REPORT
PROJECT: 24674-5.2.2

ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
CLARIDGE 9a LANDS - 4789 BANK STREET
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Prepared for CLARIDGE HOMES (BANK ST.) INC.
by IBI GROUP

SEPTEMBER 2017

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

1 INTRODUCTION

1.1 Purpose

The purpose of this report is to investigate and confirm the adequacy of public services for the proposed site. This report will review major municipal infrastructure including water supply, wastewater collection and disposal and management of stormwater. This report will also include a Sedimentation and Erosion Control Plan. A review of traffic components will be the subject of separate reports.

This report is being prepared as a technical document in support of a re-zoning application for the subdivision, and was prepared in accordance with the November 2009 "Servicing Study Guidelines for Development Applications" in the City of Ottawa. **Appendix A** contains a customized copy of those guidelines which can be used as a quick reference for the location of each of the guideline items within the study report.

1.2 Background

Development in the Leitrim Development Area started 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 Claridge Lands were not included in the original CDP limits.

In 2012, the City of Ottawa expanded its urban envelop under OPA 76. Part of that expansion included an 87 ha expansion in Leitrim including OPA 76 expansion areas 8a, 9a and 9b. The Claridge property covers about 35 ha and forms part of expansion area 9a located east of Bank Street. **Figure 1.2** shows the original CDP plus the three expansion areas in Leitrim and the Claridge property. To support that expansion, the new land owners are in the process of updating the 2007 Serviceability Report. The 2016 Final Draft Updated Serviceability Report (updated 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 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 Draft Updated Serviceability Report (Class EA OPA 76 Areas 8a, 9a & 9b)** 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 & 9b in the LDA. The subject site is included in expansion area 9a. The report is currently in final draft format and is undergoing final approval by the City of Ottawa and the SNC. The design of the subject site is proposed to be developed as per the recommendations of the final draft report recommendations.

   The Claridge 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 Claridge 9a Lands

The current draft plan of subdivision for the Claridge 9a Lands is shown on **Figure 1.3**. The property covers about 25 ha and is located in the east portion of the LDA abutting and immediately east of Bank Street. Analdea Drive and the McCann 9a expansion lands are located to the north of the property and the Urbandale 9b expansion lands to the south. The proposed development will include a mixture of various residential types including singles, semis, on street towns and two mixed use blocks. The development will also include a neighbourhood park, part of a community park and part of a school site.

Figure 1.4 shows a preliminary but potential phasing plan for the subdivision. The first phase will concentrate on developing both the western and eastern portions of the property including the connecting Street No. 1. It will include 124 singles and 156 on street townhouses. This phasing plan will require cooperation with other landowners in expansion areas 9a and 9b for both water supply and storm sewer outlets.

Phasing of the balance of the site will be determined by market conditions and coordination with adjacent developments.

1.5 Existing Infrastructure

Figure 1.5 shows the location of existing major municipal infrastructure in the vicinity of the subdivision. As noted in Section 1.3, a 375 mmØ sanitary sub-trunk sewer, which bisects the Claridge 9a lands, was constructed in 2010 to service the Sundance Village (Claridge Homes) and Findlay by the Park (Lemay Homes) developments located north of the subject site. That sewer, which is called the Bank Street East Sub-Trunk Sewer in the 2016 report, will also be the wastewater outlet for the Claridge 9a lands.

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 Claridge 9a property. That sewer, which will be partially re-routed in the north east of the subject lands, will provide the minor storm runoff outlet for the Claridge 9a lands.

The Findlay Creek Village Stormwater Facility located south of the subject site was commissioned in 2006. As per the recommendation of the 2016 Final Draft 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.

1.6 Pre-Consultation

The Owner, Claridge Homes (Bank Street) Inc. has worked with the City over the last three years to develop its draft plan, which is shown in **Figure 1.3**. This work has included a number of pre-consultation meetings including one on October 20, 2014, the meeting notes from which are included in **Appendix A**.

1.7 Existing Topography

The site generally slopes from the north east towards the east and south east. Existing slopes are in the 0.5% to 2.0% range located between the 94.5 m and 92.0 m contours. **Figure 1.6** shows the existing site topography. Existing surface drainage is captured in two temporary ditches which are adjacent and parallel to the existing 1950 mm storm sewer. That runoff is eventually captured in ditch inlet structures and routed to the existing storm sewer which outlets to the existing stormwater facility. The site is partially vegetated.

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

1.8 Geotechnical Considerations

Golder Associates Ltd. was retained to prepare a geotechnical investigation for the existing residential development Sundance Village located to the north of the subject site. That report addressed the sewer construction requirements for the two existing sewers which bisect the site. In 2013, Golder Associates Ltd. also completed another report for the subject site: “Geotechnical Investigation Proposed Residential Development East of Bank Street and South of Analdea Drive, Ottawa, Ontario”. The objectives of the investigation were to prepare a report to:

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

Among other items, the report recommendations will also review the following:

- Site grading;
- Foundation design;
- Pavement structure;
- Sewer and Watermain Construction;
- Groundwater Control;
- Grade Raises

Existing subsurface information indicate that the site consists mostly of silty clay, sandy silt, sand, boulders and glacial till on top of dolomitic limestone bedrock. These conditions will provide a suitable base for subdivision construction.

1.9 Watercourses and Setbacks

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 same to the storm sewer. Much of those existing ditches will be decommissioned in favour of local sewers as part of the site development. The one exception will be the northern portion of the existing ditch located east of the existing storm sewer. This ditch captures both major storm runoff from the Findlay by the Park development and some lands east of the Claridge Lands. This ditch is proposed to remain and be rerouted to the proposed pond expansion. There are no watercourses on or near the site that will require setbacks.

2 WATER SUPPLY

2.1 Existing Conditions

As stated in Section 1.5 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 1.5** shows the existing water supply system adjacent to the subject site.

2.2 Serviceability Study

The preferred water distribution plan for the Leitrim Development Area was included in the 2016 Final Draft Updated Serviceability Report. A copy of the recommended plan, **Figure 2.2** is included in **Appendix B**. The Claridge Lands are included in the south portion of OPA 76 Area 9a as shown on **Figure 2.2**. The recommended water plan for Area 9a includes a connection to the watermain on Bank Street and two connections to the existing 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 site. All other pipes in the site will be 150 and 200 mm diameter.

2.2.1 Water Demands

The Claridge 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. 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 commercial 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 B**.

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 Draft 2015 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 B**.

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 Claridge 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 Draft 2015 report. The fire flow demands used for the Claridge 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 B**.

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 McCann 9a expansion lands to connect to an existing 200 mm diameter watermain on Rotary Way at Fernside Street. The proposed watermain layout for the Claridge Lands is shown on **Figure 2.1**.

As discussed in Section 1.4 and as shown **on Figure 1.4**, is a proposed first phase. The first phase will include the connections to the Bank Street and Rotary Way watermains providing two connections for the phase. A separate watermain analysis has been conducted for Phase 1 to demonstrate the phase meets the hydraulic requirements. The results of the hydraulic analysis for the Claridge Lands is included in **Appendix B** and is summarized as follows:

SCENARIO	CLARIDGE LANDS	PHASE 1 ONLY
Basic Day (Max HGL) Pressure (kPa)	527.3 – 577.1	527.7 – 578.0
Peak Hour Pressure (kPa)	419.0 – 468.0	423.1 – 472.4
Design Fire flow @ 140 kPa Residual Pressure (l/s) - Single Family/Townhouse - ICI	 150.6 – 221.5 227.0 – 243.8	 145.2 – 217.3 218.0 – 237.5

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

Maximum Pressure — The majority of 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 for both analysis is 419.0 kPa which exceeds the minimum 276 kPa (40 psi) requirement.

Fire Flow — The majority of the residential nodes exceed the requirement of 167 l/s for fire flow. There are several nodes adjacent to the McGann Lands which have slightly lower fire flow rates than the requirement. These flows will increase when connected to the McGann Lands. The ICI nodes have fire flow close to the conservative requirement of 250 l/s.

3 SANITARY SEWERS

3.1 Existing Conditions

As noted earlier, the wastewater outlet for the subdivision will be the Bank Street East 375 mm diameter sub-trunk sewer which bisects the southern portion of the property. That sewer was installed in 2010 to support the Sundance Village (Claridge Homes) and Findlay by the Park (Lemay Homes) developments.

The Claridge 9a 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 within 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 Draft 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 Draft 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 Draft 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 Draft Report are included in **Appendix C**. 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 C** 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 Draft 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 C**.

The 2016 Final Draft 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 Draft Report are included in **Appendix C**. 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 Draft Report are also included in **Appendix C**.

The 2016 Final Draft 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 Draft 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 Claridge Plan of subdivision includes the following development statistics:

- Single units = 220
- Townhouse units = 269
- Mixed Use = 1.96 ha
- School area (partial site) = 0.68 ha
- Park area = 2.00 ha

In accordance with the 2005 CDP and the 2016 Final Draft 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 Claridge property will be about 30 l/s and the estimated peak wastewater flow from both OPA 76 expansion areas 9a and 9b is 66 l/s.

3.4 Recommended Sanitary Plan

The 2016 Final Draft 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 9a. 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 Draft 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 Claridge 9a Lands be in accordance with that proposed in the 2016 Final Draft Updated Serviceability Report. That plan is shown on Figure 3.12 from the Draft Report and a copy is included in **Appendix C**. No temporary or interim changes are needed to the overall preferred wastewater plan to accommodate Phase 1. The main features of that plan are that some sanitary sewers proposed for the subject site need to provide capacity for upstream external developments within the balance of OPA 76 expansion area 9a. The 2016 report also recommended that a high level local sewer be constructed in Street No. 1 and connect to the 375 mm diameter sub-trunk sewer near node 1334. A second sanitary sewer connection to the Sub-Trunk Sewer is also proposed near node 1335. The latter connection will serve as the wastewater outlet for the expansion area 9b lands located south of the subject site.

4 STORMWATER MANAGEMENT

4.1 Existing Conditions

The subject site is located north of the existing Findlay Creek Village Stormwater Facility. OPA 76 expansion area 9b is located between that facility and the subject site. 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 Claridge 9a lands. 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 Draft 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 report recommended that the existing 1950 mm diameter pipe be intercepted south of the subject site in the 9b expansion lands and that a new 3000 mm diameter sewer be constructed to outlet to the storm pond expansion which is recommended to be located immediately east of the subject site and OPA 76 expansion area 9b. The balance of the existing 1950 mm diameter sewer south of the point of interception could then be removed. For reference, a copy of Figure 6.2 Preferred Minor Storm Plan from the 2016 Final Draft Updated Serviceability Report is provided in **Appendix D**.

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 MOE. 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	0.34
375	0.25
450	0.195
525	0.16
600	0.132
675	0.113
750 and larger	0.1

- 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 Draft 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 must provide for minor stormwater runoff from the balance of the expansion area 9a lands located north of the Claridge 9a lands. The 2016 Final Updated Serviceability Report identified a preferred minor storm sewer plan that included 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 Draft Report is included in **Appendix D** for reference.

4.3 Recommended Minor Storm Plan

The recommended minor storm plan for the expanded LDA is included in **Appendix D**. Figure 6.2, Preferred Minor Storm Sewer Plan from the 2016 Final Draft Report shows a preferred minor storm sewer layout for not only the subject property but for adjacent lands in the expansion area 9a as well as the balance of the area 9b lands. **Figure 4.1** shows the recommended minor storm plan for Phase 1 for the subject site. Because the recommended outlet for the Phase 1 storm sewers is to be located in expansion area 9b which is located to the south of the Claridge Lands, coordination with other owners will be required.

The key recommendation from the 2016 Serviceability Report is that the existing 1950 mm diameter sewer, at a location about 120 m south of the Claridge property, 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 and removed.

The preferred plan is essentially to continue to use the remaining portion of the 1950 mm diameter pipe to service the existing developments north of expansion area 9a and permit a small portion of area 9a to also connect and outlet to that pipe. However, most of expansion area 9a, including the subject site, will be serviced by a new minor storm sewer system that will be oversized as

needed to provide an outlet for the remaining upstream properties in area 9a. Figure 6.2, Preferred Minor Storm Plan, together with a storm sewer design sheet, from the 2016 Final Draft report are included in **Appendix D** for reference.

It is therefore recommended that the minor storm plan for the Claridge 9a lands be in accordance with Figure 6.2 from the 2016 Final Draft Updated Serviceability Report. That report provides a plan that demonstrates how the subject site can be serviced with a minor storm sewer system. Coordination with the owners of expansion area 9b will be required to complete the proposed storm sewer outlet as well as the pond expansion.

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 Claridge property is development is discussed in **Section 4.6**.

The major flow from the subject site and the upstream 9a lands is proposed to be conveyed, via the street patterns, to the southeast corner of the subject site. From there, the flow will be conveyed into the OPA Expansion Area 9b streets to a swale located in an easement immediately south of the large park area. This swale will convey the runoff into the expanded cell of the 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 Updated Serviceability Report (a copy of Figure 6.11 is included in **Appendix D**) indicated the major flow outlet location as 13. The following table summarizes the major system evaluation results as presented in the 2016 Updated Serviceability Report. It should be noted that the total major flow presented in the table below is from both the Claridge property and the upstream area 9a lands.

Table 4.1 Summary of Major Flow – Subject Site

ZONE	LOCATION (FIGURE 6.11)	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								
Northern Half of Zone 13	13	18	1.09	0.13	0.22	0.35	0.77	0.27
100 Year 3 Hour Chicago Storm + 20%								
Northern Half of Zone 13	13	18	4.37	0.13	0.40	***0.53***	1.05	0.56

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

At the location 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 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 was 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 Updated Serviceability Report.

Table 4.2 Hydraulic Gradient 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	EXISTING	SANI INFLOW OPTION 1		SANI INFLOW OPTION 2		SANI INFLOW OPTION 1		SANI INFLOW OPTION 2	
	PROPOSED	*PROPOSED*	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

XPSWMM NODE	USF (M)	FINISHED GRADE (M)	STORM HYDRAULIC GRADE LINE							
			100 YEAR 24 HOUR SCS				100 YEAR 3 HOUR CHICAGO			
	EXISTING	EXISTING	SANI INFLOW OPTION 1		SANI INFLOW OPTION 2		SANI INFLOW OPTION 1		SANI INFLOW OPTION 2	
	PROPOSED	*PROPOSED*	HGL (M)	USF–HGL (M)	HGL (M)	USF–HGL (M)	HGL (M)	USF–HGL (M)	HGL (M)	USF–HGL (M)
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

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

Please note that the node locations referenced in **Table 4.2** are included on **Figure 1.5**, 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 Updated Serviceability Report. A copy of that plan is included in **Appendix A**.

4.6 External Drainage

There are two sources of external drainage to the subject site. These are, the existing residential developments of Sundance Village and Findlay by the Park (Zone 10 in the 2016 USR) and the area 9a lands north of the Claridge property. Both minor and major flows from those areas will need to be accommodated by the Claridge property either through or around the site.

Minor and Major Flow from Upstream Area 9a Lands

As stated earlier, the stormwater management design of the subject site will provide oversized storm sewers for the area 9a upstream lands. The design of the subject site must also allow for ultimate major storm runoff from these lands. The 2016 Final Draft Updated Serviceability Report included both elements. Also, assuming the Claridge Lands develop prior to the balance of the upstream area 9a lands, there are some exterior drainage works, including ditching and ditch inlets that will most likely be needed to temporarily deal with existing surface runoff which generally flows from the northwest to the southeast.

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.

Major Flow from Sundance Village and Findlay by the Park

The subject site is located on lands that presently convey external major flow towards the existing eastern inlet of the Findlay Creek Village Stormwater Facility. The major flow from Sundance Village and Findlay by the Park is conveyed via existing ditches located on the west and east side of the 1950 mm diameter eastern trunk alignment. The flow is captured in ditch inlets and conveyed into the existing Findlay Creek Village Stormwater Facility. The 2016 Final Draft Updated Serviceability Report recommended that the existing major flow in the eastern ditch be conveyed around the subject site, within a permanent channel east of the development boundary, to the expanded cell of the Findlay Creek Village Stormwater Facility. This ditch is indicated as location 10 in Figure 6.11 Major Flow Routing Features from the 2016 Final Draft Updated Serviceability Report (located in **Appendix D**). To ensure early development construction activities do not impact the existing flow patterns, it is proposed to complete the permanent east channel concurrent with the development of the Area 9a expansion lands.

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 Claridge area 9a 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.

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.

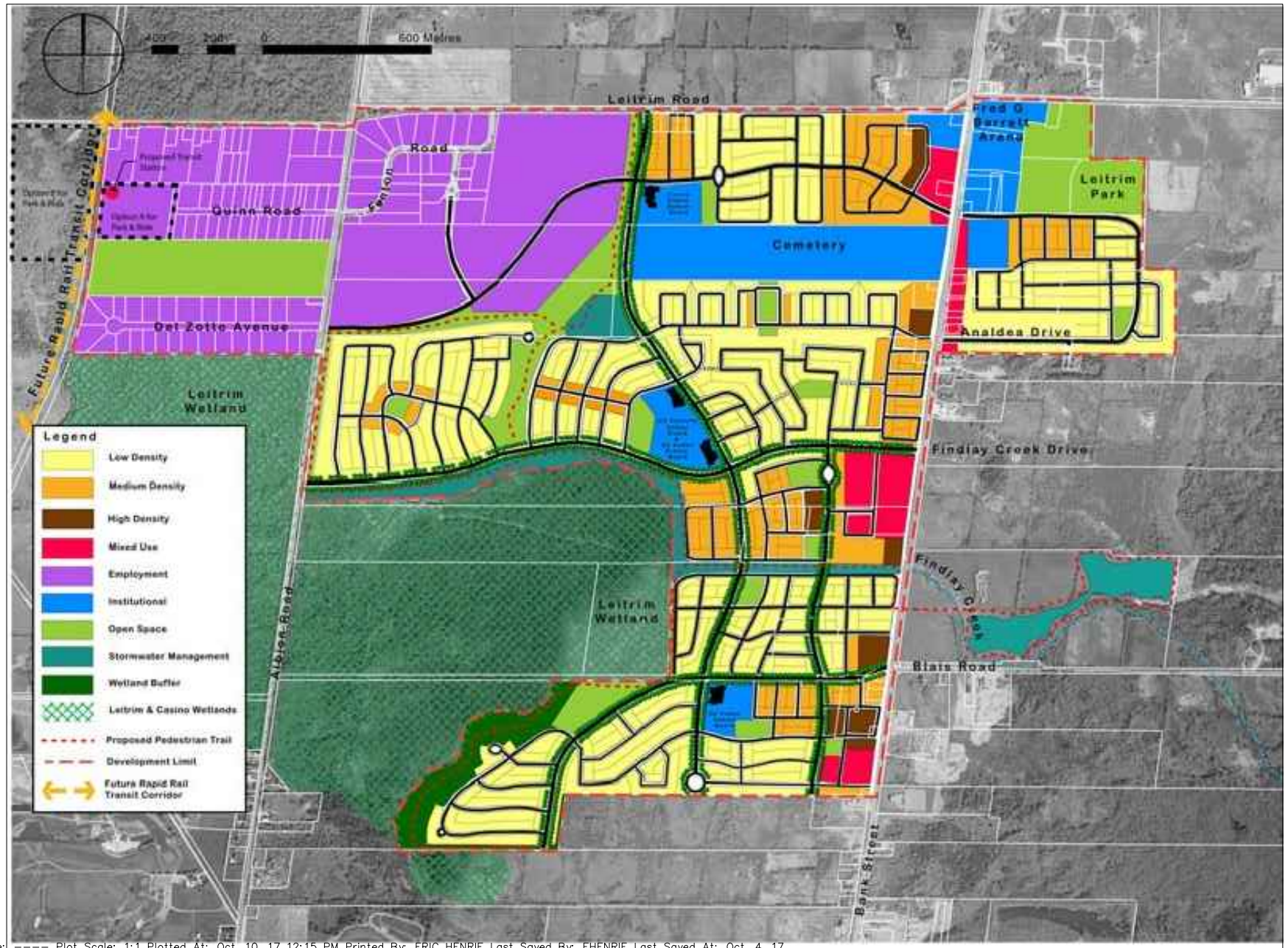
7 CONCLUSIONS AND RECOMMENDATIONS

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

From an assessment of major municipal infrastructure perspective, it is recommended that the development application for the Claridge area 9a lands at 4789 Bank Street be accepted and that the development of the property move forward.



J:\24674-LeitrimExpa\5.9 Drawings\59civil\current\Assessment of Adequacy of Public Services Report\FIGURE 1.1.dwg Layout Name: FIGURE 1.1

Plot Style: ---- Plot Scale: 1:1 Plotted At: Oct. 10, 17 12:15 PM Printed By: ERIC HENRIE Last Saved By: EHENRIE Last Saved At: Oct. 4, 17

IBI

Scale

Project Title

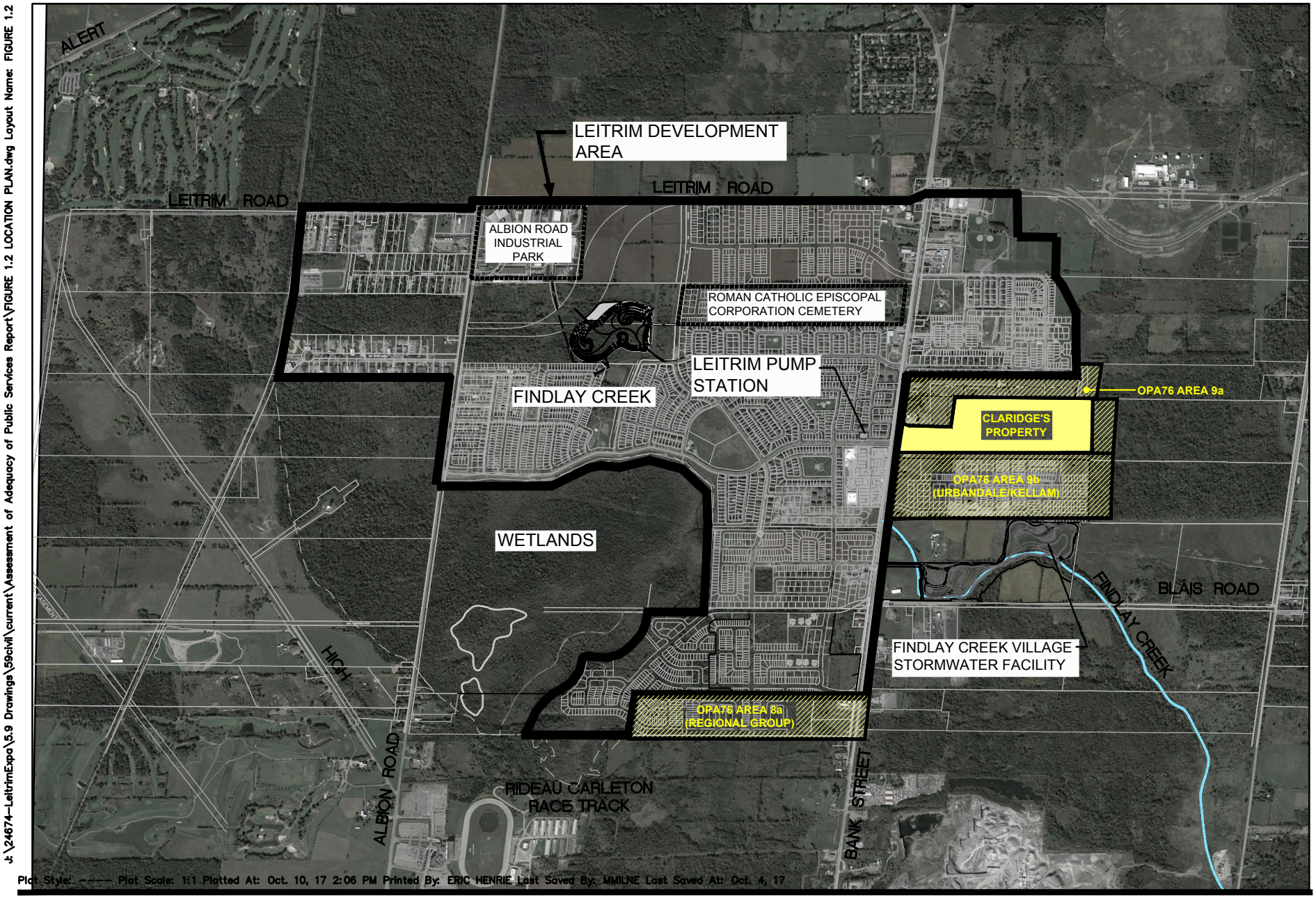
ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
CLARIDGE 9a LANDS - 4789 BANK STREET
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title

2005
LEITRIM COMMUNITY
DESIGN PLAN

Sheet No.

FIGURE 1.1



J:\24674-LeitrimExpo\5.9 Drawings\59civil\current\Assessment of Adequacy of Public Services Report\FIGURE 1.2 LOCATION PLAN.dwg Layout Name: FIGURE 1.2

Plot Style: ----- Plot Scale: 1:1 Plotted At: Oct. 10, 17 2:06 PM Printed By: ERIC HENRIE Last Saved By: MMILNE Last Saved At: Oct. 4, 17

IBI

Scale

Project Title

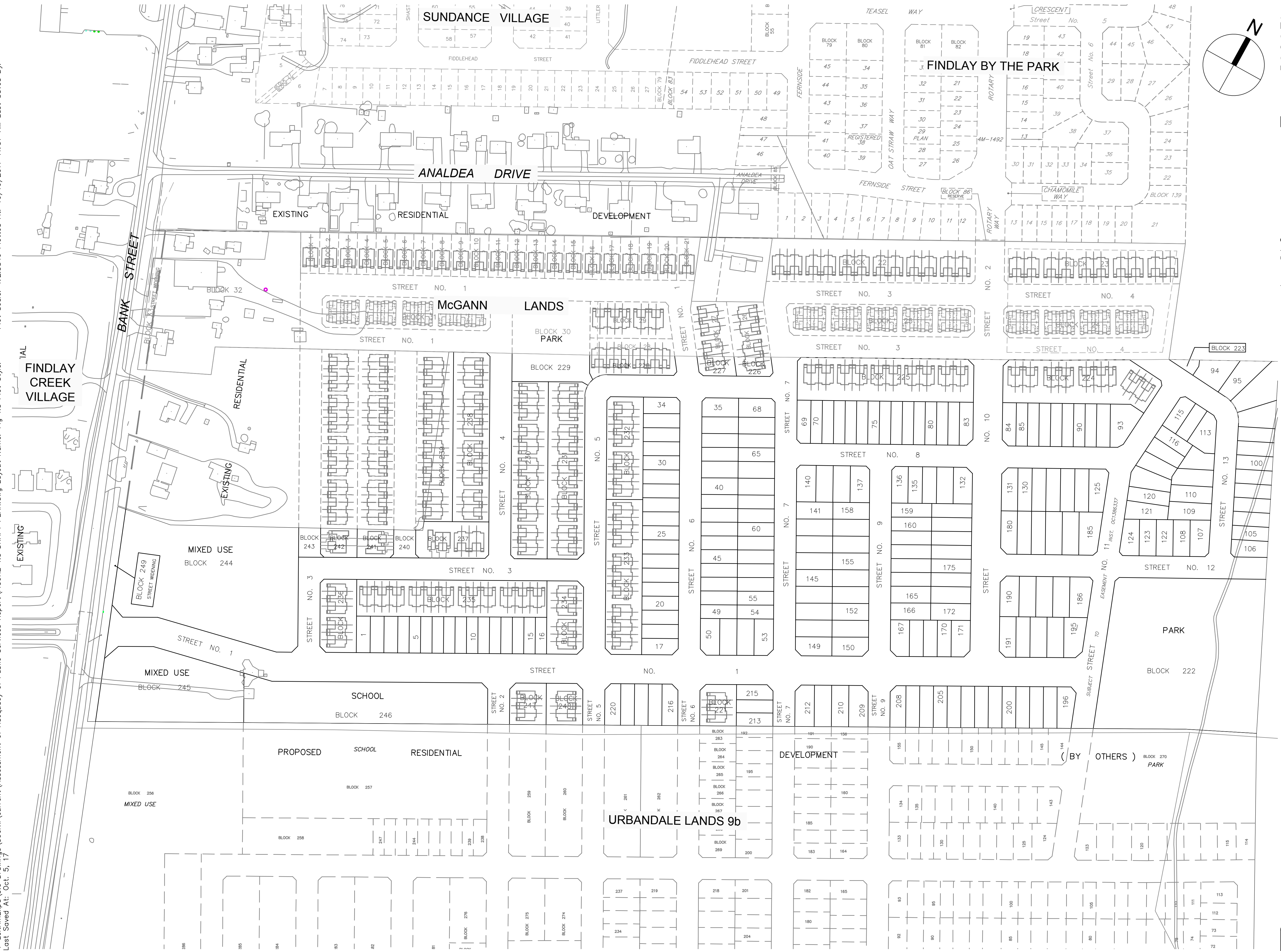
ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
CLARIDGE 9a LANDS - 4789 BANK STREET
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title

OPA 76
AREAS 8a, 9a and 9b
AND CLARIDGE'S LAND
LOCATION PLAN

Sheet No.

FIGURE 1.2



DRAFT PLAN OF SUBDIVISION OF
PART OF LOTS 18 And **19**
CONCESSION 5 (RIDEAU FRONT)
Geographic Township of Gloucester
CITY OF OTTAWA
Prepared by Annis , O'Sullivan , Vollebekk Ltd.

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 we are the owners of the lands to be subdivided and that this plan was prepared in accordance with our instructions.

Date

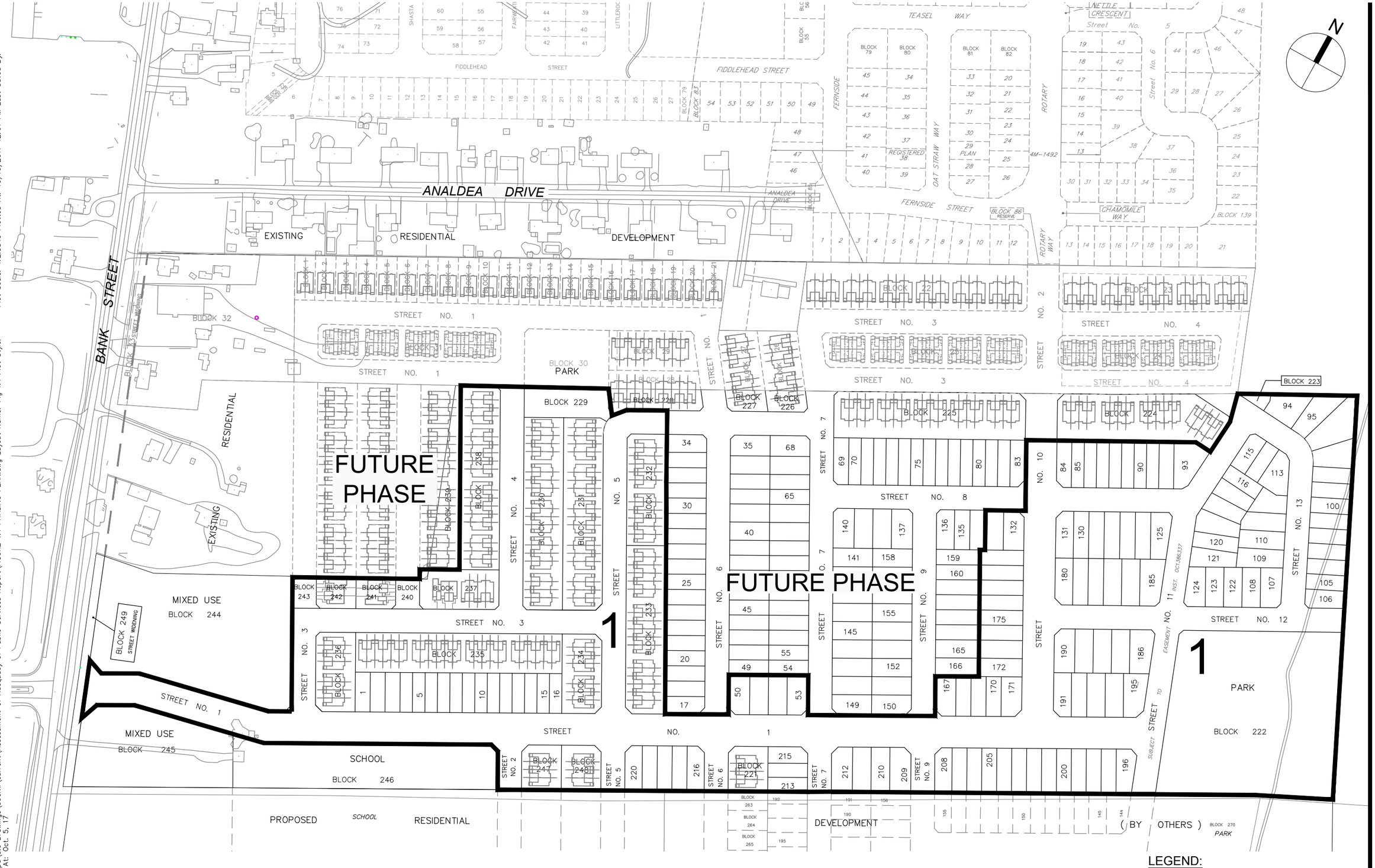
ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51-17 OF THE PLANNING ACT
(a) see plan
(b) see plan
(c) see plan
(d) single family, multi-family residential housing, park land, open space and Institutional
(e) see plan
(f) see plan
(g) see plan
(h) City of Ottawa
(i) see soils report
(j) see plan
(k) sanitary,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

Scale
N.T.S.

Project Title
ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
CLARIDGE 9a LANDS - 4789 BANK STREET
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title
DRAFT PLAN OF SUBDIVISION

Sheet No.
FIGURE 1.3



Project Title

ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
CLARIDGE 9a LANDS - 4789 BANK STREET
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Scale N.T.S.

Drawing Title

PHASING PLAN

Sheet No.

FIGURE 1.4

IBI

Layout Name: Fig 1.4 Plot Style: ---- Plot Scale: 1:2.5849 Plotted At: 10/10/2017 12:01 PM Last Saved By:

\24674-LeitrimExpo\5.9 Drawings\59civil\current\Assessment of Adequacy of Public Services Report\FIGURE 1.4 PHASING PLAN.dwg
emrie Last Saved At: Oct. 5, 17

LEITRIM SANITARY PUMP STATION

P/S

400ø FORCE MAIN

300ø FORCE MAIN

FINDLAY CREEK DRIVE

CEDAR CREEK DRIVE

BANK STREET

EX. 400ø

EX. 600ø

EX. 300ø

EXISTING 400Ø WATERMAIN

FINDLAY CREEK

FINDLAY CREEK VILLAGE

EXISTING 3000x3600mm STORM SEWER

S770

R773

OPA76 EXPANSION AREA 9b (URBANDALE)

EXISTING FINDLAY CREEK VILLAGE STORMWATER FACILITY

RESIDENTIAL

EXISTING

MIXED USE

SCHOOL

PARK

AMALFA

LEGEND:

- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- S141 STORM MANHOLE ID
- DRAINAGE DITCH

N

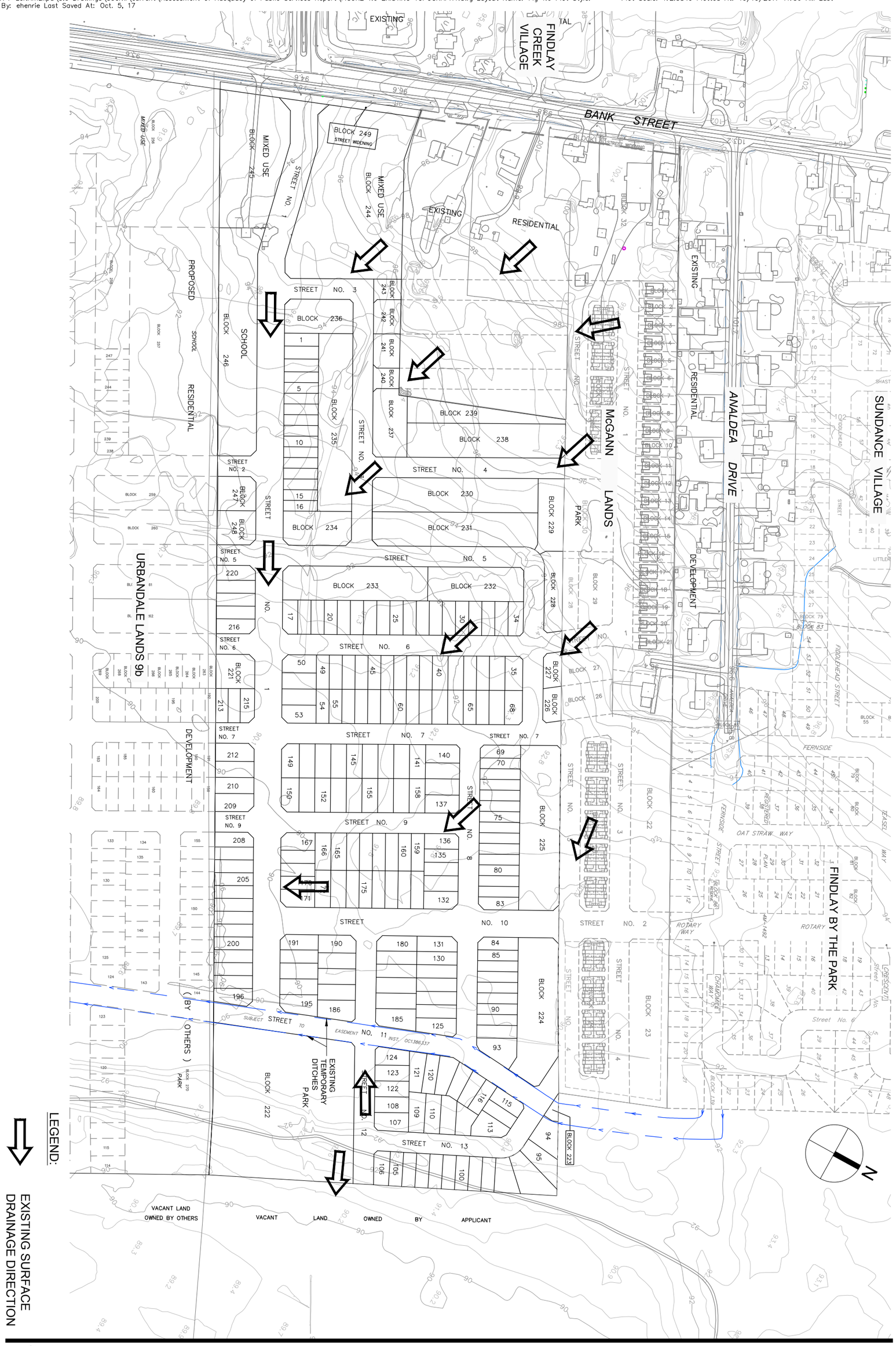
Scale N.T.S.

Project Title
ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
CLARIDGE 9a LANDS - 4789 BANK STREET
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title
EXISTING MUNICIPAL INFRASTRUCTURE

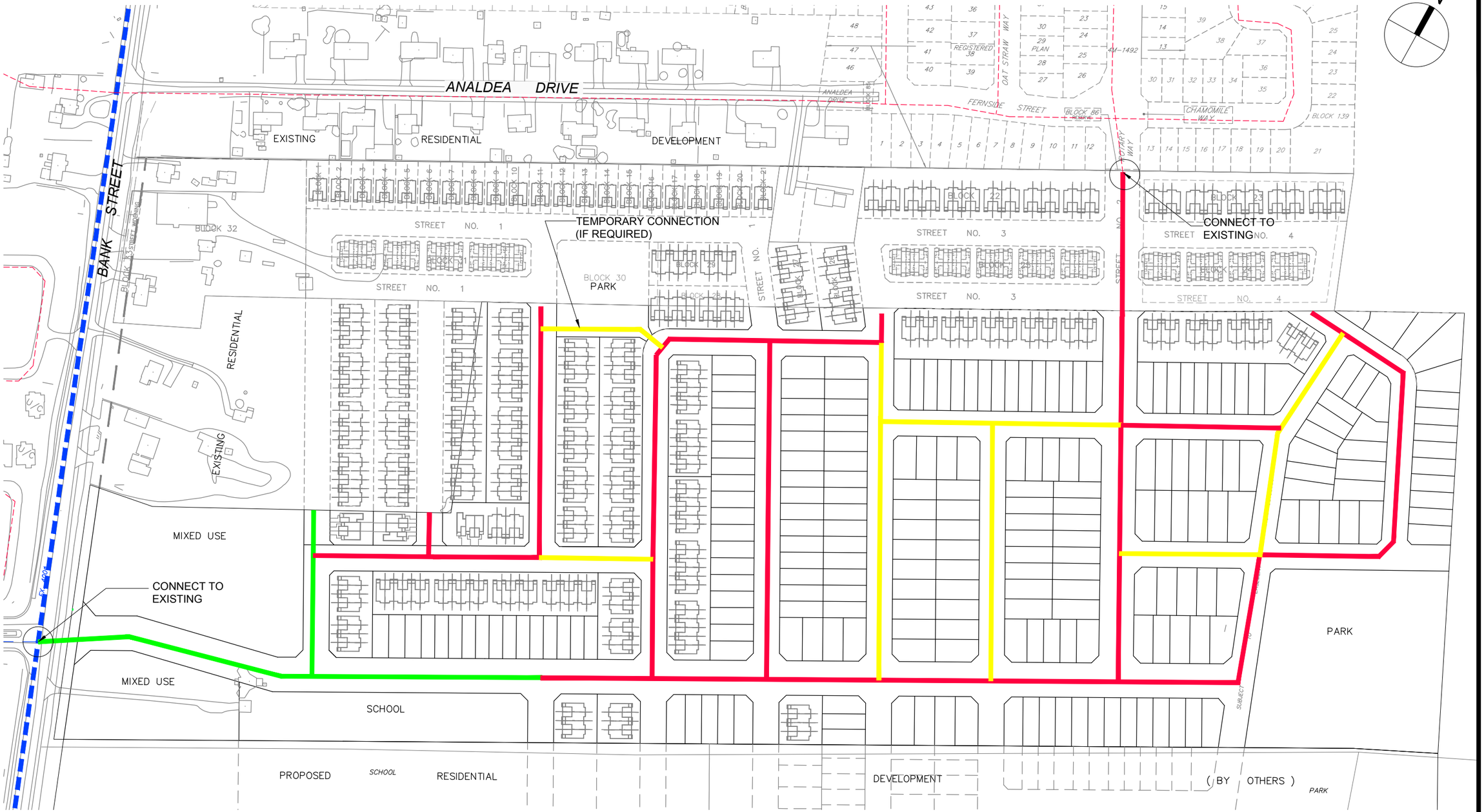
Sheet No.
FIGURE 1.5

J:\24674-LeitrimExpa\5.9 Drawings\59civil\current\Assessment of Adequacy of Public Services Report\FIGURE 1.5 EXISTING MUNICIPAL INFRASTRUCTURE.dwg Layout Name: FIGURE 1.5 Plot Style: ---- Plot Scale: 1:2.5849 Plotted At: 10/10/2017
11:57 AM Last Saved By: ehenrie Last Saved At: Oct. 5, 17



Sheet No.	Drawing Title	Project Title	Scale
FIGURE 1.6	EXISTING TOPOGRAPHY	ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES CLARIDGE 9a LANDS - 4789 BANK STREET LEITRIM DEVELOPMENT AREA CITY OF OTTAWA	N.T.S.

IBI



LEGEND:

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

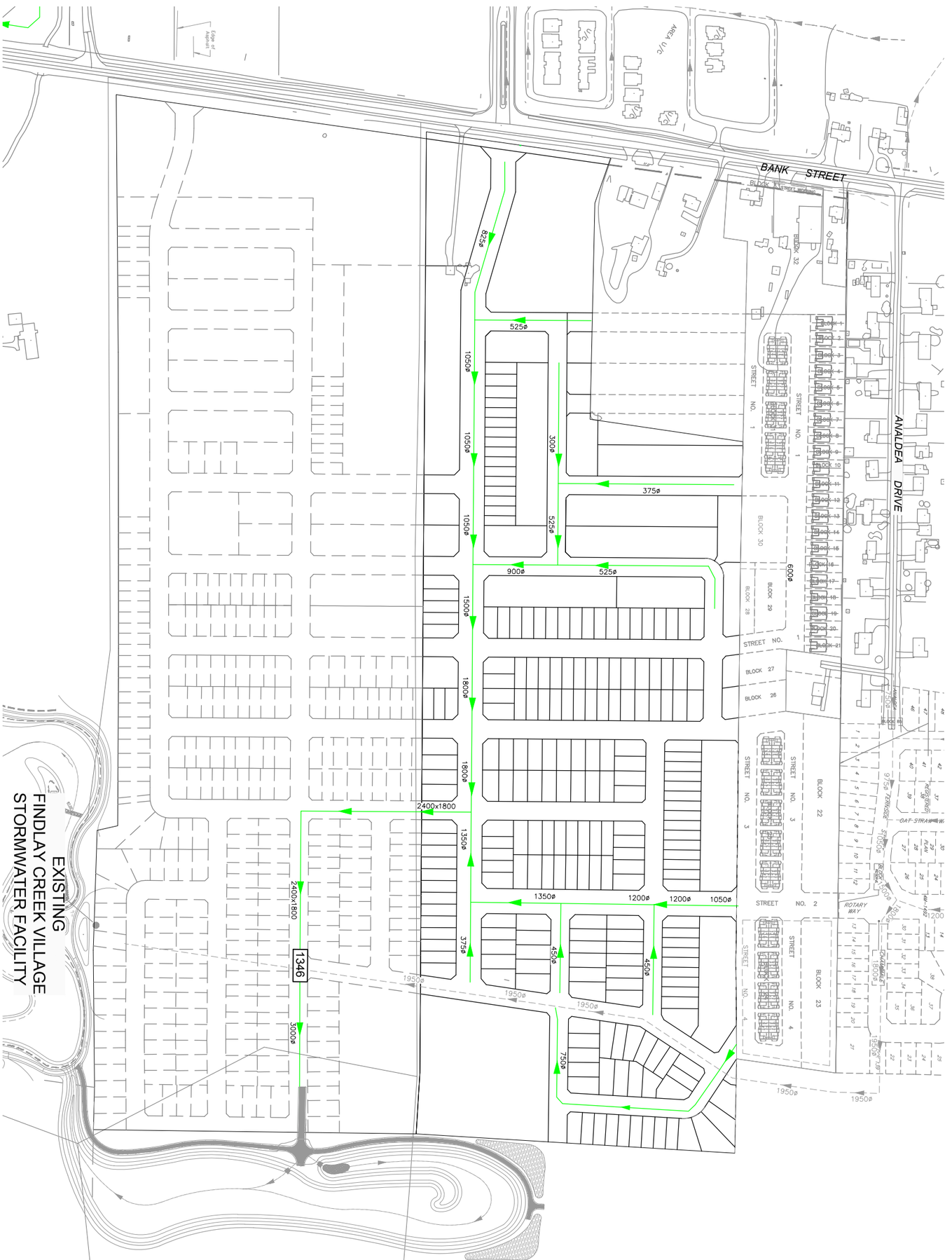
IBI

Scale N.T.S.

Project Title
ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
CLARIDGE 9a LANDS - 4789 BANK STREET
LEITRIM DEVELOPMENT AREA
CITY OF OTTAWA

Drawing Title
PROPOSED WATER DISTRIBUTION PLAN

Sheet No.
FIGURE 2.1



LEGEND :

EXISTING SEWER, DIRECTION AND SIZE

PROPOSED SEWER, DIRECTION AND SIZE

Sheet No.	Drawing Title	Project Title	Scale
FIGURE 4.1	PHASE 1 MINOR STORM PLAN	ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES CLARIDGE 9a LANDS - 4789 BANK STREET LEITRIM DEVELOPMENT AREA CITY OF OTTAWA	N.T.S.

IBI

APPENDIX A

- **City of Ottawa Servicing Study Guidelines Checklist**
- **Meeting Notes from October 24, 2014 Pre-Consultation Meeting with City of Ottawa**
- **Figure 8.1 – Macro Grading Plan from 2016 Final Draft Updated Serviceability Report**

Development Servicing Study Checklist

The following table is a customized copy of the current City of Ottawa's Development Servicing Study Checklist. It is meant to be a quick reference for location of each of the items included on the list. The list contains the various item description and the study section in which the topic is contained.

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.	Report Title, Figure 1.3
√	Plan showing the site and location of all existing services.	Figure 1.5
√	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.	Section 3.2 Figure 1.3
√	Summary of Pre-consultation Meeting with City and other approval agencies.	Section 1.6
√	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.	Sections 1.3, 2.2, 3.2
√	Statement of objectives and servicing criteria	Section 2.2.1, 2.2.3, 3.3 & 4.2
√	Identification of existing and proposed infrastructure available in the immediate area.	Figure 1.5
√	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).	Sections 1.9, 4.6
√	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.	Detail Design
√	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.	Figure 1.3
√	Reference to geotechnical studies and recommendations concerning servicing.	Section 1.8

√	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 • Property limits including bearings and dimensions • Existing and proposed structures and parking areas • Easements, road widening and rights-of-way • Adjacent street names	Noted

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	Sections 2.2.1
√	Identify boundary conditions	Section 2.2.1 & 2.2.4, Appendix B
√	Confirmation of adequate domestic supply and pressure	Section 2.3 & Appendix B
√	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 2.3 & Appendix B
√	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.	Appendix B
	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defining phases of the project including the ultimate design.	Section 2.2.4, 2.3
	Address reliability requirements such as appropriate location of shut-off valves.	Detail Design
√	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 Appendix B
√	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.	Section 2.3 Detail Design
√	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 B

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.	Detail Design
√	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 3.2, Appendix C
√	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 3.2, 3.4
	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix "C") format.	Section 3.3 & Detail Design
√	Description of proposed sewer network including sewers, pumping stations and forcemains.	Section 3.4 & Figure 3.12 in Appendix C
√	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 1.9
√	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	Section 3.2, 3.4, Appendix C
√	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.	Detail Design
√	Special considerations such as contamination, corrosive environment etc.	Detail Design

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, Appendix D
√	Analysis of available capacity in existing public infrastructure.	Section 4.1, 4.3, Appendix D
√	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Section 1.7, Figure 2.13 in Appendix A

√	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.	N/A
√	Set-back from private sewage disposal systems.	N/A
√	Watercourse and hazard lands setbacks.	Section 1.9, 4.6
√	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	Section 1.6
√	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).	N/A
√	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 1.9, 4.6
	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.	Section 1.7
√	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	Section 4.2, 4.3, Appendix D
	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 Detail Design
√ √	100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Section 4.4 Detail Design
	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 1.8,

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 1.6, 1.9, 4.6
	Application for Certification of Approval (CofA) under the Ontario Water resources Act.	Detail Design
√	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

CONCLUSION CHECKLIST

	ITEM DESCRIPTION	LOCATION
√	Clearly stated conclusions and recommendations	Section 7.1 & 7.2
	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.	Detail Design
√	All draft and final reports shall be signed and stamped by professional Engineer registered in Ontario.	Completed

PC2014-0240 – 4789 Bank Street Leitrim Exp 9a, Claridge

October 20 2014 Meeting Notes

General –
- Both the EMP and the MSS should be done prior to submission

Plan – General
- Ensure road and path connection to the north and south
- Maintain an open view and frontages of the parks and storm blocks to the public streets
- Push street 7 across to Street 2
- Look to break up blocks of towns with more of a variety in housing types.

Transportation
- Street 1 is 26 m r.o.w.
- Second entrance to bank may be need through 9B
- Sidewalks along street 1 and 3
- Sidewalk connections between collectors and parks, schools and storm blocks.
- Collector transit likely street 1 and 12 to Rotary Way. Contact OC transpo
- A TIS will be required – with Community Transportation Study component to look at Bank Street intersection(s). TIS needs to address all modes
- Noise study will be needed for Bank Street
- Findlay Creek intersection may need RMA and may need to be wider than the 26 m to accommodate turn lines and signals
- Street 10, 13 and 14 intersections are too close on Street 12. As option extend St. 9 north, remove the extension of 10 and add a walkway block out to 12
- Local roads minimum of 18m

Parks – Master Plan for parks as a requirement for subdivision
- Implementation of landowners agreement needs to be sorted out
- Need concept plans for parks in and for subdivision

Infrastructure – must all comply with MSS
- Proximate to Analdea wells – so will need a groundwater impact assessment
- Indicated these are not clay soils. A geotechnical study is still needed
- Stormwater management report is required
- Adequacy of services and hydraulic watermain analysis needed

Other – Archaeological Assessment is needed
- Phase 1 ESA needed may lead to Record of Site Condition abutting Bank Street uses.
- Per Development Community (Expansion Area) of the Official Plan a Financial Implementation Plan will be needed
- Bird hazard report needed due to proximity of airport

Environmental – EIS, TCR and Endangered Species needed.

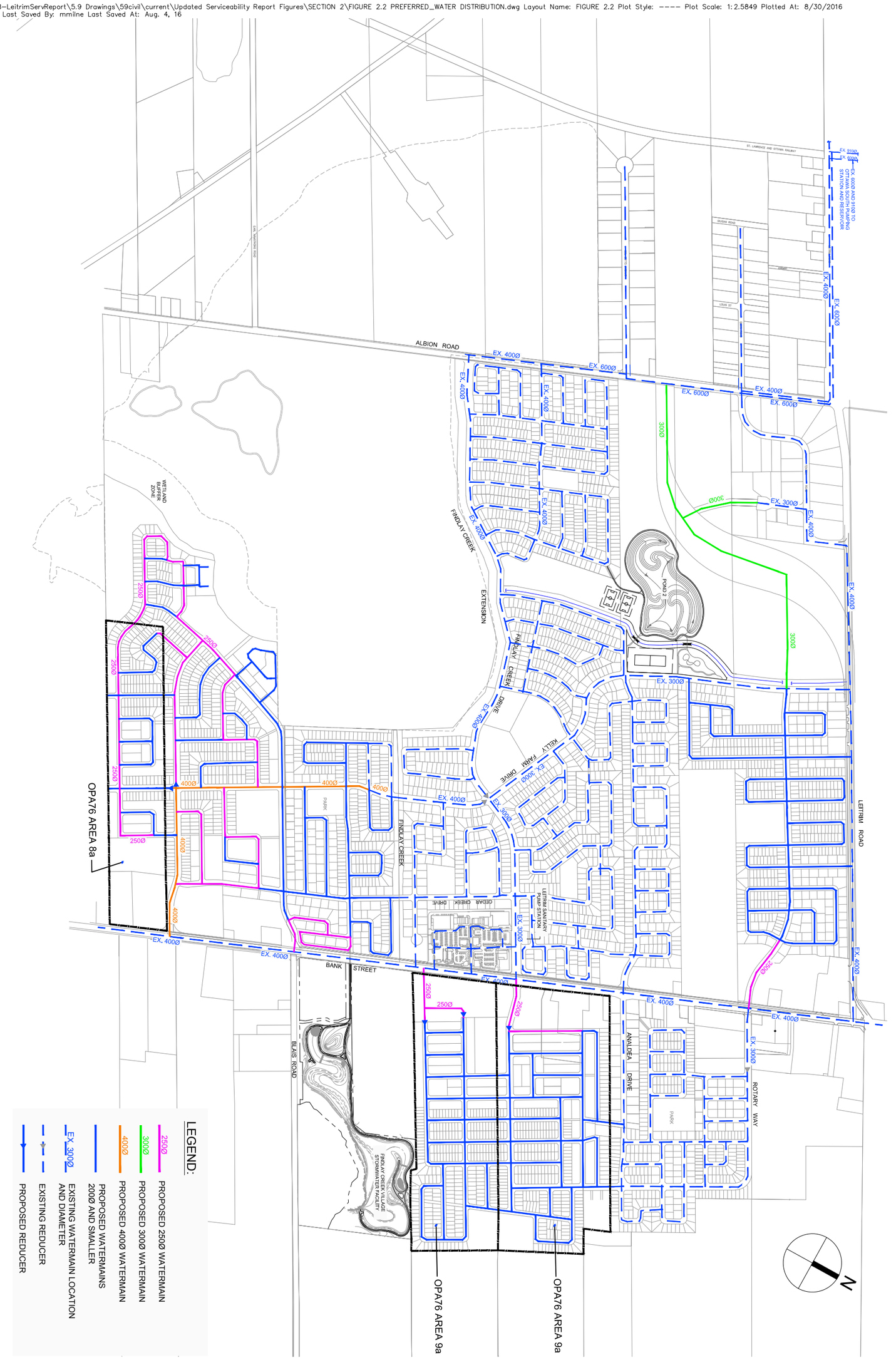
Sheet No.	Drawing Title	Project Title	Scale
FIGURE 8.1	MACRO GRADING AND DRAINAGE PLAN	UPDATED SERVICEABILITY PLAN (CLASS EA OPA76 AREAS 8a, 9a and 9b) LEITRIM DEVELOPMENT AREA	N.T.S.

IBI

APPENDIX B

- **Figure 2.2 from the Updated Serviceability Plan Leitrim Development Area**
- **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: 8/30/2016 9:49 AM Last Saved By: mmilne Last Saved At: Aug. 4, 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 : CLARIDGE LANDS
LEITRIM DEVELOPMENT AREA
LOCATION : CITY OF OTTAWA

FILE: 34674-5.7
DATE PRINTED: 5-Oct-17
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	TOWN HOUSE UNITS	MEDIUM DENSITY (ha)	POPULATION	INDUST. (ha)	COMM. (ha)	INSTIT. (ha)	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	
S13-010		14		38				0.15		0.15	0.38		0.38	0.84		0.84	10,000
S13-020	8	4		38			4.21	0.15	2.44	2.59	0.38	3.65	4.04	0.85	6.58	7.42	15,000
S13-026		9		24		4.59		0.10	2.66	2.75	0.25	3.98	4.23	0.54	7.17	7.71	10,000
S13-041		28		76				0.31		0.31	0.77		0.77	1.68		1.68	10,000
S13-050		24		65				0.26		0.26	0.66		0.66	1.44		1.44	10,000
S13-060	20			68				0.28		0.28	0.69		0.69	1.52		1.52	10,000
S13-065		19		51				0.21		0.21	0.52		0.52	1.14		1.14	10,000
S13-070		22		59				0.24		0.24	0.60		0.60	1.32		1.32	10,000
S13-080		37		100				0.40		0.40	1.01		1.01	2.23		2.23	10,000
S13-090		39		105				0.43		0.43	1.07		1.07	2.35		2.35	10,000
S13-115	5	8		39				0.16		0.16	0.39		0.39	0.86		0.86	10,000
S13-125	12	4		52				0.21		0.21	0.52		0.52	1.15		1.15	10,000
S13-135	5	10		44				0.18		0.18	0.45		0.45	0.98		0.98	10,000
S13-145	6	10		47				0.19		0.19	0.48		0.48	1.06		1.06	10,000
S13-155	9			31				0.12		0.12	0.31		0.31	0.68		0.68	10,000
S13-165	21			71				0.29		0.29	0.72		0.72	1.59		1.59	10,000
S13-175	8			27				0.11		0.11	0.28		0.28	0.61		0.61	10,000
S13-185	8			27				0.11		0.11	0.28		0.28	0.61		0.61	10,000
S13-195	14			48				0.19		0.19	0.48		0.48	1.06		1.06	10,000
S13-205	9	6		47				0.19		0.19	0.47		0.47	1.04		1.04	10,000
S13-215	4	3		22				0.09		0.09	0.22		0.22	0.48		0.48	10,000
S13-225		33		89				0.36		0.36	0.90		0.90	1.99		1.99	10,000
S13-235		32		86				0.35		0.35	0.88		0.88	1.93		1.93	10,000
S13-245		24		65				0.26		0.26	0.66		0.66	1.44		1.44	10,000
S13-265		36		97				0.39		0.39	0.98		0.98	2.17		2.17	10,000
S13-275	1	8		25				0.10		0.10	0.25		0.25	0.56		0.56	10,000
S14-270		23		62				0.25		0.25	0.63		0.63	1.38		1.38	15,000
S14-280		32		86				0.35		0.35	0.88		0.88	1.93		1.93	10,000
S14-290	18			61				0.25		0.25	0.62		0.62	1.36		1.36	10,000
S14-300	28			95				0.39		0.39	0.96		0.96	2.12		2.12	10,000
S14-500	20			68				0.28		0.28	0.69		0.69	1.52		1.52	10,000
TOTALS	**196**	**425**		**1,814**						**12.44**			**26.01**			**54.16**	

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

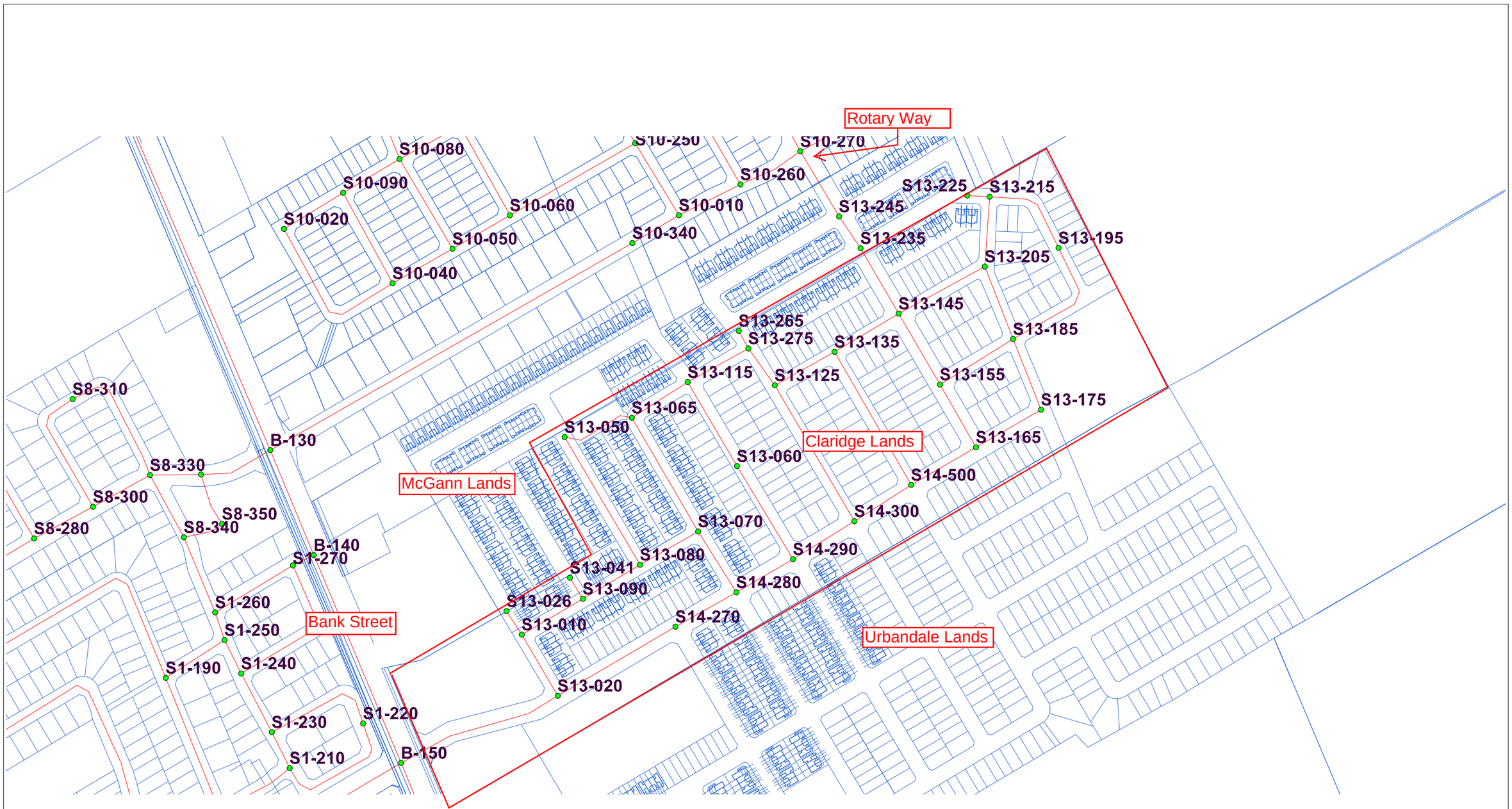
PEAKING FACTORS

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)

Claridge Lands - Node Id's

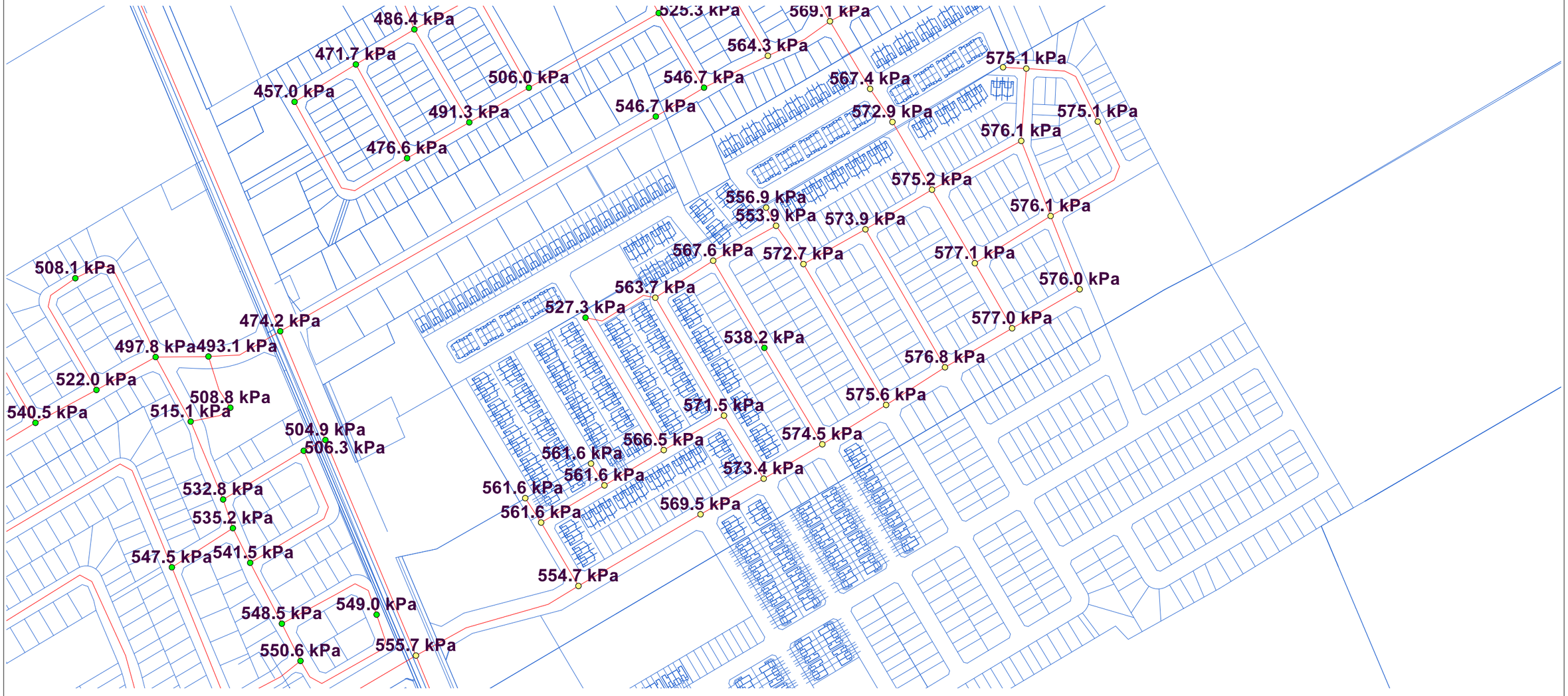


Date: Friday, October 06, 2017

Claridge Lands - Pipe Sizes

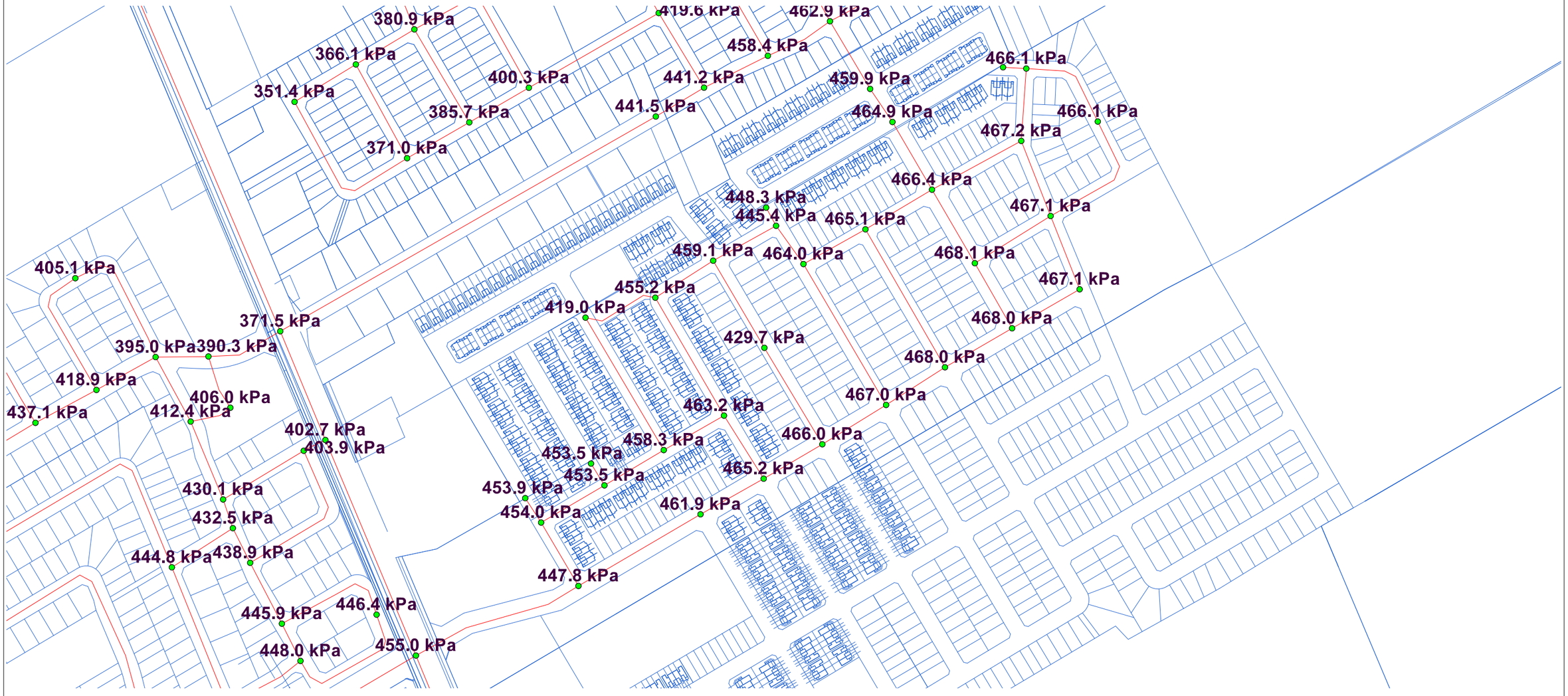
Date: Thursday, October 05, 2017

Claridge Lands - Basic Day (Max HGL) Pressures



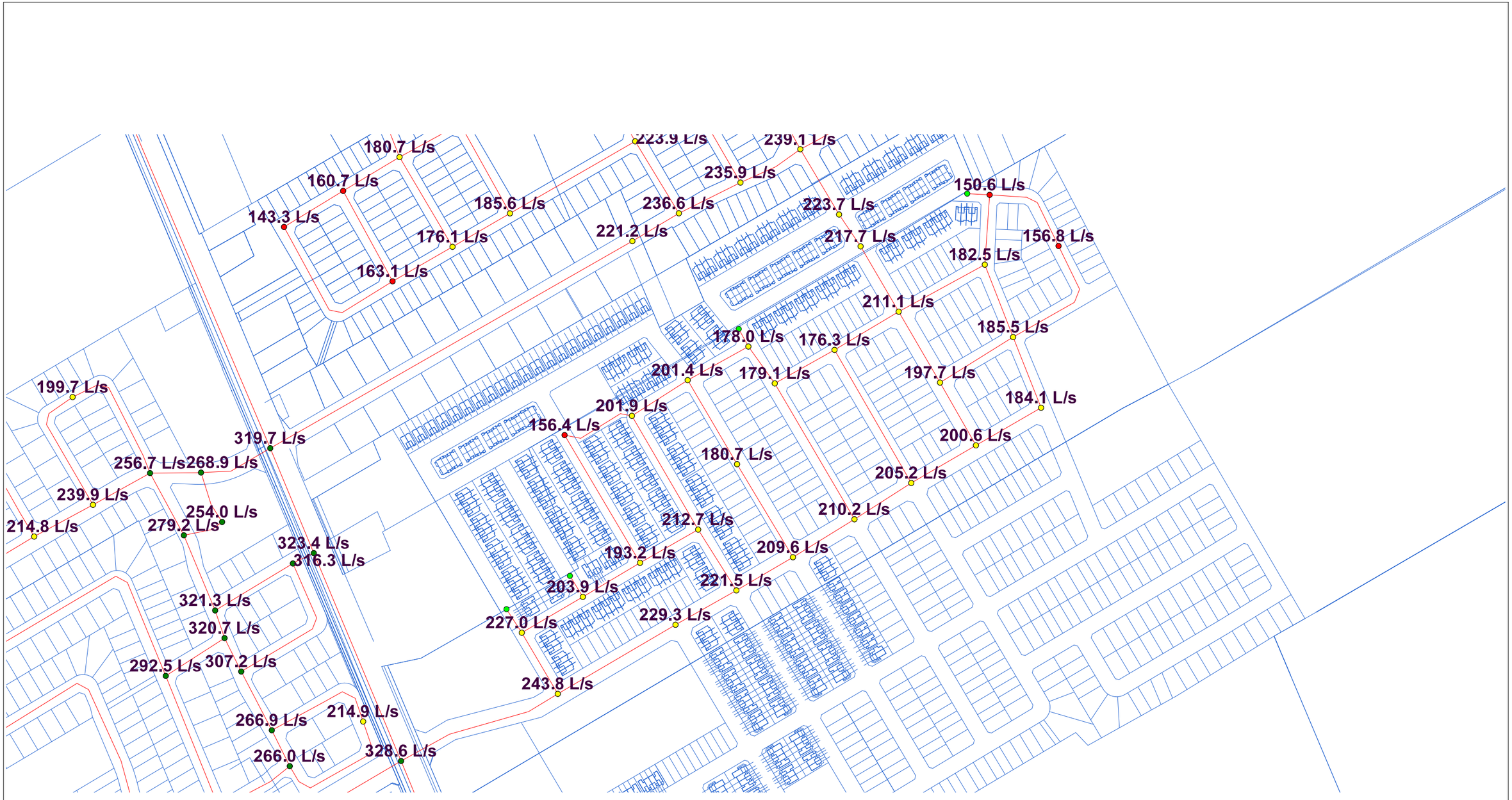
Date: Thursday, October 05, 2017

Claridge Lands - HGL 144m - Peak Hour Pressures



Date: Thursday, October 05, 2017

Claridge Lands - HGL 144m - Max Day + Fire - Fire Design Flows



Date: Thursday, October 05, 2017

Basic Day (Max HGL) HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
42		S10-090	0.11	103.50	151.64	471.73
43		S10-100	0.47	105.00	151.70	457.62
44		S10-101	0.11	104.85	151.68	458.85
45		S10-105	0.17	104.75	151.67	459.74
46		S10-110	0.23	104.50	151.66	462.11
47		S10-120	0.21	102.00	151.64	486.44
48		S10-130	0.04	99.70	151.62	508.82
49		S10-140	0.09	99.00	151.62	515.66
50		S10-150	0.18	97.80	151.62	527.38
51		S10-160	0.12	103.00	151.64	476.66
52		S10-180	0.12	104.00	151.66	467.06
53		S10-190	0.18	101.00	151.65	496.37
54		S10-200	0.11	103.50	151.63	471.63
55		S10-210	0.16	101.50	151.63	491.19
56		S10-220	0.28	99.00	151.61	515.54
57		S10-230	0.15	98.20	151.61	523.33
58		S10-250	0.13	98.00	151.61	525.29
59		S10-260	0.10	94.00	151.59	564.32
60		S10-270	0.14	93.50	151.58	569.10
61		S10-280	0.09	93.00	151.58	574.08
62		S10-290	0.19	94.00	151.60	564.40
63		S10-300	0.33	96.00	151.61	544.90
64		S10-310	0.13	94.50	151.60	559.51
65		S10-330	0.17	95.80	151.60	546.79
66		S10-340	0.00	95.80	151.59	546.73
67		S13-010	0.15	94.00	151.31	561.58
68		S13-020	2.59	94.70	151.31	554.73
69		S13-026	2.75	94.00	151.31	561.57
70		S13-041	0.31	94.00	151.31	561.59
71		S13-050	0.26	97.50	151.31	527.34
72		S13-060	0.28	96.40	151.33	538.23
73		S13-065	0.21	93.80	151.32	563.65
74		S13-070	0.24	93.00	151.32	571.47
75		S13-080	0.40	93.50	151.31	566.52
76		S13-090	0.43	94.00	151.31	561.59
77		S13-115	0.16	93.40	151.32	567.62
78		S13-125	0.21	92.90	151.34	572.68
79		S13-135	0.18	92.80	151.36	573.87
80		S13-145	0.19	92.70	151.40	575.22
81		S13-155	0.12	92.50	151.39	577.05
82		S13-165	0.29	92.50	151.38	576.97

Basic Day (Max HGL) HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
83		S13-175	0.11	92.60	151.38	576.02
84		S13-185	0.11	92.60	151.39	576.06
85		S13-195	0.19	92.70	151.39	575.08
86		S13-205	0.19	92.60	151.39	576.12
87		S13-215	0.09	92.70	151.39	575.09
88		S13-225	0.36	92.70	151.39	575.09
89		S13-235	0.35	93.00	151.47	572.92
90		S13-245	0.26	93.60	151.50	567.40
91		S13-265	0.39	94.50	151.33	556.87
92		S13-275	0.10	94.80	151.33	553.93
93		S14-270	0.25	93.20	151.31	569.46
94		S14-280	0.35	92.80	151.32	573.44
95		S14-290	0.25	92.70	151.33	574.50
96		S14-300	0.39	92.60	151.34	575.63
97		S14-500	0.28	92.50	151.36	576.79
98		S2-100	0.16	95.00	151.99	558.48
99		S2-110	0.19	94.60	152.08	563.30
100		S2-120	0.11	94.18	152.08	567.35
101		S3-110	0.15	94.85	152.69	566.82
102		S3-120	0.25	94.39	152.66	570.95
103		S3-130	0.15	94.29	152.59	571.34
104		S3-140	0.46	94.90	152.38	563.26
105		S3-160	0.32	93.92	152.46	573.60
106		S3-180	0.45	94.29	152.54	570.83
107		S3-190	0.28	94.60	152.34	565.83
108		S3-210	0.18	94.18	152.22	568.76
109		S3-400	0.10	94.09	152.66	573.94
110		S3-410	0.19	94.20	152.61	572.34
111		S3-420	0.11	93.92	152.56	574.62
112		S3-430	0.33	93.32	152.39	578.88
113		S3-450	0.20	93.58	151.59	568.45
114		S3-460	0.16	93.82	151.59	566.06
115		S3-480	0.27	94.16	151.58	562.62
116		S3-500	0.13	93.71	151.54	566.66
117		S3-510	0.22	93.95	151.53	564.26
118		S3-530	0.12	93.89	151.53	564.80
119		S3B-100	0.24	93.55	152.17	574.42
120		S3B-105	0.17	93.60	152.03	572.57
121		S3B-110	0.13	93.65	152.05	572.25
122		S3B-120	0.35	93.75	151.91	569.91
123		S3B-140	0.18	93.95	151.49	563.85

Peak Hour - HGL 144m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
42		S10-090	0.60	103.50	140.86	366.11
43		S10-100	0.71	105.00	141.02	352.95
44		S10-101	0.18	104.85	140.96	353.83
45		S10-105	0.27	104.75	140.93	354.58
46		S10-110	0.36	104.50	140.91	356.83
47		S10-120	0.32	102.00	140.88	380.98
48		S10-130	0.24	99.70	140.84	403.16
49		S10-140	0.48	99.00	140.84	409.97
50		S10-150	0.96	97.80	140.83	421.63
51		S10-160	0.18	103.00	140.88	371.21
52		S10-180	0.18	104.00	140.93	361.88
53		S10-190	0.27	101.00	140.91	391.07
54		S10-200	0.60	103.50	140.85	366.01
55		S10-210	0.84	101.50	140.84	385.52
56		S10-220	0.43	99.00	140.82	409.81
57		S10-230	0.23	98.20	140.82	417.62
58		S10-250	0.68	98.00	140.82	419.63
59		S10-260	0.56	94.00	140.78	458.45
60		S10-270	0.76	93.50	140.74	462.89
61		S10-280	0.48	93.00	140.75	467.95
62		S10-290	0.69	94.00	140.78	458.44
63		S10-300	0.65	96.00	140.81	439.06
64		S10-310	0.43	94.50	140.79	453.58
65		S10-330	0.40	95.80	140.80	440.94
66		S10-340	0.00	95.80	140.86	441.51
67		S13-010	0.84	94.00	140.33	454.01
68		S13-020	7.42	94.70	140.40	447.80
69		S13-026	7.71	94.00	140.32	453.95
70		S13-041	1.68	94.00	140.28	453.50
71		S13-050	1.44	97.50	140.26	418.99
72		S13-060	1.52	96.40	140.25	429.72
73		S13-065	1.14	93.80	140.26	455.23
74		S13-070	1.32	93.00	140.26	463.15
75		S13-080	2.23	93.50	140.26	458.26
76		S13-090	2.35	94.00	140.28	453.51
77		S13-115	0.86	93.40	140.25	459.12
78		S13-125	1.15	92.90	140.25	464.02
79		S13-135	0.98	92.80	140.26	465.09
80		S13-145	1.06	92.70	140.30	466.43
81		S13-155	0.68	92.50	140.27	468.14
82		S13-165	1.59	92.50	140.26	468.04

Peak Hour - HGL 144m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
83		S13-175	0.61	92.60	140.26	467.06
84		S13-185	0.61	92.60	140.26	467.07
85		S13-195	1.06	92.70	140.26	466.06
86		S13-205	1.04	92.60	140.28	467.19
87		S13-215	0.48	92.70	140.26	466.05
88		S13-225	1.99	92.70	140.26	466.04
89		S13-235	1.93	93.00	140.44	464.87
90		S13-245	1.44	93.60	140.53	459.88
91		S13-265	2.17	94.50	140.25	448.30
92		S13-275	0.56	94.80	140.25	445.37
93		S14-270	1.38	93.20	140.34	461.92
94		S14-280	1.93	92.80	140.27	465.20
95		S14-290	1.36	92.70	140.26	466.03
96		S14-300	2.12	92.60	140.26	467.00
97		S14-500	1.52	92.50	140.26	467.99
98		S2-100	0.88	95.00	141.36	454.33
99		S2-110	1.05	94.60	141.43	458.86
100		S2-120	0.60	94.18	141.43	462.98
101		S3-110	0.23	94.85	141.88	460.85
102		S3-120	0.38	94.39	141.85	465.06
103		S3-130	0.23	94.29	141.80	465.58
104		S3-140	1.65	94.90	141.61	457.76
105		S3-160	0.50	93.92	141.71	468.31
106		S3-180	0.68	94.29	141.76	465.21
107		S3-190	1.53	94.60	141.57	460.30
108		S3-210	0.96	94.18	141.49	463.65
109		S3-400	0.52	94.09	141.86	468.13
110		S3-410	1.01	94.20	141.80	466.49
111		S3-420	0.60	93.92	141.79	469.05
112		S3-430	0.51	93.32	141.67	473.75
113		S3-450	0.30	93.58	141.21	466.72
114		S3-460	0.25	93.82	141.21	464.37
115		S3-480	0.41	94.16	141.21	461.04
116		S3-500	0.20	93.71	141.21	465.45
117		S3-510	0.36	93.95	141.21	463.10
118		S3-530	0.19	93.89	141.21	463.69
119		S3B-100	0.36	93.55	141.54	470.31
120		S3B-105	0.26	93.60	141.47	469.10
121		S3B-110	0.19	93.65	141.48	468.71
122		S3B-120	0.54	93.75	141.41	467.04
123		S3B-140	0.27	93.95	141.21	463.10

		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)
55		S10-250	166.80	S10-020	210.87	119.52	223.90	240.07	S10-020	117.68	110.01	223.90	223.90
56		S10-260	166.77	S10-020	219.72	116.42	235.91	249.17	S10-020	122.91	106.54	235.92	235.91
57		S10-270	166.81	S10-020	221.92	116.15	239.11	261.35	S10-020	111.49	104.88	239.12	239.11
58		S10-280	166.76	S10-020	220.23	115.47	236.62	216.78	S10-280	139.96	107.28	216.78	216.78
59		S10-290	166.86	S10-020	219.31	116.38	235.41	238.73	S10-200	135.14	107.79	235.26	235.26
60		S10-300	167.03	S10-020	218.06	118.25	233.87	250.08	S10-200	110.18	107.24	229.72	229.72
61		S10-310	166.80	S10-020	218.95	116.84	234.82	258.50	S10-200	106.32	105.35	234.92	234.82
62		S10-330	166.84	S10-020	217.61	118.01	233.00	238.83	S10-020	132.42	109.31	233.00	233.00
63		S10-340	166.67	S10-020	226.29	118.89	246.28	221.19	S10-340	139.96	110.08	221.19	221.19
64		S13-010	250.38	S13-010	91.32	103.32	227.88	227.88	S13-050	138.31	108.11	226.98	226.98
65		S13-020	254.04	S13-050	122.26	107.18	243.80	254.37	S13-050	121.67	107.12	243.81	243.80
66		S13-050	167.33	S13-050	108.51	108.57	156.44	156.44	S13-050	139.96	111.78	156.44	156.44
67		S13-060	167.36	S13-060	172.49	114.00	180.70	180.71	S13-060	139.96	110.68	180.71	180.70
68		S13-065	167.19	S13-050	212.76	115.51	204.91	201.87	S13-065	139.96	108.08	201.87	201.87
69		S13-070	167.27	S13-050	223.09	115.77	212.70	212.69	S13-070	139.96	107.28	212.69	212.69
70		S13-080	167.68	S13-050	193.88	113.28	193.21	201.26	S13-050	121.90	105.94	193.21	193.21
71		S13-090	167.74	S13-050	216.60	116.10	208.20	203.92	S13-090	139.96	108.28	203.92	203.92
72		S13-115	167.06	S13-060	211.87	115.02	201.89	202.35	S13-275	137.63	107.44	201.36	201.36
73		S13-125	167.19	S13-125	173.39	110.59	179.06	179.07	S13-125	139.96	107.18	179.07	179.06
74		S13-135	167.12	S13-135	166.70	109.81	176.35	176.35	S13-135	139.96	107.08	176.35	176.35
75		S13-145	167.15	S13-145	238.64	117.05	211.14	211.14	S13-145	139.96	106.98	211.14	211.14
76		S13-155	166.98	S13-155	216.03	114.55	197.71	197.71	S13-155	139.96	106.78	197.71	197.71
77		S13-165	167.39	S13-165	220.62	115.01	200.62	200.62	S13-165	139.96	106.78	200.62	200.62
78		S13-175	166.95	S13-175	186.86	111.67	184.09	184.11	S13-175	139.96	106.88	184.11	184.09
79		S13-185	166.95	S13-185	190.17	112.01	185.51	185.53	S13-185	139.96	106.88	185.53	185.51
80		S13-195	167.15	S13-195	104.26	103.34	156.81	156.82	S13-195	139.96	106.98	156.82	156.81
81		S13-205	167.14	S13-205	182.67	111.24	182.52	182.53	S13-205	139.96	106.88	182.53	182.52
82		S13-215	166.89	S13-215	80.21	100.89	150.57	150.58	S13-215	139.96	106.98	150.58	150.57
83		S13-235	167.55	S10-020	234.27	116.91	260.37	217.68	S13-235	139.96	107.28	217.68	217.68
84		S13-245	167.33	S10-020	230.90	117.16	254.02	223.67	S13-245	139.96	107.88	223.67	223.67
85		S13-275	166.92	S13-275	169.24	112.07	178.01	178.01	S13-275	139.96	109.08	178.01	178.01
86		S14-270	250.63	S14-270	92.70	102.66	229.33	229.33	S14-270	139.96	107.48	229.33	229.33
87		S14-280	167.55	S13-050	234.63	116.74	222.71	227.91	S13-060	127.27	105.79	221.53	221.53
88		S14-290	167.29	S13-060	222.83	115.44	209.59	218.65	S13-060	120.65	105.01	209.59	209.59
89		S14-300	167.63	S13-060	233.27	116.41	217.92	210.19	S14-300	139.96	106.88	210.19	210.19
90		S14-500	167.36	S14-500	228.73	115.84	205.20	205.20	S14-500	139.96	106.78	205.20	205.20
91		S2-100	166.83	S2-100	265.70	122.11	230.33	230.33	S2-100	139.96	109.28	230.33	230.33
92		S2-110	166.86	S10-020	276.51	122.82	386.95	257.20	S2-110	139.96	108.88	257.20	257.20
93		S2-120	166.78	S10-020	275.98	122.34	382.62	281.34	S2-120	139.96	108.46	281.34	281.34
94		S3-110	166.82	S10-020	288.27	124.27	440.66	473.91	S10-020	117.73	106.86	440.66	440.66
95		S3-120	166.92	S10-020	288.62	123.84	436.05	466.18	S10-020	119.61	106.60	436.05	436.05
96		S3-130	166.82	S10-020	287.47	123.63	433.05	478.39	S10-020	108.15	105.33	433.05	433.05
97		S3-140	167.13	S3-140	261.39	121.57	224.99	224.99	S3-140	139.96	109.18	224.99	224.99
98		S3-160	166.99	S10-020	285.60	123.07	414.98	517.31	B-210	61.01	100.15	423.20	414.98
99		S3-180	250.45	S10-020	247.06	119.50	428.91	465.28	S10-020	114.51	105.98	428.91	428.91
100		S3-190	166.95	S3-190	150.97	110.01	170.45	170.45	S3-190	139.96	108.88	170.45	170.45
101		S3-210	166.85	S3-210	157.03	110.20	172.32	172.32	S3-210	139.96	108.46	172.32	172.32
102		S3-400	166.77	S10-020	289.33	123.62	432.86	531.59	S10-020	67.97	101.03	432.86	432.86
103		S3-410	166.86	S3-410	-115.51	82.41	119.96	119.96	S3-410	139.96	108.48	119.96	119.96
104		S3-420	166.78	S10-020	287.40	123.25	423.52	523.98	S10-020	64.91	100.54	423.52	423.52
105		S3-430	167.00	S10-020	284.18	122.32	408.88	474.23	B-210	83.54	101.85	407.55	407.55
106		S3-450	166.87	S3-450	216.15	115.64	197.37	197.37	S3-450	139.96	107.86	197.37	197.37
107		S3-460	166.83	S3-460	246.14	118.94	215.40	215.40	S3-460	139.96	108.10	215.40	215.40
108		S3-480	166.94	S10-020	268.99	121.61	355.51	275.52	S3-480	139.96	108.44	275.52	275.52

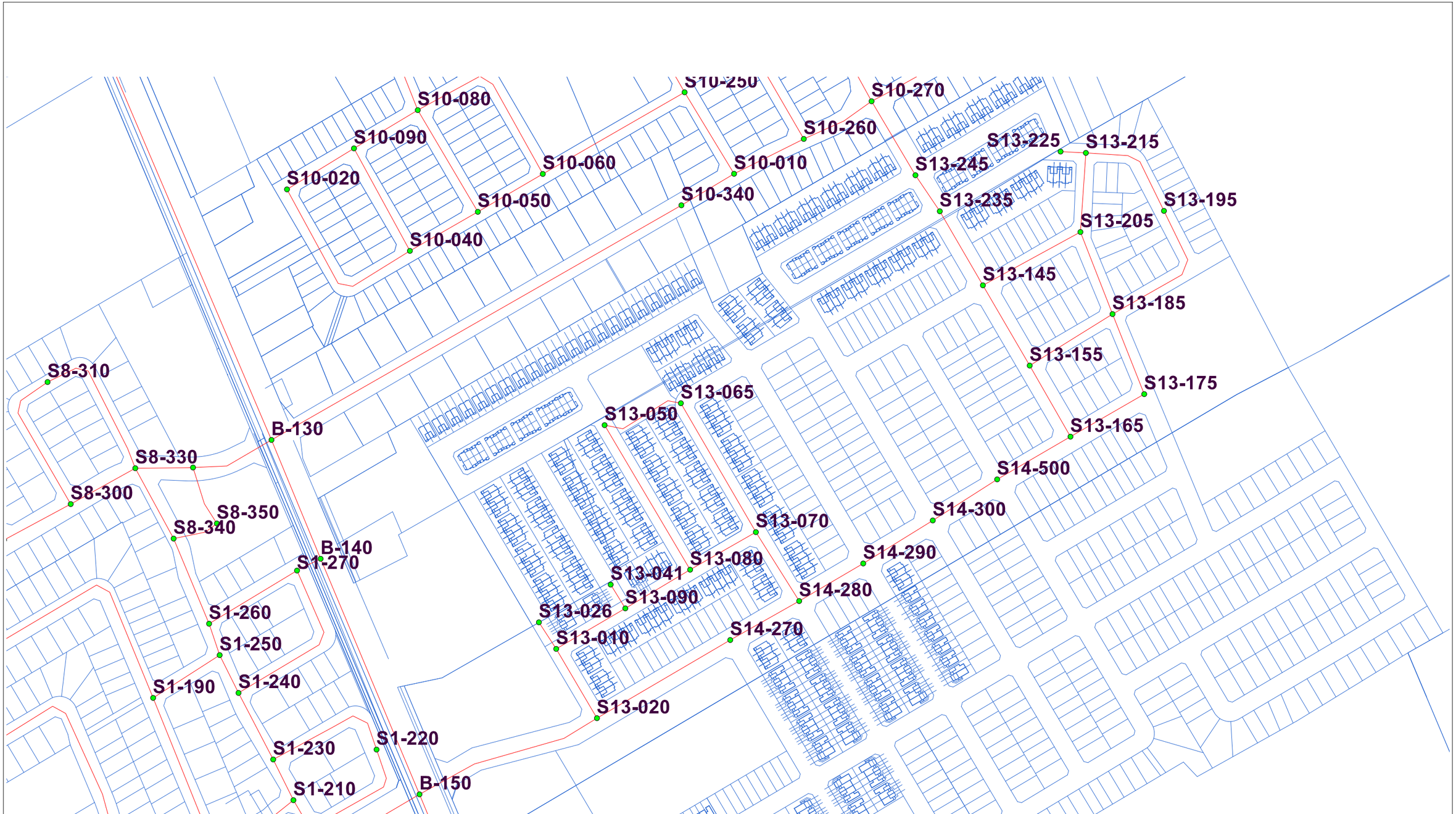
Peak Hour - HGL 144m - Pipe Report

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
56		1009	S10-200	S10-150	288.44	204.00	110.00	2.90	0.09	0.02	0.08
57		1003	S10-210	S10-130	74.32	204.00	110.00	0.71	0.02	0.000	0.01
58		1047	S10-220	S10-300	157.24	204.00	110.00	3.18	0.10	0.02	0.10
59		1637	S10-230	S10-220	74.71	204.00	110.00	-2.01	0.06	0.00	0.04
60		1023	S10-250	S10-230	43.73	204.00	110.00	3.64	0.11	0.01	0.12
61		1027	S10-250	S10-010	95.90	204.00	110.00	0.20	0.01	0.0000	0.000
62		1031	S10-260	S10-270	78.44	204.00	110.00	8.53	0.26	0.05	0.60
63		1033	S10-270	S10-280	122.73	204.00	110.00	-3.88	0.12	0.02	0.14
64		1035	S10-280	S10-290	171.30	204.00	110.00	-4.36	0.13	0.03	0.17
65		1037	S10-290	S10-300	239.92	204.00	110.00	-3.09	0.09	0.02	0.09
66		1039	S10-300	S10-310	81.31	204.00	110.00	5.11	0.16	0.02	0.23
67		1043	S10-300	S10-150	75.59	204.00	110.00	-5.67	0.17	0.02	0.28
68		1633	S10-310	S10-330	81.88	204.00	110.00	-3.65	0.11	0.01	0.12
69		1041	S10-310	S10-270	142.54	204.00	110.00	6.37	0.19	0.05	0.35
70		1061	S10-310	S10-290	77.74	204.00	110.00	1.96	0.06	0.00	0.04
71		1635	S10-330	S10-230	80.12	204.00	110.00	-5.42	0.17	0.02	0.26
72		1051	S10-330	S10-260	140.78	155.00	100.00	1.37	0.07	0.01	0.09
73		1557	S10-340	B-130	475.25	204.00	110.00	-7.96	0.24	0.25	0.53
74		153	S1-100	S1-170	56.78	204.00	110.00	4.57	0.14	0.01	0.19
75		331	S1-100	S1-290	57.94	204.00	110.00	2.24	0.07	0.00	0.05
76		109	S1-100	S3B-190	182.57	297.00	120.00	30.01	0.43	0.15	0.84
77		107	S1-110	S1-100	164.87	297.00	120.00	36.83	0.53	0.20	1.23
78		149	S1-120	S1-110	51.61	204.00	110.00	-3.01	0.09	0.00	0.09
79		151	S1-120	S2-120	108.86	204.00	110.00	-3.79	0.12	0.01	0.13
80		147	S1-140	S1-120	354.02	204.00	110.00	-5.55	0.17	0.10	0.27
81		157	S1-150	S1-190	379.11	204.00	110.00	5.06	0.15	0.09	0.23
82		155	S1-150	S1-140	78.11	204.00	110.00	-10.38	0.32	0.07	0.86
83		669	S1-150	S1-170	356.22	204.00	110.00	3.71	0.11	0.05	0.13
84		161	S1-170	S1-180	83.92	204.00	110.00	6.84	0.21	0.03	0.40
85		163	S1-180	S1-190	162.82	204.00	110.00	2.11	0.06	0.01	0.05
86		165	S1-180	S1-210	94.05	204.00	110.00	4.32	0.13	0.02	0.17
87		167	S1-210	S1-230	45.73	204.00	110.00	3.01	0.09	0.00	0.09
88		667	S1-220	S1-210	152.34	204.00	110.00	-1.21	0.04	0.00	0.02
89		183	S1-230	S1-240	75.46	204.00	110.00	3.84	0.12	0.01	0.14
90		185	S1-230	S1-220	135.92	204.00	110.00	-1.01	0.03	0.00	0.01
91		169	S1-240	S1-250	42.48	204.00	110.00	-0.71	0.02	0.000	0.01
92		779	S1-240	S1-270	175.60	204.00	110.00	4.34	0.13	0.03	0.17
93		175	S1-250	S1-190	79.62	204.00	110.00	-5.70	0.17	0.02	0.28
94		171	S1-250	S1-260	33.34	204.00	110.00	4.91	0.15	0.01	0.22
95		179	S1-270	S1-260	103.44	204.00	110.00	-5.02	0.15	0.02	0.22
96		333	S1-290	S3-480	119.54	204.00	110.00	1.04	0.03	0.00	0.01
97		343	S1-300	S3-460	118.34	155.00	100.00	0.12	0.01	0.0000	0.000
98		341	S1-300	S1-290	168.86	204.00	110.00	-0.86	0.03	0.00	0.01
99		1891	S13-020	S14-270	155.49	250.00	110.00	11.43	0.23	0.06	0.38
100		1893	S13-020	B-150	195.70	250.00	110.00	-36.15	0.74	0.63	3.23
101		1895	S13-020	S13-010	80.84	250.00	110.00	17.30	0.35	0.07	0.83
102		2117	S13-026	S13-010	31.93	250.00	110.00	-7.71	0.16	0.01	0.18
103		2119	S13-041	S13-090	28.06	204.00	110.00	-1.68	0.05	0.000	0.03
104		2111	S13-060	S13-115	111.04	204.00	110.00	0.56	0.02	0.000	0.00
105		2115	S13-065	S13-050	85.32	155.00	100.00	-0.66	0.04	0.00	0.02
106		1919	S13-065	S13-115	75.47	204.00	110.00	1.98	0.06	0.00	0.04
107		1905	S13-065	S13-070	150.00	204.00	110.00	-2.46	0.08	0.01	0.06
108		1909	S13-070	S13-080	76.21	155.00	100.00	-0.39	0.02	0.000	0.01
109		1907	S13-070	S14-280	81.87	204.00	110.00	-3.39	0.10	0.01	0.11
110		1911	S13-080	S13-090	75.88	204.00	110.00	-4.72	0.14	0.02	0.20

Peak Hour - HGL 144m - Pipe Report

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
111		1917	S13-080	S13-050	168.98	204.00	110.00	2.10	0.06	0.01	0.04
112		1913	S13-090	S13-010	80.61	204.00	110.00	-8.75	0.27	0.05	0.63
113		1927	S13-125	S13-275	51.66	155.00	100.00	1.05	0.06	0.00	0.06
114		1923	S13-125	S13-135	78.10	155.00	100.00	-1.57	0.08	0.01	0.12
115		1941	S13-125	S14-300	179.48	155.00	100.00	-0.62	0.03	0.00	0.02
116		1925	S13-135	S13-145	85.04	155.00	100.00	-3.17	0.17	0.04	0.44
117		1943	S13-135	S14-500	175.06	155.00	100.00	0.62	0.03	0.00	0.02
118		1945	S13-145	S13-155	93.51	204.00	110.00	5.63	0.17	0.03	0.28
119		1959	S13-145	S13-205	111.81	204.00	110.00	4.78	0.15	0.02	0.21
120		1947	S13-155	S13-165	82.41	204.00	110.00	3.59	0.11	0.01	0.12
121		1973	S13-155	S13-185	98.11	155.00	100.00	1.36	0.07	0.01	0.09
122		1949	S13-165	S14-500	85.34	204.00	110.00	2.36	0.07	0.00	0.06
123		1951	S13-165	S13-175	85.69	204.00	110.00	-0.35	0.01	0.000	0.00
124		1953	S13-175	S13-185	86.59	204.00	110.00	-0.96	0.03	0.000	0.01
125		1955	S13-185	S13-205	88.64	155.00	100.00	-1.68	0.09	0.01	0.13
126		1975	S13-185	S13-195	151.14	204.00	110.00	1.47	0.04	0.00	0.02
127		2041	S13-195	S13-215	110.93	204.00	110.00	0.41	0.01	0.000	0.00
128		1957	S13-205	S13-215	79.72	155.00	100.00	2.06	0.11	0.02	0.20
129		1971	S13-215	S13-225	25.54	204.00	110.00	1.99	0.06	0.00	0.04
130		1963	S13-235	S13-245	43.77	204.00	110.00	-16.58	0.51	0.09	2.05
131		1961	S13-235	S13-145	86.18	204.00	110.00	14.65	0.45	0.14	1.63
132		1965	S13-245	S10-270	86.46	204.00	110.00	-18.02	0.55	0.21	2.40
133		1929	S13-265	S13-275	22.79	204.00	110.00	-2.17	0.07	0.00	0.05
134		1931	S13-275	S13-115	79.06	204.00	110.00	-1.68	0.05	0.00	0.03
135		1887	S14-280	S14-270	79.69	204.00	110.00	-10.05	0.31	0.06	0.81
136		1939	S14-290	S13-060	123.66	204.00	110.00	2.08	0.06	0.01	0.04
137		1885	S14-290	S14-280	74.70	204.00	110.00	-4.73	0.14	0.02	0.20
138		1883	S14-300	S14-290	82.28	204.00	110.00	-1.29	0.04	0.00	0.02
139		1881	S14-500	S14-300	76.79	204.00	110.00	1.46	0.04	0.00	0.02
140		713	S2-100	S1-140	165.62	204.00	110.00	5.75	0.18	0.05	0.29
141		145	S2-110	S2-100	166.13	204.00	110.00	6.63	0.20	0.06	0.38
142		143	S2-110	S3-140	84.01	155.00	100.00	-7.65	0.41	0.19	2.23
143		141	S2-120	S2-110	264.85	204.00	110.00	0.03	0.00	0.00	0.00
144		111	S3-110	S8-100	98.30	204.00	110.00	15.65	0.48	0.18	1.85
145		1077	S3-110	L-150	809.68	297.00	120.00	-16.43	0.24	0.22	0.28
146		97	S3-120	S3-110	168.32	297.00	120.00	-13.04	0.19	0.03	0.18
147		741	S3-120	S4-210	230.06	155.00	100.00	-4.70	0.25	0.21	0.90
148		129	S3-130	S3-140	99.34	155.00	100.00	7.01	0.37	0.19	1.90
149		101	S3-130	S3-180	85.17	297.00	120.00	21.05	0.30	0.04	0.44
150		99	S3-130	S3-120	153.82	297.00	120.00	-17.35	0.25	0.05	0.31
151		739	S3-130	S4-240	250.39	204.00	110.00	-10.94	0.33	0.24	0.95
152		105	S3-160	S1-110	206.75	297.00	120.00	39.84	0.58	0.29	1.42
153		313	S3-160	S3-430	170.85	393.00	120.00	33.52	0.28	0.05	0.26
154		187	S3-160	S3-420	95.96	393.00	120.00	-60.40	0.50	0.08	0.79
155		133	S3-180	S3-190	103.45	155.00	100.00	6.92	0.37	0.19	1.85
156		103	S3-180	S3-160	283.87	297.00	120.00	13.46	0.19	0.05	0.19
157		135	S3-190	S3-210	342.86	155.00	100.00	2.24	0.12	0.08	0.23
158		139	S3-210	S2-120	84.39	155.00	100.00	4.43	0.23	0.07	0.81
159		137	S3-210	S3-190	181.26	155.00	100.00	-3.15	0.17	0.08	0.43
160		191	S3-400	S4-250	254.47	393.00	120.00	-62.53	0.52	0.21	0.84
161		309	S3-400	S3-410	272.65	155.00	100.00	2.14	0.11	0.06	0.21
162		311	S3-410	S3-420	287.06	155.00	100.00	1.13	0.06	0.02	0.06
163		189	S3-420	S3-400	98.04	393.00	120.00	-59.87	0.49	0.08	0.77
164		1295	S3-430	S3B-100	82.75	204.00	110.00	13.76	0.42	0.12	1.46
165		315	S3-430	S7-050	182.82	393.00	120.00	19.24	0.16	0.02	0.09

Claridge Lands - Phase 1



Date: Friday, October 06, 2017

Phase 1 Basic Day (Max HGL) HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
42		S10-090	0.11	103.50	151.70	472.28
43		S10-100	0.47	105.00	151.75	458.14
44		S10-101	0.11	104.85	151.73	459.39
45		S10-105	0.17	104.75	151.72	460.28
46		S10-110	0.23	104.50	151.71	462.65
47		S10-120	0.21	102.00	151.70	487.00
48		S10-130	0.04	99.70	151.68	509.39
49		S10-140	0.09	99.00	151.68	516.23
50		S10-150	0.18	97.80	151.68	527.95
51		S10-160	0.12	103.00	151.70	477.21
52		S10-180	0.12	104.00	151.72	467.60
53		S10-190	0.18	101.00	151.71	496.92
54		S10-200	0.11	103.50	151.69	472.19
55		S10-210	0.16	101.50	151.68	491.76
56		S10-220	0.28	99.00	151.67	516.12
57		S10-230	0.15	98.20	151.66	523.91
58		S10-250	0.13	98.00	151.66	525.87
59		S10-260	0.10	94.00	151.65	564.91
60		S10-270	0.14	93.50	151.64	569.74
61		S10-280	0.09	93.00	151.65	574.70
62		S10-290	0.19	94.00	151.66	565.00
63		S10-300	0.33	96.00	151.67	545.48
64		S10-310	0.13	94.50	151.66	560.11
65		S10-330	0.17	95.80	151.66	547.38
66		S10-340	0.00	95.80	151.65	547.29
67		S13-010	0.15	94.00	151.35	562.01
68		S13-020	2.59	94.70	151.35	555.17
69		S13-026	2.75	94.00	151.35	562.00
70		S13-041	0.31	94.00	151.35	562.01
71		S13-050	0.26	97.50	151.36	527.74
72		S13-065	0.21	93.80	151.36	564.03
73		S13-070	0.24	93.00	151.36	571.88
74		S13-080	0.40	93.50	151.35	566.93
75		S13-090	0.43	94.00	151.35	562.01
76		S13-145	0.19	92.70	151.51	576.26
77		S13-155	0.12	92.50	151.49	578.02
78		S13-165	0.29	92.50	151.47	577.89
79		S13-175	0.11	92.60	151.48	576.97
80		S13-185	0.11	92.60	151.49	577.03
81		S13-195	0.19	92.70	151.49	576.06
82		S13-205	0.19	92.60	151.50	577.14

Phase 1 Basic Day (Max HGL) HGL 155m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
83		S13-215	0.09	92.70	151.49	576.08
84		S13-225	0.36	92.70	151.49	576.07
85		S13-235	0.35	93.00	151.56	573.81
86		S13-245	0.26	93.60	151.58	568.20
87		S14-270	0.25	93.20	151.36	569.91
88		S14-280	0.35	92.80	151.36	573.89
89		S14-290	0.25	92.70	151.39	575.08
90		S14-300	0.39	92.60	151.41	576.32
91		S14-500	0.28	92.50	151.44	577.57
92		S2-100	0.16	95.00	152.03	558.85
93		S2-110	0.19	94.60	152.12	563.64
94		S2-120	0.11	94.18	152.11	567.70
95		S3-110	0.15	94.85	152.72	567.10
96		S3-120	0.25	94.39	152.68	571.24
97		S3-130	0.15	94.29	152.62	571.62
98		S3-140	0.46	94.90	152.41	563.57
99		S3-160	0.32	93.92	152.49	573.90
100		S3-180	0.45	94.29	152.57	571.13
101		S3-190	0.28	94.60	152.37	566.15
102		S3-210	0.18	94.18	152.26	569.10
103		S3-400	0.10	94.09	152.69	574.22
104		S3-410	0.19	94.20	152.64	572.62
105		S3-420	0.11	93.92	152.59	574.90
106		S3-430	0.33	93.32	152.42	579.18
107		S3-450	0.20	93.58	151.63	568.84
108		S3-460	0.16	93.82	151.63	566.45
109		S3-480	0.27	94.16	151.62	563.02
110		S3-500	0.13	93.71	151.58	567.05
111		S3-510	0.22	93.95	151.57	564.65
112		S3-530	0.12	93.89	151.57	565.19
113		S3B-100	0.24	93.55	152.20	574.74
114		S3B-105	0.17	93.60	152.06	572.90
115		S3B-110	0.13	93.65	152.08	572.59
116		S3B-120	0.35	93.75	151.94	570.26
117		S3B-140	0.18	93.95	151.53	564.23
118		S3B-145	0.18	94.10	151.19	559.40
119		S3B-150	0.12	93.25	151.14	567.28
120		S3B-160	0.17	93.60	151.13	563.72
121		S3B-170	0.23	95.80	151.19	542.81
122		S3B-180	0.21	95.80	151.17	542.62
123		S3B-190	0.00	95.80	151.37	544.54

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
42		S10-090	0.60	103.50	141.14	368.81
43		S10-100	0.71	105.00	141.27	355.44
44		S10-101	0.18	104.85	141.22	356.40
45		S10-105	0.27	104.75	141.20	357.18
46		S10-110	0.36	104.50	141.18	359.46
47		S10-120	0.32	102.00	141.15	383.68
48		S10-130	0.24	99.70	141.12	405.91
49		S10-140	0.48	99.00	141.12	412.74
50		S10-150	0.96	97.80	141.11	424.42
51		S10-160	0.18	103.00	141.16	373.90
52		S10-180	0.18	104.00	141.20	364.49
53		S10-190	0.27	101.00	141.18	393.71
54		S10-200	0.60	103.50	141.13	368.75
55		S10-210	0.84	101.50	141.12	388.28
56		S10-220	0.43	99.00	141.11	412.61
57		S10-230	0.23	98.20	141.10	420.43
58		S10-250	0.68	98.00	141.11	422.43
59		S10-260	0.56	94.00	141.08	461.33
60		S10-270	0.76	93.50	141.04	465.89
61		S10-280	0.48	93.00	141.06	470.91
62		S10-290	0.69	94.00	141.08	461.33
63		S10-300	0.65	96.00	141.09	441.89
64		S10-310	0.43	94.50	141.08	456.45
65		S10-330	0.40	95.80	141.09	443.79
66		S10-340	0.00	95.80	141.14	444.25
67		S13-010	0.84	94.00	140.72	457.81
68		S13-020	7.42	94.70	140.77	451.47
69		S13-026	7.71	94.00	140.71	457.76
70		S13-041	1.68	94.00	140.69	457.50
71		S13-050	1.44	97.50	140.68	423.14
72		S13-065	1.14	93.80	140.68	459.40
73		S13-070	1.32	93.00	140.68	467.27
74		S13-080	2.23	93.50	140.68	462.36
75		S13-090	2.35	94.00	140.69	457.51
76		S13-145	1.06	92.70	140.73	470.70
77		S13-155	0.68	92.50	140.71	472.39
78		S13-165	1.59	92.50	140.70	472.29
79		S13-175	0.61	92.60	140.70	471.31
80		S13-185	0.61	92.60	140.70	471.32
81		S13-195	1.06	92.70	140.69	470.31
82		S13-205	1.04	92.60	140.71	471.45

Phase 1 Peak Hour HGL 144m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
83		S13-215	0.48	92.70	140.69	470.31
84		S13-225	1.99	92.70	140.69	470.30
85		S13-235	1.93	93.00	140.83	468.69
86		S13-245	1.44	93.60	140.89	463.43
87		S14-270	1.38	93.20	140.73	465.79
88		S14-280	1.93	92.80	140.69	469.32
89		S14-290	1.36	92.70	140.69	470.26
90		S14-300	2.12	92.60	140.69	471.24
91		S14-500	1.52	92.50	140.69	472.23
92		S2-100	0.88	95.00	141.56	456.28
93		S2-110	1.05	94.60	141.62	460.75
94		S2-120	0.60	94.18	141.62	464.87
95		S3-110	0.23	94.85	142.03	462.37
96		S3-120	0.38	94.39	142.01	466.60
97		S3-130	0.23	94.29	141.96	467.15
98		S3-140	1.65	94.90	141.79	459.48
99		S3-160	0.50	93.92	141.88	469.95
100		S3-180	0.68	94.29	141.93	466.82
101		S3-190	1.53	94.60	141.75	462.04
102		S3-210	0.96	94.18	141.68	465.46
103		S3-400	0.52	94.09	142.02	469.65
104		S3-410	1.01	94.20	141.96	468.05
105		S3-420	0.60	93.92	141.95	470.63
106		S3-430	0.51	93.32	141.84	475.42
107		S3-450	0.30	93.58	141.42	468.83
108		S3-460	0.25	93.82	141.42	466.47
109		S3-480	0.41	94.16	141.42	463.14
110		S3-500	0.20	93.71	141.42	467.55
111		S3-510	0.36	93.95	141.42	465.20
112		S3-530	0.19	93.89	141.42	465.78
113		S3B-100	0.36	93.55	141.73	472.09
114		S3B-105	0.26	93.60	141.66	470.95
115		S3B-110	0.19	93.65	141.67	470.55
116		S3B-120	0.54	93.75	141.61	468.94
117		S3B-140	0.27	93.95	141.42	465.20
118		S3B-145	0.27	94.10	141.32	462.69
119		S3B-150	0.19	93.25	141.26	470.46
120		S3B-160	0.25	93.60	141.26	467.02
121		S3B-170	0.34	95.80	141.26	445.51
122		S3B-180	0.32	95.80	141.26	445.49
123		S3B-190	0.00	95.80	141.29	445.81

		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)
55		S10-250	166.80	S10-020	210.78	119.51	222.78	238.22	S10-020	118.32	110.07	222.78	222.78
56		S10-260	166.77	S10-020	219.35	116.38	234.09	246.25	S10-020	124.00	106.65	234.10	234.09
57		S10-270	166.81	S10-020	221.20	116.07	236.71	255.76	S10-020	115.05	105.24	236.71	236.71
58		S10-280	166.76	S10-020	219.73	115.42	234.60	214.66	S10-280	139.96	107.28	214.66	214.66
59		S10-290	166.86	S10-020	218.96	116.34	233.63	236.17	S10-200	135.55	107.83	233.07	233.07
60		S10-300	167.03	S10-020	217.93	118.24	232.43	247.71	S10-200	110.72	107.30	228.10	228.10
61		S10-310	166.80	S10-020	218.64	116.81	233.13	255.21	S10-200	107.38	105.46	232.86	232.86
62		S10-330	166.84	S10-020	217.35	117.98	231.41	236.60	S10-020	133.12	109.39	231.42	231.41
63		S10-340	166.67	S10-020	226.53	118.92	245.00	220.64	S10-340	139.96	110.08	220.64	220.64
64		S13-010	250.38	S13-050	74.34	101.59	218.01	222.98	S13-050	130.27	107.29	218.01	218.01
65		S13-020	254.04	S13-050	109.75	105.90	237.49	249.91	S13-050	117.42	106.68	237.51	237.49
66		S13-050	167.33	S13-050	73.10	104.96	146.56	146.56	S13-050	139.96	111.78	146.56	146.56
67		S13-065	167.19	S13-065	119.84	106.03	160.93	160.93	S13-065	139.96	108.08	160.93	160.93
68		S13-070	167.27	S13-050	197.18	113.12	194.43	199.50	S13-050	128.65	106.13	194.43	194.43
69		S13-080	167.68	S13-050	171.36	110.99	181.04	191.34	S13-050	114.70	105.21	181.05	181.04
70		S13-090	167.74	S13-050	199.57	114.37	196.35	197.18	S13-050	138.15	108.10	196.35	196.35
71		S13-145	167.15	S13-145	207.70	113.90	193.40	193.40	S13-145	139.96	106.98	193.40	193.40
72		S13-155	166.98	S13-155	192.30	112.12	186.06	186.08	S13-155	139.96	106.78	186.08	186.06
73		S13-165	167.39	S13-165	199.62	112.87	189.76	189.76	S13-165	139.96	106.78	189.76	189.76
74		S13-175	166.95	S13-175	164.41	109.38	175.15	175.15	S13-175	139.96	106.88	175.15	175.15
75		S13-185	166.95	S13-185	166.30	109.57	175.84	175.84	S13-185	139.96	106.88	175.84	175.84
76		S13-195	167.15	S13-195	79.39	100.80	150.82	150.83	S13-195	139.96	106.98	150.83	150.82
77		S13-205	167.14	S13-205	156.18	108.54	172.45	172.45	S13-205	139.96	106.88	172.45	172.45
78		S13-215	166.89	S13-215	55.13	98.33	145.22	145.23	S13-215	139.96	106.98	145.23	145.22
79		S13-235	167.55	S13-235	229.36	116.41	205.36	205.36	S13-235	139.96	107.28	205.36	205.36
80		S13-245	167.33	S10-020	229.19	116.99	249.38	213.71	S13-245	139.96	107.88	213.71	213.71
81		S14-270	250.63	S14-270	83.71	101.74	226.09	226.09	S14-270	139.96	107.48	226.09	226.09
82		S14-280	167.55	S13-050	229.43	116.21	217.30	223.38	S13-050	128.02	105.86	217.30	217.30
83		S14-290	167.29	S14-290	226.83	115.85	203.87	203.87	S14-290	139.96	106.98	203.87	203.87
84		S14-300	167.63	S14-300	207.13	113.74	193.70	193.70	S14-300	139.96	106.88	193.70	193.70
85		S14-500	167.36	S14-500	199.06	112.81	189.52	189.52	S14-500	139.96	106.78	189.52	189.52
86		S2-100	166.83	S2-100	267.37	122.28	231.18	231.18	S2-100	139.96	109.28	231.18	231.18
87		S2-110	166.86	S10-020	278.67	123.04	391.43	258.16	S2-110	139.96	108.88	258.16	258.16
88		S2-120	166.78	S10-020	278.15	122.56	387.12	282.46	S2-120	139.96	108.46	282.46	282.46
89		S3-110	166.82	S10-020	290.10	124.45	445.07	475.91	S10-020	119.37	107.03	445.07	445.07
90		S3-120	166.92	S10-020	290.50	124.04	440.57	468.17	S10-020	121.36	106.77	440.57	440.57
91		S3-130	166.82	S10-020	289.38	123.82	437.47	480.56	S10-020	109.75	105.49	437.48	437.47
92		S3-140	167.13	S3-140	262.89	121.73	225.72	225.72	S3-140	139.96	109.18	225.72	225.72
93		S3-160	166.99	S10-020	287.58	123.27	419.56	519.98	B-210	61.30	100.18	426.27	419.56
94		S3-180	250.45	S10-020	249.35	119.74	433.46	467.38	S10-020	116.27	106.16	433.46	433.46
95		S3-190	166.95	S3-190	152.47	110.16	170.92	170.92	S3-190	139.96	108.88	170.92	170.92
96		S3-210	166.85	S3-210	158.57	110.36	172.81	172.81	S3-210	139.96	108.46	172.81	172.81
97		S3-400	166.77	S10-020	291.24	123.81	437.55	534.20	S10-020	69.68	101.20	437.55	437.55
98		S3-410	166.86	S3-410	-114.12	82.55	120.22	120.22	S3-410	139.96	108.48	120.22	120.22
99		S3-420	166.78	S10-020	289.34	123.45	428.16	526.61	B-210	65.75	100.63	435.82	428.16
100		S3-430	167.00	S10-020	286.19	122.53	413.48	476.57	B-210	84.01	101.89	410.53	410.53
101		S3-450	166.87	S3-450	218.00	115.83	198.10	198.10	S3-450	139.96	107.86	198.10	198.10
102		S3-460	166.83	S3-460	247.99	119.13	216.24	216.24	S3-460	139.96	108.10	216.24	216.24
103		S3-480	166.94	S10-020	271.33	121.85	360.17	276.75	S3-480	139.96	108.44	276.75	276.75
104		S3-500	166.80	S10-020	271.89	121.46	362.71	276.60	S3-500	139.96	107.99	276.60	276.60
105		S3-510	166.89	S10-020	271.98	121.71	363.16	238.29	S3-510	139.96	108.23	238.29	238.29
106		S3-530	166.79	S10-020	272.05	121.65	363.32	279.74	S3-530	139.96	108.17	279.74	279.74
107		S3B-100	166.91	S10-020	281.24	122.25	402.74	297.16	S3B-100	139.96	107.83	297.16	297.16
108		S3B-105	166.84	S3B-105	160.27	109.95	173.36	173.36	S3B-105	139.96	107.88	173.36	173.36

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
56		1009	S10-200	S10-150	288.44	204.00	110.00	2.59	0.08	0.02	0.07
57		1003	S10-210	S10-130	74.32	204.00	110.00	0.56	0.02	0.000	0.00
58		1047	S10-220	S10-300	157.24	204.00	110.00	2.79	0.09	0.01	0.08
59		1637	S10-230	S10-220	74.71	204.00	110.00	-1.74	0.05	0.00	0.03
60		1023	S10-250	S10-230	43.73	204.00	110.00	3.21	0.10	0.00	0.10
61		1027	S10-250	S10-010	95.90	204.00	110.00	-0.03	0.000	0.00	0.00
62		1031	S10-260	S10-270	78.44	204.00	110.00	7.28	0.22	0.04	0.45
63		1033	S10-270	S10-280	122.73	204.00	110.00	-3.24	0.10	0.01	0.10
64		1035	S10-280	S10-290	171.30	204.00	110.00	-3.72	0.11	0.02	0.13
65		1037	S10-290	S10-300	239.92	204.00	110.00	-2.68	0.08	0.02	0.07
66		1039	S10-300	S10-310	81.31	204.00	110.00	4.41	0.13	0.01	0.18
67		1043	S10-300	S10-150	75.59	204.00	110.00	-4.95	0.15	0.02	0.22
68		1633	S10-310	S10-330	81.88	204.00	110.00	-3.16	0.10	0.01	0.10
69		1041	S10-310	S10-270	142.54	204.00	110.00	5.41	0.17	0.04	0.26
70		1061	S10-310	S10-290	77.74	204.00	110.00	1.73	0.05	0.00	0.03
71		1635	S10-330	S10-230	80.12	204.00	110.00	-4.72	0.14	0.02	0.20
72		1051	S10-330	S10-260	140.78	155.00	100.00	1.16	0.06	0.01	0.07
73		1557	S10-340	B-130	475.25	204.00	110.00	-7.15	0.22	0.21	0.43
74		153	S1-100	S1-170	56.78	204.00	110.00	4.27	0.13	0.01	0.17
75		331	S1-100	S1-290	57.94	204.00	110.00	2.55	0.08	0.00	0.06
76		109	S1-100	S3B-190	182.57	297.00	120.00	27.94	0.40	0.13	0.74
77		107	S1-110	S1-100	164.87	297.00	120.00	34.76	0.50	0.18	1.11
78		151	S1-120	S2-120	108.86	204.00	110.00	-3.47	0.11	0.01	0.11
79		149	S1-120	S1-110	51.61	204.00	110.00	-3.04	0.09	0.00	0.09
80		147	S1-140	S1-120	354.02	204.00	110.00	-5.27	0.16	0.09	0.25
81		157	S1-150	S1-190	379.11	204.00	110.00	4.68	0.14	0.07	0.20
82		155	S1-150	S1-140	78.11	204.00	110.00	-9.75	0.30	0.06	0.77
83		669	S1-150	S1-170	356.22	204.00	110.00	3.46	0.11	0.04	0.11
84		161	S1-170	S1-180	83.92	204.00	110.00	6.27	0.19	0.03	0.34
85		163	S1-180	S1-190	162.82	204.00	110.00	1.93	0.06	0.01	0.04
86		165	S1-180	S1-210	94.05	204.00	110.00	3.93	0.12	0.01	0.14
87		167	S1-210	S1-230	45.73	204.00	110.00	2.73	0.08	0.00	0.07
88		667	S1-220	S1-210	152.34	204.00	110.00	-1.10	0.03	0.00	0.01
89		185	S1-230	S1-220	135.92	204.00	110.00	-0.90	0.03	0.00	0.01
90		183	S1-230	S1-240	75.46	204.00	110.00	3.45	0.11	0.01	0.11
91		779	S1-240	S1-270	175.60	204.00	110.00	3.94	0.12	0.03	0.14
92		169	S1-240	S1-250	42.48	204.00	110.00	-0.69	0.02	0.000	0.01
93		175	S1-250	S1-190	79.62	204.00	110.00	-5.14	0.16	0.02	0.24
94		171	S1-250	S1-260	33.34	204.00	110.00	4.36	0.13	0.01	0.17
95		179	S1-270	S1-260	103.44	204.00	110.00	-4.59	0.14	0.02	0.19
96		333	S1-290	S3-480	119.54	204.00	110.00	1.23	0.04	0.00	0.02
97		343	S1-300	S3-460	118.34	155.00	100.00	0.15	0.01	0.000	0.00
98		341	S1-300	S1-290	168.86	204.00	110.00	-0.98	0.03	0.00	0.01
99		1893	S13-020	B-150	195.70	250.00	110.00	-31.76	0.65	0.50	2.54
100		1895	S13-020	S13-010	80.84	250.00	110.00	15.26	0.31	0.05	0.65
101		1891	S13-020	S14-270	155.49	250.00	110.00	9.07	0.18	0.04	0.25
102		2117	S13-026	S13-010	31.93	250.00	110.00	-7.71	0.16	0.01	0.18
103		2119	S13-041	S13-090	28.06	204.00	110.00	-1.68	0.05	0.000	0.03
104		2115	S13-065	S13-050	85.32	155.00	100.00	0.34	0.02	0.000	0.01
105		1905	S13-065	S13-070	150.00	204.00	110.00	-1.48	0.05	0.00	0.02
106		1909	S13-070	S13-080	76.21	155.00	100.00	0.65	0.03	0.00	0.02
107		1907	S13-070	S14-280	81.87	204.00	110.00	-3.45	0.11	0.01	0.11
108		1911	S13-080	S13-090	75.88	204.00	110.00	-2.68	0.08	0.01	0.07
109		1917	S13-080	S13-050	168.98	204.00	110.00	1.10	0.03	0.00	0.01
110		1913	S13-090	S13-010	80.61	204.00	110.00	-6.71	0.21	0.03	0.39

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
111		1945	S13-145	S13-155	93.51	204.00	110.00	5.83	0.18	0.03	0.30
112		1959	S13-145	S13-205	111.81	204.00	110.00	4.91	0.15	0.02	0.22
113		1947	S13-155	S13-165	82.41	204.00	110.00	3.76	0.12	0.01	0.13
114		1973	S13-155	S13-185	98.11	155.00	100.00	1.39	0.07	0.01	0.10
115		1951	S13-165	S13-175	85.69	204.00	110.00	-0.51	0.02	0.000	0.00
116		1949	S13-165	S14-500	85.34	204.00	110.00	2.68	0.08	0.01	0.07
117		1953	S13-175	S13-185	86.59	204.00	110.00	-1.12	0.03	0.00	0.01
118		1975	S13-185	S13-195	151.14	204.00	110.00	1.42	0.04	0.00	0.02
119		1955	S13-185	S13-205	88.64	155.00	100.00	-1.76	0.09	0.01	0.15
120		2041	S13-195	S13-215	110.93	204.00	110.00	0.36	0.01	0.000	0.00
121		1957	S13-205	S13-215	79.72	155.00	100.00	2.11	0.11	0.02	0.21
122		1971	S13-215	S13-225	25.54	204.00	110.00	1.99	0.06	0.00	0.04
123		1961	S13-235	S13-145	86.18	204.00	110.00	11.80	0.36	0.09	1.10
124		1963	S13-235	S13-245	43.77	204.00	110.00	-13.73	0.42	0.06	1.45
125		1965	S13-245	S10-270	86.46	204.00	110.00	-15.17	0.46	0.15	1.74
126		1887	S14-280	S14-270	79.69	204.00	110.00	-7.69	0.24	0.04	0.50
127		1885	S14-290	S14-280	74.70	204.00	110.00	-2.32	0.07	0.00	0.05
128		1883	S14-300	S14-290	82.28	204.00	110.00	-0.96	0.03	0.000	0.01
129		1881	S14-500	S14-300	76.79	204.00	110.00	1.16	0.04	0.00	0.02
130		713	S2-100	S1-140	165.62	204.00	110.00	5.40	0.17	0.04	0.26
131		145	S2-110	S2-100	166.13	204.00	110.00	6.28	0.19	0.06	0.34
132		143	S2-110	S3-140	84.01	155.00	100.00	-7.26	0.38	0.17	2.02
133		141	S2-120	S2-110	264.85	204.00	110.00	0.08	0.00	0.0000	0.000
134		1077	S3-110	L-150	809.68	297.00	120.00	-16.00	0.23	0.21	0.26
135		111	S3-110	S8-100	98.30	204.00	110.00	14.99	0.46	0.17	1.71
136		97	S3-120	S3-110	168.32	297.00	120.00	-12.61	0.18	0.03	0.17
137		741	S3-120	S4-210	230.06	155.00	100.00	-4.47	0.24	0.19	0.82
138		129	S3-130	S3-140	99.34	155.00	100.00	6.70	0.36	0.17	1.75
139		99	S3-130	S3-120	153.82	297.00	120.00	-16.70	0.24	0.04	0.28
140		101	S3-130	S3-180	85.17	297.00	120.00	20.20	0.29	0.03	0.40
141		739	S3-130	S4-240	250.39	204.00	110.00	-10.43	0.32	0.22	0.87
142		105	S3-160	S1-110	206.75	297.00	120.00	37.80	0.55	0.27	1.29
143		313	S3-160	S3-430	170.85	393.00	120.00	32.22	0.27	0.04	0.25
144		187	S3-160	S3-420	95.96	393.00	120.00	-57.64	0.48	0.07	0.72
145		133	S3-180	S3-190	103.45	155.00	100.00	6.64	0.35	0.18	1.72
146		103	S3-180	S3-160	283.87	297.00	120.00	12.88	0.19	0.05	0.18
147		135	S3-190	S3-210	342.86	155.00	100.00	2.12	0.11	0.07	0.21
148		139	S3-210	S2-120	84.39	155.00	100.00	4.15	0.22	0.06	0.72
149		137	S3-210	S3-190	181.26	155.00	100.00	-2.99	0.16	0.07	0.39
150		309	S3-400	S3-410	272.65	155.00	100.00	2.06	0.11	0.05	0.20
151		191	S3-400	S4-250	254.47	393.00	120.00	-59.77	0.49	0.20	0.77
152		311	S3-410	S3-420	287.06	155.00	100.00	1.05	0.06	0.02	0.06
153		189	S3-420	S3-400	98.04	393.00	120.00	-57.19	0.47	0.07	0.71
154		1295	S3-430	S3B-100	82.75	204.00	110.00	13.09	0.40	0.11	1.33
155		315	S3-430	S7-050	182.82	393.00	120.00	18.62	0.15	0.02	0.09
156		701	S3-450	S1-300	122.30	204.00	110.00	-0.32	0.01	0.000	0.00
157		339	S3-460	S3-450	120.24	204.00	110.00	-0.02	0.000	0.00000	0.0000
158		833	S3-460	S3-480	160.89	204.00	110.00	-0.08	0.00	0.0000	0.000
159		831	S3-500	S3-510	95.83	204.00	110.00	0.23	0.01	0.0000	0.000
160		829	S3-500	S3-480	70.15	204.00	110.00	-0.74	0.02	0.000	0.01
161		825	S3-530	S3-510	94.21	204.00	110.00	0.13	0.00	0.0000	0.000
162		827	S3-530	S3-500	35.90	204.00	110.00	-0.31	0.01	0.0000	0.00
163		1297	S3B-100	S3B-110	90.83	204.00	110.00	8.76	0.27	0.06	0.63
164		1603	S3B-105	S3B-100	101.17	155.00	100.00	-3.97	0.21	0.07	0.66
165		1305	S3B-110	S3B-120	106.07	204.00	110.00	8.57	0.26	0.06	0.60

APPENDIX C

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

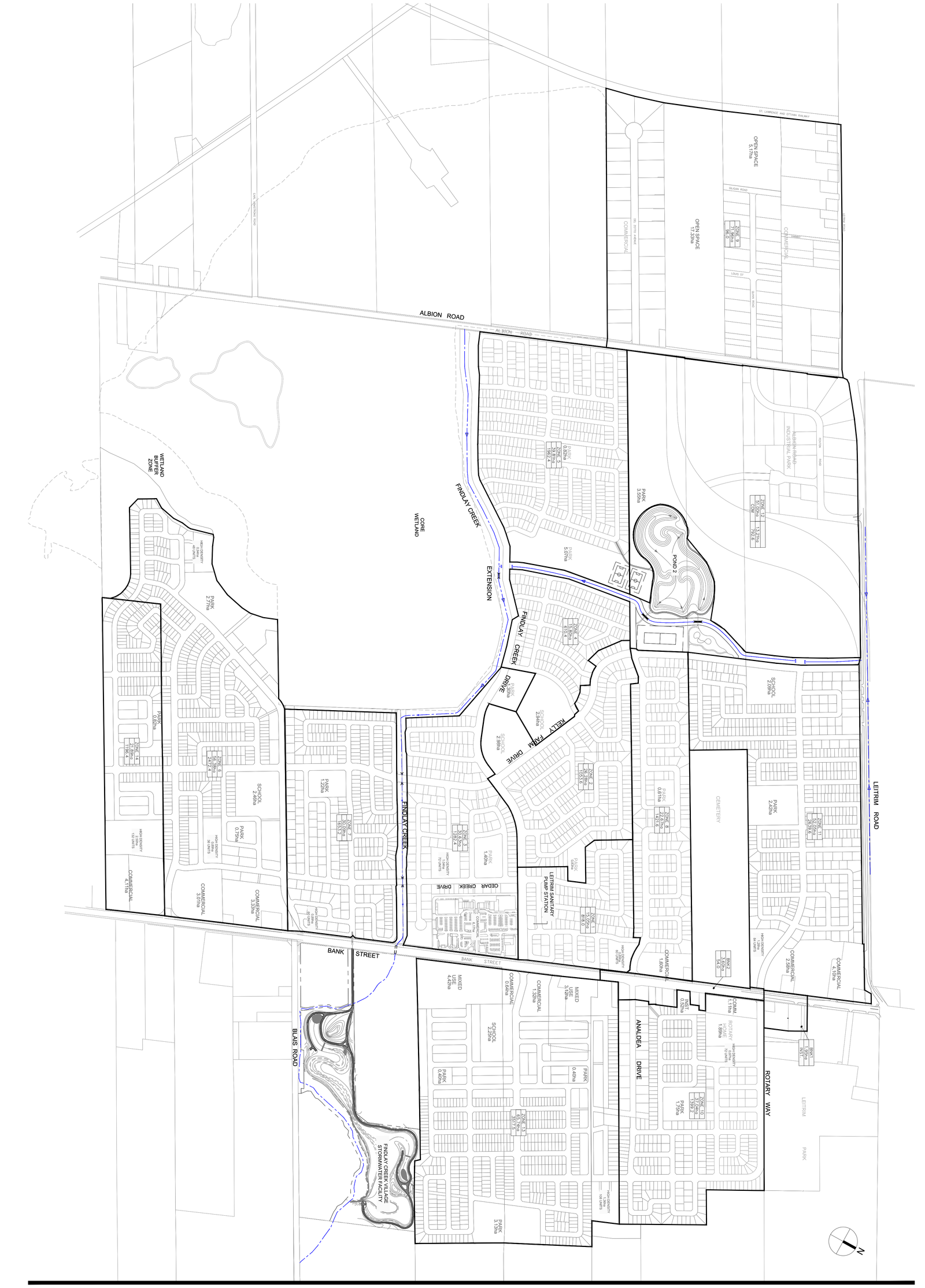
3.4 Preferred Wastewater Plan

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.

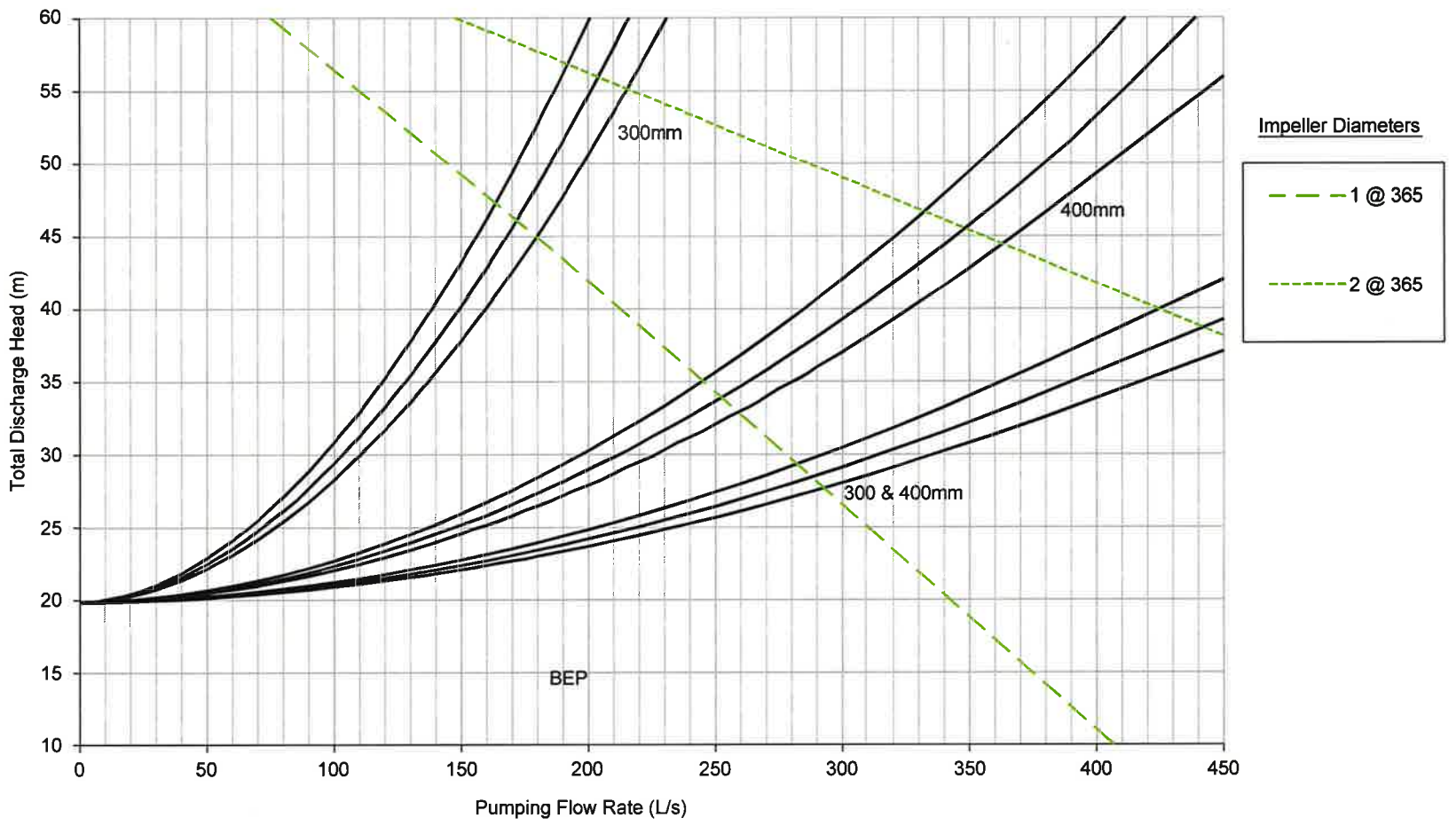


Sheet No.	Drawing Title	Project Title	Scale
FIGURE 3.8	FINAL BUILD-OUT PLAN	UPDATED SERVICEABILITY PLAN (CLASS EA OPA76 AREAS 8a, 9a and 9b) LEITRIM DEVELOPMENT AREA	N.T.S.

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

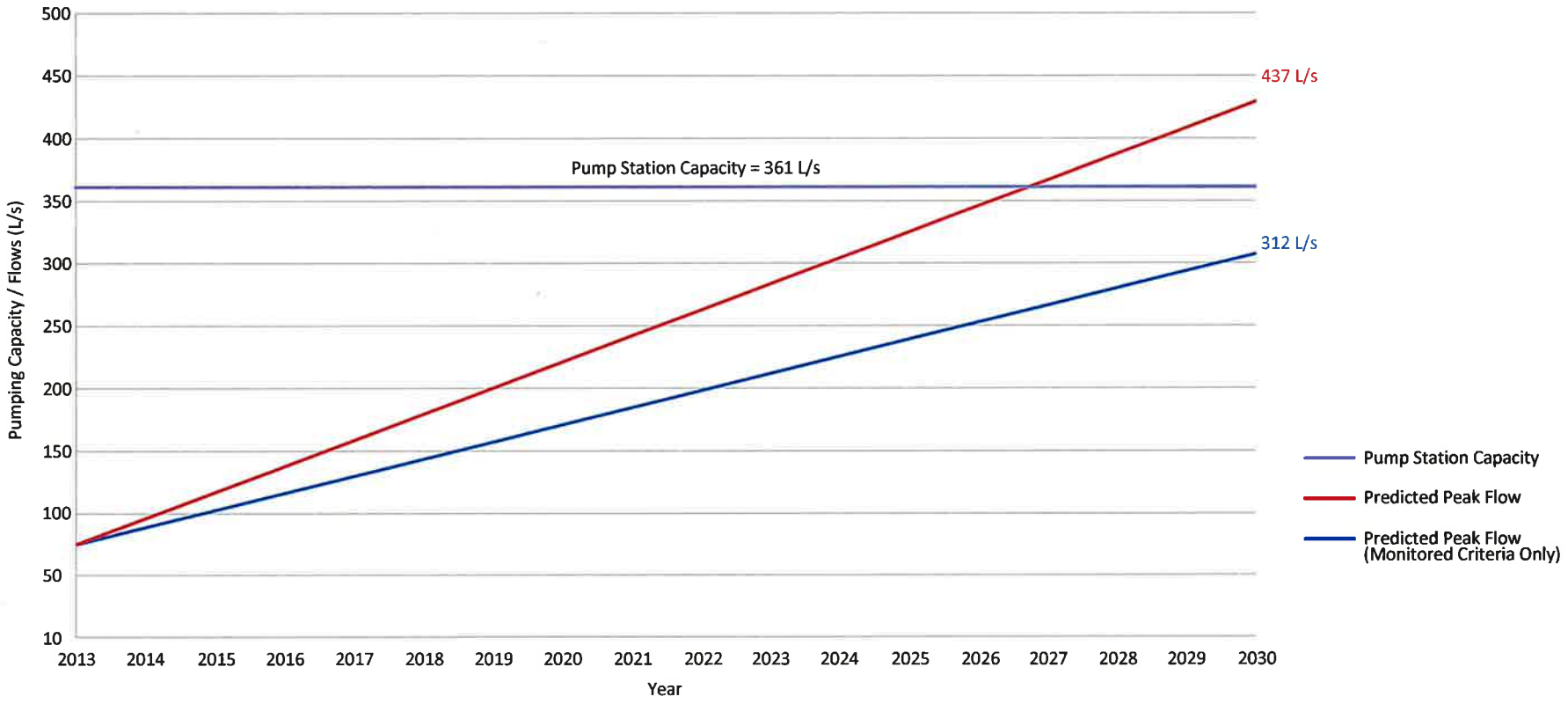
SYSTEM PUMP
CURVES POTENTIAL
160 HP PUMPS

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 D

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

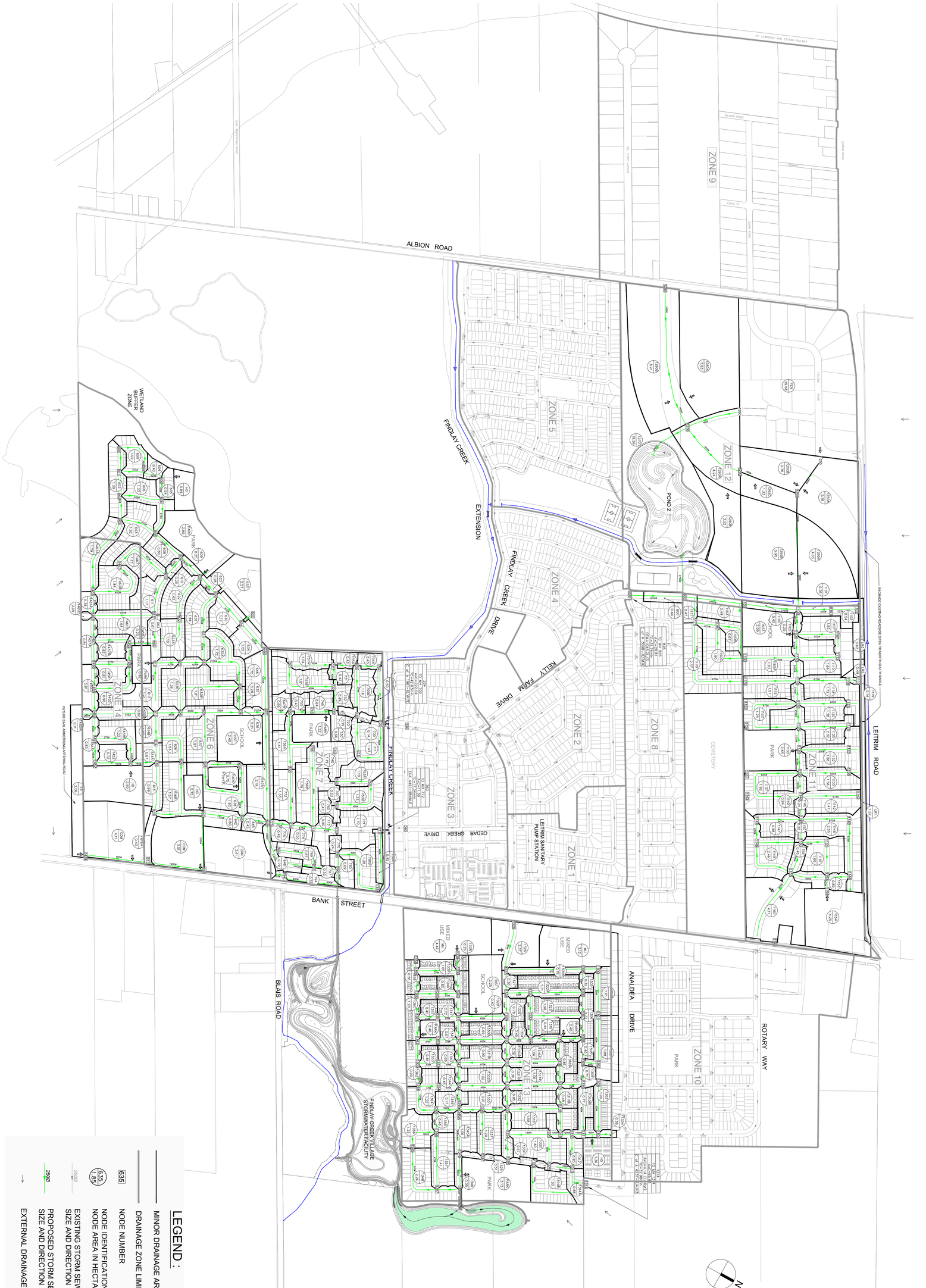
Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

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

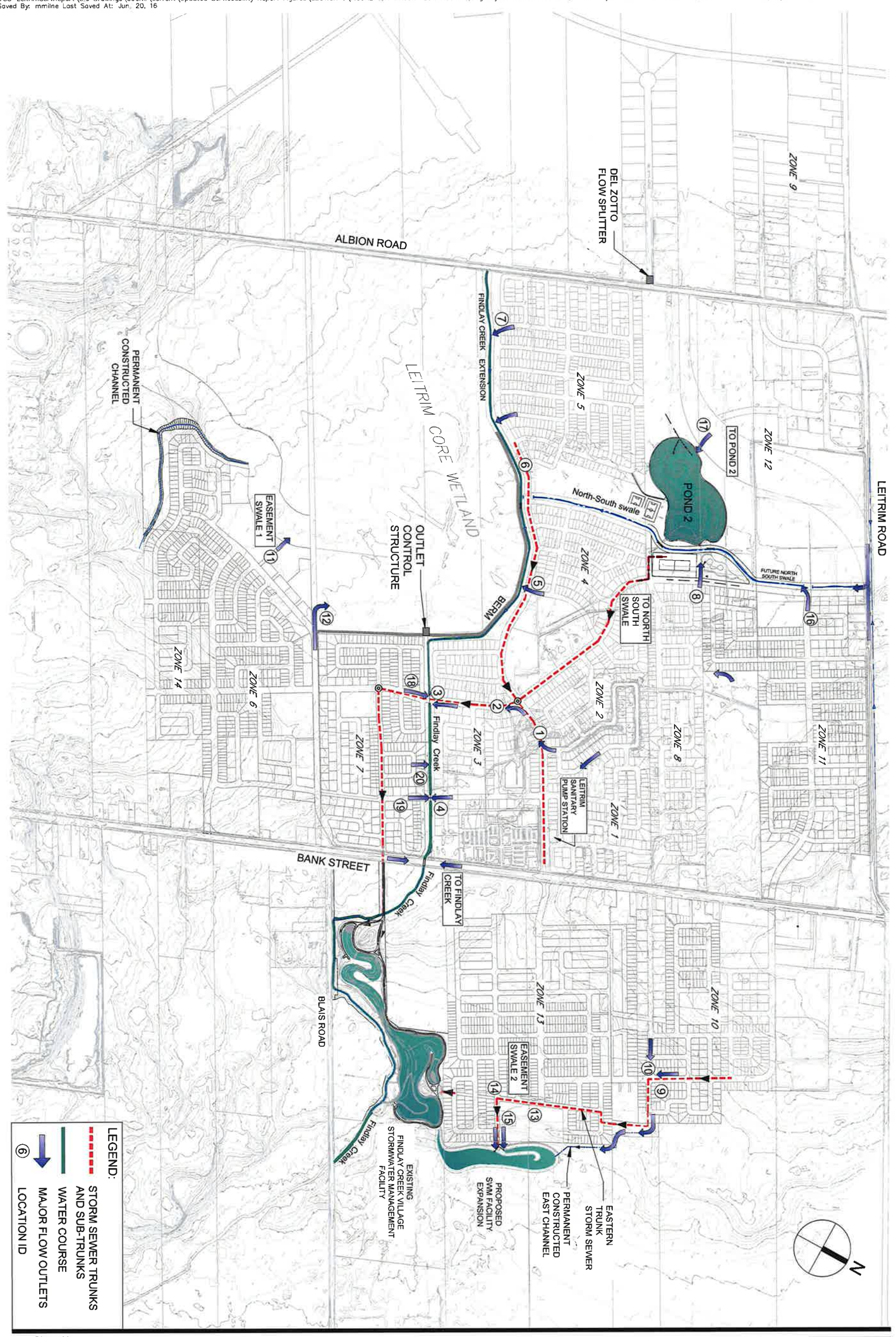
Project Title

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

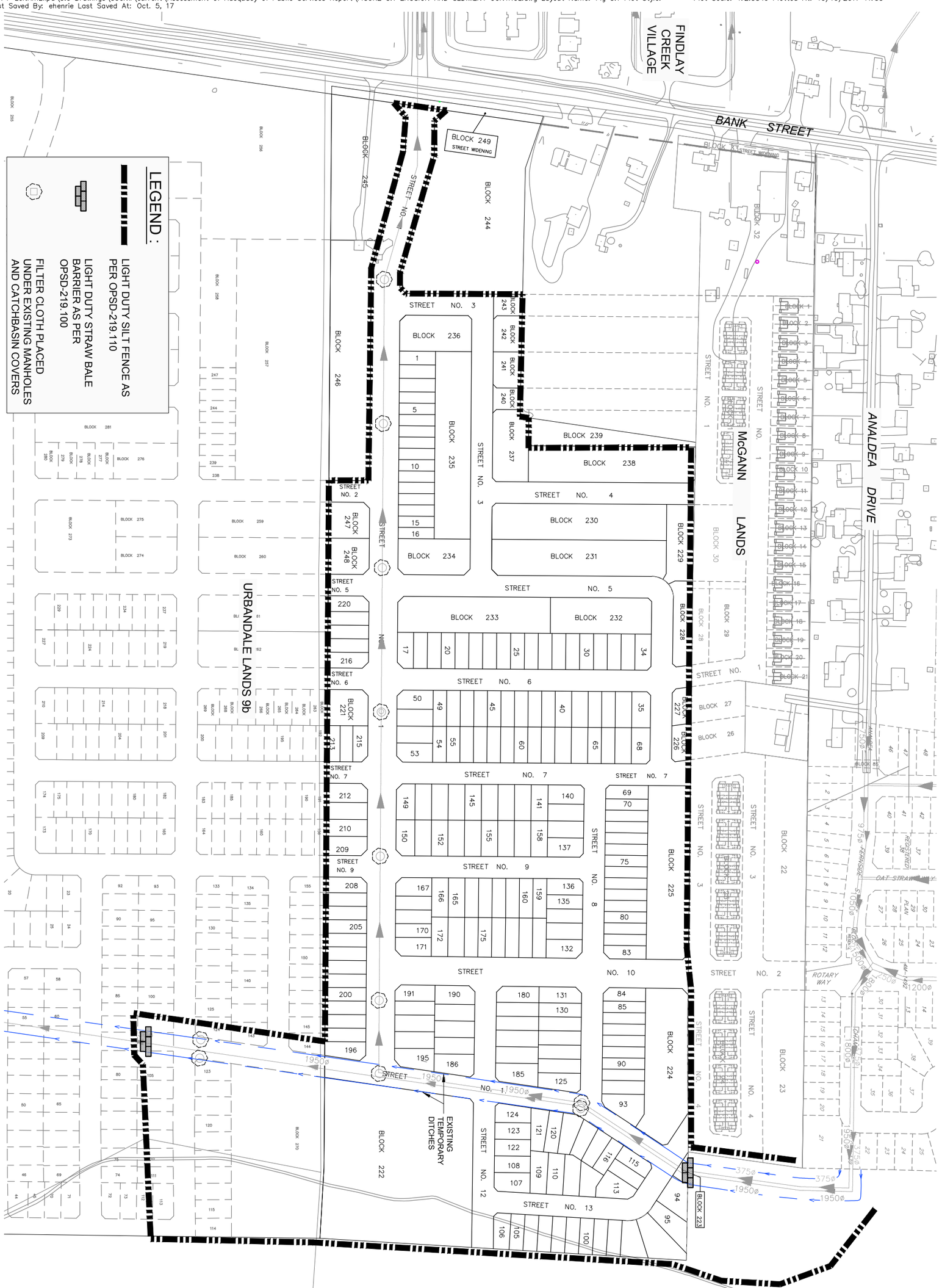
Scale

DRAFT
N.T.S.

IBI

APPENDIX E

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



Sheet No.	Drawing Title	Project Title	Scale
FIGURE 5.1	EROSION AND SEDIMENT CONTROL PLAN	ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES CLARIDGE 9a LANDS - 4789 BANK STREET LEITRIM DEVELOPMENT AREA CITY OF OTTAWA	N.T.S.

IBI