6.0 WASTEWATER SERVICING

6.1 Introduction

As indicated previously, the subject development is within the City of Ottawa West Urban Community (former City of Kanata). This area is serviced by local gravity sewers and pump stations that discharge to a regional trunk system that carries flows to the Robert O. Pickard Environmental Centre for treatment of wastewater.

There are several trunk sanitary sewers and pump stations servicing the West Urban Community including the East March Trunk, Marchwood Trunk, Kanata Lakes Trunk, North Kanata Trunk, March Pump Station, and the Briar Ridge Pump Station. These all drain into the Watt's Creek Relief Sewer that provides service to the entire West Urban Community and flows into the Acres Road Pump Station. An Existing Wastewater Collection System Schematic (Figure 2) from the 2013 Infrastructure Master Plan is included in **Appendix C-1** for reference.

The outlet for the Kanata North Urban Expansion Area is the existing March Pump Station. The City has indicated that the inlet to the March Pump Station is a reasonable limit for wastewater analysis.

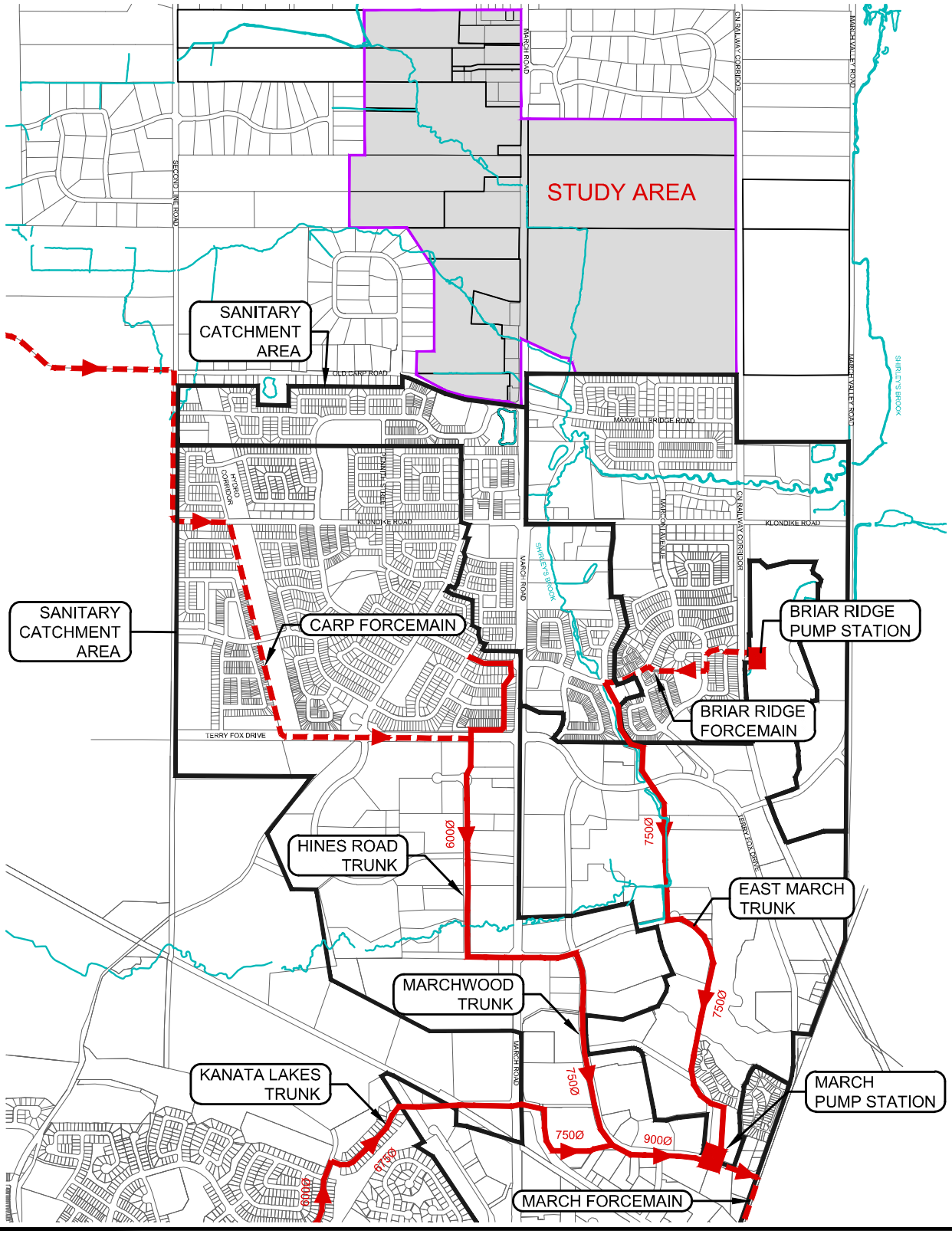
Based on the proposed land use, a probable wastewater flow was calculated to be 182.2L/s. Further details on the calculations of this flow rate are discussed in Section 6.6.1.2.

6.2 Existing Wastewater Infrastructure

There are three trunk sewers that drain to the March Pump Station. These are the East March Trunk, Marchwood Trunk and the Kanata Lakes Trunk. These trunk sewers and their drainage boundaries are shown on **Figure 6.2.** The East March Trunk and Marchwood Trunk sewers are the two most viable options to service development of the KNUEA. The Kanata Lakes Trunk Sewer is located farther from the development area and is not a viable option for servicing the Kanata North Urban Expansion Area.

The following is a brief description of each trunk sewer along with capacity and probable flow rates. The flow generation and wastewater modelling, completed in 2013 on behalf of the City, is provided in the *2013 Infrastructure Master Plan Wastewater Collection System Assessment* (2013 IMP) prepared by Stantec, dated Sept 2013. This document provides the most current sanitary analysis of the entire City and establishes a basis upon which the KNUEA can be evaluated. Where information was not available in the 2013 IMP, namely for trunk sewers, information was obtained from the *West Urban Community – Wastewater Collection System Master Servicing Plan Study* (2012 WUC, RVA, July 2012).

The data obtained from the above noted Master Plans provides flow data for existing flows monitored as of 2010, and projected flows for 2031. The projected flow data in the 2031 IMP has accounted for the full development/buildout of the KNUEA. Therefore during the analysis of KNUEA on existing infrastructure, design KNUEA flows have only been added where 2013 IMP data was not available.



KANATA NORTH
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FIGURE NO. 6.2
NORTH KANATA WASTEWATER TRUNK INFRASTRUCTURE

DATE
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M:\2012\112117\CADDesign_MSS\FIGURES\FIGURE 7.1 - WASTEWATER COLLECTION INFRASTRUCTURE.dwg, WW COLL, Feb 23, 2016 - 1:40pm, lseely

SHT8x11.DWG - 216mmx279mm

The **East March Trunk** (EMT) is a 750mm diameter pipe that extends north from the March Pump Station through the Kanata Research Park to Shirleyôs Brook Drive, with the upper reach generally follows the creek corridor. The pipe has a free-flow capacity of 550 L/s and an obvert elevation of 72.1m at Shirleyôs Brook Drive. Flow generation and modelling for the City indicates peak flow rates in the EMT of 96 L/s in 2010, and projects a flow of 255 L/s in 2031. Therefore, the EMT is currently flowing at approximately 17% of the free-flow capacity, and will reach 46% at build-out. These values account for the full buildout of the KNUEA.

The **Marchwood Trunk** (MWT) is 750mm to 900mm in diameter, and generally follows Legget Drive. Flow from the Kanata Lakes Trunk combines with the Marchwood Trunk, west of Schneider Road, in a 900mm diameter sewer which conveys all flows to the March Pump Station. Upstream, the MWT decreases in size to a 750mm pipe south of Farrar Road; the trunk continues north on Legget Drive, turning west at Solandt Drive and generally services land on the west side of March Road. The upper reach of the MWT is located at the intersection of Solandt Drive and Hines Road with an obvert elevation of 77.3m. The lower-reach of the MWT has a free-flow capacity of 1,100 L/s. Flow generation by the City has an estimated peak flow of 230 L/s in 2010, and 592 L/s in 2031. This puts the free-flow capacity at approximately 21% (2010) and 54% (2031), including full development of the KNUEA.

The **Hines Road Trunk** (HRT) is essentially a northward continuation of the Marchwood Trunk. The HRT is a 600mm gravity pipe that services lands in North Kanata, and conveys flow from the Carp Forcemain to the Marchwood Trunk and March Pump Station. The upper reach of the HRT is located at the intersection of Morganôs Grant Way and March Road with an obvert elevation of 79.7m. The upper-reach of the MWT has a free-flow capacity of 205 L/s, based on as-built information. The free flow capacity of the HRT is unknown.

The **March Pump Station** (MPS) is located at the downstream end of these trunk sewers with a firm capacity of 490 L/s. City modelling has peak flows of 326 L/s (2010) and 771 L/s (2031). This represents 67% and 157% of the firm capacity. Pumps currently discharge through the March Forcemain, routing flow south along Herzberg Road to the March Road Trunk. There are significant planned changes that will affect how this facility operates, and the reader is directed to the next section on planned infrastructure for details.

The **Briar Ridge Pump Station** (BRPS) is located south of Klondike Road and east of the railway corridor. This facility discharges into the East March Trunk and has a firm design capacity of 183 L/s with three pumps installed. Due to low initial flows, only two of the three pumps are currently installed; as such the station has a temporary firm capacity of 53 L/s. Flow monitoring by City staff will determine when the third pump is required.

Capacities of the various systems are summarized in in **Table 6.2**. This information is taken from the 2013 IMP, 2012 WUC, and supplementary 2013 IMP data provided by the City. Relevant excerpts and supplementary information are included in **Appendix C-2** for reference.

Table 6.2: Existing Capacity and 2031 Wastewater Flow

Infrastructure	Obvert Elevation	Flow	Ex. Capacity	Design Flow	Q/Q_{full} Capacity (%)	Available Flow
		2010 (L/s)	**(L/s)**	**2031 (L/s)**	**2031**	**2031 (L/s)**
March Pump Station	-	**371(2008)**	**416 (IMP)** **586 (upgrade)***	**256**	**44%**	**330**
Briar Ridge Pump Station	61.15	21**	53 (Ex) 183 (Ult) **175 (IMP)**	**124**	**71%**	**51**
East March Trunk	72.1	*96*	*550 (WUC)* *259 (Asbuilt)****	**255**	98%	5***
MarchWood Trunk	77.3	*230*	*1,100*	**592**	54%	508
Hines Road Trunk	79.7		205	**135**	66%	70

Note values in bold are from the 2013 IMP (and supplementary data), italics are from the 2012 WUC report.

*March Pump Station is scheduled to be upgraded to an ultimate firm capacity of +/-586L/s per March PS Class EA report.

** Based on monitored SCADA data provided by the City included in **Appendix C**.

*** Available Flow based on Novatech analysis of as-built capacity of the existing EMT. Supporting calculations are included in Table C-6e: Sanitary Sewer Capacity Analysis ï East March Trunk, included in **Appendix C**.

6.3 Planned Wastewater Infrastructure

There are two major planned wastewater infrastructure works planned as noted in the Cityôs 2013 Infrastructure Master Plan which will have an impact on the future servicing of the proposed development. The planned wastewater infrastructure works are shown on **Figure 6.3**.

Phase 2 of the **North Kanata Trunk** (NKT) will extend a 1200mm pipe with a design capacity of 1,290 L/s from the March Pump Station (MPS) to the temporary cap where Phase 1 construction ended. A gravity connection will be made from the Marchwood Trunk to the NKT, allowing wastewater to bypass the MPS. This measure will significantly reduce flow to the station, thereby increasing residual capacity at the MPS. Construction of the NKT is expected to be complete by 2018 as per the 2013 IMP.

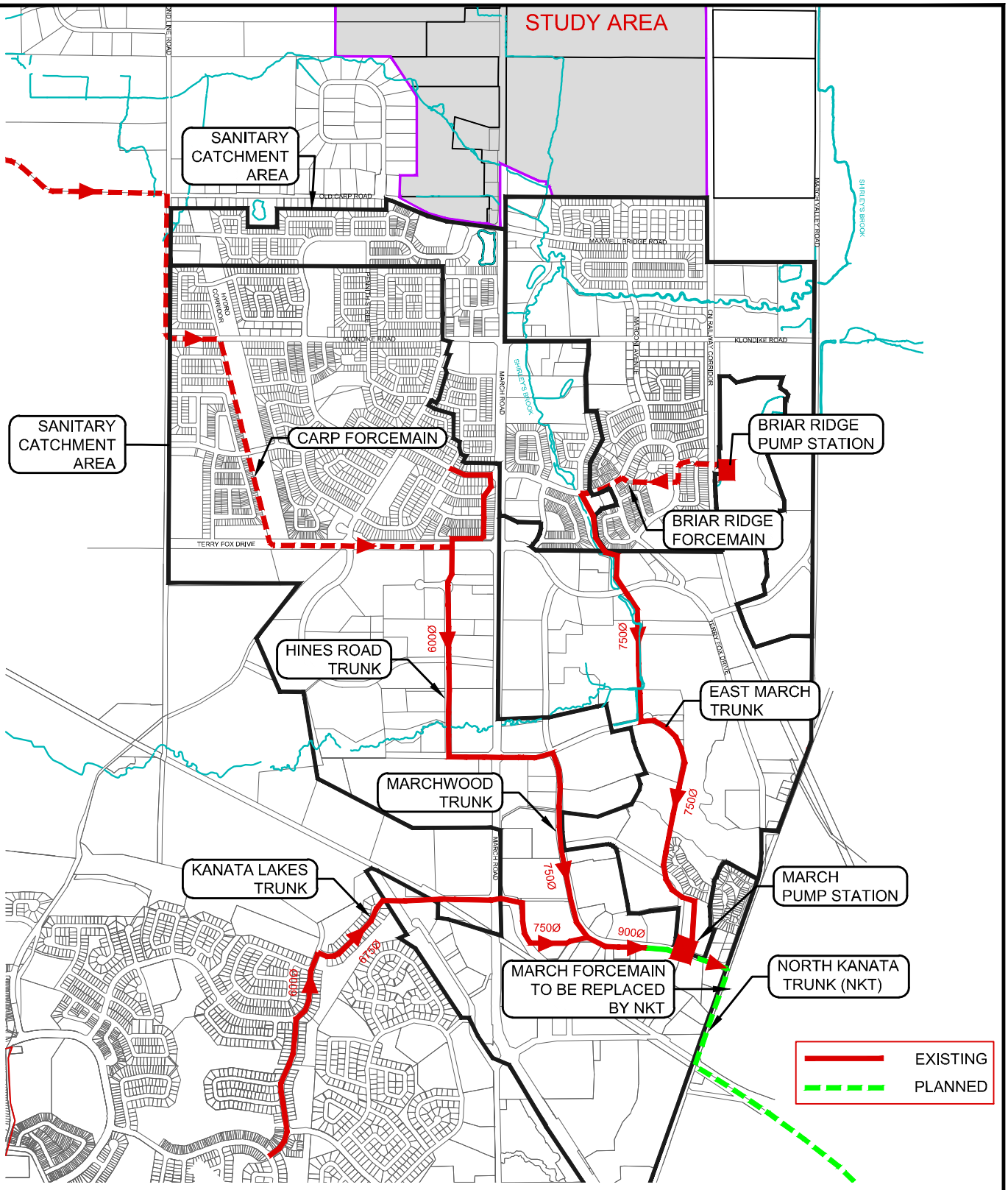

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FIGURE NO. 6.3

NORTH KANATA PLANNED WASTEWATER TRUNK INFRASTRUCTURE

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M:\2012\112117\CADDesign_MSS\FIGURES\FIGURE 7.3 - PLANNED WASTEWATER INFRASTRUCTURE.dwg, PWW COLL, Feb 11, 2016 - 9:37am, lseely

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The **March Pump Station** (MPS) will be converted to a low-lift facility that connects to the North Kanata Trunk. The March Forcemain will be decommissioned as part of these works. The 2013 IMP indicates that construction would occur sometime between 2013 and 2018. With diversion of the Marchwood Trunk, there will be no urgency to complete this project. The projected 2031 flow from the 2013 IMP in this configuration is 256 L/s, or 44% of the station firm capacity.

Supporting information on the Planned Wastewater Infrastructure work from the 2013 IMP is included in **Appendix C-1** for reference.

6.4 Viable Off-site Trunk Servicing Evaluation

As indicated previously, the Kanata Lakes Trunk Sewer is located farther from the development area and is not a viable option for servicing the proposed development. Therefore, the Hines Road, Marchwood and East March Trunk Sewers and the Briar Ridge Pump Station were evaluated to determine the preferred servicing option for the Kanata North Urban Expansion Area.

6.4.1 Trunk Sewers

There are two initial constraints to review when evaluating these trunk sewers which are elevation and capacity. The elevations were obtained from record drawings provided by the City and the capacities of each trunk sewer was obtained from the *WUC Master Servicing Plan by RVA*.

Elevation
Hines Road Trunk (by Morganôs Grant and March) = 79.7m
Marchwood Trunk (by Solandt and Hines) obvert = 77.3m
East March Trunk (by Shirleyôs Brook Dr.) obvert = 72.1m

Capacity
Hines Road Trunk = 205L/s (upper reach of MWT)
Marchwood Trunk = 1,100L/s, reaching 52% capacity by 2031 with a remaining capacity of 526 L/s.
East March Trunk = 550 L/s, reaching 31% capacity by 2031 with a remaining capacity is 378 L/s.

The capacities are based on the projected 2031 buildout of the existing drainage areas tributary to each trunk sewer and do not include the subject development. There are no indications that there are HGL issues in any of these trunk sewers, therefore HGL was not part of the initial evaluation.

Based on these two constraints the most viable option to provide a wastewater outlet for the subject lands is the East March Trunk Sewer. The connection point to the East March Trunk Sewer is proposed at the intersection of Shirleyôs Brook Drive and Sandhill Road just east of March Road. The East March Trunk Sewer and its catchment area are shown on **Figure 6.4.1**. There are two possible routes for a sewer to this connection point from the KNUEA. One is southward along March Road and along Shirleyôs Brook Drive. The second option is to service the development using the Briar Ridge Pump Station. A connection can be made to the existing sanitary sewer that runs along the Ottawa Central Railway corridor to the Briar Ridge Pump Station. The Briar Ridge Forcemain then connects to the East March

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FIGURE NO. 6.4.1

EXISTING WASTEWATER
CATCHMENT AREAS
- EAST MARCH TRUNK

DATE APR 2016 | JOB 112117

SCALE AS SHOWN

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SCALE
1:10,000
0 100 200 300 400

STUDY AREA

MARCH ROAD
KLONDIKE ROAD
OTTAWA CENTRAL RAILWAY
MARCH VALLEY DRIVE
SANDHILL ROAD
SHIRLEYS BROOK DRIVE
OLD CARP ROAD
HYDRO CORRIDOR
TERRY FOX DRIVE
LEGGET DRIVE
SOLANDT ROAD

BRIAR RIDGE P.S.
MARCH P.S.

A 1 89.95 ha
A 2 150.41 ha
A 3 40.12 ha
A 4 12.21 ha
A 5 31.76 ha
A 6 19.34 ha
A 7 32.74 ha
A 8 17.31 ha
A 9 17.12 ha

EAST MARCH TRUNK (750mmØ)

LEGEND

- EXISTING RESIDENTIAL
- FUTURE RESIDENTIAL
- COMMERCIAL
- INSTITUTIONAL
- INDUSTRIAL
- OPEN SPACE
- P.S. PUMP STATION
- (12) SANITARY NODE ID #
- SANITARY MANHOLE
- SANITARY SEWER

M:\2012\112117\CAD\Design_MSS\FIGURES\FIGURE 7.2.dwg, Existing Boundaries, Feb 24, 2016 - 10:45am, lseely

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Trunk Sewer at the same connection point. Each of these servicing options is evaluated subsequently.

It should be noted that the actual capacity of the East March Trunk may be less than calculated in the WUC Master Servicing Plan. Upon review of the as-built drawings, there are some isolated sections of the EMT that have reduced capacity. Our analysis concludes that, overall, there is sufficient residual capacity in the EMT to service the KNUEA without surcharge. Capacity review of the EMT is included in **Appendix C-3**.

6.4.2 Briar Ridge Pump Station

The **Briar Ridge Pump Station** (BRPS) is located south of Klondike Road and east of the railway corridor. The inlet to the BRPS has an obvert elevation of 61.15m at the wet well. This facility has a firm capacity of 183 L/s with three pumps installed. The Briar Ridge Pump Station was originally designed to accommodate an approximate net drainage area of 128ha with a design flow of 174L/s. (BRPS Pre-Design Report, by CCL June 2001) The BRPS discharges via two forcemains, a 200mm and a 300mm diameter respectively, which outlet to the East March Trunk Sewer by the intersection of Shirleyøs Brook Drive and Sandhill Road just east of March Road.

The BRPS is currently operating with a single duty pump and a single standby pump and has a firm capacity of 53L/s (MOE CofA, August 2001, included in **Appendix C-4**). At full build out, the two existing pumps are designed to be upgraded with larger impellers and a third pump installed for standby to provide a firm capacity of 183L/s. Flow monitoring by City staff will determine when the upgrades are required. The sanitary catchment area for the BRPS is shown on **Figure 6.3**.

Monitored flow data was obtained from the City of Ottawa which included typical winter flows (2016) and flows from four major storm events (refer to **Appendix C-4**). Analysis of this data concluded that the maximum dry weather flow into the BRPS is currently 18.9 L/s (as of March 2016). This flow is relative to a drainage area of 81ha, based on current development, out of the total drainage area of 130ha.

The flow from the total drainage area can be re-calculated using the dry weather flow rate of 18.9 L/s for the existing developments. The calculation includes a combination of current monitored flow (dry weather flow rate) for existing areas and typical design criteria for the future development areas. Therefore, the total flow into the BRPS is re-calculated to be 109 L/s. A BRPS Capacity analysis is included in **Appendix C-4** for reference.

A review of the extraneous flows was also completed using the monitored flow data. It was concluded that monitored inflow and infiltration flow values, since 2011, are comparable to the design allowance of 0.28 L/s/ha. Refer to the design sheet as noted above.

In conclusion, the Briar Ridge Pump Station currently has a firm capacity of 53 L/s. When upgrades are completed the pump station will have a firm capacity of 183 L/s. If the re-calculated inflow to the pump station is 108 L/s, then the excess capacity of the pump station is 75 L/s. As mentioned previously, the upgrades involve larger impellers and the installation of a third pump as per the original design. These upgrades would require an amendment to the MOE Certificate of Approval.

6.5 Wastewater Servicing Options

Six off-site sanitary servicing alternatives were developed and are summarized below. A figure illustrating each option is also attached for reference. The existing topography within the subject property shows a ridge that runs north-south through the eastern side of the property. This ridge is a natural drainage boundary as indicated in some of the servicing scenarios. These servicing alternatives and a preliminary evaluation were included in a technical memorandum and presented to the Master Servicing Study Technical Advisory Committee for their review. A copy of this technical memorandum and subsequent City comments are provided in **Appendix C-5** for reference.

Option 1
The area west of March Road and west of the ridge will be serviced by a new gravity sanitary sewer along March Road to Shirleyøs Brook Drive. The area east of the ridge will drain by gravity to a small pump station (50L/s) and a forcemain will carry the pumped sewage to the proposed sanitary sewer on March Road. A gravity overflow from the new pump station is proposed to outlet to the proposed Stormwater Management Facility east of the existing rail corridor.

This servicing option will require upgrading an existing 375mm diameter sanitary sewer along Shirleyøs Brook Drive to a 600mm diameter to be able to accommodate the increased flows and the existing sewer will be lowered to provide a lower outlet elevation. This servicing option is shown on **Figure 6.5.1.**

Option 2
The area west of March Road and west of the ridge will be serviced by a new gravity sanitary sewer along March Road to Shirleyøs Brook Drive. The area east of the ridge will drain by gravity to the existing 375mm diameter sanitary sewer along the rail corridor by the eastern property limit. This existing sanitary sewer outlet is to the Briar Ridge Pump Station (BRPS).

This servicing option will require upgrading an existing 375mm diameter sanitary sewer along Shirleyøs Brook Drive to a 600mm diameter to be able to accommodate the increased flows and provide a lower outlet elevation. Upgrades will also be required to existing infrastructure along the rail corridor. A section of the existing 375mm diameter sanitary sewer will be replaced with 450mm diameter sewer. The BRPS can accommodate the flow from the Kanata North Urban Expansion Area (50L/s) within the ultimate design capacity of the station (183L/s). This servicing option is shown on **Figure 6.5.2.**

Option 3
This option proposes that the development outlet to the sanitary sewer along the existing rail corridor. A substantial amount of the existing sanitary sewer along the rail corridor would require upgrading or replacing to service the development. A 525mm diameter sanitary sewer would be installed to replace the existing 375mm and 450mm diameter sewers along the rail corridor. The BRPS will also require upgrading to service the development by expanding the original ultimate design capacity of the BRPS from 183L/s to a firm capacity of 256L/s. The existing 200mm and 300mm diameter forcemains from the BRPS to the EMT will also require adding an additional 300mm diameter forcemain. This servicing option is shown on **Figure 6.5.3.**

Option 4
This option proposes a single, larger pump station (182.2L/s), located east of the ridge, to service the development area. The pump station would outlet via a proposed forcemain along March Road and connect to a new gravity sanitary sewer on Shirleyøs Brook Drive and connect into the existing sanitary sewer on Shirleyøs Brook Drive. This option will require the existing 375mm diameter sewer on Shirleyøs Brook Drive to be upgraded to a 600mm diameter sewer. This servicing option is shown on **Figure 6.5.4.**

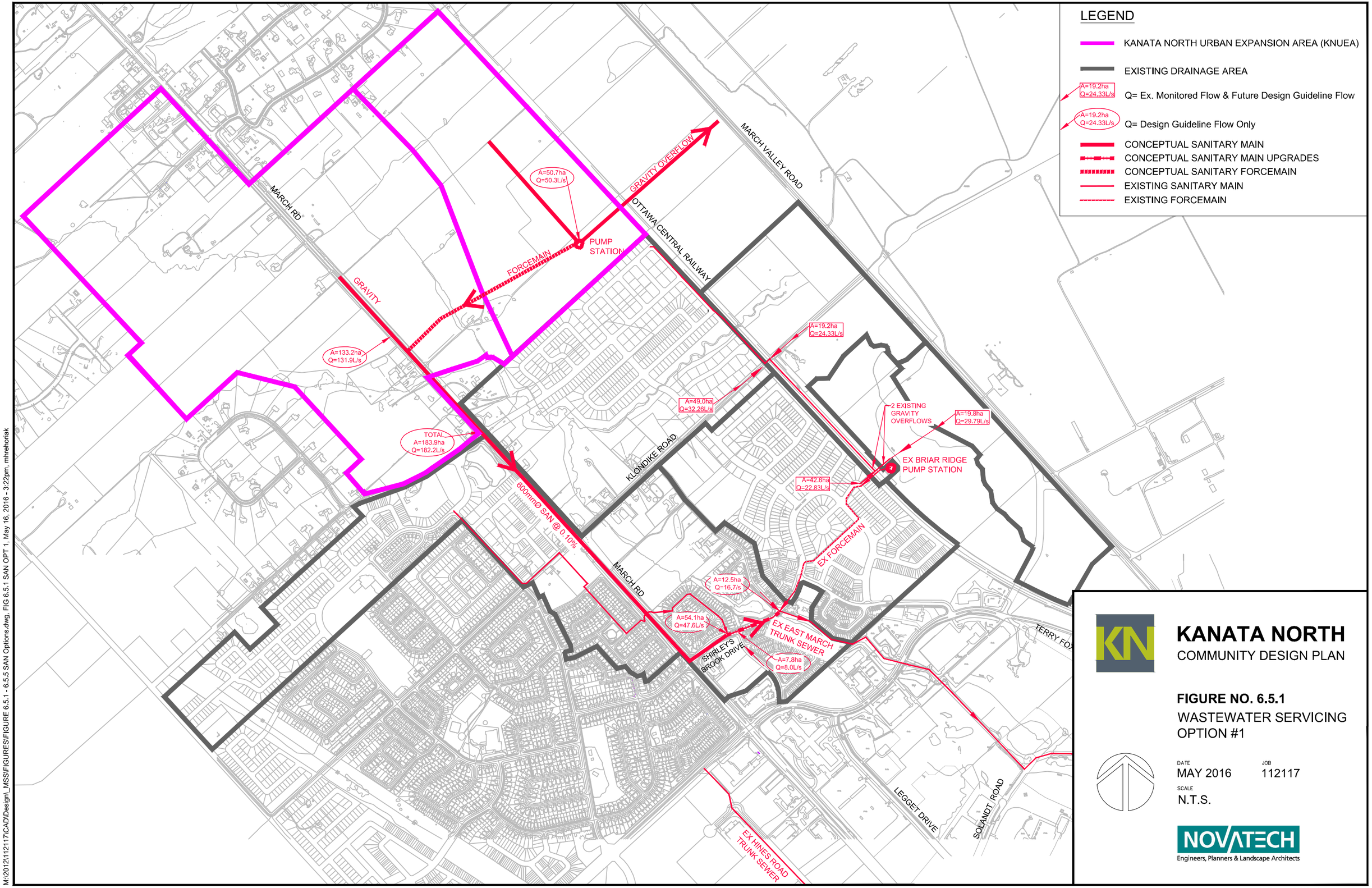
The City of Ottawa has asked that consideration be given to extending the proposed forcemain along March Road approximately 1230m beyond Shirleyøs Brook Drive. This proposed forcemain would connect to the existing Marchwood Trunk Sewer. Once the NKT is completed the proposed flows would bypass the March Pump Station. This is considered as option 4b as shown on **Figure 6.5.4**. There is a significant cost associated with this additional forcemain therefore; this option was not considered a viable option for servicing the KNUEA.

Option 5A (Similar to Option 2)
The area west of March Road will be serviced by a new gravity sanitary sewer along March Road. The area east of March Road will drain by gravity to the existing sanitary sewer along the existing rail corridor, and then to the BRPS. A 525mm diameter sanitary sewer would be installed to replace the existing 375mm and 450mm diameter sewers along the rail corridor. The BRPS will also require upgrading to service the development by expanding the original ultimate design capacity of the BRPS from 183L/s to a firm capacity of 205L/s.

This servicing option will require upgrading an existing 375mm diameter sanitary sewer along Shirleyøs Brook Drive to a 600mm diameter to be able to accommodate the increased flows and the existing sewer will be lowered to provide a lower outlet elevation. This servicing option is shown on **Figure 6.5.5a.**

Option 5B (Similar to Option 2)
The area west of March Road and a portion of the area east of March Road will be serviced by a new gravity sanitary sewer along March Road. The remainder of the area east of March Road will drain by gravity to the existing sanitary sewer along the existing rail corridor, and then to the BRPS. This option will require a portion of the existing 375mm diameter sewer be replaced with a 450mm diameter sewer along the rail corridor. The BRPS can accommodate the flow from the Kanata North Urban Expansion Area (52L/s) within the ultimate design capacity of the station (183L/s).

This servicing option will require upgrading an existing 375mm diameter sanitary sewer along Shirleyøs Brook Drive to a 600mm diameter to be able to accommodate the increased flows and the existing sewer will be lowered to provide a lower outlet elevation. This servicing option is shown on **Figure 6.5.5b.**



KANATA NORTH
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FIGURE NO. 6.5.1
WASTEWATER SERVICING OPTION #1

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M:\2012\112117\CAD\Design_MSS\FIGURES\FIGURE 6.5.1 - 6.5.5 SAN Options.dwg, FIG 6.5.1 SAN OPT 1, May 16, 2016 - 3:22pm, mhrehoriak

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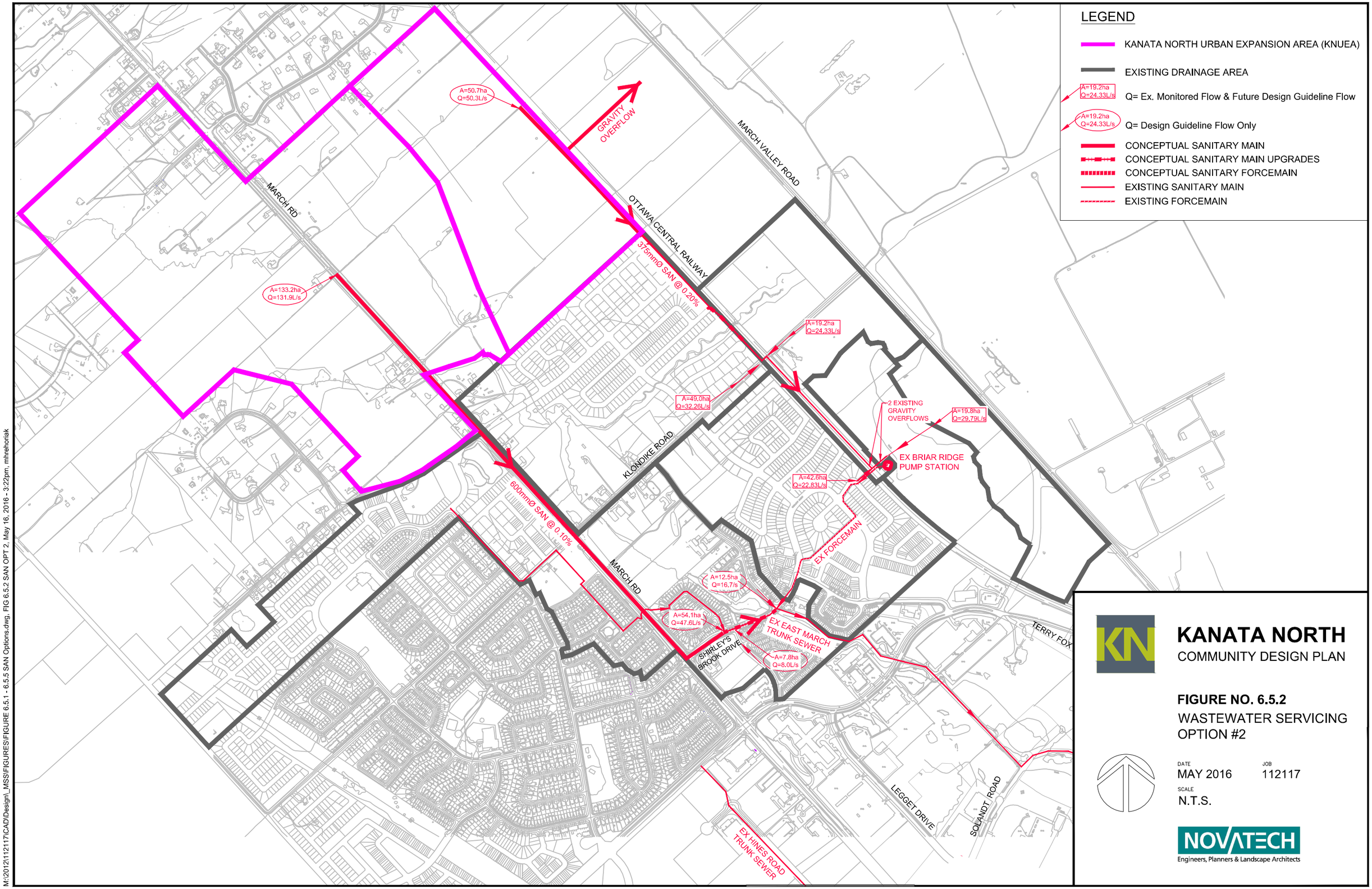

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FIGURE NO. 6.5.2
WASTEWATER SERVICING
OPTION #2

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SCALE N.T.S.

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M:\2012\112117\CADDesign_MSS\FIGURES\FIGURE 6.5.1 - 6.5.5 SAN Options.dwg, FIG 6.5.2 SAN OPT 2, May 16, 2016 - 3:22pm, mhrehoriak

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LEGEND

- KANATA NORTH URBAN EXPANSION AREA (KNUEA)
- EXISTING DRAINAGE AREA
- A=19.2ha Q=24.33L/s — Q= Ex. Monitored Flow & Future Design Guideline Flow
- A=19.2ha Q=24.33L/s — Q= Design Guideline Flow Only
- CONCEPTUAL SANITARY MAIN
- CONCEPTUAL SANITARY MAIN UPGRADES
- CONCEPTUAL SANITARY FORCEMAIN
- EXISTING SANITARY MAIN
- EXISTING FORCEMAIN

MARCH RD
MARCH VALLEY ROAD
OTTAWA CENTRAL RAILWAY
KLONDIKE ROAD
SHIRLEY'S BROOK DRIVE
TERRY FOX
LEGGET DRIVE
SOLANDT ROAD
A=91.9ha Q=91.3L/s
GRAVITY OVERFLOW
525mmØ SAN @ 0.20%
TOTAL A=183.9ha Q=182.2L/s
A=92.0ha Q=91.0L/s
A=19.2ha Q=24.33L/s
A=49.0ha Q=32.26L/s
600mmØ SAN @ 0.40%
2 EXISTING GRAVITY OVERFLOWS
A=19.8ha Q=29.79L/s
EX BRIAR RIDGE PUMP STATION
A=42.6ha Q=22.83L/s
UPGRADE EX FORCEMAIN
A=12.5ha Q=16.7/s
A=54.1ha Q=47.6L/s
EX EAST MARCH TRUNK SEWER
A=7.8ha Q=8.0L/s
EX HINES ROAD TRUNK SEWER

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 6.5.3
WASTEWATER SERVICING OPTION #3

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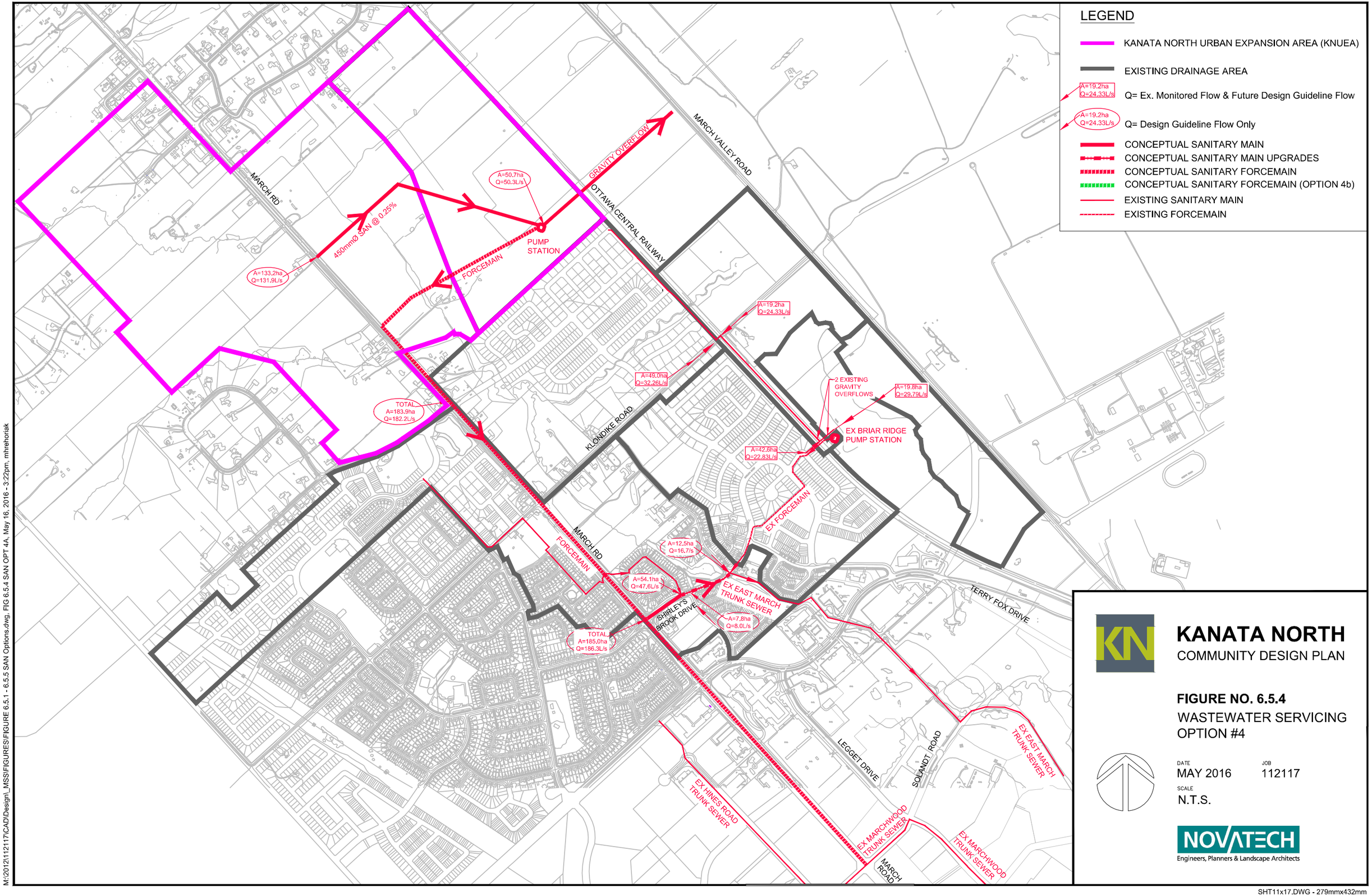

KANATA NORTH
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FIGURE NO. 6.5.4
WASTEWATER SERVICING
OPTION #4

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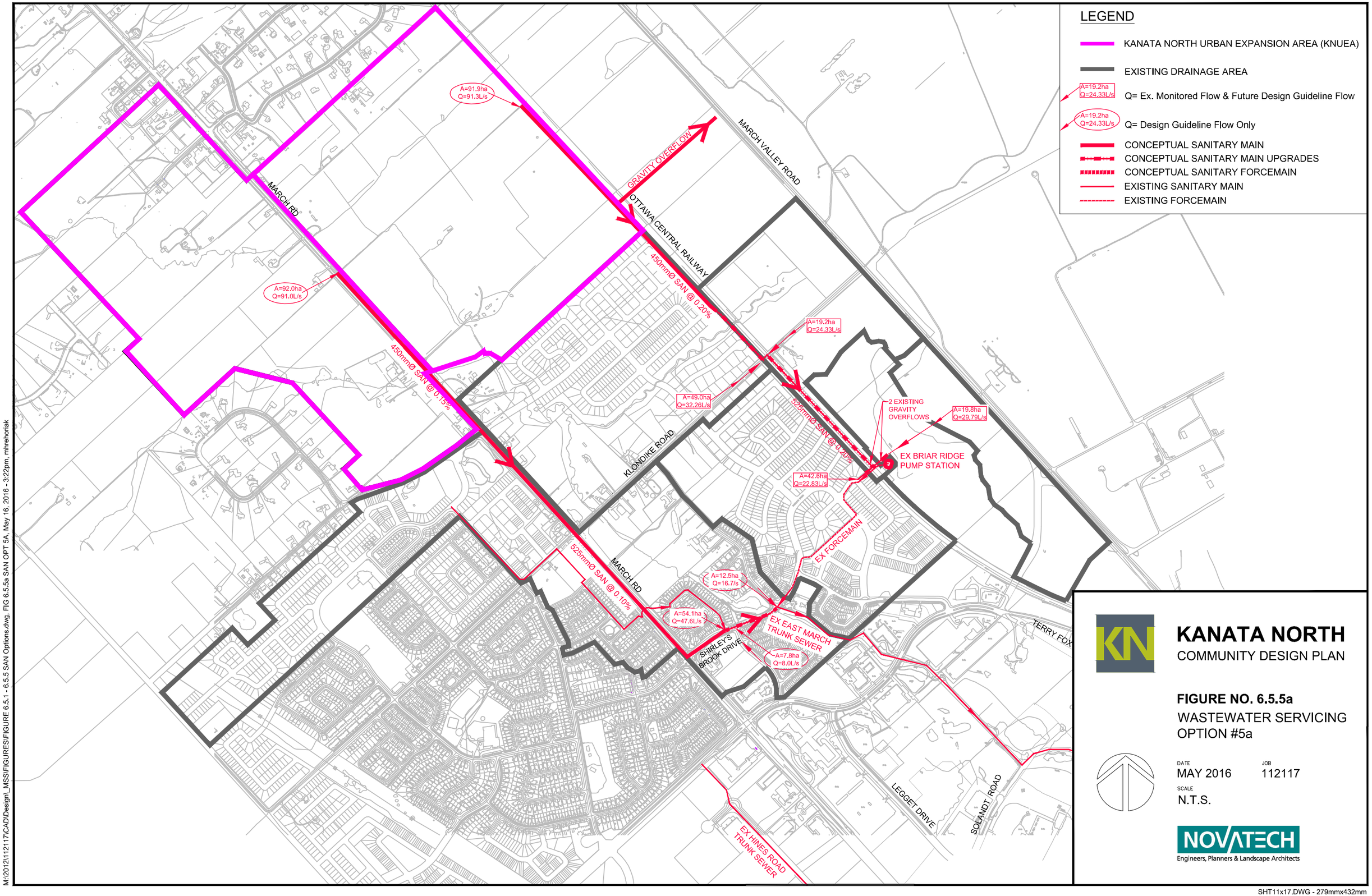

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FIGURE NO. 6.5.5a
WASTEWATER SERVICING
OPTION #5a

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M:\2012\112117\CAD\Design_MSS\FIGURES\FIGURE 6.5.1 - 6.5.5 SAN Options.dwg, FIG 6.5.5a SAN OPT 5A, May 16, 2016 - 3:22pm, mhrehoriak

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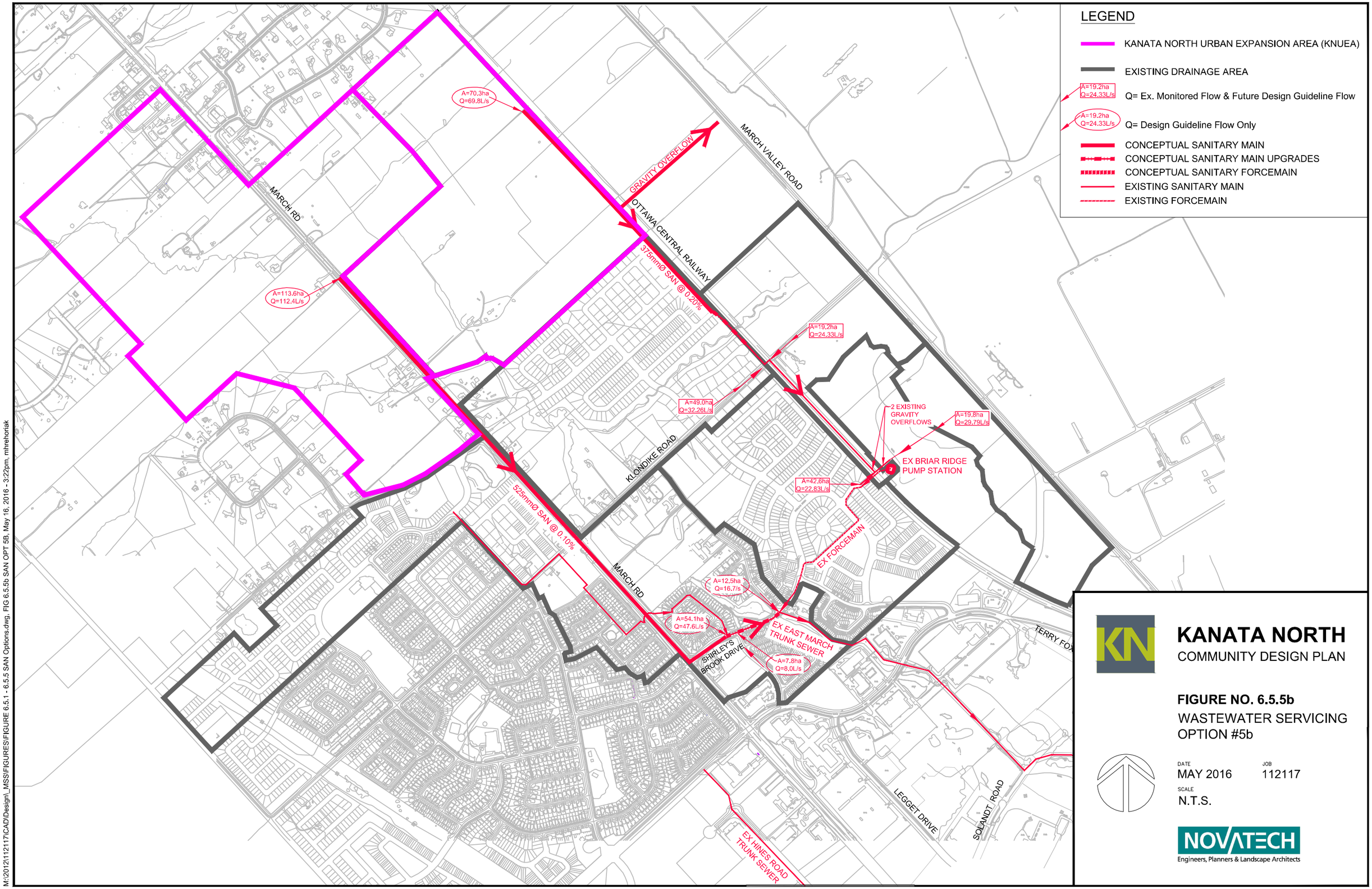

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FIGURE NO. 6.5.5b
WASTEWATER SERVICING
OPTION #5b

DATE MAY 2016
JOB 112117
SCALE N.T.S.

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M:\2012\112117\CAD\Design_MSS\FIGURES\FIGURE 6.5.1 - 6.5.5 SAN Options.dwg, FIG 6.5.5b SAN OPT 5B, May 16, 2016 - 3:22pm, mhrehoriak

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6.5.1 Evaluation of Options

In order to evaluate the sanitary servicing alternatives, criteria and indicators were established which include design and constructability/functionality, caring and healthy communities, natural environment and economy. **Table 6.5.1** is a summary of the works required for each of the options. The evaluation and analysis of each of the criteria is presented in an evaluation matrix shown in **Table 6.5.2**. Preliminary cost estimates have also been prepared for each of the servicing alternatives and **Table 6.5.3** is a summary of the cost comparison for each of the servicing alternatives.

Table 6.5.1 – Summary of Works Required for each Option

Criteria	Option					
	1	**2**	**3**	**4**	**5A**	**5B**
New Pump Station	52L/s	No	No	185L/s	No	No
BRPS Upgrades (above current 53L/s)	No	Minor	Major	No	Minor	Minor
BRPS Ultimate Capacity	183L/s	183L/s	256L/s	183L/s	205L/s	183L/s
Upgrades to Rail Corridor Trunk Sewer (from 375mmø or 450mmø)	No	164m to 450mmø	930m to 525mmø	No	930m to 525mmø	164m to 450mmø
New March Road Sewer	Gravity	Gravity	No	Forcemain	Gravity	Gravity
Upgrades to Shirleyøs Brook Trunk Sewer (from 375mmø)	201m to 600mmø	201m to 600mmø	No	201m to 600mmø	201m to 600mmø	201m to 600mmø

Table 6.5.2: Evaluation Matrix - Off-Site Sanitary Outlet Options
Kanata North Urban Expansion Area

Critieria	Indicators	Option #1 Area below ridge to local PS and total area gravity outlet to March Rd sewer	Option #2 Area below ridge gravity outlet to BRPS, West area gravity outlet to March Rd sewer	Option #3 Total area gravity outlet to BRPS	Option #4 Total area outlet to local PS with forcemain along March Rd
Design and Constructability/Functionality					
Geotechnical issues and construction risks	Potential for encountering poor soils/rock and/or elevated groundwater conditions.	Lower end of March Rd - possible rock Upper end of March Rd - rock	Lower end of March Rd - possible rock Upper end of March Rd - rock Gravity outlet to BRPS - high groundwater and rock	Gravity outlet to BRPS - high groundwater and rock	Upper end of March Rd - rock
Infrastructure requirements	Extent of works required.	Significant off-site works.	Significant off-site works. Flow to BRPS fits within firm capacity of station	Significant upgrades to BRPS and forcemain. New Shirley's Brook crossing.	Significant off-site works.
Operational Impacts	Amount of maintenance intensive infrastructure required.	Substantial gravity sewer where no intensive maintenance is required. O & M required for proposed pump station and forcemain.	All gravity sewers - no intensive maintenance required. O & M required for BRPS	Substantial portion of the sewers are gravity so no intensive maintenance required. O & M required for upgraded pump station and forcemain.	O & M required for proposed pump station and forcemain.
Construction Scheduling	Impact of construction on development timing.	Off-site works need to be in place prior to development.	Off-site works need to be in place prior to development.	Off-site gravity sewer needed immediately. PS upgrades required.	PS and off-site works need to be in place.
Property Acquisition	Ease of property acquisition. (Depends on status of lands and adjacent lands ie. Vacant, leased or owner occupied).	All municipal ROW downstream. Requirement to cross under rail corridor for sanitary overflow on proponents land.	All municipal ROW downstream. Requirement to cross under rail corridor for sanitary overflow on proponents land.	All municipal ROW downstream. Requirement to cross under rail corridor for sanitary overflow on proponents land.	All municipal ROW downstream. Requirement to cross under rail corridor for sanitary overflow on proponents land.
System Reliability	Proximity of a storm sewer, swm or other surface water for emergency overflow.	Adjacent existing watercourse will be used for emergency overflow on proponents land.	Adjacent existing watercourse will be used for emergency overflow on proponents land from gravity sewer to reduce HGL.	Adjacent existing watercourse will be used for emergency overflow on proponents land from gravity sewer to reduce HGL.	Adjacent existing watercourse will be used for emergency overflow on proponents land.
Servicing Flexibility	Ease of accomodating potential changes in servicing plans.	On-site servicing is flexible for area above ridge. Area below ridge will require PS before development.	On-site servicing is flexible when outlets are in place.	On-site servicing is flexible when outlets are in place.	On-site servicing is flexible when outlets are in place.
Phasing	Flexibility of design to allow multiple phasing options.	Phasing is flexible for area above ridge. Area below ridge can be flexible after the PS is installed.	Phasing is flexible when outlets are in place.	Phasing is flexible when outlets and PS upgrades are in place.	Phasing is flexible when outlets are in place.
Caring and Healthy Communities					
Displacement of Residents, Community/Recreation Facilities and Institutions	Affects areas of residence, instituions or businesses.	Substantial disruption to March Road corridor.	Disruption to March Road corridor. Disruption to Brookside Subdivision.	Gravity sewers off-site and forcemain through ex. residential neighbourhoods (Brookside and Briar Brook).	Substantial disruption to March Road corridor.
Disruption to Existing Community	Extent of works affecting existing residences and businesses and visibility of additional infrastructure and traffic disruption.	March Rd traffic disruption (commuter). Potential business disruption.	Substantial March Rd traffic disruption (commuter). Potential business disruption.	Gravity sewers off-site and forcemain through ex. residential neighbourhoods (Brookside and Briar Brook). Local traffic disruptions.	March Rd traffic disruption (commuter). Potential business disruption.
Natural Environment					
Impact on Significant Natural Features	Loss of natural area due to installation of works.	None	None	None	None
Impact on Aquatic Systems	Potential impact on fish habitat due to installation of works.	Overflow from PS to existing ditch. Rare emergency overflow may impact.	Overflow from sewer to existing ditch. Rare emergency overflow may impact.	Overflow from sewer to existing ditch. Rare emergency may impact.	Overflow from PS to existing ditch. Rare emergency overflow may impact.
Impact on Quality and Quantity of Surface Water and Groundwater	Potential impact on water quality in Shirley's Brook and watershed resulting from rare emergency overflows to pump station failure.	Overflow from PS to existing ditch. Rare emergency overflow may impact.	Overflow from sewer to existing ditch. Rare emergency overflow may impact.	Overflow from sewer to existing ditch. Rare emergency may impact.	Overflow from PS to existing ditch. Rare emergency overflow may impact.
Impact on Global Warming	Difference in carbon dioxide emissions resulting from occasional use of diesel generator.	Occasional use of genset.	None	Occasional use of genset.	Occasional use of genset.
Effects on Urban Greenspace, Open Space and Vegetation (ie. Trees, shrubs, etc.)	Disruption to greenspace and trees.	None	None	None	None
Economy					
Potential to Use Combined Service Corridor	Length and area of service corridor.	March Rd gravity sewer shared with watermain extension.	March Rd gravity sewer shared with watermain extension.	No shared corridors.	March Rd gravity sewer shared with watermain extension.
Efficiency of Use of Existing Infrastructure	Use of existing capacity.	Ex capacity in the East March Trunk will be utilized.	Ex capacity in the East March Trunk will be utilized. Ex design capacity in the BRPS will be utilized.	Will utilize ex capacity in BRPS and East March Trunk.	Ex capacity in the East March Trunk will be utilized.
Energy Consumption	Pumping requirements.	Approx. 1/3 of site will be pumped.	Approx. 1/3 of site will be pumped.	Entire site pumped.	Entire site pumped.
Impact on Future Lands/Development					
Capital Costs					
Operating Costs					

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Table 6.5.2: Evaluation Matrix - Off-Site Sanitary Outlet Options
Kanata North Urban Expansion Area

Critieria	Option #5a Area east of March Rd outlet to BRPS, West area outlet to March Rd gravity sewer	Option #5b Valecraft below ridge and all of Metcalfe to BRPS, remainder of lands to March Rd gravity sewer
Design and Constructability/Functionality		
Geotechnical issues and construction risks	Lower end of March Rd - possible rock Upper end of March Rd - rock Gravity outlet to BRPS - high groundwater and rock	Lower end of March Rd - possible rock Upper end of March Rd - rock Gravity outlet to BRPS - high groundwater and rock
Infrastructure requirements	Significant off-site works.	Significant off-site works.
Operational Impacts	All gravity sewers - no intensive maintenance required. O & M required for upgraded BRPS.	All gravity sewers - no intensive maintenance required. O & M required for upgraded BRPS.
Construction Scheduling	Off-site works need to be in place prior to development.	Off-site works need to be in place prior to development.
Property Acquisition	All municipal ROW downstream. Requirement to cross under rail corridor for sanitary overflow on proponents land.	All municipal ROW downstream. Requirement to cross under rail corridor for sanitary overflow on proponents land.
System Reliability	Adjacent existing watercourse will be used for emergency overflow on proponents land from gravity sewer to reduce HGL.	Adjacent existing watercourse will be used for emergency overflow on proponents land from gravity sewer to reduce HGL.
Servicing Flexibility	On-site servicing is flexible when outlets are in place.	On-site servicing is flexible when outlets are in place.
Phasing	Phasing is flexible when outlets are in place.	Phasing is flexible when outlets are in place.
Caring and Healthy Communities		
Displacement of Residents, Community/Recreation Facilities and Institutions	Disruption to March Road corridor. Disruption to Brookside Subdivision.	Disruption to March Road corridor. Disruption to Brookside Subdivision.
Disruption to Existing Community	March Rd traffic disruption (commuter). Business disruption. Traffic and residential disruption in Brookside Subdivision.	March Rd traffic disruption (commuter). Business disruption. Traffic and residential disruption in Brookside Subdivision.
Natural Environment		
Impact on Significant Natural Features	None	None
Impact on Aquatic Systems	Overflow from sewer to existing ditch. Rare emergency overflow may impact.	Overflow from sewer to existing ditch. Rare emergency overflow may impact.
Impact on Quality and Quantity of Surface Water and Groundwater	Overflow from sewer to existing ditch. Rare emergency overflow may impact.	Overflow from sewer to existing ditch. Rare emergency overflow may impact.
Impact on Global Warming	None	None
Effects on Urban Greenspace, Open Space and Vegetation (ie. Trees, shrubs, etc.)	None	None
Economy		
Potential to Use Combined Service Corridor	March Rd gravity sewer shared with watermain extension.	March Rd gravity sewer shared with watermain extension.
Efficiency of Use of Existing Infrastructure	Ex capacity in the East March Trunk will be utilized. Ex capacity in the BRPS will be utilized.	Ex capacity in the East March Trunk will be utilized. Ex capacity in the BRPS will be utilized.
Energy Consumption	BRPS capacity will need to be increased.	BRPS capacity will need to be increased.
Impact on Future Lands/Development		
Capital Costs		
Operating Costs		

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31-Mar-16

Table 6.5.3 – Cost Summary Table

	Unit	Option 1	Option 2	Option 3	Option 4	Option 5A	Option 5B
Outlet - East March Trunk Sewer							
Total Area	ha	183.9	133.2	N/A	183.9	92.0	113.6
Design Flow	L/s	182.2	131.9	N/A	182.2	91.0	112.4
Gross Cost	**$**	**$11,313**	**$7,274**	**N/A**	**$14,974**	**$6,550**	**$7,120**
Gross Unit Flow Cost	**$ / (L/s)**	**$62**	**$54**	**N/A**	**$82**	**$71**	**$63**
Outlet - Briar Ridge Pump Station							
Tributary Area	ha	N/A	50.7	183.9	N/A	91.9	70.3
Design Flow	L/s	N/A	50.3	182.2	N/A	91.3	69.8
Gross Cost	**$**	**N/A**	**$3,755**	**$12,967**	**N/A**	**$7,090**	**$4,112**
Gross Unit Flow Cost	**$ / (L/s)**	**N/A**	**$75**	**$71**	**N/A**	**$78**	**$59**
Total Gross Costs	**$**	**$11,313**	**$11,029**	**$12,967**	**$14,974**	**$13,640**	**$11,232**
Avg Gross Unit Flow Cost	**$ / (L/s)**	**$62**	**$61**	**$71**	**$82**	**$75**	**$62**

Note: All costs are shown as $1,000s. Detailed cost tables are included in **Appendix C-6**.

Based on our review and analysis of the servicing alternatives, the preferred sanitary servicing alternative is Option 2 for the following reasons:

- Maximizes the use of gravity sewers.
- Maximizes the use of existing infrastructure. This option requires the least amount of upgrades to the existing sewer system which reduces costs.
- A new pump station will not be required which reduces the overall cost of this servicing option and reduces operation and maintenance requirements.
- This scenario uses the excess capacity within the BRPS. This option has the smallest area draining to the Briar Ridge Pump Station and does not require any upgrades to the original design of the pump station.
- The gravity sewer on March Road will accommodate additional connections if required. There are existing properties along March Road north of Shirleyôs Brook Drive that currently do not have a connection to a municipal sewer. The design of the sanitary sewer along March Road has been designed to accommodate wastewater flows from these properties.
- Offers flexibility for future growth. The sewer along March Road could be extended to service future development.
- Results in the lowest capital and operations and maintenance costs of all the options.

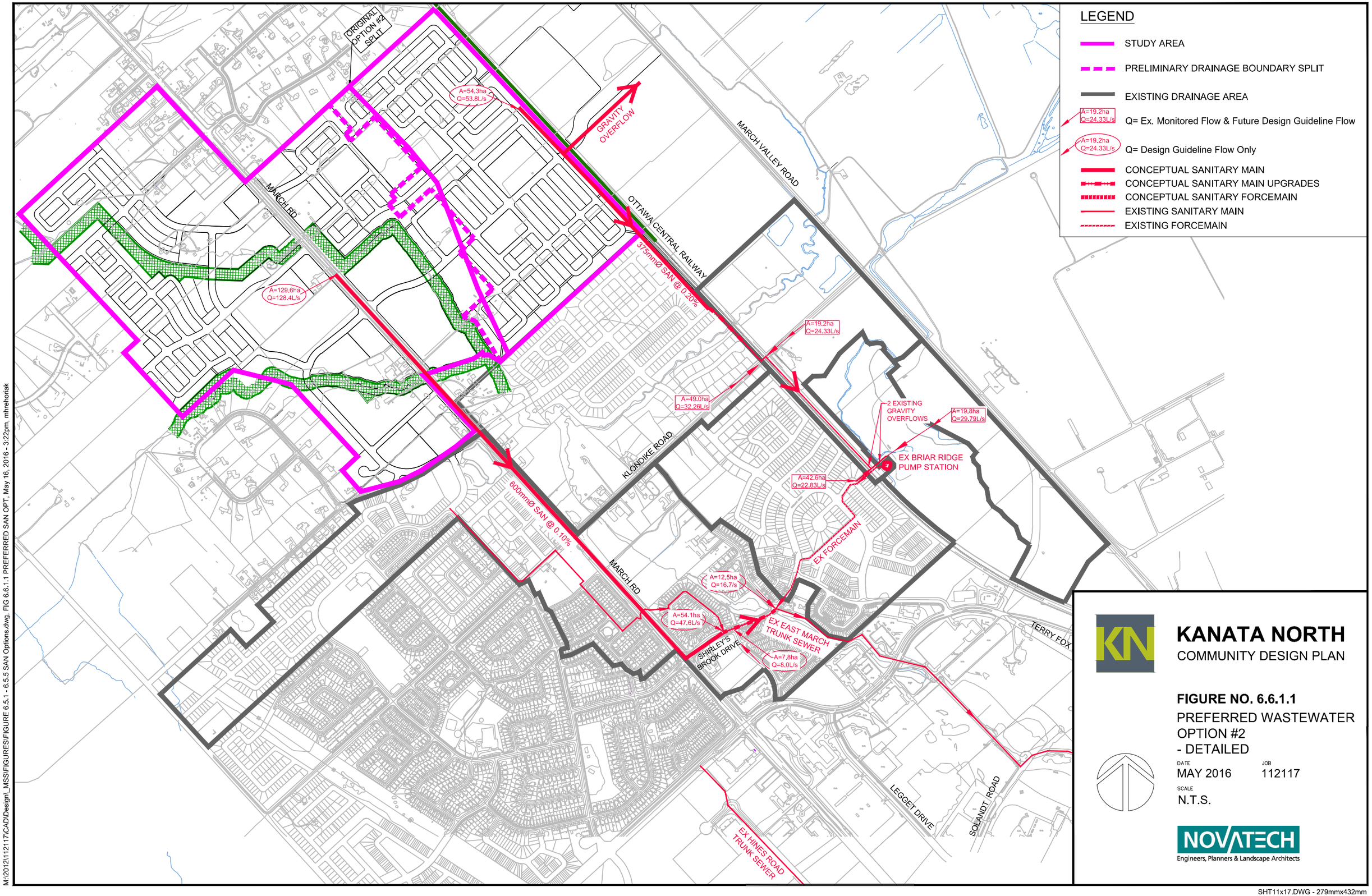
6.6 Detailed Wastewater Servicing Evaluation

6.6.1 Onsite Servicing

6.6.1.1 Design Criteria

The proposed development will be serviced by a gravity sanitary sewer network within the road right-of-ways. A proposed trunk sanitary sewer (preferred wastewater Option 2) and associated drainage areas are shown on **Figure 6.6.1.1** and in more detail in the Onsite & Offsite Sanitary Drainage Area Plans (112117-SAN1 & 112117-SAN2.) for the KNUEA. Sanitary sewers, for the proposed development, are designed based on criteria established in Section 4.0 of the *City of Ottawa Sewer Design Guidelines* (October 2012) and are summarized as follows:

Commercial/Institutional flows = 50,000 L/ha/day
Industrial flows = 35,000 L/ha/day
Population Flow = 350 L/capita/day
Infiltration = 0.28 L/s/ha
Single Family Home = 3.4 persons per unit
Townhouse = 2.7 persons per unit
Apartment = 1.8 persons per unit
Maximum Residential Peak Factor = 4.0
Commercial/Institutional Peak Factor = 1.5
Industrial Peak Factor = per MOE/City of Ottawa graph (included in **Appendix C-6**)
Minimum velocity = 0.6m/s
Manningôs n = 0.013



KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 6.6.1.1
PREFERRED WASTEWATER OPTION #2
- DETAILED

DATE MAY 2016
JOB 112117
SCALE N.T.S.

NOVATECH
Engineers, Planners & Landscape Architects

M:\2012\112117\CAD\Design_MSS\FIGURES\FIGURE 6.5.1 - 6.5.5 SAN Options.dwg, FIG 6.6.1.1 PREFERRED SAN OPT, May 16, 2016 - 3:22pm, mhrehoriak

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6.6.1.2 Probable Wastewater Flow

Based on the land uses proposed in the Demonstration Plan (**Figure 4.2**) the following flow rates were calculated. Detailed flow calculations are included in **Appendix C-6**.

Table 6.6.1 – Land Use and Probable Flow

	Area (ha)	Units*	Population**	Population Flow (L/s)	Peak Factor	Infiltration (L/s)	Total Sanitary Flow (L/s)
Schools	11.12			9.7	1.5	3.1	12.8
Creek Corridor	12.22			0.0	0.0	0.0	0.0
SWM Blocks	4.08			0.0	0.0	0.0	0.0
Parks	10.65			0.0	0.0	0.0	0.0
Commercial - Mixed Use	15.91			13.8	1.5	4.5	18.3
Park and Ride	2.54			0.0	0.0	0.7	0.7
Misc. Ex. Lands (School)	5.70			4.9	1.5	1.6	6.5
Fire Hall	0.83			0.7	1.5	0.2	1.0
Residential	80.10					22.4	22.4
Singles	64.14	1056	3590	43.6	3.0	0.0	0.0
Street Townhouse		1045	2822	34.3	3.0	0.0	0.0
Multi-Unit Residential	15.96	1144	2574	31.3	3.0	0.0	0.0
Roads	40.21			0.0	0.0	11.3	11.3
Total	**183.36**	**3339**	**8986**	**138.4**		**43.8**	**182.2**

* Based on May 13, 2016 Novatech Memo (included in **Appendix C-6**) + 10%
** Population calculated based on the following:
Singles = 3.4 persons per unit
Street Townhouse = 2.7 persons per unit
Multi-Unit Residential = 50% Towns @ 2.7 persons per unit & 50% Apartments @ 1.8 persons per unit

For the purpose of this analysis and evaluation, a trunk wastewater sewer network was established within the proposed road network as shown on the Demonstration Plan. The purpose is to demonstrate the feasibility of servicing the property using the Demonstration Plan. It is expected that refinements to the design of the trunk storm sewer system will be made as plans of subdivision are developed. For example there is an option of servicing a portion of the KNUEA in the northwest corner from a sewer along March Road as opposed to through the KNUEA lands. A cost benefit analysis could be completed during the detail design to determine the preferable option to service this area.

One of the constraints for wastewater servicing is the existing tributaries to Shirleyís Brook. The wastewater sewer network was designed to minimize crossings of the wastewater sewer with these tributaries. However, some tributary crossings are proposed. The proposed crossings will be in rock and will require a clay cap to prevent surface water in the tributaries from migrating into the underlying trenches. Details of the proposed crossings will be provided at the detailed design stage.

Another site constraint was the depth to bedrock. Where possible, the trunk wastewater sewer network was design to reduce rock removal. A review was also conducted of the proposed sanitary trunk sewer network with respect to other proposed trunk networks such as storm sewer and watermain to avoid sewer conflicts. The trunk sewer network for the proposed development is shown on **Figure 6.6.1.2a** and the off-site sewers are shown on **Figure 6.6.1.2b**. The detailed drainage areas are shown on the attached Onsite Sanitary Drainage Area Plan (112117-SAN1) included in **Appendix C-6**.

6.6.1.3 On-Site Servicing Evaluation

As indicated previously, a trunk wastewater sewer network was established. This servicing design was determined based on factors such as optimum routing to the outlet/connection point, minimizing creek crossings, avoiding crossing conflicts with other sewers/watermain, minimizing rock removal and following the right-of-way layout on the preferred demonstration plan. The following criteria were used to evaluate the infrastructure servicing concept.

HILLSVIEW ESTATES SUBDIVISION

POND 3

SHIRLEY'S BROOK

MARCH VALLEY ROAD

WASTEWATER OVERFLOW

POND 1

POND 2

MARCH ROAD

CN RAILWAY CORRIDOR (+30m)

BROOKSIDE SUBDIVISION

MAXWELL BRIDGE ROAD

UPGRADE EX. 375mmØ TO 450mmØ

MARCHBROOK CIRCLE

MORGAN'S GRANT SUBDIVISION

MORGAN'S GRANT SWMF

SHIRLEY'S BROOK SWMF

MATCHLINE
SEE: FIGURE 6.6.1.2b (OFF-SITE)

200mmØ
250mmØ
300mmØ
375mmØ
600mmØ

LEGEND

- KANATA NORTH URBAN EXPANSION AREA (KNUEA)
- PROPOSED MAINLINE SANITARY SEWER
- MAINLINE SANITARY SEWER ALTERNATE ROUTES
- PROPOSED SWM FACILITY
- CREEK CORRIDOR
- *EXISTING MAINLINE SANITARY SEWER*

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 6.6.1.2a

PROPOSED WASTEWATER INFRASTRUCTURE - ONSITE

DATE MAY 2016

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M:\2012\112117\CAD\Design_MSS\FIGURES\Figure 6.6.1.2 - PROP WASTEWATER INFRASTRUCTUE.dwg, 6.6.1.2a, May 18, 2016 - 1:26pm, mhrehoriak

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MATCHLINE
SEE: FIGURE 6.6.1.2a (ON-SITE)

MARCH ROAD

300mmØ

200mmØ

600mmØ

POND 2

250mmØ

MARCHBROOK CIRCLE

MORGAN'S GRANT SUBDIVISION

MORGAN'S GRANT SWMF

600mmØ

300mmØ

300mmØ

HALTON TERRACE

300mmØ

375mmØ

FLAMBOROUGH WAY

450mmØ

610mmØ

MARCH ROAD

200mmØ

200mmØ

200mmØ

BROOKSIDE SUBDIVISION

MAXWELL BRIDGE ROAD

250mmØ

200mmØ

CN RAILWAY CORRIDOR (± 30m)

375mmØ

375mmØ

UPGRADE EX.
375mmØ TO
450mmØ

SHIRLEY'S BROOK

250mmØ

200mmØ

SHIRLEY'S BROOK SWMF

450mmØ

BRIAR RIDGE
PUMP STATION

2 - EXISTING
WASTEWATER
OVERFLOW

SANITARY
FORCEMAIN

UPGRADE EX.
375mmØ TO
600mmØ

375mmØ

375mmØ

600mmØ SAN

SHIRLEY'S
BROOK
DRIVE

EXISTING
EAST MARCH
TRUNK

750mmØ

TERRY FOX

LEGEND

- KANATA NORTH URBAN EXPANSION AREA (KNUEA)
- PROPOSED MAINLINE SANITARY SEWER
- MAINLINE SANITARY SEWER ALTERNATE ROUTES
- PROPOSED SWM FACILITY
- CREEK CORRIDOR
- *EXISTING MAINLINE SANITARY SEWER*

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 6.6.1.2b

PROPOSED WASTEWATER INFRASTRUCTURE
- OFFSITE

DATE MAY 2016

JOB 112117

SCALE N.T.S.

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M:\2012\112117\CAD\Design_MSS\FIGURES\Figure 6.6.1.2 -PROP WASTEWATER INFRASTRUCTUE.dwg, 6.6.1.2b, May 17, 2016 - 12:31pm, mhrehoriak

SHT11x17 DWG - 279mmx432mm

Table 6.6.1.3: Wastewater Servicing Evaluation

	Criteria	Indicators	Evaluation	
Design and Construction	Geotechnical issues and construction risks	Potential of poor soils/rock/elevated groundwater etc.	X	Deep trunk sewers in rock
	Infrastructure requirements	Extent of new infrastructure required	X	Substantial offsite works
	Operational Impacts	Amount of maintenance intensive infrastructure required	~	Gravity sewer where possible, may require more O&M for Pump Station
	Construction Scheduling	Impact of construction on development timing	~	Full Trunk sewers on March Road required first
	System Reliability	Proximity of emergency overflow	✓	Overflow to Pond 3
	Servicing Flexibility	Ease of accommodating potential changes in servicing plans.	✓	Sewers to follow future ROWs, residual capacity available
Land-Use	Property Acquisition	Ease of property acquisition	✓	Contained within existing and proposed corridors
	Phasing	Flexibility of design to allow multiple phasing options	~	Full Trunk sewers on March Road required first
	Impact on Future Lands/Development	Allowance of residual capacity for future growth	✓	Residual capacity available
Social	Displacement of Residents, Community/Recreation Facilities and Institutions	Affects areas of residence, institutions or businesses	~	Excavation on March Road and Brookside subdivision
	Disruption to Existing Community	Extent of works affecting existing residences and businesses and traffic disruption	~	Excavation on March Road and Brookside subdivision
Natural	Impact on Significant Natural Features	Loss of natural area due to installation of works	✓	Follows land-use plan
	Impact on Aquatic Systems	Potential impact on fish habitat due to installation of works	✓	3 Creek crossings, deep trunks only
	Impact on Quality and Quantity of Surface Water and Groundwater	Minimize creek crossings and depth of excavation	✓	3 Creek crossings, deep trunks only
	Effects on Urban Greenspace, Open Space and Vegetation	Disruption to greenspace and trees	✓	Follows land-use plan
Economic	Potential to Use Combined Service Corridor	Use of existing corridors where possible	✓	Follows land-use plan, and contained within ex corridors
	Efficiency of Use of Existing Infrastructure	Use of excess capacity in existing infrastructure	✓	Extension of existing system with minimal upgrades
	Energy Consumption	Gravity servicing instead of pump stations	~	Increased pump station capacity
	Capital Costs	Initial construction cost	✓	Standard sewer design, deep trunk sewers as required
	Operating Costs	Ongoing operations and maintenance requirements	~	Gravity sewer where possible, O&M for Pump Station

Good ✓ Okay ~ Poor X

6.6.2 Effects on Downstream Infrastructure

The evaluation of Option 2 indicated that downstream upgrades were required for this servicing option. Since there are upgrades required to the existing sanitary infrastructure, flows must be calculated from the existing development areas to determine the upgrades required.

City staff agreed that wastewater modelling for the KNUEA should use the flow generation parameters recommended by the TAC. These flow generation parameters are as follows:

Residential Flow, Existing = 200 L/cap/day
Residential Flow, Future = 350 L/cap/day
ICI Flow, Existing = 20,000 L/ha/day
ICI Flow, Future = 50,000 L/ha/day
I/I Flow, Existing = 0.35 L/s/ha (Jan 2008 monitored event)
I/I Flow, Future = 0.28 L/s/ha

Using these flow generation parameters, a hydraulic analysis of the East March Trunk was completed for the steady-state condition.

In addition, potential future flows were incorporated into the flow calculations. This included flows for undeveloped properties along March Road not currently serviced by municipal sanitary infrastructure and future drainage to the BRPS. These future flows were assumed based on current zoning, and are subject to change. These properties are shown on the On-Site & Off-site Sanitary Drainage Area Plans (112117-SAN1 & 112117-SAN2) in **Appendix C**.

Design flows are shown in Sanitary Sewer Design Sheets included in **Appendix C-6**. Drainage areas, flow routes, and pipe sizes are shown on the Offsite Sanitary Drainage Area Plan (112117-SAN2) also included in **Appendix C-6**. Upgrades to the existing sewer system are highlighted in the Sanitary Sewer Design Sheets and are summarized in **Table 6.6.2**.

Table 6.6.2 – Upgrades to Existing Wastewater Infrastructure

Location	Upgrade	Timing
Ex. Brookside San Sewer	Ex. 375mm to be upgraded to 450mm diameter ï approx. 160m.	Anticipated to be required at approx. 70% buildout. (46L/s)
Briar Ridge Pump Station	Internal Pump Station upgrades (as per design)	Anticipated to be required at approx. 15% buildout.(10L/s)
Shirleyøs Brook Drive San Sewer	Ex. 375mm to be upgraded to 600mm diameter ï approx. 240m	Required immediately

Wastewater bypass pumping will be required during the construction of the sections of sewer to be upgraded. BRPS will need to be upgraded to its Ultimate Firm Capacity and will need an MOE amendment. This option will have a negligible impact on the existing operation and maintenance programs for existing infrastructure. The upgrade along the existing rail corridor passes below Shirleyøs Brook and will require a construction method that is sensitive to the surrounding environment. Refer to plan and profile drawings included in **Appendix E** for further details.

6.6.3 Hydraulic Grade Line Analysis

A Hydraulic Grade Line (HGL) analysis should be performed on wastewater trunk sewers to determine if surcharged conditions may be present. If the HGL is analysed and determined to be above the obvert of the sanitary sewers then measures such as overflows may be required to protect buildings/basements. These measures may include establishing minimum underside of footing elevations for all proposed buildings to be above the HGL, per City Design Guidelines. In addition, sanitary sewer overflows may be provided to allow relief of the system prior to potential flooding of basements.

Based on the information provided by the City with respect to the EMT and any future trunk sewer works (i.e., NKT Phase 2 works) it is assumed that there are free flow conditions within the EMT and MPS. As such, no HGL analysis was performed on the EMT.

An HGL analysis is required to be completed on the BRPS to ensure that, when the future lands are added to the system, there are no negative impacts to the existing developments. The existing BRPS has two existing overflow outlets to provide relief to the system in the event of failure. With the additional flows generated by the KNUEA, an additional overflow outlet would be required to minimize any negative impacts on the existing subdivision.

The HGL in the Trunk sewer, along the existing rail corridor to the BRPS, was analysed using Autodesk Storm and Sanitary Analysis (SSA). This model was used to determine the elevation and location of an additional sanitary overflow. Based on *City of Ottawa Sewer Design Guidelines*, the overflow must outlet to a Stormwater Management Facility, and be located 0.5m above the 100 year water level. This is to ensure that the overflow outlet is able to operate under free flow conditions during major storm events. A flow monitoring system will be required on the wastewater overflow to the SWM Facility to alert City staff if a wastewater overflow occurs. This system will need to be specified during the detailed design phase of the wastewater and SWM Facility.

The HGL is governed by the overflow elevation provided. The BRPS contains a primary over flow at an elevation of 67.29. The design of the Brookside subdivision proposed a secondary overflow at an invert elevation of 67.30. The resultant HGL for the sanitary sewer upstream of this secondary overflow is 67.44. This is the starting point for the HGL model. Four scenarios were modelled and summarized in an email to City Staff. A copy of the email and a plan and profile drawing showing the hydraulic grade lines for the scenarios is included in **Appendix C-7**. The scenarios evaluated are as follows:

Scenario #1 ï Original HGL resulting from the development of the Brookside Subdivision.

Scenario #2 ï KNUEA flow of 52 L/s added to original HGL resulting from development of the Brookside Subdivision

Scenario #3 ï KNUEA flow of 52L/s added to original HGL resulting from development of Brookside Subdivision and upgraded trunk sewers downstream (approx. 900m of ex 375mm and 450mm upgraded to 600mm)

Scenario #4 ï KNUEA flow of 52 L/s added to original HGL resulting from the development of the Brookside Subdivision with proposed tertiary (third) overflow to the proposed KNUEA SWM pond. Elevation of overflow is 67.50 and resultant HGL is 67.67

Scenario #2 shows the increase in the HGL which is not a reasonable option since it impacts the existing subdivision. Scenario #3 is the most expensive since it requires approximately 900m of sewer to be upgraded. Scenario #4 is the preferred option because it has no impact on the existing subdivision with reasonable costs to provide the third overflow.

The model for the preferred scenario was then updated using design flows calculated using the Demonstration Plan. The updated SSA model indicates that an overflow outlet elevation of 67.50 will be able to provide relief to the existing trunk sewer along the rail corridor and not raise the HGL in the existing sanitary sewers tributary to the BRPS. The Autodesk SSA Modeling information has been provided in **Appendix C-7**, and the proposed overflow outlet has been shown on the Onsite Sanitary Drainage Area Plan (112117-SAN1). A summary of the SSA model is provided in **Table 6.6.3** below.

Table 6.6.3 – Summary of HGL SSA Model

	Node ID	HGL (m)				
		Previous BRPS HGL Analysis	KNUEA Analysis	KNUEA minus Previous	Preliminary Underside of Footings	Freeboard (0.3m Minimum)
Existing	201	67.44	67.44	0.00		
	201A	67.50	67.50	0.00		
	201B	67.56	67.55	-0.01		
	202	67.63	67.62	-0.01		
	203	67.69	67.67	-0.02		
	204	67.73	67.71	-0.02		
	205	67.78	67.74	-0.04		
	206	67.79	67.76	-0.03		
	207	67.82	67.77	-0.05		
	208	67.88	67.79	-0.09		
	209	67.90	67.80	-0.10		
Proposed	KNCDP-9		67.80		69.0	1.2
	KNCDP-OUT		67.51		69.3	2.2

6.6.4 Sensitivity Analysis

A sensitivity analysis is conducted to test the sensitivity of the wastewater network which incorporates a variance in the design conditions, and evaluates the system response. This provides an understanding of how the network would be affected should the land use density increase appreciably. The wastewater collection network was tested by adjusting two of the key design parameters. In the first test, the proposed population flow increases from 350 L/s to 450 L/s which is an increase of 28.5%. The second test increases the infiltration rate from 0.28 L/s/ha to 0.5 L/s/ha which is an increase of 78.6%. All other design conditions remain fixed, including existing monitored flows. The results of the sensitivity analysis are summarized in **Table 6.6.4** with details provided in **Appendix C-8**.

Table 6.6.4: Wastewater Sensitivity Analysis

Sewer Reach					Results		
Location	**From Node**	**To Node**	**Nominal Pipe Size (mm)**	**Free-Flow Capacity (L/s)**	**Design Condition**	**Flow (L/s)**	**Q/Qcap (%)**
March Road Trunk (Above ridge)	MR-3	MH 186	600	202.4	Standard Design	138.3	68
					Scenario 1 Q_{pop}=450L/s	160.7	79
					Scenario 2 Q_{Inf}=0.50L/s/ha	164.6	81
Shirleyøs Brooke Drive	MH 186	EX MH 1	600	202.4	Standard Design	184.4	91
					Scenario 1 Q_{pop}=450L/s	205.3	101
					Scenario 2 Q_{Inf}=0.50L/s/ha	210.6	104
Rail Corridor Trunk (Below Ridge)	E-9	MH 209	375	85.7	Standard Design	66.5	78
					Scenario 1 Q_{pop}=450L/s	80.7	94
					Scenario 2 Q_{Inf}=0.50L/s/ha	78.1	91
BRPS Trunk	MH 209	PS	450	132.9 to 197.2	Standard Design	178.1	73 - 99
					Scenario 1 Q_{pop}=450L/s	190.6	83 -106
					Scenario 2 Q_{Inf}=0.50L/s/ha	198.6	82 -109

The conclusion from this analysis is that the wastewater system has been designed with an appropriate amount of residual capacity to permit land use flexibility and to safeguard the community should flow rates temporarily exceed expected values. This design approach permits a moderate degree of intensification within the KNUEA. In similar fashion, minor adjustments to the land use plan are readily accommodated.

6.7 Wastewater Summary and Recommendations

Following is a summary of the core wastewater system findings for the Kanata North Urban Expansion Area Lands:

1. The March Pump Station is to be the wastewater outlet for the KNUEA.

2. The two constraints of elevation and capacity were reviewed to determine that the East March Trunk Sewer is the most viable option to service the KNUEA. The connection point to the East March Trunk Sewer is proposed at the intersection of Shirleyøs Brook Drive and Sandhill Road just east of March Road.

3. Off-site servicing was further evaluated and it was recommended that two routes will be used to service the KNUEA. A sanitary sewer will be constructed northward along March Road and along Shirleyøs Brook Drive. The second sanitary sewer will be installed and connected to the existing sanitary sewer that runs along the existing Abandoned CN Railway corridor to the Briar Ridge Pump Station. The Briar Ridge Forcemain then connects to the East March Trunk Sewer at the same connection point.

4. The Briar Ridge Pump Station was reviewed and it was determined that there is a residual capacity of 74L/s that can be used to service the KNUEA. Upgrades will be required to the BRPS which involve larger impellers and the installation of a third pump as per the original design. These upgrades will require an amendment to the MOE Certificate of Approval.

5. Six off-site servicing alternatives were reviewed and evaluated and Option #2 was recommended as the preferred option based on the reasons provided in Section 6.5. Option #2 includes a new gravity sanitary sewer along March Road that services the area west of March Road and west of the ridge. The area east of the ridge will be serviced by the existing 375mm diameter sanitary sewer along the rail corridor which outlets to the Briar Ridge Pump Station (BRPS). Upgrades will be required to the BRPS as well as to the existing sanitary sewer system as noted previously.

6. This servicing option will require upgrading an existing 375mm diameter sanitary sewer along Shirleyøs Brook Drive to a 600mm diameter to be able to accommodate the increased flows and provide a lower outlet elevation. Upgrades will also be required to existing infrastructure along the rail corridor. A section of the existing 375mm diameter sanitary sewer will be replaced with 450mm diameter sewer. The BRPS can accommodate the flow from the Kanata North Urban Expansion Area (50L/s) within the ultimate design capacity of the station (183L/s).

7. On-site servicing was reviewed and design criteria provided which provides guidance for future draft plan applications. A preliminary trunk wastewater sewer network was designed based on the Demonstration Plan to confirm feasibility of servicing the KNUEA. Based on the land uses provided in the Demonstration Plan, flow rates were calculated and the total flow for the KNUEA is calculated to be 182.2 L/s.

8. A servicing evaluation was completed and is summarized to document the results using the criteria and indicators as shown in Section 6.6.1.3 on the preferred sanitary servicing solution.

9. An analysis was completed to understand the effects on the downstream infrastructure and any upgrades that may be required. It was confirmed that downstream upgrades will be required and details are provided in Section 6.6.2.

10. An HGL analysis was also completed on the BRPS to ensure that, when the future lands are added to the system, there are no negative impacts to the existing developments. This analysis concluded that an overflow outlet (at elevation of 67.50) will be able to provide relief to the existing trunk sewer along the rail corridor and not raise the HGL in the existing sanitary sewers tributary to the BRPS.

11. A sensitivity analysis was completed and concluded that residual capacity exists in the wastewater network which permits design flexibility for a moderate degree of intensification within KNUEA and suggests the system can readily accommodate moderate change and minor adjustments to the land use plan are readily accommodated.

7.0 WATER DISTRIBUTION

7.1 Background

Water for the majority of City of Ottawa residents is taken from the Ottawa River, where it is treated at the Lemieux Island and Britannia Water Purification Plants and then distributed through pumping stations, storage facilities and over 2,500km of watermains. Water distribution systems operate under pressure, and different pressure zones are required to provide appropriate levels of service to all parts of the City. Pressures are maintained in the system by either pumping or by using elevated storage. Due to the complex operation of the Cityôs many different pressure zones, planning and analyses are needed for each major pressure zone, and for the system as a whole.

Design of the City of Ottawaôs water supply system has evolved over the years based on management practices, legislative requirements, engineering methods, and public health and safety considerations. The current design practices have allowed the City to establish a water supply system that provides an excellent level of service and value to the residents and businesses of the City of Ottawa. Planning of the public water system has been developed based on the following basic set of objectives:

- Quality (to provide drinking water that meets or exceeds all federal and provincial health guidelines, standards and regulations);
- Quantity (to provide sufficient water at adequate pressure to meet the needs of the existing population and future growth, taking into account patterns of peak demands and fire-fighting requirements);
- Reliability (to ensure a constant supply of water even under emergency conditions such as power failures, or failures of individual system components);
- Demand Management Planning (to pursue demand management opportunities as a cost effective means of ensuring the long-term sustainability of the water supply system);
- Affordability (to minimize life-cycle costs of the water supply system while maintaining appropriate levels of services)

7.2 Existing Water Infrastructure

The KNUEA is located at the north end of Kanata in the West Urban Community (WUC). The KNUEA is bounded by residential estate lots and farmland lots to the northeast and northwest. These properties are serviced by individual/private wells. There are existing urban residential developments to the southeast and southwest of the KNUEA. These properties are within the 2Ww pressure zone. Refer to excerpts from the 2013 IMP in **Appendix D**. The Morganôs Grant pressure zone is approximately 250m to the southwest. The Britannia Filtration Plant and Pumping Station services this community from a large diameter feedermain routed through Bells Corners. A second feedermain was recently constructed through Crystal Beach and the NCC Greenbelt to improve system reliability and capacity. Assisted by the Carlington Heights Pumping Station, these two pumping facilities supply water to the WUC.

A north-south feedermain generally follows the Teron Road / March Road corridor towards North Kanata. Between Shirleyøs Brook Drive and Klondike Road, the water main is reduced to a 400mm pipe and continues north to the Zone 2Ww boundary at Old Carp Road.

The Morganøs Grant Pressure Zone is an isolated parcel located west of March Road and south of the Study Area. There is a small local pump station at the intersection of Klondike Road and Wimbledon Way to meet pressure servicing requirements in this area. The station is needed due to local high topography with ground elevations between 91m and 109m. The Morganøs Grant Pump Station (MGPS) operates with discharge HGL values from 138m to 151m.

An existing water distribution schematic taken from the 2013 Infrastructure Master Plan is attached in **Appendix C**, and depicts a skeletonized system for the entire City of Ottawa. Most of the features discussed above can be identified on this high-level drawing. Figure 3 from the Stantec Report highlights the North Kanata area and depicts the Morganøs Grant Pressure Zone and part of the 2Ww Pressure Zone, in relation to the Study Area.

7.3 Planned Water Infrastructure

The City has identified several projects in the 2013 Infrastructure Master Plan to reinforce the current water distribution system. Specific to the WUC, some of these projects will directly affect the KNUEA, and have been listed below:

March Road Pipe Upgrades: the March Road Watermain is predominantly a 600mm feedermain system with several short sections of 400mm pipe. These smaller pipe segments restrict capacity, and reduce system pressure in North Kanata. Replacement of the undersized pipes with 600mm conduit is proposed and construction is expected between 2019-2024 in the 2013 IMP. The timing of these upgrades is based on demand due to growth.

Morgan's Grant Secondary Supply and PRV: the objective of this project is to provide a secondary link between the 3W pressure zone and the Morganøs Grant pressure zone. This infrastructure would improve system reliability in the event of mechanical failure at the MGPS. Staff advises this project has not been scheduled. This project is only relevant to the Study Area if itøs determined a connection is needed to this pressure zone.

Glen Cairn Pump Station Upgrades & Reservoir Expansion: these are two distinct projects. City staff advises some pump improvements were done recently at the same time as the Campeau Drive facility works. Additional upgrades are expected in the future, the timing and need for which will be strongly linked to growth in the WUC.

No work is currently scheduled on the reservoir expansion. City staff has indicated work on the reservoir will be needed around 2019.

7.4 Water Servicing Alternatives and Evaluation

Stantec Consulting was retained to analyze the regional-level impact to the water distribution system associated with development of the Kanata North Urban Expansion Area. Their analysis and findings are presented subsequently. Stantecôs *'Kanata North Urban Expansion Potable Water Assessment Report'* is contained in **Appendix D** for reference.

Topographical contours and a preliminary collector road system were provided for Stantecôs use in their analysis. Land use areas and estimated populations were also provided as shown in **Table 7.4**.

Table 7.4: Land Use and Estimated Populations

	Area (ha)	Units*	Population**
Schools	11.12		
Creek Corridor	12.22		
SWM Blocks	4.08		
Parks	10.65		
Commercial - Mixed Use	15.91		
Park and Ride	2.54		
Misc. Ex. Lands (School)	5.70		
Fire Hall	0.83		
Residential	80.10		
Singles	64.14	1056	3590
Street Townhouse		1045	2822
Multi-Unit Residential	15.96	1144	2574
Roads	40.21		
Total	**183.36**	**3339**	**8986**

* Based on May 13, 2016 Novatech Memo (included in **Appendix C-6**) + 10%
** Population calculated based on the following:
Singles = 3.4 persons per unit
Street Townhouse = 2.7 persons per unit
Multi-Unit Residential = 50% Towns @ 2.7 persons per unit & 50% Apartments @ 1.8 persons per unit

The projected water demands as provided in the Stantec report are shown in **Table 7.5** below.

Table 7.5: Projected Water Demands

Condition	Demand (L/s)	Min/Max Allowable Operating Pressures (psi)	Limits of Design Operating Pressures (psi)
Average Day	39.0	80psi (Max)	48-87
Max Day	52.0	40psi (Min)	44-80
Peak Hour	89.3	40psi (Min)	40-87*
Max Day + Fire Flow	177.0	20psi (Min)	23-65**

*With the exception of Node N_KNUE22 which reached a minimum pressure of 39 psi in the peak hour scenario. The elevation assigned to this node in the model (93.9m) exceeded the node elevation that was identified as serviceable per the report (93.0m).

**With the exception of Node N_KNUE26 which is able to maintain a residual pressure of 16psi with an applied fireflow of 125L/s. This node is able to maintain the required residual pressure of 20psi with an applied fireflow of 115L/s. This node achieves a lower fireflow as a result of being on a dead end. As mentioned in the report, dead ends were used to show potential future service connections. In actual implementation these dead ends will have smaller watermains connected to them to provide looping which will increase the available fireflow.

There is a 24m elevation change between the northwest corner and southeast corner of the development. This grade change affects all potential water servicing alternatives. The site is adjacent to two existing water distribution pressure zones. The southeast boundary of the site is adjacent to Zone 2Ww and the Morganôs Grant Pressure Zone is to the southwest of the site. Figure 1-3, from the Stantec Report, shows the existing watermain infrastructure, the subject site and the pressure zone areas.

It is preferable to connect to the Zone 2Ww pressure zone since it is at comparable elevations to the subject property. This will allow for servicing of all of the development area to be within tolerable servicing limits. Pressure reducing valves would be required if the development were serviced from the Morganôs Grant Pressure Zone because of excessively high pressures within the watermain system for the majority of the development. A small area in the northeastern portion of the site, below the ridge at lower elevations, will require pressure reduction valves regardless of which pressure zone is chosen to service the development.

Therefore, the preferred servicing alternative is to service the development through connection to the Zone 2Ww pressure distribution zone.

It is proposed to extend the existing 406mm diameter watermain along March Road north to service the development. A secondary connection to the existing watermain along Old Carp Road at Halton or at Celtic Ridge can be made with a 305mm diameter watermain to provide redundancy in the system. Figure 2-1, from the Stantec Report, shows the preliminary proposed watermain system and connection points to the existing system.

Refer to **Figure 7.1** for proposed onsite watermain infrastructure. Detailed watermain drawings (112117-WM1 and 112117-WM2) are included in **Appendix D.** There are some watermain crossings proposed under Tributaries 2 and 3. The proposed trenches for these crossings will be in rock and will require a clay cap to prevent surface water in the tributaries from migrating into the underlying trenches. Details of the proposed crossings will be provided at detailed design.

Based on the modelling completed by Stantec, the following recommendations were made:

- The Kanata North Urban Expansion should be serviced entirely from the Zone 2Ww pressure zone due to topography and location.

- Site grading should not exceed 93m to maintain minimum pressures greater than 40 psi.

- Services installed in areas where the grade is less than 74m will need pressure reducing valves to keep the maximum pressure below 80 psi.

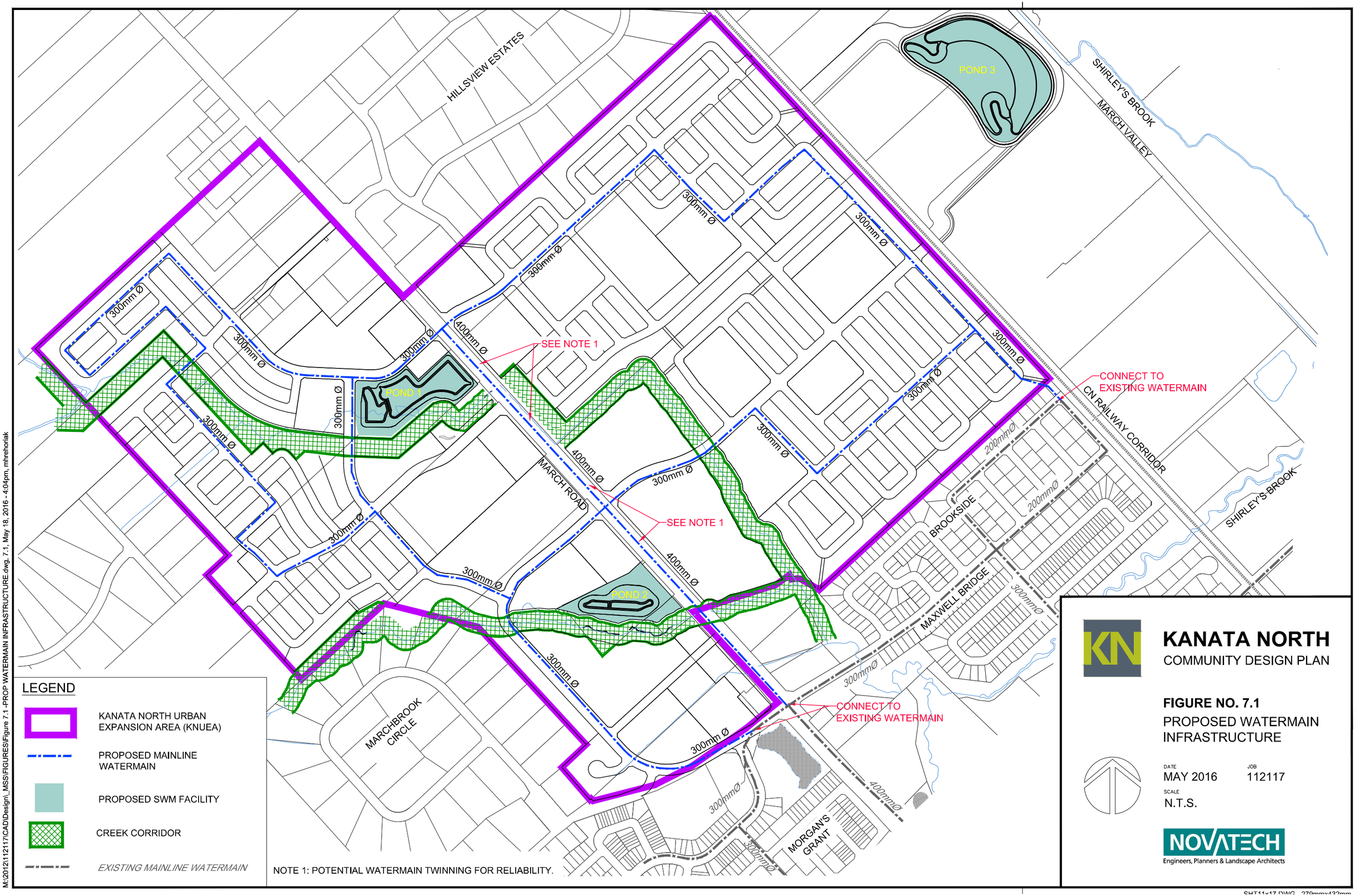
- To improve minimum pressures, two sections of off-site 406mm diameter watermain could be upgraded to reduce headloss from full buildout demands. In particular the upgrade along March Road and Solandt Drive would be required prior to any development within the KNUEA above the 93m elevation.

- A secondary connection from Old Carp Road is the preferred secondary connection over the Celtic Ridge connection. However, either connection will adequately service the development.

It should be noted that it is not anticipated that site grading within the KNUEA will be above the 93m elevation. Therefore, the two existing sections along March Road and Solandt Drive do not require upgrading to service the KNUEA. Also, in the ultimate, full build out scenario, both secondary connections should be completed.

The staging of development is unknown at this time. The City has agreed that a maximum of 200 units can be constructed and serviced with the single watermain connection along March Road. Once more than 200 units have been constructed a secondary connection is required for system reliability. This secondary connection can either be at the Old Carp Road location, the Celtic Ridge location or a second watermain within the March Road ROW (in the interim). Internal looping will also be required as development progresses. This will be reviewed at the subdivision stage on a case by case basis.

The on-site servicing was evaluated in order to confirm the preferred servicing alternative and to understand the impacts of the servicing scenario and provide any mitigation required. On-site servicing was determined based on factors such as optimum routing to the outlet/connection points, minimizing creek crossings, avoiding crossing conflicts with other



KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 7.1
PROPOSED WATERMAIN
INFRASTRUCTURE

DATE
MAY 2016

JOB
112117

SCALE
N.T.S.

NOVATECH
Engineers, Planners & Landscape Architects

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sewers, and following the right-of-way layout on the Demonstration Plan. The following criteria in **Table 7.6** were used to evaluate the on-site watermain system.

Table 7.6: Watermain Servicing Evaluation

	Criteria	Indicators	Evaluation	
Design and Construction	Geotechnical issues and construction risks	Potential of poor soils/rock/elevated groundwater etc.	✓	Standard depth watermain
	Infrastructure requirements	Extent of new infrastructure required	~	Some offsite works
	Operational Impacts	Amount of maintenance intensive infrastructure required	✓	Standard watermain design
	Construction Scheduling	Impact of construction on development timing	~	Full Trunk watermain on March Road required first
	System Reliability	Proximity of emergency overflow	✓	Multiple connection locations to existing system
	Servicing Flexibility	Ease of accommodating potential changes in servicing plans.	✓	Water to follow future ROWs, residual capacity available
Land-Use	Property Acquisition	Ease of property acquisition	✓	Contained within existing and proposed corridors
	Phasing	Flexibility of design to allow multiple phasing options	~	Full Trunk watermain on March Road required first
	Impact on Future Lands/Development	Allowance of residual capacity for future growth	□	Residual capacity available
Social	Displacement of Residents, Community/Recreation Facilities and Institutions	Affects areas of residence, institutions or businesses	~	Excavation on March Road
	Disruption to Existing Community	Extent of works affecting existing residences and businesses and traffic disruption	~	Excavation on March Road and Brookside subdivision
Natural	Impact on Significant Natural Features	Loss of natural area due to installation of works	✓	Follows land-use plan
	Impact on Aquatic Systems	Potential impact on fish habitat due to installation of works	✓	4 Creek crossings, Standard depth watermain
	Impact on Quality and Quantity of Surface Water and Groundwater	Minimize creek crossings and depth of excavation	✓	4 Creek crossings, Standard depth watermain
	Effects on Urban Greenspace, Open Space and Vegetation	Disruption to greenspace and trees		Follows land-use plan
Economic	Potential to Use Combined Service Corridor	Use of existing corridors where possible	✓	Follows land-use plan, and contained within ex corridors
	Efficiency of Use of Existing Infrastructure	Use of excess capacity in existing infrastructure	✓	Extension of existing system with minimal upgrades
	Capital Costs	Initial construction cost	✓	Standard watermain design
	Operating Costs	Ongoing operations and maintenance requirements	✓	Standard watermain design

Good ✓ Okay ~ Poor X

7.5 Water Summary and Recommendations

The following conclusions are presented as a summary of the findings of this hydraulic analysis, as completed by Stantec, for the KNUEA:

- The Kanata North Urban Expansion should be serviced entirely from the Zone 2Ww pressure zone due to topography and location.
- Site grading should not exceed 93m to maintain minimum pressures greater than 40 psi.
- Services installed in areas where the grade is less than 74m will need pressure reducing valves to keep the maximum pressure below 80 psi.
- A secondary connection from Old Carp Road is the preferred secondary connection over the Celtic Ridge connection. However, either connection will adequately service the development.
- It is recommended that both secondary connections be completed prior to full build out of the KNUEA. As an interim measure, a second watermain within the March Road ROW could be provided.
- A servicing evaluation was completed and is summarized to document the results using the criteria and indicators as shown in **Section 7.4** on the preferred water servicing solution.

8.0 IMPACTS AND MITIGATION

The preferred servicing options were determined based on factors as outlined in the above analysis and evaluation. The preferred servicing options are combined and shown on **Figures 8.1** and **8.2** for on-site and off-site servicing respectively. The evaluation included criteria and indicators related to design and construction, land use, social, natural and economic. This section outlines the impacts and mitigations required. The evaluation concluded that most did not require mitigating. The environmental and social impacts of the Preferred Land Use Plan require mitigation. Recommended mitigation measures to minimize or offset negative effects and maximize positive effects are provided below.

8.1 Natural Environment

A summary of the existing natural features within the KNUEA lands is provided in the Environmental Management Plan (EMP) prepared for the Kanata North CDP (Novatech, 2016). Elements assessed include:

- geology
- groundwater
- surface water and fish habitat
- terrestrial features and habitat
- woodlots

Potential servicing related impacts to the natural environment and recommended mitigation measures are outlined as follows.

Natural Features and Tree Retention

The development of the KNUEA lands will impact some wooded areas, and retain others as identified in the Kanata North EMP. The preferred servicing options will follow the proposed road and pathway patterns to minimise additional disturbance due to underground servicing.

Creek Crossings and Aquatic Systems

The recommended road pattern will result in new road crossings of the existing Tributaries 2 and 3. The preferred servicing options will follow the proposed road pattern so that additional creek crossings will not be required.

Groundwater and Surface Water

Where possible, the depth of excavation required to install underground services will be minimized. During the detailed design stage, standard geotechnical assessments will be performed to establish required measures during construction (i.e. clay barriers on deep services, erosion and sediment control, etc.) Where possible, offsite drainage will be maintained through the site to continue to provide base flows to the Tributaries.

It was noted in the geotechnical investigations report that, during the construction of the KNUEA, bedrock removal will likely require drilling and blasting; activities that can potentially cause groundwater level lowering and/or adverse water quality problems in nearby wells. There are a limited number of wells in the vicinity of the proposed development. A proactive approach to well protection should be taken with respect to mitigating the effects of blasting

HILLSVIEW ESTATES SUBDIVISION

POND 3

SHIRLEY'S BROOK

MARCH VALLEY ROAD

POND 1

TRIBUTARY 2

MARCH ROAD

CN RAILWAY CORRIDOR (± 30m)

BROOKSIDE SUBDIVISION

SHIRLEY'S

POND 2

TRIBUTARY 3

MAXWELL BRIDGE ROAD

MARCHBROOK CIRCLE

SHIRLEY'S BROOK SWMF

MORGAN'S GRANT SWMF

MORGAN'S GRANT SUBDIVISION

LEGEND

- KANATA NORTH URBAN EXPANSION AREA (KNUEA)
- PROPOSED MAINLINE STORM SEWER
- PROPOSED MAINLINE WATERMAIN
- PROPOSED MAINLINE SANITARY SEWER
- PROPOSED SWM FACILITY
- CREEK CORRIDOR
- *EXISTING CULVERTS*
- *EXISTING MAINLINE STORM SEWER*
- *EXISTING MAINLINE WATERMAIN*
- *EXISTING MAINLINE SANITARY SEWER*
- *EXISTING SWM FACILITY*

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 8.1

PROPOSED COMBINED INFRASTRUCTURE - ONSITE

DATE MAY 2016

JOB 112117

SCALE N.T.S.

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M:\2012\112117\CAD\Design_MSS\FIGURES\Figure 8.1-8.2-PROP COMBINED INFRASTRUCTURE.dwg, FIG 8.1, May 26, 2016 - 2:31pm, tbrooks

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MARCH ROAD

POND 2

CN RAILWAY CORRIDOR (± 30m)

BROOKSIDE SUBDIVISION

MAXWELL BRIDGE ROAD

SHIRLEY'S BROOK

MARCHBROOK CIRCLE

MORGAN'S GRANT SWMF

SHIRLEY'S BROOK SWMF

MORGAN'S GRANT SUBDIVISION

HALTON TERRACE

FLAMBOROUGH WAY

SHIRLEY'S BROOK DRIVE

MARCH ROAD

TERRY FOX

LEGEND

- KANATA NORTH URBAN EXPANSION AREA (KNUEA)
- PROPOSED MAINLINE STORM SEWER
- PROPOSED MAINLINE WATERMAIN
- PROPOSED MAINLINE SANITARY SEWER
- PROPOSED SWM FACILITY
- CREEK CORRIDOR
- *EXISTING CULVERTS*
- *EXISTING MAINLINE STORM SEWER*
- *EXISTING MAINLINE WATERMAIN*
- *EXISTING MAINLINE SANITARY SEWER*
- *EXISTING SWM FACILITY*

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 8.2

PROPOSED COMBINED INFRASTRUCTURE - OFFSITE

DATE MAY 2016

JOB 112117

SCALE N.T.S.

NOVATECH
Engineers, Planners & Landscape Architects

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SHT11x17 DWG - 279mmx432mm

on local wells. The impact of blasting can be mitigated by using techniques to reduce the seismic wave velocities resulting from blasting in the vicinity of existing wells.

A monitoring program should also be implemented to document any changes to existing wells during and after construction. The extent of the area to obtain a baseline on water quality, and the location and number of wells to be monitored for water levels will be confirmed at the time of approval of plans of subdivision.

8.2 Social Environment

Key considerations of the social environment for servicing include:

- disruption of existing communities,
- displacement of existing uses and facilities,

Potential servicing related impacts to the social environment and recommended mitigation measures are outlined as follows.

Disruption to Existing Community

The Trunk services (wastewater and water) along March Road and Shirleyôs Brook Drive will impact residents and businesses along March Road temporarily during construction. The impacts will be minimized through design and construction measures such as scheduling of work hours, and the proposed location of the services within the existing right-of-way. The stormwater servicing will have minimal impact on the existing community as the works are proposed to be contained within the KNUEA.

Displacement of Existing Uses

The preferred servicing options follow the Land Use Plan, and will not require the displacement of existing users.

8.3 Conclusion

Based on the above analysis, the preferred servicing options will be contained to the proposed road and pathways, and will have minimal impact on the existing natural and social environment.

9.0 UTILITY INFRASTRUCTURE

Select utility companies were circulated a copy of the KNUEA, along with a general description of the intended land use. The purpose of the circulation was to:

- Establish the limits of existing utility infrastructure near the study area;
- Alert the utilities that a CDP is underway, and plan for future development;
- Identify if there are any known constraints to extend utility service.

Hydro One
Hydro One protects an easement for an aerial transmission line that traverses the western edge of the Morganõs Grant community. The line crosses near the roadway intersection of Old Carp and Second Line, continuing generally in an east-west direction. This infrastructure is approximately 1km west of the KNUEA, and will not be affected by development of the KNUEA. Hydro One does not service this area.

Hydro Ottawa
Hydro Ottawa provides service to this area. Pole mounted Hydro Ottawa infrastructure was recently upgraded on March Road between Klondike Road and Old Carp Road in conjunction with the City-initiated March Road widening. This is a 27kV aerial line located on the east side of March Road, that continues northward past the KNUEA. The existing pole line along the east side of March Road will require upgrading to service this size of development. Taller poles with two circuits and larger conductors would be required back to Klondike Road.

Enbridge Gas
Enbridge reports a 6ò high-pressure gas main is located on the west side of March Road in the vicinity of KNUEA. This is the service main for Constance Bay, and is well suited to service the study area lands. Some pressure reducing stations would be installed to service the development otherwise there are no known constraints for gas service.

Communications
Bell Canada has fibre-optic cable at the intersection of March Road and Old Carp Road. This existing infrastructure would require reinforcing to service the KNUEA. The existing infrastructure would be extended north on March Road with a number of splitting points within the development.

Rogers Ottawa has fibre-optic cable along March Road with larger cable up to the Old Carp Road intersection. This existing infrastructure would require upgrading to service the proposed development.

Conclusion
The location of existing utility infrastructure along March Road is presented on **Figure 3.9**. This information was developed in consultation with the respective utility companies, all of whom have indicated that there is adequate proximity and supply to service future development within the study area. The utility firms have requested they are kept apprised throughout the CDP process; but no further investigation or analysis is deemed necessary until detail design.

10.0 PROJECT LISTING

The Master Servicing Study component of the Kanata North Urban Expansion Area CDP satisfies the requirements of Phase 1 and 2 of the Municipal Class EA Process and where required Phase 1 through 4. The process is outlined in detail in Section 1.3 ñIntegrated Planning Process.ò Infrastructure projects that will be undertaken in concert with development of the KNUEA CDP and their schedule classification are outlined below.

10.1 EA Projects

The following projects fall under the *Environmental Assessment Act*:

Wastewater Management Projects

- Trunk wastewater sewers in future roadways and utility corridors (Schedule B)
- Increase capacity of the existing Briar Ridge Pump Station (Schedule B)
- Water crossing of Tributary 2 watercourse with wastewater sewer upstream of March Road (Schedule B) (included in trunk sewer project)
- Water crossing of Tributary 2 watercourse with wastewater sewer downstream of March Road (Schedule B) (included in trunk sewer project)

Water Distribution Projects

- Trunk Watermain in future roadways and utility corridors (Schedule B)
- Water crossing of Tributary 2 with watermain upstream of March Road (two locations) (Schedule B)
- Water crossing of Tributary 3 with watermain upstream of March Road (Schedule B) (included in trunk sewer project)
- Water crossing of Tributary 2 with watermain downstream of March Road (Schedule B)

Stormwater Management Projects

- Trunk storm sewers in future roadways and utility corridors (Schedule B)
- Water crossing of Tributary 2 watercourse with storm sewer upstream of March Road (Schedule B)
- Water crossing of Tributary 3 watercourse with storm sewer upstream of March Road (Schedule B) (included in trunk sewer project)
- Water crossing of Tributary 2 watercourse with storm sewer downstream of March Road (Schedule B) (included in trunk sewer project)
- Realignment of the Tributary 2 watercourse upstream of March Road (Schedule B)
- Stormwater retention Pond 1 and associated storm sewers (Schedule B)
- Stormwater retention Pond 2 and associated storm sewers (Schedule B)
- Stormwater retention Pond 3 and associated storm sewers (Schedule B)

All of the above projects will require an Environmental Compliance Approval from the Ministry of the Environment.

Review agencies and the public will have an opportunity to review the Class EA documentation being prepared for the KNUEA CDP, and have the ability to appeal to the OMB. The assessment and review process is being integrated with the Planning Act as the

development application process is occurring simultaneously. Notification of the conditions of planning approvals and the Class EA documents will be advertised through a Notice of Completion and there will be an opportunity to appeal to the Ontario Municipal Board (OMB). If a project has been appealed to the OMB, the requirements of the integrated approach have not been met until the OMB renders a decision allowing the project to proceed. As outlined in section 2.8.1 of this Class EA, a Part II Order (PIIO) request may also be made to the Minister of the Environment or delegate.

However, the purpose of the integration provisions is to coordinate requirements under the Planning Act with this Class EA. When reviewing a PIIO request, the Minister of the Environment or delegate will consider the purpose and intent of the integration provisions.

Under the Planning Act, appeals to the OMB may be made to any of the Official Plan and zoning by-law amendments or to the approval of subdivisions. The Class EA documents and the preferred municipal infrastructure projects will not be subject to additional EA approval requirements with the submission of subsequent site plans or plans of subdivisions. Once the application is approved under the Planning Act, the requirements of the Class EA are met and projects identified in the Class Environmental Assessments for the KNUEA CDP are approved and can proceed to construction and no additional notification under the EA Act is necessary. This allows the integration of both planning processes while ensuring the intent and requirements of both Acts are met.

10.2 Development Approvals

Section 4 of the City of Ottawa Official Plan outlines the policies for review of development applications, and can be used as a guide to the development approvals process. Specific studies required for each development application vary, and will be identified through a pre-application consultation meeting with City Staff at the beginning of the design and review process. A Planning Rationale will typically be required to describe how the development proposal meets the intent of the Official Pan, Kanata North Community Design Plan and related City approved design guidelines. Other studies which may be required depending on location, context and the nature of the application include a Geotechnical Study, Community Transportation Study, Servicing and Stormwater Management Study, Environmental Impact Statement, Tree Conservation Report, etc.

Use of Existing Studies

Many of the studies and assessments prepared through the CDP process provide significant detail and direction to support development applications. It is anticipated that for a period of generally 5 years from approval of the CDP, new development applications will be able to rely on the existing studies prepared through the CDP process. For example, heritage and archaeological conditions have been assessed for the entire KNUEA and a Stage 1 Archaeological report has been accepted by the Ministry of Tourism, Culture and Sport. Detailed analysis of transportation and servicing requirements has been provided in the Master Plan documents. In some instances, supplementary materials may be required to support changes to such things as the local road pattern or servicing to properly assess the subdivision.

Environmental studies of existing conditions have been completed through the CDP process, identifying natural heritage features and areas, and including general recommendations for mitigation. These studies are expected to form the basis of the

combined Environmental Impact Statements-Tree Conservation Reports (EIS-TCR) that will be required to support the subsequent plans of subdivision and zoning by-law applications for the KNUEA. Additional field studies may be necessary to update and refine the existing conditions information collected as part of the CDP and EMP process. The combined EIS-TCRs will provide detailed site-specific recommendations for the protection of the identified natural heritage system features and trees identified for retention, as well as for the mitigation of anticipated impacts from development.

City of Ottawa Development Approvals Process

Development approvals for the majority of lands within the Kanata North Community Design Plan will initially proceed by Plan of Subdivision in order to establish the necessary road network, servicing infrastructure and parkland dedication.

Zoning Amendments will be required to permit the development established by the Land Use Plan in conjunction with approval of a plan of subdivision and/or site plan. The lands are currently zoned Rural Countryside Zone. It is anticipated that zoning amendments will amend the zoning to appropriate urban residential and mixed use zones to enable development in accordance with the Land Use Plan.

Applications for some development blocks will require Site Plan Control Approval as required by the City's Site Plan Control By-Law (2014-256, as amended).

The City will impose conditions on the development of the land through the subdivision or site plan process. These conditions will address provision of such matters as:

- Parks, open space and protection of natural heritage features;
- Water, sanitary sewers, and stormwater management facilities;
- Transit;
- Construction of roads and infrastructure;
- Widening and daylight triangles; and,
- Utilities.

The execution of development agreements will be required before development is allowed to proceed.

External Agency Approvals

Through the development approval process there are also points of contact where the developer will be required to reach out to external agencies for additional approvals, including but not limited to:

- Ministry of Environment (MOE)

All sanitary sewers, storm drainage, and stormwater facilities are regulated under the Ontario Water Resources Act and will require an Environmental Certificate of Approval from the Ministry of the Environment.

- Department of Fisheries and Oceans (DFO)

Proposed works that may constitute a harmful alteration, disruption or destruction (HADD) of fish habitat and require authorization from DFO under the Fisheries Act may include but are not limited to:

- The realignment of Tributary 2 of Shirleyøs Brook;
- The removal of the existing weir structures along Tributary 3 of Shirleyøs Brook;
- The installation of culvert crossings on Tributaries 2 and 3, and at March Road;
- The realignment of Shirleyøs Brook Main Branch at March Valley Road.
- Conservation Authority (CA)
- Proposed enhancements to watercourses are regulated under Section 28 of the Conservation Authorities Act. Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses will require approval from the Mississippi Valley Conservation Authority (MVCA)
- Ministry of Tourism, Culture and Sport (MCTS)
- Archaeological Clearance for Stage 1 Archaeological Assessment and Stage 2 must be provided by the MCTS.
- Ministry of Natural Resources and Forestry (MNRF)
- The Endangered Species Act (S.O. 2007, c.6) is administered by the MNRF. Registration of activity and/or a permit is required for disruption of Species at Risk. An Overall Benefit Permit may also be required to ensure mitigation in some instances.
- National Capital Commission (NCC)
- The NCCøs Federal Land Use and Review Approval Process (FLUDA) is required when there is a defined project taking place on federal lands.

10.3 Development Charge Projects

The Development Charges Act, 1997 (DCA) gives the authority to the City of Ottawa to pass a new Development Charges (DC) By-law every five years. Development charges are one-time fees levied by municipalities on new residential and non-residential properties to help pay for a portion of the growth-related capital infrastructure requirements. The adoption of this study will signify Counciløs intention to ensure that any increase in the need for service attributable to growth, based on the requirements outlined in the legislation, will be included in a future Development Charge Background Study.

The following is a list of the DC eligible growth related projects in Kanata North that should be covered in accordance with Schedule B of the Development Charges Background Study:

- March Road widening to four lanes;
- March Road intersections;
- Oversizing of sanitary sewers above 375 mm;
- Upgrade to the Briar Ridge Pump Station;
- Upgrade to off-site 400mm watermains;
- Land acquisition for park and ride and fire station.

11.0 COST ESTIMATES

11.1 Municipal Infrastructure

Preliminary costing has been prepared for the extension of municipal infrastructure to service the KNUEA. These costs do not include any proposed local infrastructure within future right-of-ways, except for the extension of sanitary sewers along the rail corridor to service lands below the ridge. The extension along the rail corridor would likely occur within a future right-of-way and it is anticipated that this sewer may be able to allow direct connections. Any costs to provide high-level sewers for local servicing along trunk sewers are excluded from these estimates. As such, the costs are limited to the value of works required to extend municipal infrastructure to the perimeter of each quadrant (northwest, northeast, southeast, & southwest). All cost estimates indicated below include a 60% capital cost allowance.

Stormwater Management cost estimates for each of the three proposed ponds are summarized in **Tables 11.1** through **11.3.** These costs include any proposed works within the SWM block from the inlet structure to the receiving watercourse. The detailed costing for each SWMF is included in **Appendix B**. It is not anticipated that any trunk storm sewers are required to service the KNUEA lands.

Table 11.1: Costing - Pond 1

Item Description	Qty	Unit	Unit Rate	Construction Cost	Capital Cost Allowance	Capital Cost ($2016)
Earthworks						
i) Earth Excavation (incl Topsoil Stripping)	45,000	m^3	$10	$450,000	$270,000	$720,000
ii) Rock Excavation	34,000	m^3	$40	$1,360,000	$816,000	$2,176,000
iii) Clay Liner (0.6m Thick)	12,000	m^2	$9	$108,000	$64,800	$173,000
Inlet						
i) Flow Splitter	1.0	ea.	$30,000	$30,000	$18,000	$48,000
ii) 1950mm dia. Storm Sewer	12	m	$2,200	$26,000	$15,600	$42,000
iii) 2100mm dia. Storm Sewer	33	m	$2,400	$79,000	$47,400	$126,000
iv) Manhole	1	ea.	$30,000	$30,000	$18,000	$48,000
v) Concrete Headwall	2	ea.	$20,000	$40,000	$24,000	$64,000
Outlet						
i) Structure (incl control & minor piping)	1	ea.	$5,000	$5,000	$3,000	$8,000
ii) 600mm dia. Storm Sewer	59	m	$350	$21,000	$12,600	$34,000
iii) MH's	2	ea.	$30,000	$60,000	$36,000	$96,000
iv) Concrete Headwall	1.0	ea.	$20,000	$20,000	$12,000	$32,000
v) Overflow spillway	1	ea.	$3,000	$3,000	$1,800	$5,000
Rock Check Dam	2	ea.	$3,000	$6,000	$3,600	$10,000
Hydro Seeding	11,000	m^2	4	$44,000	$26,400	$70,000
Landscaping Allowance	1	LS	95,000	$95,000	$57,000	$152,000
Access Road/ Pathway Connection	650	m	205	$133,000	$79,800	$213,000
Total: Pond 1						**$4,017,000**

Table 11.2: Costing - Pond 2

Item Description	Qty	Unit	Unit Rate	Construction Cost	Capital Cost Allowance	Capital Cost ($2016)
Earthworks						
i) Earth Excavation (incl Topsoil Stripping)	10,500	m^3	$10	$105,000	$63,000	$168,000
ii) Rock Excavation	2,000	m^3	$40	$80,000	$48,000	$128,000
iii) Clay Liner (0.6m Thick)	2,700	m^2	$9	$24,000	$14,400	$38,000
Inlet						
i) 1800mm dia. Storm Sewer	82	m	$2,000	$164,000	$98,400	$262,000
ii) Manhole	1	ea.	$30,000	$30,000	$18,000	$48,000
iii) Concrete Headwall	1	ea.	$20,000	$20,000	$12,000	$32,000
Outlet						
i) Structure (incl control & minor piping)	1	ea.	$40,000	$40,000	$24,000	$64,000
ii) 375mm dia. Storm Sewer	95	m	$200	$19,000	$11,400	$30,000
iii) MH's	1	ea.	$20,000	$20,000	$12,000	$32,000
iv) Concrete Headwall	1	ea.	$15,000	$15,000	$9,000	$24,000
v) Overflow spillway	1.0	ea.	$3,000	$3,000	$1,800	$5,000
Rock Check Dam	2	ea.	$3,000	$6,000	$3,600	$10,000
Hydro Seeding	9,000.0	m^2	$4	$36,000	$21,600	$58,000
Landscaping Allowance	1	LS	$63,000	$63,000	$37,800	$101,000
Access Road/ Pathway Connection	500	m	205	$103,000	$61,800	$165,000
Total: Pond 2						**$1,165,000**

Table 11.3: Costing - Pond 3

Item Description	Qty	Unit	Unit Rate	Construction Cost	Capital Cost Allowance	Capital Cost ($2016)
Earthworks						
i) Earth Excavation (incl Topsoil Stripping)	75,800	m^3	$10	$758,000	$454,800	$1,213,000
ii) Rock Excavation	500	m^3	$40	$20,000	$12,000	$32,000
iii) Clay Liner (0.6m Thick)	1000	m^2	$9	$9,000	$5,400	$14,000
Clearing and Grubbing	6	ha	$10,000	$60,000	$36,000	$96,000
Inlet					$0	$0
i) Manhole	1	ea.	$30,000	$30,000	$18,000	$48,000
ii) Rail Line Crossing - 1950mm Conc Pipe	75	m	$2,200	$165,000	$99,000	$264,000
iii) Rail Line Crossing - 2250mm Conc Pipe	63	m	$2,600	$164,000	$98,400	$262,000
iv) Concrete Headwall	2	ea.	$20,000	$40,000	$24,000	$64,000
v) Ditching (incl Earth Excavation)	500	m	$700	$350,000	$210,000	$560,000
vi) 1800mm Conc Pipe	177.0	m	$2,000	$354,000	$212,400	$566,000
vii) 2440mm Conc Pipe	30.0	m	$3,000	$90,000	$54,000	$144,000
ix) Flow Splitter manhole	2	ea.	$30,000	$60,000	$36,000	$96,000
Outlet					$0	$0
i) Structure	1	ea.	$50,000	$50,000	$30,000	$80,000
ii) 975mm Conc Pipe	76.0	m	$900	$68,000	$40,800	$109,000
iii) Concrete Headwall	2	ea.	$20,000	$40,000	$24,000	$64,000
iv) Ditching (incl Earth Excavation)	15	m	$100	$2,000	$1,200	$3,000
v) Overflow Spillway	1	ea.	$3,000	$3,000	$1,800	$5,000
vi) Road Reinstatement	40	m	$100	$4,000	$2,400	$6,000
Rock Check Dam	2	ea.	$3,000	$6,000	$3,600	$10,000
Hydro Seeding	53,000	m^2	$4	$212,000	$127,200	$339,000
Landscaping Allowance	1	LS	$225,000	$225,000	$135,000	$360,000
Access Road/ Pathway Connection	1,600	m	$205	$328,000	$196,800	$525,000
Total: Pond 3						**$4,860,000**

High-level costing of municipal infrastructure that could be subject to development charges are highlighted in the following tables. **Tables 11.4.1** and **11.4.2** depict the Construction Cost, the Capital Cost Allowance, and the Total Capital Cost for each item. The capital cost allowance is a 60% increase over the construction estimate to account for engineering, contingency allowance, project management and construction supervision costs. For simplicity, all costs have been rounded to the nearest thousand dollars. Items that are in bold italics are Development Charges Eligible Projects in accordance to the criteria in Schedule B of the DC Background Study.

Wastewater trunk servicing cost estimate summarized in **Tables 11.4.1 and 11.4.2** includes the costs of the two extensions of trunk sewers. The first extension is the trunk sewer along March Road to the second proposed major intersection. This is approximately 2100m of new sewer along March Road from the East March Trunk, including any upgrades. The second extension is the trunk sewer connecting to the BRPS, starting from the existing 450mm trunk under Shirleyøs Brook, then into the KNUEA, along future right-of-wayøs, and to the edge of the northeast quadrant. This is approximately 1700m of new sewer along the existing rail corridor, including any upgrades. The detailed costing is included in **Appendix C-6**.

Table 11.4.1: Costing ï Wastewater Collection ï March Road Trunk Sewer

Item Description	Qty	Unit	Unit Rate	Construction Cost	Capital Cost Allowance	Capital Cost ($2016)
Erosion and Sediment Control	1	LS	$75,000	$75,000	$45,000	$120,000
Ground Water Pumping & Management	1	LS	$180,000	$180,000	$108,000	$288,000
Traffic Control	1	LS	$95,000	$95,000	$57,000	$152,000
Sanitary Sewer						
i) 600mm dia. Conc. 65-D (3 - 4m deep)	660	m	$450	$297,000	$178,200	$475,000
ii) 600mm dia. Conc. 65-D (4 - 5m deep)	220	m	$550	$121,000	$72,600	$194,000
iii) 600mm dia. Conc. 65-D (5 - 6m deep)	440	m	$650	$286,000	$171,600	$458,000
iv) 600mm dia. Conc. 65-D (6 - 7m deep)	319	m	$750	$239,000	$143,400	$382,000
v) 600mm dia. Conc. 65-D (7 - 8m deep)	291	m	$850	$247,000	$148,200	$395,000
vi) Upsize Ex. 375 to 600mm (2 - 6m) (SB Drive)	201	m	$1,300	$261,000	$156,600	$418,000
Sanitary Manholes						
i) 1200mm dia. (4m - 5m in height)	7	ea	$7,000	$49,000	$29,400	$78,000
ii) 1200mm dia. (5m - 6m in height)	4	ea	$9,000	$36,000	$21,600	$58,000
iii) 1200mm dia. (6m - 7m in height)	3	ea	$10,000	$30,000	$18,000	$48,000
iv) 1200mm dia. (7m - 8m in height)	2	ea	$11,000	$22,000	$13,200	$35,000
v) 1200mm dia. (8m - 9m in height)	3	ea	$12,000	$36,000	$21,600	$58,000
vi) Upsize ex 1200mm MH to 1500mm	4	ea	$20,000	$80,000	$48,000	$128,000
Rock Excavation	8,000	m^3	$120	$960,000	$576,000	$1,536,000
Roadway Reinstatement	12,400	m^2	$100	$1,240,000	$744,000	$1,984,000
Iron Adjustment	23	ea	$500	$12,000	$7,200	$19,000
TV (x2)	2,131	m	$10	$21,000	$12,600	$34,000
By Pass Pumping	201	m	$200	$40,000	$24,000	$64,000
Shirley's Brook Dr Storm Sewer - Reinstatement	1	LS	$218,480	$218,000	$130,800	$349,000
Total: Outlet - March Road Trunk Sewer						**$7,273,000**

Table 11.4.2: Costing ï Wastewater Collection ï Briar Ridge Pump Station Outlet

Item Description	Qty	Unit	Unit Rate	Construction Cost	Capital Cost Allowance	Capital Cost ($2016)
Erosion and Sediment Control	1	LS	$10,000	$10,000	$6,000	$16,000
Ground Water Pumping & Management	1	LS	$20,000	$20,000	$12,000	$32,000
Traffic Control	1	LS	$10,000	$10,000	$6,000	$16,000
Sanitary Sewer						
i) 375mm dia. PVC (3 - 4m deep) [no Reinstate]	627	m	$300	$188,000	$112,800	$301,000
ii) 375mm dia. PVC (3 - 4m deep) [Reinstate]	191	m	$300	$57,000	$34,200	$91,000
iii) 375mm dia. PVC (4 - 5m deep)	225	m	$350	$79,000	$47,400	$126,000
iv) Upsize Ex. 375 to 450mm (3 - 6m) (Under SB)	164	m	$1,300	$213,000	$127,800	$341,000
Sanitary Manholes						
i) 1200mm dia. (2m - 4m in height)	9	ea	$6,000	$54,000	$32,400	$86,000
ii) 1200mm dia. (4m - 5m in height)	2	ea	$7,000	$14,000	$8,400	$22,000
iii) 1200mm dia. (5m - 6m in height)	1	ea	$9,000	$9,000	$5,400	$14,000
iv) Recore ex manholes	3	ea	$5,000	$15,000	$9,000	$24,000
Sanitary Overflow						
i) 375mm dia. PVC (2 - 3m deep) [no Reinstate]	465	m	$300	$140,000	$84,000	$224,000
ii) 1200mm dia. (2m - 3m in height)	4	ea	$5,000	$20,000	$12,000	$32,000
Roadway Reinstatement	2,800	m^2	$100	$280,000	$168,000	$448,000
Iron Adjustment	19	ea	$500	$10,000	$6,000	$16,000
TV (x2)	1,672	m	$10	$17,000	$10,200	$27,000
By Pass Pumping	164	m	$200	$33,000	$19,800	$53,000
BRPS Upgrades to meet firm capacity	1	LS	$500,000	$500,000	$300,000	$800,000
BRPS Sharing of Original Cost	21.6%	LS	$1,866,102	$403,000	$241,800	$645,000
Sharing of Ex Trunk Sewer Along Rail Corridor	41.0%	LS	$673,248	$276,000	$165,600	$442,000
Total: Outlet - Briar Ridge Pump Station						**$3,756,000**

Watermain Trunk servicing cost estimate summarized in **Table 11.5.1** includes the costs of extending the existing 406mm diameter watermain along March Road. The extension will connect at old Carp Road, and extends 1100m to the second proposed major intersection. The detailed costing is included in **Appendix D**.

Table 11.5.1: Costing ï Water Distribution ï March Road and 2 Secondary Connections

Item Description	Qty	Unit	Unit Rate	Construction Cost	Capital Cost Allowance	Capital Cost ($2016)
Erosion and Sediment Control	1	LS	$15,000	$15,000	$9,000	$24,000
Ground Water Pumping & Management	1	LS	$10,000	$10,000	$6,000	$16,000
Traffic Control	1	LS	$20,000	$20,000	$12,000	$32,000
Watermain						
i) 406mm dia.	1,100	m	$630	$693,000	$415,800	$1,109,000
ii) 305mm dia (secondary connections)	200	m	$450.00	$90,000.00	$54,000	$144,000
Valve Chambers						
i) 406mm dia.	7	ea	$18,000	$126,000	$75,600	$202,000
ii) 305 mm dia	2	ea	$12,000.00	$24,000.00	$14,400	$38,000
Hydrants	15	ea	$6,000	$90,000	$54,000	$144,000
Rock Excavation	400	m^3	$120	$48,000	$28,800	$77,000
Roadway Reinstatement	1,300	m^2	$100	$130,000	$78,000	$208,000
Iron Adjustment	9	ea	$500	$4,500	$2,700	$7,000
City Connection Charges	3	ea	$30,000	$90,000	$54,000	$144,000
Total: On-site Watermain						**$2,145,000**

12.0 IMPLEMENTATION AND STAGING

12.1 Environmental Assessment Amendment Process

As noted previously, development should proceed in a manner that is consistent with the Master Plans. As with the Community Design Plan, it is not possible to anticipate every circumstance or issue that may arise over the course of the development of the lands and it may not be feasible to implement the projects as described in the environmental assessment reports. A major change to the project would require an addendum outlining the implications of the change and made available for public review. Not all changes however would be considered as major. Below is summary of a well-defined process that permits landowners to make modification as necessary as the detailed planning and designs proceed following approval of the environmental assessments.

Minor Changes
Minor changes are those that do not appreciably change the expected environmental impacts or proposed mitigation associated with the project. These are modifications that typically arise as projects are refined through the planning and design process, such as, a design change within the cross section of a roadway, landscaping around storm ponds, and natural habitat compensation as part of another approval process, would be considered minor.

Changes in alignment or facility footprints that do not affect more than three participating landowners should have the consensus of those land owners and would also be considered as minor. All affected landowners and appropriate stakeholders will be provided details of proposed minor changes. Minor changes will be dealt with at the time of detailed design through the City's development review process.

Major Changes
Major changes are those that substantially change the environmental net impacts with the project or occur as a result of a change in the environmental setting for the project. An example of a major change would be a proposed change in the number stormwater management facilities, or a change to a project that affects (increases) the identified project EA schedule.

If the proposed modification is major, the recommendations and conclusions in the EA would require updating. An addendum to the EA would be required to document the change, identify the associated impacts and mitigation measures and allow related concerns to be addressed and reviewed by the appropriate stakeholders. Notice of the addendum will be posted and the addendum made available for public review. Only those changes identified in the addendum are open for review.

12.2 Detail Design

The Master Servicing Study has developed a high-level servicing solution that demonstrates feasibility and guides future development. The report is not intended to provide a street-by-street detail design; rather this enhanced level of detail will be completed in conjunction with Plan of Subdivision and/or Site Plan applications. The more rigorous field investigation and design undertaken on a site-by-site basis will inevitably lead to adjustments from the design herein. These alterations are both normal and expected as any design evolves into a final constructed format.

The detail design solution will depend upon several factors. One of these factors is the geotechnical information including maximum permissible grade raises. Another factor is the water elevation in Shirleyøs Brook and its tributaries. Both of these may affect the detailed grading design but can be mitigated by a variety of design techniques (such as pre-loading, light-weight fill, slab-on-grade dwellings (no basement), or pile foundations). The precise mitigation is best finessed during detail design.

Typical road cross sections including March Road widening (interim and ultimate), collector, arterial and local road cross sections are included in **Appendix E** for reference. Additional variations of the cross sections are provided in the Transportation Master Plan.

12.3 Infrastructure Staging

As demonstrated in the Master Servicing Study, Transportation Master Plan and the Environmental Master Plan, development can generally proceed from any location within the Study Area. Development is expected to begin close to March Road and spread out to the east and west. It is anticipated that development will occur incrementally through Plans of Subdivision with associated infrastructure and services being installed.

Where properties of non-participating landowners are located within a development phase, such properties shall not be required to develop with the balance of the lands in that phase. Through the review of draft plans of subdivision, consideration may be given to accommodate the potential integration of these individual properties.

Topography does play a role in the staging of sanitary servicing, as the KNUEA is geographically defined by the north-south ridge east of March Road. Generally, lands above the ridge will be serviced by the March Road Trunk Sewer while lands below (east of) the ridge will be serviced by the Briar Ridge Pump Station. Alternative options that result in a more efficient sanitary servicing scenario may be considered through the development review process. This may include some exchange of drainage areas above and below the ridge.

12.4 Core Services Staging

Details of the staging of the core servicing are set out in the following **Table 12.4**. More specific servicing staging is provided in the subsequent section.

Table 12.4 – Core Services Staging

INFRASTRUCTURE REQUIREMENT	DEVELOPMENT STAGE
Sanitary Servicing	
Extension of March Road Trunk Sewer and upgrade to Shirleyôs Brook Drive sanitary sewer to 600mm	Required prior to any development serviced from March Road
Briar Ridge Pump Station Upgrade	Servicing capacity is available up to 10 L/s of flow calculated from new development. Upgrade will be required for additional flow
Extension of sanitary sewer along the rail corridor, and upgrade to sanitary sewer in Brookside Subdivision to 450mm	Servicing capacity is available up to 46 L/s of flow calculated from new development. Upgrade will be required for additional flow
Water Servicing	
Water services extended from off-site	Required prior to any development serviced from March Road
Stormwater Management	
Stormwater management facilities	Required concurrent with lands tributary to the facility
Shirleyôs Brook realignment and outlet for Pond 3	Required concurrent with the lands tributary to the facility
Transportation	
Signalization of intersections on March Road	Required concurrent with initiation of adjacent development
March Road upgrade to four lanes through the CDP limits	To be determined through future City Transportation Master Plan updates and subject to Front Ending Agreement between City and landowners.
Kanata North Park and Ride	TBD based upon development timing and funding availability
Kanata North Transitway BRT extension	To be determined through future City Transportation Master Plan updates

12.5 Servicing Staging

Further information with respect to staging is provided below since some of the works are inter-connected or depend on other works to be completed first.

Stormwater Management

The development of the Stormwater Management Facilities will be triggered by development within the drainage area of each of the stormwater management ponds.

Pond 1 services the northwest quadrant as shown on **Figure 12.5.1**. This work does not require any downstream improvements, but will require a portion of Tributary 2 to be realigned. The off-site drainage channel from the west (Panandrick Estates) will need to be piped through the proposed development to maintain the current drainage outlet to Tributary 2.

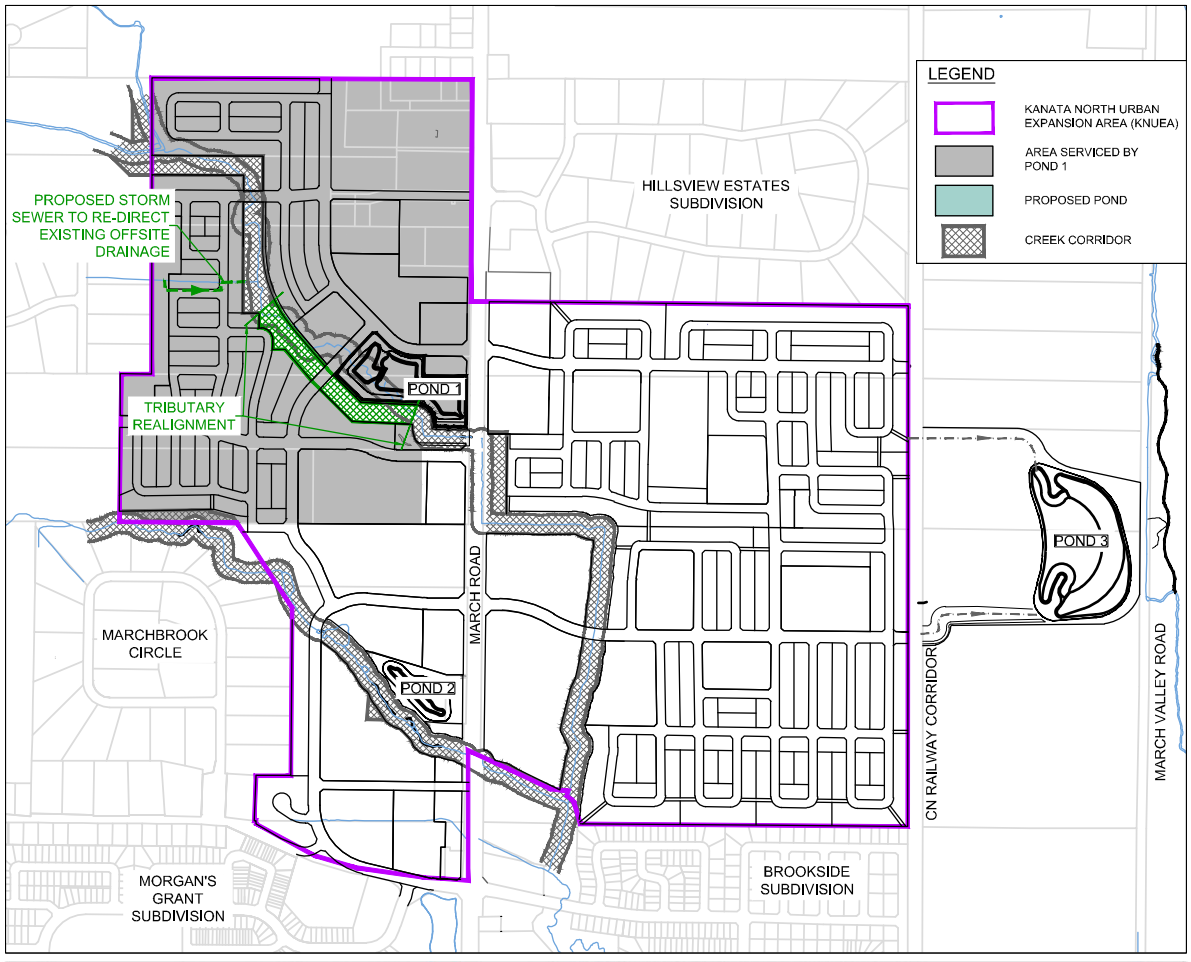

Figure 12.5.1: Stormwater Management Pond 1 and Service Area

Pond 2 services the southwest quadrant as shown on **Figure 12.5.2**. This work does not require any downstream improvements. Development of this service area will require that the existing drainage from the west (Marchbrook Circle) be re-directed around the proposed development.

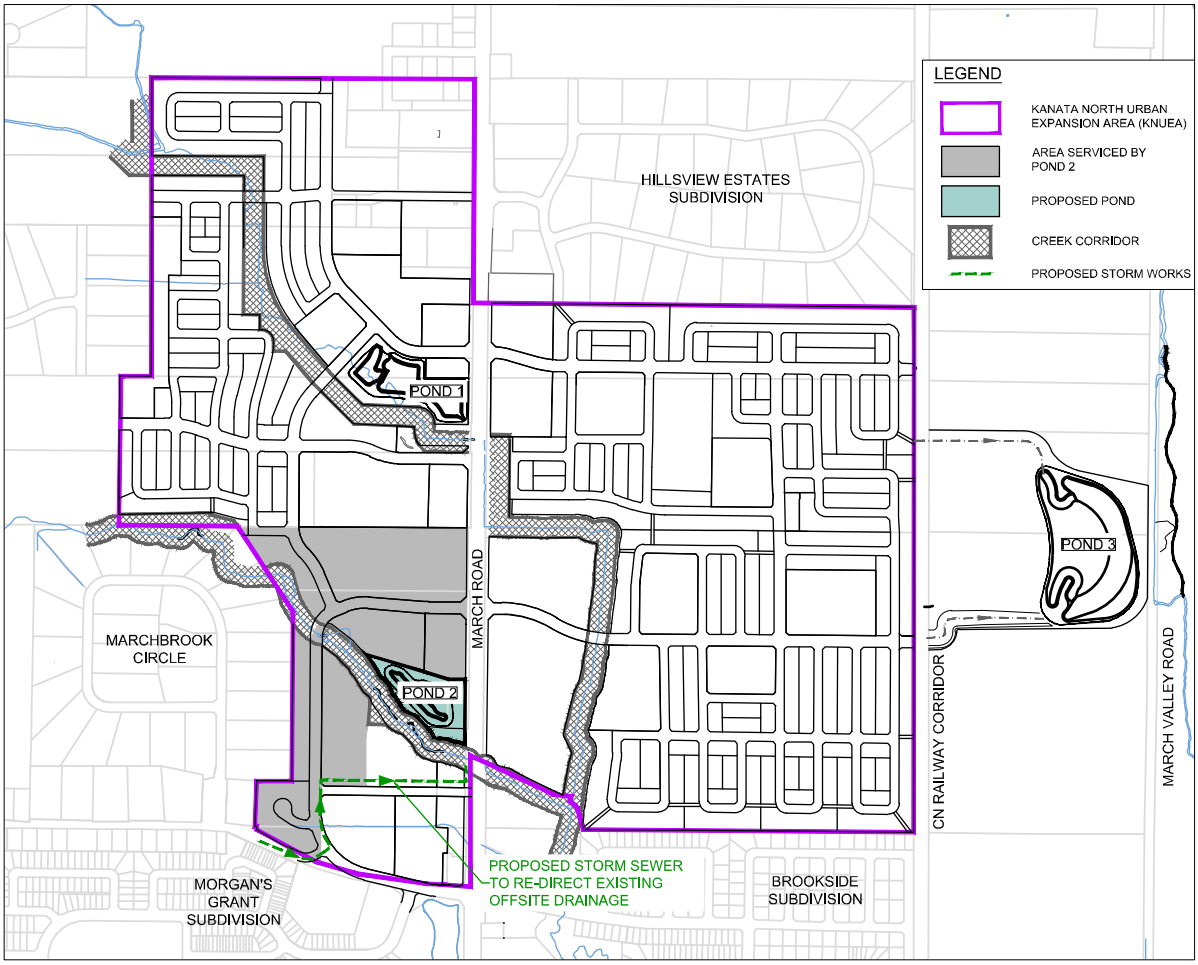

Figure 12.5.2: Stormwater Management Pond 2 and Service Area

Pond 3 services the northeast and southeast quadrants as shown on **Figure 12.5.3**. This work requires upgrades to existing culverts crossing under March Valley Road, and should be constructed concurrently with the re-alignment of Shirleyôs Brook, as indicated in the EMP. Additional rail corridor culverts may be required to convey major overland flow from KNUEA to Pond 3. There are existing culverts to convey this flow however, their locations may not work with the proposed subdivision layout. Exact locations will be determined at the detailed design stage.

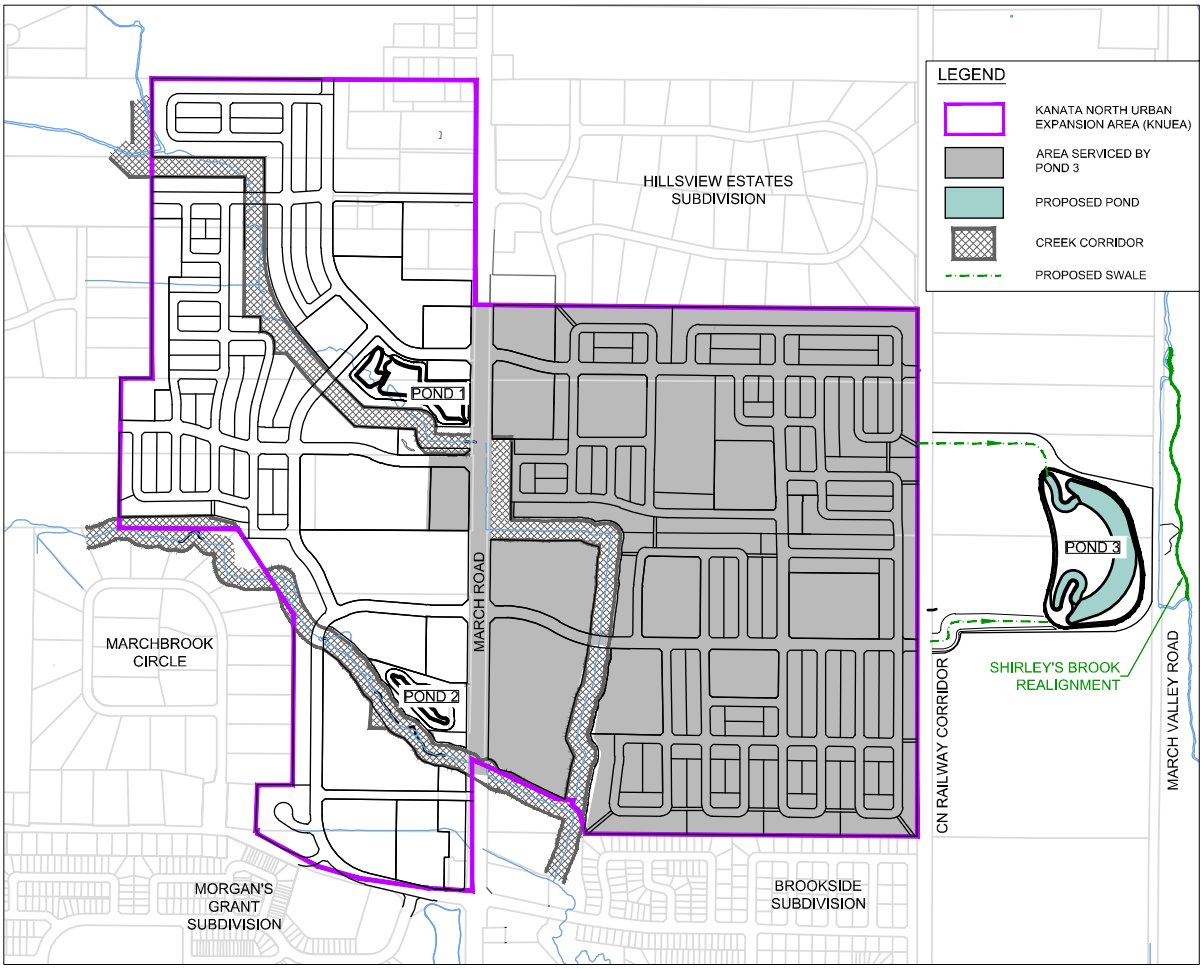

Figure 12.5.3: Stormwater Management Pond 3 and Service Area

Wastewater

The first stage of wastewater servicing will be the trunk sewer along March Road north of Tributary 2, and the associated upgrades to the existing sewer along Shirley's Brook Drive. These works will provide a wastewater outlet for the KNUEA lands west of the ridge to the existing East March Trunk sewer. The service area for this phase is shown in **Figure 12.5.4**. The total flow for this service area will be approximately 129L/s.

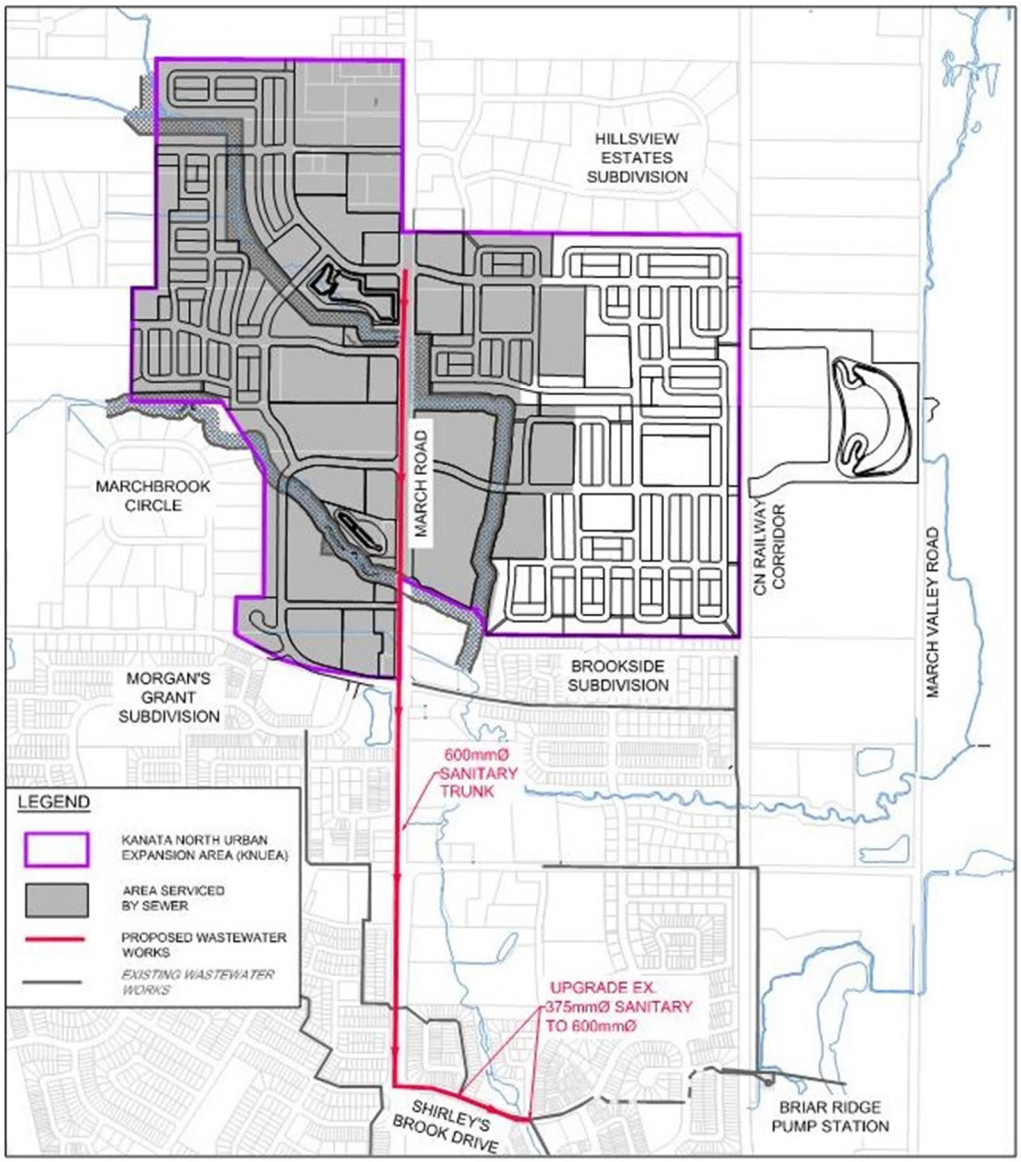

Figure 12.5.4: March Road Sanitary Sewer and Service Area

The second stage of wastewater servicing will be the trunk sewer along the rail corridor, within existing and future roadways. This will require upgrades to the existing sewer crossing under Shirley's Brook, and an increase in capacity of the Briar Ridge Pump Station (BRPS.) These works will provide a wastewater outlet for the KNUEA lands east of the ridge to BRPS and ultimately to the existing East March Trunk sewer. The service area for this phase is shown in **Figure 12.5.5**. The total flow for this service area will be approximately 54L/s.

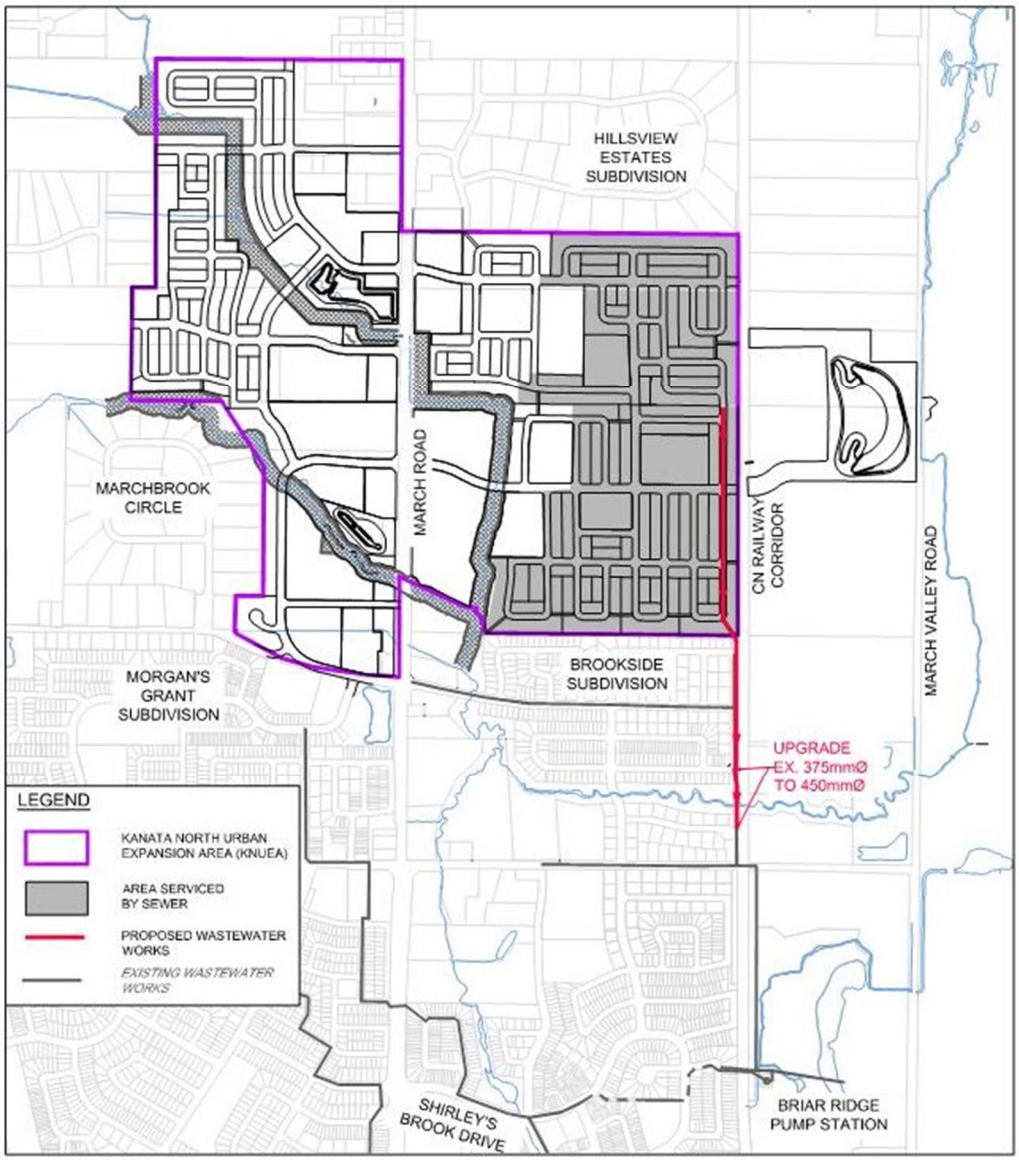

Figure 12.5.5: Rail Corridor Sanitary Sewer to BRPS and Service Area

Water

The first phase of watermain trunk servicing will be the extension of the existing 406mm diameter watermain from Halton Terrace along March Road north of Tributary 2. This work will be required prior to the development of any KNUEA lands, and does not require any off-site improvements. The watermain phasing is shown in **Figure 12.5.6.**

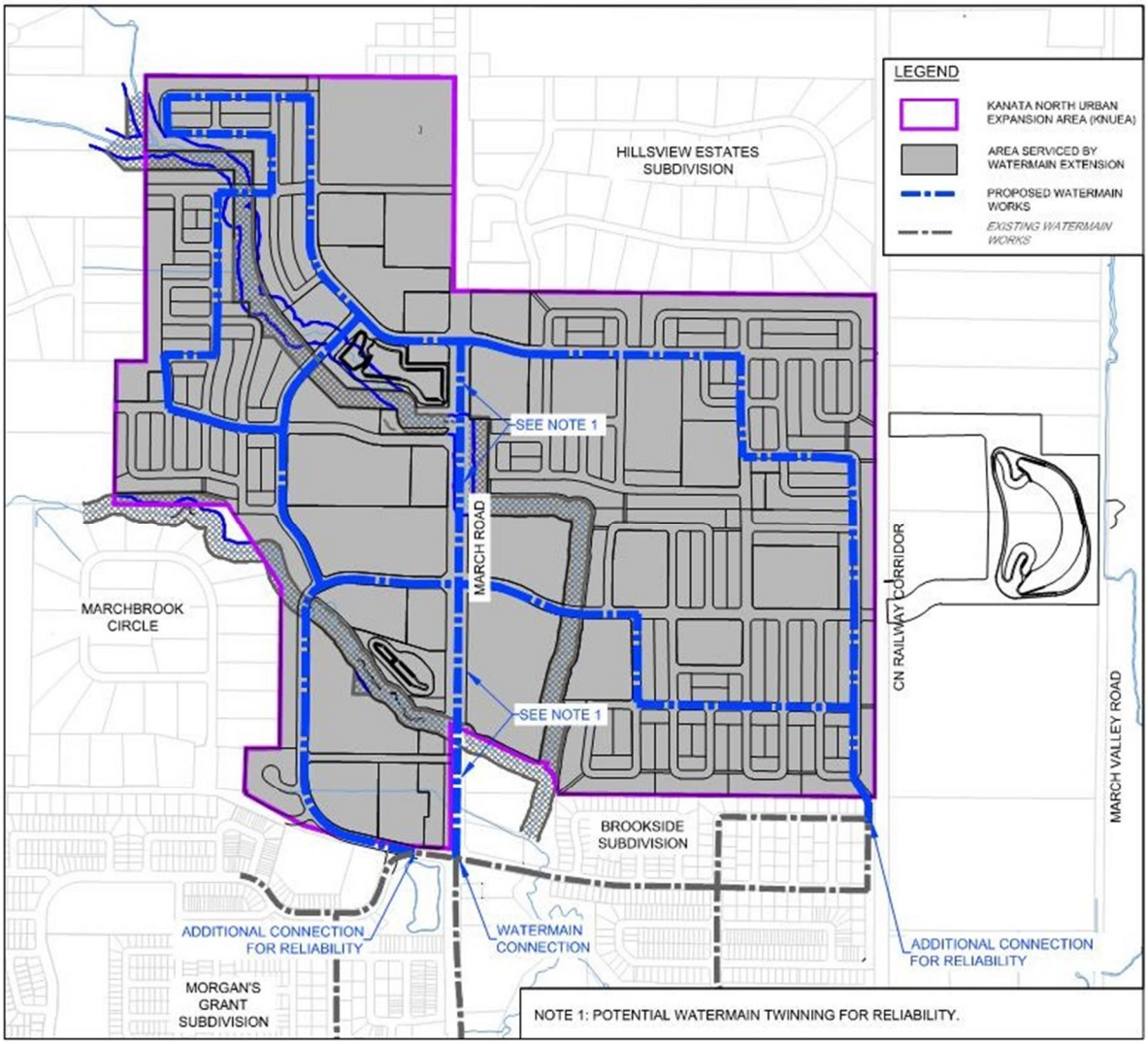

Figure 12.5.6: Water Service Area

There are additional watermain works which will be required to allow for improved watermain network reliability. It is recommended that proposed developments with high daily demands be provided with two connection points. Secondary connections are also required to improve reliability of the watermain servicing the KNUEA lands. The City has agreed that a maximum of 200 units can be constructed and serviced with the single watermain connection along March Road. Once more than 200 units have been constructed a secondary connection is required for system reliability. This secondary connection can either be at the Old Carp Road location, the Celtic Ridge location or a second watermain within the March Road ROW. The location would be confirmed as subdivision applications are reviewed by the City. At full build out the both secondary connections should be completed.

13.0 CONCLUSIONS

This Master Servicing Study has evaluated servicing alternatives for the KNUEA and recommended preferred servicing alternatives for storm, wastewater and water servicing. These recommended servicing alternatives serve as a functional design and demonstrates feasibility of servicing the proposed development. Design criteria were also provided to facilitate future detailed design work. The servicing solutions presented herein are not intended to be fixed; in fact it is anticipated that Plan of Subdivision applications will alter some of the local road and layout configurations. To this end, the servicing design is intentionally conservative to permit flexibility in the land use plan and development densities.

This report has been completed in accordance with the Municipal Class Environmental Assessment process. Principal findings and recommendations of the Master Servicing Study are summarized below.

Storm Drainage

- The EMP evaluates the stormwater management servicing options for the KNUEA and recommends servicing the development using three stormwater management ponds. The EMP also outlines design criteria for the stormwater management system.

- The storm drainage design includes a dual-drainage approach and design criteria are provided which provides guidance for future draft plan and site plan applications.

- A preliminary trunk sewer network was designed based on the Demonstration Plan to confirm feasibility of servicing the KNUEA.

- The preliminary trunk sewer network was modelled and adjusted to ensure the HGL for the storm sewer system is no more than 0.6m above the obvert of the storm sewer at any given point.

- A preliminary grading plan was prepared and used to develop overland flow catchment areas.

- Allowable release rates were developed based on land use for the minor and major storm systems. These allowable release rates should be used in future detailed designs for the development.

- A storm sewer servicing evaluation was completed and is summarized to document the results using the criteria and indicators as shown in **Section 5.5** on the preferred storm servicing solution.

- Additional capacity has been incorporated into the storm sewer system which permits design flexibility for a moderate degree of intensification within KNUEA and suggests the system can readily accommodate moderate change and minor adjustments to the land use plan are readily accommodated.

- Drainage solutions for two off-site, upstream drainage areas are provided and incorporated into the storm servicing design.

- The existing ditch and culverts within the abandoned rail corridor have the capacity to convey the major system flows from the proposed development to Pond 3.

Wastewater Collection

- The March Pump Station is to be the wastewater outlet for the KNUEA.

- The two constraints of elevation and capacity were reviewed to determine that the East March Trunk Sewer is the most viable option to service the KNUEA. The connection point to the East March Trunk Sewer is proposed at the intersection of Shirleyøs Brook Drive and Sandhill Road just east of March Road.

- Off-site servicing was further evaluated and it was recommended that two routes will be used to service the KNUEA. A sanitary sewer will be constructed northward along March Road and along Shirleyøs Brook Drive. The second sanitary sewer will be installed and connected to the existing sanitary sewer that runs along the existing Abandoned CN Railway corridor to the Briar Ridge Pump Station. The Briar Ridge Forcemain then connects to the East March Trunk Sewer at the same connection point.

- The Briar Ridge Pump Station was reviewed and it was determined that there is a residual capacity of 74L/s that can be used to service the KNUEA. Upgrades will be required to the BRPS which involve larger impellers and the installation of a third pump as per the original design. These upgrades will require an amendment to the MOE Certificate of Approval.

- Six off-site servicing alternatives were reviewed and evaluated and Option #2 was recommended as the preferred option based on the reasons provided in Section 6.5. Option #2 includes a new gravity sanitary sewer along March Road that services the area west of March Road and west of the ridge. The area east of the ridge will be serviced by the existing 375mm diameter sanitary sewer along the rail corridor which outlets to the Briar Ridge Pump Station (BRPS). Upgrades will be required to the BRPS as well as to the existing sanitary sewer system as noted previously.

- This servicing option will require upgrading an existing 375mm diameter sanitary sewer along Shirleyøs Brook Drive to a 600mm diameter to be able to accommodate the increased flows and provide a lower outlet elevation. Upgrades will also be required to existing infrastructure along the rail corridor. A section of the existing 375mm diameter sanitary sewer will be replaced with 450mm diameter sewer. The BRPS can accommodate the flow from the Kanata North Urban Expansion Area (50L/s) within the ultimate design capacity of the station (183L/s).

- On-site servicing was reviewed and design criteria provided which provides guidance for future draft plan applications. A preliminary trunk wastewater sewer network was designed based on the Demonstration Plan to confirm feasibility of servicing the KNUEA. Based on the land uses provided in the Demonstration Plan, flow rates were calculated and the total flow for the KNUEA is calculated to be 182.2 L/s.

- A servicing evaluation was completed and is summarized to document the results using the criteria and indicators as shown in **Section 6.6.1.3** on the preferred sanitary servicing solution.

- An analysis was completed to understand the effects on the downstream infrastructure and any upgrades that may be required. It was confirmed that downstream upgrades will be required and details are provided in **Section 6.6.2**.

- An HGL analysis was also completed on the BRPS to ensure that, when the future lands are added to the system, there are no negative impacts to the existing developments. This analysis concluded that an overflow outlet (at elevation of 67.50) will be able to provide relief to the existing trunk sewer along the rail corridor and not raise the HGL in the existing sanitary sewers tributary to the BRPS.

- A sensitivity analysis was completed and concluded that residual capacity exists in the wastewater network which permits design flexibility for a moderate degree of intensification within KNUEA and suggests the system can readily accommodate moderate change and minor adjustments to the land use plan are readily accommodated.

Water Distribution

- The Kanata North Urban Expansion should be serviced entirely from the Zone 2Ww pressure zone due to topography and location.

- Site grading should not exceed 93m to maintain minimum pressures greater than 40 psi.

- Services installed in areas where the grade is less than 74m will need pressure reducing valves to keep the maximum pressure below 80 psi.

- A secondary connection from Old Carp Road is the preferred secondary connection over the Celtic Ridge connection. However, either connection will adequately service the development.

- It is recommended that both secondary connections be completed prior to full build out of the KNUEA. As an interim measure, a second watermain within the March Road ROW could be provided.

- A servicing evaluation was completed and is summarized to document the results using the criteria and indicators as shown in **Section 7.4** on the preferred water servicing solution.

Utility Infrastructure

- Each utility company (Hydro Ottawa, Enbridge Gas, Bell Canada, Rogers Ottawa) has confirmed their plant is in reasonable proximity to the KNUEA, and that this future development can be serviced.

The MSS component of the Kanata North CDP satisfies the requirements of Phases 1 and 2 of the Municipal Class EA Process. Infrastructure projects that will be undertaken in concert with development of the KNUEA and their schedule classification are outlined in detail in the report.

In conclusion, the development reflected in the KNCDP Preferred Land Use Plan can be adequately serviced by extending existing municipal water and wastewater infrastructure and constructing three stormwater facilities to service the development.

14.0 RELIANCE CLAUSE

This report has been prepared by Novatech, on behalf of the Kanata North Landowners Group and in support of the Kanata North Community Design Plan. It is hereby acknowledged that Metcalfe Realty Company Limited, J.G. Rivard Ltd. and 8409706 Canada Inc. (Valecraft Homes), 3223701 Canada Inc. (Brigil) and 7089121 Canada Inc. (Junic/Multivesco) can rely upon and utilize this report for the purpose of obtaining approval of the community design plan and for their own use to seek development approval. It is further acknowledged that future confirmed participating landowners within the Kanata North Landowners Group can rely upon and utilize this report for the purpose of obtaining approval of the community design plan and for their own use to seek development approval.

All of which is respectfully submitted.

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