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**PRELIMINARY
FUNCTIONAL SERVICING REPORT**

DAIN WEST

CITY OF WELLAND

Prepared for:

**555 Canal Bank Developments GP Inc.
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Prepared by:

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- Watermain Distribution Plan – DWG# **0585-WM-FSR**
- Sanitary Drainage Plan – DWG# **0585-SAN-FSR**
- Overall Sanitary Drainage Area Plan – DWG# **0585-OSAN-FSR**
- Storm Drainage Plan – DWG# **0585-STM-FSR**
- Overall Site Grading Plan – DWG# **0585-GP-FSR**
- Dain City West Draft Plan of Subdivision – May 29, 2020
- Typical Road Cross Section – 15.0m R.O.W.
- Road Section-Utility Locations – 18.0m R.O.W.
- Road Section-Utility Locations – 21.0m R.O.W.
- Typical Canal Bank Street Cross Section



References

- Design Guidelines for Sewage Works 2008 – PIBS 6879
Ontario Ministry of the Environment (2008)
- Existing 2014 Consolidated Regional Official Plan
Regional Municipality of Niagara (2014)
- City of Welland Municipal Standards
City of Welland (February 2013)
- *Memorandum* - “Empire Homes Development – Water Distribution System Review”
GHD (December 2019)
- Welland City Water and Wastewater Servicing – Preliminary Capacity Assessment
WSP (March 2020)



EXECUTIVE SUMMARY

Upper Canada Planning & Engineering Ltd. (Upper Canada Consultants) has been retained by 555 Canal Bank Developments GP Inc. to prepare a Functional Servicing Report in support of the Draft Plan of Subdivision application for the 74.7 hectare development site known as Dain West, located on the former John Deere site in the City of Welland.

Water Servicing

A Water Distribution System Review was prepared by GHD for the City of Welland. Based on the findings of this study, the existing infrastructure shall have adequate capacity for the Dain West development. The maximum ground elevation within the site is approximately 181.30m which is below the maximum elevation of 185.00m that was recommended within this study. To service the site, the existing 300mm diameter watermain will be extended within the site with a connection to the existing 200mm diameter PVC watermain. The private 200mm diameter cast iron watermain shall be removed and replaced with new 200mm diameter PVC watermain from St. Clair Drive and shall be extended within the site. The site shall be serviced with watermain ranging from 50mm to 300mm in diameter.

Sanitary Servicing

A sanitary analysis concluded that the existing gravity sanitary sewer network shall have adequate capacity to convey peak sanitary flows from the proposed development to the Dain City pumping station.

The Niagara Region is undertaking efforts to upgrade the existing Dain City pumping station in response to wet weather flow concerns within the existing sanitary sewer system. As part of these upgrades, the projected sanitary flows from the proposed Dain West development and adjacent Dain East development are to be accounted for to ensure the pumping station has capacity to service the future development in the Dain City area.

Stormwater Management

Stormwater quality improvements are to be provided to an MECP *Enhanced* level (80% TSS Removal) for stormwater discharging from the site into the Welland Recreational Canal. Quantity controls are not considered necessary for the stormwater discharging to the Welland Recreational Canal.

To provide the required MECP *Enhanced* quality improvement levels prior to discharge into the Welland Recreational Canal, a stormwater management wet pond facility is proposed.



INTRODUCTION

This report is to address the servicing needs for the mixed residential development of Dain West. The site is located at the former John Deere facility in the City of Welland, east of the Welland Recreational Canal, south of the Canadian National Railway lands, north of St. Clair Drive, and northwest of the VERBIO Diesel Canada lands. The site is a brownfield development, located on former industrial land.

The site is 74.7 hectares and is proposed to consist of flexible zoning permitting a maximum density of 872 mixed residential units in a mix of single detached, semi-detached and town home dwellings. The balance of the lands are to be used for a 4.06 hectare mixed use block which may accommodate retail, commercial, and/or residential units (Block 63), and a 2.33 hectare school block (Block 64), as shown in the enclosed Draft Plan of Subdivision (dated May 29, 2020). Using a population density of 2.91 persons per unit for single and semi-detached units and 2.12 persons per unit for townhouse units, the proposed Dain West development has a proposed approximate equivalent population of 3,853 persons.

It is proposed that the site be serviced with urban roadways conforming to the current City of Welland development standards, including associated asphalt roads with a proposed structure of 450mm of Granular 'A' roadway base on finished subgrade, 75mm of HL8 base course asphalt, and 40mm of HL3 surface course asphalt. Additionally, the site will include concrete curb, catch basins, storm sewers, sanitary sewers, watermain and associated utilities located in a joint-use trench installation.

See Appendix A for the proposed 15m, 18m, and 21m internal right of way cross sections and the 30m Canal Bank Street right of way cross section.

The objectives of this study are as follows:

1. Identify domestic and fire protection water service needs for the site.
2. Identify sanitary servicing needs for the site.
3. Provide a summary of the stormwater management plan for the site.
4. Provide a summary of the preliminary grading plan for the site.

WSP Canada Inc. was retained by 555 Canal Bank Developments GP Inc. to prepare a design brief regarding the Welland City Water and Wastewater Servicing and that brief should be read in conjunction with this report (WSP, 2020).



WATER SERVICING

A study of the water demand for the Dain City area was conducted by GHD for the City of Welland in December of 2019 and has been included in Appendix B of this report for reference. The study analysed existing and future conditions for the existing infrastructure (the Welland Water Treatment Plant, Bemis Park Elevated Tank, etc.) and concluded that the existing infrastructure could provide adequate domestic and fire supply for the proposed Dain West development (referred to as the former John Deere facility) in addition to the adjacent Dain East development to the east of the subject lands (GHD, 2019).

The GHD study referenced a total future population of 13,173 persons between the future developments (GHD, 2019). Using a population density of 2.91 persons per unit for single and semi-detached units and 2.12 persons per unit for townhouse units, the proposed Dain West development has a proposed approximate equivalent population of 3,853 persons while the adjacent Dain East has an approximate equivalent population of 3,709 persons, for a combined future population of 7,562. Therefore, GHD's conclusions regarding the capacities of the existing infrastructure remain valid as it pertains to the Dain West and Dain East development.

The study prepared by GHD concluded that the existing maximum ground elevation of 189.00m within the adjacent development may result in watermain pressures dropping below the minimum 40 psi in specific areas of the site and recommended limiting the ground elevation to 185.00m. As shown in the enclosed Overall Site Grading Plan (DWG# 0585-GP-FSR), a maximum road elevation of 181.30m has been maintained within the site. Therefore, the existing water supply infrastructure is expected to have adequate capacity for the proposed Dain West development.

There are three existing watermains within or adjacent to the subject lands:

- An existing 200mm diameter PVC watermain that was constructed in 1997 along Canal Bank Street to the west of the subject lands,
- An existing 200mm diameter cast iron watermain that was constructed in 1945 which runs northerly into southeast corner the subject lands; and,
- An existing 300mm diameter AC watermain that was constructed in 1971 which connects to the existing 200mm diameter cast iron waterman and runs easterly, crossing the existing Gio Rail lands on the eastern limit of the site with a connection to the existing 400mm diameter watermain which serves as the single supply to the Dain City area.



To service the proposed development, it is proposed to extend the existing 300mm diameter watermain within the subject lands with a connection to the existing 1997 200mm diameter PVC watermain. Due to the 75-year-old age of the private 200mm diameter cast iron watermain installed in 1945, this main shall be removed and replaced with new 200mm diameter PVC watermain from St. Clair Drive and shall be extended within the site. The site shall be serviced with watermain ranging from 50mm to 300mm in diameter.

An Overall Watermain Distribution Plan has been provided with this report for reference (DWG# 0585-WD-FSR).

SANITARY SERVICING

To analyse the existing sanitary sewer capacity downstream of the subject lands, the equivalent population of 3,853 was used for the Dain West development and the equivalent population of 3,709 persons was used for the Dain East development.

As shown in the sanitary sewer design sheet included in Appendix C, the receiving sanitary sewers shall have adequate capacity to service the Dain West and adjacent Dain East developments. The receiving existing 400mm diameter sanitary sewer at the southern limit of the Dain West lands will flow at approximately 63% full upon full build-out and the existing 450mm diameter trunk sanitary sewer which conveys peak sanitary flows to the Dain City pumping station on Crescent Drive will flow approximately 76% full upon full build-out of both the Dain West and Dain East lands.

Internal sanitary sewers ranging from 200mm to 375mm in diameter shall be constructed to service the Dain West development as shown in the Sanitary Drainage Plan that has been provided with this report (DWG# 0585-SAN-FSR).

Upgrade efforts to the existing Dain City pumping station are being undertaken by the Niagara Region in response to wet weather flow concerns within the existing sanitary sewer system. As part of these upgrades, the projected sanitary flows from the proposed Dain West development and adjacent Dain East development are to be accounted for to ensure the pumping station has capacity to service the future development in the Dain City area.

The proposed units are to be constructed with water efficient fixtures to reduce peak sanitary flows discharging from the site. It is proposed to monitor the sanitary flows discharging from the site over a 10 year period to ensure the reduced peak sanitary flows are maintained.

The Overall Sanitary Drainage Area Plan used in this analysis has been provided with this report for reference (DWG# 0585-OSAN-FSR).



STORMWATER MANAGEMENT

A Preliminary Stormwater Management Plan has been prepared to address the overall stormwater management strategy for the site and has been submitted along with this Functional Servicing Report. The following shall summarize the findings of this Preliminary Stormwater Management Plan.

The overall drainage areas for the site ultimately convey peak stormwater flows to the Welland Recreational Canal. Based on the design criteria provided by the MECP and the City of Welland, it is proposed to provide stormwater quality control for site stormwater flows discharging to the Welland Canal to MECP *Enhanced* levels to allow for the MECP Environmental Compliance Approval review to be completed through the Transfer of Review process. Stormwater management quantity controls and downstream erosion controls are not considered necessary for stormwater flows discharging to the Welland Recreational Canal.

To provide the required stormwater quality controls, a wet pond facility is proposed. The wet pond facility will provide stormwater quality improvements to MECP *Enhanced* levels (80% TSS Removal) in accordance with MECP guidelines.

Minor peak stormwater flows up to and including the 5 year design storm event shall be captured by the proposed urban storm sewer system within the subject lands. Canal Bank Street shall be realigned as part of the site development and shall include new storm sewers as part of the road reconstruction. The proposed storm sewers within Canal Bank Street and the development lands shall convey the peak flows to the proposed wet pond facility prior to discharging to the Welland Recreational Canal. For major storms in excess of the 5 year design storm event, stormwater flows shall surcharge from the internal storm sewers and be conveyed westerly overland through the proposed road allowances directly to the Welland Recreational Canal.

An Overall Storm Drainage Area Plan has been provided with this report for reference (DWG# 0585-STM-FSR).

PRELIMINARY GRADING PLAN

An Overall Site Grading Plan has been provided with this report to demonstrate the preliminary grading strategy for the Dain West development (DWG# 0585-GP-FSR).

The majority of the site has been graded to create major overland flow paths for the conveyance of stormwater flows to the Welland Recreational Canal. Based on the preliminary road grades shown in the accompanying drawing all roads will be designed to meet City of Welland minimum road grade slopes from approximately 0.5% within the site. Where the proposed lot boundaries abut Blocks 72 and 73, the proposed grading will match the existing ground elevations.



In accordance with the recommendations stated within the GHD Water Distribution Study (GHD, 2019), the maximum ground elevation does not exceed 185.00m.

A noise berm has been proposed along the eastern limit of the site, due to the adjacent Gio Rail tracks. The berm has a varying peak elevation in accordance with the noise requirements and side slopes of approximately 2.5:1 on the eastern side and approximately 2.5% on the western side within the park.

CONCLUSIONS AND RECOMMENDATIONS

The following shall summarize the conclusions and recommendations found above:

Water Servicing

- The GHD study indicates that the existing 400mm diameter trunk watermain that supplies the Dain City area has adequate capacity for the proposed development.
- The site shall not exceed a maximum ground elevation of 185.00m to ensure a minimum water pressure of 40 psi is maintained within the entire site.
- The site shall be serviced with watermains ranging from 150mm to 300mm in diameter.

Sanitary Servicing

- The existing sanitary sewers shall have adequate capacity to service the proposed development and convey peak sanitary flows to the Dain City pumping station.
- The site shall be serviced with sanitary sewers ranging from 200mm to 375mm in diameter.
- Following the upgrades to the Dain City pumping station, there will be adequate capacity within the existing infrastructure to service the site.

Stormwater Management

- A stormwater management wet pond facility shall provide stormwater quality improvements to an MECP Normal level (80% TSS Removal) for the site prior to discharging to the Welland Recreational Canal.
- Stormwater quantity controls are not considered necessary for stormwater flows discharging ultimately to the Welland Recreational Canal.



Preliminary Grading

- The site will be graded such that the majority of the site overland flows are conveyed within the roadways to the Welland Recreational Canal.
- Internal road grades to meet City of Welland Design Standards with a minimum of 0.5%.
- A maximum grade of 185.00m will not be exceeded within the site per the water servicing requirements established by the GHD study.
- The existing ground elevations within Blocks 72 and 73 will be maintained along the proposed rear lot boundaries

Based on the above and the accompanying Servicing Plans, we are of the opinion that there exists, or will exist adequate municipal servicing for this development.

This report has been undertaken based upon information provided by 3rd parties and has been prepared based upon the best available practices and procedures, however all calculations and documentation is preliminary and is not to be used for construction and is subject to change based upon future discoveries or input from external parties. We trust the above comments are satisfactory for approval. If you have any questions or require additional information, please do not hesitate to contact our office.

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Reviewed By:

Adam Keane, P.Eng.

Encl.



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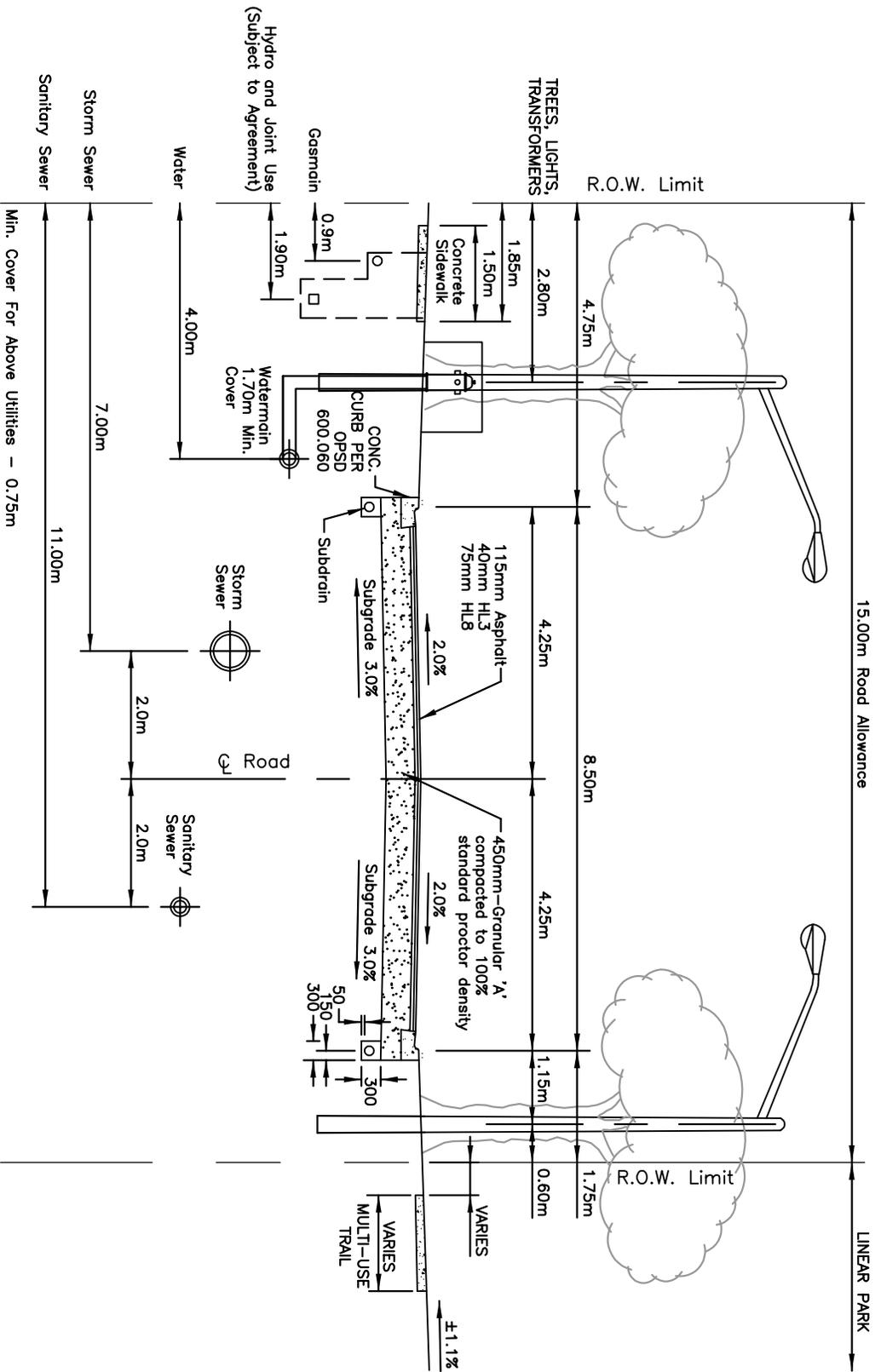
APPENDICES



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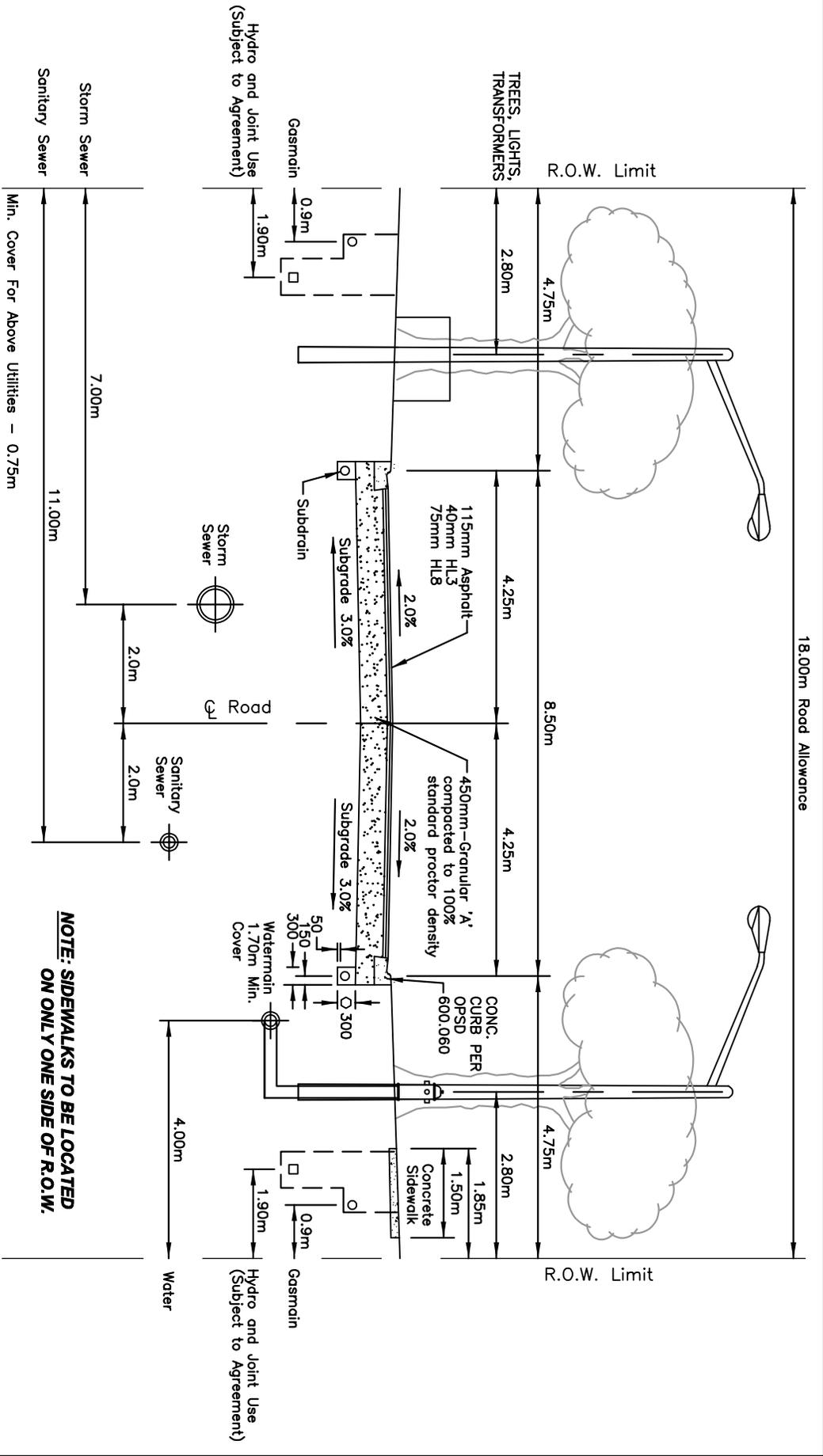
APPENDIX A

Proposed Typical 15m R.O.W. Cross Section
Proposed Typical 18m R.O.W. Cross Section
Proposed Typical 21m R.O.W. Cross Section
Proposed Typical 30m R.O.W. Cross Section



TYPICAL ROAD CROSS SECTION - 15.0m R.O.W.

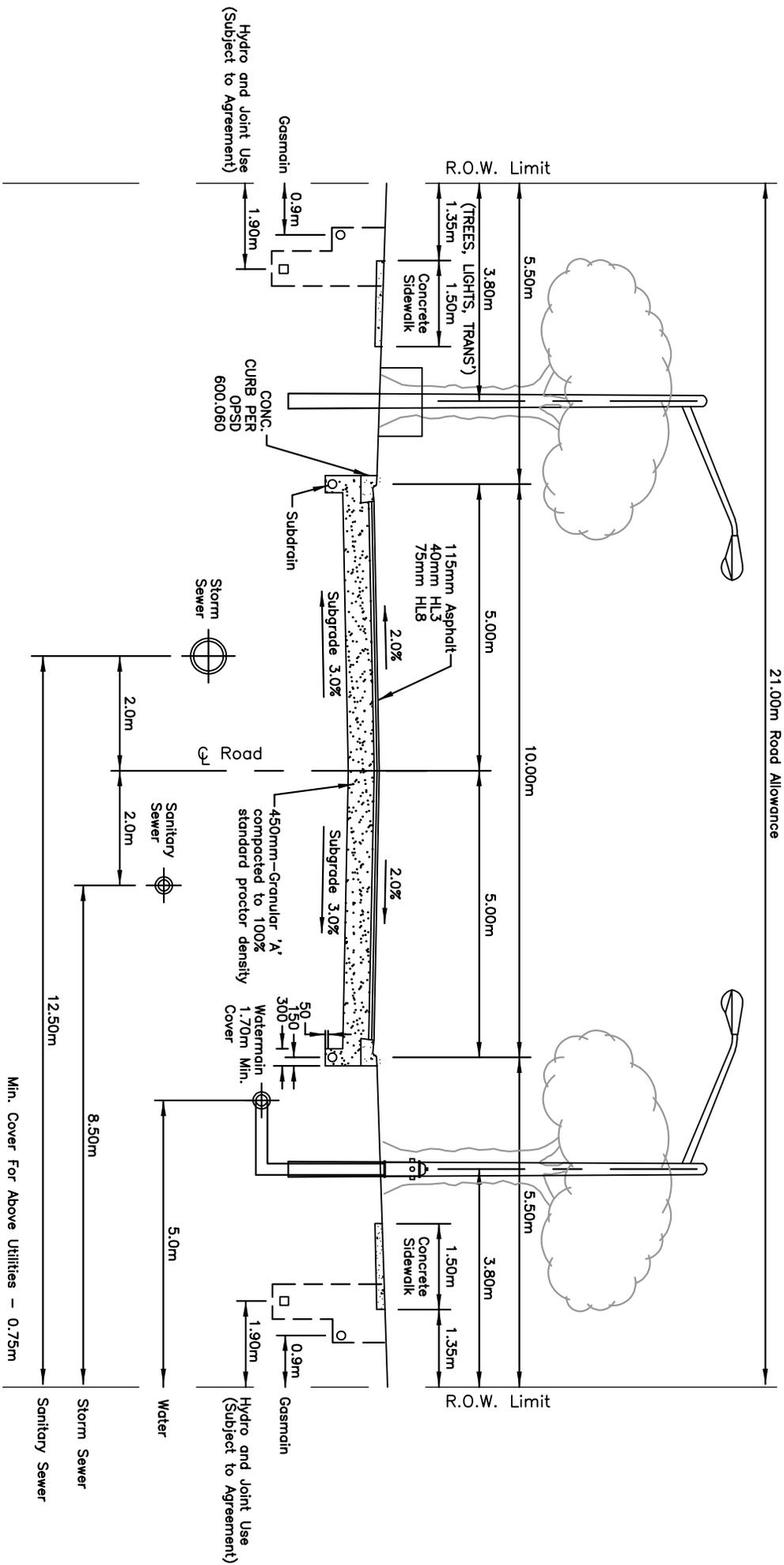
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TYPICAL ROAD CROSS SECTION - 18.0m R.O.W.

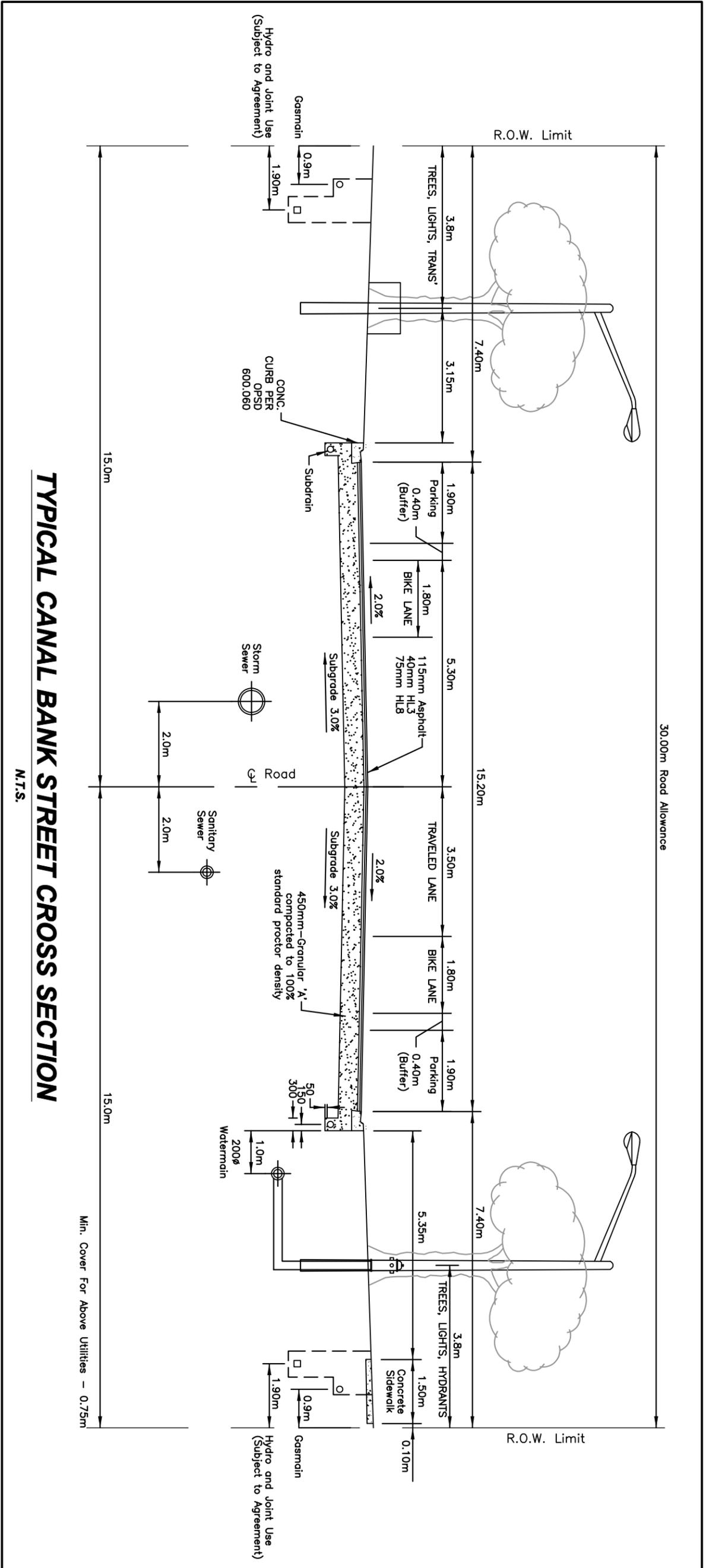
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NOTE: SIDEWALKS TO BE LOCATED ON ONLY ONE SIDE OF R.O.W.



ROAD SECTION-UTILITY LOCATIONS-21.0m R.O.W.

N.T.S.



TYPICAL CANAL BANK STREET CROSS SECTION



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APPENDIX B

GHD Memorandum – Dated December 3, 2019



Memorandum

December 3, 2019

To: Marvin Ingebrigsten, P.Eng Ref. No.: 11155923

From: Samantha McCauley, P.Eng *SM* Tel: 905-346-3857

CC:

Subject: Empire Homes Development – Water Distribution System Review

1. Introduction

GHD was retained by the City of Welland to review the impacts of the proposed Empire Homes Development on the Welland water distribution system. Figure 1.1, attached at end, shows the location of the proposed development, which is broken up into three areas – Dain City Residential, Former John Deere, and Canal Bank/Dain Avenue.

Results of the completed analysis are described herein.

2. Model Set Up

2.1 Existing Model

The City of Welland's existing InfoWater all pipe water model was used as the base for the completion of this analysis. A model review was last conducted in 2018 with recent watermain construction projects incorporated, and updates made to the Welland Water Treatment Plant (WTP), including addition of pump curves for recently replaced pumps, and modification of base operational settings (on/off pump settings) to match settings determined from a review of 2017 SCADA data.

The City of Welland's existing InfoWater model also includes future development scenarios (average day and maximum day extended period simulations). These future development scenarios incorporate planned developments previously reviewed. These developments include:

- GE Plant (Built)
- Canal View Heights (Built/In construction)
- Hunter's Pointe Development Area (Future)
- Northern Reach Land Development (Future)
- Sauer Avenue, Louise Street, and Station Street (Future)

The review of the Empire Homes Development was completed using the future development scenarios.



2.2 Empire Homes Development Demands

Populations were provided by WSP for the proposed Empire Homes Development. Average day demands (ADD) were calculated using a per capita demand of 320 L/cap-day, a value which the City previously selected for use for development reviews. Maximum day demands (MDD) were calculated using a peaking factor of 1.5, which is the peaking factor used in the model established from historical demand data. The peak hour demand (PHD) peaking factor, which is based on the model MDD EPS demand pattern, is 1.87 (2.81 x ADD). Similar to the MDD peaking factor, the PHD peaking factor is based on historical demand data. Table 2.1 summarizes the demands assigned to the model for the Empire Homes Development, along with the resulting PHD.

Table 2.1 Empire Homes Development Demands

Location	Population	ADD (L/s)	MDD (L/s)	PHD (L/s)
Former John Deere	3200	11.85	17.78	33.25
Dain City Residential	2990	11.07	16.61	31.06
Canal Bank/Dain Avenue	6983	25.86	38.79	72.54
Total	13173	48.78	73.18	136.85

In addition to the demands noted above, a fire flow was also required to be used to assess the MDD + Fire Flow condition. The proposed development includes a mix of land uses, including single and multi-family units. The City's single family residential fire flow requirement is 67 L/s, while the City's requirement for multi-family units and some commercial properties is 133 L/s. A fire flow of 133 L/s was selected for the purpose of this analysis as it is a better representation of the fire flow needs for the development as a whole. This fire flow is applied at hour 7:00 of the MDD EPS scenario.

2.3 Development Servicing

Watermains and junctions were added to the model to represent the Empire Homes Development. Since a proposed servicing plan was not provided, watermain locations were assumed, with only watermains forming the assumed backbone of the servicing scheme (i.e. watermains connecting to the existing distribution network) included. Elevations were assigned to the junctions added to the model using the City's 1 m contours with the highest elevation for each area assigned. Figure 2.1 shows the watermains and junctions added to the model, including watermain sizing and assigned junction ground elevations. All pipes were assigned a C-Factor of 135, consistent with the C-Factor for plastic pipe established when the City's model was calibrated.

3. Review of Storage Requirements

Prior to completing the hydraulic analysis for the Empire Homes Development, a review of the City of Welland's overall storage capacity and existing and future storage requirements was completed. Per the MECP Design Guidelines for Drinking Water Systems, storage requirements for a water distribution system are as follows:

- Equalization Storage (A) = 25% of Maximum Day Demand
- Fire Storage (B) = 378 L/s for 6 hours (Based on MECP Equivalent Population Fire Flow Requirement)
- Emergency Storage (C) = 25% of A+B



The additional storage required for Empire Homes is 2.0 ML.

The total existing storage capacity was determined from the Region of Niagara Master Plan (2016). Table 3.1 summarizes the existing storage capacity, the existing and future storage requirement calculated in the master plan, and the existing and future storage requirement with and without the Empire Homes Development, calculated using the model demands and the procedure outlined above. As shown, the master plan appears to have included sufficient demand to account for the Empire Homes Development. Both the master plan and the model based calculations indicate that there is sufficient storage in the existing system to support the addition of the Empire Homes Development.

Table 3.1 Review of Storage Requirements

Description	Storage (ML)
Total Available Storage	37.0
Existing Required Storage – Master Plan	18.5
2041 Required Storage – Master Plan	21.6
Future Required Storage without Empire Homes Development – Model Demands	18.4
Future Required Storage with Empire Homes Development – Model Demands	20.4

4. Hydraulic Analysis

4.1 Design Criteria

In reviewing the impact of the Empire Homes Development on the existing distribution system, the following design criteria, as per City of Welland design standards and the MECP Design Guidelines for Drinking Water Systems, were used:

- Preferred system pressure between 350 to 550 kPa (50 to 80 psi)
- Minimum system pressure during normal operating conditions to be greater than 275 kPa (40 psi)
- Maximum system pressure during normal operating conditions to be less than 700 kPa (100 psi)
- System pressure with a 133 L/s fire flow during MDD to be greater than 140 kPa (20 psi)

4.2 Normal Operating Condition

Table 4.1 summarizes the minimum pressure during the ADD and MDD EPS scenarios within the proposed development with the existing water treatment plant pumping scheme.

Table 4.1 Empire Homes Development Normal Operating Pressures

Junction ID	Location	Junction Elevation	Minimum ADD EPS Pressure	Minimum MDD EPS Pressure
435701WJ01	Former John Deere	177 m	375 kPa (54 psi)	364 kPa (53 psi)
J-EH-1	Former John Deere	177 m	373 kPa (54 psi)	358 kPa (52 psi)
J-EH-2	Canal Bank/Dain Avenue	178 m	361 kPa (52 psi)	324 kPa (47 psi)
J-EH-3	Canal Bank/Dain Avenue	178 m	364 kPa (53 psi)	364 kPa (53 psi)
J-EH-4	Dain City Residential	189 m	257 kPa (37 psi)	243 kPa (35 psi)
J-EH-5	Canal Bank/Dain Avenue	177 m	373 kPa (54 psi)	347 kPa (50 psi)



As shown, pressures meet the design criteria at all locations with the exception of the Dain City Residential area, which does not meet the minimum 275 kPa (40 psi) requirement. The lower pressures in the Dain City Residential area are predominately due to the high ground elevation (maximum of 189 m) in this area in comparison to the hydraulic grade line of the system.

The top water level of the Bemis Elevated Tank, which represents the maximum hydraulic grade line of the system, is 219m – based on this top water level, and before accounting for any losses, the maximum pressure in the Dain City Residential area (at an elevation of 189 m) would, therefore, only be 294 kPa (43 psi). The low pressures in this area are further exacerbated by the current operating procedures at the WTP, where high lift pumps are shut down mid-morning, coinciding with periods of higher demand. Table 4.2 summarizes the minimum and maximum WTP flow and the minimum and maximum tank percent full with and without the Empire Homes Development. Note that both with and without the Empire Homes Development, the minimum percent full for the Bemis Tank coincides with the mid-morning WTP shutdown, while the maximum WTP flow coincides with the filling period that occurs when the WTP pumps turn back on after this mid-morning shutdown.

Table 4.2 Minimum and Maximum WTP Flow and Bemis Elevated Tank Volume

Parameter	Without Empire Homes Development		With Empire Homes Development	
	Minimum	Maximum	Minimum	Maximum
ADD EPS WTP Flow	0 L/s	326 L/s	0 L/s	328 L/s
ADD EPS Bemis Tank % Full	77%	100%	65%	100%
MDD EPS WTP Flow	0 L/s	789 L/s	0 L/s	799 L/s
MDD EPS Bemis Tank % Full	72%	100%	63%	100%

As shown in Table 4.2, with the addition of the Empire Homes development, there is an increase in the amount of drawdown that occurs at the Bemis Tank during the WTP mid-morning shutdown. The tank percent full of 63% that occurs during MDD EPS with the addition of the Empire Homes Development, corresponds to an HGL of 215.4 m, which is significantly lower than what it is needed to supply 275 kPa (40 psi) to the Dain City Residential area.

Modifying the WTP operating procedures, so that pumps are no longer off during mid-morning higher demand periods, would increase the minimum pressure in this area to above the MECP minimum; however, this strategy is not preferred since it relies exclusively on the operations of the WTP and limits the effective operating range of the Bemis Tank. Alternatively, limiting the ground elevation in the Dain City Residential area to 185 m would also increase the pressure to above 275 kPa (40 psi) without any modifications to the existing pumping scheme. Installation of a small booster pumping station to supply this area could also be considered as an alternative. Replacing the old cast iron watermain on Forks Road and increasing the size of the proposed watermain in this area was also reviewed as an alternative to limit headloss, however this would not increase the pressure to above 275 kPa (40 psi) due to the issue with the Bemis Tank HGL discussed above.

In addition to the pressures within the proposed Empire Homes Development, the pressures of the existing system were also reviewed. The addition of the Empire Homes Development results in a minor drop in pressure for the remainder of the system. The average drop to ADD pressure is 12 kPa (1.7 psi) and the average drop to MDD pressure is 17 kPa (2.5 psi). All system pressures in the existing network remain above 275 kPa (40 psi).



4.3 Fire Flow

Table 4.3 summarizes the available fire flow at each of the junctions added to the model to represent the Empire Homes Development. As shown, the existing system is capable of supplying greater than 133 L/s of fire flow (during MDD) to this development.

Table 4.3 Empire Homes Available Fire Flow

Junction ID	Location	Available Fire Flow during MDD (L/s)
435701WJ01	Former John Deere	248
J-EH-1	Former John Deere	174
J-EH-2	Canal Bank/Dain Avenue	173
J-EH-3	Canal Bank/Dain Avenue	191
J-EH-4	Dain City Residential	143
J-EH-5	Canal Bank/Dain Avenue	136

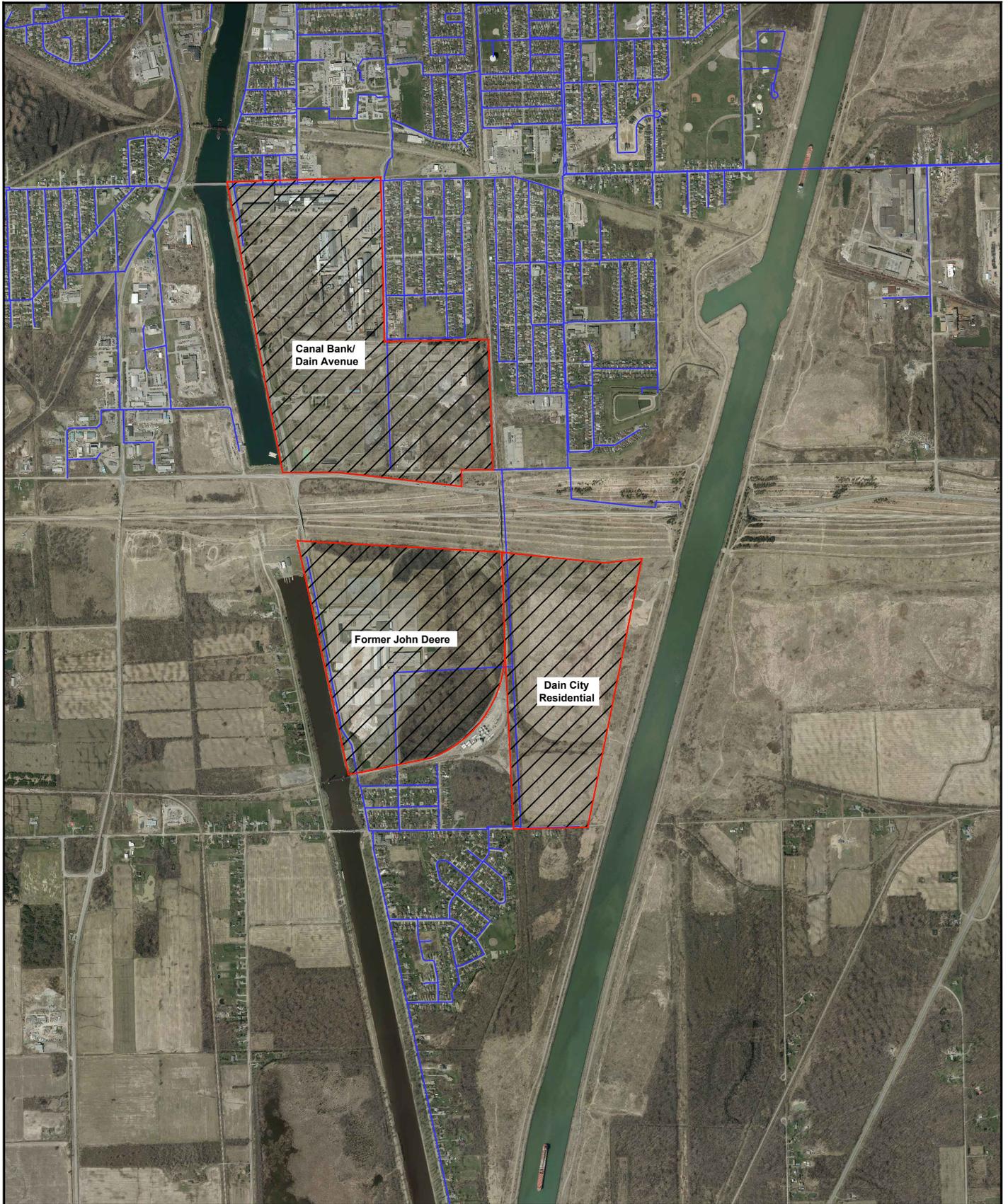
Additionally, the impact of the Empire Homes Development on the available fire flow within the existing system is minor, with many of the hydrants in the vicinity of the development having improved fire flow due to increased looping within the system. For hydrants within the existing system that do experience a drop in available fire flow with the addition of the Empire Homes Development, the average drop is approximately 1.3 L/s and does not change the NFPA 291 classification of the hydrant.

5. Conclusions and Recommendations

The City of Welland's water distribution system can supply water demand and fire flow to the proposed Empire Homes Development. This development will result in minor reductions in existing system pressure and available fire flow; however existing pressures will remain within MECF requirements.

During normal operating procedures, adequate pressure can be supplied to the Former John Deere and Canal Bank/Dain Avenue development areas without any modifications to the existing system operating procedures. However, the elevation in the Dain City Residential area (maximum elevation of 189m) results in pressures below the MECF recommendation of 275 kPa (40 psi) during high demand periods while the WTP is offline (mid-morning). Although these low pressures can be mitigated through changes to the operations of the WTP (eliminating mid-morning shut down), this strategy is not preferred since it relies exclusively on the operations of the WTP and limits the effective operating range of the Bemis Tank. Instead, the City should consider limiting the elevation of this portion of the development to a maximum of 185 m. Alternatively, a small booster station for this area could be considered.

Once a site servicing plan is developed, the Empire Homes Development should be reassessed to confirm required watermain sizing and connection locations to the existing system. Phasing plans should also be reviewed once available to confirm that suitable pressure and fire flow can be supplied not only during full buildout but during all interim phases.



Source: City of Welland 2013 Ortho Mosaic

NTS

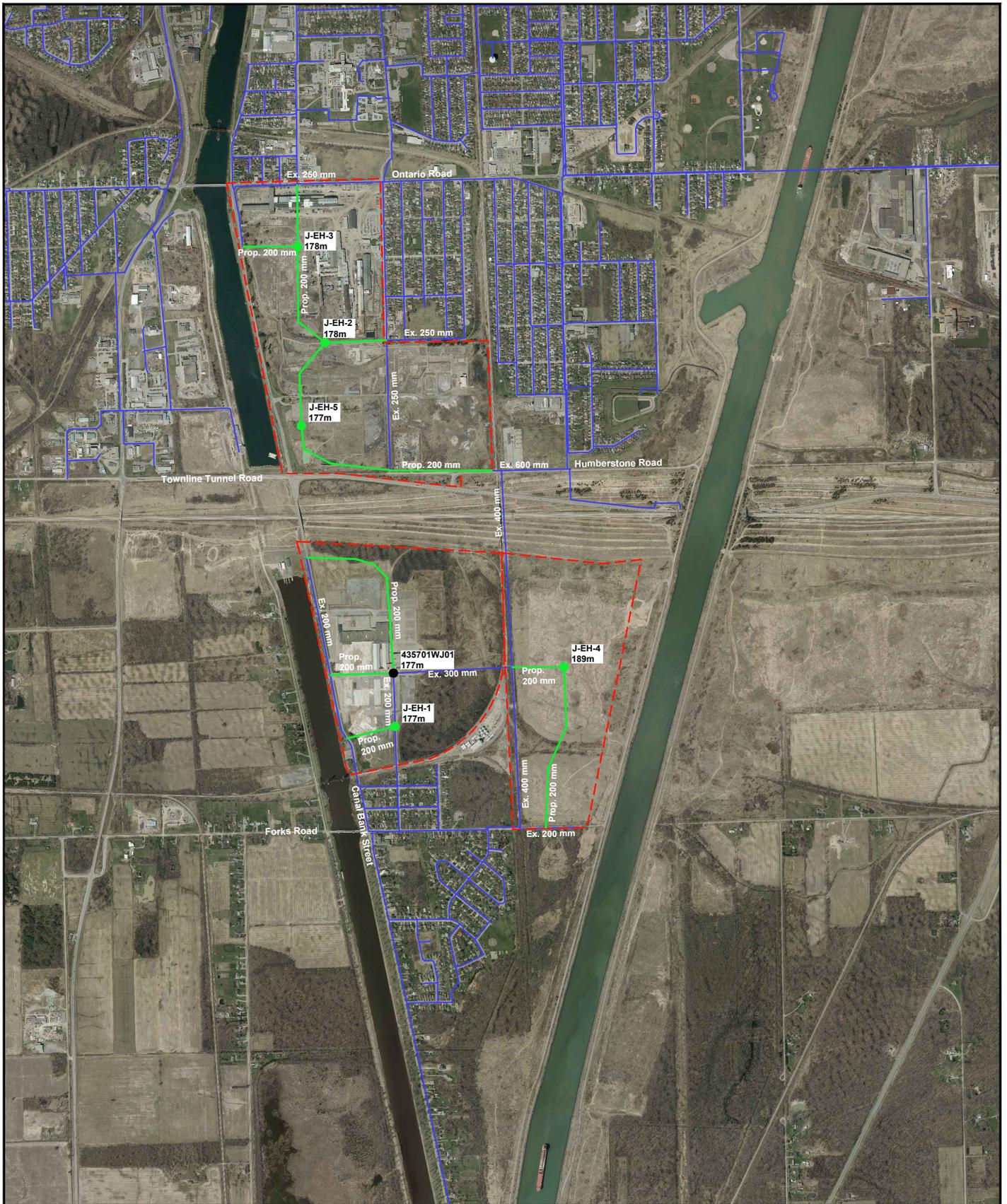


CITY OF WELLAND
EMPIRE HOMES DEVELOPMENT

11155923

LOCATION PLAN

FIGURE 1.1



Source: City of Welland 2013 Ortho Mosaic

NTS



CITY OF WELLAND
EMPIRE HOMES DEVELOPMENT

11155923

WATER SERVICING

FIGURE 2.1



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APPENDIX C
Sanitary Sewer Design Sheet

UPPER CANADA CONSULTANTS
30 HANNOVER DRIVE, UNIT #3
ST. CATHARINES, ONTARIO, L2W 1A3

DESIGN FLOWS										SEWER DESIGN									
RESIDENTIAL:	320 LITRES/PERSON/DAY (AVERAGE DAILY FLOW FOR EXISTING DWELLINGS)									PIPE ROUGHNESS:	0.013 FOR MANNING'S EQUATION								
RESIDENTIAL:	225 LITRES/PERSON/DAY (AVERAGE DAILY FLOW FOR DAIN WEST AND 401 CANAL BANK STREET)									PIPE SIZES:	1.016 IMPERIAL EQUIVALENT FACTOR								
INDUSTRIAL:	15000 LITRES/HECTARE/DAY (AVERAGE HEAVY INDUSTRIAL FLOW)									PERCENT FULL:	TOTAL PEAK FLOW / CAPACITY								
INFILTRATION RATE:	0.10 LITRES/HECTARE (INDUSTRIAL, INSTITUTIONAL, AND OPEN SPACE)																		
INFILTRATION RATE:	0.28 LITRES/HECTARE (EXISTING RESIDENTIAL)																		
INFILTRATION RATE:	0.18 LITRES/HECTARE (FUTURE RESIDENTIAL)																		

MUNICIPALITY: CITY OF WELLAND
PROJECT : DAIN WEST **SANITARY SEWER DESIGN SHEET**
PROJECT NO: 0585

LOCATION		RESIDENTIAL							INDUSTRIAL			TOTAL PEAK FLOW		DESIGN FLOW				
Description	Land use	Increment Area (hectares)	Accumulated Area (hectares)	Population Density (persons/hectare)	Population Increment	Total Population Served	Peaking Factor	Peak Flow (L/s)	Area (hectares)	Peaking Factor	Peak Flow (L/s)	Infiltration Flow (L/s)	Total Peak Flow (L/s)	Pipe Diameter (mm)	Pipe Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Check Percent Full
A1 - DAIN WEST	Residential	39.04	39.04	98.7	3853	3853	3.35	33.59				7.03	40.62					
A2 - CHURCH LANDS	Institutional	0.75	0.75	162.7	122	122	4.22	1.91				0.08	1.98					
A3 - VERBIO DIESEL CANADA	Industrial								3.30	4.80	2.75	0.33	0.33					
A4 - HURON-ERIE-FORKS	Residential	16.64	56.43	22.4	372	4347	3.30	39.16				12.09	51.25	400	0.16	0.670	86.90	59.0%
A5 - 401 CANAL BANK STREET	Residential	53.98	53.98	68.7	3709	3709	3.36	32.48				9.72	42.19					
A6 - SOUTH FORKS	Residential	6.48	60.46	48.6	315	4024	3.33	36.06				10.88	46.94	375	0.40	1.015	115.68	40.6%
A7 - KINGSWAY-GLENWOOD	Residential	8.54	8.54	13.3	114	114	4.23	1.78				2.39	4.18					
A8 - KINGSWAY	Residential	3.07	11.61	13.7	42	156	4.19	2.42				3.25	5.67					
A9 - CRESCENT-THORNTON	Residential	20.77	149.27	21.5	447	8974	3.00	74.80				32.04	106.84	450	0.30	0.992	162.91	65.6%
A10 - HAUN-CUNARD-WHITFIE	Residential	13.00	13.00	11.5	150	150	4.19	2.33				3.64	5.97					
A11 - TALBOT	Residential	1.60	1.60	58.1	93	93	4.25	1.46				0.29	1.75					
A12 - REGETTA	Residential	5.73	20.33	29.8	171	414	4.02	6.16				4.96	11.12					
A13 - DAIN SOUTH-SOUTH	Residential	10.63	10.63	56.4	600	600	3.93	8.74				1.91	10.65					
TO PUMPING STATION			180.23			9988	2.96	84.75				38.91	123.66	450	0.30	0.992	162.91	75.9%