated Serviceability Report is included in **Appendix C**.

1.9 Geotechnical Considerations

A geotechnical investigation for the proposed residential development will be undertaken by Golder Associates. The objectives of the investigation will be to prepare a report to:

- Determine the subsoil and groundwater conditions at the site by means of boreholes and;
- To provide geotechnical recommendations pertaining to design of the proposed development including construction considerations.

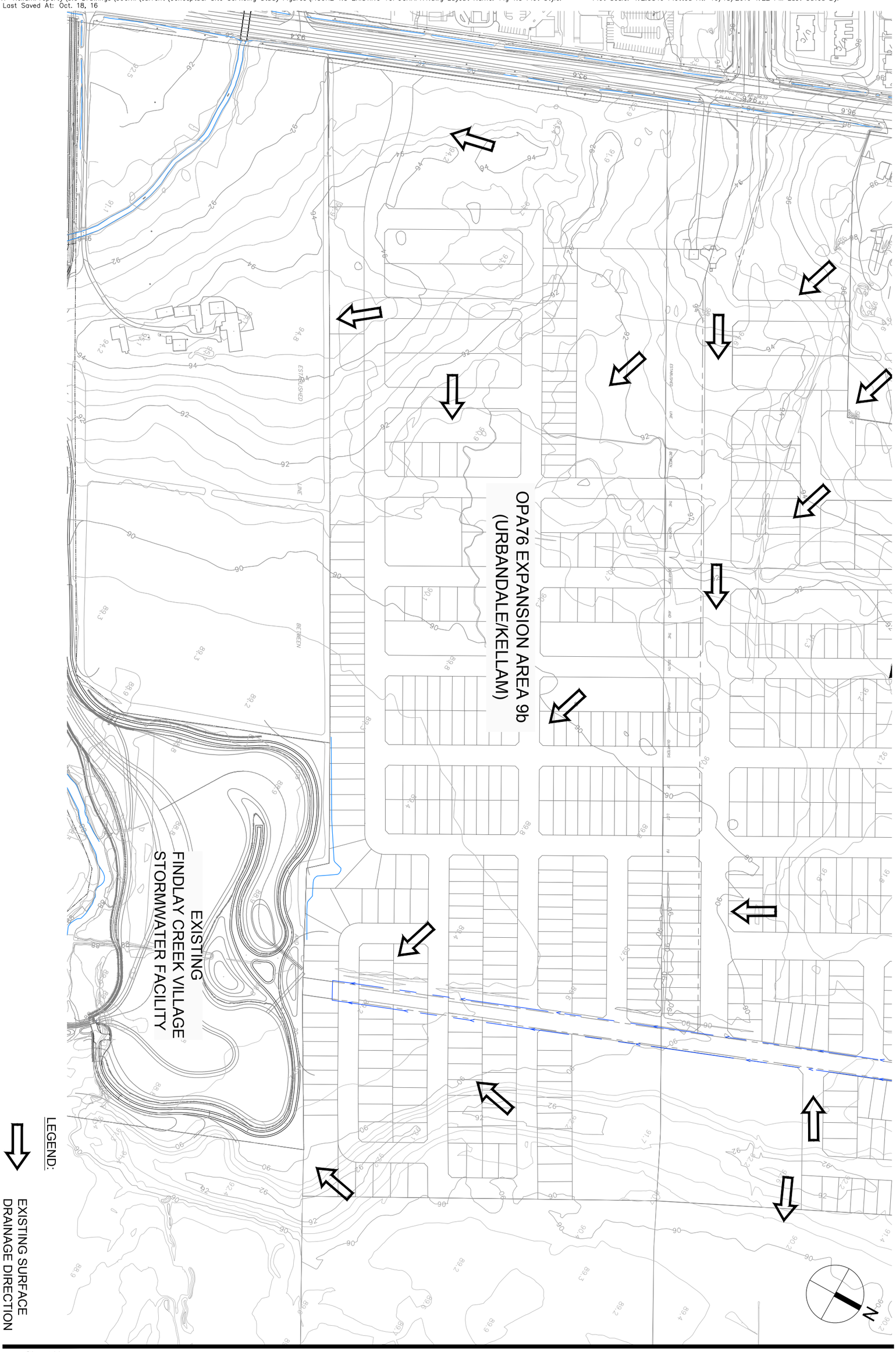
Among other items, the report will comment on the following:

- Site grading;
- Foundation design;
- Pavement structure;
- Infrastructure Construction;
- Groundwater Control;
- Corrosion.

1.10 Watercourses and Setbacks

There are no environmental issues associated with development of the subject site. Previous developments received CA permits to replace a previous watercourse with two temporary drainage ditches.

Construction of the above noted 1950 mm diameter storm sewer, which bisects the eastern portion of the site, also included construction of two temporary drainage ditches, one on either side of the storm sewer. Those ditches were designed to capture existing surface runoff and route it to the storm sewer. Much of those existing ditches will be decommissioned in favour of local sewers as part of the site development. The South Nation Conservation will be consulted to determine if a permit is needed for the proposed filling. There are no watercourses on or near the site that will require setbacks.



Sheet No.

FIGURE 1.5

Drawing Title

EXISTING TOPOGRAPHY
AND DRAINAGE PATTERNS

Project Title

CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
URBANDALE/KELLAM LANDS
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Scale

N.T.S.

IBI

2 WATER SUPPLY

2.1 Existing Conditions

As stated in **Section 1.6** there is an existing 400mm diameter watermain on Bank Street west of the site and an existing 200 mm watermain on Rotary Way at Fernside Street north of the site in the Findlay by the Park development. Connections to both these watermains are proposed to provide a looped watermain system for the development. **Figure 1.4** shows the existing water supply system adjacent to the subject site.

2.2 2016 Final Updated Serviceability Report

The preferred water distribution plan for the Leitrim Development Area was included in the 2016 Final Updated Serviceability Report. A copy of the recommended plan, **Figure 2.2** is included in **Appendix D**. The Urbandale/Kellam Lands are included in the OPA 76 Area 9b as shown on **Figure 2.2**. The recommended water plan for Area 9b includes a connection to the watermain on Bank Street and several connections to the Claridge OPA 76 Area 9a development to the north. A 250 mm diameter watermain is recommended to connect to the 400 mm diameter watermain on Bank Street and extend north adjacent to the mixed use and school site. All other pipes in the site will be 150 and 200 mm diameter.

2.2.1 Water Demands

The Urbandale/Kellam Lands is predominantly a residential site consisting of single family lots and street townhouses. A mixed use site adjacent to Bank Street and a school block are also proposed however, the school block will be serviced from the Area 9a lands to the north. Per unit population density and consumption rates are taken from Tables 4.1 and 4.2 at the Ottawa Design Guidelines – Water Distribution and are summarized as follows:

- Single Family 3.4 person per unit
- Townhouse and Semi-Detached 2.7 person per unit
- Average Apartment 1.8 person per unit
- Residential Average Day Demand 350 l/cap/day
- Residential Peak Daily Demand 875 l/cap/day
- Residential Peak Hour Demand 1,925 l/cap/day
- ICI Average Day Demand 50,000 l/gross ha/day
- ICI Peak Daily Demand 75,000 l/gross ha/day
- ICI Peak Hour Demand 135,000 l/gross ha/day

As there are no details on the school and mixed use blocks a conservation average water demand of 50,000 l/gross ha/day is used for the ICI land.

A water demand calculation sheet is included in **Appendix D**.

As the Leitrim Development Area has a population larger than 3,000 persons, the City of Ottawa has provided system level demands for large growth areas. The system level demands were used in the 2016 Final Updated Serviceability Report hydraulic analysis and is used in this analysis for all existing lands in the Leitrim Development Area. The system level demands are summarized in **Table 2.1**.

Table 2.1 – LDA Unit Water Demands

	AVERAGE (l/Unit/Day)	OUTDOOR WATER DEMAND (l/Unit/Day)	MAX. DAY (l/Unit/Day)	PEAK DAY (l/Unit/Day)*
Single Family	567	1049	Average + OWD	2.1 x Max Day
Townhouse (Medium Density)	558	0	Average	1.6 x Max Day
Apartment (High Density)	400	0	Average	1.6 x Max Day
Employee* (ICI)	85	0	Average	1.5 x Max Day
Water Loss per Connection	80	N/A	Average	Average

* 100 employees/hectare assumed for ICI land use

The City of Ottawa has also provided external water demand criteria for locations downstream of the LDA, summarized in **Table 2.2**.

Table 2.2 – External Water Demand Criteria for Locations Downstream of the LDA

LOCATION	CRITERIA
Carlsbad Trickle Feed	829 Dwelling Units
Existing South of FCV	200 Dwelling Units
Russell	11.8 MLD pumped over 20 hours

The Russell demand will be added to the average and maximum day demand, but will not be included in the peak hour calculations as the pumping is stopped during the peak hour period. Correspondence from the City of Ottawa regarding the LDA water demands is included in **Appendix D**.

2.2.2 System Pressures

The 2010 City of Ottawa Water Distribution Guidelines states that the preferred practice for design of a new distribution system is to have normal operating pressures range between 345 kPa (50 psi) and 552 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in the guidelines are as follows:

Minimum Pressure — Minimum system pressure under peak hour demand conditions shall not be less than 276 kPa (40 psi).

Fire Flow — During the period of maximum day demand, the system pressure shall not be less than 140 kPa (20 psi) during a fire flow event.

Maximum Pressure — Maximum pressure at any point in the distribution system shall not exceed 689 kPa (100 psi). In accordance with the Ontario Building/Plumbing Code the maximum pressure should not exceed 552 kPa (80 psi). Pressure reduction controls may be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa.

2.2.3 Fire Flow Rate

The majority of the residential units in the Urbandale/Kellam Lands site will be single family homes and traditional town and row houses. It is expected that all these units will meet the requirements of Item 4.1 and 4.2 of Technical Bulletin ISD7B-20.4-02 revision to Ottawa Design Guidelines – Water, in which the fire flow requirement is capped at 10,000 l/min. There is a mixed use block adjacent to Bank Street and a school block to the south of the site; without further details of these blocks at this time the industrial/commercial/institution (ICI) lands are assigned a fire flow rate of 15,000 l/min which is consistent with the 2016 Final Updated Serviceability Report. The fire flow demands used for the Urbandale/Kellam Lands are summarized as follows:

- Single Family/Townhouse 10,000 l/min (166.7 l/s)
- ICI 15,000 l/min (250.0 l/s)

2.2.4 Hydraulic Model

A computer model for the Leitrim development area water distribution system has been developed using the H_20 map version 6.0 program produced by MWH Soft. The source of water is the Ottawa South Pumping Station (OSPS) which is located approximately 1 km north of Leitrim Road adjacent to the future rapid rail transit corridor.

The City of Ottawa has been supplying potable water to the Leitrim area for decades. Over the years the City has made modifications and improvements to the delivery network. The Gloucester South Pump Station was decommissioned in 2005 and the Ottawa South Pumping Station (OSPS) were brought into service in 2001. The latter facility is currently delivering water to the downstream customers at the hydraulic grade line of about 155 m.

In an effort to better integrate the downstream areas including Riverside South, Longfields/Davidson Heights in Barrhaven and Leitrim, the City is planning to lower the hydraulic grade line at the Ottawa South station to about 146 m. For the hydraulic analysis of the water distribution system, a hydraulic boundary condition has been provided by the City at Leitrim Road and the rail corridor at the northwest corner of the LDA. A hydraulic grade line elevation of 144 meters is to be used for peak hour and maximum day plus fire analysis which represents the 146 meter level at the OSPS and the demands from the Riverside South community. For average day analysis the current level of 155 meters at the OSPS will be applied at the boundary condition to determine the maximum pressure in the water system. Correspondence from the City of Ottawa concerning boundary conditions is included in **Appendix D**.

2.3 Proposed Water Plan

The subject site will be serviced by connecting a 250 mm diameter watermain to the existing 400 mm diameter watermain on Bank Street at the west side of the site. A 200 mm diameter will be extended east through the site and north through the OPA 76 Area 9a expansion lands to connect to an existing 200 mm diameter watermain on Rotary Way at Fernside Street. The proposed watermain layout for the Urbandale/Kellam Lands is shown on **Figure 2.1**.

As discussed in **Section 1.5**, the subject property is proposed to be designed in one phase. Should the construction of the development be phased the watermain connections to Bank Street and Rotary Way will be required for the first phase. The results of the hydraulic analysis for the Urbandale/Kellam Lands is included in **Appendix D** and is summarized as follows:

ANALDEA DRIVE

ROTARY WAY

BANK STREET

CONNECT TO EXISTING

MIXED USE

PARK

EX. 300ø

FUTURE CONNECTION TO AREA 9a

FUTURE CONNECTION TO AREA 9a

OPA AREA 9a
OPA AREA 9b

SCHOOL

PARK

MIXED USE

PARK

CONNECT TO EXISTING

N

LEGEND:

- PROPOSED 250mmØ WATERMAIN
- PROPOSED 200mmØ WATERMAIN
- PROPOSED 150mmØ WATERMAIN
- EXISTING 400mmØ WATERMAIN
- EXISTING 200mmØ WATERMAIN

IBI

Scale N.T.S.

Project Title
CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
URBANDALE/KELLAM LANDS
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title
PROPOSED WATER DISTRIBUTION PLAN

Sheet No.
FIGURE 2.1

SCENARIO	CLARIDGE LANDS
Basic Day (Max HGL) Pressure (kPa)	557.1 – 578.1
Peak Hour Pressure (kPa)	455.3 – 473.2
Design Fire flow @ 140 kPa Residual Pressure (l/s) - Single Family/Townhouse - ICI	 148.2 – 332.0 245.1 – 267.3

A comparison of the results and design criteria is summarized as follows:

Maximum Pressure — All nodes under Basic Day using the HGL of 155 m at the OSPS are above 552 kPa (80 psi) therefore pressure reducing control is recommended for this development. There is no area where the pressure exceeds the maximum level of 689 kPa (100 psi) in unoccupied areas.

Minimum Pressure — The lowest minimum pressure during peak hour conditions is 455.3 kPa which exceeds the minimum 276 kPa (40 psi) requirement.

Fire Flow — For the analysis of the Urbandale/Kellam Lands, the minimum design fire flow under maximum day conditions with minimum system pressure of 140 kPa (20 psi) for single family and townhouse users is 148.2 l/s which is marginally less than the requirement of 167 l/s (10,000 l/min.) as discussed in **Section 2.3.3**. The lower fire flows occur at the boundary with the Claridge Lands to the north where the streets are temporarily dead ended, the fire flows at these locations will increase once the pipes are connected to the adjacent development. For the mixed use blocks the minimum design fire flow is 245.1 l/s which is close to the conservative requirement of 250 l/s (15,000 l/min).

3 WASTEWATER DISPOSAL

3.1 Existing Conditions

Stated in **Section 1.6**, the wastewater outlet for the subdivision will be the Bank Street East 375 mm diameter sub-trunk sewer which bisects the OPA 76 Area 9a Lands north of the subject site. That sewer was installed in 2010 to support the Sundance Village (Claridge Homes) and Findlay by the Park (Lemay Homes) developments.

The Urbandale/Kellam 9b lands were outside the City's urban boundary when the 2007 Final Serviceability Report was completed. The 2007 Report however, outlined two options to service the Sundance Village and Findlay by the Park developments. One of those options, the 375 mm diameter Bank Street East gravity sub-trunk sewer was built in 2010. As noted above, that sewer is located north of the subject site. However, the existing sub-trunk sewer did not include wastewater flows from the two OPA 76 expansion areas 9a and 9b, nor were wastewater flows from the Leitrim expansion lands included in the design of the Leitrim Sanitary Pump Station (LSPS) which was commissioned in 2002.

3.2 2016 Final Updated Serviceability Report

In 2012, the City of Ottawa expanded its urban envelope. That expansion included the inclusion of another 87 ha of land in the LDA. Wastewater flows from those lands are also proposed to be tributary to the LSPS. Two of those expansion areas, 9a and 9b are located east of Bank Street. The 2016 Final Updated Serviceability Report for Leitrim recommended that future wastewater flows from those two expansion areas, which includes the subject site, outlet to the existing 375 mm diameter Bank Street East Sub-Trunk Sewer, even though flows from the two expansion areas were not included in the original sub-trunk sewer design.

The 2016 Final Report concluded that the existing Bank Street East Sub-Trunk Sewer had sufficient capacity to handle flows from the expansion areas 9a and 9b. For reference, copies of pages 23 and 24 from the 2016 Final Report are included in **Appendix E**. Those pages include Table 3.13 Capacity Analysis of Existing Sub-Trunk Sewers which provides a historical review of capacity versus flows for several sub-trunk sewers in the LDA, including the subject sewer. Page 24 includes a highlighted discussion of the ability of the existing sewer to handle flows from both expansion areas 9a and 9b. Also included in **Appendix E** is the spreadsheet for Zone 13 (expansion areas 9a and 9b) which provides a detail design of the entire expansion areas east of Bank Street including the capacity of the existing Bank Street East Sub-Trunk Sewer and the expected peak flow from the expanded drainage area. The 2016 Final Report concluded that the capacity of the existing sub-trunk sewer is 102 l/s and that the expected peak flow from the expanded drainage area, including the subject site is 99 l/s. Therefore, there is sufficient capacity in the existing Bank Street East Sub-Trunk Sewer to accept flows from the OPA 76 expansion areas 9a and 9b.

As noted above, the LSPS, which was commissioned in 2002, also did not included the OPA 76 expansion lands in its tributary drainage area. It originally included only those tributary limits from the 2005 Leitrim CDP. According to the MOE ECA certificate, the station has a firm capacity of 361 l/s. A copy of Certificate No. 2799-8PJJRH is included in **Appendix E**.

The 2016 Final Updated Serviceability Report for Leitrim completed a review of the potential impact on the Leitrim Pump Station of total wastewater flows including the OPA 76 expansion lands. For reference, copies of Pages 21 and 22 which include Section 3.3.2 Expanded LDA Built-Out and 3.3.3 Sensitivity Analysis from the 2016 Final Report are included in **Appendix E**. Figures 3.8, Final Build Out Plan, Figure 3.9 Pump Performance Curves and Figure 3.10

Sensitivity Analysis and related spreadsheets from the 2016 Final Report are also included in **Appendix E**.

The 2016 Final Report concluded that predicted wastewater flows from the enlarged tributary area could range between 312 l/s and 436 l/s. The smaller flow rate was based on using monitored criteria as predicted by analysis of existing monitored information at the station and the larger flow rate was based on standard MOE design criteria. Because there is a possibility that peak wastewater flows could surpass the capacity of the Leitrim Pump Station, a contingency plan was recommended in the 2016 Final Report. A key component of that plan was to continue monitoring wastewater flows into the station. If flow generation behaviour is similar in the future to historical generation rates, then ultimate wastewater flows at final build out will be less than the station's capacity. If future flows are greater than the current station capacity, then larger pumps can be installed in the existing station.

3.3 Design Criteria

The estimated wastewater flows from the subject site are based on City of Ottawa and MOECC design criteria. Among other items, these include:

- Average residential flow = 350 l/c/d
- Peak residential flow factor = Harmon Formula (2.0 to 4.0)
- Average ICI flow = 50,000 l/s/ha
- Peak ICI flow factor = 1.5
- Inflow and Infiltration Rate = 0.28 l/s/ha
- Minimum Full Flow Velocity = 0.60 m/s
- Maximum Full Flow Velocity = 3.0 m/s
- Minimum Pipe Size = 200 mm diameter

The current Urbandale/Kellam Plan of subdivision includes the following development statistics:

- Single units = 235
- Semi units = 56
- Townhouse units = 224
- Mixed Use = 3.31 ha
- School area (partial site) = 1.56 ha
- Park area = 1.47 ha

In accordance with the 2005 CDP and the 2016 Final Updated Serviceability Report, the following density rates are estimated for the subject site:

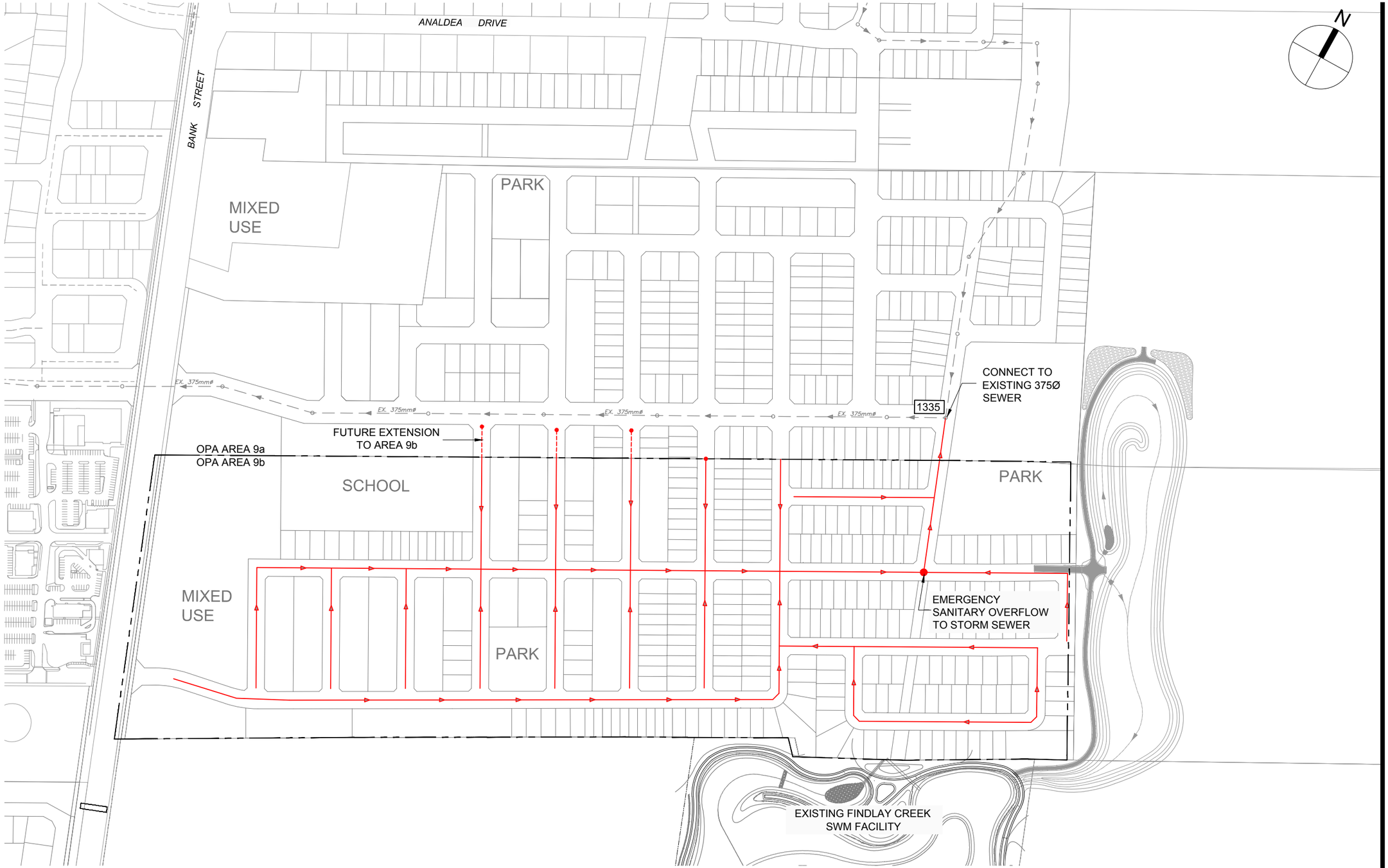
- Single units = 3.2
- Semi units = 3.2
- Townhouse units = 2.4
- Apartment units = 1.9

Based on the above criteria, the estimated peak wastewater flow from the Urbandale/Kellam property will be about 40 l/s and the estimated peak wastewater flow from both OPA 76 expansion areas 9a and 9b is 66 l/s which is less than the 70.9 l/s allowed for Zone 13 in the 2016 Serviceability Report.

3.4 Recommended Sanitary Plan

The 2016 Final Serviceability Report recommended a detailed wastewater plan for the expanded Leitrim Development Area including the expansion areas 9a and 9b east of Bank Street. The subject property is included in area 9b. That report demonstrated that there was sufficient available capacity in the Bank Street East Sub-Trunk Sewer for flows from not only the subject property but for all lands east of Bank Street. The 2016 Final Report also completed a review of the impact of the OPA 76 expansion lands on the Leitrim Pump Station. That report concluded that flows from the expansion areas, including the subject site could conditionally outlet to the pump station. The condition is that a contingency plan, wastewater flow monitoring at the station, continue. The City must therefore continue to monitor flows into the station.

It is therefore recommended that the Wastewater Plan for the Urbandale/Kellam 9b Lands be in accordance with that proposed in the 2016 Final Updated Serviceability Report. That plan is shown on **Figure 3.12** from the Report and a copy is included in **Appendix E**. The proposed wastewater (sanitary sewer) layout for the Urbandale/Kellam Lands is shown on **Figure 3.1**. The sanitary sewers flow in a north east direction and connect to the existing Bank Street East Sub-Trunk Sewer at one location (Node 1335 from the 2016 Serviceability Report). The proposed sanitary sewers will only drain the Area 9b lands except for a small area of the Area 9a lands on the north boundary to correspond with the road layout as shown on **Figure 3.1**. An emergency sanitary sewer overflow to the storm sewer outletting to the Findlay Creek Stormwater Management Facility is proposed and shown on **Figure 3.1**.



Project Title
CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
URBANDALE/KELLAM LANDS
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Scale N.T.S.

Drawing Title
PROPOSED WASTEWATER PLAN

Sheet No.
FIGURE 3.1

4 STORMWATER MANAGEMENT

4.1 Existing Conditions

The subject site is located north of the existing Findlay Creek Village Stormwater Facility. A 1950 mm/2100 mm diameter storm sewer, which outlets to the existing storm pond, was constructed in 2010 to service the Sundance Village and Findlay by the Park developments both located north of the subject site and the OPA 76 Expansion Area 9a. The existing storm sewer bisects the eastern portion of the subject site.

Although the subject site is located near both the existing storm trunk sewer and the existing stormwater management facility, the 2016 EMP and 2016 Final Updated Serviceability reports both concluded that neither infrastructure had the capacity to convey and treat runoff from the subject site. The latter report recommended that an expansion to the existing stormwater facility be constructed and a larger storm sewer be constructed to convey flows to that expansion. The 2016 Final Updated Serviceability Report recommended that the existing 1950 mm diameter pipe be intercepted in the northeast portion of the subject site and that a new 3000 mm diameter sewer be constructed to outlet to the stormwater facility expansion which is recommended to be located immediately east of the subject site.

It is further recommended in the 2016 Final Updated Serviceability Report that the remainder of the existing 1950 mm diameter sewer south of the point of interception be removed to approximately 50 m upstream of the existing eastern flow splitter to the stormwater facility. The remaining 1950 mm diameter pipe will be used to convey a portion of the subject site to the existing eastern inlet.

For reference, a copy of Figure 6.2 Preferred Minor Storm Plan from the 2016 Final Updated Serviceability Report is provided in **Appendix F**.

4.2 Storm Sewer Design Criteria

The minor system storm sewers are proposed to be sized based on the rational method, applying standards of both the City of Ottawa and MOECC. Some of the key criteria for this site include the following:

- Sewer Sizing: Rational Method
- Design Return Period: 1:5 year (local and collector streets)
  1:10 year (arterial roads)
- Initial Time of Concentration 10 minutes
- Manning's: 0.013
- Minimum Velocity: 0.80 m/s
- Maximum Velocity: 3.00 m/s
- Minimum Slope:

PIPE DIAMETER (MM)	SLOPE (%)
250	0.432
300	0.340
375	0.250
450	0.195
525	0.160

600	0.132
675	0.113
750 and larger	0.100

- Runoff Coefficients:

DEVELOPMENT		RUNOFF COEFFICIENT, C
Residential	Front Yards	0.71
	Rear Yards	0.55
Institutional, Commercial and Industrial		0.75
Parks	Neighbourhood	0.20
	Community	0.30

These runoff coefficients were taken from the 2016 Final Updated Serviceability Report. These coefficients can also be confirmed at the time of final design when more detailed site lotting is available.

As with the wastewater plan, the development of the subject property, where applicable, must provide for minor stormwater runoff from OPA 76 Expansion Area 9a located north of the subject site. The 2016 Final Updated Serviceability Report identified a preferred minor storm sewer plan that included some oversized storm sewers on the subject site which will provide the required capacity for the upstream properties. A copy of the relevant storm sewer design sheet as well as Figure 6.1 Storm Drainage Area Plan from the 2016 Final Updated Serviceability Report is included in **Appendix F** for reference.

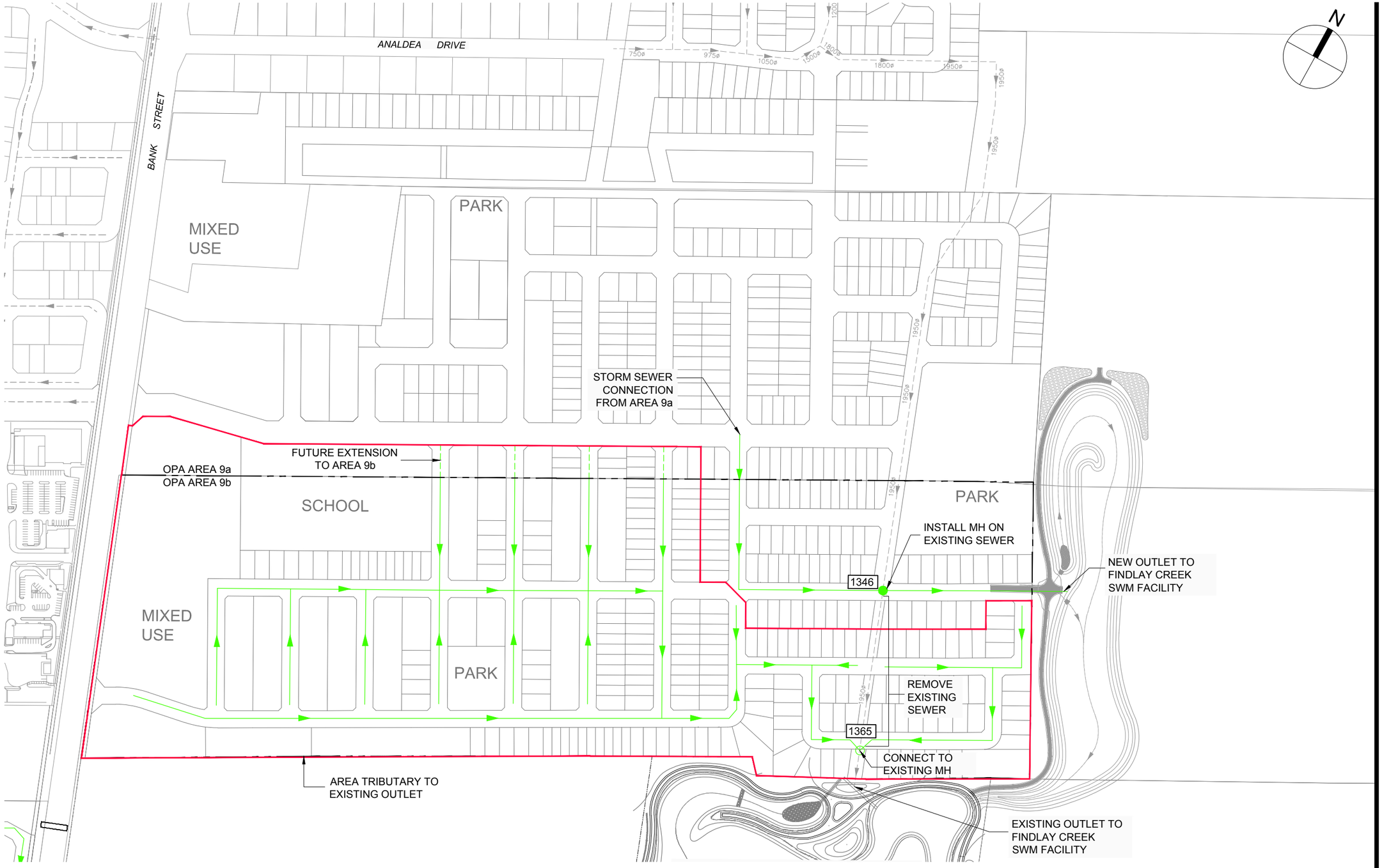
4.3 Recommended Minor Storm Plan

The recommended minor storm plan for the expanded LDA is included in **Appendix F**. Figure 6.2, Preferred Minor Storm Sewer Plan from the 2016 Final Updated Serviceability Report shows a preferred minor storm sewer layout for not only the subject property but for adjacent lands in the expansion area 9a. **Figure 4.1** shows the recommended minor storm plan for the subject site.

The key recommendation from the 2016 Final Updated Serviceability Report is that the existing 1950 mm diameter sewer, at a location about 120 m from the northern property boundary, be intercepted (at node 1346 on **Figure 4.1**) and a new 3000 mm diameter storm sewer be constructed to outlet eastward to the proposed storm pond expansion. The remaining portion of the existing 1950 mm diameter sewer south of node 1346 could then be decommissioned to approximately 50 m north of the existing eastern flow splitter (Node 1365). The remaining 1950 mm diameter pipe will be used to convey a portion of the subject site to the existing eastern inlet of the stormwater facility.

The preferred plan, north of the interception point with the future 3000 mm diameter sewer, is essentially to continue to use the remaining portion of the 1950 mm diameter pipe to service the existing developments north of OPA 76 Expansion Area 9a and permit a small portion of area 9a to also connect and outlet to that pipe. Figure 6.2, Preferred Minor Storm Plan, together with a storm sewer design sheet, from the 2016 Final Updated Serviceability Report are included in **Appendix F** for reference.

It is therefore recommended that the minor storm plan for the subject site be in accordance with Figure 6.2 from the 2016 Final Updated Serviceability Report. That report provides a plan that demonstrates how the subject site can be serviced with a minor storm sewer system.



LEGEND :

- 375ø — EXISTING SEWER
- PROPOSED SEWER
- 1365 — NODE FROM 2016 FINAL SERVICEABILITY REPORT

IBI

Scale N.T.S.

Project Title
CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
URBANDALE/KELLAM LANDS
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title
PROPOSED
MINOR STORM PLAN

Sheet No.
FIGURE 4.1

4.4 Dual Drainage

Development of the subject site will include a stormwater strategy using the dual drainage system. The system features a combination of on-site detention (surface ponding) with inlet control devices (ICDs) and direct conveyance with no ponding. It accommodates both minor and major stormwater runoff. During frequent storms the effective runoff collected by catchment areas is directly released via catch basin inlets into the network of storm sewers, called the minor system. During less frequent storms, the balance of the flow (in excess of the minor flow) is accommodated by a system of rear yard swales and street segments called the major system. The main advantage of this arrangement is its ability to adjust the rate of total inflow into the minor system to satisfy the required level of service. The required total inflow is typically maintained by the restriction of the capacity and the density of the inlets directly connected into this system. As noted, during less frequent storms, the balance of the flow is accommodated by the major system. Typically, this accommodation is achieved by the attenuation on catchment surfaces called on-site detention and/or direct conveyance of the flow to a recipient. For the subject site, the major flow is conveyed to the expanded Findlay Creek Village Stormwater Facility. It should be noted that the facility will need to be expanded to accommodate the subject lands.

Surface runoff from the subject site presently flows to ditches located on the west and east side of the existing eastern trunk sewer which services Leitrim Development Area lands north of the subject site (Sundance Village and Findlay by the Park). These ditches enter the storm sewer via ditch inlet where it is conveyed to the eastern inlet of the existing Findlay Creek Village Stormwater Facility. Discussion as to how the major flow runoff from these existing sites will be dealt with when the subject site is developed is discussed in **Section 4.6**.

The major flow from the subject site and the upstream OPA 76 Expansion Area 9a is proposed to be conveyed, via the street patterns, to three discharge locations located either on the east or south of the subject lands. All three outlets convey major flow to the expanded Findlay Creek Village Stormwater Facility.

Evaluation of this major flow route was discussed in Section 6.3.6.3, Watercourses and Major Flow Channels, and Figure 6.11, Major Flow Routing Features, from the 2016 Final Updated Serviceability Report (a copy of Figure 6.11 is included in **Appendix F**). The major system outlet locations are indicated as 13, 14 and 15. Location 13 is on the northeast portion of the property. The major flow from the upstream OPA 76 Expansion Area 9a plus a small portion from the subject site is proposed to be routed to this location. The major flow will be conveyed to the expanded Findlay Creek Village Stormwater Facility via a swale located in an easement immediately south of the neighbourhood park. Location 14 is proposed to be located on the southern portion of the site where the future easement for the existing 1950 mm diameter pipe will be located. The major flow from the southern portion of the subject site is proposed to be conveyed to this location where it will be conveyed into the Findlay Creek Village Stormwater Facility. Location 15 is located on the east-west street right-of-way immediately south of the neighbourhood park and swale easement. The major flow from most of the subject site is proposed to be conveyed to this street where the flow will be routed to the cell of the expanded Findlay Creek Village Stormwater Facility.

The following table summarizes the major system evaluation results as presented in the 2016 Final Updated Serviceability Report. It should be noted that the total major flow presented in the table below includes major flow contribution from the OPA 76 Expansion Area 9a, where applicable.

Table 4.1 Summary of Major Flow – Subject Site

DESCRIPTION (ZONE 13)	LOCATION (FIGURE 6.11, APPENDIX F)	ROW (M)	MAX. CUMULATIVE FLOW (CMS)	STATIC DETPH OF PONDING (EST) (M)	DEPTH OF OVERFLOW (M)	TOTAL DEPTH (M)	VELOCITY (M/S)	DXV (M^2/S)
100 Year 3 Hour Chicago Storm								
Area 9a and portion of Area 9b.	13	18	1.09	0.13	0.22	0.35	0.77	0.27
Southern portion of Area 9b	14	18	0.00	-	-	-	-	-
West and north portion of Area 9b	15	18	1.03	0.12	0.23	0.35	0.67	0.23
100 Year 3 Hour Chicago Storm + 20%								
Area 9a and portion of Area 9b.	13	18	4.37	0.13	0.40	***0.53***	1.05	0.56
Southern portion of Area 9b	14	18	1.13	0.12	0.23	0.35	0.62	0.22
West and north portion of Area 9b	15	18	2.66	0.12	0.34	***0.47***	0.83	0.39

Note: The information presented in the above table was extracted from Table 6.15 from the 2016 Final Updated Serviceability Report.

At the locations noted in the above table, the maximum ponding depth is at the maximum allowable 0.35 m, and the product of depth and velocity is less than 0.6 m^2/s, as per the OSDG for the 100 year 3 hour Chicago storm event. In addition, at this preliminary design stage, the static depth of ponding is unknown. Therefore, it was assumed that the depth of static ponding would be less than the balance between total depth (0.35 m) and cascading depth during the 100 year storm event.

For the 100 year 3 hour Chicago storm event increased by 20%, the total estimated static and dynamic ponding exceeds 0.35 m at the major system outlet location. During detail design, the major system will be evaluated in greater detail.

4.5 Hydraulic Evaluation

The storm sewer system for the LDA, including the subject site, was hydraulically evaluated as part of the 2016 Final Updated Serviceability Report. The hydraulic grade line (HGL) for the eastern trunk sewer plus its proposed reconnection to the expanded cell of the Findlay Creek Village Stormwater Facility as well as the connection to future areas to the existing eastern inlet were included in that analysis. The following table shows the HGL for the subject site, Zone 13, for two sanitary inflow options. The sanitary inflow options are discussed in detail in Section 6.4.1 in the 2016 Final Updated Serviceability Report.

Table 4.2 Hydraulic Grade Line Analysis – Subject Site

XPSWMM NODE	USF (M)	FINISHED GRADE (M)	STORM HYDRAULIC GRADE LINE							
			100 YEAR 24 HOUR SCS				100 YEAR 3 HOUR CHICAGO			
	EXISTING *PROPOSED*	EXISTING *PROPOSED*	SANI INFLOW OPTION 1		SANI INFLOW OPTION 2		SANI INFLOW OPTION 1		SANI INFLOW OPTION 2	
			HGL (M)	USF–HGL (M)	HGL (M)	USF–HGL (M)	HGL (M)	USF–HGL (M)	HGL (M)	USF–HGL (M)
New Inlet Trunk										
POND	n/a	n/a	88.61	n/a	88.60	n/a	88.40	n/a	88.40	n/a
NE-FS	n/a	n/a	88.62	n/a	88.60	n/a	88.47	n/a	88.47	n/a
S142B	*89.95*	*92.10*	88.66	1.29	88.65	1.30	88.53	1.42	88.53	1.42
S142A	*89.95*	*92.22*	88.82	1.13	88.82	1.13	88.76	1.19	88.76	1.19
S142	*n/a*	*92.40*	89.19	n/a	89.19	n/a	89.20	n/a	89.20	n/a
S141	*n/a*	*92.60*	89.37	n/a	89.36	n/a	89.41	n/a	89.41	n/a
S140	*n/a*	*92.65*	89.50	n/a	89.49	n/a	89.57	n/a	89.57	n/a
S139	*90.60*	*92.75*	89.61	0.99	89.61	0.99	89.70	0.90	89.70	0.90
S138	*n/a*	*n/a*	89.74	n/a	89.74	n/a	89.86	n/a	89.86	n/a
S137	*n/a*	*91.50*	89.87	n/a	89.87	n/a	90.01	n/a	90.01	n/a
S136	*n/a*	*n/a*	90.06	n/a	90.06	n/a	90.21	n/a	90.21	n/a
S135	91.75	93.80	90.26	1.49	90.26	1.49	90.44	1.31	90.44	1.31
S134	91.90	93.95	90.52	1.38	90.52	1.38	90.72	1.18	90.72	1.18
S133	91.93	93.98	90.74	1.19	90.74	1.19	90.95	0.98	90.95	0.98
Existing Eastern Trunk										
POND	n/a	n/a	88.61	n/a	88.60	n/a	88.40	n/a	88.40	n/a
S145	n/a	n/a	88.61	n/a	88.60	n/a	88.40	n/a	88.40	n/a
S144	*90.05*	*92.20*	88.61	1.44	88.60	1.45	88.48	1.57	88.48	1.57
S144A	*90.05*	*92.20*	88.61	1.44	88.60	1.45	88.50	1.55	88.50	1.55

Note: The information presented in the above table were extracted from Table 6.21 from the 2016 Final Updated Serviceability Report.

Please note that the node locations referenced in **Table 4.2** are included on **Figure 1.4**, Existing Municipal Infrastructure.

The HGL results presented in **Table 4.2** indicate that the minimum 0.3 m clearance between the USF and HGL is maintained across the subject site and along the Leitrim Development Area eastern trunk, including the proposed connection, to the expanded cell of the Findlay Creek Village Stormwater Facility. The analysis is based on a preliminary Macro Grading and Drainage Plan, Figure 8.1 from the 2016 Final Updated Serviceability Report. A copy of that plan is included in **Appendix F**.

4.6 External Drainage

There is one source of external drainage to the subject site. This is the future OPA 76 Expansion Area 9a. Both minor and major flows from those areas will need to be accommodated through the subject site.

As stated earlier, the stormwater management design of the subject site will provide oversized storm sewers for the OPA 76 Expansion Area 9a which are located upstream of the subject site. The design of the subject site must also allow for ultimate major storm runoff from these lands as noted in the 2016 Final Updated Serviceability Report.

The development of area 9a includes the construction of a permanent east channel to convey existing major flow from Sundance Village and Findlay by the Park around area 9a (east of the development boundary) to the expanded cell of the Findlay Creek Village Stormwater Facility. It is recommended that this permanent channel be constructed with the development of area 9a.

If design and construction timing for area 9a is behind that of the subject site, then some exterior drainage works, including ditching and ditch inlets, may be needed to temporarily deal with both existing surface runoff from area 9a and major flow from Sundance Village and Findlay by the Park.

The existing 1950 mm diameter storm sewer located in the eastern portion of the subject site will continue to provide the minor storm outlet for the Sundance Village and Findlay by the Park communities. The lower section of that pipe, as noted above, is proposed to be modified as part of the development of the subject site.

5 EROSION AND SEDIMENTATION CONTROL PLAN

During construction, existing conveyance systems and water courses can be exposed to sediment loading. Development of a subdivision such as the Urbandale/Kellam Area 9b lands can potentially create deleterious material which can enter the natural environment and gain access to fish and amphibian habitat. In order to prevent site generated sediments from entering the environment, an Erosion and Sedimentation Control Plan (ESCD) will be implemented prior to development. Although a generic ESCP can be developed as part of this report and subsequent Design Briefs, the final plan will be developed and implemented by the Owner's general contractor.

The erosion and sedimentation strategy for the subject site could include erection of silt fences, straw bale barriers and rock check dams. These measures will ensure protection of both adjacent developments and the natural environment adjacent to and downstream of the site.

A copy of a potential Erosion and Sedimentation Control Plan, **Figure 5.1**, is included in **Appendix E**.

Other elements of an ESCP could also include installation of bulkhead barriers at the nearest existing downstream manholes to ensure deleterious material does not gain access to those sewers and potentially the Leitrim Sanitary Pump Station and/or Findlay Creek Village Stormwater Facility. Also, the final ESCP will incorporate features to deal with disposal of any taken water. Some of the features or general requirements are sometimes conditions of a Permit To Take Water.

Sheet No.

FIGURE 5.1

Drawing Title

EROSION AND SEDIMENT CONTROL PLAN

Project Title

CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
URBANDALE/KELLAM LANDS
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Scale

N.T.S.

IBI

6 APPROVALS AND PERMIT REQUIREMENTS

6.1 City of Ottawa

The City of Ottawa will review all development documents including final working drawings and related reports. Upon completion, the City will approve the local watermains, under Permit No. 008-202; submit the sewer and pond extension MOECC applications to the province and eventually issue a Commence Work Notification for both.

6.2 Province of Ontario

The Ministry of Environment and Climate Change (MOECC) will approve the local sewers and pond extension under Section 53 of the Ontario Water Resources Act and issue Environmental Compliance Approvals for both. A Permit To Take Water will also need to be issued by the MOECC.

6.3 Conservation Authority

The South Nation Conservation will be contacted to confirm if any permits are required from the agency.

6.4 Federal Government

There are no required permits, authorizations or approvals needed expressly for this development from the federal government.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusion

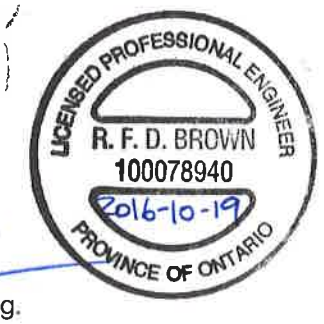
While some infrastructure which is needed to help service the subject site already exists, the development plan will include expansion and extension of those infrastructure to adequately service the site with water supply, wastewater collection and disposal and management of stormwater runoff. The extension of the existing watermains through the subject site will provide a reliable source of both drinking water and fire flows. The outlet wastewater sewer already is in place and the City will continue to monitor flows into the Leitrim Pump Station. Development of the subject property will also include an expansion of the existing stormwater facility and construction of new storm sewers as needed to service both the site and upstream external lands. Therefore, including both existing and proposed major infrastructure there will be suitable public services put in place to service the subject site.

7.2 Recommendation

Once the major municipal infrastructures identified in **Section 7.1** are implemented, the subject site can proceed to final development. This report therefore recommends that the City provide relevant draft conditions and that the planning and development review processes for the subject lands move forward.

Prepared by:

IBI GROUP



Lance Erion, P. Eng.

Rikke Brown, P. Eng.

APPENDIX A

- **City of Ottawa Servicing Study Guidelines Checklist**

Appendix A

November 2009 City of Ottawa Servicing Study Guidelines for Development Applications - Checklist

General Content

	ITEM DESCRIPTION	LOCATION
	Executive Summary (for larger reports only)	N/A
√	Date and revision number of the report	Front Cover
√	Location Map and plan showing municipal address, boundary, and layout of proposed development.	Figures 1.1 and 1.3
√	Plan showing the site and location of all existing services.	Figure 1.4
√	Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Sections 1.2, 2.2, 3.3 and 4.2
√	Summary of Pre-consultation Meeting with City and other approval agencies.	Appendix B
√	Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	Section 1.3
√	Statement of objectives and servicing criteria	Sections 2.2, 3.3 and 4.3
√	Identification of existing and proposed infrastructure available in the immediate area.	Figures 1.4, 2.1, 3.1 and 4.1
√	Identification of Environmentally Significant Areas, Watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	Section 1.10
√	Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Figure 1.5 and Appendix C
√	Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	n/a
√	Proposed phasing of the development, if applicable.	n/a
√	Reference to geotechnical studies and recommendations concerning servicing.	Section 1.9
√	All preliminary and formal site plan submissions should have the following information: Metric scale North arrow (including construction North) Key plan Name and contact information of applicant and property owner	

ITEM DESCRIPTION		LOCATION
	Property limits including bearings and dimensions Existing and proposed structures and parking areas Easements, road widening and rights-of-way Adjacent street names	

Development Servicing Report: Water

ITEM DESCRIPTION		LOCATION
√	Confirm consistency with Master Servicing Study, if available	Section 2.2
√	Availability of public infrastructure to service proposed development	Section 2.1
√	Identification of system constraints – external water needed	Section 2.2.1
√	Identify boundary conditions	Section 2.2.4
√	Confirmation of adequate domestic supply and pressure	Section 2.2.1
√	Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Section 2.2.3
√	Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Section 2.2.2 and 2.2.3
√	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defining phases of the project including the ultimate design.	Section 2.3
	Address reliability requirements such as appropriate location of shut-off valves.	N/A
	Check on the necessity of a pressure zone boundary modification.	N/A
√	Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range.	Section 2.3
√	Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Figure 2.3 and Figure 2.1
	Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities and timing of implementation.	N/A
√	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Section 2.2.1
√	Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	Appendix D

Development Servicing Report: Wastewater

	ITEM DESCRIPTION	LOCATION
√	Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Section 3.3
√	Confirm consistency with Master Servicing Study and/or justifications for deviations.	Section 3.2
√	Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age condition of sewers.	Section 3.3
√	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 3.1 and Figure 1.4
√	Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Section 3.3
√	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix "C") format.	Appendix E
√	Description of proposed sewer network including sewers, pumping stations and forcemains.	Section 3.4 and Figure 3.1
√	Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	Section 1.10
	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	N/A
	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A
√	Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	Sections 3.4
√	Special considerations such as contamination, corrosive environment, check soils, etc.	Section 1.9

Development Servicing Report: Stormwater Checklist

	ITEM DESCRIPTION	LOCATION
√	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Section 4.1 and Appendix F
√	Analysis of available capacity in existing public infrastructure.	Sections 4.1 and 4.3 and Appendix F

	ITEM DESCRIPTION	LOCATION
√	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Figure 1.5
√	Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Section 4.3
√	Water quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Section 4.3
√	Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	Section 4.4
	Set-back from private sewage disposal systems.	N/A
√	Watercourse and hazard lands setbacks.	Sections 1.10 and 4.6
	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	N/A
√	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	Section 4.3
√	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	Section 4.4
√	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	Section 1.8 and Figure 1.5
	Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Detail Design
	Any proposed diversion of drainage catchment areas from one outlet to another.	N/A
√	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	Sections 4.2 and 4.3 and Appendix F
	If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	N/A
	Identification of potential impacts to receiving watercourses	N/A
	Identification of municipal drains and related approval requirements.	N/A
√	Descriptions of how the conveyance and storage capacity will be achieved for the development.	Section 4.4 and Detail Design
√	100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building	Section 4.4 and Detail Design

	ITEM DESCRIPTION	LOCATION
	elevations (MBE) and overall grading.	
√	Inclusion of hydraulic analysis including hydraulic grade line elevations.	Section 4.5
√	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Section 5
	Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	N/A
√	Identification of fill constraints related to floodplain and geotechnical investigation.	Section 1.9

Approval and Permit Requirements: Checklist

	ITEM DESCRIPTION	LOCATION
√	Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	Section 6.3
√	Application for Certification of Approval (CofA) under the Ontario Water resources Act.	Section 6.2
	Changes to Municipal Drains	N/A
√	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	Section 6.4

Conclusion Checklist

	ITEM DESCRIPTION	LOCATION
√	Clearly stated conclusions and recommendations	Section 7
	Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	N/A
√	All draft and final reports shall be signed and stamped by professional Engineer registered in Ontario.	Done

APPENDIX B

- **Record of Discussions from January 7, 2013 Pre-Consultation Meeting with City of Ottawa**

07 January 2013

Dist List

See Attachment

RECORD OF DISCUSSIONS (ROD) -
LEITRIM EAST URBAN EXPANSION AREA, PART 9B – URBANDALE CORPORATION
PRECONSULTATION WITH URBANDALE CORPORATION, CITY OF OTTAWA,
LOCATION – Room 4105 07 January 2013

Chair:	Patricia MacMillan	City of Ottawa
In attendance:	Mary Jarvis	Urbandale
	Justin Robitaille	Urbandale
	Don Morse	City of Ottawa
	Gordon Elliott	City of Ottawa
	Joseph Zagorski	City of Ottawa
	Jennifer Hemmings	City of Ottawa
	Matthew Hayley	City of Ottawa
Secretary:	Patricia MacMillan	City of Ottawa
Regrets:	Asad Yousfani	City of Ottawa

ITEM	TOPIC	ACTION
1	**Introductory Remarks** Patricia MacMillan (PM) welcomed all. She then asked Mary Jarvis (MJ) to present a brief background to the development proposal for Phase 9B of the Leitrim East Urban Expansion Area.	
2	**Project** Background MJ gave a history of the lands including their inclusion into the Urban Area as identified in the Official Plan. She noted that Urbandale is looking for approximately 850 residential units on a 29 hectare site. The development will be comprised of a mix of densities with most of the units likely being a medium density type of residential dwelling. It is Urbandale's goal to meet the	

ITEM	TOPIC	ACTION
	minimum average density target of 34 units per hectare. A commercial plaza on a parcel approximately 8 acres in size is also being proposed. Parkland is proposed in the south-east corner. Urbandale used the Bank Street alignment as a guide for the internal road alignments. Urbandale tried to keep the road network in alignment with Bank Street. They want to move away from the single-loaded road proposed at the southern limit of the lands.	
	Urbandale hopes to develop approximately 100 – 150 units per year. This schedule will result in a build-out of the lands in 5-6 years. However, servicing the lands will happen all at once. MJ has not yet received confirmation that a school site is required on these lands.	
	MJ noted that this is a development application package. In order to implement the development, an Official Plan Amendment, a Zoning By-law Amendment and a Plan of Subdivision are required.	MJ
	<u>Servicing</u>	
	1) Joe Zagorski (JZ) wants the Terms of Reference (TOR) for the Master Drainage Plan/ Master Servicing Study report to be updated to encompass all lands being added to the Urban Area. With regards to this issue, it should not be a piecemeal approach. The study update would include sanitary, storm, and watermain distribution systems. In addition a SWM plan that would include the requirements for pond upgrades shall be prepared. These studies should include all 3 parcels including the lands on the west side of Bank Street.	MJ
	However, prior to the drafting of these documents, Bob Wingate should meet with the City to discuss their parameters. Further, JZ would like to review the TOR prior to the work on the study being done.	MJ/JZ
	2) Gord Elliot (GE) noted the following:	
	• Services for sanitary and storm sewers exist along Street no. 6.	
	• Storm Water Management exists off-site but connections to the pond can be made. How this is to be done will be determined as part of the service study update.	MJ/GE
	• A new outlet to the forebay of the stormwater management pond is required. The pond was originally	MJ

ITEM	TOPIC	ACTION
	designed for rural land uses. This likely will require adjustments to the road pattern and/or ROW width to accommodate a new trunk storm sewer.	
	• Bank Street drainage will have to be picked up through these lands.	MJ
	<u>Roadway Design and Sidewalks</u>	
	1) GE noted that a servicing alignment has been identified assuming future road locations. The existing/planned services can't support any more infrastructure. This limitation should be considered in the determination of ROW widths. With regards to the sidewalks, an 18 metre ROW is acceptable subject to servicing needs.	MJ
	2) Jennifer Hemmings (JH) agreed that a sidewalk on the park side of the street may not be necessary depending on the final size and configuration of the park block. Parks Planning does want some connection to the park.	MJ
	3) MJ asked if Urbandale could design the sidewalks adjacent to the curb. She was told by GE that this would be acceptable on small streets but on larger ROW's there needs to be a setback. It is Urbandale's responsibility to refer to the City approved ROW cross sections for guidance.	MJ
	4) GE noted that street No. 10 may not be large enough (18 m ROW) to accommodate servicing. Urbandale could explore constructing local sewers back (to the west) and then run them down streets 5/7 to the pond.	MJ
	5) GE stated that once IBI knows how to service the site, the size of pipes, how to get to the streets noted above, it will then be possible to determine the required ROW widths.	MJ
	<u>Geotechnical</u>	
	Borehole information will be required as part of a master servicing information package since it has to be addressed. Another option is to produce a separate report.	MJ
	<u>Development Charges</u>	
	MJ asked if there are any changes to the required calculations to the Development Charges By-law. She wants to know how much Lemay and Claridge owe for stormwater management.	

ITEM	TOPIC	ACTION
	The City assumes that the reference to the Lemay/Claridge lands is to the lands east of Bank Street. With this assumption, GE stated that development charges are not owed for sanitary sewers. Development charges are owed for storm sewers.	MJ
	Clarification on what Development Charges are owed will be obtained from Gary Baker.	PM
	<u>Design Comments</u> Don Morse (DM) stated that the preference regarding the street network is for more of a grid pattern, no cul-de-sacs or P-loops. He also wants a new schedule put into the Community Design Plan to include the Urbandale, Remer and Claridge lands. This schedule change/insertion can be done through the Official Plan Amendment process. The illustration prepared for the previous Claridge preconsultation, and attended by Urbandale, should be used as an illustration of the design comments for these lands as well.	MJ
	<u>Park Requirements</u> JH discussed the park requirements. The parks should be larger and central to the developments. Urbandale should think about not having a park close or adjacent to the SWM pond. Her preference is to have:	MJ
	1) A parkette in a higher density area. 0.8 hectares would be an adequate size, and	
	2) A large, neighbourhood park 2.5 – 3.2 hectares in size that would contain a splash pad, outdoor rink and other associated infrastructure for more of a central park.	
	3) Connections must be made to all green spaces throughout the subdivision and to adjoining areas including to the SWM pond.	MJ
	4) A plan should be drawn for sidewalks and pathways.	MJ
	The decision on parkland design will depend on how parkland dedication works out. All involved will have to work with what area is ultimately determined. JH stated that she is flexible with park locations but that she wants them to be closer to higher density residential areas.	MJ/JH
	With regards to the stormwater management pond, the pathway locations will have to be tweaked.	MJ

ITEM	TOPIC	ACTION
	Environmental Requirements Mathew Hayley (MH) requires the following: 1) A Tree Conservation Report: It will help to inform park location since the City will want to preserve particularly important trees. 2) An EIS: Some of the background information for this report has already been undertaken. The EIS can build on any material gathered previously but will need to consider whether there is habitat for endangered and threatened species and potential impact on any adjacent significant woodlands / rural natural features. General 1) PM noted that in a related preconsultation meeting with Claridge Homes on December 5, 2012, it was stated that of all the school boards, the French Catholic School Board is the only school board that does not have a site in this community. If they require a site, it will have to be accommodated. 2) MJ confirmed that a severance application will be submitted in June 2013. Urbandale will be confirming their unit mix through that submission. 3) MJ asked about the submission requirements for a Noise Study and an Archaeological Study. PM will get this information for her. 4) MJ asked about the fencing requirements for the site. PM will get this answer for her. 5) MJ also expressed concern about the well associated with the farm house immediately to the south of Urbandale's lands. PM will find out about the implications of the well. Next Steps 1) Urbandale will revise their concept plan 2) Urbandale will communicate with the French Catholic School Board to understand their locational needs and include a site if required on concept plan 3) Urbandale will apply for severance 4) PM will clarify the application of the Development Charges	MJ MJ MJ MJ PM PM PM MJ MJ MJ MJ

ITEM	TOPIC	ACTION
	By-law for Urbandale 5) Urbandale will arrange for and participate in the preparation of the Master Servicing Study for Leitrim Urban Expansion Areas. <u>Take Aways</u> 1) Development Charges need to be clarified. 2) ROW's for all streets need to be determined. 3) The requirement for a school site needs to be determined. 4) The requirements for a sidewalk on the park side of the street to be determined through the processing of the plan of subdivision. 5) Direction is needed from transportation engineering regarding what transportation studies will be required for the Official Plan Amendment. 6) A concept plan needs to be finalized with defined ROW's, sidewalks, parkland and pathway connections.	MJ/JZ
3	**Closing Remarks** PM thanked everyone for their participation and input, concluding the meeting at 1000 hrs.	

Attachment # 1

Distribution List

Mary Jarvis	Urbandale
Justin Robitaille	Urbandale
Don Morse	City of Ottawa
Gordon Elliott	City of Ottawa
Joseph Zagorski	City of Ottawa
Jennifer Hemmings	City of Ottawa
Matthew Hayley	City of Ottawa
Asad Yousfani	City of Ottawa
Patricia MacMillan	City of Ottawa

APPENDIX C

- **Figure 8.1 – Macro Grading Plan from 2016 Final Updated Serviceability Report**

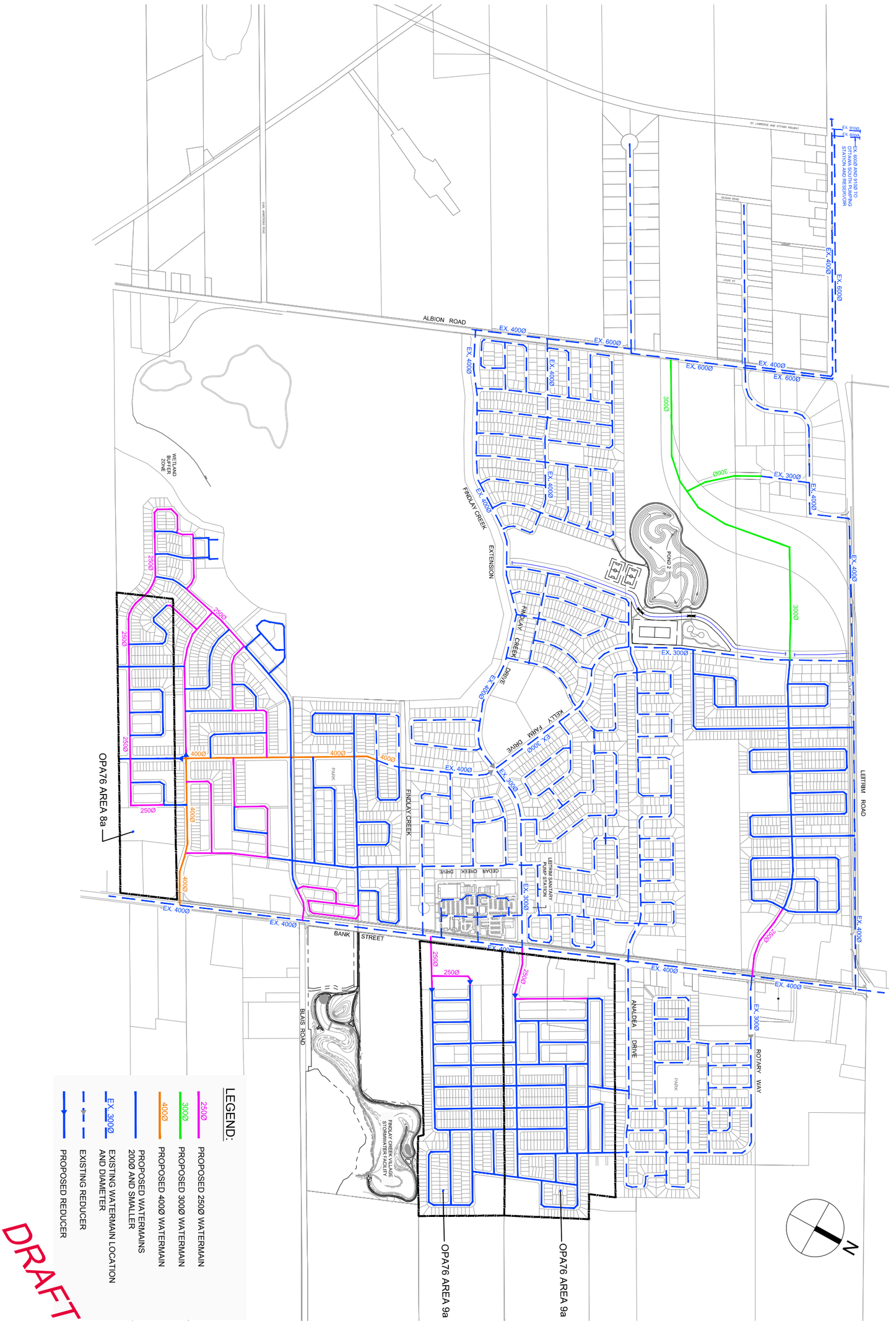
Sheet No.	Drawing Title	Project Title	Scale
FIGURE 8.1	MACRO GRADING AND DRAINAGE PLAN	UPDATED SERVICEABILITY PLAN (CLASS EA OPA76 AREAS 8a, 9a and 9b) LEITRIM DEVELOPMENT AREA	N.T.S.

IBI

APPENDIX D

- **Figure 2.2 from the 2016 Final Updated Serviceability Report**
- **Correspondence from the City of Ottawa**
- **Watermain Demand Calculation Sheets**
- **Hydraulic Model Output**

J:\34738-LeitrimServReport\5.9 Drawings\59civil\current\Updated Serviceability Report Figures\SECTION 2\FIGURE 2.2 PREFERRED_WATER DISTRIBUTION.dwg Layout Name: FIGURE 2.2 Plot Style: ---- Plot Scale: 1:2.5849 Plotted At: 6/27/2016 2:05 PM Last Saved By: mmilne Last Saved At: Jun. 27, 16



Sheet No.	Drawing Title	Project Title	Scale
FIGURE 2.2	PREFERRED WATER DISTRIBUTION PLAN	UPDATED SERVICEABILITY PLAN (CLASS EA OPA76 AREAS 8a, 9a and 9b) LEITRIM DEVELOPMENT AREA	N.T.S.

IBI

Lance Erion

Subject: FW: Leitrim Serviceability Update, September 2014

From: Rogers, Christopher [mailto:Christopher.Rogers@ottawa.ca]
Sent: Friday, October 24, 2014 11:10 AM
To: Bob Wingate
Cc: Zagorski, Joseph; Diduch, Roman
Subject: Leitrim Serviceability Update, September 2014

Bob,

Comments on the draft report are as follows:

- An introduction is needed to explain the purpose of the report, as this strongly influences the level of detail expected.
- Construction of the new 610mm main on Leitrim was completed in 2014. The project limits included Leitrim Road, from the CPR corridor to Albion, and on Albion from Leitrim to Fenton. This project provides a redundant supply to the majority of the existing Zone 3C, including LDA, via Albion and Findlay Creek.
- The information used for the analysis is dated. Please note the following:

- System-level demands for large growth areas are now estimated as given in the table below. The numbers used in your analysis are conservative, except for the unit demands for apartments. These numbers should only be used for establishing the backbone of the proposed distribution system. Design guideline demands should be used for local system designs.
- The post zone reconfiguration OSPS HGL is currently expected to be 146m. Note that the current Zone 3C remains at 155m. The plan should consider post-reconfiguration boundary conditions for pressure minima, and pre-reconfiguration conditions for pressure maxima.
- Zone 3C will be supplied by two pumping facilities, the OSPS and the Barrhaven PS. Rather that updating the Riverside South development numbers, we propose using our estimated future boundary conditions at Leitrim/CPR = 144m for peak hour and max day + fire (i.e. no need to consider RS development in your model). The development downstream of FCV can be represented as given in Table 2.2, but consider 829 units for Carlsbad.

- Provide figure clearly illustrating existing and proposed service areas, sub-areas identified in OPA 76, existing watermains (including new 610), proposed future watermains. Watermains should be colour-coded to emphasize mains larger than 200mm (nominal).
- Figure 2.2 as referenced in Section 2.4 was not provided in my copy of the report. Review of proposed network cannot be completed without figure as requested above. Focus should be on backbone of network and connection points to existing system.
- Review of alternatives would be better focussed on viable options, such as sizing and configuration of backbone distribution system. For example, if the second E-W main from the north (pipe 1557) were to be sized at 305mm, could this potentially allow for downsizing of downstream mains, to increase number of 6" mains? The City's interest here is to ensure design demands will be met with minimum network pipe sizing, so as to avoid high water age in the system.
- Provide figure illustrating distribution of residual pressure at model nodes under various design conditions, employing a suitable colour-coding scheme.
- Notwithstanding the above point, local sizing and fire demands will need to be reviewed for each plan of subdivision and site plan, and local system sizing will need to be finalized based on the City's design guideline demands, rather than the system-level demands considered in this report.

	Average (L/unit/day)	Outdoor Water Demand (L/unit/day)	Max Day (L/unit/day)	Peak Hour
SFH (OGB)	567	1049	Average + OWD	2.1 x Max Day
MLT (OGB)	558	0	Average	1.6 x Max Day
APT (OGB)	400	0	Average	1.6 x Max Day
EMP (OGB)	85	0	Average	1.5 x Max Day
Water Loss per connection	80	N/A	Average	Average
	Sum above for total Average Day		Sum above for total Max Day	Sum above for tc Peak Hour

Regards,

Chris Rogers, M.A.Sc., P.Eng.
Senior Project Manager
Policy Development and Urban Design Branch
Gestionnaire principal de projet
Direction de l'élaboration des politiques et de l'esthétique urbaine

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27785
ottawa.ca/planning / ottawa.ca/urbanisme

IBI GROUP
333 PRESTON STREET
OTTAWA, ONTARIO
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

PROJECT : URBANDALE/KELLAM OPA76 AREA 9b LANDS
LEITRIM DEVELOPMENT AREA
LOCATION : CITY OF OTTAWA

FILE: 34347-5.7
DATE PRINTED: 19-Oct-16
DESIGN: L.E.
PAGE: 1 OF 1

NODE	RESIDENTIAL				NON-RESIDENTIAL (ICI)			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND (l/min)
	SINGLE FAMILY UNITS	TOWNHOUSE/ SEMI DETACHED UNITS	MEDIUM DENSITY (ha)	POPULATION	INDUST. (ha)	COMM. (ha)	INSTIT. (ha)	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	
S14-100	16			54				0.22		0.22	0.55		0.55	1.21		1.21	10,000
S14-110	19			65				0.26		0.26	0.65		0.65	1.44		1.44	10,000
S14-120	11			37				0.15		0.15	0.38		0.38	0.83		0.83	10,000
S14-130	23			78				0.32		0.32	0.79		0.79	1.74		1.74	10,000
S14-140	13	8		66				0.27		0.27	0.67		0.67	1.47		1.47	10,000
S14-150	1	18		52				0.21		0.21	0.53		0.53	1.16		1.16	10,000
S14-160		18		49				0.20		0.20	0.49		0.49	1.08		1.08	10,000
S14-170		29		78				0.32		0.32	0.79		0.79	1.74		1.74	10,000
S14-180		27		73				0.30		0.30	0.74		0.74	1.62		1.62	10,000
S14-190	16			54				0.22		0.22	0.55		0.55	1.21		1.21	10,000
S14-200	5	16		60				0.24		0.24	0.61		0.61	1.34		1.34	10,000
S14-210		24		65				0.26		0.26	0.66		0.66	1.44		1.44	10,000
S14-220	3	18		59				0.24		0.24	0.60		0.60	1.31		1.31	10,000
S14-230	7	17		70				0.28		0.28	0.71		0.71	1.55		1.55	10,000
S14-240		28		76				0.31		0.31	0.77		0.77	1.68		1.68	10,000
S14-250		16		43		0.58		0.18	0.34	0.51	0.44	0.50	0.94	0.96	0.91	1.87	15,000
S14-260		10		27		2.74		0.11	1.59	1.70	0.27	2.38	2.65	0.60	4.28	4.88	15,000
S14-270		16		43				0.18		0.18	0.44		0.44	0.96		0.96	10,000
S14-280		32		86				0.35		0.35	0.88		0.88	1.93		1.93	10,000
S14-290		32		86				0.35		0.35	0.88		0.88	1.93		1.93	10,000
S14-300	17			58				0.23		0.23	0.59		0.59	1.29		1.29	10,000
S14-320	15			51				0.21		0.21	0.52		0.52	1.14		1.14	10,000
S14-330	30			102				0.41		0.41	1.03		1.03	2.27		2.27	10,000
S14-340	18			61				0.25		0.25	0.62		0.62	1.36		1.36	10,000
S14-350	12			41				0.17		0.17	0.41		0.41	0.91		0.91	10,000
S14-360	29			99				0.40		0.40	1.00		1.00	2.20		2.20	10,000
S14-500	4			14				0.06		0.06	0.14		0.14	0.30		0.30	10,000
TOTALS	**239**	**309**		**1,647**						**8.59**			**19.56**			**41.88**	

POPULATION DENSITY

Single Family	3.4 persons/unit
Semi Detached & Townhouse	2.7 persons/unit
Medium Density	1.8 persons/unit

WATER DEMAND RATES

Residential	350 l/cap/day
ICI	50,000 l/ha/day

PEAKING FACTORS

Maximum Daily	
Residential	2.5 x avg. day
ICI	1.5 x avg. day
Maximum Hourly	
Residential	2.2 x max. day
ICI	1.8 x max. day

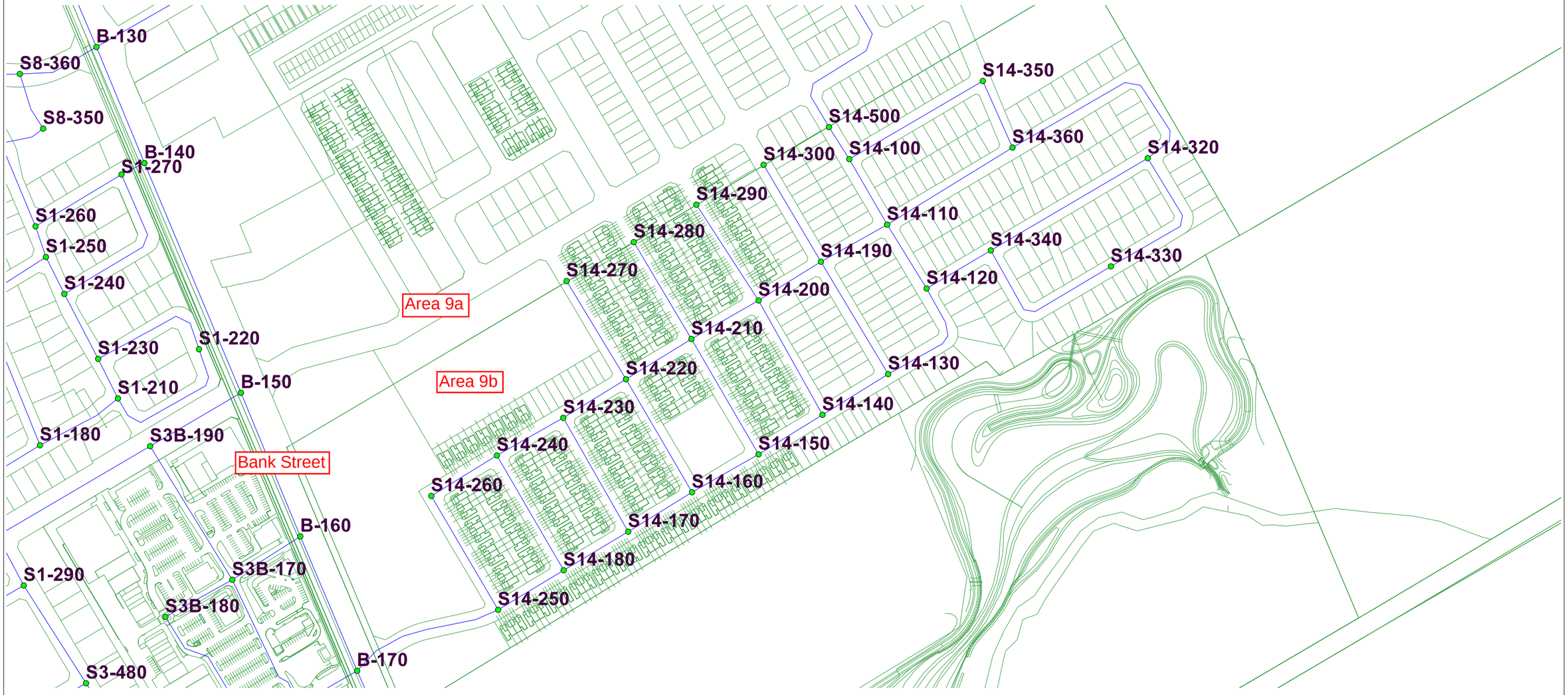
FIRE DEMANDS

Single Family & Townhouses	10,000 l/min (166.7 l/s)
ICI	15,000 l/min (250 l/s)

Urbandale/Kellam Lands Pipe Sizes (mm)

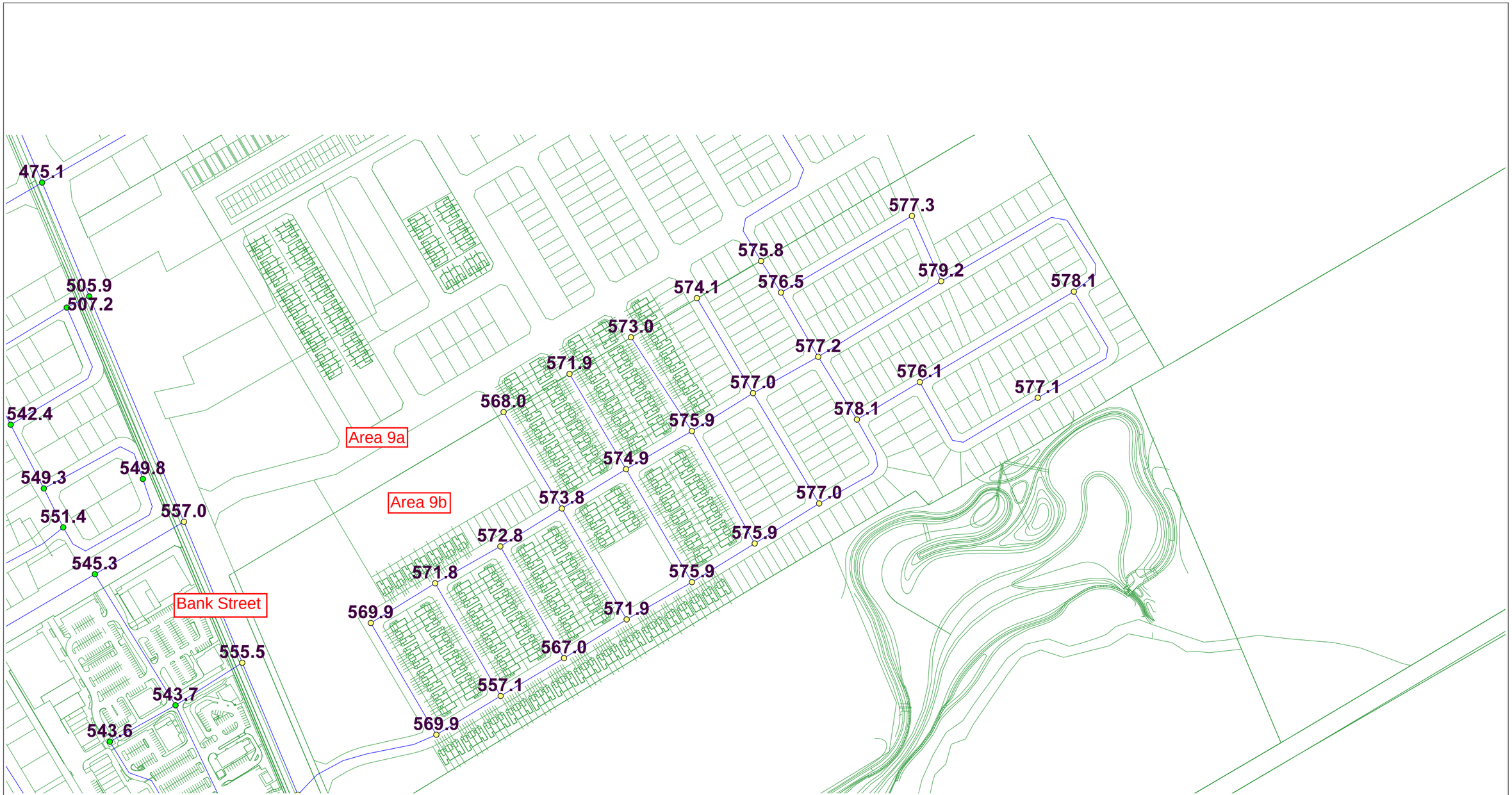
Date: Tuesday, October 18, 2016

Urbandale/Kellam Lands Node ID's



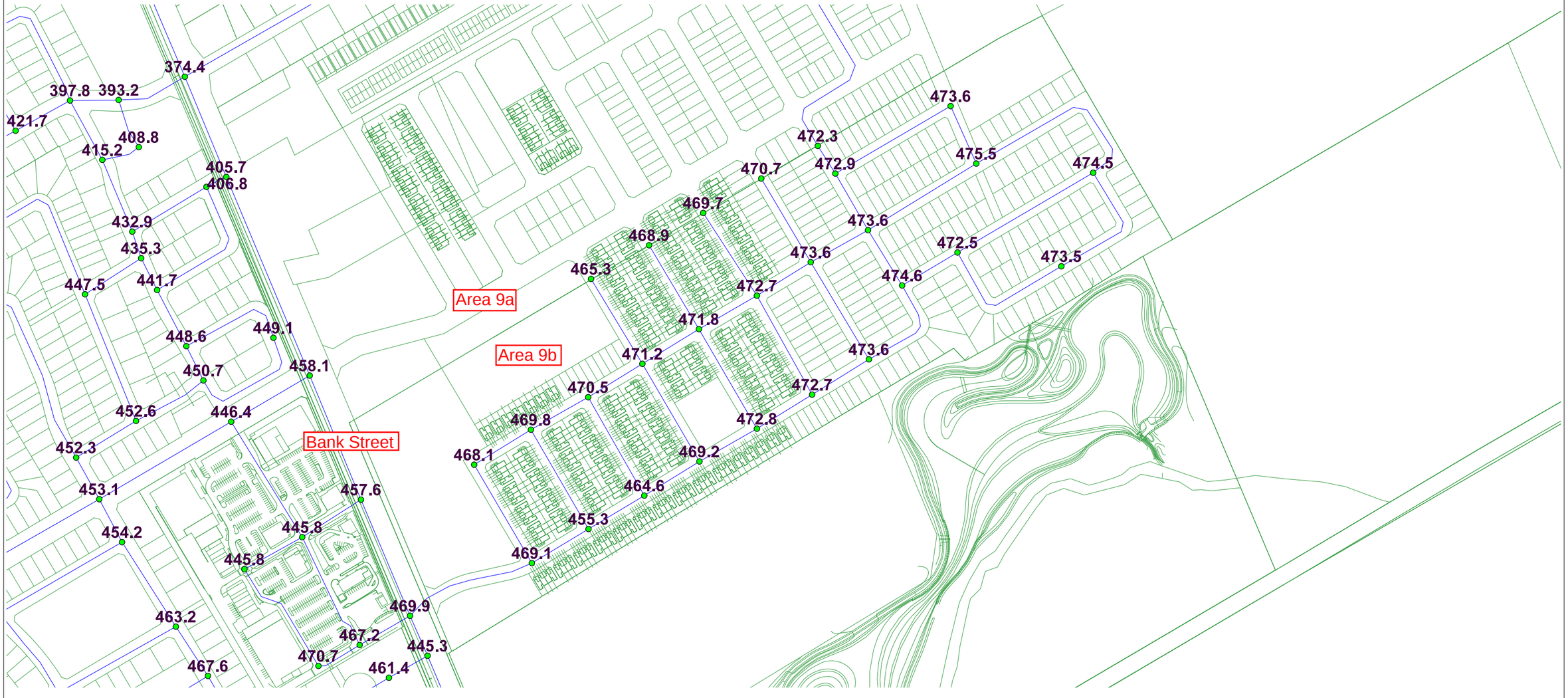
Date: Tuesday, October 18, 2016

Urbandale/Kellam Lands - Basic Day (Max HGL) - Pressures (kPa)



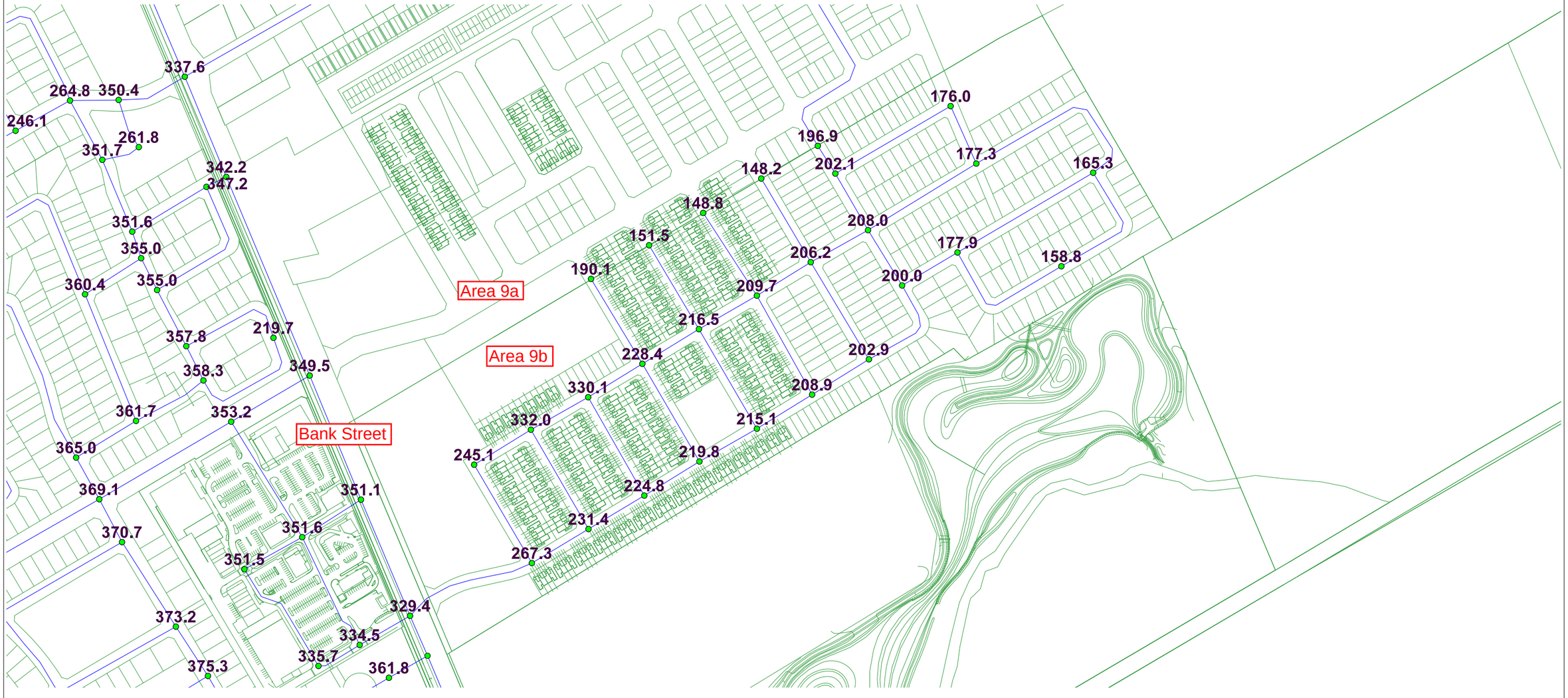
Date: Tuesday, October 18, 2016

Urbandale?Kellam Lands HGL 144m - Peak Hour - Pressures (kPa)



Date: Tuesday, October 18, 2016

Urbandale?Kellam Lands HGL 144m - Max Day + Fire - Fireflows (l/s)



Date: Tuesday, October 18, 2016

Basic Day HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1		482	0.00	102.70	155.00	512.49
2		B-100	0.52	104.60	152.11	465.52
3		B-110	0.30	105.20	151.85	457.13
4		B-130	0.07	103.20	151.69	475.12
5		B-140	0.00	100.00	151.62	505.88
6		B-150	0.00	94.60	151.44	556.95
7		B-160	0.00	94.60	151.29	555.48
8		B-170	0.00	93.30	151.15	566.91
9		B-175	0.00	95.80	151.05	541.40
10		B-190	0.34	95.00	149.94	538.36
11		B-200	0.68	98.25	148.15	488.97
12		B-210	144.28	98.25	147.40	481.61
13		L-100	0.00	102.70	154.99	512.38
14		L-110	0.95	101.60	154.83	521.58
15		L-120	0.93	99.20	154.58	542.66
16		L-130	0.53	97.60	154.45	557.10
17		L-135	0.89	96.50	154.33	566.69
18		L-140	1.94	95.30	153.78	573.06
19		L-150	0.13	96.50	152.92	552.89
20		L-160	0.18	98.10	152.75	535.57
21		L-170	0.17	99.50	152.48	519.21
22		S1-100	0.00	95.22	151.72	553.66
23		S1-110	0.00	95.05	152.06	558.70
24		S1-120	0.23	95.10	152.07	558.23
25		S1-140	0.17	95.50	151.96	553.29
26		S1-150	0.30	95.90	151.86	548.33
27		S1-170	0.15	95.30	151.73	552.93
28		S1-180	0.10	95.25	151.72	553.35
29		S1-190	0.36	95.77	151.72	548.27
30		S1-210	0.07	95.44	151.71	551.38
31		S1-220	0.13	95.60	151.71	549.80
32		S1-230	0.12	95.65	151.70	549.29
33		S1-240	0.13	96.35	151.70	542.36
34		S1-250	0.06	97.00	151.70	536.01
35		S1-260	0.10	97.24	151.70	533.63
36		S1-270	0.18	99.89	151.65	507.25
37		S1-290	0.13	95.09	151.66	554.35
38		S1-300	0.13	94.65	151.64	558.43
39		S10-010	0.08	95.80	151.69	547.67
40		S10-020	0.10	105.00	151.73	457.92
41		S10-040	0.15	103.00	151.73	477.52

Basic Day HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
42		S10-050	0.10	101.50	151.73	492.21
43		S10-060	0.16	100.00	151.73	506.86
44		S10-080	0.15	102.00	151.73	487.34
45		S10-090	0.11	103.50	151.73	472.62
46		S10-100	0.47	105.00	151.79	458.49
47		S10-101	0.11	104.85	151.77	459.73
48		S10-105	0.17	104.75	151.76	460.62
49		S10-110	0.23	104.50	151.75	463.00
50		S10-120	0.21	102.00	151.73	487.34
51		S10-130	0.04	99.70	151.72	509.72
52		S10-140	0.09	99.00	151.72	516.57
53		S10-150	0.18	97.80	151.71	528.29
54		S10-160	0.12	103.00	151.73	477.55
55		S10-180	0.12	104.00	151.75	467.94
56		S10-190	0.18	101.00	151.75	497.26
57		S10-200	0.11	103.50	151.72	472.53
58		S10-210	0.16	101.50	151.72	492.09
59		S10-220	0.28	99.00	151.70	516.46
60		S10-230	0.15	98.20	151.70	524.25
61		S10-250	0.13	98.00	151.70	526.21
62		S10-260	0.10	94.00	151.68	565.25
63		S10-270	0.14	93.50	151.67	570.04
64		S10-280	0.09	93.00	151.68	575.01
65		S10-290	0.19	94.00	151.69	565.32
66		S10-300	0.33	96.00	151.70	545.82
67		S10-310	0.13	94.50	151.69	560.43
68		S10-330	0.17	95.80	151.69	547.71
69		S10-340	0.00	95.80	151.69	547.66
70		S11-100	0.30	95.35	152.86	563.57
71		S11-400	0.08	95.10	152.77	565.13
72		S14-100	0.22	92.40	151.23	576.46
73		S14-110	0.26	92.30	151.20	577.16
74		S14-120	0.15	92.20	151.19	578.09
75		S14-130	0.32	92.30	151.18	576.99
76		S14-140	0.27	92.40	151.17	575.93
77		S14-150	0.21	92.40	151.17	575.86
78		S14-160	0.20	92.80	151.16	571.89
79		S14-170	0.32	93.30	151.16	566.96
80		S14-180	0.30	94.30	151.16	557.14
81		S14-190	0.22	92.30	151.18	577.01
82		S14-200	0.24	92.40	151.17	575.93

Basic Day HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
83		S14-210	0.26	92.50	151.17	574.88
84		S14-220	0.24	92.60	151.16	573.84
85		S14-230	0.28	92.70	151.16	572.84
86		S14-240	0.31	92.80	151.16	571.84
87		S14-250	0.51	93.00	151.15	569.86
88		S14-260	1.70	93.00	151.15	569.86
89		S14-270	0.18	93.20	151.16	567.96
90		S14-280	0.35	92.80	151.17	571.94
91		S14-290	0.35	92.70	151.17	572.99
92		S14-300	0.23	92.60	151.18	574.07
93		S14-320	0.21	92.20	151.20	578.13
94		S14-330	0.41	92.30	151.20	577.13
95		S14-340	0.25	92.40	151.19	576.14
96		S14-350	0.17	92.30	151.21	577.29
97		S14-360	0.40	92.10	151.21	579.18
98		S14-500	0.06	92.50	151.26	575.78
99		S2-100	0.16	95.00	152.04	558.98
100		S2-110	0.19	94.60	152.13	563.74
101		S2-120	0.11	94.18	152.12	567.79
102		S3-110	0.15	94.85	152.71	567.00
103		S3-120	0.25	94.39	152.67	571.13
104		S3-130	0.15	94.29	152.61	571.51
105		S3-140	0.46	94.90	152.41	563.55
106		S3-160	0.32	93.92	152.47	573.73
107		S3-180	0.45	94.29	152.56	571.00
108		S3-190	0.28	94.60	152.37	566.11
109		S3-210	0.18	94.18	152.26	569.11
110		S3-400	0.10	94.09	152.67	574.06
111		S3-410	0.19	94.20	152.62	572.46
112		S3-420	0.11	93.92	152.57	574.74
113		S3-430	0.33	93.32	152.40	578.94
114		S3-450	0.20	93.58	151.63	568.85
115		S3-460	0.16	93.82	151.62	566.44
116		S3-480	0.27	94.16	151.61	562.93
117		S3-500	0.13	93.71	151.55	566.74
118		S3-510	0.22	93.95	151.54	564.30
119		S3-530	0.12	93.89	151.53	564.82
120		S3B-100	0.24	93.55	152.17	574.41
121		S3B-105	0.17	93.60	152.02	572.51
122		S3B-110	0.13	93.65	152.04	572.20
123		S3B-120	0.35	93.75	151.90	569.82

Basic Day HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
124		S3B-140	0.18	93.95	151.47	563.62
125		S3B-145	0.18	94.10	151.23	559.78
126		S3B-150	0.12	93.25	151.24	568.23
127		S3B-160	0.17	93.60	151.23	564.69
128		S3B-170	0.23	95.80	151.29	543.72
129		S3B-180	0.21	95.80	151.27	543.55
130		S3B-190	0.00	95.80	151.45	545.28
131		S3B-200	0.23	94.20	151.14	557.95
132		S4-100	0.08	95.00	152.85	566.88
133		S4-120	0.09	95.05	153.13	569.12
134		S4-130	0.03	94.80	153.43	574.50
135		S4-140	0.05	94.53	153.26	575.56
136		S4-150	0.18	94.66	153.09	572.61
137		S4-170	0.22	94.90	152.96	568.94
138		S4-190	0.19	94.37	153.04	574.91
139		S4-200	0.06	94.28	153.16	576.93
140		S4-210	0.15	93.93	152.95	578.34
141		S4-240	0.13	93.85	152.92	578.83
142		S4-250	0.03	93.75	152.95	580.11
143		S5-100	0.00	95.10	153.73	574.54
144		S5-110	0.07	95.25	153.79	573.65
145		S5-120	0.04	95.15	153.79	574.64
146		S5-140	0.14	95.25	153.84	574.10
147		S5-150	0.15	95.45	153.85	572.23
148		S5-160	0.15	95.50	153.85	571.77
149		S5-170	0.18	95.60	153.85	570.79
150		S5-180	0.22	95.65	153.86	570.42
151		S5-200	0.10	95.55	153.88	571.58
152		S5-220	0.10	95.60	153.94	571.68
153		S5-230	0.20	95.65	153.89	570.73
154		S5-250	0.10	95.30	153.85	573.79
155		S5-260	0.22	95.45	153.92	572.92
156		S5-280	0.11	95.55	153.97	572.44
157		S5-300	0.27	95.80	154.00	570.27
158		S5-320	0.31	96.25	154.09	566.78
159		S5-340	0.27	96.05	154.05	568.38
160		S5-360	0.12	95.65	154.01	571.88
161		S5-370	0.00	95.75	154.05	571.32
162		S5-380	0.19	95.85	154.07	570.55
163		S5-390	0.16	95.80	154.07	571.04
164		S5-400	0.09	96.15	154.07	567.61

Basic Day HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
165		S5-410	0.24	96.70	154.07	562.23
166		S5-420	0.00	96.50	154.14	564.83
167		S5-430	0.16	95.80	154.09	571.18
168		S5-450	0.08	95.90	154.11	570.41
169		S5-460	0.00	96.30	154.25	567.88
170		S5-470	0.38	96.80	154.23	562.77
171		S5-480	0.19	96.00	154.16	569.94
172		S5-500	0.21	96.20	154.17	568.08
173		S5-520	0.11	96.20	154.17	568.03
174		S5-530	0.00	96.70	154.31	564.54
175		S5-540	0.37	97.10	154.26	560.17
176		S7-050	0.06	93.70	152.38	574.99
177		S7-100	0.15	94.10	152.37	571.00
178		S7-110	0.11	94.10	152.36	570.93
179		S7-120	0.10	94.20	152.36	569.95
180		S7-130	0.09	94.50	152.36	567.01
181		S7-150	0.13	94.60	152.37	566.09
182		S7-155	0.07	94.30	152.37	569.05
183		S7-160	0.11	94.70	152.37	565.08
184		S7-170	0.20	94.60	152.37	566.05
185		S7-190	0.13	94.55	152.36	566.54
186		S7-220	0.22	94.25	152.37	569.57
187		S7-250	0.22	94.40	151.35	558.07
188		S7-260	0.18	94.55	151.29	556.01
189		S7-270	0.22	95.00	151.00	548.79
190		S7-275	0.26	94.80	151.14	552.14
191		S7-280	0.09	94.60	151.52	557.79
192		S7-290	0.20	94.45	151.63	560.37
193		S7-300	0.19	94.30	151.58	561.28
194		S7-310	0.33	94.70	152.36	565.04
195		S7-330	0.35	95.85	150.86	539.03
196		S7-335	0.07	95.10	151.05	548.25
197		S7-340	0.24	95.70	150.68	538.80
198		S7-345	0.18	94.80	151.10	551.68
199		S7-355	0.32	95.20	151.02	547.03
200		S7-360	0.16	94.65	151.21	554.28
201		S7-365	0.24	94.60	151.27	555.27
202		S8-100	0.09	94.90	152.53	564.68
203		S8-110	0.13	95.50	152.49	558.45
204		S8-130	0.10	95.30	152.46	560.10
205		S8-140	0.13	95.38	152.36	558.37

Basic Day HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
206		S8-150	0.22	95.70	152.34	554.98
207		S8-170	0.15	95.50	152.31	556.72
208		S8-180	0.33	95.50	152.22	555.82
209		S8-200	0.43	95.69	152.14	553.19
210		S8-240	0.49	96.28	151.88	544.79
211		S8-260	0.47	96.70	151.84	540.37
212		S8-270	0.16	96.19	151.84	545.37
213		S8-280	0.16	96.58	151.82	541.28
214		S8-300	0.16	98.40	151.75	522.81
215		S8-310	0.31	99.80	151.74	508.94
216		S8-330	0.13	100.83	151.72	498.71
217		S8-340	0.18	99.05	151.71	516.01
218		S8-350	0.28	99.70	151.71	509.64
219		S8-360	0.00	101.30	151.71	493.96
220		S9-100	1.46	101.00	154.66	525.84
221		S9-110	0.83	101.50	154.33	517.69

Peak Hour HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1		482	0.00	102.70	144.00	404.70
2		B-100	0.78	104.60	141.66	363.18
3		B-110	0.45	105.20	141.48	355.52
4		B-130	0.40	103.20	141.41	374.45
5		B-140	0.00	100.00	141.40	405.65
6		B-150	0.00	94.60	141.34	458.06
7		B-160	0.00	94.60	141.30	457.58
8		B-170	0.00	93.30	141.25	469.90
9		B-175	0.00	95.80	141.25	445.34
10		B-190	0.50	95.00	141.15	452.20
11		B-200	1.02	98.25	140.96	418.55
12		B-210	41.37	98.25	140.89	417.82
13		L-100	0.00	102.70	143.99	404.59
14		L-110	1.42	101.60	143.83	413.80
15		L-120	1.40	99.20	143.59	435.02
16		L-130	0.79	97.60	143.48	449.56
17		L-135	1.34	96.50	143.35	459.13
18		L-140	2.90	95.30	142.93	466.72
19		L-150	0.29	96.50	142.25	448.31
20		L-160	0.33	98.10	142.13	431.44
21		L-170	0.26	99.50	141.93	415.81
22		S1-100	0.00	95.22	141.46	453.13
23		S1-110	0.00	95.05	141.63	456.48
24		S1-120	1.25	95.10	141.63	455.95
25		S1-140	0.92	95.50	141.55	451.26
26		S1-150	1.61	95.90	141.50	446.81
27		S1-170	1.45	95.30	141.46	452.30
28		S1-180	0.41	95.25	141.44	452.62
29		S1-190	1.47	95.77	141.44	447.50
30		S1-210	0.10	95.44	141.43	450.68
31		S1-220	0.20	95.60	141.43	449.10
32		S1-230	0.18	95.65	141.43	448.60
33		S1-240	0.20	96.35	141.42	441.69
34		S1-250	0.09	97.00	141.42	435.33
35		S1-260	0.16	97.24	141.42	432.95
36		S1-270	0.28	99.89	141.41	406.83
37		S1-290	0.34	95.09	141.44	454.24
38		S1-300	0.51	94.65	141.44	458.48
39		S10-010	0.44	95.80	141.25	445.35
40		S10-020	0.56	105.00	141.26	355.36
41		S10-040	0.80	103.00	141.26	374.96

Peak Hour HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
42		S10-050	0.56	101.50	141.26	389.65
43		S10-060	0.88	100.00	141.26	404.33
44		S10-080	0.80	102.00	141.27	384.80
45		S10-090	0.60	103.50	141.26	370.06
46		S10-100	0.71	105.00	141.37	356.42
47		S10-101	0.18	104.85	141.33	357.49
48		S10-105	0.27	104.75	141.32	358.31
49		S10-110	0.36	104.50	141.30	360.63
50		S10-120	0.32	102.00	141.28	384.92
51		S10-130	0.24	99.70	141.26	407.23
52		S10-140	0.48	99.00	141.25	414.06
53		S10-150	0.96	97.80	141.25	425.76
54		S10-160	0.18	103.00	141.28	375.14
55		S10-180	0.18	104.00	141.31	365.64
56		S10-190	0.27	101.00	141.30	394.89
57		S10-200	0.60	103.50	141.26	370.04
58		S10-210	0.84	101.50	141.26	389.59
59		S10-220	0.43	99.00	141.25	413.97
60		S10-230	0.23	98.20	141.24	421.80
61		S10-250	0.68	98.00	141.25	423.79
62		S10-260	0.56	94.00	141.23	462.80
63		S10-270	0.76	93.50	141.21	467.49
64		S10-280	0.48	93.00	141.21	472.46
65		S10-290	0.69	94.00	141.23	462.79
66		S10-300	0.65	96.00	141.24	443.29
67		S10-310	0.43	94.50	141.23	457.90
68		S10-330	0.40	95.80	141.23	445.21
69		S10-340	0.00	95.80	141.27	445.53
70		S11-100	0.44	95.35	142.19	458.98
71		S11-400	0.38	95.10	142.10	460.54
72		S14-100	1.21	92.40	140.66	472.87
73		S14-110	1.44	92.30	140.63	473.63
74		S14-120	0.83	92.20	140.63	474.56
75		S14-130	1.74	92.30	140.63	473.61
76		S14-140	1.47	92.40	140.64	472.69
77		S14-150	1.16	92.40	140.65	472.85
78		S14-160	1.08	92.80	140.68	469.21
79		S14-170	1.74	93.30	140.71	464.62
80		S14-180	1.62	94.30	140.77	455.34
81		S14-190	1.21	92.30	140.63	473.62
82		S14-200	1.34	92.40	140.64	472.67

Peak Hour HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
83		S14-210	1.44	92.50	140.65	471.84
84		S14-220	1.31	92.60	140.69	471.21
85		S14-230	1.55	92.70	140.71	470.47
86		S14-240	1.68	92.80	140.74	469.79
87		S14-250	1.87	93.00	140.87	469.06
88		S14-260	4.88	93.00	140.77	468.11
89		S14-270	0.96	93.20	140.69	465.33
90		S14-280	1.93	92.80	140.65	468.85
91		S14-290	1.93	92.70	140.63	469.68
92		S14-300	1.29	92.60	140.63	470.66
93		S14-320	1.14	92.20	140.62	474.48
94		S14-330	2.27	92.30	140.62	473.48
95		S14-340	1.36	92.40	140.62	472.53
96		S14-350	0.91	92.30	140.63	473.63
97		S14-360	2.20	92.10	140.63	475.53
98		S14-500	0.30	92.50	140.69	472.26
99		S2-100	0.88	95.00	141.59	456.54
100		S2-110	1.05	94.60	141.64	460.97
101		S2-120	0.60	94.18	141.64	465.08
102		S3-110	0.23	94.85	142.04	462.42
103		S3-120	0.38	94.39	142.01	466.65
104		S3-130	0.23	94.29	141.97	467.21
105		S3-140	1.65	94.90	141.80	459.62
106		S3-160	0.50	93.92	141.88	470.00
107		S3-180	0.68	94.29	141.93	466.87
108		S3-190	1.53	94.60	141.76	462.17
109		S3-210	0.96	94.18	141.70	465.63
110		S3-400	0.52	94.09	142.02	469.69
111		S3-410	1.01	94.20	141.97	468.09
112		S3-420	0.60	93.92	141.95	470.67
113		S3-430	0.51	93.32	141.84	475.44
114		S3-450	0.30	93.58	141.44	468.95
115		S3-460	0.25	93.82	141.44	466.59
116		S3-480	0.41	94.16	141.43	463.24
117		S3-500	0.20	93.71	141.42	467.55
118		S3-510	0.36	93.95	141.42	465.19
119		S3-530	0.19	93.89	141.42	465.77
120		S3B-100	0.36	93.55	141.73	472.08
121		S3B-105	0.26	93.60	141.66	470.92
122		S3B-110	0.19	93.65	141.67	470.53
123		S3B-120	0.54	93.75	141.60	468.90

Peak Hour HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
124		S3B-140	0.27	93.95	141.41	465.11
125		S3B-145	0.27	94.10	141.31	462.67
126		S3B-150	0.19	93.25	141.28	470.66
127		S3B-160	0.25	93.60	141.28	467.19
128		S3B-170	0.34	95.80	141.30	445.82
129		S3B-180	0.32	95.80	141.29	445.77
130		S3B-190	0.00	95.80	141.35	446.36
131		S3B-200	0.36	94.20	141.28	461.35
132		S4-100	0.44	95.00	142.13	461.80
133		S4-120	0.48	95.05	142.33	463.29
134		S4-130	0.16	94.80	142.57	468.13
135		S4-140	0.28	94.53	142.45	469.57
136		S4-150	0.96	94.66	142.30	466.84
137		S4-170	1.21	94.90	142.19	463.40
138		S4-190	0.93	94.37	142.26	469.29
139		S4-200	0.32	94.28	142.37	471.21
140		S4-210	0.80	93.93	142.20	473.00
141		S4-240	0.61	93.85	142.18	473.63
142		S4-250	0.16	93.75	142.22	474.93
143		S5-100	0.00	95.10	142.81	467.49
144		S5-110	0.40	95.25	142.86	466.49
145		S5-120	0.24	95.15	142.85	467.43
146		S5-140	0.76	95.25	142.88	466.78
147		S5-150	0.80	95.45	142.88	464.82
148		S5-160	0.80	95.50	142.88	464.32
149		S5-170	0.96	95.60	142.88	463.34
150		S5-180	1.21	95.65	142.89	462.89
151		S5-200	0.56	95.55	142.91	464.06
152		S5-220	0.56	95.60	142.97	464.21
153		S5-230	1.09	95.65	142.93	463.32
154		S5-250	0.56	95.30	142.91	466.52
155		S5-260	0.63	95.45	142.96	465.57
156		S5-280	0.60	95.55	143.01	465.03
157		S5-300	1.45	95.80	143.02	462.75
158		S5-320	1.69	96.25	143.09	458.98
159		S5-340	1.45	96.05	143.08	460.82
160		S5-360	0.64	95.65	143.04	464.43
161		S5-370	0.00	95.75	143.08	463.83
162		S5-380	0.60	95.85	143.10	462.99
163		S5-390	0.25	95.80	143.10	463.48
164		S5-400	0.14	96.15	143.10	460.06

Peak Hour HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
165		S5-410	0.36	96.70	143.10	454.67
166		S5-420	0.00	96.50	143.17	457.31
167		S5-430	0.36	95.80	143.11	463.61
168		S5-450	0.27	95.90	143.13	462.83
169		S5-460	0.00	96.30	143.28	460.32
170		S5-470	0.59	96.80	143.25	455.21
171		S5-480	0.58	96.00	143.17	462.24
172		S5-500	0.60	96.20	143.18	460.34
173		S5-520	0.40	96.20	143.17	460.28
174		S5-530	0.00	96.70	143.33	456.97
175		S5-540	0.56	97.10	143.28	452.53
176		S7-050	0.32	93.70	141.82	471.54
177		S7-100	0.80	94.10	141.81	467.56
178		S7-110	0.60	94.10	141.81	467.51
179		S7-120	0.15	94.20	141.81	466.53
180		S7-130	0.14	94.50	141.81	463.59
181		S7-150	0.68	94.60	141.81	462.63
182		S7-155	0.29	94.30	141.81	465.58
183		S7-160	0.60	94.70	141.81	461.63
184		S7-170	1.09	94.60	141.81	462.60
185		S7-190	0.68	94.55	141.81	463.10
186		S7-220	0.96	94.25	141.82	466.10
187		S7-250	0.67	94.40	141.39	460.49
188		S7-260	0.28	94.55	141.39	458.96
189		S7-270	0.34	95.00	141.33	453.95
190		S7-275	0.39	94.80	141.35	456.19
191		S7-280	0.48	94.60	141.46	459.14
192		S7-290	1.09	94.45	141.49	461.00
193		S7-300	1.05	94.30	141.47	462.23
194		S7-310	0.51	94.70	141.81	461.63
195		S7-330	0.53	95.85	141.30	445.35
196		S7-335	0.11	95.10	141.33	453.04
197		S7-340	0.37	95.70	141.27	446.54
198		S7-345	0.27	94.80	141.34	456.08
199		S7-355	0.48	95.20	141.33	452.02
200		S7-360	0.25	94.65	141.37	457.79
201		S7-365	0.36	94.60	141.38	458.36
202		S8-100	0.48	94.90	141.88	460.39
203		S8-110	0.72	95.50	141.85	454.15
204		S8-130	0.52	95.30	141.83	455.94
205		S8-140	0.43	95.38	141.76	454.49

Peak Hour HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
206		S8-150	0.45	95.70	141.74	451.19
207		S8-170	0.34	95.50	141.73	453.01
208		S8-180	0.51	95.50	141.67	452.47
209		S8-200	0.65	95.69	141.63	450.18
210		S8-240	0.75	96.28	141.49	443.02
211		S8-260	0.72	96.70	141.47	438.76
212		S8-270	0.25	96.19	141.47	443.75
213		S8-280	0.25	96.58	141.46	439.82
214		S8-300	0.25	98.40	141.44	421.74
215		S8-310	0.47	99.80	141.43	407.96
216		S8-330	0.20	100.83	141.43	397.82
217		S8-340	0.27	99.05	141.42	415.22
218		S8-350	0.45	99.70	141.42	408.85
219		S8-360	0.00	101.30	141.42	393.17
220		S9-100	3.03	101.00	143.64	417.80
221		S9-110	1.24	101.50	143.35	410.11

Max Day + Fire HGL 144m - Fireflow Design Report

		ID	Total Demand (L/s)	Critical Node 1 ID	Critical Node 1 Pressure (kPa)	Critical Node 1 Head (m)	Adjusted Fire-Flow (L/s)	Available Flow @Hydrant (L/s)	Critical Node 2 ID	Critical Node 2 Pressure (kPa)	Critcal Node 2 Head (m)	Adjusted Available Flow (L/s)	Design Flow (L/s)
1		B-100	250.52	B-110	212.52	126.29	340.05	334.84	B-100	139.96	118.88	334.84	334.84
2		B-110	250.30	B-110	202.54	125.87	322.07	322.07	B-110	139.96	119.48	322.07	322.07
3		B-130	166.74	S10-020	268.46	130.60	337.62	341.69	S10-020	136.37	117.12	337.62	337.62
4		B-140	250.00	S10-020	213.88	121.83	342.18	372.21	S10-020	113.23	111.55	342.19	342.18
5		B-150	250.00	S10-020	217.70	116.82	349.51	412.55	B-210	74.81	102.23	348.17	348.17
6		B-160	250.00	S10-020	218.52	116.90	351.05	400.36	B-210	74.93	102.25	337.74	337.74
7		B-170	250.00	B-210	214.51	115.19	329.37	402.26	B-210	61.79	99.61	329.38	329.37
8		B-190	250.34	B-210	153.31	110.65	261.31	305.60	B-210	83.21	103.49	261.33	261.31
9		B-200	250.68	B-210	58.55	104.23	200.97	205.70	B-210	132.60	111.78	200.97	200.97
10		B-210	310.95	B-210	166.74	115.27	327.28	327.28	B-210	139.96	112.53	327.28	327.28
11		L-110	250.95	B-110	339.45	136.24	2,369.42	1,220.01	L-110	139.98	115.88	1,220.05	1,220.05
12		L-120	250.93	B-110	333.04	133.19	1,491.99	1,052.93	L-120	139.97	113.48	1,052.95	1,052.95
13		L-130	250.53	B-110	329.29	131.20	1,203.30	1,522.51	B-110	40.02	101.68	1,203.31	1,203.30
14		L-135	250.89	B-110	324.30	129.60	1,015.83	1,233.69	S10-020	58.21	102.44	1,015.34	1,015.34
15		L-140	251.94	B-110	290.48	124.94	590.16	683.96	B-110	89.17	104.40	590.16	590.16
16		L-150	166.80	B-110	296.39	126.75	443.38	532.75	B-110	75.78	104.23	443.39	443.38
17		L-160	166.85	B-110	288.61	127.55	409.06	468.53	B-100	93.65	107.66	410.68	409.06
18		L-170	166.84	B-110	278.48	127.92	373.09	412.20	B-100	104.04	110.12	371.28	371.28
19		S1-100	166.67	S10-020	277.52	123.54	369.11	425.34	B-210	91.95	104.60	373.29	369.11
20		S1-110	166.67	S10-020	283.12	123.94	390.87	446.22	S10-020	96.30	104.88	390.87	390.87
21		S1-120	166.90	S10-020	283.91	124.07	392.97	348.35	S1-120	139.96	109.38	348.35	348.35
22		S1-140	166.84	S10-020	281.56	124.23	386.51	281.56	S1-140	139.96	109.78	281.56	281.56
23		S1-150	166.97	S10-020	279.52	124.42	378.80	278.87	S1-150	139.96	110.18	278.87	278.87
24		S1-170	166.82	S10-020	276.68	123.53	364.99	342.80	S1-170	139.96	109.58	342.80	342.80
25		S1-180	166.77	S10-020	275.04	123.32	361.67	313.12	S1-180	139.96	109.53	313.12	313.12
26		S1-190	167.03	S10-020	274.46	123.78	360.44	300.36	S1-190	139.96	110.05	300.36	300.36
27		S1-210	166.74	S10-020	273.93	123.39	358.34	272.73	S1-210	139.96	109.72	272.73	272.73
28		S1-220	166.80	S1-220	249.37	121.05	219.70	219.70	S1-220	139.96	109.88	219.70	219.70
29		S1-230	166.79	S10-020	273.73	123.58	357.75	273.72	S1-230	139.96	109.93	273.72	273.72
30		S1-240	166.80	S10-020	272.89	124.20	355.03	316.31	S1-240	139.96	110.63	316.31	316.31
31		S1-250	166.73	S10-020	272.85	124.84	354.99	330.82	S1-250	139.96	111.28	330.82	330.82
32		S1-260	166.77	S10-020	271.86	124.98	351.59	331.84	S1-260	139.96	111.52	331.84	331.84
33		S1-270	166.85	S10-020	270.95	127.54	347.21	328.50	S1-270	139.96	114.17	328.50	328.50
34		S1-290	166.80	S10-020	278.37	123.50	370.74	303.68	S1-290	139.96	109.37	303.68	303.68
35		S1-300	166.80	S1-300	247.54	119.91	216.49	216.49	S1-300	139.96	108.93	216.49	216.49
36		S10-010	166.75	S10-020	230.25	119.30	244.69	251.97	S10-020	130.50	109.12	244.70	244.69
37		S10-020	166.77	S10-020	93.92	114.58	147.79	147.79	S10-020	139.96	119.28	147.79	147.79
38		S10-040	166.82	S10-020	143.18	117.61	168.44	171.82	S10-020	133.15	116.59	168.44	168.44
39		S10-050	166.77	S10-020	166.96	118.54	181.97	191.83	S10-020	121.64	113.91	181.98	181.97
40		S10-060	166.83	S10-020	181.19	118.49	191.95	205.92	S10-020	115.36	111.77	191.95	191.95
41		S10-080	166.82	S10-020	174.22	119.78	186.90	201.87	S10-020	112.70	113.50	186.90	186.90
42		S10-090	166.78	S10-020	138.18	117.60	165.90	171.07	S10-020	129.33	116.70	165.90	165.90
43		S10-100	250.47	S10-100	143.94	119.69	253.68	253.68	S10-100	139.96	119.28	253.68	253.68
44		S10-101	166.78	S10-101	212.59	126.54	220.21	220.21	S10-101	139.96	119.13	220.21	220.21
45		S10-105	166.84	S10-105	178.19	122.93	189.30	189.30	S10-105	139.96	119.03	189.30	189.30
46		S10-110	166.90	S10-110	214.10	126.35	220.62	220.62	S10-110	139.96	118.78	220.62	220.62
47		S10-120	166.88	S10-020	227.58	125.22	240.97	224.77	S10-120	139.96	116.28	224.77	224.77
48		S10-130	166.71	S10-200	225.54	122.72	228.98	240.46	S10-200	122.32	112.18	228.99	228.98
49		S10-140	166.76	S10-200	223.21	121.78	226.29	229.92	S10-200	134.36	112.71	226.29	226.29
50		S10-150	166.85	S10-200	224.61	120.72	227.99	235.39	S10-200	128.59	110.92	227.99	227.99
51		S10-160	166.79	S10-160	217.00	125.14	217.51	217.51	S10-160	139.96	117.28	217.52	217.51
52		S10-180	166.79	S10-180	220.22	126.47	225.09	225.09	S10-180	139.96	118.28	225.09	225.09
53		S10-190	166.85	S10-020	225.69	124.03	238.15	236.61	S10-190	139.96	115.28	236.61	236.61
54		S10-200	166.78	S10-200	202.03	124.12	205.37	205.37	S10-200	139.96	117.78	205.37	205.37
55		S10-210	166.83	S10-200	219.32	123.88	222.04	217.01	S10-210	139.96	115.78	217.01	217.01
56		S10-220	166.98	S10-020	227.16	122.18	240.36	237.33	S10-200	137.61	113.04	235.72	235.72
57		S10-230	166.85	S10-020	225.16	121.18	237.28	245.16	S10-020	129.32	111.40	237.28	237.28

		ID	Total Demand (L/s)	Critical Node 1 ID	Critical Node 1 Pressure (kPa)	Critical Node 1 Head (m)	Adjusted Fire-Flow (L/s)	Available Flow @Hydrant (L/s)	Critical Node 2 ID	Critical Node 2 Pressure (kPa)	Critcal Node 2 Head (m)	Adjusted Available Flow (L/s)	Design Flow (L/s)
58		S10-250	166.80	S10-020	221.00	120.55	231.50	245.43	S10-020	120.41	110.29	231.50	231.50
59		S10-260	166.77	S10-020	229.50	117.42	243.51	252.92	S10-020	127.60	107.02	243.51	243.51
60		S10-270	166.81	S10-020	231.26	117.10	246.18	262.96	S10-020	118.01	105.54	246.19	246.18
61		S10-280	166.76	S10-020	229.85	116.46	244.01	219.87	S10-280	139.96	107.28	219.87	219.87
62		S10-290	166.86	S10-020	229.10	117.38	243.01	242.41	S10-200	139.16	108.20	241.84	241.84
63		S10-300	167.03	S10-020	228.11	119.28	241.77	254.86	S10-200	112.62	107.49	236.57	236.57
64		S10-310	166.80	S10-020	228.79	117.85	242.48	262.42	S10-200	109.57	105.68	241.61	241.61
65		S10-330	166.84	S10-020	227.54	119.02	240.69	243.21	S10-020	136.64	109.74	240.70	240.69
66		S10-340	166.67	S10-020	236.70	119.95	255.26	226.25	S10-340	139.96	110.08	226.25	226.25
67		S11-100	250.30	B-110	260.89	121.97	456.71	436.78	S11-100	139.96	109.63	436.78	436.78
68		S11-400	166.75	B-110	297.40	125.45	463.30	425.44	S11-400	139.96	109.38	425.45	425.45
69		S14-100	166.89	S14-100	228.34	115.70	202.15	202.15	S14-100	139.96	106.68	202.15	202.15
70		S14-110	166.93	S14-110	238.88	116.68	207.98	207.98	S14-110	139.96	106.58	207.98	207.98
71		S14-120	166.82	S14-120	224.65	115.13	199.99	199.99	S14-120	139.96	106.48	199.99	199.99
72		S14-130	166.99	S14-130	229.50	115.72	202.89	202.89	S14-130	139.96	106.58	202.89	202.89
73		S14-140	166.94	S14-140	239.92	116.88	208.90	208.90	S14-140	139.96	106.68	208.90	208.90
74		S14-150	166.88	S14-150	250.08	117.92	215.11	215.11	S14-150	139.96	106.68	215.11	215.11
75		S14-160	166.87	S14-160	255.52	118.88	219.77	219.77	S14-160	139.96	107.08	219.77	219.77
76		S14-170	166.99	S14-170	260.28	119.86	224.80	224.80	S14-170	139.96	107.58	224.80	224.80
77		S14-180	166.97	S14-180	264.32	121.27	231.45	231.45	S14-180	139.96	108.58	231.45	231.45
78		S14-190	166.89	S14-300	234.82	116.26	206.24	207.37	S14-300	137.02	106.28	206.24	206.24
79		S14-200	166.91	S14-290	240.30	116.92	209.71	210.87	S14-290	137.02	106.38	209.71	209.71
80		S14-210	166.93	S14-280	250.65	118.08	216.53	217.74	S14-280	137.02	106.48	216.53	216.53
81		S14-220	166.91	S14-270	265.40	119.68	228.38	230.98	S14-270	134.08	106.28	228.38	228.38
82		S14-230	166.95	S10-020	267.43	119.99	330.09	237.24	S14-230	139.96	106.98	237.24	237.24
83		S14-240	166.98	S10-020	267.95	120.14	332.02	241.94	S14-240	139.96	107.08	241.94	241.94
84		S14-250	250.51	S14-180	169.81	110.33	267.32	272.36	S14-180	130.78	106.35	267.33	267.32
85		S14-260	251.70	S14-260	125.84	105.84	245.07	245.08	S14-260	139.96	107.28	245.08	245.07
86		S14-270	166.85	S14-270	201.72	113.78	190.13	190.13	S14-270	139.96	107.48	190.13	190.13
87		S14-280	167.02	S14-280	81.76	101.14	151.54	151.54	S14-280	139.96	107.08	151.54	151.54
88		S14-290	167.02	S14-290	69.52	99.79	148.84	148.85	S14-290	139.96	106.98	148.85	148.84
89		S14-300	166.90	S14-300	66.61	99.40	148.16	148.17	S14-300	139.96	106.88	148.17	148.16
90		S14-320	166.88	S14-320	134.51	105.93	165.26	165.26	S14-320	139.96	106.48	165.26	165.26
91		S14-330	167.08	S14-330	110.32	103.56	158.78	158.78	S14-330	139.96	106.58	158.78	158.78
92		S14-340	166.92	S14-340	172.99	110.05	177.90	177.90	S14-340	139.96	106.68	177.90	177.90
93		S14-350	166.84	S14-350	168.00	109.44	175.98	175.98	S14-350	139.96	106.58	175.98	175.98
94		S14-360	167.07	S14-360	171.15	109.57	177.26	177.26	S14-360	139.96	106.38	177.26	177.26
95		S14-500	166.73	S14-500	218.39	114.79	196.92	196.92	S14-500	139.96	106.78	196.92	196.92
96		S2-100	166.83	S2-100	273.63	122.92	234.46	234.46	S2-100	139.96	109.28	234.46	234.46
97		S2-110	166.86	S10-020	285.97	123.78	405.94	261.81	S2-110	139.96	108.88	261.82	261.82
98		S2-120	166.78	S10-020	285.44	123.31	401.69	286.81	S2-120	139.96	108.46	286.81	286.81
99		S3-110	166.82	B-110	296.32	125.09	461.86	483.19	S10-020	124.81	107.59	460.41	460.41
100		S3-120	166.92	B-110	296.79	124.68	458.25	475.43	S10-020	126.80	107.33	455.83	455.83
101		S3-130	166.82	S10-020	295.87	124.48	451.53	488.62	S10-020	114.13	105.94	451.53	451.53
102		S3-140	167.13	S3-140	268.35	122.29	228.37	228.37	S3-140	139.96	109.18	228.37	228.37
103		S3-160	166.99	S10-020	294.04	123.93	432.83	530.42	B-210	64.96	100.55	440.36	432.83
104		S3-180	250.45	S10-020	256.91	120.51	447.68	475.27	S10-020	120.67	106.60	447.68	447.68
105		S3-190	166.95	S3-190	157.90	110.71	172.65	172.65	S3-190	139.96	108.88	172.65	172.65
106		S3-210	166.85	S3-210	164.21	110.94	174.62	174.62	S3-210	139.96	108.46	174.62	174.62
107		S3-400	166.77	S10-020	297.56	124.46	451.49	544.27	S10-020	72.81	101.52	451.49	451.49
108		S3-410	166.86	S3-410	-109.19	83.06	121.11	121.12	S3-410	139.96	108.48	121.12	121.11
109		S3-420	166.78	S10-020	295.73	124.10	441.79	536.80	S10-020	69.68	101.03	441.79	441.79
110		S3-430	167.00	S10-020	292.63	123.18	426.34	486.04	B-210	86.53	102.15	423.21	423.21
111		S3-450	166.87	S3-450	225.18	116.56	201.00	201.00	S3-450	139.96	107.86	201.00	201.00
112		S3-460	166.83	S3-460	255.13	119.86	219.58	219.58	S3-460	139.96	108.10	219.58	219.58
113		S3-480	166.94	S10-020	278.75	122.61	373.18	281.73	S3-480	139.96	108.44	281.73	281.73
114		S3-500	166.80	S10-020	279.20	122.20	375.27	281.54	S3-500	139.96	107.99	281.54	281.54

	ID	Total Demand (L/s)	Critical Node 1 ID	Critical Node 1 Pressure (kPa)	Critical Node 1 Head (m)	Adjusted Fire-Flow (L/s)	Available Flow @Hydrant (L/s)	Critical Node 2 ID	Critical Node 2 Pressure (kPa)	Critcal Node 2 Head (m)	Adjusted Available Flow (L/s)	Design Flow (L/s)
115	S3-510	166.89	S10-020	279.27	122.45	375.69	242.13	S3-510	139.96	108.23	242.13	242.13
116	S3-530	166.79	S10-020	279.32	122.39	375.80	284.87	S3-530	139.96	108.17	284.87	284.87
117	S3B-100	166.91	S10-020	288.09	122.95	415.86	301.46	S3B-100	139.96	107.83	301.46	301.46
118	S3B-105	166.84	S3B-105	165.82	110.52	175.15	175.15	S3B-105	139.96	107.88	175.15	175.15
119	S3B-110	166.80	S10-020	286.96	122.93	411.28	256.98	S3B-110	139.96	107.93	256.98	256.98
120	S3B-120	167.02	S10-020	285.34	122.87	404.70	270.25	S3B-120	139.96	108.03	270.25	270.25
121	S3B-140	166.85	S10-020	279.88	122.51	378.82	343.97	S3B-140	139.96	108.23	343.97	343.97
122	S3B-145	166.85	S10-020	276.48	122.31	366.49	283.61	S3B-145	139.96	108.38	283.61	283.61
123	S3B-150	250.12	B-210	218.31	115.53	335.67	381.05	B-210	93.44	102.79	335.68	335.67
124	S3B-160	250.17	B-210	217.53	115.80	334.48	392.90	B-210	79.19	101.68	334.49	334.48
125	S3B-170	250.23	S10-020	218.66	118.11	351.55	383.39	B-210	94.18	105.41	338.43	338.43
126	S3B-180	250.21	S10-020	218.67	118.12	351.55	359.80	B-210	117.64	107.81	337.53	337.53
127	S3B-190	250.00	S10-020	219.45	118.19	353.18	397.17	B-210	93.58	105.35	350.14	350.14
128	S3B-200	166.90	S10-020	275.20	122.28	361.84	302.53	S3B-200	139.96	108.48	302.53	302.53
129	S4-100	166.75	B-110	300.44	125.66	485.88	348.97	S4-100	139.96	109.28	348.97	348.97
130	S4-120	166.76	B-110	306.44	126.32	531.31	388.19	S4-120	139.96	109.33	388.19	388.19
131	S4-130	166.70	B-110	313.74	126.82	570.17	695.67	S10-020	60.59	100.98	566.83	566.83
132	S4-140	166.72	B-110	310.08	126.17	537.93	654.41	S10-020	63.32	100.99	534.38	534.38
133	S4-150	166.85	B-110	305.32	125.82	520.87	403.75	S4-150	139.96	108.94	403.76	403.76
134	S4-170	166.89	S4-170	255.77	121.00	216.56	216.56	S4-170	139.96	109.18	216.56	216.56
135	S4-190	166.86	B-110	304.38	125.43	510.05	408.83	S4-190	139.96	108.65	408.83	408.83
136	S4-200	166.73	B-110	307.80	125.69	519.15	631.63	S10-020	63.83	100.79	515.47	515.47
137	S4-210	166.82	B-110	302.93	124.84	498.30	383.95	S4-210	139.96	108.21	383.96	383.96
138	S4-240	166.80	B-110	302.19	124.69	492.72	417.72	S4-240	139.96	108.13	417.72	417.72
139	S4-250	166.70	B-110	303.61	124.73	489.27	596.73	S10-020	63.34	100.21	485.33	485.33
140	S5-100	166.67	B-110	320.60	127.82	646.23	783.42	S10-020	61.87	101.41	643.02	643.02
141	S5-110	166.74	B-110	321.56	128.06	665.66	779.15	S10-020	77.84	103.19	662.47	662.47
142	S5-120	166.71	B-110	321.56	127.96	666.75	773.81	S10-020	81.55	103.47	663.56	663.56
143	S5-140	166.81	B-110	322.43	128.15	683.58	781.76	S10-020	87.88	104.22	680.43	680.43
144	S5-150	166.82	B-110	323.24	128.44	699.53	315.54	S5-150	139.96	109.73	315.54	315.54
145	S5-160	166.82	S5-160	287.63	124.85	235.97	235.97	S5-160	139.96	109.78	235.97	235.97
146	S5-170	166.85	S5-170	205.09	116.53	189.36	189.36	S5-170	139.96	109.88	189.36	189.36
147	S5-180	166.89	S5-180	196.76	115.73	186.05	186.05	S5-180	139.96	109.93	186.05	186.05
148	S5-200	166.77	S5-200	288.86	125.03	236.84	236.84	S5-200	139.96	109.83	236.84	236.84
149	S5-220	166.77	B-110	324.79	128.74	724.57	814.07	S10-020	95.31	105.33	721.56	721.56
150	S5-230	166.87	B-110	323.62	128.68	705.72	789.97	S10-020	96.77	105.53	702.63	702.63
151	S5-250	166.77	B-110	322.69	128.23	688.23	783.08	S10-020	90.03	104.49	685.09	685.09
152	S5-260	166.89	B-110	323.89	128.50	712.19	791.68	S10-020	99.64	105.62	709.12	709.12
153	S5-280	166.78	B-110	324.96	128.71	733.64	803.00	S10-020	105.90	106.36	730.66	730.66
154	S5-300	166.94	B-110	326.21	129.09	749.40	840.90	S10-020	95.87	105.58	746.49	746.49
155	S5-320	166.98	S5-320	258.77	122.66	216.54	216.54	S5-320	139.96	110.53	216.54	216.54
156	S5-340	166.94	B-110	327.63	129.48	778.47	872.97	S10-020	96.19	105.87	775.72	775.72
157	S5-360	166.79	B-110	325.91	128.91	753.36	814.72	S10-020	110.63	106.94	750.46	750.46
158	S5-370	166.67	B-110	326.89	129.11	774.54	828.69	S10-020	114.77	107.46	771.75	771.75
159	S5-380	166.86	B-110	328.54	129.38	799.17	402.90	S5-380	139.96	110.13	402.90	402.90
160	S5-390	166.83	S5-410	320.04	128.46	270.75	269.73	S5-390	139.96	110.08	269.73	269.73
161	S5-400	166.76	S5-400	83.47	104.67	152.42	152.42	S5-400	139.96	110.43	152.42	152.42
162	S5-410	166.91	S5-410	273.80	124.64	228.01	228.02	S5-410	139.96	110.98	228.02	228.01
163	S5-420	166.67	B-110	328.91	130.07	824.60	848.48	S10-020	129.15	109.68	822.13	822.13
164	S5-430	166.83	B-110	328.87	129.36	801.47	420.91	S5-430	139.96	110.08	420.91	420.91
165	S5-450	166.75	B-110	329.10	129.48	811.89	921.26	S10-020	91.29	105.22	809.35	809.35
166	S5-460	166.67	B-110	332.79	130.26	924.54	1,113.58	S10-020	61.74	102.60	923.02	923.02
167	S5-470	167.05	B-110	332.13	130.69	898.55	1,044.01	S10-020	80.42	105.01	896.74	896.74
168	S5-480	166.86	B-110	330.79	129.76	878.26	278.25	S5-480	139.96	110.28	278.25	278.25
169	S5-500	166.88	S5-500	303.98	127.22	249.30	249.32	S5-500	139.96	110.48	249.32	249.30
170	S5-520	166.78	S5-520	298.78	126.69	244.70	244.72	S5-520	139.96	110.48	244.72	244.70
171	S5-530	166.67	B-110	334.19	130.80	990.45	1,193.97	S10-020	61.66	102.99	989.65	989.65

		ID	Total Demand (L/s)	Critical Node 1 ID	Critical Node 1 Pressure (kPa)	Critical Node 1 Head (m)	Adjusted Fire-Flow (L/s)	Available Flow @Hydrant (L/s)	Critical Node 2 ID	Critical Node 2 Pressure (kPa)	Critcal Node 2 Head (m)	Adjusted Available Flow (L/s)	Design Flow (L/s)
172		S5-540	167.04	B-110	332.67	131.05	955.90	329.70	S5-540	139.96	111.38	329.70	329.70
173		S7-050	166.73	S10-020	291.97	123.50	423.99	439.84	B-210	119.79	105.92	415.37	415.37
174		S7-100	166.82	S10-020	291.73	123.87	423.54	425.02	B-210	130.68	107.44	413.67	413.67
175		S7-110	166.78	S10-020	291.52	123.85	422.97	414.53	S7-310	134.08	107.78	409.63	409.63
176		S7-120	166.77	S10-020	291.52	123.95	422.96	397.24	S7-310	135.06	107.98	393.34	393.34
177		S7-130	166.76	S10-020	291.52	124.25	422.95	381.47	S7-310	138.00	108.58	379.97	379.97
178		S7-150	166.80	S10-020	291.80	124.38	423.72	281.46	S7-150	139.96	108.88	281.46	281.46
179		S7-155	166.74	S10-020	291.83	124.08	423.74	273.37	S7-155	139.96	108.58	273.37	273.37
180		S7-160	166.78	S10-020	291.73	124.47	423.53	276.65	S7-160	139.96	108.98	276.65	276.65
181		S7-170	166.87	S7-170	254.15	120.54	218.63	218.63	S7-170	139.96	108.88	218.63	218.63
182		S7-190	166.80	S10-020	291.69	124.32	423.45	289.44	S7-190	139.96	108.83	289.44	289.44
183		S7-220	166.89	S10-020	291.89	124.04	424.01	270.30	S7-220	139.96	108.53	270.30	270.30
184		S7-250	166.89	B-210	277.32	122.70	331.25	288.12	S7-250	139.96	108.68	288.12	288.12
185		S7-260	166.85	B-210	274.18	122.53	323.96	291.61	S7-260	139.96	108.83	291.61	291.61
186		S7-270	166.89	S7-270	247.07	120.21	220.93	220.93	S7-270	139.96	109.28	220.93	220.93
187		S7-275	166.93	S7-275	265.68	121.91	235.65	235.65	S7-275	139.96	109.08	235.65	235.65
188		S7-280	166.76	B-210	280.79	123.25	342.86	255.98	S7-280	139.96	108.88	255.98	255.98
189		S7-290	166.87	B-210	283.53	123.38	350.94	251.64	S7-290	139.96	108.73	251.65	251.65
190		S7-300	166.86	S7-300	237.96	118.58	210.41	210.41	S7-300	139.96	108.58	210.41	210.41
191		S7-310	167.00	S7-310	190.69	114.16	185.21	185.22	S7-310	139.96	108.98	185.22	185.21
192		S7-330	167.02	S7-330	242.14	120.56	220.26	220.27	S7-330	139.96	110.13	220.27	220.26
193		S7-335	166.74	S7-335	198.03	115.31	190.50	190.50	S7-335	139.96	109.38	190.50	190.50
194		S7-340	166.91	B-210	261.23	122.36	294.80	258.14	S7-340	139.96	109.98	258.14	258.14
195		S7-345	166.85	S7-345	263.14	121.65	233.35	233.35	S7-345	139.96	109.08	233.35	233.35
196		S7-355	166.99	S7-355	251.69	120.88	225.36	225.36	S7-355	139.96	109.48	225.36	225.36
197		S7-360	166.83	B-210	272.64	122.47	317.65	257.63	S7-360	139.96	108.93	257.63	257.63
198		S7-365	166.91	S7-365	230.23	118.09	207.67	207.67	S7-365	139.96	108.88	207.67	207.67
199		S8-100	166.76	S10-020	290.50	124.54	433.83	294.65	S8-110	139.76	109.16	294.53	294.53
200		S8-110	166.80	S8-110	45.65	100.16	143.37	143.37	S8-110	139.96	109.78	143.37	143.37
201		S8-130	166.77	S10-020	288.79	124.77	425.39	250.85	S8-130	139.96	109.58	250.85	250.85
202		S8-140	166.80	S8-140	255.82	121.49	220.69	220.69	S8-140	139.96	109.66	220.69	220.69
203		S8-150	166.89	S8-150	194.08	115.51	187.02	187.02	S8-150	139.96	109.98	187.02	187.02
204		S8-170	166.82	S8-170	240.62	120.06	211.10	211.10	S8-170	139.96	109.78	211.10	211.10
205		S8-180	167.00	S8-180	220.86	118.04	200.08	200.08	S8-180	139.96	109.78	200.08	200.08
206		S8-200	167.10	S8-200	209.33	117.05	194.59	194.60	S8-200	139.96	109.97	194.60	194.59
207		S8-240	167.16	S8-240	227.28	119.47	205.97	205.97	S8-240	139.96	110.56	205.97	205.97
208		S8-260	167.14	S8-260	214.99	118.64	199.59	199.59	S8-260	139.96	110.98	199.59	199.59
209		S8-270	166.83	S8-270	232.91	119.96	209.07	209.07	S8-270	139.96	110.47	209.07	209.07
210		S8-280	166.83	S8-280	246.20	121.70	219.35	219.35	S8-280	139.96	110.86	219.35	219.35
211		S8-300	166.83	S8-300	266.45	125.59	246.14	246.15	S8-300	139.96	112.68	246.15	246.14
212		S8-310	166.98	S8-310	213.66	121.60	204.79	204.79	S8-310	139.96	114.08	204.79	204.79
213		S8-330	166.80	S8-330	266.82	128.06	264.81	264.81	S8-330	139.96	115.11	264.81	264.81
214		S8-340	166.85	S10-020	271.72	126.78	351.71	288.06	S8-340	139.96	113.33	288.06	288.06
215		S8-350	166.95	S8-350	270.65	127.32	261.81	261.81	S8-350	139.96	113.98	261.81	261.81
216		S8-360	166.67	S10-020	271.40	129.00	350.37	278.29	S8-360	139.96	115.58	278.29	278.29
217		S9-100	251.46	S9-100	40.92	105.18	212.96	212.96	S9-100	139.96	115.28	212.96	212.96
218		S9-110	250.83	S9-110	58.55	107.47	216.82	216.83	S9-110	139.96	115.78	216.83	216.82

Peak Hour HGL 155m - Pipe Report

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
1		1001	S10-200	S10-210	79.01	204.00	110.00	2.57	0.08	0.01	0.07
2		1003	S10-210	S10-130	74.32	204.00	110.00	0.37	0.01	0.000	0.00
3		1009	S10-200	S10-150	288.44	204.00	110.00	2.18	0.07	0.01	0.05
4		101	S3-130	S3-180	85.17	297.00	120.00	20.19	0.29	0.03	0.40
5		1011	S10-140	S10-210	145.49	204.00	110.00	-1.36	0.04	0.00	0.02
6		1013	S10-130	S10-220	75.09	204.00	110.00	4.09	0.13	0.01	0.15
7		1019	S10-060	S10-250	164.60	204.00	110.00	2.97	0.09	0.01	0.09
8		1023	S10-250	S10-230	43.73	204.00	110.00	2.56	0.08	0.00	0.06
9		1027	S10-250	S10-010	95.90	204.00	110.00	-0.27	0.01	0.000	0.00
10		1029	S10-010	S10-260	78.41	204.00	110.00	5.24	0.16	0.02	0.24
11		103	S3-180	S3-160	283.87	297.00	120.00	13.03	0.19	0.05	0.18
12		1031	S10-260	S10-270	78.44	204.00	110.00	5.55	0.17	0.02	0.27
13		1033	S10-270	S10-280	122.73	204.00	110.00	-2.36	0.07	0.01	0.06
14		1035	S10-280	S10-290	171.30	204.00	110.00	-2.84	0.09	0.01	0.08
15		1037	S10-290	S10-300	239.92	204.00	110.00	-2.11	0.06	0.01	0.05
16		1039	S10-300	S10-310	81.31	204.00	110.00	3.45	0.11	0.01	0.11
17		1041	S10-310	S10-270	142.54	204.00	110.00	4.08	0.12	0.02	0.15
18		1043	S10-300	S10-150	75.59	204.00	110.00	-3.97	0.12	0.01	0.15
19		1047	S10-220	S10-300	157.24	204.00	110.00	2.24	0.07	0.01	0.05
20		105	S3-160	S1-110	206.75	297.00	120.00	36.48	0.53	0.25	1.21
21		1051	S10-330	S10-260	140.78	155.00	100.00	0.87	0.05	0.01	0.04
22		1053	S10-100	S10-101	50.12	204.00	110.00	10.10	0.31	0.04	0.82
23		1055	S10-180	S10-190	151.58	204.00	110.00	3.19	0.10	0.01	0.10
24		1057	S10-160	S10-120	149.71	204.00	110.00	1.12	0.03	0.00	0.01
25		1059	S10-110	S10-190	78.46	204.00	110.00	2.11	0.06	0.00	0.05
26		1061	S10-310	S10-290	77.74	204.00	110.00	1.42	0.04	0.00	0.02
27		1063	S8-180	S8-200	249.86	204.00	110.00	4.42	0.14	0.04	0.18
28		1067	S8-100	S8-110	152.54	155.00	100.00	2.28	0.12	0.04	0.24
29		1069	S8-340	S8-350	47.07	204.00	110.00	0.98	0.03	0.000	0.01
30		107	S1-110	S1-100	164.87	297.00	120.00	33.66	0.49	0.17	1.04
31		1073	S8-360	S8-330	58.07	204.00	110.00	-3.00	0.09	0.01	0.09
32		1075	S8-360	S8-350	61.66	204.00	110.00	-0.53	0.02	0.000	0.00
33		1077	S3-110	S11-400	232.18	297.00	120.00	-15.49	0.22	0.06	0.25
34		1079	S11-100	L-150	224.89	297.00	120.00	-16.31	0.24	0.06	0.27
35		109	S1-100	S3B-190	182.57	297.00	120.00	25.18	0.36	0.11	0.61
36		111	S3-110	S8-100	98.30	204.00	110.00	14.51	0.44	0.16	1.61
37		1167	S9-100	L-110	318.80	204.00	110.00	-8.55	0.26	0.19	0.60
38		1169	S5-100	S5-120	108.92	393.00	120.00	-42.15	0.35	0.04	0.40
39		1177	S5-110	S5-250	99.65	393.00	120.00	-48.94	0.40	0.05	0.53
40		1179	S5-250	S5-260	101.67	393.00	120.00	-48.10	0.40	0.05	0.52
41		1181	S5-260	S5-280	87.89	393.00	120.00	-47.77	0.39	0.04	0.51
42		1183	S5-280	S5-360	77.82	393.00	120.00	-47.21	0.39	0.04	0.50
43		1185	S5-360	S5-370	82.50	393.00	120.00	-46.26	0.38	0.04	0.48
44		1187	S5-370	S5-420	205.70	393.00	120.00	-42.38	0.35	0.08	0.41
45		1189	S5-530	L-135	69.30	610.00	120.00	-111.62	0.38	0.02	0.29
46		1191	S5-460	S5-530	229.47	610.00	120.00	-103.98	0.36	0.06	0.25
47		1195	S5-140	S5-110	185.76	155.00	100.00	1.82	0.10	0.03	0.16
48		1197	S5-120	S5-140	81.22	393.00	120.00	-42.39	0.35	0.03	0.41
49		1199	S5-140	S5-150	91.67	204.00	110.00	-0.01	0.000	0.00	0.00
50		1201	S5-150	S5-160	89.09	204.00	110.00	0.71	0.02	0.000	0.01
51		1203	S5-160	S5-170	93.65	204.00	110.00	0.47	0.01	0.000	0.00
52		1205	S5-170	S5-180	309.65	155.00	100.00	-0.49	0.03	0.00	0.01
53		1207	S5-180	S5-200	82.50	155.00	100.00	-2.26	0.12	0.02	0.23
54		1209	S5-200	S5-220	84.06	155.00	100.00	-4.34	0.23	0.07	0.78
55		1211	S5-220	S5-260	251.89	155.00	100.00	0.95	0.05	0.01	0.05

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
56		1217	S5-230	S5-250	242.69	155.00	100.00	1.40	0.07	0.02	0.10
57		1219	S5-230	S5-220	81.44	393.00	120.00	-47.45	0.39	0.04	0.50
58		1221	S5-230	S5-140	104.10	393.00	120.00	44.96	0.37	0.05	0.46
59		1225	S5-160	S5-180	219.91	155.00	100.00	-0.56	0.03	0.00	0.02
60		1227	S5-150	S5-200	201.89	155.00	100.00	-1.52	0.08	0.02	0.11
61		1233	S5-300	S5-280	258.35	155.00	100.00	1.17	0.06	0.02	0.07
62		1237	S5-320	S5-300	313.77	155.00	100.00	2.13	0.11	0.07	0.21
63		1239	S5-320	S5-520	86.75	155.00	100.00	-4.83	0.26	0.08	0.95
64		1241	S5-520	S5-500	77.26	155.00	100.00	-1.28	0.07	0.01	0.08
65		1243	S5-500	S5-480	76.12	155.00	100.00	1.25	0.07	0.01	0.08
66		1245	S5-480	S5-450	77.26	155.00	100.00	3.47	0.18	0.04	0.52
67		1247	S5-450	S5-430	73.96	204.00	110.00	5.59	0.17	0.02	0.27
68		1249	S5-430	S5-380	82.34	204.00	110.00	4.20	0.13	0.01	0.16
69		1251	S5-380	S5-370	102.48	204.00	110.00	3.88	0.12	0.01	0.14
70		1255	S5-340	S5-360	261.31	155.00	100.00	1.59	0.08	0.03	0.12
71		1259	S5-320	S5-340	233.16	155.00	100.00	1.02	0.05	0.01	0.05
72		1261	S5-220	S5-300	81.11	393.00	120.00	-53.31	0.44	0.05	0.62
73		1263	S5-300	S5-340	83.29	393.00	120.00	-53.80	0.44	0.05	0.63
74		1265	S5-340	S5-450	81.80	393.00	120.00	-55.82	0.46	0.06	0.68
75		1269	S5-540	S5-500	241.27	155.00	100.00	3.13	0.17	0.10	0.43
76		1271	S5-540	S5-520	166.44	155.00	100.00	3.95	0.21	0.11	0.66
77		1273	S5-540	S5-530	23.78	155.00	100.00	-7.64	0.41	0.05	2.23
78		1277	S5-470	S5-480	235.95	155.00	100.00	2.80	0.15	0.08	0.35
79		1279	S5-470	S5-450	165.98	393.00	120.00	58.20	0.48	0.12	0.73
80		1281	S5-470	S5-460	27.00	393.00	120.00	-61.60	0.51	0.02	0.82
81		1283	S5-430	S5-410	238.60	155.00	100.00	1.03	0.05	0.01	0.05
82		1287	S5-400	S5-390	125.32	155.00	100.00	0.04	0.00	0.00000	0.0000
83		1289	S5-400	S5-410	132.33	155.00	100.00	-0.18	0.01	0.000	0.00
84		129	S3-130	S3-140	99.34	155.00	100.00	6.52	0.35	0.16	1.66
85		1291	S5-410	S5-390	94.71	204.00	110.00	0.49	0.02	0.000	0.00
86		1293	S5-380	S5-390	73.31	204.00	110.00	-0.28	0.01	0.0000	0.00
87		1295	S3-430	S3B-100	82.75	204.00	110.00	13.25	0.41	0.11	1.36
88		1297	S3B-100	S3B-110	90.83	204.00	110.00	8.87	0.27	0.06	0.65
89		13	L-100	L-110	276.53	393.00	120.00	51.17	0.42	0.16	0.58
90		1301	S3B-120	S3B-140	168.24	204.00	110.00	11.90	0.36	0.19	1.11
91		1303	S3B-120	S3B-105	92.93	155.00	100.00	-3.76	0.20	0.06	0.60
92		1305	S3B-110	S3B-120	106.07	204.00	110.00	8.68	0.27	0.07	0.62
93		1315	S3B-140	S3-530	77.07	204.00	110.00	-3.12	0.10	0.01	0.09
94		1317	S7-050	S7-100	84.33	393.00	120.00	15.79	0.13	0.01	0.07
95		1319	S7-100	S7-110	81.51	393.00	120.00	15.10	0.12	0.00	0.06
96		1321	S7-110	S7-120	77.35	393.00	120.00	0.80	0.01	0.0000	0.000
97		1323	S7-120	S7-130	71.05	393.00	120.00	0.65	0.01	0.0000	0.000
98		1327	S7-150	S7-100	164.67	155.00	100.00	-0.59	0.03	0.00	0.02
99		1329	S7-150	S7-160	80.63	204.00	110.00	1.60	0.05	0.00	0.03
100		133	S3-180	S3-190	103.45	155.00	100.00	6.48	0.34	0.17	1.64
101		1331	S7-190	S7-160	73.83	204.00	110.00	-0.42	0.01	0.000	0.00
102		1337	S7-110	S7-190	79.48	204.00	110.00	0.77	0.02	0.000	0.01
103		1339	S7-050	S7-155	185.91	204.00	110.00	1.98	0.06	0.01	0.04
104		1341	S7-190	S7-170	180.03	204.00	110.00	0.51	0.02	0.000	0.00
105		1343	S7-160	S7-170	182.03	204.00	110.00	0.58	0.02	0.000	0.00
106		1347	S7-130	S7-310	117.88	204.00	110.00	0.51	0.02	0.000	0.00
107		135	S3-190	S3-210	342.86	155.00	100.00	2.05	0.11	0.07	0.20
108		1353	S7-110	S7-290	242.99	204.00	110.00	12.93	0.40	0.31	1.30
109		1363	S7-100	S7-220	173.89	204.00	110.00	-0.70	0.02	0.00	0.01
110		1365	S7-050	S7-220	156.77	204.00	110.00	1.66	0.05	0.00	0.03

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
111		1367	S3B-140	S7-250	86.28	204.00	110.00	5.29	0.16	0.02	0.25
112		1369	S7-250	S7-260	148.42	204.00	110.00	2.07	0.06	0.01	0.04
113		137	S3-210	S3-190	181.26	155.00	100.00	-2.90	0.15	0.07	0.37
114		1371	S7-275	S7-260	76.28	204.00	110.00	-7.02	0.21	0.03	0.42
115		1373	S7-260	S7-280	81.13	204.00	110.00	-10.31	0.32	0.07	0.85
116		1375	S7-280	S7-290	80.53	204.00	110.00	-7.62	0.23	0.04	0.49
117		1379	S7-290	S7-300	149.46	204.00	110.00	4.22	0.13	0.02	0.16
118		1381	S7-280	S7-300	154.40	204.00	110.00	-3.17	0.10	0.01	0.10
119		139	S3-210	S2-120	84.39	155.00	100.00	3.99	0.21	0.06	0.67
120		1391	B-190	S7-340	116.52	204.00	110.00	-11.54	0.35	0.12	1.05
121		1393	S7-330	S7-340	100.42	204.00	110.00	5.76	0.18	0.03	0.29
122		1395	S7-330	S7-270	80.95	204.00	110.00	-6.29	0.19	0.03	0.34
123		1399	S7-355	S7-335	120.91	204.00	110.00	-1.95	0.06	0.00	0.04
124		1401	S7-360	S7-260	83.91	204.00	110.00	-5.08	0.16	0.02	0.23
125		1403	S7-360	S7-365	174.25	204.00	110.00	-2.19	0.07	0.01	0.05
126		1405	S7-365	S7-250	268.80	204.00	110.00	-2.55	0.08	0.02	0.06
127		141	S2-120	S2-110	264.85	204.00	110.00	-0.03	0.000	0.00000	0.0000
128		143	S2-110	S3-140	84.01	155.00	100.00	-7.08	0.38	0.16	1.93
129		145	S2-110	S2-100	166.13	204.00	110.00	6.00	0.18	0.05	0.31
130		147	S1-140	S1-120	354.02	204.00	110.00	-4.99	0.15	0.08	0.22
131		149	S1-120	S1-110	51.61	204.00	110.00	-2.82	0.09	0.00	0.08
132		15	L-110	L-120	605.10	393.00	120.00	41.20	0.34	0.23	0.39
133		151	S1-120	S2-120	108.86	204.00	110.00	-3.42	0.10	0.01	0.11
134		153	S1-100	S1-170	56.78	204.00	110.00	2.80	0.09	0.00	0.08
135		1547	B-170	B-175	52.05	393.00	120.00	22.51	0.19	0.01	0.13
136		155	S1-150	S1-140	78.11	204.00	110.00	-9.19	0.28	0.05	0.69
137		1557	S10-340	B-130	475.25	204.00	110.00	-5.95	0.18	0.15	0.31
138		157	S1-150	S1-190	379.11	204.00	110.00	4.15	0.13	0.06	0.16
139		1579	S5-100	S4-130	135.58	393.00	120.00	92.51	0.76	0.23	1.73
140		1581	B-160	B-150	160.20	393.00	120.00	-35.96	0.30	0.05	0.30
141		1583	S3B-160	S3B-150	56.17	297.00	120.00	-7.47	0.11	0.00	0.06
142		1587	B-170	S3B-160	69.46	297.00	120.00	-18.24	0.26	0.02	0.33
143		1589	S3B-190	B-150	108.64	297.00	120.00	6.90	0.10	0.01	0.06
144		1591	S3B-190	S3B-170	161.69	297.00	120.00	18.28	0.26	0.05	0.34
145		1593	S3B-170	B-160	83.22	297.00	120.00	-1.06	0.02	0.000	0.00
146		1595	S3B-170	S3B-180	78.85	297.00	120.00	7.98	0.12	0.01	0.07
147		1597	S3B-170	S3B-160	147.41	297.00	120.00	11.02	0.16	0.02	0.13
148		1599	S3B-150	S3B-180	150.13	297.00	120.00	-7.66	0.11	0.01	0.07
149		1601	S5-100	S5-110	85.64	393.00	120.00	-50.36	0.42	0.05	0.56
150		1603	S3B-105	S3B-100	101.17	155.00	100.00	-4.02	0.21	0.07	0.68
151		1607	S3B-140	S3B-145	136.07	204.00	110.00	9.47	0.29	0.10	0.73
152		161	S1-170	S1-180	83.92	204.00	110.00	4.78	0.15	0.02	0.21
153		1615	S3B-145	S3B-200	49.61	204.00	110.00	9.20	0.28	0.03	0.69
154		1617	S3B-200	B-175	53.08	204.00	110.00	8.84	0.27	0.03	0.64
155		1621	S7-150	S7-155	76.27	204.00	155.00	-1.69	0.05	0.00	0.02
156		1629	S7-275	S7-270	76.89	204.00	110.00	6.63	0.20	0.03	0.38
157		163	S1-180	S1-190	162.82	204.00	110.00	1.33	0.04	0.00	0.02
158		1633	S10-310	S10-330	81.88	204.00	110.00	-2.48	0.08	0.00	0.06
159		1635	S10-330	S10-230	80.12	204.00	110.00	-3.75	0.11	0.01	0.13
160		1637	S10-230	S10-220	74.71	204.00	110.00	-1.42	0.04	0.00	0.02
161		1639	S10-101	S10-110	100.10	204.00	110.00	5.82	0.18	0.03	0.30
162		1641	S10-101	S10-105	103.27	204.00	110.00	4.10	0.13	0.02	0.15
163		1643	S10-105	S10-110	99.86	204.00	110.00	3.83	0.12	0.01	0.14
164		1645	B-175	B-190	430.28	393.00	120.00	31.35	0.26	0.10	0.23
165		165	S1-180	S1-210	94.05	204.00	110.00	3.04	0.09	0.01	0.09

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
166		167	S1-210	S1-230	45.73	204.00	110.00	2.08	0.06	0.00	0.04
167		169	S1-240	S1-250	42.48	204.00	110.00	-0.87	0.03	0.000	0.01
168		17	L-120	L-130	320.65	393.00	120.00	39.80	0.33	0.12	0.36
169		171	S1-250	S1-260	33.34	204.00	110.00	3.05	0.09	0.00	0.09
170		175	S1-250	S1-190	79.62	204.00	110.00	-4.01	0.12	0.01	0.15
171		177	B-140	S1-270	26.56	204.00	110.00	-6.89	0.21	0.01	0.40
172		1785	S14-100	S14-110	78.02	204.00	110.00	5.80	0.18	0.02	0.29
173		1787	S14-110	S14-120	77.45	204.00	110.00	2.49	0.08	0.00	0.06
174		1789	S14-120	S14-130	128.06	204.00	110.00	-1.42	0.04	0.00	0.02
175		179	S1-270	S1-260	103.44	204.00	110.00	-3.94	0.12	0.01	0.14
176		1791	S14-130	S14-140	79.76	204.00	110.00	-2.79	0.09	0.01	0.08
177		1793	S14-140	S14-150	77.45	204.00	110.00	-4.80	0.15	0.02	0.21
178		1795	S14-150	S14-160	78.97	204.00	110.00	-6.57	0.20	0.03	0.37
179		1797	S14-160	S14-170	77.33	204.00	110.00	-6.88	0.21	0.03	0.40
180		1799	S14-170	S14-180	77.58	204.00	110.00	-9.17	0.28	0.05	0.69
181		1801	S14-110	S14-190	78.32	204.00	110.00	0.99	0.03	0.000	0.01
182		1803	S14-190	S14-200	75.64	204.00	110.00	-1.88	0.06	0.00	0.04
183		1805	S14-200	S14-210	79.83	204.00	110.00	-4.62	0.14	0.02	0.19
184		1807	S14-210	S14-220	79.16	204.00	110.00	-7.38	0.23	0.04	0.46
185		1809	S14-220	S14-230	75.97	250.00	110.00	-10.42	0.21	0.02	0.32
186		1811	S14-230	S14-240	78.64	250.00	110.00	-11.41	0.23	0.03	0.38
187		1813	S14-190	S14-130	135.06	155.00	100.00	0.37	0.02	0.00	0.01
188		1815	S14-200	S14-140	135.14	155.00	100.00	-0.53	0.03	0.00	0.02
189		1817	S14-210	S14-150	137.46	155.00	100.00	-0.61	0.03	0.00	0.02
190		1819	S14-220	S14-160	134.98	155.00	100.00	0.77	0.04	0.00	0.03
191		1821	S14-230	S14-170	135.07	155.00	100.00	-0.55	0.03	0.00	0.02
192		1823	S14-240	S14-180	136.98	155.00	100.00	-2.00	0.11	0.03	0.19
193		1825	S14-180	S14-250	78.83	204.00	110.00	-12.79	0.39	0.10	1.27
194		1827	S14-250	B-170	162.21	250.00	110.00	-30.63	0.62	0.39	2.38
195		1829	S14-240	S14-260	79.49	250.00	110.00	-11.09	0.23	0.03	0.36
196		183	S1-230	S1-240	75.46	204.00	110.00	2.56	0.08	0.00	0.06
197		1831	S14-260	S14-250	136.10	250.00	110.00	-15.97	0.33	0.10	0.71
198		1833	S14-220	S14-270	118.32	250.00	110.00	0.96	0.02	0.000	0.00
199		1837	S14-210	S14-280	116.33	204.00	110.00	1.93	0.06	0.00	0.04
200		1841	S14-200	S14-290	117.63	204.00	110.00	1.93	0.06	0.00	0.04
201		1845	S14-190	S14-300	116.02	204.00	110.00	1.29	0.04	0.00	0.02
202		185	S1-230	S1-220	135.92	204.00	110.00	-0.66	0.02	0.000	0.01
203		1851	S14-110	S14-360	151.70	155.00	100.00	0.88	0.05	0.01	0.04
204		1853	S14-320	S14-360	245.43	204.00	110.00	-1.68	0.05	0.01	0.03
205		1855	S14-320	S14-330	163.18	204.00	110.00	0.94	0.03	0.00	0.01
206		1857	S14-330	S14-340	172.80	204.00	110.00	-1.33	0.04	0.00	0.02
207		1859	S14-340	S14-120	76.94	204.00	110.00	-3.09	0.09	0.01	0.09
208		1861	S14-340	S14-320	187.70	155.00	100.00	0.39	0.02	0.00	0.01
209		1863	S14-100	S14-350	159.46	204.00	110.00	3.91	0.12	0.02	0.14
210		1865	S14-350	S14-360	75.10	204.00	110.00	3.00	0.09	0.01	0.09
211		1869	S14-100	S14-500	39.10	204.00	110.00	-10.93	0.33	0.04	0.95
212		187	S3-160	S3-420	95.96	393.00	120.00	-57.45	0.47	0.07	0.72
213		1873	S7-340	S7-355	181.03	204.00	110.00	-6.16	0.19	0.06	0.33
214		189	S3-420	S3-400	98.04	393.00	120.00	-57.01	0.47	0.07	0.71
215		19	L-130	S9-100	593.00	204.00	110.00	-5.52	0.17	0.16	0.27
216		191	S3-400	S4-250	254.47	393.00	120.00	-59.58	0.49	0.20	0.77
217		193	S4-250	S4-200	161.89	393.00	120.00	-66.15	0.55	0.15	0.93
218		195	S4-200	S4-140	75.41	393.00	120.00	-72.02	0.59	0.08	1.09
219		1965	S10-270	S14-500	514.36	204.00	110.00	11.23	0.34	0.51	1.00
220		197	S4-140	S4-130	98.31	393.00	120.00	-77.76	0.64	0.12	1.26

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
221		199	S4-130	S4-120	150.30	204.00	110.00	14.60	0.45	0.24	1.62
222		203	S4-100	S3-110	79.39	204.00	110.00	11.78	0.36	0.09	1.09
223		205	S4-120	S4-150	83.67	204.00	110.00	6.25	0.19	0.03	0.34
224		2069	7000	482	1.00	610.00	120.00	187.96	0.64	0.000	0.75
225		207	S4-150	S4-190	83.68	204.00	110.00	7.50	0.23	0.04	0.47
226		2071	482	L-100	20.12	393.00	120.00	51.17	0.42	0.01	0.58
227		2081	S7-345	S7-360	57.36	204.00	110.00	-7.02	0.21	0.02	0.42
228		2083	S7-335	S7-345	233.00	204.00	110.00	-2.06	0.06	0.01	0.04
229		2085	S7-355	S7-345	75.10	204.00	110.00	-4.68	0.14	0.01	0.20
230		209	S4-190	S4-210	78.99	204.00	110.00	9.80	0.30	0.06	0.78
231		2091	S11-400	S11-100	351.85	297.00	120.00	-15.87	0.23	0.09	0.26
232		21	L-130	L-135	410.94	610.00	120.00	114.20	0.39	0.12	0.30
233		211	S4-210	S4-240	81.34	204.00	110.00	4.56	0.14	0.02	0.19
234		213	S4-240	S4-250	91.11	204.00	110.00	-6.41	0.20	0.03	0.35
235		221	S4-170	S4-100	80.68	155.00	100.00	4.35	0.23	0.06	0.78
236		223	S4-170	S4-150	241.69	155.00	100.00	-3.25	0.17	0.11	0.46
237		225	S4-140	S4-150	124.69	155.00	100.00	5.46	0.29	0.15	1.19
238		227	S4-200	S4-190	86.38	155.00	100.00	5.55	0.29	0.11	1.23
239		23	L-135	S9-110	766.19	297.00	120.00	1.24	0.02	0.00	0.00
240		27	L-150	L-140	770.28	393.00	120.00	-64.22	0.53	0.68	0.88
241		29	L-160	L-150	240.53	393.00	120.00	-47.62	0.39	0.12	0.51
242		309	S3-400	S3-410	272.65	155.00	100.00	2.05	0.11	0.05	0.20
243		31	B-100	B-110	378.19	393.00	120.00	46.25	0.38	0.18	0.48
244		311	S3-410	S3-420	287.06	155.00	100.00	1.04	0.06	0.02	0.06
245		313	S3-160	S3-430	170.85	393.00	120.00	33.51	0.28	0.05	0.26
246		315	S3-430	S7-050	182.82	393.00	120.00	19.75	0.16	0.02	0.10
247		33	B-110	B-130	446.31	393.00	120.00	24.98	0.21	0.07	0.15
248		331	S1-100	S1-290	57.94	204.00	110.00	5.68	0.17	0.02	0.28
249		333	S1-290	S3-480	119.54	204.00	110.00	3.23	0.10	0.01	0.10
250		339	S3-460	S3-450	120.24	204.00	110.00	-0.73	0.02	0.000	0.01
251		341	S1-300	S1-290	168.86	204.00	110.00	-2.11	0.06	0.01	0.05
252		343	S1-300	S3-460	118.34	155.00	100.00	0.58	0.03	0.00	0.02
253		35	B-130	B-140	129.42	393.00	120.00	22.17	0.18	0.02	0.12
254		37	B-140	B-150	256.88	393.00	120.00	29.06	0.24	0.05	0.20
255		41	B-190	B-200	450.09	393.00	120.00	42.39	0.35	0.18	0.41
256		633	L-170	B-100	548.72	393.00	120.00	47.03	0.39	0.27	0.49
257		667	S1-220	S1-210	152.34	204.00	110.00	-0.86	0.03	0.00	0.01
258		669	S1-150	S1-170	356.22	204.00	110.00	3.43	0.10	0.04	0.11
259		677	S4-100	S4-120	391.49	204.00	110.00	-7.86	0.24	0.20	0.52
260		679	S4-190	S4-170	291.71	155.00	100.00	2.31	0.12	0.07	0.24
261		701	S3-450	S1-300	122.30	204.00	110.00	-1.03	0.03	0.00	0.01
262		713	S2-100	S1-140	165.62	204.00	110.00	5.12	0.16	0.04	0.23
263		715	S8-100	S3-140	351.03	155.00	100.00	2.21	0.12	0.08	0.22
264		721	L-160	L-170	388.49	393.00	120.00	47.29	0.39	0.19	0.50
265		739	S3-130	S4-240	250.39	204.00	110.00	-10.36	0.32	0.22	0.86
266		741	S3-120	S4-210	230.06	155.00	100.00	-4.44	0.24	0.19	0.82
267		779	S1-240	S1-270	175.60	204.00	110.00	3.23	0.10	0.02	0.10
268		785	482	L-130	1,244.29	610.00	120.00	136.79	0.47	0.52	0.42
269		789	S10-010	S10-340	61.71	204.00	110.00	-5.95	0.18	0.02	0.31
270		791	B-200	B-210	190.43	393.00	120.00	41.37	0.34	0.07	0.39
271		795	B-160	B-170	150.42	393.00	120.00	34.90	0.29	0.04	0.28
272		815	L-140	L-130	574.40	393.00	120.00	-67.12	0.55	0.55	0.96
273		825	S3-530	S3-510	94.21	204.00	110.00	-0.82	0.03	0.000	0.01
274		827	S3-530	S3-500	35.90	204.00	110.00	-2.49	0.08	0.00	0.06
275		829	S3-500	S3-480	70.15	204.00	110.00	-3.87	0.12	0.01	0.14

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
276		831	S3-500	S3-510	95.83	204.00	110.00	1.18	0.04	0.00	0.02
277		833	S3-460	S3-480	160.89	204.00	110.00	1.05	0.03	0.00	0.01
278		843	B-130	S8-360	86.06	204.00	110.00	-3.54	0.11	0.01	0.12
279		845	S8-330	S8-300	74.32	204.00	110.00	-3.93	0.12	0.01	0.14
280		847	S8-300	S8-280	76.13	204.00	110.00	-6.23	0.19	0.03	0.34
281		849	S8-280	S8-270	75.87	204.00	110.00	-4.01	0.12	0.01	0.15
282		851	S8-270	S8-240	77.83	204.00	110.00	-4.58	0.14	0.01	0.19
283		853	S8-240	S8-200	251.85	204.00	110.00	-8.20	0.25	0.14	0.56
284		863	S8-180	S8-200	249.63	204.00	110.00	4.43	0.14	0.04	0.18
285		865	S8-180	S8-170	77.28	204.00	110.00	-9.36	0.29	0.06	0.71
286		867	S8-170	S8-140	82.66	204.00	110.00	-6.63	0.20	0.03	0.38
287		869	S8-140	S8-130	75.22	204.00	110.00	-10.58	0.32	0.07	0.89
288		871	S8-130	S8-100	72.98	204.00	110.00	-9.54	0.29	0.05	0.74
289		873	S8-130	S8-110	150.65	155.00	100.00	-1.56	0.08	0.02	0.12
290		879	S8-140	S8-150	151.65	204.00	110.00	3.52	0.11	0.02	0.12
291		883	S8-170	S8-150	149.68	204.00	110.00	-3.07	0.09	0.01	0.09
292		893	S8-240	S8-260	186.13	204.00	110.00	2.87	0.09	0.01	0.08
293		895	S8-270	S8-260	112.83	204.00	110.00	0.32	0.01	0.000	0.00
294		899	S8-280	S8-260	182.90	204.00	110.00	-2.47	0.08	0.01	0.06
295		901	S8-300	S8-310	151.48	204.00	110.00	2.06	0.06	0.01	0.04
296		905	S8-330	S8-310	153.09	204.00	110.00	-1.59	0.05	0.00	0.03
297		909	S8-330	S8-340	80.61	204.00	110.00	2.31	0.07	0.00	0.05
298		911	S8-340	S1-260	92.76	204.00	110.00	1.05	0.03	0.00	0.01
299		919	S10-040	S10-020	190.37	204.00	110.00	-0.32	0.01	0.000	0.00
300		921	S10-040	S10-050	78.83	204.00	110.00	0.36	0.01	0.000	0.00
301		923	S10-050	S10-060	75.70	204.00	110.00	1.85	0.06	0.00	0.04
302		925	S10-060	S10-080	189.73	204.00	110.00	-2.00	0.06	0.01	0.04
303		929	S10-080	S10-090	74.84	204.00	110.00	2.32	0.07	0.00	0.05
304		931	S10-090	S10-020	79.02	204.00	110.00	0.88	0.03	0.000	0.01
305		935	S10-080	S10-050	118.80	204.00	110.00	2.05	0.06	0.01	0.04
306		937	S10-090	S10-040	117.47	204.00	110.00	0.84	0.03	0.000	0.01
307		941	S5-420	S5-460	264.16	393.00	120.00	-42.38	0.35	0.11	0.41
308		943	B-110	S10-100	252.49	297.00	120.00	20.82	0.30	0.11	0.43
309		949	S10-110	S10-080	75.90	204.00	110.00	7.17	0.22	0.03	0.44
310		953	S10-120	S10-130	77.72	204.00	110.00	5.83	0.18	0.02	0.30
311		955	S10-130	S10-140	77.55	204.00	110.00	1.87	0.06	0.00	0.04
312		957	S10-140	S10-150	77.45	204.00	110.00	2.75	0.08	0.01	0.07
313		965	S10-160	S10-180	80.79	204.00	110.00	-6.65	0.20	0.03	0.38
314		97	S3-120	S3-110	168.32	297.00	120.00	-12.52	0.18	0.03	0.17
315		971	S10-120	S10-190	79.56	204.00	110.00	-5.03	0.15	0.02	0.23
316		987	S10-180	S10-100	73.71	204.00	110.00	-10.01	0.31	0.06	0.81
317		99	S3-130	S3-120	153.82	297.00	120.00	-16.58	0.24	0.04	0.28
318		999	S10-160	S10-200	78.78	204.00	110.00	5.34	0.16	0.02	0.25

APPENDIX E

- **Pages 23 and 24 from the 2016 Final Updated Serviceability Report**
- **Zone 13 Sanitary Sewer Spreadsheet from the 2016 Final Updated Serviceability Report**
- **MOE Certificate No. 2799-8PJJRH for Leitrim Sanitary Pump Station**
- **Pages 21 and 22 from the 2016 Final Updated Serviceability Report**
- **Figure 3.8, Final Build Out Plan from the 2016 Final Updated Serviceability Report**
- **Figure 3.9, Pump Performance Curves from the 2016 Final Updated Serviceability Report**
- **Figure 3.10, Sensitivity Analysis from the 2016 Final Updated Serviceability Report**
- **Wastewater Build Out Flow Projection Spreadsheet from the 2016 Final Updated Serviceability Report**
- **Sensitivity Analysis Spreadsheet from the 2016 Final Updated Serviceability Report**
- **Figure 3.12, Preferred Wastewater Plan – 2016 Final Updated Serviceability Report**

Zone 13 (OPA 76 Areas 9a and 9b) can be serviced with a direct connection to the existing 375 mm diameter Bank Street East Sub-Trunk Sewer which bisects the zone. One short section of 300 mm diameter sewer is needed in Zone 13 and the balance of the future sewers in the area can be 200 mm diameter.

The existing 375 mm diameter sub-trunk sewer in Zone 13 was constructed in 2011 as part of the required servicing for Zone 10. A significant portion of that sewer will be at depths of 6 m or more. It is therefore recommended that consideration of a secondary high level sanitary sewer be constructed in portions of Zone 13 as indicated in **Figure 3.12** (full size plan located in **Appendix C**).

The 375 mm diameter Kelly Farm Drive North Sub-Trunk sewer is presently terminated in Kelly Farm Drive at node 826. Zone 11 and a portion of the employment area Zone 12 requires a 375 mm diameter extension of that sewer to node 1100. From there Zone 12 can be serviced with 200 mm diameter sewers and Zone 11 will require sections of 300 mm and 250 mm diameter sewers. The balance of Zone 11 can be readily serviced with 200 mm diameter sewers.

3.4.2 Analysis of Existing Sub-Trunk Sewer Capacities

As stated earlier, wastewater flows from all the undeveloped areas in the expanded LDA will be tributary to one of four existing sub-trunk sewers. These are the:

- 600 mm diameter Park trunk
- 375 mm diameter Kelly Farm Drive North sub-trunk
- 375 mm diameter Kelly Farm Drive South sub-trunk
- 375 mm diameter Bank Street East sub-trunk

Each of these sewers was sized based on MOECC design criteria but included only the former limits of the LDA (2005 CDP limits).

The following table provides a review of the existing capacity of the four sub-trunk sewers together with predicted build out flow projection from both the 2007 Final Serviceability Report and this Updated Serviceability Report.

Table 3.13 Capacity Analysis of Existing Sub-Trunk Sewers

SUB-TRUNK SEWER	CAPACITY (L/S)	CONTRIBUTING ZONES	PREDICTED BUILD-OUT FLOW (L/S)	
			2007 FINAL SERVICEABILITY REPORT	2016 UPDATED REPORT
Park	231	9 and Part 12	102	118
Kelly Farm Drive North	82	11 and Part 12	63	67
Kelly Farm Drive South	116	6, 7 and 14	84	108
Bank Street East	102	10 and 13	48	99

The wastewater sewer design spreadsheets, which are located in **Appendix C**, provide a detailed analysis for each sub-trunk sewer. Sewer capacities were based on as-built gradients. All future wastewater flow predictions are based on MOECC design criteria.

The drainage areas tributary to the Park sewer has essentially remained unchanged since 2007 and consequently the expected peak wastewater flows between 2007 and 2016 are similar.

The estimated flows tributary to the Kelly Farm Drive North sewer have increased by about 5 l/s to account for the expanded Zone 11 which has increased by the addition of the 6.07 ha "cemetery" lands. The existing sub-trunk sewer still has sufficient capacity to handle the additional flow increase.

The estimated flows tributary to the Kelly Farm Drive South sewers have increased by about 21 l/s which represents the addition of Zone 14 to its tributary area. However, the existing sewer, which has an average as built slope of 0.44%, still has a full flow capacity in excess of the increased flow estimate: (116 l/s vs. 108 l/s).

The Bank Street East sewer was originally designed to handle wastewater flows from only Zone 10. The 2007 peak flow estimate for Zone 10 was 48 l/s. The 375 mm diameter sub-trunk sewer was constructed in 2011. Between nodes 1335 and 1326 which is the sewer section constructed through Zone 13, the sewer was constructed at an average as built slope of 0.31% and has a full flow capacity of 102 l/s which should be sufficient to carry the estimated peak flow of 99 l/s from both Zones 10 and 13.

The existing sub-trunk sewers were also constructed sufficiently deep to ensure that the undeveloped lands, including the OPA 76 Areas 8a, 9a and 9b, can be serviced by gravity.

It is proposed to outlet wastewater flows from OPA 76 expansion area 8a (Zone 14) to the existing Kelly Farm Drive South sub-trunk sewer. That sewer is presently terminated at node 730 at an obvert elevation of 88.50 meters, which is about 5.5 meters below proposed road grade. That sewer requires a southern extension of about 225 m to node 647 in order to reach Zone 6 at a proposed invert elevation of 88.74 meters. That elevation is over six meters below the proposed road grade. The proposed design at node 647 is shown on **Figure 8.3** (full size plan located in **Appendix G**).

Zone 14 is located on the highest ground in Leitrim ranging between 96 and 108 meters. At node 647, which is located about 500 meters from OPA Expansion Area 8a, the proposed sub-trunk sewer will be about eight meters below the lowest proposed road grades in the expansion area. Therefore, the expansion Area 8a, can be easily connected by gravity to the proposed southern extension of the Kelly Farm Drive South Sub-trunk sewer.

Wastewater flows from the two OPA 76 Areas 9a and 9b (Zone 13) are proposed to be routed to the existing 375 mm diameter Bank Street East sub-trunk sewer. That sewer was originally designed to accept and carry wastewater flows from only Zone 10. The sewer is located in the center of the expansion area and was constructed at depths ranging between 5.5 and 10 meters below proposed road grades. The existing invert elevations of the sewer at nodes 1325 and 1335 are indicated on **Figure 3.12** (full size plan located in **Appendix C**).

It is proposed to construct two new separate wastewater sewer systems for each of the new expansion Areas 9a and 9b. OPA 76 Area 9a is mostly located north of the Bank Street East sewer. Because of the depth of the existing trunk sewer, it is proposed to construct a separate 200 mm diameter high level sanitary sewer, between nodes 1326 and 1335 as shown on **Figures 3.11 and 3.12** (both full size plans are located in **Appendix C**), to provide the wastewater outlet for expansion Area 9a. The high level sewer is proposed to connect to the existing sub-trunk sewer at node 1335 at an invert elevation of about 87.00 meters as indicated in **Figure 3.12** (full size plan located in **Appendix C**). At the time of final design of the wastewater plan for expansion Area 9a, in conjunction with discussions with the City of Ottawa, a final decision regards the acceptability of the proposed high level sewer can be confirmed.

It is proposed to construct a separate wastewater plan for expansion Area 9b and connect it to the existing Bank Street East sub-trunk sewer at node 1335 at the existing obvert elevation of 86.89 meters which will be about 5.5 meters below final proposed road grades. A sanitary overflow

IBI Group
400-333 Preston Street
Ottawa, Ontario
K1S 5N4

WASTEWATER SEWER DESIGN SHEET

DRAFT UPDATED SERVICIABILITY REPORT
(CLASS EA OPA 76 AREAS 8A, 9A and 9B)
LEITRIM DEVELOPMENT AREA
ZONE 13 AND BANK ST.

LOCATION				RESIDENTIAL												ICI AREAS							INFILTRATION ALLOWANCE				TOTAL FLOW	PROPOSED SEWER DESIGN						
				UNIT TYPE				HARMON PEAKING FACTOR					MODIFIED PEAKING FACTOR					AREA (Ha)						PEAK FLOW (L/s)	AREA (Ha)			FLOW		CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY	
STREET	AREA ID	FROM MH	TO MH	Single	Semi	TH	APT	AREA (Ha)	POPULATION IND	POPULATION CUM	PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha)	POPULATION IND	POPULATION CUM	PEAK FACTOR	PEAK FLOW (L/s)	INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM		PARK	IND	CUM							L/s	(%)
	1326, COM, COM	1326	1327					0.41	0.0	0.0	4.00	0.00								1.96	1.96			1.13		2.37	2.37	0.66	1.80	20.24	160.00	200	0.35	0.624	18.44	91.12
	1327, MU	1327	1328			35		2.22	130.8	130.8	4.00	2.12								2.34	4.30			2.49		4.56	6.93	1.94	6.55	20.24	80.00	200	0.35	0.624	13.69	67.65
	1306A	1306	1322			63		1.56	151.2	151.2	4.00	2.45												0.00		1.56	1.56	0.44	2.89	20.24	180.00	200	0.35	0.624	17.36	85.74
	1322A	1322	1328			18		0.52	43.2	194.4	4.00	3.15												0.00		0.52	2.08	0.58	3.73	20.24	80.00	200	0.35	0.624	16.51	81.56
	1328	1328	1330			11		0.57	26.4	351.6	4.00	5.70									4.30			2.49		0.57	9.58	2.68	10.87	20.24	155.00	200	0.35	0.624	9.37	46.31
	1306B, 1306C, PARK	1306	1324			61		1.54	146.4	146.4	4.00	2.37												0.00	0.40	1.94	1.94	0.54	2.92	20.24	240.00	200	0.35	0.624	17.33	85.60
	1322B	1322	1324			54		1.73	129.6	129.6	4.00	2.10												0.00		1.73	1.73	0.48	2.58	20.24	150.00	200	0.35	0.624	17.66	87.23
	1324	1324	1330			19		0.53	45.6	321.6	4.00	5.21												0.00		0.53	4.20	1.18	6.39	20.24	75.00	200	0.35	0.624	13.86	68.45
	1330	1330	1332	30				1.58	96.0	769.2	3.87	12.06									4.30			2.49		1.58	15.36	4.30	18.85	20.24	155.00	200	0.35	0.624	1.39	6.88
	1332A, 1332B	1332	1334	61				3.14	195.2	964.4	3.81										4.30			2.49		3.14	18.50	5.18	7.67	20.24	165.00	200	0.35	0.624	12.57	62.12
	1300	1300	1309		46	17		2.61	188.0	188.0	4.00	3.05												0.00		2.61	2.61	0.73	3.78	20.24	375.00	200	0.35	0.624	16.47	81.34
	1307	1307	1309			30		0.60	72.0	72.0	4.00	1.17												0.00		0.60	0.60	0.17	1.33	20.24	80.00	200	0.35	0.624	18.91	93.41
	---	1309	1310					0.00	0.0	260.0	4.00	4.21												0.00		0.00	3.21	0.90	5.11	20.24	75.00	200	0.35	0.624	15.13	74.75
	1310	1310	1311			61		1.29	146.4	406.4	4.00	6.59												0.00		1.29	4.50	1.26	7.85	20.24	165.00	200	0.35	0.624	12.40	61.24
	1303, HD	1303	1311		22		108	2.52	275.6	275.6	4.00	4.47												0.00		2.52	2.52	0.71	5.17	20.24	230.00	200	0.35	0.624	15.07	74.45
	1311	1311	1319	15				0.92	48.0	730.0	3.88	11.49												0.00		0.92	7.94	2.22	13.71	20.24	80.00	200	0.35	0.624	6.53	32.28
	1315	1315	1317	6		10		0.66	43.2	43.2	4.00	0.70												0.00		0.66	0.66	0.18	0.88	20.24	150.00	200	0.35	0.624	19.36	95.63
	1317	1317	1319	12				0.83	38.4	81.6	4.00	1.32												0.00		0.83	1.49	0.42	1.74	20.24	165.00	200	0.35	0.624	18.50	91.41
	1319	1319	1334	31				1.86	99.2	910.8	3.83	14.12												0.00		1.86	11.29	3.16	17.28	20.24	170.00	200	0.35	0.624	2.97	14.65
	---	1334	Ex. 207A						0.0	1875.2	3.61	27.40												0.00		0.00	29.79	8.34	35.74	36.70	25.00	250	0.35	0.724	0.96	2.61
	1308A	1308	Ex. 139A	12				0.79	38.4	38.4	4.00	0.62												0.00		0.79	0.79	0.22	0.84	20.24	90.00	200	0.35	0.624	19.40	95.83
	1308B	1308	1314	26				1.57	83.2	83.2	4.00	1.35												0.00		1.57	1.57	0.44	1.79	20.24	240.00	200	0.35	0.624	18.46	91.17
	1314	1314	Ex. 140A	5				0.38	16.0	99.2	4.00	1.61												0.00		0.38	1.95	0.55	2.15	20.24	80.00	200	0.35	0.624	18.09	89.36
	1338, MU	1338	1341			76		3.49	182.4	182.4	4.00	2.96								3.32	3.32			1.92		6.80	6.80	1.90	6.78	20.24	210.00	200	0.35	0.624	13.46	66.52
	1341, INST	1341	1342			35		1.28	84.0	266.4	4.00	4.32						2.25	2.25		3.32			3.22		3.53	10.33	2.89	10.43	20.24	78.00	200	0.35	0.624	9.81	48.48
	1342	1342	1343			55		1.69	132.0	398.4	4.00	6.46							2.25		3.32			3.22		1.69	12.02	3.37	13.04	20.24	78.00	200	0.35	0.624	7.20	35.57
	1343	1343	1344	36				1.72	115.2	513.6	3.97	8.26							2.25		3.32			3.22		1.72	13.74	3.85	15.32	20.24	78.00	200	0.35	0.624	4.92	24.30
	1344	1344	1345	36				1.71	115.2	628.8	3.92	9.99							2.25		3.32			3.22		1.71	15.45	4.33	17.53	20.24	78.00	200	0.35	0.624	2.71	13.38
	1358, PARK	1358	1362			64		2.06	153.6	153.6	4.00	2.49												0.00	0.40	2.46	2.46	0.69	3.18	20.24	273.00	200	0.35	0.624	17.07	84.30
	1362	1362	1364	21		12		1.46	96.0	249.6	4.00	4.04												0.00		1.46	3.92	1.10	5.14	20.24	156.00	200	0.35	0.624	15.10	74.60
	1364	1364	1355	26				1.42	83.2	332.8	4.00	5.39												0.00		1.42	5.34	1.50	6.89	20.24	125.00	200	0.35	0.624	13.36	65.97
	1355	1355	1345	6				0.33	19.2	352.0	4.00	5.70												0.00		0.33	5.67	1.59	7.29	59.68	78.00	300	0.35	0.818	52.39	87.78
											4.00																								
	1345	1345	1346	31				1.78	99.2	1080.0	3.78	16.53														1.78	22.90	6.41	22.94	59.68	150.00	300	0.35	0.818	36.74	61.56
									0.0																										
	1365A	1365	1356	17				1.21	54.4	54.4	4.00	0.88												0.00		1.21	1.21	0.34	1.22	20.24	135.00	200	0.35	0.624	19.02	93.97
	1356	1356	1357	23				1.40	73.6	128.0	4.00	2.07												0.00		1.40	2.61	0.73	2.80	20.24	210.00	200	0.35	0.624	17.44	86.14
	1365B	1365	1357	25				1.58	80.0	80.0	4.00	1.30												0.00		1.58	1.58	0.44	1.74	20.24	215.00	200	0.35	0.624	18.50	91.41
	1357, PARK	1357	1346	13				0.94	41.6	249.6	4.00	4.04												0.00	3.13	4.07	8.26	2.31	6.36	20.24	190.00	200	0.35	0.624	13.89	68.60
	1345	1346	1335	23				1.40	73.6	1403.2	3.70	21.03							0.00		0.00			0.00		1.40	32.56	9.12	30.15	59.68	160.00	300	0.35	0.818	29.53	49.48
	1335	1335	Ex. 207A	11				0.63	35.2	1438.4	3.69	21.52														0.63	33.19	9.29	30.81	59.68	65.00	300	0.35	0.818	28.87	48.38
Bank Street	BNK1, BNK2	BNK1	BNK2					0.00	0.0	0.0	4.00	0.00								5.55	5.55			3.21		5.55	5.55	1.55	4.77	20.24	725.00	200	0.35	0.624	15.48	76.46
Capacity Check For	Zone 10 Future			158		89	72	7.86	856.0	856	3.84	13.32						0.52	0.52	1.11	1.11			0.28	0.93	10.42	10.42	2.92	16.52							
	Zone 10 Existing			79		121							23.91	543.2	543.2	1.90	3.34	1.89	1.89					1.09	0.82	26.62	26.62	7.45	11.89							
Bank St. East Sub-Trunk	Zone 13			466	68	621	108	51.93	3404.4	3404	3.40	46.82						2.25	2.25	7.62	7.62			5.71	3.93	65.72	65.72	18.40	70.93							
Total To Sub-Trunk																													99.35	101.84	742.00	375	0.31	0.893	2.49	2.45
		Ex MH 141	Ex MH 110																																
			Ex MH 110		56	64	60						5.61	446.8	446.8	1.90	2.75			6.17	6.17			1.21	0.00	11.78	11.78	3.30	4.51							
		Ex MH 110	Ex MH 100																										103.86	105.07	95.00	375	0.33	0.922	1.22	1.16
Capacity Check For	Peak Flow From LDA																												430.69						
Conroy Road Trunk																																			
Sewer	Conroy Road	Kemp Dr	Neely St	70									21.90	224.0	224.0	2.76	2.50									21.90	21.90	6.13	439.33	413.64	396.00	525	0.85	1.850	-25.69	-6.21
	Conroy Road	Neely St	Park Ln											0	224.0	2.76	2.50									0.00	21.90	6.13	439.33	405.13	265.00	600	0.40	1.390	-34.20	4.38

Design Parameters:

Residential			ICI Areas				
			Ave. Flows (L/ha/day)			Peak Factor	
SF/SD	3.2	p/p/u		Mod.	Reg.	Mod.	Reg.
TH	2.4	p/p/u	INST	10,000	50,000	1.0	1.0
APT	1.9	p/p/u	COM	17,000	50,000	1.0	1.0
Other	60	p/p/Ha	IND	10,000	35,000	1.0	1.0

Notes:

1. Mannings coefficient (n) = 0.013

	MOE Criteria	Monitored Criteria
2. Average Demand (per capita):	350 (L/c/d)	280 (L/c/d)
3. Infiltration allowance:	0.28 (L/s/ha)	0.28 (L/s/ha)
4. Residential Peaking Factor: *Harmon Formula = 1+(14/(4+P^0.5)) where P = population in thousands*	Harmon	1.90

Designed: M.B.

Checked: J.I.M.

Dwg. Reference: Figure 3.9

No.	Revision	Date
1.	DRAFT SUBMISSION NO. 1	2014-12-05
2.	DRAFT SUBMISSION NO.2	2015-04-20
3.	DRAFT SUBMISSION NO.3	2016-06-27

File Reference: 34738.5.7.1 | **Date:** 2016-06-27 | **Sheet No:** 5 of 5

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDED ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER 2799-8PJJRH
Issue Date: June 22, 2012

City of Ottawa
110 Laurier Ave West
Ottawa, Ontario
K1P 1J1

Site Location: 3173 Findlay Creek Drive
City of Ottawa, Ontario

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

a sewage work consisting of sanitary sewers, sewage pumping station and dual forcemains as follows:

Proposed Works

One (1) emergency overflow structure connecting a sanitary sewer and a storm sewer at the intersection of Findlay Creek Drive and Kelly Farm Drive in Leitrim Development Area, consisting of the following:

- an overflow chamber (1680 millimetres by 2440 millimetres), equipped with check valve to prevent flows from the storm sewer to the sanitary sewer;
- a reversed sloped 1050 millimetre diameter pipe connecting an existing sanitary manhole and the overflow chamber; and
- a 1200 millimetre by 900 millimetre concrete pipe connecting the overflow chamber to an existing 2700 millimetre diameter storm sewer;

Previous Works

SANITARY SEWERS

Sanitary sewers on Bank Street and Conroy Road starting from a dual forcemain discharge chamber located 175 metres south of the intersection of Bank Street and Leitrim Road and sanitary sewer travels north on Bank Street and Conroy Road to the intersection of Conroy Road and Queensdale avenue where the sanitary sewer is connected to an existing 762 millimetre diameter sanitary sewer;

SANITARY SEWAGE PUMPING STATION

A sanitary sewage pumping station, located on 3173 Findlay Creek Drive having a firm capacity of 361 litres per second at a total dynamic head of 32.9 metres, consisting of:

- a 3.66 metres diameter by approximately 14.5 metres depth below grade, reinforced fibreglass plastic (RFP) wet well, equipped with three (3) constant speed, submersible pumps (one lead pump, one lag pump and backup pump), each rated at 150 litres per second at a total dynamic head of 36 metres, including liquid level sensors, station piping, capped external pump-out connection for emergency wet well pump-out by portable pump if required,

- a winterized pump station control building of approximately 8 metres by 11.5 metres overall plan area, housing a 200 kilowatts stand-by power diesel generator set with intake and exhaust system, fuel supply system with two (2) 1135 litre indoor fuel tanks in a concrete spill containment enclosure, pump, generator and level controls, electrical power service, telemetry system for remote station status indication, site work and landscaping as required;

SANITARY DUAL FORCEMAINS

- a 1255 metres long 300 millimetre diameter PVC sanitary forcemain from pumping station to a discharge maintenance chamber located on Bank Street, 175 metres south of the intersection of Leitrim Road and Bank street;

- a 1255 metres long 400 millimetre diameter PVC sanitary forcemain from pumping station to a discharge maintenance chamber located on Bank Street, 175 metres south of the intersection of Leitrim Road and Bank street;

all in accordance with the supporting documents set out in Schedule "A" attached to this *Approval.*

For the purpose of this environmental compliance approval, the following definitions apply:

"*Approval*" means this entire document and any schedules attached to it, and the application;

"*Director*" means a person appointed by the Minister pursuant to section 5 of the *EPA* for the purposes of Part II.1 of the *EPA;*

"*District Manager*" means the District Manager of the Ottawa District Office;

"*EPA*" means the Environmental Protection Act, R.S.O. 1990, c.E.19, as amended;

"*Ministry*" means the ministry of the government of Ontario responsible for the *EPA* and *OWRA* and includes all officials, employees or other persons acting on its behalf;

"*Owner*" means the City of Ottawa and includes its successors and assignees;

"OWRA" means the Ontario Water Resources Act, R.S.O. 1990, c. O.40, as amended;

"Substantial Completion" has the same meaning as *"substantial performance"* in the Construction Lien Act;

"Previous Works" means those portions of the sewage works previously constructed and approved under an approval;

"Proposed Works" means the sewage works described in the Owner's application, this *Approval,* to the extent approved by this *Approval;*

"*Works"* means the sewage works described in the *Owner* 's application, and this *Approval,* and includes both *Proposed Works* and *Previous Works.*

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

(1) The *Owner* shall ensure that any person authorized to carry out work on or operate any aspect of the *Works* is notified of this *Approval* and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

(2) Except as otherwise provided by these conditions, the *Owner* shall design, build, install, operate and maintain the *Works* in accordance with the description given in this *Approval,* and the application for approval of the W*orks.*

(3) Where there is a conflict between a provision of any document in the schedule referred to in this *Approval* and the conditions of this *Approval,* the Conditions in this *Approval* shall take precedence, and where there is a conflict between the documents in the schedule, the document bearing the most recent date shall prevail.

(4) Where there is a conflict between the documents listed in the Schedule, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

(5) The Conditions of this *Approval* are severable. If any Condition of this *Approval,* or the application of any requirement of this *Approval* to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this *Approval* shall not be affected thereby.

2. EXPIRY OF APPROVAL

The approval issued by this *Approval* will cease to apply to those parts of the *Proposed Works* which have not been constructed within five (5) years of the date of this *Approval.*

3. CHANGE OF OWNER

(1) The *Owner* shall notify the *District Manager* and the *Director,* in writing, of any of the following changes within thirty (30) days of the change occurring:

(a) change of *Owner;*

(b) change of address of the *Owner;*

(c) change of partners where the *Owner* is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c.B17 shall be included in the notification to the *District Manager;* and

(d) change of name of the corporation where the *Owner* is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Informations Act, R.S.O. 1990, c. C39 shall be included in the notification to the *District Manager.*

(2) In the event of any change in ownership of the *Works,* other than a change to a successor municipality, the *Owner* shall notify in writing the succeeding owner of the existence of this *Approval,* and a copy of such notice shall be forwarded to the *District Manager* and the *Director.*

4. UPON THE SUBSTANTIAL COMPLETION OF THE PROPOSED WORKS

(1) Upon the *Substantial Completion* of the *Proposed Works,* the *Owner* shall prepare a statement, certified by a Professional Engineer, that the *Proposed Works* are constructed in accordance with this *Approval,* and upon request, shall make the written statement available for inspection by *Ministry* personnel.

(2) Within six (6) months of the *Substantial Completion* of the *Proposed Works,* a set of as-built drawings showing the works "as constructed" shall be prepared. These drawings shall be kept up to date through revisions undertaken from time to time and a copy shall be retained at the *Works* for the operational life of the *Works.*

5. OPERATION AND MAINTENANCE

(1) The *Owner* shall exercise due diligence in ensuring that, at all times, the *Works* and the related equipment and appurtenances used to achieve compliance with this *Approval* are properly operated and maintained. Proper operation and maintenance shall include effective performance, adequate funding, adequate operator staffing and training, including training in all procedures and other requirements of

this *Approval* and the *OWRA* and regulations, process controls and alarms and the use of process chemicals and other substances used in the *Works.*

(2) The *Owner* shall prepare an operations manual within six (6) months of *Substantial Completion* of the *Works,* that includes, but not necessarily limited to, the following information:

(a) operating procedures for routine operation of the *Works;*

(b) inspection programs, including frequency of inspection, for the *Works* and the methods or tests employed to detect when maintenance is necessary;

(c) repair and maintenance programs, including the frequency of repair and maintenance for the *Works;*

(d) procedures for the inspection and calibration of monitoring equipment;

(e) a spill prevention control and countermeasures plan, consisting of contingency plans and procedures for dealing with equipment breakdowns, potential spills and any other abnormal situations, including notification of the *District Manager;* and

(f) procedures for receiving, responding and recording public complaints, including recording any follow-up actions taken.

(3) The *Owner* shall maintain the operations manual current and retain a copy at the location of the *Works* for the operational life of the *Works.* Upon request, the *Owner* shall make the manual available to *Ministry* staff.

(4) The *Owner* shall maintain at the location of the *Works* a log book in which all overflow events will be recorded by providing such information as the date of each occurrence, their respective duration and the volume of sanitary wastewater transferred to the storm sewer network for each overflow event.

Schedule "A"

1. Application for Approval of Sewage Works dated September 22, 2011 and submitted by Theodore Woytowich, Project Manager of City of Ottawa;

2. a report entitled "Leitrim Development Area Sanitary Overflow Analysis" dated August 2011 and prepared by IBI Group;

3. a project description summary and calculation sheet, as well as engineering drawings dated September 19, 2011, and all other supporting information and documentation provided by IBI Group; and

4. the application dated May 3, 2001, including final plans, specifications, hydraulic design data sheets and Design Brief dated April 27, 2001, with application dated May 13, 2008 including final plans and specifications prepared by Ainley Graham and Associates, and with application dated April 15, 2010 received on April 16, 2010 including description of work brief, pump curves, and pump station wet well design all as prepared by Ainley Group, Consulting Engineers Planners.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the *Works* are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the *Approval* and the practice that the *Approval* is based on the most current document, if several conflicting documents are submitted for review. The condition also advises the Owners their responsibility to notify any person they authorized to carry out work pursuant to this *Approval* the existence of this *Approval.*

2. Condition 2 is included to ensure that the *Works* are constructed in a timely manner so that standards applicable at the time of Approval of the *Works* are still applicable at the time of construction, to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the *Ministry* records are kept accurate and current with respect to the approved works and to ensure that subsequent owners of the *Works* are made aware of the *Approval* and continue to operate the *Works* in compliance with it.

4. Condition 4 is included to ensure that the *Works* are constructed in accordance with the approval and that record drawings of the *Works* "as constructed" are maintained for future references.

5. Condition 5 is included to require that the *Works* be properly operated, maintained, funded, staffed and equipped such that the environment is protected and deterioration, loss, injury or damage to any person or property is prevented. As well, the inclusion of a comprehensive operations manual governing all significant areas of operation, maintenance and repair is prepared, implemented and kept up-to-date by the *Owner* and made available to the *Ministry.* Such a manual is an integral part of the operation of the *Works.* Its compilation and use should assist the *Owner* in staff training, in proper plant operation and in identifying and planning for contingencies during possible abnormal conditions. The manual will also act as a benchmark for *Ministry* staff when reviewing the *Owner'* s operation of the *Works.*

Upon issuance of the environmental compliance approval, I hereby revoke Approval No(s). 4879-858QXC issued on May 11, 2010.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are

substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of
Part II.1 of the Environmental Protection Act
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 22nd day of June, 2012

THIS APPROVAL WAS MAILED
ON June 26, 2012
(Signed)

Mansoor Mahmood, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

NH/
c: District Manager, MOE Ottawa District Office
Jim Moffatt P. Eng., IBI Group ✓

3.3.2 Expanded LDA Build-Out

Based on the established monitored flow criteria, a sanitary spreadsheet titled "Wastewater Build-Out Flow Projection", was completed to estimate peak wastewater flows to the Leitrim Sanitary Pump Station at total build-out of the LDA. The spreadsheet and **Figure 3.8**, Final Build-Out Plan, as a full sized plan are included in **Appendix C**.

As discussed in **Section 3.3.1**, monitored flow criteria was used to predict the build-out peak wastewater flows for existing developments in the LDA and MOECC criteria was used to estimate peak wastewater flows for all future developments, which include undeveloped lands within the original LDA boundary and the OPA 76 expansion lands. **Table 3.11** shows the relevant criteria.

Table 3.11 Wastewater Flow Criteria

	MONITORED	MOECC
Average Residential	280 l/c/d	350 l/c/d
Residential Peaking Factor	1.9	Harmon (2.0 to 4.0)
Inflow/Infiltration Allowance	0.28 l/s/ha	0.28 l/s/ha
Employment/Retail	17,000 l/s/ha	50,000 l/s/ha
Institutional	10,000 l/s/ha	50,000 l/s/ha
ICI Peaking Factor	1.0	1.5

Table 3.12 identifies the various measured land uses and calculated populations at build-out.

Table 3.12 Build-Out Population and Land Use Areas Tributary to LPS

	2005 LDA		OPA 76 EXPANSION AREA		TOTALS	
	POPULATION	AREA (HA)	POPULATION	AREA (HA)	POPULATION	AREA (HA)
Residential	15,463	284.4	4,714	69.3	20,177	353.7
Employment/Retail	–	126.9	–	11.7	–	138.6
Institutional	–	14.8	–	2.3	–	17.1
Park	–	45.4	–	4.3	–	49.7
Total	15,463	471.5	4,714	87.6	20,177	559.1

The estimated peak flow from the built-out LDA is 436 l/s. This is about 21% greater than the firm capacity of the pump station. Therefore, based on the TOR design flow criteria, there is potentially insufficient capacity at the LPS to handle peak flows at build out.

Although it is prudent to use MOECC design criteria for future developments in the LDA, especially for sewer sizing, based on past experience and as confirmed by flow monitoring, an overestimate of total tributary flows to the LPS is possible. It is therefore recommended that the wastewater monitoring program continue at the LPS. Based on the current behaviour of the LDA wastewater system, peak wastewater flows at build out will be less than the ultimate pump station capacity.

However, it is recognized that it is prudent to establish a contingency plan to deal with the unlikely event that wastewater generation behaviour in the LDA changes, to the point that it threatens to surpass the LPS capacity. Therefore, the capacities of the station, forcemains and downstream gravity sewers to Park Lane were reviewed.

The existing pumps in the LPS are Flygt model CP3231 110 Hp units. Three of these pumps are designed to fit within the 3.66 m diameter wet well. The performance curves of the pumps are shown on **Figure 3.1**. The pump manufacturers were contacted to investigate the feasibility of

increasing pumping capacities without a major overhaul of the wet well or associated piping. The present pumps at the station can be replaced with the same model but with larger 160 Hp motors. The larger pumps can fit within the existing station infrastructure. Some related motor control adjustments would also need to be completed within the station to accommodate the larger units, but this is not an insurmountable task.

Figure 3.9 has been prepared to show the expected performance of the larger pumps at the LPS. Two of the larger pumps operating simultaneously using both existing forcemains can handle about 440 l/s which would be sufficient to deal with the predicted peak flow of 436 l/s.

The wastewater spreadsheet included in **Appendix D** also provides a capacity review of the outlet gravity sewer. It is potentially possible that some existing Conroy Road Collector Sewer segments are marginally undersized, if called upon to handle 436 l/s.

In summary, if the capacity of the LSP needs to be increased, it can be completed without a major overhaul of the station or outlet system. Larger pumps can fit in the existing wet well; the existing 300/400 diameter forcemain system is already sufficiently sized to accommodate up to 436 l/s and downstream gravity sewers to Park Lane most likely will not need capacity improvements. If the City feels that the gravity outlet system in Conroy Road might be undersized then it can expand the existing "Conroy Road Sewer Twinning" capital project presently identified in the Wastewater Master Plan. It is therefore recommended that the wastewater flow monitoring program continue at the LPS to confirm wastewater flows do not exceed the firm station capacity of 361 l/s.

3.3.3 Sensitivity Analysis

Figure 3.10 shows the results of a sensitivity analysis for total wastewater flow estimate tributary to the Leitrim Pump Station. Based on the combined MOECC/monitored criteria, it is estimated that the LPS could be called upon to handle a peak flow of 436 l/s at build out, which is about 21% more than the station capacity. Since monitored flows to the station indicate peak flows are less than those predicted by the MOECC criteria, a second estimate, based entirely on monitored criteria, was completed. That analysis indicates that peak wastewater flows in Leitrim will be 312 l/s which is 14% less than the approved station pumping capacity.

It is clear then that the wastewater monitoring program at the Leitrim Pump Station must continue until the area is built out. The results of that program provide the best information on which future projects regarding capacity upgrades should be implemented, if any.

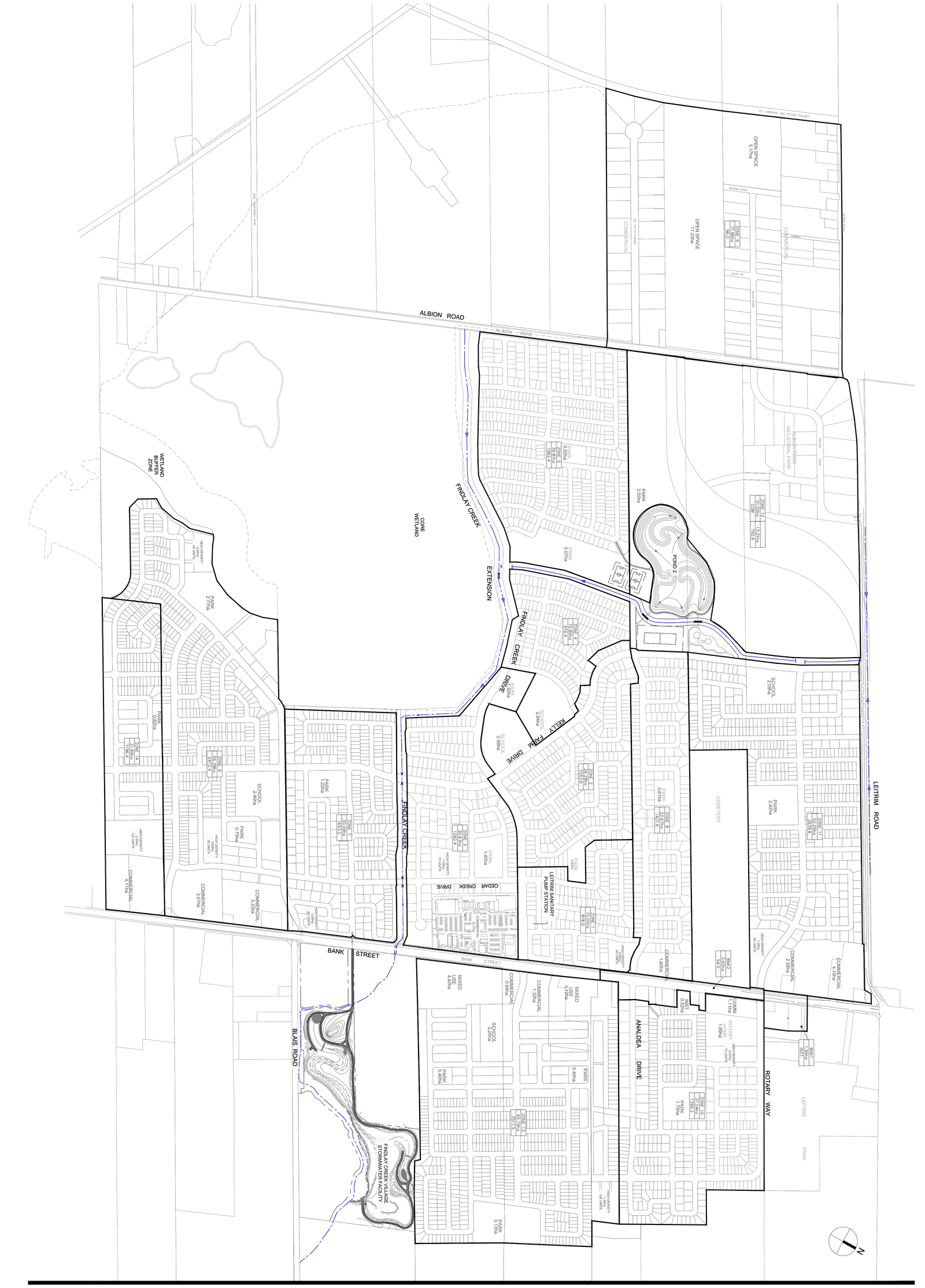
3.4 Preferred Wastewater Plan

3.4.1 Description of Preferred Plan

Based on the design criteria, which was reviewed in previous sections, **Figure 3.11** Wastewater Drainage Area Plan (full size plan) and associated Wastewater Sewer Design Sheets were completed and both of these documents are located in **Appendix C**. The Preferred Wastewater Plan, which is shown in **Figure 3.12** is also located in **Appendix C** as a full size plan.

The preferred plan builds on the four existing sub-trunk sewers. Most of the employment Zone 12 can be served via a 375 mm diameter sewer extension from the existing 600 mm diameter Park Trunk Sewer which presently terminates in Diamond Jubilee Park south of the zone. From there a 300 mm diameter sewer can service the requirements of Zone 9. The balance of Zones 9 and 12 can be serviced with 200 mm diameter sewers.

Zones 6, 7 and 14 can be serviced with a 375 mm diameter extension to the existing 375 diameter Kelly Farm South Sub-Trunk Sewer which presently terminates at node 730. 300 mm and 250 mm diameter sewer extensions into Zone 6 will provide the servicing needs for both Zones 6 and 14. Most of the balance of the sewers in Zones 6, 7 and 14 will be 200 mm diameter.

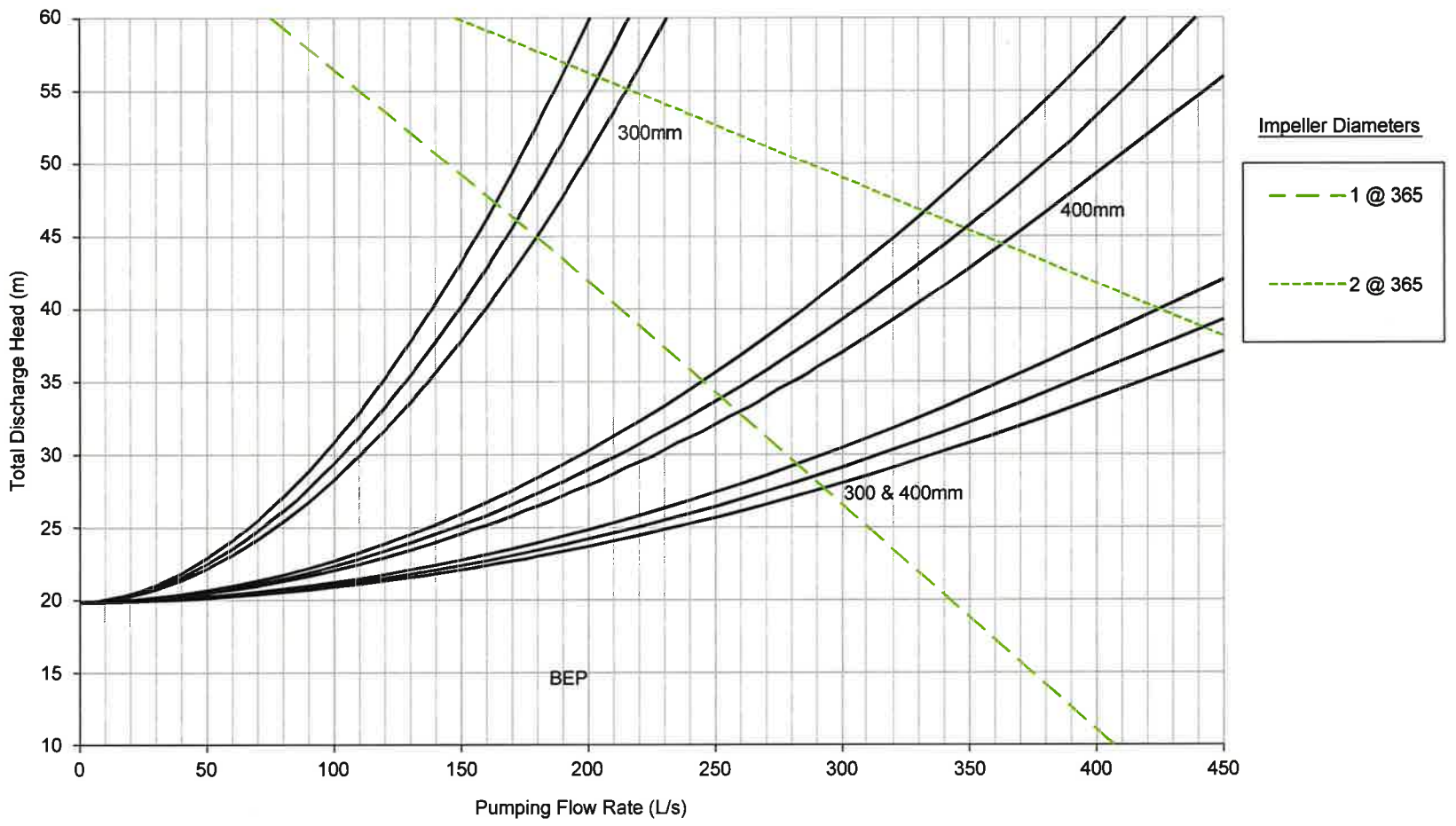


Sheet No.	Drawing Title	Project Title	Scale
FIGURE 3.8	FINAL BUILD-OUT PLAN	UPDATED SERVICEABILITY PLAN (CLASS EA OPA76 AREAS 8a, 9a and 9b) LEITRIM DEVELOPMENT AREA	N.T.S.

IBI

J:\34738-LeitrimServReport\5.9 Drawings\59civil\current\Updated Serviceability Report Figures\SECTION 3\FIGURE 3.9 SYSTEM PUMP CURVES-POTENTIAL.dwg Layout

CP 3231-63-430 Pumps with 430 Drive Units (160 HP) and 365 mm Impellers
System and Pump Curve Ranges (C = 120, 130 & 140) for Leitrim Forcemain Final Design



Plot Style: ---- Plot Scale: 1:1 Plotted At: Jun. 17, 16 11:31 AM Printed By: MARIAN MILNE Last Saved By: MMILNE Last Saved At: Apr. 7, 15

IBI

Scale

Project Title

UPDATED SERVICEABILITY REPORT
(CLASS EA OPA 76 AREAS 8a, 9a and 9b)
LEITRIM DEVELOPMENT AREA

Drawing Title

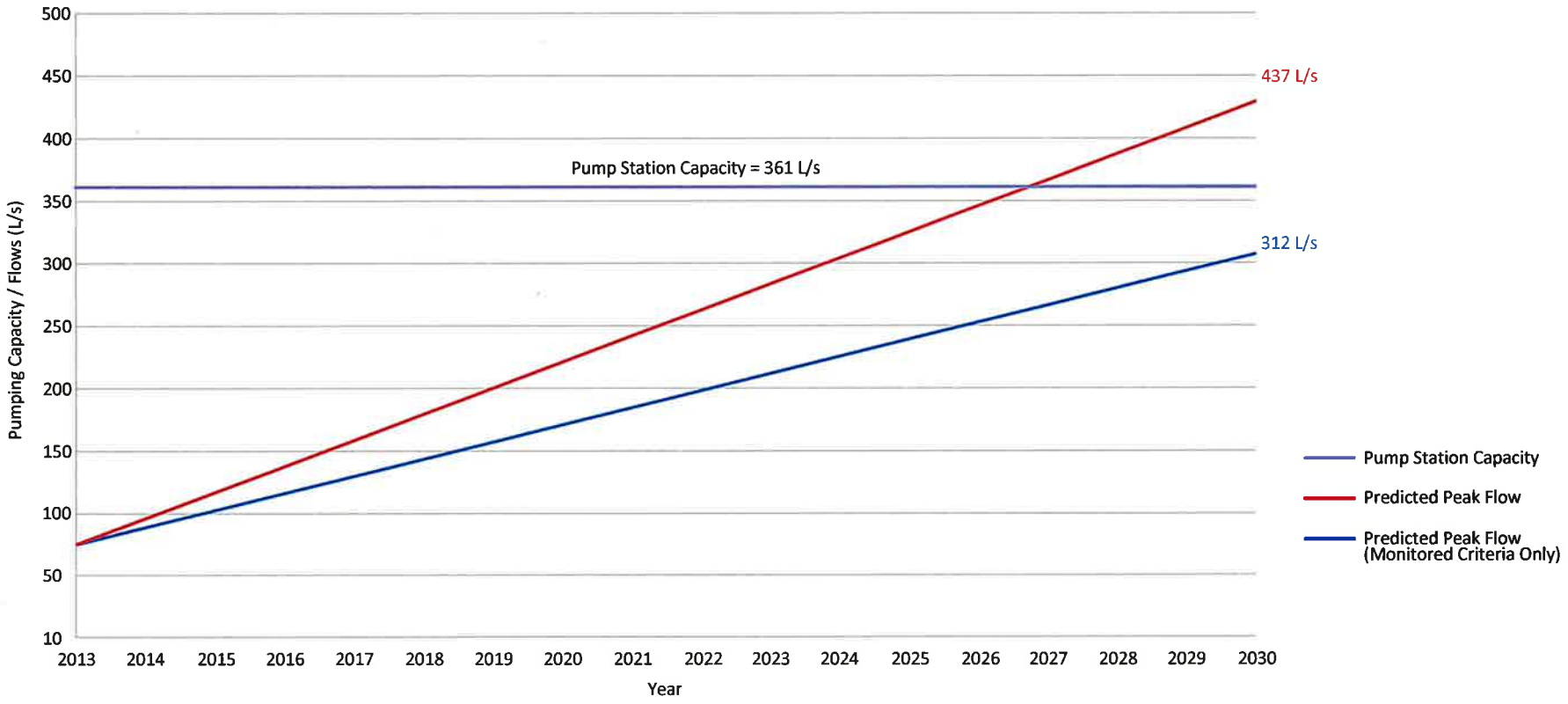
SYSTEM PUMP
CURVES POTENTIAL
160 HP PUMPS

DRAFT

Sheet No.

FIGURE 3.9

J:\34738-LeitrimServReport\5.9 Drawings\59civil\current\Updated Serviceability Report Figures\SECTION 3\FIGURE 3.10 LEITRIM PUMP STATION CAPACITY.dwg Layout Name: FI



Plot Style: ---- Plot Scale: 1:1 Plotted At: Jun. 21, 16 1:44 PM Printed By: MARIAN MILNE Last Saved By: MMILNE Last Saved At: Jun. 21, 16

IBI

Scale

Project Title

UPDATED SERVICEABILITY REPORT
(CLASS EA OPA 76 AREAS 8a, 9a and 9b)
LEITRIM DEVELOPMENT AREA

Drawing Title

LEITRIM PUMP STATION
CAPACITY REVIEW

DRAFT

Sheet No.

FIGURE 3.10

IBI Group
400-333 Preston Street
Ottawa, Ontario
K1S 5N4

WASTEWATER BUILD-OUT FLOW PROJECTION

DRAFT UPDATED SERVICIABILITY REPORT
(CLASS EA OPA 76 AREAS 8A, 9A and 9B)
LEITRIM DEVELOPMENT AREA

LOCATION				RESIDENTIAL									ICI AREAS								INFILTRATION ALLOWANCE				TOTAL FLOW	PROPOSED SEWER DESIGN						
				UNIT TYPES				AREA	POPULATION		PEAK FACTOR	PEAK FLOW	AREA (Ha)						PEAK FLOW	FLOW	AREA (Ha)					CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
													INSTITUTIONAL		COMMERCIAL		INDUSTRIAL				PARK	IND	CUM								
STREET	AREA ID	FROM MH	TO MH	SF	SD	TH	APT	(Ha)	IND	CUM		(L/s)	IND	CUM	IND	CUM	IND	CUM	(L/s)	(L/s)					(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	(%)
MOMITORED CRITERIA	ZONE 1			91	72	76	60	15.05	818.0	818.0	1.90	5.04							0.00	4.21		15.05	15.05		9.25						
	ZONE 2			211	74	59	0	22.47	1053.6	1053.6	1.90	6.49	2.98	2.98					0.34	7.36	0.83	26.28	26.28		14.19						
	ZONE 3			71	74	81	72	15.84	795.2	795.2	1.90	4.90			6.17	6.17			1.21	6.92	2.70	24.71	24.71		13.03						
	ZONE 4			170	8	17	0	12.86	610.4	610.4	1.90	3.76	2.94	2.94					0.34	4.42		15.80	15.80		8.52						
	ZONE 5			266	37	85	0	33.92	1173.6	1173.6	1.90	7.23							0.00	11.15	5.89	39.81	39.81		18.37						
	ZONE 8			59	230	182	0	19.84	1361.6	1361.6	1.90	8.38			1.60	1.60			0.31	6.17	0.61	22.05	22.05		14.87						
	ZONE 10			79	0	121	0	23.91	543.2	543.2	1.90	3.34	1.89	1.89	0.00	0.00			0.22	7.45	0.82	26.62	26.62		11.02						
MOMITORED CRITERIA								143.89	6355.60	6355.60	1.90	39.13	7.81	7.81	7.77	7.77	0.00	0.00	2.43	47.69	10.85	170.32	170.32		89.26						
MOE CRITERIA	ZONE 3					165	48	5.92	487.2	487.2	3.98	6.28							0.00	1.66		5.92	5.92		7.94						
	ZONE 5			119	81	62	0	0.00	788.8	788.8	3.86	9.88							0.00	0.00	0.00	0.00	0.00	0.00	9.88						
	ZONE 6			422	6	393	84	43.65	2472.4	2472.4	3.51	28.14	2.46	2.46	6.34	6.34			1.53	15.79	3.93	56.38	56.38		45.46						
	ZONE 7			244	0	316	60	28.79	1653.2	1653.2	3.65	19.55			0.08	0.08			0.02	8.43	1.22	30.09	30.09		27.99						
	ZONE 8				6	17	0	0.62	60.0	60.0	4.00	0.78							0.00	0.17	0.00	0.62	0.62		0.95						
	ZONE 9							11.83	96.0	96.0	4.00	1.24			37.63	37.63			7.40	20.15	22.50	71.96	71.96		28.80						
	ZONE 10			158	0	89	72	7.86	856.0	856.0	3.84	10.66	0.52	0.52	1.11	1.11			0.28	2.92	0.93	10.42	10.42		13.86						
	ZONE 11			342	52	508	84	40.86	2639.6	2639.6	3.49	29.85	2.09	2.09	6.68	6.68			1.56	14.57	2.42	52.05	52.05		45.98						
	ZONE 12							13.21	792.6	792.6	3.86	9.92			51.00	51.00			10.03	18.97	3.55	67.76	67.76		38.93						
	ZONE 14			126	0	226	132	17.37	1196.4	1196.4	3.75	18.17			4.11	4.11			2.38	6.13	0.41	21.89	21.89		26.67						
	ZONE 13			466	68	621	108	51.95	3517.5	3517.5	3.38	48.20	2.25	2.25	7.62	7.62			5.71	18.41	3.93	65.74	65.74		72.32						
	BNK1							0.00	0.0	0.0	4.00	0.00	1.95	1.95					0.23	0.55		1.95	1.95		0.77						
	BNK2							0.90	54.0	54.0	4.00	0.70			2.70	2.70			0.53	1.01		3.60	3.60		2.24						
MOE CRITERIA								222.96	14613.70	14613.70	2.79	165.14	9.27	9.27	117.27	117.27	0.00	0.00	73.23	108.75	38.89	388.38	388.38		347.12						
Combined Total								366.85	20969.30	20969.30		204.28	17.08	17.08	125.04	125.04	0.00	0.00	75.66	156.44	49.74	558.70	558.70		436.37						
								366.85	20969.30	20969.30															436.37						
Capacity Check For Conroy Road Trunk Sewer	Peak Flow From LDA																															
	Conroy Road	*Kemp Dr*	*Neely St*	*70*				*21.90*	*224.0*	*224.0*	*2.76*	*2.50*										*21.90*	*21.90*	*6.13*	*445.01*	*413.64*	*396.00*	*525*	*0.85*	*1.850*	*-31.37*	*-7.58*
	Conroy Road	*Neely St*	*Park Ln*						*0*	*224.0*	*2.76*	*2.50*										*0.00*	*21.90*	*6.13*	*445.01*	*405.13*	*265.00*	*600*	*0.40*	*1.390*	*-39.88*	*4.38*

Design Parameters:

Residential			ICI Areas					
			Ave. Flows (L/ha/day)			Peak Factor	
SF/SD	3.2	p/p/u		Mod.	Reg.	Mod.	MOE
TH	2.4	p/p/u	INST	10,000	50,000	1.0	1.0
APT	1.9	p/p/u	COM	17,000	50,000	1.0	1.0
Other	60	p/p/Ha	IND	10,000	35,000	1.0	MOE Chart

Notes:
1. Mannings coefficient (n) = 0.013

	MOE Criteria	Monitored Criteria
2. Demand (per capita):	350 (L/c/d)	280 (L/c/d)
3. Infiltration allowance:	0.28 (L/s/ha)	0.28 (L/s/ha)
4. Residential Peaking Factor: *Harmon Formula = 1+(14/(4+P^0.5)) where P = population in thousands*	Harmon	1.90

Designed: M.B., W.Y.
Checked: J.I.M.
Dwg. Reference: Figure 3.8

No.	Revision	Date
1.	DRAFT SUBMISSION NO.1	2014-12-05
2.	DRAFT SUBMISSION NO.2	2015-04-20
3.	DRAFT SUBMISSION NO.3	2016-06-27

File Reference: 34738.5.7.1
Date: 2016-06-27
Sheet No: 1 of 1

IBI

SENSITIVITY ANALYSIS - 4

SANITARY SEWER DESIGN SHEET

UPDATED SERVICEABILITY REPORT
(Class EA OPA 76 Areas 8a, 9a and 9b)
LEITRIM DEVELOPMENT AREA

LOCATION				RESIDENTIAL								ICI AREAS							INFILTRATION ALLOWANCE				TOTAL FLOW	PROPOSED SEWER DESIGN						
				UNIT TYPES				AREA	POPULATION		PEAK FACTOR	PEAK FLOW	AREA (Ha)						PEAK FLOW	AREA (Ha)			FLOW		CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
													INSTITUTIONAL		COMMERCIAL		INDUSTRIAL												
STREET	AREA ID	FROM MH	TO MH	SF	SD	TH	APT	(Ha)	IND	CUM		(L/s)	IND	CUM	IND	CUM	IND	CUM	(L/s)	PARK	IND	CUM	(L/s)	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	(%)
	ZONE 1			91	72	76	60	15.05	818.0	818.0	1.90	5.04							0.00		15.05	15.05	4.21	9.25							
	ZONE 2			211	74	59	0	22.47	1053.6	1053.6	1.90	6.49	2.98	2.98					0.34	0.83	26.28	26.28	7.36	14.19							
	ZONE 3			71	64	246	120	21.76	1250.4	1250.4	1.90	7.70			6.17	6.17			1.21	2.70	30.63	30.63	8.58	17.49							
	ZONE 4			170	8	17	0	12.86	610.4	610.4	1.90	3.76	2.94	2.94					0.34		15.80	15.80	4.42	8.52							
	ZONE 5			385	118	147	0	33.92	1962.4	1962.4	1.90	12.08							0.00	5.89	39.81	39.81	11.15	23.23							
	ZONE 6			422	6	393	84	43.65	2472.4	2472.4	1.90	15.22	2.46	2.46	6.34	6.34			1.53	3.93	56.38	56.38	15.79	32.54							
	ZONE 7			244	0	316	60	28.87	1653.2	1653.2	1.90	10.18							0.00	1.22	30.09	30.09	8.43	18.60							
	ZONE 8			59	236	199	0	20.46	1421.6	1421.6	1.90	8.75			1.60	1.60			0.31	0.61	22.67	22.67	6.35	15.42							
MODIFIED CRITERIA	ZONE 9							11.83	96.0	96.0	1.90	0.59			37.63	37.63			7.40	22.50	71.96	71.96	20.15	28.14							
	ZONE 10			237	0	210	72	31.77	1654.2	1654.2	1.90	10.19	2.41	2.41	1.11	1.11			0.50	1.75	37.04	37.04	10.37	21.05							
	ZONE 11			342	52	508	84	40.86	2639.6	2639.6	1.90	16.25	2.09	2.09	6.68	6.68			1.56	2.42	52.05	52.05	14.57	32.38							
	ZONE 12							0.00	0.0	0.0	1.90	0.00			64.60	64.60			12.71	3.55	68.15	68.15	19.08	31.79							
	BNK1							0.00	0.0	0.0	1.90	0.00	1.95	1.95					0.23		1.95	1.95	0.55	0.77							
	BNK2							0.90	54.0	54.0	1.90	0.33			2.70	2.70			0.53		3.60	3.60	1.01	1.87							
								284.40	15685.80	15685.80	1.90	96.58	14.83	14.83	126.83	126.83	0.00	0.00	26.67	45.40	471.46	471.46	132.01	255.26							
MOE CRITERIA	ZONE 14			126	0	226	132	17.37	1218.0	1218.0	1.90	7.50			4.11	4.11			0.81	0.41	21.89	21.89	6.13	14.44							
	ZONE 13			466	68	621	108	51.95	3517.5	3517.5	1.90	21.66	2.25	2.25	7.62	7.62			1.76	3.93	65.74	65.74	18.41	41.82							
								69.32	4735.50	4735.50	1.90	29.16	2.25	2.25	11.73	11.73	0.00	0.00	2.57	4.34	87.63	87.63	24.54	56.26							
Combined Total								353.72	20421.30	20421.30	1.90	125.74	17.03	17.03	138.56	138.56	0.00	0.00	29.24	49.74	559.09	559.09	156.55	311.53							

Design Parameters:

Residential			ICI Areas				
			Ave. Flows (L/ha/day)			Peak Factor	
				Mod.	Reg.	Mod.	MOE
SF/SD	3.2	p/p/u	INST	10,000	50,000	1.0	1.0
TH	2.4	p/p/u	COM	17,000	50,000	1.0	1.0
APT	1.9	p/p/u	IND	10,000	35,000	1.0	MOE Chart
Other	60	p/p/Ha					

Notes:

1. Mannings coefficient (n) = 0.013

	MOE Criteria	Monitored Criteria
2. Demand (per capita):	350 (L/c/d)	280 (L/c/d)
3. Infiltration allowance:	0.28 (L/s/ha)	0.28 (L/s/ha)
4. Residential Peaking Factor: *Harmon Formula = 1+(14/(4+P^0.5)) where P = population in thousands*	Harmon	1.90

Designed: M.B.

Checked:

Dwg. Reference:

No.	Revision	Date
0.	DRAFT	3/7/2014

File Reference: 34738.5.7.1

Date: 12/1/2014

Sheet No: 1 of 1

J:\34738-LeitrimServReport\5.9 Drawings\59civil\current\Updated Serviceability Report Figures\SECTION 3\FIGURE 3.12 PREFERRED WASTEWATER.dwg Layout Name: FIGURE 3.12 Plot Style: ---- Plot Scale: 1:2.5849 Plotted At: 8/30/2016 10:16
AM Last Saved By: mmilne Last Saved At: Aug. 30, 16

Sheet No.	Drawing Title	Project Title	Scale
FIGURE 3.12	PREFERRED WASTEWATER PLAN	UPDATED SERVICEABILITY PLAN (CLASS EA OPA76 AREAS 8a, 9a and 9b) LEITRIM DEVELOPMENT AREA	N.T.S.

IBI

APPENDIX F

- **Figure 6.2, Preferred Minor Storm Plan from the 2016 Final Updated Serviceability Report**
- **Zone 13 Storm Sewer Design Sheet from the 2016 Final Updated Serviceability Report**
- **Figure 6.1, Storm Drainage Area Plan from the 2016 Final Updated Serviceability Report**
- **Figure 6.11, Major Flow Routing Features from the 2016 Final Updated Serviceability Report**

Sheet No.

FIGURE 6.2

Drawing Title

PREFERRED MINOR STORM PLAN

Project Title

UPDATED SERVICEABILITY PLAN
(CLASS EA OPA76 AREAS 8a, 9a and 9b)
LEITRIM DEVELOPMENT AREA

Scale

N.T.S.

IBI

IBI Group
400-333 Preston Street
Ottawa, Ontario
K1S 5N4

STORM SEWER DESIGN SHEET

DRAFT UPDATED SERVICIABILITY REPORT
(CLASS EA OPA 76 AREAS 8A, 9A and 9B)
LEITRIM DEVELOPMENT AREA
ZONE 13

LOCATION				AREA (Ha)							RATIONAL DESIGN FLOW										SEWER DATA								
STREET	AREA ID	FROM MH	TO MH	C= 0.20	C= 0.30	C= 0.40	C= 0.55	C= 0.60	C= 0.71	C= 0.75	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (5yr) (L/s)	(%)
	1300A, MU	1300	1327						0.76	3.12	8.01	8.01	10.00	1.78	11.78	104.19	122.14	178.56	834.10				834.10	1,074.02	310.00	675			1.50	2.908	239.92	22.34%
	1326	1326	1327						0.41	1.96	4.90	4.90	10.00	2.13	12.13	104.19	122.14	178.56	510.11				510.11	669.70	155.00	825			0.20	1.214	159.59	23.83%
	1327	1327	1328				0.12		0.18		0.54	13.44	12.13	0.76	12.89	94.15	110.32	161.19	1,265.37				1,265.37	1,560.35	80.00	1050			0.30	1.746	294.98	18.90%
	1305	1305	1306				0.18		0.14		0.55	0.55	10.00	1.02	11.02	104.19	122.14	178.56	57.47				57.47	95.70	80.00	300			0.90	1.312	38.24	39.95%
	1322A	1306	1328				0.91		0.80		2.97	3.52	11.02	2.16	13.17	99.11	116.16	169.77	349.08				349.08	448.66	260.00	525			1.00	2.008	99.58	22.20%
	1328	1328	1330				0.36		0.42		1.38	18.34	12.89	0.97	13.86	91.05	106.67	155.83	1,669.96				1,669.96	2,383.47	155.00	1050			0.70	2.667	713.52	29.94%
	1323	1323	1324				1.07		0.91		3.43	3.43	12.00	0.61	12.61	94.70	110.96	162.13	325.01				325.01	491.48	80.00	525			1.20	2.199	166.47	33.87%
	1306	1306	1308				0.46		0.27		1.24	1.24	10.00	1.47	11.47	104.19	122.14	178.56	128.81				128.81	200.37	155.00	375			1.20	1.757	71.56	35.71%
	1315, PARK	1308	1324	0.40					0.44		1.09	2.33	11.47	1.45	12.92	97.02	113.70	166.15	225.78				225.78	448.66	175.00	525			1.00	2.008	222.88	49.68%
	1324	1324	1330				0.21		0.24		0.79	6.55	12.92	1.04	13.96	90.93	106.53	155.63	595.97				595.97	844.60	80.00	900			0.20	1.286	248.63	29.44%
	1330A	1330	1331				0.18		0.18		0.63	25.53	13.96	0.74	14.70	87.08	101.99	148.97	2,222.74				2,222.74	3,297.98	80.00	1500			0.20	1.808	1,075.24	32.60%
	1316A	1316	1331				0.50		0.56		1.87	1.87	10.00	3.53	13.53	104.19	122.14	178.56	194.82				194.82	248.09	180.00	600			0.15	0.850	53.26	21.47%
	1331A	1331	1332				0.18		0.18		0.63	28.03	14.70	0.92	15.62	84.55	99.02	144.61	2,369.62				2,369.62	3,792.13	80.00	1800			0.10	1.444	1,422.51	37.51%
	1317A	1317	1332				0.50		0.56		1.87	1.87	10.00	3.22	13.22	104.19	122.14	178.56	194.82				194.82	271.77	180.00	600			0.18	0.931	76.94	28.31%
	1332	1332	1333				0.67		0.18		1.38	31.28	15.62	0.92	16.54	81.61	95.56	139.53	2,552.27				2,552.27	3,792.13	80.00	1800			0.10	1.444	1,239.86	32.70%
	1300B	1300	1301				1.14		0.47		2.67	2.67	10.00	1.48	11.48	104.19	122.14	178.56	278.27				278.27	401.29	160.00	525			0.80	1.796	123.02	30.66%
	1301	1301	1309				0.85		1.03		3.33	6.00	11.48	1.41	12.90	96.95	113.62	166.04	582.05				582.05	757.92	220.00	600			1.40	2.597	175.87	23.20%
	1308, 1309	1309	1317				0.33		0.61	0.17	2.06	8.07	12.90	1.13	14.03	91.03	106.64	155.80	734.30				734.30	1,038.80	155.00	750			0.80	2.278	304.50	29.31%
	1316B	1315	1317				0.47		0.39		1.49	1.49	10.00	2.88	12.88	104.19	122.14	178.56	155.08				155.08	200.65	155.00	525			0.20	0.898	45.56	22.71%
	1317B	1317	1318				0.29		0.19		0.82	10.37	14.03	1.21	15.24	86.82	101.69	148.53	900.65				900.65	1,286.19	80.00	1200			0.10	1.102	385.54	29.98%
	1318	1318	1333				0.90		0.78		2.92	13.29	15.24	2.15	17.39	82.79	96.94	141.56	1,100.14				1,100.14	1,626.92	180.00	1200			0.16	1.394	526.78	32.38%
	1303	1303	1304				0.49		0.51		1.76	1.76	10.00	2.11	12.11	104.19	122.14	178.56	182.95				182.95	317.25	180.00	525			0.50	1.420	134.30	42.33%
	1304, HD	1304	1311				0.11		0.27	1.36	3.54	5.29	12.11	0.31	12.42	94.22	110.39	161.30	498.64				498.64	784.52	50.00	600			1.50	2.688	285.88	36.44%
	1310B	1311	1312				0.29		0.48		1.39	6.68	12.42	0.66	13.08	92.93	108.88	159.08	621.07				621.07	900.87	40.00	1050			0.10	1.008	279.80	31.06%
	1312	1312	1320				0.39		0.56		1.70	8.39	13.08	1.21	14.29	90.30	105.79	154.54	757.20				757.20	1,286.19	80.00	1200			0.10	1.102	528.99	41.13%
	1320	1320	1334				1.02		0.78		3.10	11.48	14.29	1.96	16.25	85.91	100.62	146.95	986.57				986.57	1,760.81	140.00	1350			0.10	1.192	774.24	43.97%
	1334	1334	1333						0.57		1.13	12.61	16.25	1.19	17.44	79.72	93.34	136.27	1,005.17				1,005.17	1,760.81	85.00	1350			0.10	1.192	755.64	42.91%
	1337	1337	1336				0.69		0.51		2.06	2.06	10.00	3.04	13.04	104.19	122.14	178.56	214.81				214.81	303.78	150.00	675			0.12	0.822	88.97	29.29%
	1333	1333	1345A				0.51		0.40		1.57	60.80	17.44	1.76	19.20	76.42	89.46	130.58	4,646.58				4,646.58	6,745.44	165.00		2400	1800	0.10	1.561	2,098.86	31.12%
	1345A	1345A	1346				0.58		0.48		1.83	62.64	19.20	1.60	20.80	72.05	84.33	123.05	4,513.22				4,513.22	6,745.44	150.00		2400	1800	0.10	1.561	2,232.22	33.09%
			1314	*Refer to MOE C of A 4237-8J4JV3*								*65.93*	*32.98*			*50.55*	*59.09*	*86.07*	*3,332.87*				*3,332.87*									
			1314	*Refer to MOE C of A 4237-8J4JV3*								*4.14*	*32.98*			*50.55*	*59.09*	*86.07*		*244.62*			*244.62*									
	1314A	*1314*	*1325*				*0.31*		*0.57*		*1.60*	*67.53*	*32.98*			*50.55*	*59.09*	*86.07*	*3,413.71*				*3,413.71*									
		1314	*1325*								*0.00*	*4.14*	*32.98*	*1.90*	*34.88*	*50.55*	*59.09*	*86.07*		*244.62*			*3,658.33*	*5,749.47*	*213.00*	*1950*			*0.15*	*1.865*	*2,091.13*	*36.37%*
	1314B	1314	1325				0.89		0.61		2.56	2.56	10.00	5.28	15.28	104.19	122.14	178.56	267.24				267.24	367.27	255.00	750			0.10	0.805	100.03	27.24%
	1325	*1325*	*1346*						*0.51*		*1.01*	*71.10*	*34.88*			*48.63*	*56.83*	*82.77*	*3,457.75*				*3,457.75*									
		1325	*1346*								*0.00*	*4.14*	*34.88*	*2.56*	*37.44*	*48.63*	*56.83*	*82.77*		*235.29*			*3,693.04*	*4,923.55*	*245.00*	*1950*			*0.11*	*1.597*	*1,230.51*	*24.99%*
	1346, PARK	1346	1349	3.13					0.30		2.33	136.07	37.44			46.29	54.09	78.76	6,299.01				6,299.01									
		1346	1349								0.00	4.14	37.44	1.04	38.48	46.29	54.09	78.76		223.93			6,522.94	18,135.33	155.00	3000			0.15	2.485	11,612.39	64.03%
											Time Of Concentration = 10min + 300m/1.5m/s = 13.33min																				
	MU, 1338	1338	1339				0.12		0.14	4.42	9.68	9.68	13.33	0.68	14.01	89.37	104.69	152.93	864.72				864.72	1,103.33	50.00	1050			0.15	1.234	238.62	21.63%
	1339, 1340	1339	1341				0.83		1.02		3.28	12.96	14.01	2.17	16.17	86.92	101.80	148.69	1,126.24				1,126.24	1,760.81	155.00	1350			0.10	1.192	634.57	36.04%
	1329, INST	1329	1341						0.40	2.25	5.48	5.48	12.00	2.27	14.27	94.70	110.96	162.13	519.01				519.01	669.70	165.00	825			0.20	1.214	150.70	22.50%
	1341	1341	1342				0.37		0.35		1.26	19.70	16.17	0.91	17.09	79.95	93.61	136.67	1,574.63				1,574.63	2,156.55	80.00	1350			0.15	1.460	581.92	26.98%
	1330B	1330	1342				0.48		0.51		1.74	1.74	12.00	3.24	15.24	94.70	110.96	162.13	164.82				164.82	248.09	165.00	600			0.15	0.850	83.26	33.56%
	1342	1342	1343				0.33		0.34		1.18	22.61	17.09	0.85	17.94	77.37	90.58	132.22	1,749.47				1,749.47	2,856.14	80.00	1500			0.15	1.566	1,106.67	38.75%
	1331B	1331	1343				0.48		0.51		1.74	1.74	12.00	3.34	15.34	94.70	110.96	162.13	164.82				164.82	303.78	165.00	675			0.12	0.822	138.96	45.74%
	1343	1343	1344				0.34		0.35		1.21	25.56	17.94	0.85	18.79	75.13	87.94	128.35	1,920.47				1,920.47	2,856.14	80.00	1500			0.15	1.566	935.66	32.76%
	1332B	1332	1344				0.51		0.51		1.79	1.79	12.00	3.34	15.34	94.70	110.96	162.13	169.17				169.17	303.78	165.00	675			0.12	0.822	134.61	44.31%
	1344, 1345	1344	1355				0.63		0.54		2.03	29.38	18.79	1.79	20.58	73.03	85.47	124.73	2,145.35				2,145.35	3,792.13	155.00	1800			0.10	1.444	1,646.78	43.43%
	1358	1358	1360				0.26		0.30		0.99	0.99	10.00	1.69	11.69	104.19	122.14	178.56	103.12				103.12	129.34	115.00	375			0.50	1.134	26.22	20.27%
	1351, 1360, PARK	1360	1362	0.40			0.84		0.77		3.03	4.02	11.69	2.84	14.53	96.04	112.54	164.46	385.73				385.73	597.22	155.00	900			0.10	0.909	211.49	35.41%
	1353, 1362	1362	1364				0.59		0.77		2.42	6.44	14.53	2.56	17.09	85.11	99.67	145.57	547.93				547.93	900.87	155.00	1050			0.10	1.008	352.93	39.18%
	1364	1364	1355				0.62		0.60		2.13	8.57	17.09	2.04	19.14	77.35	90.56	132.19	662.95				662.95	1,286.19	135.00	1200			0.10	1.102	623.25	48.46%
	1355	1355	1356				0.29		0.19		0.82	38.77	20.58	0.82	21.40	69.01	80.75	117.80	2,675.14				2,675.14	4,694.42	75.00	1950			0.10	1.523	2,019.28	43.01%
	1357	1357	1356				0.79		0.62		2.43	2.43	12.00	3.35	15.35	94.70	110.96	162.13	230.27				230.27	339.63	185.00	675			0.15	0.919	109.37	32.20%
	1356	1356	1365				0.86		0.37		2.05	43.24	21.40	1.12	22.52	67.32	78.77	114.90	2,911.23				2,911.23	5,749.47	125.00	1950			0.15	1.865	2,838.23	49.37%
	1348	1348	1365				1.37		0.89		3.85	3.85	12.50	5.14	17.64	92.61	108.51	158.53	356.69				356.69	518.75	290.00	825			0.12	0.940	162.06	31.24%
		1365	*Ex. Outlet*								*0.00*	*47.10*	*22.52*	*0.27*	*22.79*	*65.17*	*76.24*	*111.20*	*3,069.24*				*3,069.24*	*6,521.98*	*30.00*	*2100*			*0.13*	*1.824*	*3,452.75*	*52.94%*

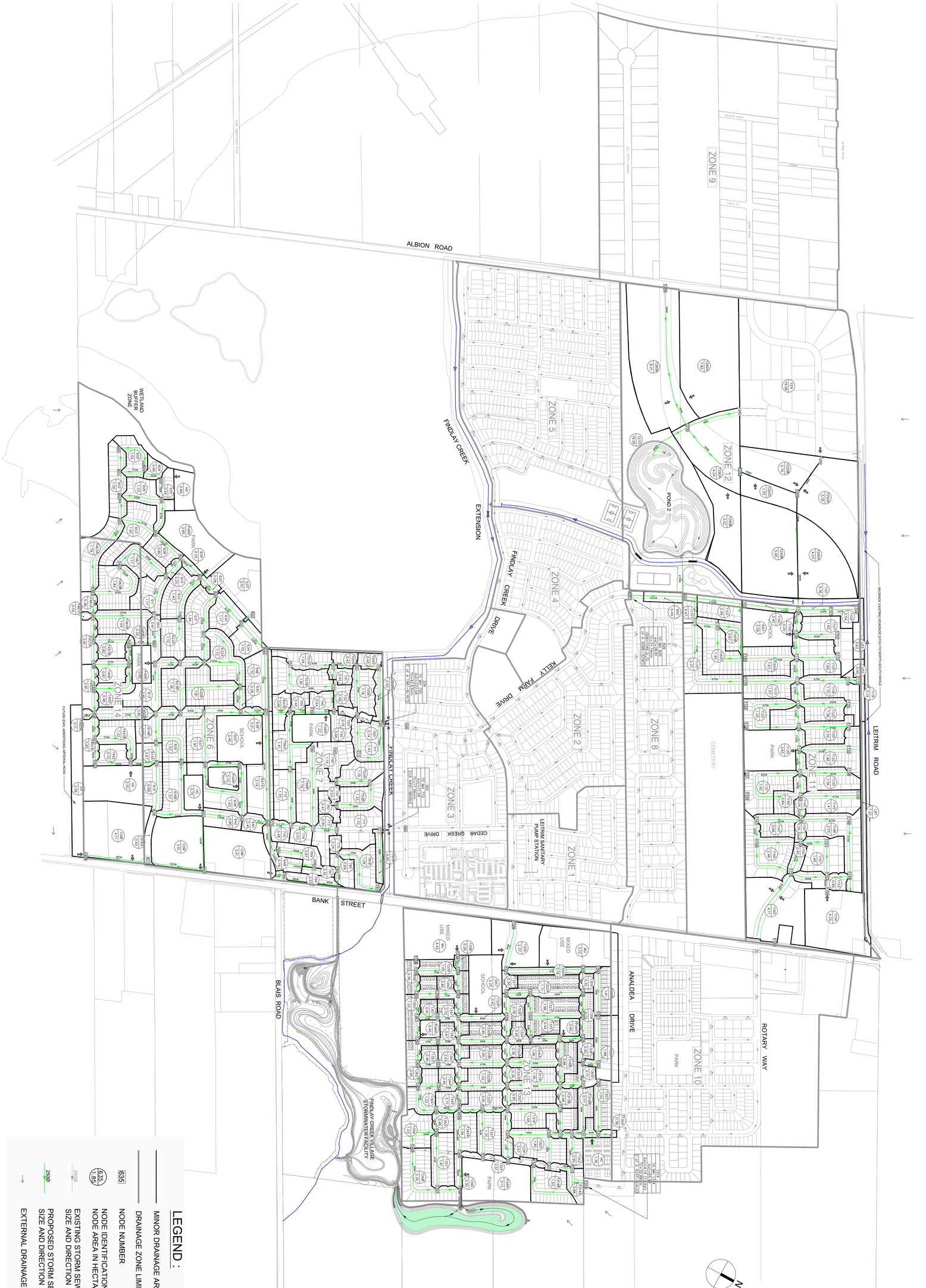
Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: P.K.
Checked: J.I.M.
Dwg. Reference: Figure 6.1

No.	Revision	Date
1.	DRAFT SUBMISSION NO.1	2014-12-05
2.	DRAFT SUBMISSION NO.2	2015-04-20
3.	DRAFT SUBMISSION NO.3	2016-06-27

File Reference: 34738 - 5.7.1
Date: 2016-06-27
Sheet No: 5 of 5



Sheet No.

FIGURE 6.1

Drawing Title

STORM DRAINAGE AREA PLAN

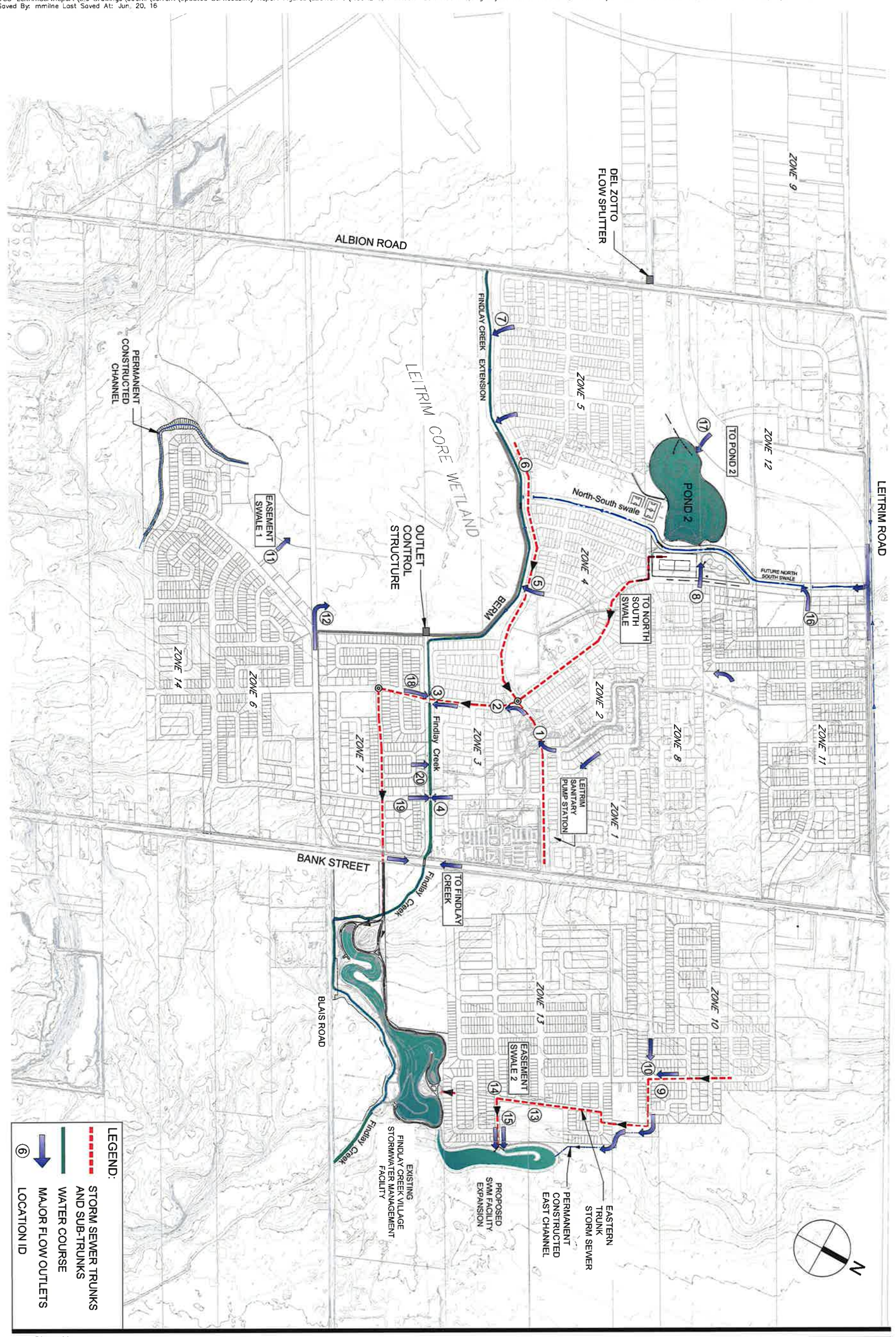
Project Title

UPDATED SERVICEABILITY PLAN
(CLASS EA OPA76 AREAS 8a, 9a and 9b)
LEITRIM DEVELOPMENT AREA

Scale

N.T.S.

IBI



Sheet No.

FIGURE 6.11

Drawing Title

MAJOR FLOW ROUTING FEATURES

Project Title

UPDATED SERVICEABILITY PLAN
(CLASS EA OPA76 AREAS 8a, 9a and 9b)
LEITRIM DEVELOPMENT AREA

Scale

DRAFT
N.T.S.

IBI

APPENDIX G

- **Figure 5.1 – Erosion and Sedimentation Control Plan**

Sheet No.

FIGURE 5.1

Drawing Title

EROSION AND SEDIMENT CONTROL PLAN

Project Title

CONCEPTUAL SITE SERVICING STUDY
OPA76 EXPANSION AREA 9b
URBANDALE/KELLAM LANDS
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Scale

N.T.S.

IBI