File: 37923 - 5.2.2

Design Brief
Riverside Park
3930 and 3960 Riverside Drive

Development Application File No. **D**__-__-__-____

Prepared for St. Mary's Lands Corporation
by IBI Group
MARCH 2018

Table of Contents

Table of Contents (continued)

List of Figures

Table of Contents (continued)

List of Appendices

1 Introduction

1.1 Scope

IBI Group has been retained by St. Mary's Lands Corporation to prepare the necessary engineering plans, specifications and documents to support the proposed concurrent vacant land condominium and re-zoning applications for the subject lands in accordance with the policies set out by the Planning and Development Branch of the City of Ottawa. This Brief will present a detailed servicing scheme to support development of the property, and will include sections on water supply, wastewater management, minor and major stormwater management along with erosion and sediment control.

1.2 Subject Site

Riverside Park (formerly known as the St. Mary's lands) is located at the northwest corner of the Riverside Drive and Hunt Club Road intersection. The Riverside Park development is approximately 6.0 hectares in size and is bounded by Hunt Club Road to the south, Riverside Drive to the east, City of Ottawa Uplands-Riverside park to the north and undeveloped environmental lands, adjacent to the Rideau River, to the west, as shown on Figure 1.

The Riverside Park vacant land condominium will consist of the creation of 4 developable blocks (or "units") along with a common access road. A current concept of the envisioned development is shown on Figure 2; however, as the blocks will be developed independently in the future through the site plan application process the ultimate development may differ from the shown concept.

1.3 Previous Studies

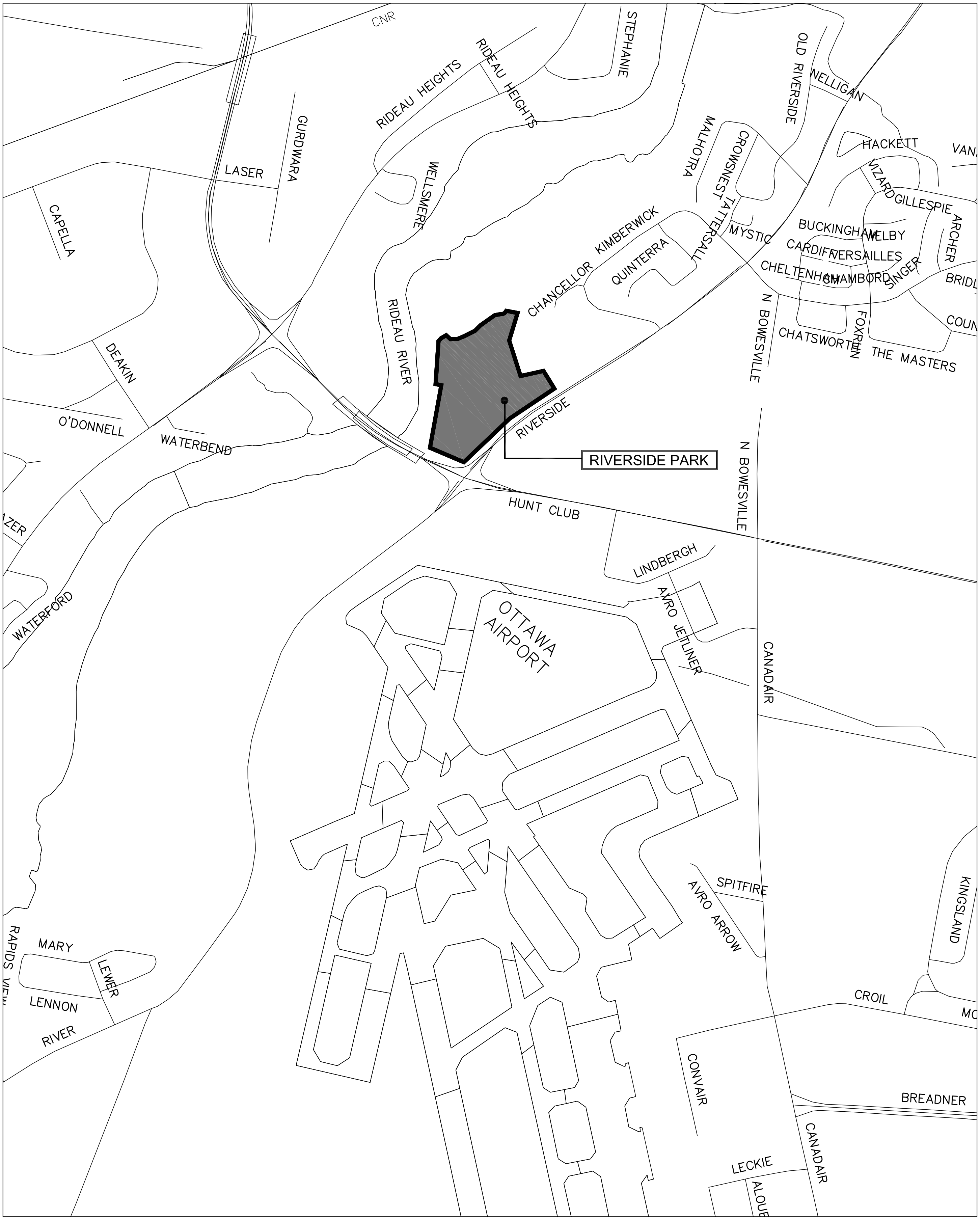
Design of this project has been undertaken in accordance with the following reports:

- Riverside Drive Land – Sanitary Sewer Servicing Study prepared by IBI Group, December 2007
- Riverside Drive Area – Brief in Support of Development of Lands Within the Riverside Drive Planning Area prepared by Cumming Cockburn & Associates Limited, May 1986
- Stormwater Management for Riverside Drive Lands prepared by Cumming Cockburn & Associates Limited, April 1987
- Riverwalk Park Stormwater Management Facility Update Stormwater Design Plan prepared by Novatech Engineering, June 1996

1.4 Geotechnical Considerations

The following are the most recent geotechnical investigation reports prepared by Golder Associates:

- Report No. 1670692-1000 March 2018
- Report No. 1670692-2000 March 2018



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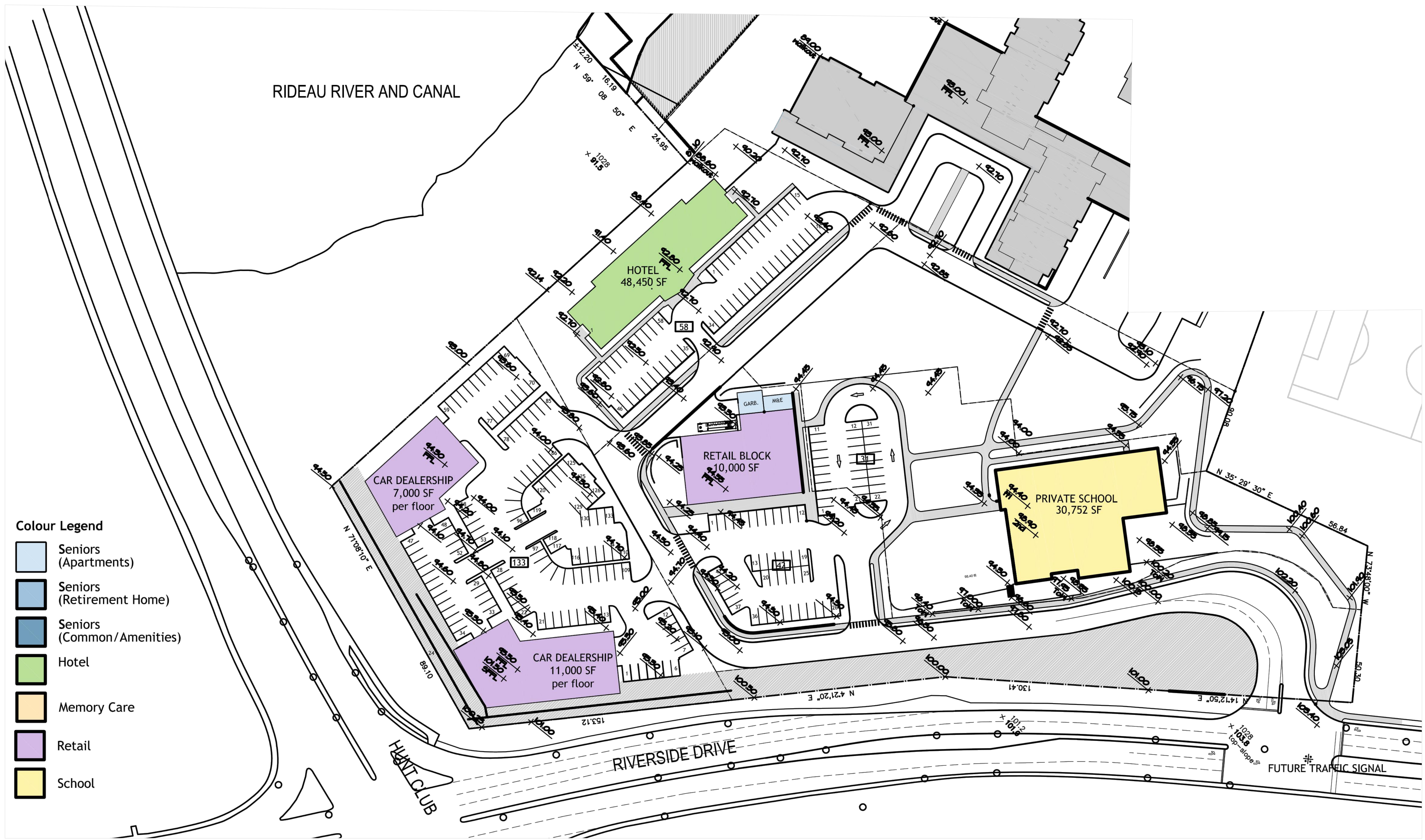
Project Title	Drawing Title	Sheet No.
RIVERSIDE PARK TAGGART REALTY MANAGEMENT	KEY PLAN	Fig 1



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Project Title: RIVERSIDE PARK
TAGGART REALTY MANAGEMENT

Drawing Title: CURRENT SITE PLAN

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The site slopes generally from Riverside Drive down towards the Rideau Rive in a rough South-East to North-West direction. The site transitions from an elevation of approximately 100m at the Riverside Drive and Hunt Club Road intersection down to 86m at the North-West limit of the developable lands. The site was previously used as a granular extraction site and has subsequently been filled to reclaim land for development purposes. Generally there is between 10m to 15m of fill across the site.

Among other items, the reports comment on the following:

- Site grading
- Pavement structure
- Infrastructure construction
- Design for earthquakes
- Environmental considerations
- Grade raise considerations

1.5 Pre-consultation

An engineering pre-consultation with the City was held in April 2017 regarding the proposed development. Notes from this meeting may be found in **Appendix E**. A subsequent pre-consult, concerned mainly with planning was then held on October 27, 2017.

It should be noted that pre-consultation with the Ministry of the Environment and Climate Change will be arranged imminently.

2 Water Supply

2.1 Existing Conditions

As previously noted, the six hectare Riverside Park site is located east of Riverside Drive and north of Hunt Club Road. An existing 406mm diameter watermain is located on Riverside Drive in pressure district **Zone 2C** which will provide the water supply to the site.

2.2 Design Criteria

2.2.1 Water Demands

Water demands have been calculated for the full development. Per unit population density and consumption rates are taken from Tables 4.1 and 4.2 at the Ottawa Design Guidelines – Water Distribution and are summarized as follows:

- Single Family 3.4 person per unit
- Townhouse and Semi-Detached 2.7 person per unit
- Average Apartment 1.8 person per unit
- Residential Average Day Demand 350 l/cap/day
- Residential Peak Daily Demand 875 l/cap/day
- Residential Peak Hour Demand 1,925 l/cap/day
- ICI Average Day Demand 28,000 l/gross ha/day
- ICI Peak Daily Demand 42,000 l/gross ha/day
- ICI Peak Hour Demand 75,600 l/gross ha/day

A watermain demand calculation sheet is included in **Appendix A** and the total water demands are summarized as follows:

- Average Day 3.37 l/s
- Maximum Day 7.75 l/s
- Peak Hour 16.65 l/s

2.2.2 System Pressure

The Ottawa Design Guidelines – Water Distribution (WDG001), July 2010, City of Ottawa, Clause 4.2.2 states that the preferred practice for design of a new distribution system is to have normal operating pressures range between 345 kPa (50 psi) and 552 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in Clause 4.2.2 of the guidelines are as follows:

Minimum Pressure	Minimum system pressure under peak hour demand conditions shall not be less than 276 kPa (40 psi)
Fire Flow	During the period of maximum day demand, the system pressure shall not be less than 140 kPa (20 psi) during a fire flow event.
Maximum Pressure	Maximum pressure at any point in the distribution system shall not exceed 689 kPa (100 psi). In accordance with the Ontario Building/Plumbing Code, the maximum pressure should not exceed 552 kPa (80 psi). Pressure reduction controls will be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa.

2.2.3 Fire Flow Rates

The current Riverside Park concept contains a senior's complex, a hotel and a mix of commercial and institutional land uses. Several calculations using the Fire Underwriting Survey (FUS) method were conducted to determine the fire flow requirement for the site. Results of the analysis provides a maximum fire flow rate of 9.000 l/min or 150 l/s is required which is used in the hydraulic analysis. A copy of the FUS calculations is included in **Appendix A**.

2.2.4 Boundary Conditions

The City of Ottawa has provided a hydraulic boundary condition at Riverside Drive where the connection to the site will occur. A copy of the boundary conditions is included in **Appendix A** and summarized as follows:

Table 2. 1 Hydraulic Boundary Conditions at Riverside Park

	RIVERSIDE DRIVE.
Max HGL (Basic Day)	134.7 m
Min HGL (Peak Hour)	125.1 m
Max Day + Fire Flow (250 l/s Fire Flow)	126.2 m

2.2.5 Hydraulic Model

A computer model for the subject development has been developed using the H20 MAP Version 6.0 program produced by MWH Soft Inc. The model includes the existing watermain and boundary condition on Riverside Drive.

2.3 Proposed Water Plan

2.3.1 Modeling Results

The hydraulic model was run under basic day, maximum day with fire flows and under peak hour conditions. Water pipes are sized to provide sufficient pressure and to deliver the required fire flows. During the design stage all mains are tested at the minimum 150 mm diameter size, while the pressure criteria is met with the minimum sized mains the fire flow requirement is not achieved at all locations. The main sizes are increased in an iterative process until the fire flow results are sufficient.

Results of the hydraulic model are include in **Appendix A** and summarized as follows:

Scenario	
Basic Day (Max HGL) Pressure Range	308.7 to 414.5 kPa
Peak Hour (Min HGL) Pressure Range	214.6 to 319.6 kPa
Max Day + 250 l/s Fire Flow Minimum Flow	170.0 l/s (10,200 l/min)

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

Maximum Pressure	All nodes have basic day pressures under 552 kPa, therefore pressure reducing control is not required for this development.
Minimum Pressure	Based on the boundary condition provided by the City for minimum pressure, the peak hour pressure at Riverside Drive is less than 276 kPa. As the elevation of the site is lower than Riverside Drive, the minimum required pressure is exceeded at nodes J6 to J9, any connection between nodes J3 and J6 may require a booster pump to meet the minimum requirement.
Fire Flow	The FUS fire demand of 150 l/s is met at all fire nodes.

2.3.2 Watermain Layout

In order to provide additional reliability to the system in case of a watermain break on Riverside Drive, there are two connections proposed to the existing watermain with an isolation valve added between the connections. All watermains are 250mm diameter as required to meet the fire flow criteria.

3 WASTEWATER DISPOSAL

3.1 Existing Conditions

In 1987 the J. Perez Corporation development, known as Riverwalk Park, included a 525 mm diameter sanitary sewer extension to the southern limits of its development and was designed to service the urban area between Riverside Drive and the Rideau River north and south of Hunt Club Road. This sewer currently terminates at the north limit of the existing City of Ottawa Uplands-Riverside Park. For reference, the original Riverwalk Park sanitary sewer design sheet and Drainage Area Plan #3675-501A are included in **Appendix B**. At its current terminus, the existing 525Ø sewer has a spare capacity of at least 108.6 l/s based on now outdated City of Ottawa design guidlines.

Subsequent to the 1987 Riverwalk Park development, the City of Ottawa commissioned a report, completed by IBI Group, to review the sanitary sewer requirements in the Riverside Drive corridor. In November 2007 the Riverside Drive Lands Sanitary Sewer Servicing Study (2007 report) was completed. For reference, excerpts from this 2007 study are also included in **Appendix B**. That study identified a total of 26.45 ha of developable property south of Chancellor Court and west of Riverside Drive. The developable properties and flow estimates from the 2007 report were:

Table 3.1 RIVERSIDE DRIVE LANDS – OWNERSHIP AND AREAS

PROPERTY	AREA (HA)		FLOW (L/S)
	GROSS (HA)	DEVELOPABLE (HA)	
Taggart Realty (St. Mary's Site)	8.58	6.35	7.29
Transport Canada	3.65	0.00	0.00
Dymon Management Ltd.	8.69	6.29	7.22
City of Ottawa/Airport Authority	34.96	13.81	15.85
TOTAL	55.88	26.45	30.36

These estimates are based on now superseded City of Ottawa flow criteria, namely an average commercial flow rate of 50,000 l/s/ha peaked at 1.5 and an infiltration allowance of 0.28l/s/ha. For reference the sanitary sewer spreadsheet from the 2007 report, as well as Figure 5 Sanitary Drainage Area Plan are included in **Appendix B**.

Because the total estimated sanitary flow from tributary areas south of Riverside Park (formerly known as the St. Mary's site) is only 30.36 l/s which is significantly less than the available capacity of 108.6 l/s, the November 2007 report further demonstrated that, theoretically, additional external lands (+/- 65 Ha) upstream of the City of Ottawa/Airport Authority property could also develop as commercial/employment uses and outlet to the study sewer.

3.2 Design Criteria

The sanitary sewers for the subject site will be based on the City of Ottawa design criteria. It should be noted that the sanitary sewer design for this study incorporates the latest City of Ottawa design parameters identified in Technical Bulletin ISTB-2018-01. Some of the key criteria will include the following:

- Commercial/Institutional flow 28,000 l/ha/d
- Residential per capital 280 l/person/d
- Harmon – correction factor K=0.8
- Peaking factor 1.5 if ICI in contributing area >20%
  1.0 if ICI in contributing area <20%
- Infiltration allowance 0.33 l/s/ha
- Velocities 0.60 m/s min. to 3.0 m/s max.

3.3 Recommended Wastewater Plan

The Riverside Park development calls for the construction of a private road and services that will service 4 blocks. The blocks will ultimately be developed at a later date via individual Site Plan Applications.

Sanitary service for the subject site will be provided via an extension of the sanitary sewer from the City of Ottawa Uplands-Riverside Park. Development of the site must also provide a corridor to accommodate the extension of the 450 mm diameter sanitary sewer to Hunt Club Road, where it can ultimately be extended from the subject site's southern property limit under the Hunt Club bridge to service development lands south of Hunt Club Road. The alignment and associated connection of the proposed sanitary sewer extension is shown on drawing 37923-C-001.

The 2007 City of Ottawa report estimated that the peaked flow from the Riverside Park site would be approximately 7.29 l/s. The current Sanitary Sewer Design Sheet, found in **Appendix B** is based on the current site concept, shown in Figure 2, and includes employment and residential uses with a total flow of 10.16 l/s, calculated using criteria identified in section 3.2.

The flows have been calculated using a conceptual plan, as such we expect that the sanitary flows will be re-calculated at the time of site plan and shall be compared to the remaining residual capacity at the downstream outlet.

Given that there is significant residual capacity at the proposed sanitary connection location, as demonstrated in the 2007 report and identified in section 3.1, and that the recently released sanitary sewer flow criteria for estimating new and existing sanitary sewer flows will result in additional residual capacity both at the proposed connection location and the downstream network, it is our recommendation that the City of Ottawa supersede the flow allocation for the subject lands with the calculated flow identified above, namely 10.16 l/s.

3.4 Sanitary Sewer Easement

The sanitary trunk sewer is proposed to be 450mm dia with inverts similar to the 2007 sanitary sewer servicing study requirements. The easement shown in the proposed plans is 10.0m wide where there are additional private infrastructure items within the easement, and 6.0m wide where the sanitary sewer trunk is the only service within the easement. A series of sections were prepared along the easement to review the ability to access the sewer in the event of future maintenance. The proposed sections include a requirement for a trench boxes and 1:1 side slopes. Profiles of the easement and sanitary sewer have also been provided and show that the approximate depth of the sewer is around 7m throughout the site. The proposed easement widths and sections have been reviewed by a geotechnical engineer and contractor, both of whom are familiar with the site, and deemed acceptable.

It should be noted that secondary manholes at each block have been added to the network to avoid service connections directly to the trunk sewer and excavating down to the deep sewer after construction.

3.5 Hunt Club Road Watermain Crossing

Extending the sanitary sewer under the Hunt Club bridge to service the lands to the south of the subject site will require crossing a City of Ottawa 610mm watermain. Based on City of Ottawa mapping the watermain, which crosses the Rideau River, runs more on less parallel with Hunt Club Road. The watermain crossing will take place +/- 100m south of the proposed sanitary MH107A. The proposed MH107A invert out is 86.60m and assuming a 450mm dia sanitary sewer is specified at 0.20% slope we can expect the sanitary invert to be +/- 86.86m at the crossing.

The City of Ottawa provided design drawings for the watermain in an effort to ensure the watermain can be crossed with the sanitary sewer. We noted the drawings are design only and no as-built elevations were provided; however, in the vicinity of the crossing the watermain appears to be climbing at a slope of +/-24%. It can be said that in a distance of 10m the watermain will change elevations by approximately 2.4m which will certainly allow a crossing to be made.

Based on the watermain design elevations provided and the sanitary crossing inverts referenced above, with the information available we can assume the sanitary sewer will cross over the watermain with 0.50m barrel to barrel clearance beginning at watermain station 1+490 and continuing westward. A crossing under the watermain, again with 0.50m barrel to barrel clearance appears to be possible from watermain station 1+505 and continuing eastward. A crossing does not appear to be feasible, with the required clearance from STA 1+490 to 1+505.

That being said, at the time of designing the sanitary sewer extension southward the designer should obtain a survey of the horizontal location of the watermain and the as-built elevation drawings to ensure the correct alignment and crossing location is chosen.

4 SITE STORMWATER MANAGEMENT

4.1 Background

The Riverside Park site falls within the drainage limits of the existing Riverwalk stormwater facility (henceforth referred to as the City of Ottawa Kimberwick Stormwater Management Facility). The design of that pond was outlined within the report "Stormwater Management for Riverside Drive Lands" completed by CCL in April of 1987. The pond was constructed in the early 1990's to support developments in the area between Riverside Drive and the Rideau River. The drainage area plan (Drawing No. 3625-501) as well as the storm sewer design sheet prepared for the Riverwalk Park development in 1987 is included in Appendix C. The subject site is included south of the Riverwalk Park development in the area identified as St. Mary's Cement with a drainage area of 7.00 ha at a runoff coefficient of 0.70.

Subsequent to that report and the construction of the facility, the stormwater pond was updated as part of the development of adjacent lands by Claridge Homes in 1996. The report "Riverwalk Park Stormwater Management Facility Updated Stormwater Design Plan" was completed by Novatech Engineering (June 1996). That report outlined the strategy to rehabilitate the facility which had fallen into disrepair, operate, maintain and monitor performance up to the point of full assumption of the facility by the City of Ottawa.

4.2 Stormwater Management Plan

In order to provide the Riverwalk Park site with an outlet to the existing pond, a new storm sewer is proposed. The proposed storm sewer will connect to existing storm MH3 (as identified on Drawing 37923-C-002). Storm runoff from the Riverside Park site was included in the design of the existing downstream sewers. The flows are identified on the storm sewer design sheet attached in Appendix C. The existing sewers downstream of the Riverwalk Park site and the Stormwater Management Facility have capacity for the subject site runoff. It should be noted that the ground surface of the inlet works to the Stormwater Management Facility is at or near the 80 meter contour while the lowest part of the upstream Riverwalk Park development is close to the 89 meter contour.

4.3 Objective

The purpose of this section is to present the dual drainage design, including the minor and major system, for the proposed site. The design includes the sizing of inlet control devices, maximum flow on the surface and hydraulic grade line analysis. The evaluation and design takes into consideration the City of Ottawa Sewer Design Guidelines (OSDG) and the June 2012 Technical Bulletin ISDTB-2012-4.

4.4 Overall Stormwater Management Approach

4.4.1 Dual Drainage Design

The site has been designed with dual drainage features, accommodating minor and major system flow. The minor system is tributary to the existing City of Ottawa Kimberwick SWM Facility. Respecting the existing site topography, it is anticipated that major system surface flows from the proposed blocks will be directed to the adjacent Rideau River. Alternatively, major system storage may be provided on these blocks. Ultimately, the blocks will be provided with detailed Site Plan Applications with full stormwater management plans.

The access road through the site is generally on continuous grade, but has been provided with a single low point to facilitate ponding. Inlet control devices (ICDs) are proposed to minimize the surcharge in the minor system during infrequent storm events and maximize use of available on-site storage. The minor system capture of ICDs along the access road is based on the 2 year flow. The minor system capture for the commercial blocks have been designed with approximately the 5 year flow (limited based on available capacity in downstream receiving storm sewer system).

The dual drainage system has been evaluated using the DDSWMM hydrological model. Further details of the modelling completed for the site are provided in the below sections.

4.4.1.1 Minor System

The storm sewers in the Riverside Park site are sized based on Standards of the City of Ottawa and the MOE. Rational Method Sewer Design Sheet and Drainage Area Plan are provided within Appendix C. Some of the key criteria include the following:

• Runoff Coefficients:	Blocks	C=0.70-0.80
	11m Access Road	C=0.90
• Initial Time of Concentration		10 minutes
• Minimum Velocity		0.80 m/s
• Maximum Velocity		3.00 m/s

Across the site, ICDs are proposed to limit the flow into the minor system during infrequent storm events up to the 100 year event. The minor system capture of ICDs along the access road is based on the 2 year flow. The minor system capture for the commercial blocks have been designed with approximately the 5 year flow (limited based on available capacity in downstream receiving storm sewer system). A summary of the minor system capture across the site is provided within **Table 4.1.**

4.4.1.2 Major System

Respecting the existing site topography, it is anticipated that major system surface flows from the proposed blocks will be directed to the adjacent Rideau River. Alternatively, major system storage may be provided on these sites. Ultimately, the blocks will be provided with detailed Site Plan Applications with full stormwater management plans.

The access road within the site is designed to accommodate on-site storage where possible. Major system storage is based on detailed grading (and volumes are generated from autoCAD) and the storage-outflow characteristics were taken into consideration assuming static conditions.

The hydrological model quantifies the routed surface flows and the resulting major flows along the access road. The primary focus of this analysis was to evaluate surface flow/ponding conditions during the 100 year storm event. The 2 year simulation was performed to assure that runoff is fully captured. Available and conceptual surface storage was accounted in the DDSWMM model and is summarized in **Table 4.1**

4.5 Hydrological Modelling

Hydrological analysis of the proposed dual drainage system of the subject site was conducted using DDSWMM. This technique offers a single storm event flow generation and routing. Land use, selected modeling routines, and input parameters are discussed in the following sections. A drainage area plan is presented in Drawing 37923-500 and model files are included in **Appendix C**. The main hydrological parameters used in the rational method spreadsheet and DDSWMM model are summarized in the following sections.

4.5.1 Hydrological Evaluation

Land use, selected modeling routines, and input parameters for the model are discussed in the following sections.

Land Use

The site will be comprised of commercial blocks with a shared access road.

Storms and Drainage Area Parameters

The main hydrology parameters are summarized below and in **Table 4.1**.

- **Design storms:** The site was evaluated using the following storms:
  - 2 year 3 hour Chicago storm event with a 10 minute time step (for dual drainage evaluation, specifically the minor system);
  - 100 year 3 hour Chicago storm event with a 10 minute time step (for dual drainage evaluation, specifically major flow conveyance); and
  - 100 year 3 hour Chicago storm event + 20% increase in intensity with a 10 minute time step (for a stress test on major flow conveyance as per the City of Ottawa Sewer Design Guidelines).
- **Infiltration:** The selected infiltration losses are consistent with the City of Ottawa Sewer Design Guidelines. The Horton values are as follows: f_o = 76.2 mm/h, f_c = 13.2 mm/h, k = 0.00115 s^{-1}.
- **Area:** The total approximate 6ha, was divided into drainage areas based on the proposed commercial blocks and the storm sewer within the access road.
- **Imperviousness:** Imperviousness ratios are based on the rational method runoff C values as per the Drainage Area Plan (provided within Appendix C).
- **Width:** The catchment width was based on the conveyance route length of the drainage area and multiplied by two. The multiplier of two was only used if the drainage area had runoff contribution from both sides of the drainage area.
- **Slope:** The ground slope was based upon the average slope for both impervious and pervious area. Generally, the slope is approximately 2% (0.02 m/m). This assumes a slope of approximately 1% for impervious or road surfaces and 3% for pervious surfaces (lot grading).
- **Detention storage depth:** Detention storage depths of 1.57 mm and 4.67 mm were used for impervious and pervious areas, respectively.
- **Manning's roughness:** Manning's roughness coefficients of 0.013 and 0.25 were used for impervious and pervious areas, respectively.
- **Major system storage and routing:** The access road is comprised of primarily continuous grade with a single low point. For the drainage area with sawtoothing (low point), available surface storage has been calculated based on the grading plan. Flow is attenuated within low point with potential overflow cascading to the next segment downstream. The total volume at the low point, up to the overflow depth, is the maximum static storage.

For street segments with ponding, cascading overflow from a low point to a downstream segment utilizes the static storage available plus an additional amount of storage equivalent to the depth required for the flow to cascade over the downstream high point. The attenuation in street sags was evaluated to account for static storage and, if overflow occurs, dynamic storage. Within this report it is referred to as double routing.

DDSWMM does not have a direct way of coding double routing since it does not allow the user to code dynamic storage over the high point. For this analysis, the method employed is that recommended in the February 2014 City of Ottawa Technical Bulletin (PIEDTB-2016-01). It accounts for overflow from a street segment (regular static storage at a sag) being conveyed to a downstream dummy segment. In other words, a regular low point segment is provided with a downstream dummy segment for further flow attenuation to account for the dynamic ponding during overflow.

There are no drainage area attributes associated with the dummy segment since it is a segment solely for routing. In addition, there is no inflow to the minor system from these dummy segments. The overflow hydrograph from the upstream catchment is routed in the dummy segment to the next "real" downstream segment. The dummy segments have the following specific characteristics:

- o Segment Length: Equivalent to the length of the maximum static storage from the street segment contributing to it.
- o Road Type: Equivalent to the right-of-way characteristics from the segment contributing to it, but with a longitudinal slope of 0.01% (0.0001 m/m).

The dummy segments for major system routing have been applied to the analysis of the subject site. The segments are referenced as D1, D2, D3, etc. within the DDSWMM modelling file. The drainage area plan presented in **Drawing 37923-500** does not show the dummy segments, but the DDSWMM output file shows the dummy segments immediately following the corresponding major segment which cascades into that dummy segment.

For street segments with continuous grade, simulations were based on the approach-capture characteristics of the catchbasin with the constraint that during the 100 year design storm the maximum cascading flow does not exceed 350 mm.

For street segments with sawtoothing, simulations were based on the constraint that during the 100 year design storm the maximum depth of ponding (including cascading flow where applicable) does not exceed 350 mm. Where surface storage is available, the storage-outflow characteristics for each low point were taken into consideration. The evaluation was undertaken assuming static ponding conditions.

- **Minor system capture:** The minor system capture for the overall site is limited to the allocated capacity of the existing SWM facility to the 5 year Rational Method flow with runoff value of 0.7. ICDs are incorporated into the design to protect the minor system from surcharge during infrequent storm events and to utilize the available on-site storage. The size of the inlet control devices (ICDs) was optimized using DDSWMM.

  The minor system inflow rate was optimized to account for continuous grade. Specifically, the model incorporates the actual flow entering the minor system on continuous grade based on approach-capture curves derived from the 1984 MTO Drainage Manual. Minor system capture was set to 2 year modelled flow for the access road; however, based on the approach-capture curve, the actual capture may be less than this. This results in there being cascading flow on the surface during both the 2 and 100 year events. Therefore, at receiving low point downstream of on grade CBs, the ICDs have been sized to fully capture the cascading flow from upstream street segments on continuous grade during the 2 year event, while minimizing ponding at the low point.

The main hydrological parameters used in the DDSWWM model are summarized in **Table 4.1**. The corresponding drainage area plan (**Drawing 37923-500**) is provided in **Appendix C**, along with a CD of model files.

Table 4.1 DDSWMM Hydrological Parameters

DRAINAGE AREA ID	AREA (HA)	D/S SEGMENT ID	XPSWMM NODE ID	IMP RATIO [Tp (h)]	Segment Length (m)	Subcatchment WIDTH (M)	AVAILABLE/CONCEPTUAL STATIC PONDING (M^3)
S20A	0.18	S20B	CBMH20	0.50	38	20	n/a
S20B	0.13	S20C	CBMH20	0.43	31	25	n/a
S20C	0.13	S20D	CBMH20	0.43	34	20	n/a
S20D	0.06	S20E	CBMH20	0.43	19	20	n/a
S20E	0.11	S107	107	0.50	39	15	n/a
S107	0.09	S106A	107	0.50	32	15	n/a
S106A	0.02	S106B	106	1.00	18	5	n/a
S106B	0.05	S105A	106	1.00	42	5	n/a
UNIT3	1.12	OUT1	105	0.79	252	126	280*
S105A	0.03	S105B	105	1.00	24	6	n/a
S105B	0.03	S104	105	1.00	23	5	n/a
UNIT1	1.18	S104	104	0.79	265	132	125*
UNIT2	0.52	OUT2	104	0.86	117	58	140*
S104	0.09	REVERA	104	1.00	81	5	6.52
REVERA	2.6	OUT3	104	0.71	585	292	540*

Note: * - conceptual storage

4.5.2 Results of the Hydrological Evaluation

The results of the DDSWMM major system evaluation are summarized in the following sections. Output files are provided within Appendix C for reference.

Table 4.2 DDSWMM Hydrological Model Results for 2 Year Chicago

Segment ID	Total Inflow	U/S Inflow	Catchment Inflow	Max Inlet Capture	Outflow	Max Storage	Storage Duration
	(cms)	(cms)	(cms)	(l/s)	(cms)	(cu.m)	(min)
S20A	0.015	0	0.015	3.34	0.011	0	0
S20B	0.021	0.011	0.01	4.8	0.017	0	0
S20C	0.026	0.017	0.009	5.83	0.02	0	0
S20D	0.025	0.02	0.005	5.58	0.019	0	0
S20E	0.028	0.019	0.009	7.59	0.021	0	0
S107	0.028	0.021	0.007	7.51	0.02	0	0
S106A	0.023	0.02	0.003	6.51	0.017	0	0
S106B	0.024	0.017	0.007	5.98	0.018	0	0
UNIT3	0.135	0	0.135	107.99	0	10.66	20
S105A	0.022	0.018	0.004	22.46	0	0	0
S105B	0.005	0	0.005	1.31	0.003	0	0
UNIT1	0.142	0	0.142	139.84	0	0.01	0
UNIT2	0.067	0	0.067	49.99	0	8.97	30
S104	0.016	0.003	0.013	15.57	0	0	0
D1	0	0	0	0	0	0	0
REVERA	0.287	0	0.287	251.99	0	4.32	10

Table 4.3 DDSWMM Hydrological Model Results for 100 Year Chicago

Segment ID	Total Inflow	U/S Inflow	Catchment Inflow	Max Inlet Capture	Outflow	Max Storage	Storage Duration
	(cms)	(cms)	(cms)	(l/s)	(cms)	(cu.m)	(min)
S20A	0.04	0	0.04	8.95	0.031	0	0
S20B	0.058	0.031	0.027	12	0.046	0	0
S20C	0.073	0.046	0.027	12	0.061	0	0
S20D	0.075	0.061	0.014	12	0.063	0	0
S20E	0.088	0.063	0.025	12	0.076	0	0
S107	0.097	0.076	0.021	12	0.085	0	0
S106A	0.092	0.085	7.00E-03	12	0.08	0	0
S106B	0.098	0.08	0.018	12	0.086	0	0
UNIT3	0.356	0	0.356	108	0	265.35	100
S105A	0.097	0.086	0.011	25	0.072	0	0
S105B	0.083	0.072	0.011	12	0.071	0	0
UNIT1	0.376	0	0.376	197	0	125	50
UNIT2	0.176	0	0.176	50	0	133.5	100
S104	0.1	0.071	0.029	88	0	3.66	10
D1	0	0	0	0	0	0	0
REVERA	0.761	0	0.761	252	0	511.52	90

4.5.2.1 Overland Flow on Street Segments

According to City of Ottawa guidelines, during the 100 year storm event the depth of flow shall not exceed 350 mm and the product of depth and velocity shall not exceed 0.6 m^2/s. To determine velocity of the cascading overflow, SWMHYMO was used. The applicable roadway sections were entered into the model with the corresponding longitudinal slopes to obtain the maximum velocity of flow using the Route Channel routine. The resulting depths were also applied for street segments with continuous grade. To determine depth of the cascading overflow for street segments with ponding, the calculation sheet from the February 2014 City of Ottawa Technical Bulletin was employed. The SWMHYMO output files are provided in **Appendix C**.

The major system flow results are summarized in **Table 4.4** and model files are enclosed in **Appendix C**.

Table 4.4 Summary of Cascading Flow during the 100 year 3 hour Chicago Storm (Model files: 37923-3CHI100.OUT and 37923VxD.OUT)

AREA ID (DUMMY SEGMENT IF APPLICABLE)	ROW	LONGITUDINAL SLOPE (%)	OVERFLOW (L/S)	VELOCITY (M/S)	MAX. STATIC PONDING DEPTH (WHERE APPLICABLE) (M)	DYNAMIC DEPTH (DYNAMIC, WHERE APPLICABLE) (M)	MAX. DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)	VXD (M^2/S)
S20A	11	4.00	31	0.932	n/a	0.031	0.031	0.029
S20B	11	6.00	46	1.200	n/a	0.033	0.033	0.040
S20C	11	4.00	61	1.112	n/a	0.040	0.040	0.045
S20D	11	2.00	63	0.870	n/a	0.046	0.046	0.040
S20E	11	2.00	76	0.909	n/a	0.049	0.049	0.045
S107	11	0.90	85	0.693	n/a	0.060	0.060	0.042
S106A	11	2.99	80	1.077	n/a	0.047	0.047	0.051
S106B	11	4.00	86	1.217	n/a	0.046	0.046	0.056
S105A	11	1.33	72	0.770	n/a	0.052	0.052	0.040
S105B	11	1.00	71	0.690	n/a	0.055	0.055	0.038
S104	11	0.50	0	0.000	0.15	0	0.15	0.000

At each location for the storm event presented, the maximum depth of water on the street is less than the maximum allowable 300 mm, and the d x v product is less than the maximum allowable product of 0.6 m^2/s as per the OSDG.

4.5.3 Hydraulic Evaluation

A static hydraulic grade line analysis has been used to evaluate the proposed storm sewer design. The static HGL calculations are based on the Darcy-Weisbach equation for headloss to calculate friction slope of the storm sewer with manhole losses through the storm sewer network. A summary of the supporting equations for friction slope and manhole losses as well as the calculation sheets for the site are provided within Appendix C for reference. The following table provides summary of the storm hydraulic grade line.

Table 4.5 Storm Hydraulic Grade Line

LOCATION	MH	USF ELEVATION (M)	HGL (M)	FB (M)
Access Road	CBMH20	N/A	98.01	N/A
Access Road	MH107	N/A	92.23	N/A
Access Road	MH106	N/A	91.91	N/A
Access Road	MH105	N/A	90.20	N/A
Access Road	MH104	N/A	90.11	N/A
REVERA	MH103	N/A	89.92	N/A
REVERA	MH102	N/A	89.64	N/A
REVERA	MH101	N/A	88.68	N/A
REVERA	MH100	N/A	81.41	N/A
OFF-SITE	MH99	N/A	78.30	N/A
OFF-SITE	MH98	N/A	78.13	N/A
EXISTING STORM	EXMH3	N/A	78.01	N/A

4.6 Summary of Model Output Files

The following is a reference list of the model output files including file names and storm event evaluated. The files are included on the CD enclosed in Appendix C.

DDSWMM:

- 2 year 3 hour Chicago: 37923-3CHI2.OUT
- 5 year, 3 hour Chicago: 37923-3CHI5.OUT
- 100 year 3 hour Chicago: 37923-3CHI100.OUT
- 100 year 3 hour Chicago +20%: 37923-3CHI120.OUT

SWMHYMO:

- 37923VxD.OUT

5 SEDIMENT AND EROSION CONTROL PLAN

5.1 General

During construction, existing stream and conveyance systems can be exposed to significant sediment loadings. Although construction is only a temporary situation, it is proposed to possibly introduce a number of mitigative construction techniques to reduce unnecessary construction sediment loadings. These may include:

- Until the local storm sewer and storm pond are constructed, groundwater in trenches will be pumped into a filter mechanism prior to release to the environment. bulkhead barriers will be installed at the nearest downstream manhole in each sewer which connects to an existing downstream sewer;
- seepage barriers will be constructed in any temporary drainage ditches (where applicable);
- sediment capture filter socks will remain on open surface structures such as maintenance holes and catchbasins until these structures are commissioned and put into use; and
- silt fence on the site perimeter will be installed.

5.2 Trench Dewatering

Any trench dewatering using pumps will be discharged into a filter trap made up of geotextile filters and straw bales similar in design to the OPSD 219.240 Dewatering Trap. These will be constructed in a bowl shape with the fabric forming the bottom and the straw bales forming the sides. Any pumped groundwater will be filtered prior to release to the existing surface runoff. The contractor will inspect and maintain the filters as needed, including sediment removal and disposal and material replacement as needed. It should be noted that that the contractor will be responsible for the design and management of the trap(s).

5.3 Bulkhead Barriers

Although the storm sewers eventually outlet into a sediment forebay, a ½ diameter bulkhead will be constructed over the lower half of the outletting sewers to reduce sediment loadings during construction. These bulkheads will trap any sediment laden flows, thus preventing any construction-related contamination into existing sewers. The bulkheads will be inspected and maintained including periodic sediment removal as needed.

5.4 Seepage Barriers

In order to further reduce sediment loading to the stormwater management facility, seepage barriers will be installed on any surface water courses at appropriate locations that may become evident during construction. These barriers will be Light Duty Straw Bale Barriers per OPSD 219.100 and Heavy Duty Silt Fence Barriers per OPSD 219.130; locations are shown on the Sediment and Erosion Control Plan included in **Appendix D**. They are typically made of layers of straw bales or geotextile fabric staked in place. All seepage barriers will be inspected and maintained as needed.

5.5 Surface Structure Filters

All catchbasins, and to a lesser degree, manholes, convey surface water to sewers. Until streets are asphalted and curbed, all catchbasins and manholes will be constructed with sediment capture inserts or equivalent located between the structure frame and cover. These will stay in place and be maintained during construction and build until it is appropriate to remove same.

6 CONCLUSION

This report has illustrated that the proposed Riverside Park vacant land condominium can be serviced by extending municipal services. The water network will be extended to provide necessary service. All sanitary and storm sewer designs for this development will be completed in conformance with City of Ottawa standards while acknowledging downstream constraints. By limiting flow into the minor storm sewer system as per the applicable local stormwater management criteria and allowing for excess surface storage on-site, all stormwater management requirements will be met. Adherence to the Sediment and Erosion Control Plan during construction will minimize harmful impacts on surface water.

Based on the information provided within this report, the plans prepared for the subject development can be serviced to meet City of Ottawa requirements.

LICENSED PROFESSIONAL ENGINEER
T. R. BRULE
PROVINCE OF ONTARIO

Terry Brule, P. Eng.
Associate

LICENSED PROFESSIONAL ENGINEER
P. M. DEIR
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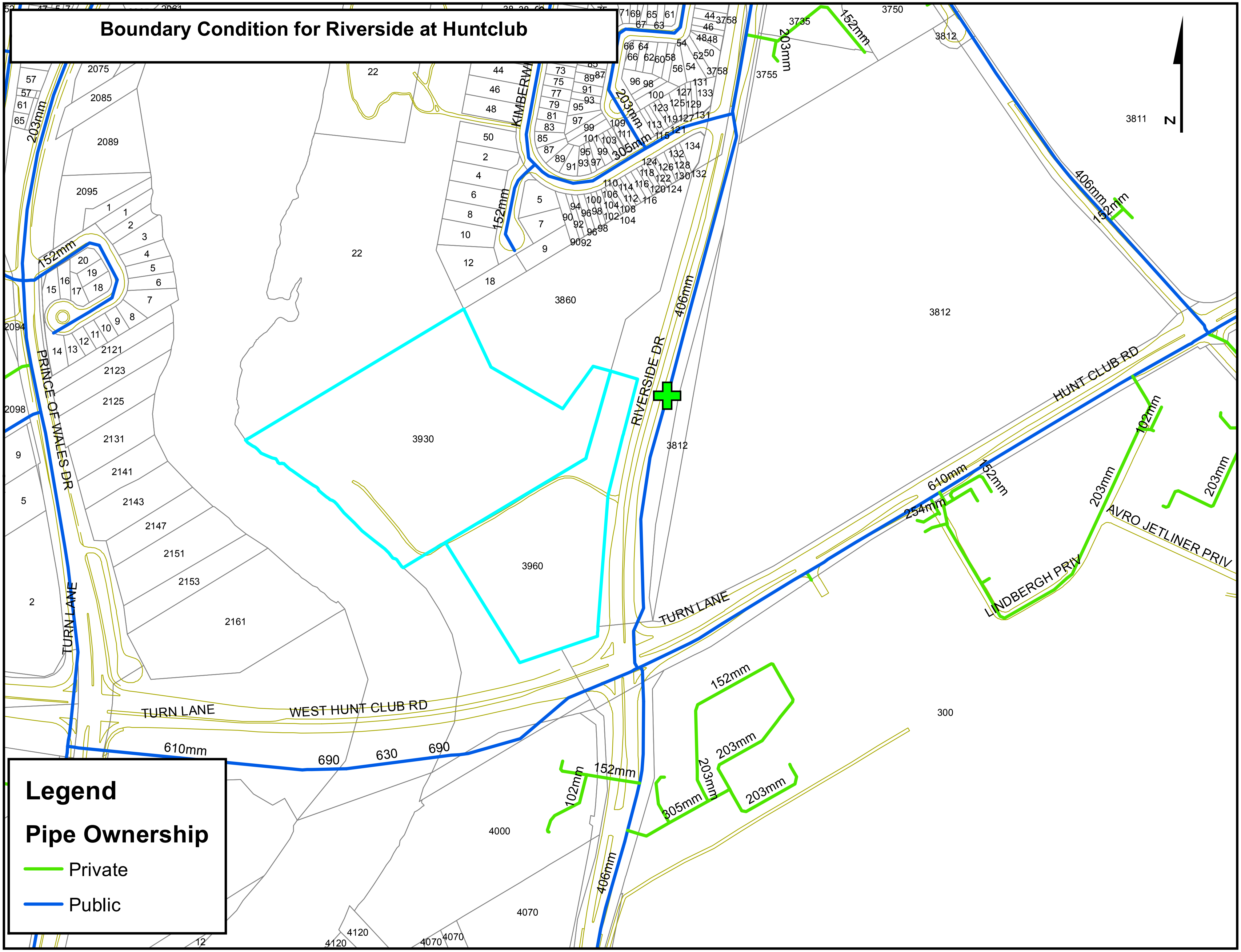
PROVINCE OF ONTARIO

Peter Deir, P. Eng.
Section 4.0

"J:\37923-RiversideProperty\5.2 Reports\5.2.2 Civil\5.2.2.1 Sewers\Design Brief\1st Submission\CTR-Design Brief-2018-03-23.docx"

APPENDIX A

Boundary Condition for Riverside at Huntclub



James Battison

From: Oram, Cody <Cody.Oram@ottawa.ca>
Sent: Wednesday, December 13, 2017 9:28 AM
To: James Battison
Cc: Alex Turner; Terry Brule; Lance Erion
Subject: RE: 37923 - Riverside at Hunt Club - Boundary Condition Request
Attachments: Riverside at Hutn Club Dec 2017.pdf

Hi James,

The following are boundary conditions, HGL, for hydraulic analysis at Riverside at Hunt Club (zone 2C) assumed to be connected to the 406mm on Riverside (see attached PDF for location).

Minimum HGL = 125.1m

Maximum HGL = 134.7m

Max Day + Fire Flow (250 L/s) = 126.2m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Regards,

Cody Oram, P.Eng. Senior Engineer
Development Review, South Services
Planning, Infrastructure and Economic Development Department | Services de planification, d'infrastructure et de développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West. Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste **13422**, fax/téléc:613-580-2576, cody.oram@ottawa.ca

From: James Battison [mailto:James.Battison@ibigroup.com]
Sent: Wednesday, December 06, 2017 2:26 PM
To: Oram, Cody <Cody.Oram@ottawa.ca>
Cc: Alex Turner <aturner@taggart.ca>; Terry Brule <tbrule@IBIGroup.com>; Lance Erion <lerion@IBIGroup.com>
Subject: 37923 - Riverside at Hunt Club - Boundary Condition Request

Hi Cody,

We are initiating our design for a development at the NW corner of Hunt Club and Riverside Drive. A location sketch is attached.

To facilitate our design we are requesting watermain boundary conditions.

The connection location is identified on the sketch referenced above and the proposed water demands can be found on the attached spreadsheet.

Should you need anything else to provide watermain boundary conditions please let us know.

It should also be noted that we will be directing the stormwater to an existing nearby pond, which can seen on the attached “services-Mark-up” sketch. We may need to have a meeting to discuss the SWM criteria to be used in our design.

Thanks.

James Battison

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IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

37923.5.7

PROJECT : Riverside and Huntclub
LOCATION : Taggart Realty Management

DATE: 2-Apr-18
DESIGN: LE

NODE	RESIDENTIAL						NON-RESIDENTIAL			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)		
	UNITS				GROSS RES. (Ha)	POP'N	COM (Ha)	IND (Ha)	INST (Ha)	Res.	Non-res.	Total	Res.	Non-res.	Total	Res.	Non-res.	Total
	SF	SD	TH	APT														
J4 (School Block)						0			0.77	0.00	0.25	0.25	0.00	0.37	0.37	0.00	0.67	0.67
J6 (Commercial - South)						0	0.89			0.00	0.29	0.29	0.00	0.43	0.43	0.00	0.78	0.78
J7 (Commercial - North)						0	0.41			0.00	0.13	0.13	0.00	0.20	0.20	0.00	0.36	0.36
J8 (Hotel Block)				70		126				0.51	0.00	0.51	1.28	0.00	1.28	2.81	0.00	2.81
J9 (Rivera Block)				300		540				2.19	0.00	2.19	5.47	0.00	5.47	12.03	0.00	12.03

ASSUMPTIONS

RESIDENTIAL DENSITIES

- Single Family (SF) 3.4 p/p/u
- Semi Detached (SD) 2.7 p/p/u
- Townhouse (TH) 2.7 p/p/u
- Apartment (APT) 1.8 p/p/u

AVERAGE DAILY DEMAND

- Residential 350 l/cap/day
- Commercia 28,000 l/ha/day
- Industrial 35,000 l/ha/day
- Institutional 28,000 l/student/d

MAXIMUM DAILY DEMAND

- Residential 875 l/cap/day
- Commercia 42,000 l/ha/day
- Industrial 52,500 l/ha/day
- Institutional 42,000 l/student/d

MAXIMUM HOURLY DEMAND

- Residential 1,925 l/cap/day -
- Commercia 75,600 l/ha/day -
- Industrial 94,500 l/ha/day -
- Institutional 75,600 l/student/d

Fire Flow Requirement from Fire Underwriters Survey

Rivera - Tower B

Building Floor Area	5,920	m^2	Tower footprint = 870m2 Podium footprint 1570m2
			Assume 1 floor tower, plus 1 tower floor plus 50% of 8 tower floors

Fire Flow

F = 220C√A

C	0.6		C =	1.5	wood frame
A	5,920	m^2		1.0	ordinary
				0.8	non-combustile
F	10,156	l/min		0.6	fire-resistive
use	10,000	l/min			

Occupancy Adjustment			-25%	non-combustile
			-15%	limited combustile
Use	-15%		0%	combustile
			+15%	free burning
Adjustment	-1500	l/min	+25%	rapid burning
Fire flow	8,500	l/min		

Sprinkler Adjustment			-30%	system conforming to NFPA 13
			-50%	complete automatic system
Use	-50%			
Adjustment	-4250	l/min		

Exposure Adjustment

Building Face		Separation	Charge
north	0	> 45	25%
east		> 45	0%
south	0	> 45	25%
west		> 45	0%
Total			50%

Separation	Charge
0 to 3m	+25%
3.1 to 10m	+20%
10.1 to 20m	+15%
20.1 to 30m	+10%
30.1 to 45m	+5%

Adjustment 4,250 l/min

Required Fire Flow

Total adjustments	-	l/min
Fire flow	8,500	l/min
Use	**9,000**	**l/min**
	150.0	**l/s**

Fire Flow Requirement from Fire Underwriters Survey

Rivera - Tower C

Building Floor Area	5,555	m^2	Tower footprint = 870m2	Podium footprint 1205m2
			Assume 1 floor tower, plus 1 tower floor plus 50% of 8 tower floors	

Fire Flow

F = 220C√A

C	0.6		C =	1.5	wood frame
A	5,555	m^2		1.0	ordinary
				0.8	non-combustile
F	9,838	l/min		0.6	fire-resistive
use	10,000	l/min			

Occupancy Adjustment			-25%	non-combustile
			-15%	limited combustile
Use	-15%		0%	combustile
			+15%	free burning
Adjustment	-1500	l/min	+25%	rapid burning
Fire flow	8,500	l/min		

Sprinkler Adjustment			-30%	system conforming to NFPA 13
			-50%	complete automatic system
Use	-50%			
Adjustment	-4250	l/min		

Exposure Adjustment

Building Face		Separation	Charge
north	0	0	25%
east		> 45	0%
south		0	25%
west		> 45	0%
Total			50%

Separation	Charge
0 to 3m	+25%
3.1 to 10m	+20%
10.1 to 20m	+15%
20.1 to 30m	+10%
30.1 to 45m	+5%

Adjustment 4,250 l/min

Required Fire Flow

Total adjustments	-	l/min
Fire flow	8,500	l/min
Use	**9,000**	**l/min**
	150.0	**l/s**

Fire Flow Requirement from Fire Underwriters Survey

Rivera - Tower D

Building Floor Area 4,460 m^2

Fire Flow

$F = 220C\sqrt{A}$

C	0.6		C =	1.5	wood frame
A	4,460	m^2		1.0	ordinary
				0.8	non-combustile
F	8,815	l/min		0.6	fire-resistive
use	9,000	l/min			

Occupancy Adjustment

			-25%	non-combustile
			-15%	limited combustile
Use	-15%		0%	combustile
			+15%	free burning
Adjustment	-1350	l/min	+25%	rapid burning
Fire flow	7,650	l/min		

Sprinkler Adjustment

			-30%	system conforming to NFPA 13
			-50%	complete automatic system
Use	-50%			
Adjustment	-3825	l/min		

Exposure Adjustment

Building Face	Separation	Charge
north	> 45	0%
east	> 45	0%
south	0	25%
west	> 45	0%
Total		25%

Separation	Charge
0 to 3m	+25%
3.1 to 10m	+20%
10.1 to 20m	+15%
20.1 to 30m	+10%
30.1 to 45m	+5%

Adjustment 1,913 l/min

Required Fire Flow

Total adjustments	(1,913)	l/min
Fire flow	5,738	l/min
Use	**6,000**	**l/min**
	100.0	**l/s**

Fire Flow Requirement from Fire Underwriters Survey

Rivera - Tower A

Building Floor Area	4,910 m^2	Tower footprint = 752m2	Podium footprint 1150m2
		Assume 1 floor tower, plus 1 tower floor plus 50% of 8 tower floors	

Fire Flow

F = 220C√A

C	0.6	C =	1.5	wood frame
A	4,910 m^2		1.0	ordinary
			0.8	non-combustile
F	9,249 l/min		0.6	fire-resistive
use	9,000 l/min			

Occupancy Adjustment

		-25%	non-combustile
		-15%	limited combustile
Use	-15%	0%	combustile
		+15%	free burning
Adjustment	-1350 l/min	+25%	rapid burning
Fire flow	7,650 l/min		

Sprinkler Adjustment

		-30%	system conforming to NFPA 13
		-50%	complete automatic system
Use	-50%		
Adjustment	-3825 l/min		

Exposure Adjustment

Building Face	Separation	Charge
north	0	25%
east	> 45	0%
south	23	10%
west	> 45	0%
Total		35%

Separation	Charge
0 to 3m	+25%
3.1 to 10m	+20%
10.1 to 20m	+15%
20.1 to 30m	+10%
30.1 to 45m	+5%

Adjustment 2,678 l/min

Required Fire Flow

Total adjustments	(1,148)	l/min
Fire flow	6,503	l/min
Use	**7,000**	**l/min**
	116.7	**l/s**

Fire Flow Requirement from Fire Underwriters Survey

Hotel

Building Floor Area	3,938	m^2

Fire Flow

$F = 220C\sqrt{A}$

C	0.6		C =	1.5	wood frame
A	3,938	m^2		1.0	ordinary
				0.8	non-combustile
F	8,283	l/min		0.6	fire-resistive
use	8,000	l/min			

Occupancy Adjustment

			-25%	non-combustile
			-15%	limited combustile
Use	-15%		0%	combustile
			+15%	free burning
Adjustment	-1200	l/min	+25%	rapid burning
Fire flow	6,800	l/min		

Sprinkler Adjustment

			-30%	system conforming to NFPA 13
			-50%	complete automatic system
Use	-50%			
Adjustment	-3400	l/min		

Exposure Adjustment

Separation	Charge
0 to 3m	+25%
3.1 to 10m	+20%
10.1 to 20m	+15%
20.1 to 30m	+10%
30.1 to 45m	+5%

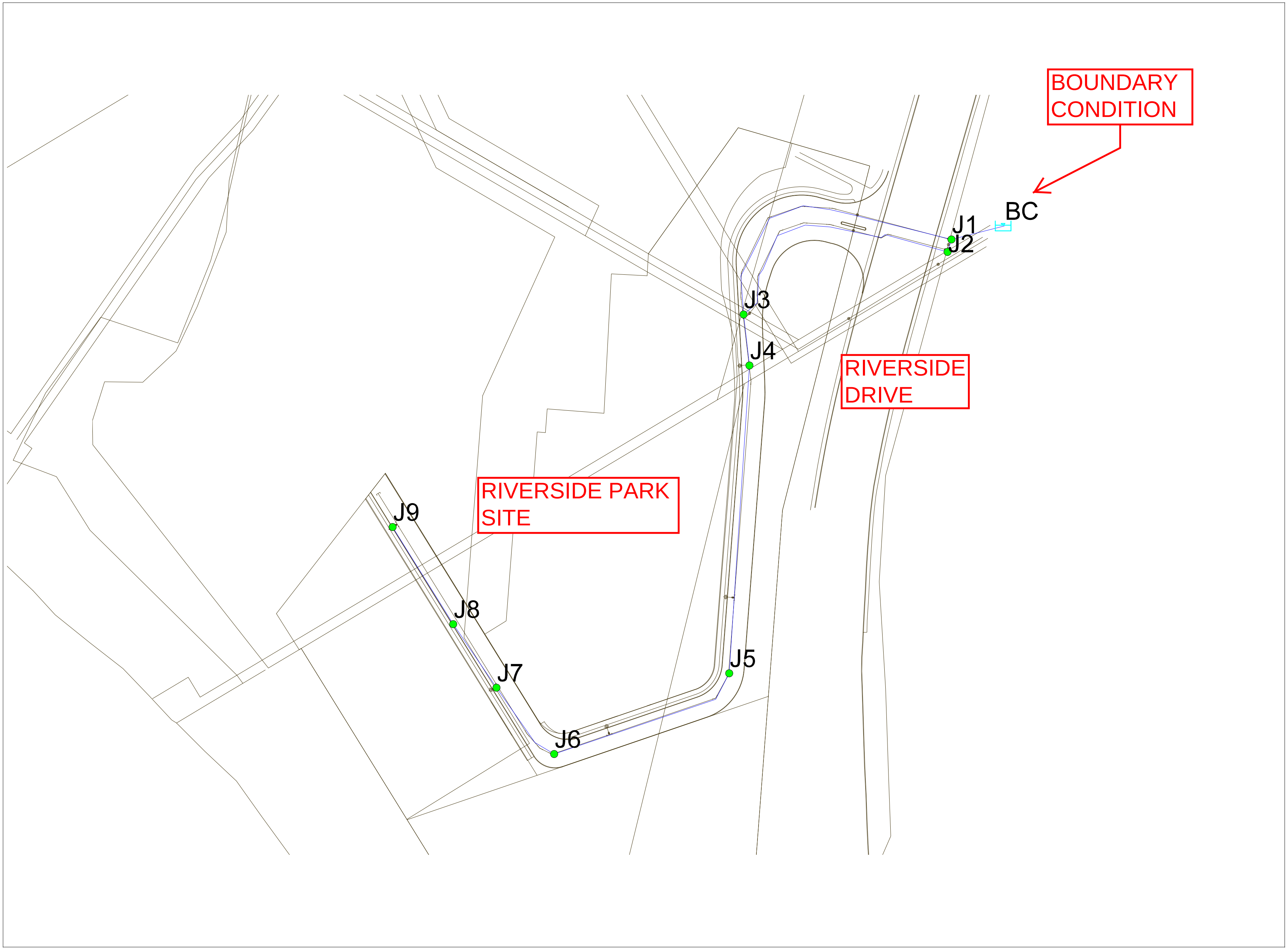
Building Face	Separation	Charge
north	23	10%
east	37	5%
south	> 45	0%
west	> 45	0%
Total		15%

Adjustment	1,020	l/min

Required Fire Flow

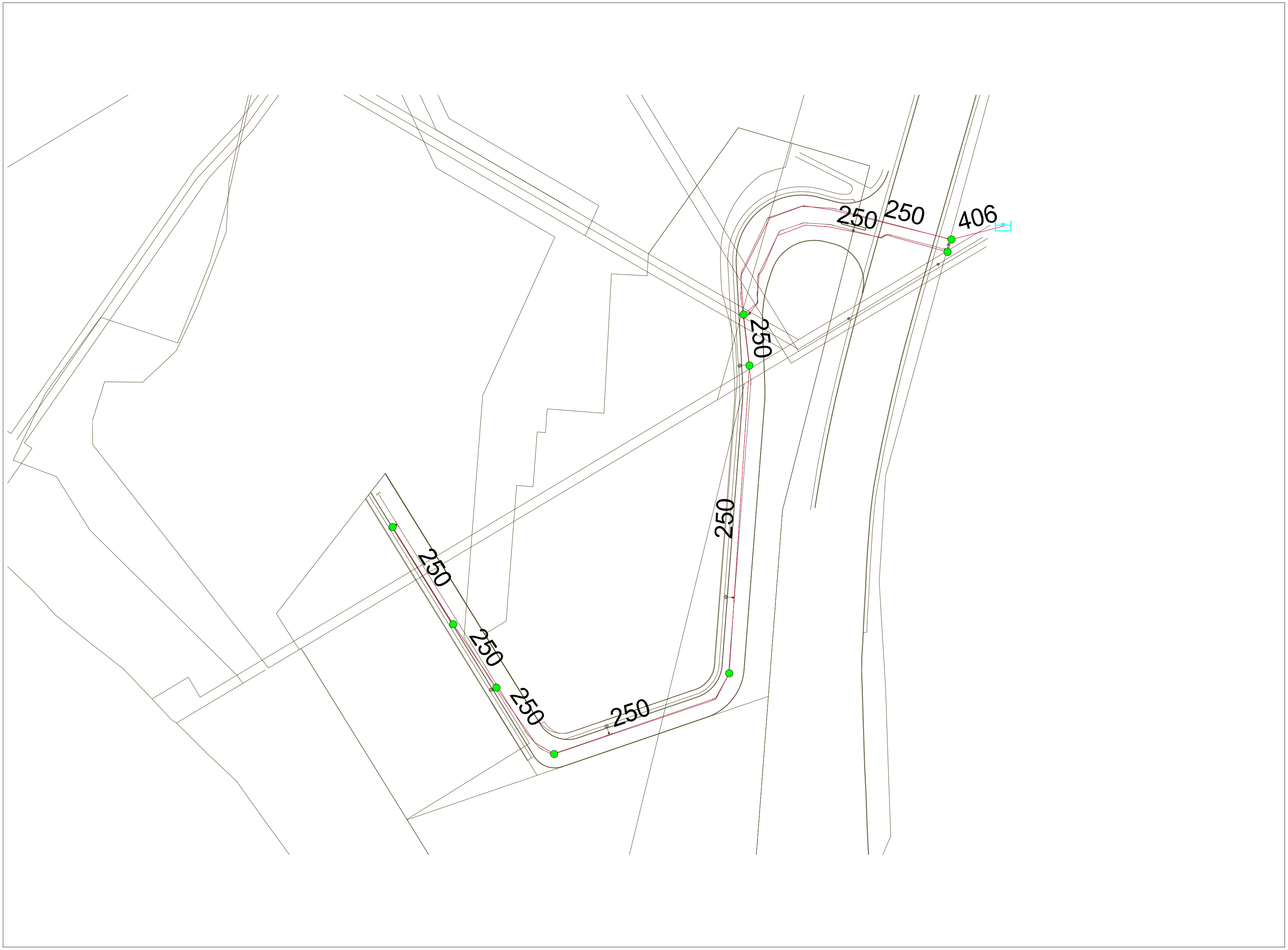
Total adjustments	(2,380)	l/min
Fire flow	4,420	l/min
Use	**4,000**	**l/min**
	66.7	**l/s**

NODE ID'S



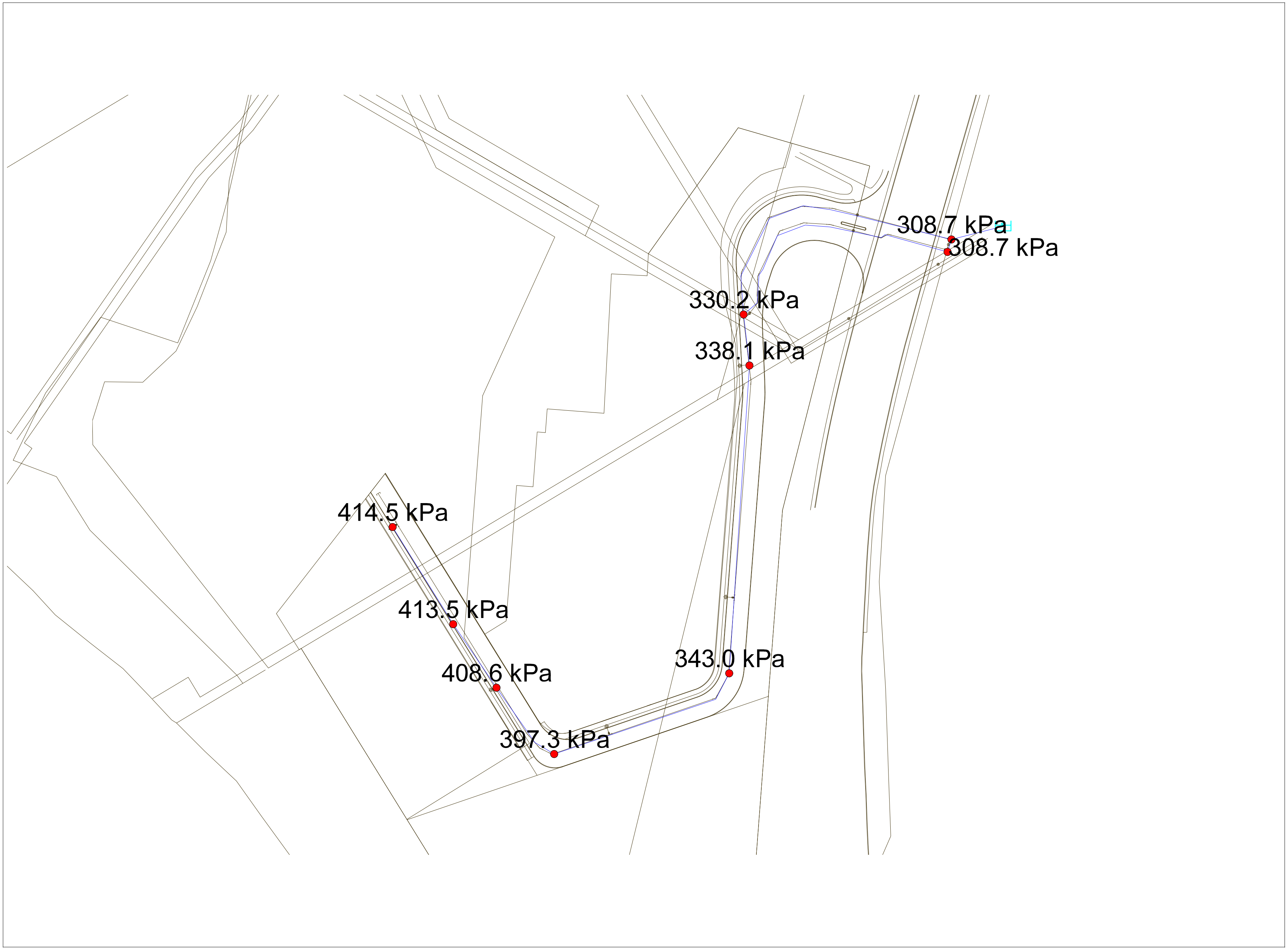
Date: Monday, April 02, 2018

PIPE SIZES



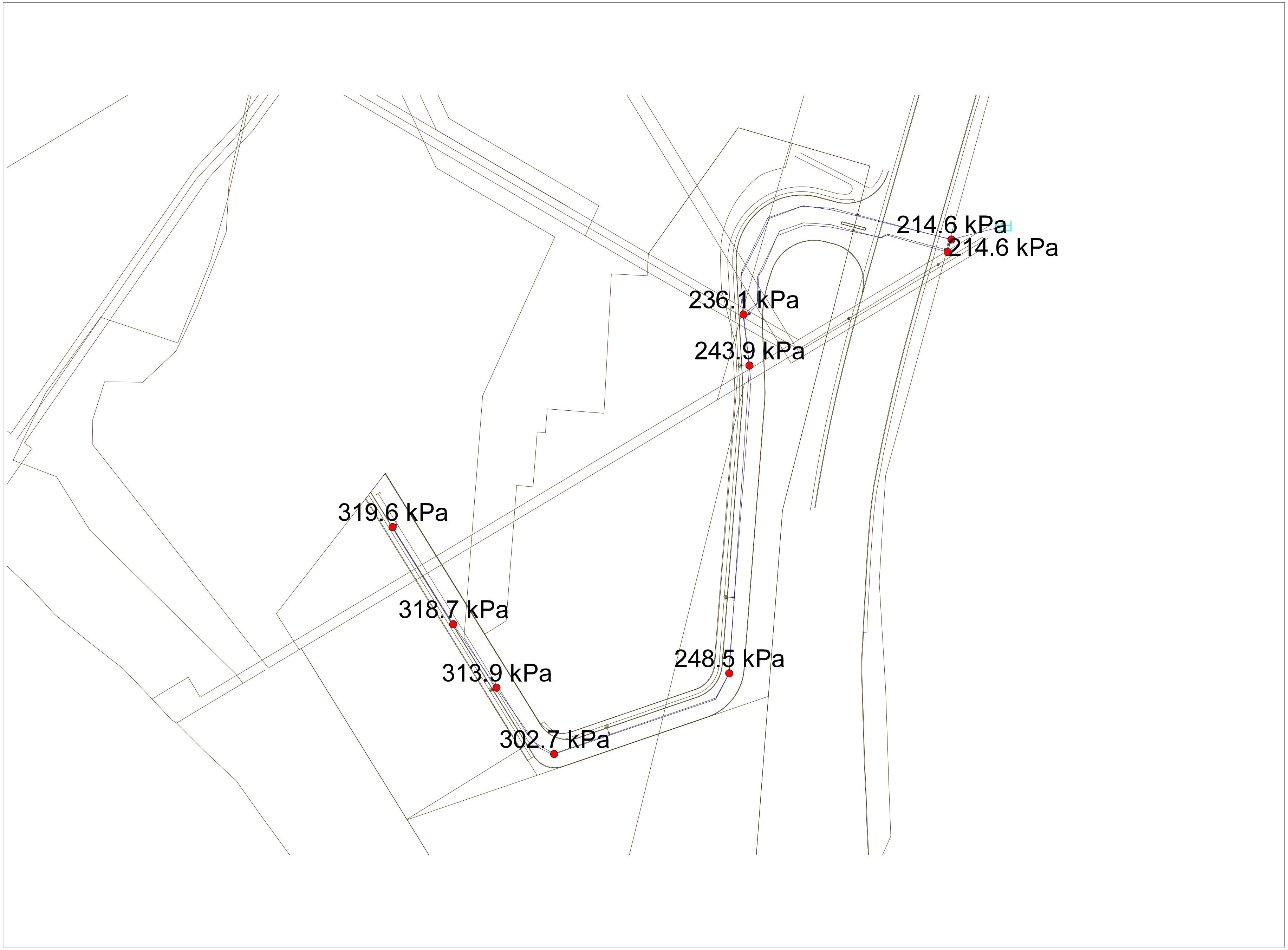
Date: Monday, April 02, 2018

BASIC DAY (MAX HGL) PRESSURES



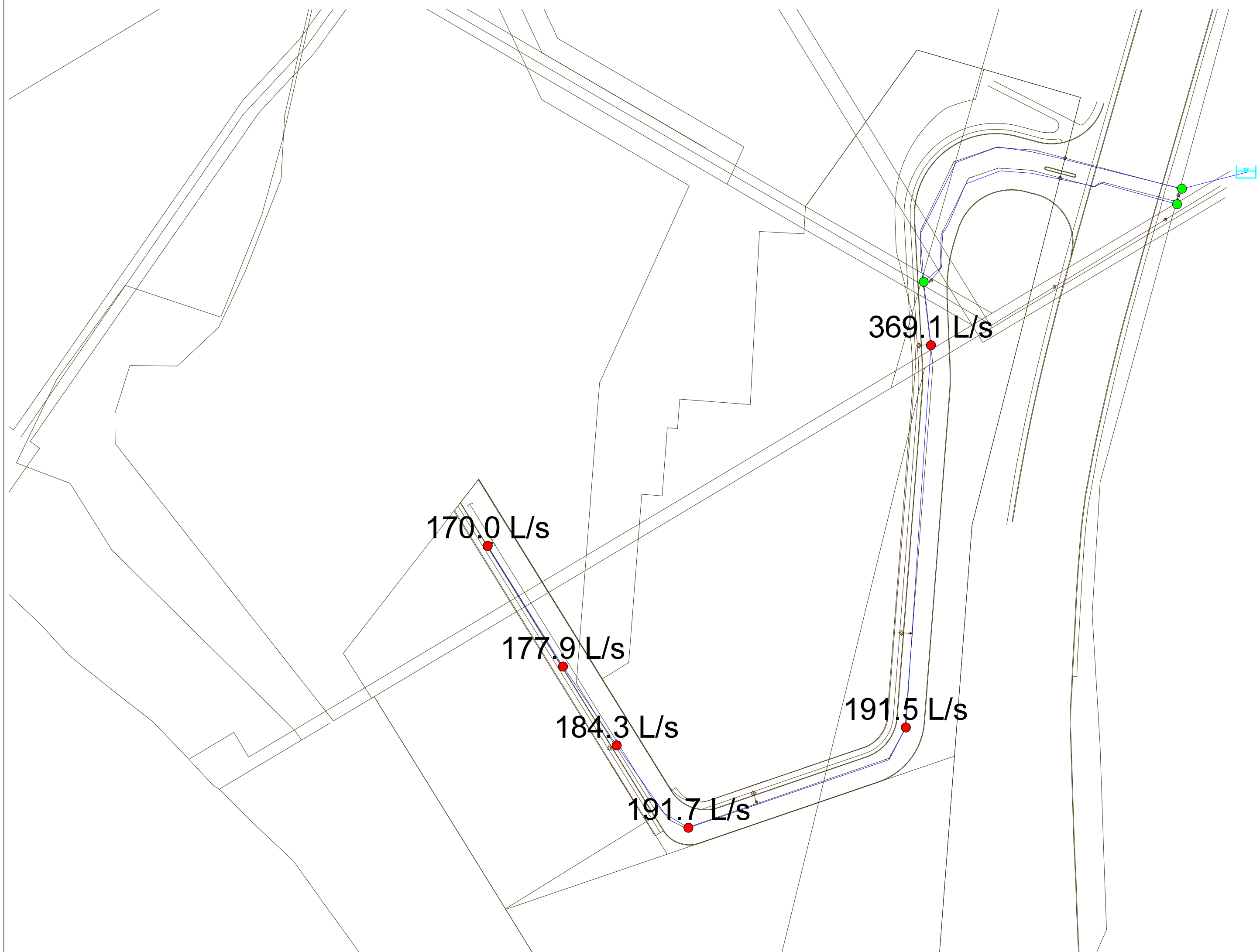
Date: Monday, April 02, 2018

PEAK HOUR PRESSURES



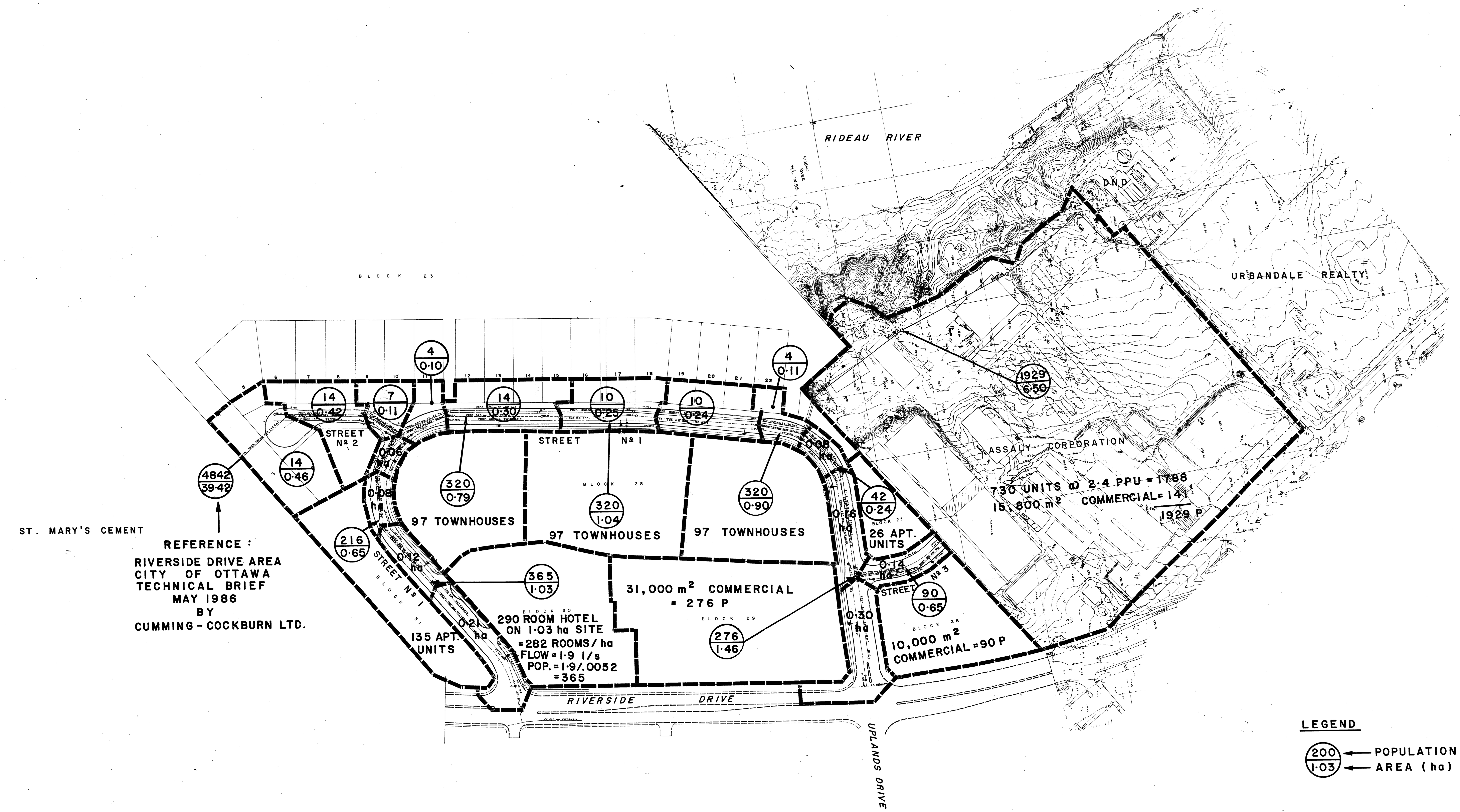
Date: Monday, April 02, 2018

MAX DAY + FIRE FIFEFLOWS



Date: Monday, April 02, 2018

APPENDIX B



City Of Ottawa
Department Of Physical Environment
Engineering And Surveys Branch

Revisions:				
No	Date	Description	Drawn By	Appr'd By

LICENSED PROFESSIONAL ENGINEER — J.L. MOFFATT — ONTARIO

CUMMING – COCKBURN & ASSOCIATES LIMITED
CONSULTING MUNICIPAL ENGINEERS
WATERLOO – TORONTO – OTTAWA

Designed By J. L. M.	Date	Structural Check By	Date
Survey Detail By	Date	Checked By	Date
Drafting By	Date	Checked By	Date

Final Measurements :

Construction Type	Inspector
Work Commenced	Instrumentman
Work Completed	Field Book #
Designer	Date
Drafting Revisions	Checked By

Design And Construction Division

C. Sim P.Eng. — Commissioner
W. R. Cole P.Eng. — Branch Director
Senior Design & Constr. Eng. — Senior Const. Coord.

J. PEREZ CORPORATION – RIVERWALK PARK
SANITARY
DRAINAGE AREA PLAN

Contract No:	Survey Books:	Scales:	Plan No:
3625		HOR. 1:1250 VERT.	501 A Sheet 1 of 1

SANITARY SEWER DESIGN SHEET

Flow Per Person: 450 litres per day, or
.0052 litres per second
Infiltration: 0.20 litres per second per hectare
3.5 ppu single family
3.3 ppu townhouses
1.6 ppu apartments

DESIGN: J.I.M.	PROJECT: Riverwalk Park –	SHEET NO.
CHECKED: W.B.	J. Perez Corporation –	
DATE: Oct. 86	City of Ottawa 3625-3	1 of 2

Rev.: March 87

CUMMING-COCKBURN & ASSOCIATES LIMITED
Consulting Municipal Engineers
Toronto-Ottawa-Waterloo-London-Brockville

LOCATION	MANHOLE		INCREMENT					CUMULATIVE				INFILTRATION			TOTAL FLOW	PROFILE				
	FROM	TO	RES. UNITS	UNIT POP. DENSITY	POP.	OTHER AREAS (ha)	AVG. FLOW L/Sec.	POP.	AVG. FLOW L/Sec.	PEAK FACTOR	PEAK FLOW L/Sec.	INCR. OF AREA (ha)	TOTAL AREA	FLOW L/Sec.	L/Sec.	PIPE DIA. (mm)	GRADE (%)	VEL. M/Sec.	CAP. L/Sec.	LENGTH Metres
External (South)		17A			4842	–		4842	25.18	4.00	100.70	39.42	39.42	7.88	108.60	525	0.20	0.896	200.50	–
Street No. 2 (cul-de-sac)	17A	16A	5	3.5	18	39.42		4860	25.27	4.00	101.08	0.51	39.93	7.99	109.07	525	0.20	0.896	200.50	49.0
" " " "	16A	15A	3	3.5	10	39.93		4870	25.32	4.00	101.30	0.37	40.30	8.06	109.40	525	0.20	0.896	200.50	53.0
" " " "	15A	5A	2	3.5	7	40.30		4877	25.36	4.00	101.40	0.11	40.41	8.08	109.50	525	0.20	0.896	200.50	28.0
Street No. 1	2A	3A	hotel		365	0.21		365	1.90	6.00	11.40	1.15	1.36	0.27	11.65	250	0.50	0.863	43.61	59.5
	3A	4A	135	1.6	216	1.36		581	3.02	6.00	18.13	0.73	2.09	0.42	18.54	250	0.50	0.863	43.61	39.5
	4A	5A	–	–	–	2.09		581	3.02	6.00	18.13	0.06	2.15	0.43	18.55	250	2.80	1.929	97.70	31.0
	5A	6A	1	3.5	4	42.56		5462	28.40	4.00	113.60	0.10	42.66	8.53	122.10	525	0.20	0.896	200.50	38.5
	6A	7A	4 97	3.5 3.3	334	42.66		5796	30.14	4.00	120.60	1.09	43.75	8.75	129.30	525	0.20	0.896	200.50	80.0
	7A	8A	3 97	3.5 3.3	330	43.75		6126	31.86	4.00	127.40	1.29	45.04	9.01	136.40	525	0.20	0.896	200.50	76.5
	8A	9A	3	3.5	10	45.04		6136	31.91	4.00	127.60	0.24	45.28	9.06	136.70	525	0.20	0.896	200.50	74.0
	9A	10A	1 97	3.5 3.3	324	45.28		6460	33.59	4.00	134.40	1.01	46.29	9.26	143.60	525	0.20	0.896	200.50	31.5

SANITARY SEWER DESIGN SHEET

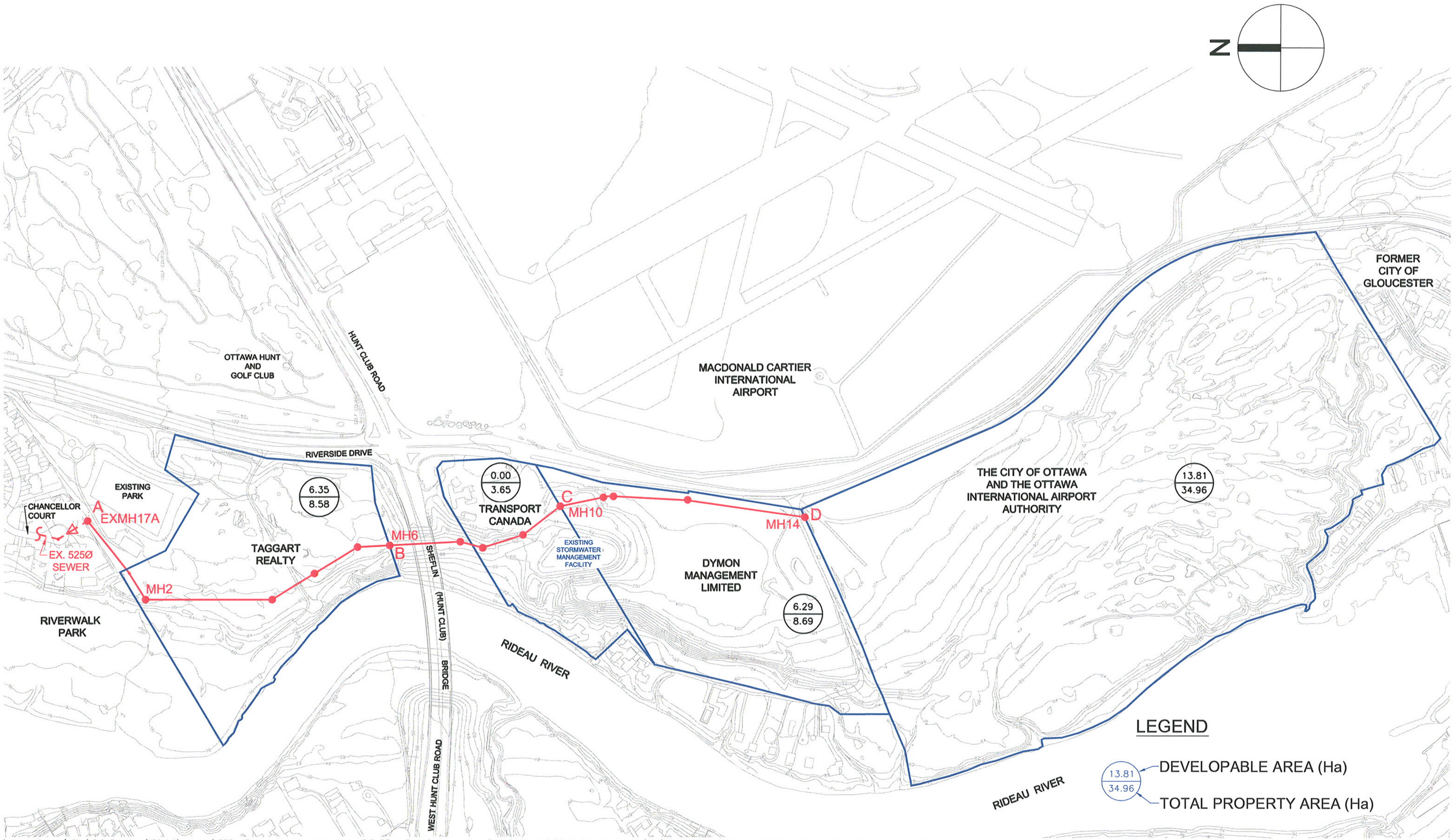
Flow Per Person: 450 litres per day, or
.0052 litres per second
Infiltration: 0.20 litres per second per hectare
3.5 ppu single family
3.3 ppu townhouses
1.6 ppu apartments

DESIGN: J.I.M.	PROJECT: Riverwalk Park –	SHEET NO.
CHECKED: W.B.	J. Perez Corporation –	
DATE: Oct. 86	City of Ottawa 3625-3	2 of 2

Rev.: Jan. 87

CUMMING-COCKBURN & ASSOCIATES LIMITED
Consulting Municipal Engineers
Toronto–Ottawa–Waterloo–London–Brockville

LOCATION	MANHOLE		INCREMENT					CUMULATIVE				INFILTRATION			TOTAL FLOW	PROFILE				
	FROM	TO	RES. UNITS	UNIT POP. DENSITY	POP.	OTHER AREAS (ha)	AVG. FLOW L/Sec.	POP.	AVG. FLOW L/Sec.	PEAK FACTOR	PEAK FLOW L/Sec.	INCR. OF AREA (ha)	TOTAL AREA	FLOW L/Sec.	L/Sec.	PIPE DIA. (mm)	GRADE (%)	VEL. M/Sec.	CAP. L/Sec.	LENGTH Metres
Street No. 3	14A	12A	Comm.		90	–		90	0.47	6.00	2.81	0.79	0.79	0.16	2.97	250	0.60	0.945	47.86	35.0
Street No. 1	12A	11A	Comm.		276	1.09		366	1.90	6.00	11.42	1.62	2.71	0.51	11.93	250	2.90	1.966	105.10	78.0
	11A	10A	26	1.6	42	2.71		408	2.12	6.00	12.73	0.32	3.03	0.59	13.32	250	2.90	1.966	105.10	37.5
Assaly Property	10A	19A	–	–	–	49.32		6868	35.70	4.00	142.80	–	49.32	9.86	152.60	525	0.20	0.896	200.50	110.0
" "	19A	23A	Mixed		1929	49.32		8797	45.70	4.00	183.00	6.50	55.92	11.18	194.18	600	0.20	0.981	286.00	219.0



J: \3704-StMary'sSite\5.9 Drawings\59civil\current\3704_Figure4.dwg Layout Name: FIGURE 4 Plot Style: ---- Plot Scale: 1:2.5849 Plotted At: 11/26/2009 1:50 PM Last Saved By: dsiurna Last Saved At: Nov. 25, 09

IBI GROUP	Scale	Project Title	Drawing Title	Sheet No.
	1:5000	ST. MARY'S SITE	SANITARY DRAINAGE AREA PLAN	FIGURE 4

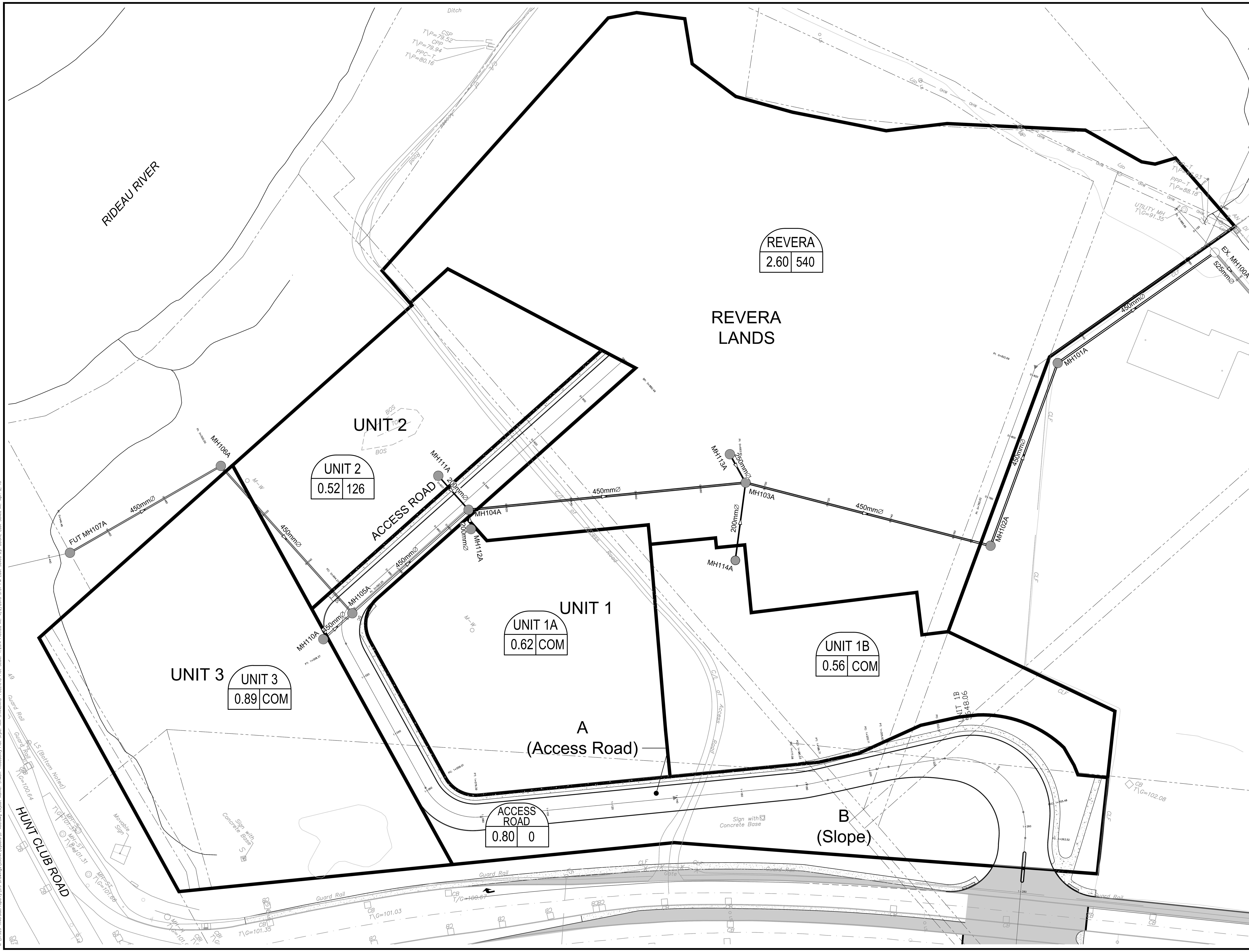
SANITARY SEWER DESIGN SHEET
RIVERSIDE DRIVE LANDS
SANITARY SEWER SERVICING STUDY
CITY OF OTTAWA

JOB #: 15215-5.7.1
DATE: NOV 07
DESIGN: JIM

LOCATION			INDIVIDUAL					CUM. RES. FLOW			LIGHT INDUSTRIAL FLOW				INFILTRATION			TOTAL	PROPOSED SEWER						
STREET	**FROM**	**TO**	**RESID. UNITS** Singles	Towns Semis	Condo	**RES. AREA (Ha)**	**POP.**	**POP.**	**PEAK FACT.**	**PEAK FLOW (l/s)**	**INCR. AREA (Ha)**	**CUM. AREA (Ha)**	**PEAK FACT.**	**PEAK FLOW (l/s)**	**INCR. AREA (Ha)**	**CUM. AREA (Ha)**	**FLOW (l/s)**	**DESIGN FLOW (l/s)**	**CAP. l/s**	**PIPE (mm)**	**LGTH. (m)**	**SLOPE %**	**VEL. (full) m/s**	**AVAIL. CAP. (l/s)**	**AVAIL. CAP. (%)**
No External Drainage Areas		Point D - MH 14									0.00														
City of Ottawa/Airport Authority	Point D - MH 14	MH 11									13.81	13.81	1.50	11.99	13.81	13.81	3.87	**15.85**	**39.22**	250	280.0	0.40	0.77	23.36	60%
Dymon Management Limited	MH 11	Point B - MH 6									6.29	20.10	1.50	17.45	6.29	20.10	5.63	**23.08**	**39.22**	250	315.0	0.40	0.77	16.14	41%
Transport Canada/Hunt Club Road																									
	Point B - MH 6	MH 2									0.00	20.10	1.50	17.45	0.00	20.10	5.63	**23.08**	**39.22**	250	355.0	0.40	0.77	16.14	41%
Taggart Realty	MH 2	Point A Ex MH 17A									6.35	26.45	1.50	22.96	6.35	26.45	7.41	**30.37**	**55.24**	300	130.0	0.30	0.76	24.87	45%
																			200.67	*525*	*0.0*	*0.20*	*0.90*	*200.67*	*100%*
External Drainage Areas																									
Potential External Drainage Contribution		Point D - MH 14									**65.00**	65.00	1.50	56.42	65.00	65.00	18.20	**74.62**							
City of Ottawa/Airport Authority	Point D - MH 14	MH 11									13.81	78.81	1.50	68.41	13.81	78.81	22.07	**90.48**	**100.21**	375	280.0	0.30	0.88	9.74	10%
Dymon Management Limited	MH 11	Point B - MH 6									6.29	85.10	1.50	73.87	6.29	85.10	23.83	**97.70**	**162.86**	450	315.0	0.30	0.99	65.16	40%
Transport Canada/Hunt Club Road																									
	Point B - MH 6	MH 2									0.00	85.10	1.50	73.87	0.00	85.10	23.83	**97.70**	**132.98**	450	355.0	0.20	0.81	35.28	27%
Taggart Realty	MH 2	Point A Ex MH 17A									6.35	91.45	1.50	79.38	6.35	91.45	25.61	**104.99**	**132.98**	450	130.0	0.20	0.81	27.99	21%
																			200.67	*525*	*0.0*	*0.20*	*0.90*	*200.67*	*100%*

Where Q = average daily per capita flow (350 l/cap.d.) or (0.0041l/sec./cap)
I = Unit of peak extraneous flow (0.28 l/sec/ha)
M = Residential Peaking factor = Harmon Peaking Factor , M = 1+(14/(4+P^0.5)) , where P = population in thousands
Commercial Sanitary Flow Rate = 50,000 litres/hectare/day
Commercial Peaking Factor = 1.50

Revised Dec 03, 2007



LEGEND :

UNIT 1B — AREA NUMBER

0.56 | 540 — POPULATION (COM=COMMERCIAL)

AREA IN HECTARES

AREA BOUNDARY

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2			
1	ISSUED FOR CITY APPROVAL	T.R.B.	2018:04:03

TAGGART
REALTY MANAGEMENT

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

RIVERSIDE PARK
3930 & 3960 RIVERSIDE DR.

LICENSED PROFESSIONAL ENGINEER
T. R. BRULE
18/03/28
PROVINCE OF ONTARIO

N

Drawing Title

SANITARY DRAINGAE
AREA PLAN

Scale
1 : 500

Design	Date
J.E.B.	MARCH 2018
Drawn	Checked
D.D. / E.H.	T.R.B.
Project No.	Drawing No.
37923	C-400

CITY PLAN No. ####

CITY FILE No. ####

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

SANITARY SEWER DESIGN SHEET

Riverside Park
CITY OF OTTAWA
Taggart Realty Management

LOCATION				RESIDENTIAL										ICI AREAS							INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL FLOW	PROPOSED SEWER DESIGN						
STREET	AREA ID	FROM MH	TO MH	AREA w/ Units (Ha)	UNIT TYPES SF	SD	TH	APT	AREA w/o Units (Ha)	POPULATION IND	CUM	PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha) INSTITUTIONAL IND	CUM	COMMERCIAL IND	CUM	INDUSTRIAL IND	CUM	PEAK FLOW (L/s)	AREA (Ha) IND	CUM	FLOW (L/s)	IND	CUM	(L/s)	CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY L/s	(%)
		MH107A	MH106A							0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	133.02	53.52	450	0.20	0.810	133.02	100.00%
		MH106A	MH105A							0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	133.02	60.75	450	0.20	0.810	133.02	100.00%
	UNIT 3	MH110A	MH105A						0.89	0.0	0.0	3.80	0.00	0.00	0.00	0.89	0.89	0.00	0.00	0.43	0.89	0.89	0.29	0.00	0.00	0.73	34.22	12.00	200	1.00	1.055	33.49	97.88%
	ACCESS ROAD	MH105A	MH104A						0.80	0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.43	0.80	1.69	0.56	0.00	0.00	0.99	133.02	47.86	450	0.20	0.810	132.03	99.26%
	UNIT 2	MH11A	MH104A	0.52				70		126.0	126.0	3.57	1.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.52	0.17	0.00	0.00	1.63	34.22	14.00	200	1.00	1.055	32.59	95.24%
	UNIT 1A	UNIT 1	MH103A						0.62	0.0	0.0	3.80	0.00	0.00	0.00	0.62	0.62	0.00	0.00	0.30	0.62	0.62	0.20	0.00	0.00	0.51	34.22	6.00	200	1.00	1.055	33.71	98.52%
		MH104A	MH103A							0.0	126.0	3.57	1.46	0.00	0.00	0.00	1.51	0.00	0.00	0.73	0.00	2.83	0.93	0.00	0.00	3.13	133.02	85.61	450	0.20	0.810	129.89	97.65%
	UNIT 1B	MH114A	MH103A						0.56	0.0	0.0	3.80	0.00	0.56	0.56	0.00	0.00	0.00	0.00	0.27	0.56	0.56	0.18	0.00	0.00	0.46	34.22	22.60	200	1.00	1.055	33.76	98.66%
	REVERA	MH113A	MH103A	2.60				300		540.0	540.0	3.37	5.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.60	2.60	0.86	0.00	0.00	6.75	62.04	10.00	250	1.00	1.224	55.29	89.12%
		MH103A	MH102A							0.0	666.0	3.33	7.18	0.00	0.56	0.00	1.51	0.00	0.00	1.01	0.00	5.99	1.98	0.00	0.00	10.16	133.02	77.80	450	0.20	0.810	122.86	92.36%
		MH102A	MH101A							0.0	666.0	3.33	7.18	0.00	0.56	0.00	1.51	0.00	0.00	1.01	0.00	5.99	1.98	0.00	0.00	10.16	133.02	59.88	450	0.20	0.810	122.86	92.36%
		MH101A	MH100A							0.0	666.0	3.33	7.18	0.00	0.56	0.00	1.51	0.00	0.00	1.01	0.00	5.99	1.98	0.00	0.00	10.16	338.60	59.08	450	1.30	2.062	328.44	97.00%
		MH100A	*EXMH3*							0.0	666.0	3.33	7.18	0.00	0.56	0.00	1.51	0.00	0.00	1.01	0.00	5.99	1.98	0.00	0.00	10.16	148.80	70.89	525	0.11	0.666	138.64	93.17%

Design Parameters:

Residential			ICI Areas			Peak Factor
SF	3.4	p/p/u	INST	28,000	L/Ha/day	1.5
TH/SD	2.7	p/p/u	COM	28,000	L/Ha/day	1.5
APT	1.8	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 280 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
where P = population in thousands

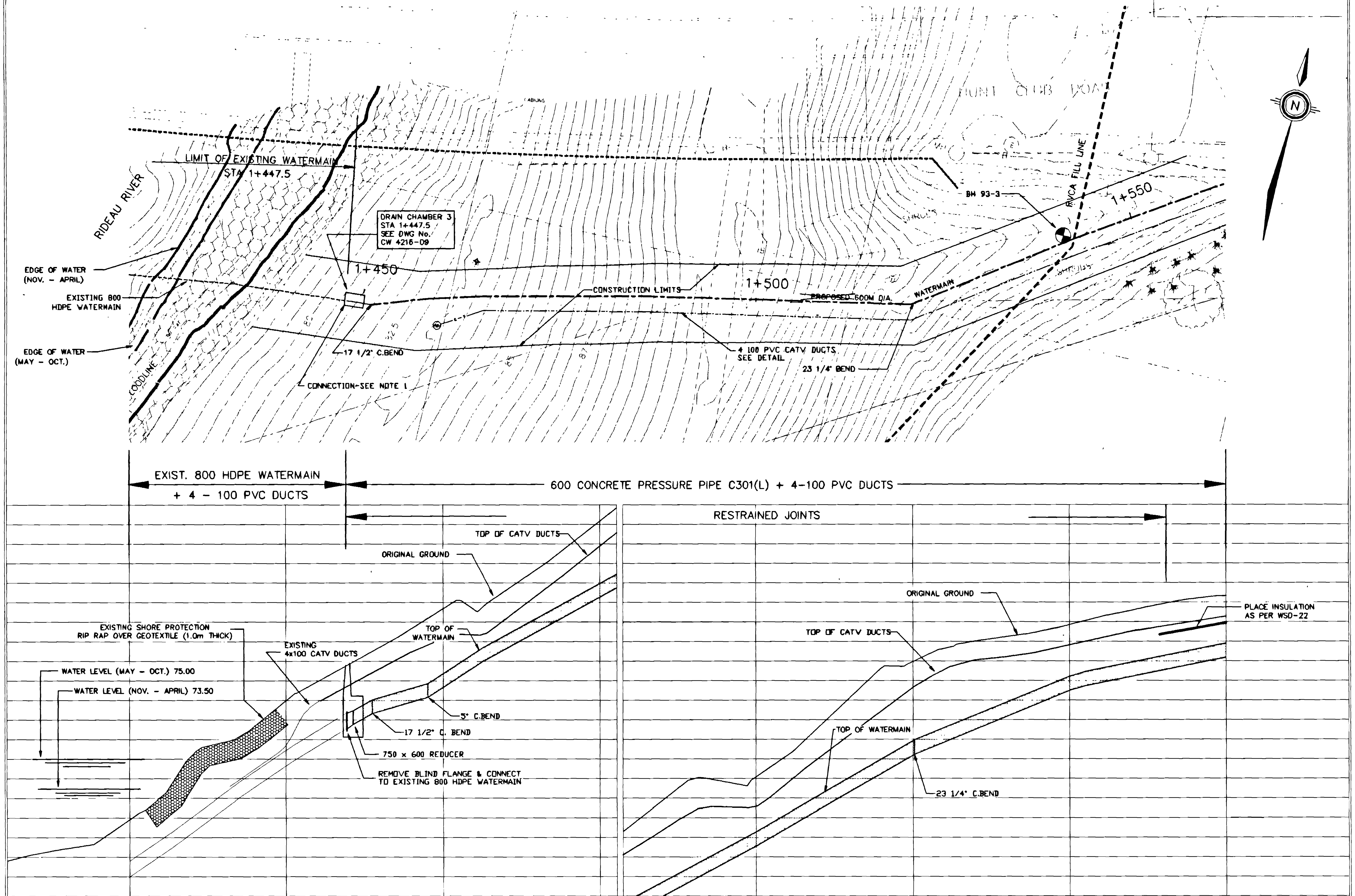
Designed: JEB
Checked: TRB
Dwg. Reference: 37923-501

No.	Revision	Date
1.	1st City submission	2018-03-28

File Reference: 37923.5.7.1 **Date:** 2018-03-28 **Sheet No:** 1 of 1

CAUTION

THE LOCATION OF UTILITIES IS APPROXIMATE ONLY, AND THE EXACT LOCATION SHOULD BE DETERMINED BY CONSULTING THE MUNICIPAL AUTHORITIES AND UTILITY COMPANIES CONCERNED. THE CONTRACTOR IS RESPONSIBLE TO PROVIDE THE LOCATION AND STATUS OF UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION OF PLANT AND EQUIPMENT FROM DAMAGE.



GROUND ELEVATION OVER MAIN	79.00, 80.25, 81.40, 82.60, 82.80, 84.15, 85.40, 87.15, 88.95, 90.45, 91.90, 91.05, 92.50, 94.30, 96.25, 95.95, 97.70, 98.15, 98.35, 98.85, 99.30, 99.75, 100.15, 100.30
TOP OF WATERMAIN	76.80, 77.45, 77.75, 78.082, 78.838, 80.660, 84.000, 85.389, 88.265, 92.954, 96.373, 97.891
STATION (BASELINE)	1+420, 1+440, REDUCER, 17 1/2° C. BEND, 5° C. BEND, 1+460, 1+480, 1+500, 23 1/4° C.BEND, 1+520, 1+540, 1+560

OTTAWA-CARLETON ENVIRONMENT and TRANSPORTATION DEPARTMENT

M.J.E. SHEFLIN, P.Eng.
ENVIRONMENT and TRANSPORTATION COMMISSIONER

Ainley Graham and Associates Limited
Consulting Engineers and Planners Ottawa

Design by:	Date
CRG & GP	JUNE /95
Drawn by:	**Date**
CRG	JUNE /95

Notes.

1. THE CONTRACTOR SHALL EXPOSE AND VERIFY THE LOCATION AND ELEVATION OF EXISTING WATERMAINS AT POINTS OF CONNECTION PRIOR TO PREPARATION OF SHOP DRAWINGS.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF THRUST PROTECTION. SHOP DRAWINGS, SIGNED AND STAMPED BY AN ENGINEER, SHALL BE SUBMITTED FOR ALL THRUST PROTECTION.

SEE "AS BUILT" NOTE AT DWG.No. CW 4216-03

No	Revision	Date
1	AS PER "AS BUILT" INFO. (RMOC; Drawn by P.G.)	MAY/96

Scales HORIZ. 1:250
VERT. 1:100

Project Title.

WATERMAIN CROSSING
RIDEAU RIVER
AT HUNT CLUB BRIDGE
PHASE II

4343-5

PLAN AND PROFILE
STA. 1+420 - STA. 1+560

Drawing No.: CW 4216 - 06
Rev. No.: 1

8477

APPENDIX C

STORM SEWER DESIGN SHEET

Q = 2.78 AIC
WHERE Q = Peak Flow in Litres Per Second (L/S)
A = Area in Hectares (ha)
I = Rainfall Intensity in Millimetres Per Hour (MM/HR)
C = Runoff Coefficient

DESIGN: J.I.M.	PROJECT: Riverwalk Park –	SHEET NO.
CHECKED: W.B.	J. Perez Corporation –	
DATE: Oct. 86	City of Ottawa 3625-3	1 of 2

DESIGN n = .013

Rev.: March 87
Sept. 87

CUMMING-COCKBURN & ASSOCIATES LIMITED
Consulting Municipal Engineers
Toronto-Ottawa-Waterloo-London-Brockville

LOCATION			INCR. AREA				CONCENTRATION TIME					SEWER DATA					
STREET	FROM M.H.	TO M.H.	HECTARE	"C"	2.78 Ac	ACCUM. 2.78 Ac	INLET	IN PIPE	TOTAL	RAINFALL INTENSITY I (MM/HR)	PEAK FLOW Q (L/S)	TYPE OF PIPE	PIPE SIZE	SLOPE %	LENGTH (M)	CAPACITY (L/S)	VELOCITY (M/S)
Street No. 1	1	2	0.12	0.80	0.27												
			0.20	0.70	0.39	0.66	15.00	0.26	15.26	80.00	52.80	Conc.	300	5.00	47.5	225.7	3.10
	2	3	1.34	0.70	2.61	3.27	15.26	0.43	15.69	79.50	260.00	Conc.	450	1.60	59.5	376.7	2.29
	3	4	0.43	0.70	0.84	4.11	15.69	0.29	15.98	78.00	320.60	Conc.	450	1.60	40.5	376.7	2.29
	4	5	0.06	0.70	0.12	4.23	15.98	0.18	16.16	77.00	325.70	Conc.	450	3.00	33.5	515.4	3.14
Street No. 2	17	15	0.88	0.45	1.10	1.10	15.00	0.95	15.95	80.00	88.00	Conc.	300	1.00	79.0	101.1	1.38
	15	5	0.11	0.45	0.14	1.24	15.95	0.31	16.26	78.00	96.72	Conc.	300	1.00	26.0	101.1	1.38
Street No. 1	5	6	0.10	0.45	0.13	5.60	16.26	0.21	16.47	77.00	431.20	Conc.	450	3.00	39.0	515.4	3.14
Assaly Property (Street No. 3)	–	14	3.41	0.62	5.87						T.C. = 19.87 min.						
Street No. 3	14	12	0.79	0.70	1.54	7.41	19.87	0.46	20.33	67.50	500.20	Conc.	750	0.25	35.0	580.6	1.27
Street No. 1	13	12	0.14	0.80	0.31												
			0.16	0.70	0.31	0.62	12.00	0.37	12.37	92.00	57.04	Conc.	300	4.00	62.0	201.9	2.77
	12	11	1.62	0.70	3.15	11.18	20.33	0.46	20.79	66.70	745.70	Conc.	750	1.20	77.5	1272.0	2.79

STORM SEWER DESIGN SHEET

Q = 2.78 AIC
WHERE Q = Peak Flow in Litres Per Second (L/S)
A = Area in Hectares (ha)
I = Rainfall Intensity in Millimetres Per Hour (MM/HR)
C = Runoff Coefficient

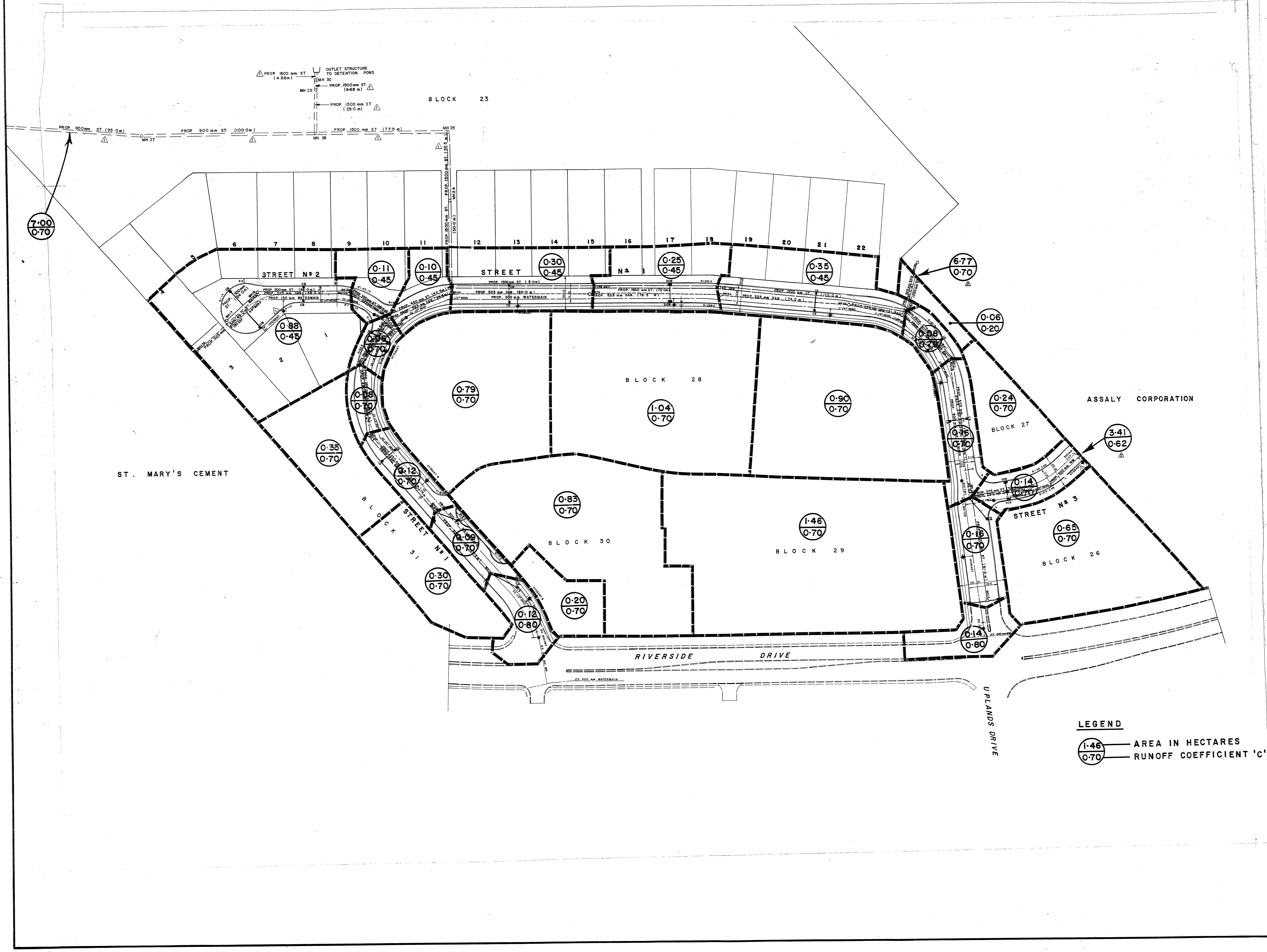
DESIGN: J.I.M.	PROJECT: Riverwalk Park –	SHEET NO.
CHECKED: W.B.	J. Perez Corporation –	
DATE: Oct. 86	City of Ottawa 3625-3	2 of 2

DESIGN n = .013

Rev.: March 87
March 31/87
Sept. 87

CUMMING-COCKBURN & ASSOCIATES LIMITED
Consulting Municipal Engineers
Toronto-Ottawa-Waterloo-London-Brockville

LOCATION			INCR. AREA				CONCENTRATION TIME					SEWER DATA					
STREET	FROM M.H.	TO M.H.	HECTARE	"C"	2.78 Ac	ACCUM. 2.78 Ac	INLET	IN PIPE	TOTAL	RAINFALL INTENSITY I (MM/HR)	PEAK FLOW Q (L/S)	TYPE OF PIPE	PIPE SIZE	SLOPE %	LENGTH (M)	CAPACITY (L/S)	VELOCITY (M/S)
	11	10	0.32	0.70	0.62	11.80	20.79	0.22	20.01	65.70	775.30	Conc.	750	1.20	37.5	1272.0	2.79
Assaly Property	North Bulkhead	10	6.77	0.70	13.17						T.C. = 23.13 min.						
			0.06	0.20	0.03	13.20	23.13	0.28	23.41	61.70	814.40	Conc.	1050	0.20	24.0	1274.0	1.43
Street No. 1	10	8	0.35	0.45	0.44												
			0.90	0.70	1.75	26.75	23.41	1.17	24.58	70.80	1894.00	Conc.	1500	0.15	110.0	2857.0	1.57
	8	7	0.25	0.45	0.31												
			1.04	0.70	2.02	29.08	24.58	0.76	25.34	68.60	1995.00	Conc.	1500	0.15	72.0	2857.0	1.57
	7	6	0.30	0.45	0.38	29.46	25.34	0.88	26.22	67.40	1986.00	Conc.	1500	0.15	82.5	2857.0	1.57
	6	28	0.79	0.70	1.54	36.60	26.22	1.52	27.74	66.00	2416.00	Conc.	1500	0.20	165.5	3296.0	1.81
St. Mary's Cement							T.C. = 15.00 + 300m/1.50m/sec. = 18.33 min.										
	26	28	7.00	0.70	13.62	13.62	18.33	2.08	20.41	71.00	967.00	Conc.	900	0.30	197.5	1034.0	1.58
	28	outlet	–	–	–	50.22	27.74	0.29	28.03	68.70	3450.00	Conc.	1500	0.25	34.8	3687.0	2.03



City Of Ottawa
Department Of Physical Environ[redacted]ent
Engineering And Surveys Branch

Revisions:

No	Date	Description	Drawn By	Appr'd By
1	87/03/30	REVISE AS PER R.M.O.C.	D.D.	
2	87/09/08	REVISE ASSALY AREAS	M.M.	

LICENSED PROFESSIONAL ENGINEER — ONTARIO

CUMMING – COCKBURN & ASSOCIATES LIMITED
CONSULTING MUNICIPAL ENGINEERS
WATERLOO – TORONTO – OTTAWA

Designed By J.I.M.	Date	Structural Check By	Date
Survey Detail By	Date	Checked By	Date
Drafting By	Date	Checked By	Date

Final Measurements :

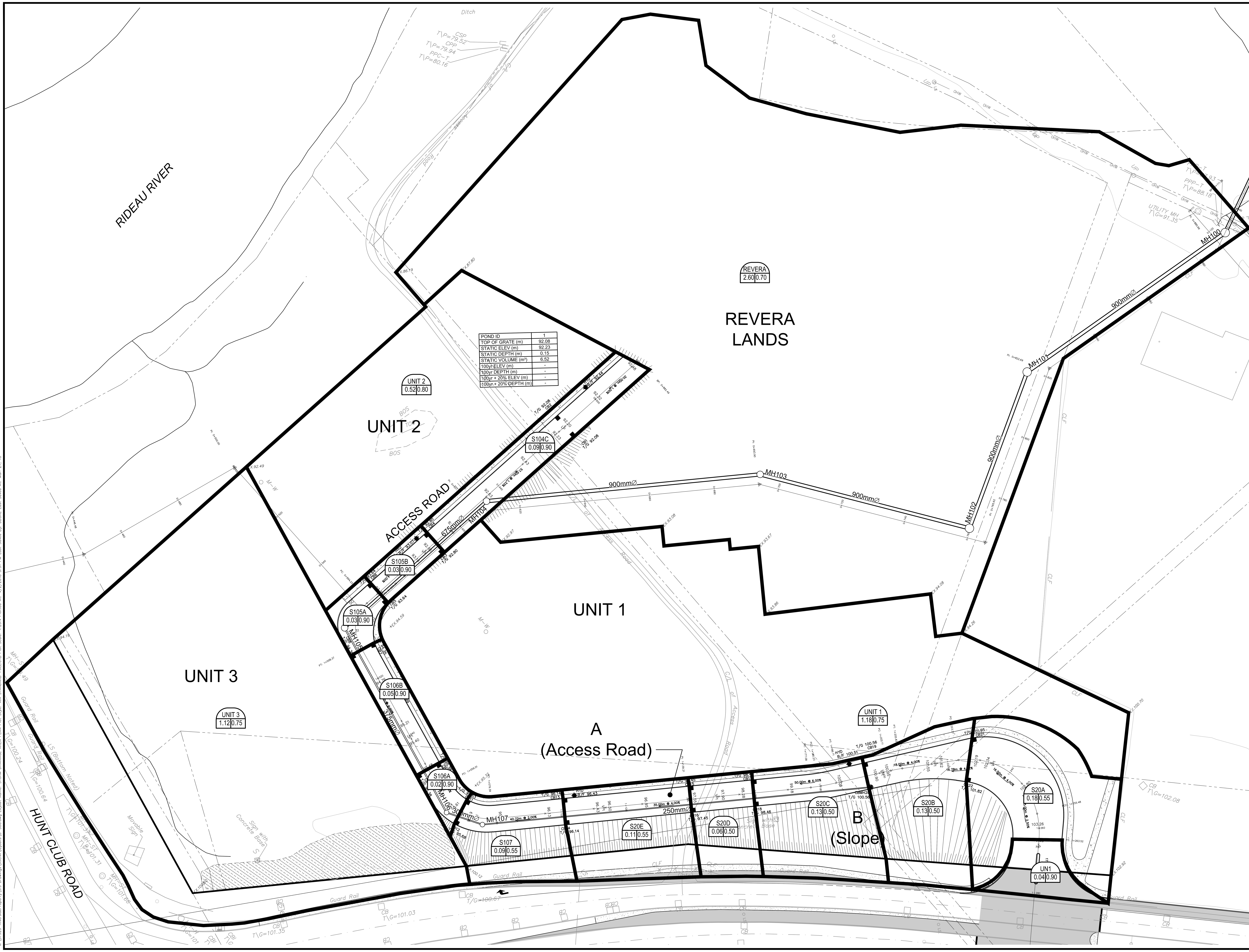
Construction Type	Inspector
Work Commenced	Instrumentman
Work Completed	Field Book #
Designer	Date
Drafting Revisions	Checked By

Design And Construction Divisio[redacted]

C. Sim P. Eng. — Commissioner
W.R. Cole [redacted] P. Eng. — Branch Director
Chief Design & Constr. Eng. — Senior Const. Co[redacted]

J. PEREZ CORPORATION – RIVERWALK P[redacted]RK
STORM
DRAINAGE AREA PLAN

Contract No	Survey Books	Scales	Plan No
3625		HOR. 1:750 VERT.	501 Sheet 1 of 1

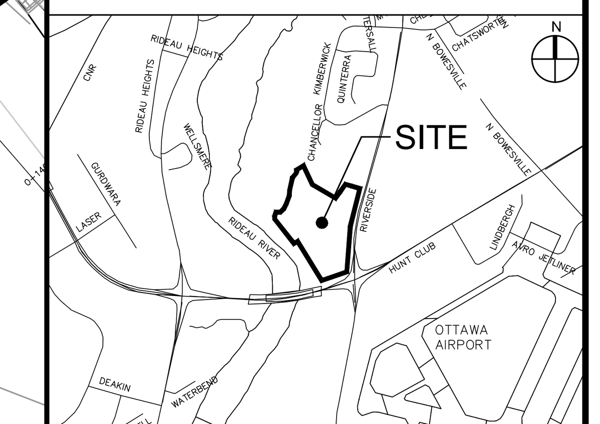


POND ID	1
TOP OF GRATE (m)	92.08
STATIC ELEV (m)	92.23
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	6.52
100yr ELEV (m)	-
100yr DEPTH (m)	-
100yr + 20% ELEV (m)	-
100yr + 20% DEPTH (m)	-

LEGEND :

S20E 0.11 0.55 — AREA NUMBER, RUN OFF COEFFICIENT, AREA IN HECTARES

— AREA BOUNDARY



No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2			
1	ISSUED FOR CITY APPROVAL	T.R.B.	2018:04:03

TAGGART REALTY MANAGEMENT

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title
RIVERSIDE PARK
3930 & 3960 RIVERSIDE DR.

LICENSED PROFESSIONAL ENGINEER
T. R. BRULE
18/03/28
PROVINCE OF ONTARIO

N

Drawing Title
STORM DRAINAGE AREA PLAN

Scale 1 : 500

Design	Date
J.E.B.	MARCH 2018
Drawn	Checked
D.D. / E.H.	T.R.B.
Project No.	Drawing No.
37923	C-500

CITY PLAN No.#####

CITY FILE No. #####

IBI

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

STORM SEWER DESIGN SHEET

Riverside Park
City of Ottawa
Taggart Realty Management

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW															SEWER DATA						
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.25	C= 0.40	C= 0.55	C= 0.60	C= 0.65	C= 0.70	C= 0.75	C= 0.80	C= 0.90	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (L/s)	AVAIL CAP (2yr) (%)
Access Road	S20A, S20B, S20C, S20D, S20E	CBMH20	MH107				0.29	0.32						0.98	0.98	10.00	0.75	10.75	76.81	104.19	122.14	178.56	75.05	101.81	119.35	174.48		75.05	135.92	120.00	250	4.80	2.682	60.87	44.78%
Access Road	S107	MH107	MH106				0.09							0.14	1.11	10.75	0.10	10.84	74.06	100.41	117.69	172.02	82.56	111.94	131.20	191.76		82.56	142.67	11.64	300	2.00	1.955	60.11	42.13%
Access Road	S106A, S106B	MH106	MH105										0.02	0.05	1.16	10.84	0.48	11.32	73.71	99.93	117.12	171.19	85.85	116.40	136.43	199.40		85.85	258.68	64.88	375	2.00	2.269	172.82	66.81%
													0.07																						
Unit 3	UNIT 3	Unit 3	MH105								1.12			2.34	2.34	10.00	0.00	10.00	76.81	104.19	122.14	178.56	179.36	243.31	285.23	416.97		179.36	297.43		450	1.00	1.812	118.08	39.70%
Access Road	105A, 105B, S104C	MH105	MH104										0.15	0.38	3.88	11.32	0.92	12.24	72.08	97.70	114.49	167.32	279.33	378.60	443.68	648.42		279.33	392.18	58.51	675	0.20	1.062	112.85	28.78%
Unit 2	UNIT 2	Unit 2	MH104									0.52		1.16	1.16	10.00	0.00	10.00	76.81	104.19	122.14	178.56	88.82	120.50	141.25	206.50		88.82	129.34		375	0.50	1.134	40.51	31.32%
Unit 1	UNIT 1	Unit 1	MH104								1.18			2.46	2.46	10.00	0.00	10.00	76.81	104.19	122.14	178.56	188.96	256.35	300.51	439.31		188.96	245.74		525	0.30	1.100	56.78	23.10%
Revera Block	REVERA	Revera	MH104							2.60				5.06	5.06	10.00	0.00	10.00	76.81	104.19	122.14	178.56	388.60	527.18	617.99	903.44		388.60	554.62		675	0.40	1.501	166.02	29.93%
Revera Lands		MH104	MH103											0.00	12.55	12.24	0.89	13.13	69.16	93.68	109.77	160.38	868.02	1,175.89	1,377.76	2,013.09		868.02	1,034.42	84.57	900	0.30	1.575	166.40	16.09%
Revera Lands		MH103	MH102											0.00	12.55	13.13	0.70	13.84	66.55	90.11	105.56	154.21	835.34	1,131.05	1,324.99	1,935.62		835.34	1,034.42	66.48	900	0.30	1.575	199.08	19.25%
Revera Lands		MH102	MH101											0.00	12.55	13.84	0.54	14.38	64.65	87.51	102.50	149.72	811.50	1,098.39	1,286.56	1,879.20		811.50	1,034.42	51.24	900	0.30	1.575	222.92	21.55%
Revera Lands		MH101	MH100											0.00	12.55	14.38	0.79	15.17	63.27	85.61	100.27	146.44	794.14	1,074.60	1,258.58	1,838.13		794.14	1,034.42	74.48	900	0.30	1.575	240.28	23.23%
STM Outlet		MH100	MH99											0.00	12.55	15.17	0.16	15.32	61.37	83.02	97.22	141.96	770.34	1,042.01	1,220.24	1,781.87		770.34	3,938.96	56.15	900	4.35	5.998	3168.62	80.44%
STM Outlet		MH99	MH98											0.00	12.55	15.32	1.46	16.78	61.01	82.52	96.64	141.11	765.81	1,035.81	1,212.95	1,771.18		765.81	1,045.56	118.68	975	0.20	1.357	279.75	26.76%
STM Outlet		MH98	EXMH3											0.00	12.55	16.78	0.88	17.66	57.86	78.21	91.56	133.67	726.21	981.65	1,149.27	1,677.74		726.21	1,045.56	71.78	975	0.20	1.357	319.35	30.54%

Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: JEB
Checked: TRB
Dwg. Reference: 37923-500

No.	Revision	
1.	1st City Submission	2018-03-28

File Reference: 37923.7.1
Date: 2018-03-28

```
*************************************************
*            D D S W M M (release 2.1)          *
*  The Dual Drainage Storm Water Management Model *
*                    Copyright                  *
*                    ---------                  *
*         AMK Associates International Ltd.     *
*************************************************
                                    August, 2004
             IBI Group
             Ottawa, Ontario
             (S/N DM00691207)
```

This release of DDSWMM will run with a maximum of

```
  500 minor system segments (pipes), including outlets
  500 major system (street) segments, including outlets
  500 subcatchments
   30 storage units for the minor system
   30 storage units for the major system
  300 computational time steps
  300 increments for rainfall hyetograph
   50 storm inlet types
   20 points describing the inlet capture curve
   50 major system segment types
    5 street segments discharging into a street junction
    5 pipes discharging into a pipe junction
    5 subcatchments discharging into a major system segment
    5 inlet groups discharging into a pipe
   30 unit area hydrographs
```

For other program constraints, please refer to the users manual

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

RUN CONTROL PARAMETERS

```
Measuring units                                    Metric


Time increment for calculation            10.00  minutes

Number of computational steps                19

Default limiting capacity of inlets    ********  l/s

Total simulation time                      3: 0  (hrs:mins)

Interval between printout                     1
```

Calculation for the minor system is not included in this simulation

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

```
         Example

         DUAL DRAINAGE SIMULATION


          RAINFALL DATA                                   Initial Julian Date
10015
                                                          Initial Time
0.00 hours

         Time      Rainfall                               Rainfall intensity
(mm/hr)
       (hr:min)    (mm/hr)
                                                   0.00E+00  0.15E+02  0.31E+02
0.46E+02  0.61E+02   0.77E+02

I---------I---------I---------I---------I----------I
          0: 0       0.00                          I*
                I
          0:10       2.82                          I**
                I
          0:20       3.50                          I***
                I
          0:30       4.69                          I****
                I
          0:40       7.30                          I*****
                I
          0:50      18.21                          I************
                I
          1: 0      76.81
I**************************************************I
          1:10      24.08                          I****************
                I
          1:20      12.36                          I*********
                I
          1:30       8.32                          I******
                I
          1:40       6.30                          I*****
                I
          1:50       5.09                          I****
                I
          2: 0       4.29                          I***
                I
          2:10       3.72                          I***
                I
          2:20       3.29                          I***
                I
          2:30       2.95                          I**
                I
          2:40       2.68                          I**
                I
          2:50       2.46                          I**
                I
          3: 0       2.28                          I**
                I

I---------I---------I---------I---------I----------I
                                                   0.00E+00  0.15E+02  0.31E+02
0.46E+02  0.61E+02   0.77E+02

     Rainfall duration   3:10 (hrs:mins.)
```

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
1	4.00	0.030	15.0	0.0130	0.009	0.030	0.0250	35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.00	0.58
3.50	0.02	1.17
5.25	0.07	1.75
7.00	0.16	2.33
8.75	0.28	2.92
10.50	0.46	3.50
12.25	0.69	4.00
14.00	0.98	4.00
15.75	1.33	4.25
17.50	1.72	4.83
19.25	2.16	5.42
21.00	2.67	6.00
22.75	3.23	6.58
24.50	3.85	7.17
26.25	4.54	7.75
28.00	5.30	8.33
29.75	6.12	8.92
31.50	7.01	9.50
33.25	7.97	10.08
35.00	9.01	10.67

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
2	4.00	0.030	15.0	0.0130	0.013	0.030	0.0250	35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.00	0.58
3.50	0.03	1.17
5.25	0.09	1.75
7.00	0.18	2.33
8.75	0.33	2.92
10.50	0.54	3.50
12.25	0.82	4.00
14.00	1.17	4.00
15.75	1.57	4.25
17.50	2.03	4.83
19.25	2.56	5.42
21.00	3.16	6.00
22.75	3.82	6.58
24.50	4.56	7.17
26.25	5.37	7.75
28.00	6.27	8.33
29.75	7.24	8.92
31.50	8.29	9.50
33.25	9.43	10.08
35.00	10.66	10.67

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement	Pavement	Height	Manning	Long.	Shoulder	Shoulder	Maximum

Flow Depth (cm)	Width (m)	Cross Slope (m/m)	of Curb (cm)	(n)	Slope (m/m)	Cross Slope (m/m)	Roughness (n)
3 35.0	4.00	0.030	15.0	0.0130	0.020	0.030	0.0250

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.01	0.58
3.50	0.04	1.17
5.25	0.11	1.75
7.00	0.23	2.33
8.75	0.41	2.92
10.50	0.67	3.50
12.25	1.01	4.00
14.00	1.43	4.00
15.75	1.92	4.25
17.50	2.49	4.83
19.25	3.14	5.42
21.00	3.87	6.00
22.75	4.69	6.58
24.50	5.59	7.17
26.25	6.59	7.75
28.00	7.68	8.33
29.75	8.88	8.92
31.50	10.17	9.50
33.25	11.57	10.08
35.00	13.07	10.67

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type Maximum Flow Depth (cm)	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)
4	4.00	0.030	15.0	0.0130	0.030	0.030	0.0250

35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.01	0.58
3.50	0.04	1.17
5.25	0.13	1.75
7.00	0.28	2.33
8.75	0.50	2.92
10.50	0.82	3.50
12.25	1.23	4.00
14.00	1.75	4.00
15.75	2.35	4.25
17.50	3.05	4.83
19.25	3.84	5.42
21.00	4.73	6.00
22.75	5.73	6.58
24.50	6.84	7.17
26.25	8.06	7.75
28.00	9.40	8.33
29.75	10.85	8.92
31.50	12.43	9.50
33.25	14.14	10.08
35.00	15.99	10.67

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
5	4.00	0.030	15.0	0.0130	0.040	0.030	0.0250	35.0

RATING CURVE

Depth Flow Spread

(cm)	(cms)	(m)
0.00	0.00	0.00
1.75	0.01	0.58
3.50	0.05	1.17
5.25	0.15	1.75
7.00	0.32	2.33
8.75	0.58	2.92
10.50	0.94	3.50
12.25	1.42	4.00
14.00	2.02	4.00
15.75	2.72	4.25
17.50	3.53	4.83
19.25	4.44	5.42
21.00	5.48	6.00
22.75	6.63	6.58
24.50	7.91	7.17
26.25	9.32	7.75
28.00	10.87	8.33
29.75	12.55	8.92
31.50	14.38	9.50
33.25	16.36	10.08
35.00	18.49	10.67

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
6	4.00	0.030	15.0	0.0130	0.060	0.030	0.0250	35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.01	0.58
3.50	0.06	1.17
5.25	0.18	1.75
7.00	0.39	2.33
8.75	0.71	2.92

10.50	1.16	3.50
12.25	1.74	4.00
14.00	2.47	4.00
15.75	3.33	4.25
17.50	4.32	4.83
19.25	5.44	5.42
21.00	6.71	6.00
22.75	8.12	6.58
24.50	9.69	7.17
26.25	11.42	7.75
28.00	13.31	8.33
29.75	15.37	8.92
31.50	17.61	9.50
33.25	20.04	10.08
35.00	22.65	10.67

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
7	4.00	0.030	15.0	0.0130	0.005	0.030	0.0250	35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.00	0.58
3.50	0.02	1.17
5.25	0.05	1.75
7.00	0.11	2.33
8.75	0.21	2.92
10.50	0.33	3.50
12.25	0.50	4.00
14.00	0.71	4.00
15.75	0.96	4.25
17.50	1.25	4.83
19.25	1.57	5.42
21.00	1.94	6.00
22.75	2.34	6.58

24.50	2.80	7.17
26.25	3.30	7.75
28.00	3.84	8.33
29.75	4.44	8.92
31.50	5.08	9.50
33.25	5.78	10.08
35.00	6.54	10.67

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
8	4.00	0.030	15.0	0.0130	0.000	0.030	0.0250	35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.00	0.58
3.50	0.00	1.17
5.25	0.01	1.75
7.00	0.02	2.33
8.75	0.03	2.92
10.50	0.05	3.50
12.25	0.07	4.00
14.00	0.10	4.00
15.75	0.14	4.25
17.50	0.18	4.83
19.25	0.22	5.42
21.00	0.27	6.00
22.75	0.33	6.58
24.50	0.40	7.17
26.25	0.47	7.75
28.00	0.54	8.33
29.75	0.63	8.92
31.50	0.72	9.50
33.25	0.82	10.08
35.00	0.92	10.67

♀

Example

DUAL DRAINAGE SIMULATION

STORM INLET DATA

1 Normal Inlet

Inlet Identification No. 1

No. of Points on Capture Curve 3

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
10.00	10.00
99999.00	99999.00

2 Normal Inlet

Inlet Identification No. 2

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
71.00	16.00
104.00	24.00
148.00	31.50
270.00	45.50
470.00	57.00
690.00	67.50
1000.00	67.50

3 Normal Inlet

Inlet Identification No. 3

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Inlet

Flow (l/s)	Flow (l/s)
0.00	0.00
78.00	17.50
111.00	24.50
161.00	32.00
296.00	45.00
510.00	57.00
780.00	66.50
1000.00	66.50

4 Normal Inlet

Inlet Identification No. 4

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
50.00	13.50
71.00	20.00
102.00	26.50
195.00	41.00
330.00	55.00
510.00	65.50
1000.00	65.50

5 Normal Inlet

Inlet Identification No. 5

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
36.00	10.00
52.00	15.50
74.00	20.50
135.00	34.50
230.00	50.00
350.00	62.00
1000.00	62.00

6 Normal Inlet

Inlet Identification No. 6

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
62.00	15.50
88.00	23.00
122.00	30.00
230.00	44.00
400.00	57.00
620.00	67.00
1000.00	67.00

7 Normal Inlet

Inlet Identification No. 7

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
36.00	10.00
52.00	15.50
74.00	20.50
135.00	34.50
230.00	50.00
350.00	62.00
1000.00	62.00

8 Storage Inlet

Inlet Identification No. 8

Maximum Storage 280.00 cu.m.

No. of Points on Storage-Capture Curve 3

Storage-Inlet Capture Relationship

Storage Volume (cu.m)	Inlet Flow (l/s)
0.00	0.00
0.01	107.99
280.00	108.00

9 Storage Inlet

Inlet Identification No. 9

Maximum Storage 125.00 cu.m.

No. of Points on Storage-Capture Curve 3

Storage-Inlet Capture Relationship

Storage Volume (cu.m)	Inlet Flow (l/s)
0.00	0.00
0.01	196.99
125.00	197.00

10 Storage Inlet

Inlet Identification No. 10

Maximum Storage 140.00 cu.m.

No. of Points on Storage-Capture Curve 3

Storage-Inlet Capture Relationship

Storage Volume (cu.m)	Inlet Flow (l/s)
0.00	0.00
0.01	49.99
140.00	50.00

11 Storage Inlet

Inlet Identification No. 11

Maximum Storage 6.52 cu.m.

No. of Points on Storage-Capture Curve 3

Storage-Inlet Capture Relationship

Storage Volume (cu.m)	Inlet Flow (l/s)
0.00	0.00
0.01	87.99
6.52	88.00

12 Storage Inlet

Inlet Identification No. 12

Maximum Storage 540.00 cu.m.

No. of Points on Storage-Capture Curve 3

Storage-Inlet Capture Relationship

Storage Volume (cu.m)	Inlet Flow (l/s)
0.00	0.00
0.01	251.99
540.00	252.00

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DATA

	Street Segment	D/S Segment	Length (m)	Type	No. of C.B.	Inlet Type		Limiting Inlet Capture (l/s)	Connecting Pipe/EXTRAN Inlet	Flow History (?)
1	S20A	S20B	38.0	5	2	2	*	6.00	CBMH20	YES
2	S20B	S20C	31.0	5	2	2	*	6.00	CBMH20	YES
3	S20C	S20D	34.0	6	2	3	*	6.00	CBMH20	YES
4	S20D	S20E	19.0	5	2	2	*	6.00	CBMH20	YES
5	S20E	S107	39.0	3	2	4	*	6.00	107	YES
6	S107	S106A	32.0	3	2	4	*	6.00	107	YES
7	S106A	S106B	18.0	1	2	5	*	6.00	106	YES
8	S106B	S105A	42.0	4	2	6	*	6.00	106	YES
9	UNIT3	OUT1	252.0	7	2	8	***	108.00	105	YES
10	S105A	S105B	24.0	5	2	1	*	12.50	105	YES
11	S105B	S104	23.0	2	2	7	*	6.00	105	YES
12	UNIT1	S104	266.0	7	2	9	***	197.00	104	YES
13	UNIT2	OUT2	117.0	7	2	10	***	50.00	104	YES
14	S104	D1	81.0	1	2	11	***	88.00	104	

```
YES
   15  D1           REVERA          26.0   8      0      1 *       0.00   PDUM
YES
   16  REVERA       OUT3           585.0   7      2     12 ***   252.00   104
YES
```

```
     *    Normal Inlet.
     **   Storage Inlet with linear relationship between Storage and Inlet Capture.
     ***  Storage Inlet with user-specified relationship between Storage and Inlet
Capture.
```

```
     Total Number of Street segments                16

     Total Length of Major System              1627.00     m

     Total Number of Inlet C.B.                     30

     Average Distance Between Inlets             108.47     m

            Outlets From Major System

                   Outlet I.D.

                   OUT1
                   OUT2
                   OUT3

          Total Number of Outlets from Major System =    3


          No. of Detention Structures     0
```

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

SUB-CATCHMENT/SURFACE RUNOFF DATA

Infiltration Parameters

```
Max. Infiltration Rate           76.20  mm/hr
Min. Infiltration Rate           13.20  mm/hr
Decay Rate                    0.001150  1/sec.
```

Unit Area Hydrograph (UAH) Data

No Unit Area Hydrograph Data

SUB-CATCHMENT DATA

No.	Subarea	Street Segment	Area (Ha.)	Imp. (%)	Manning (N) (Imp.)	Manning (N) (Perv.)	Slope (m/m)	Width (m)	Dep. Storage Imp. (mm)	Dep. Storage Perv. (mm)	Flow History (?)
1	AS20A	S20A	0.18	50.	0.0130	0.2500	0.020	20.	1.500	4.670	NO
2	AS20B	S20B	0.13	43.	0.0130	0.2500	0.020	25.	1.500	4.670	NO
3	AS20C	S20C	0.13	43.	0.0130	0.2500	0.020	20.	1.500	4.670	NO
4	AS20D	S20D	0.06	43.	0.0130	0.2500	0.020	20.	1.500	4.670	NO
5	AS20E	S20E	0.11	50.	0.0130	0.2500	0.020	15.	1.500	4.670	NO
6	AS107	S107	0.09	50.	0.0130	0.2500	0.020	15.	1.500	4.670	NO
7	AS106A	S106A	0.02	100.	0.0130	0.2500	0.020	5.	1.500	4.670	NO
8	AS106B	S106B	0.05	100.	0.0130	0.2500	0.020	5.	1.500	4.670	NO
9	AUNIT3	UNIT3	1.12	79.	0.0130	0.2500	0.020	126.	1.500	4.670	NO
10	AS105A	S105A	0.03	100.	0.0130	0.2500	0.020	6.	1.500	4.670	NO
11	AS105B	S105B	0.03	100.	0.0130	0.2500	0.020	5.	1.500	4.670	NO
12	AUNIT1	UNIT1	1.18	79.	0.0130	0.2500	0.020	133.	1.500	4.670	NO
13	AUNIT2	UNIT2	0.52	86.	0.0130	0.2500	0.020	58.	1.500	4.670	NO
14	AS104	S104	0.09	100.	0.0130	0.2500	0.020	5.	1.500	4.670	NO
15	AREVERA	REVERA	2.60	71.	0.0130	0.2500	0.020	292.	1.500	4.670	NO

*   Inflow Hydrograph Input Directly
** Inflow hydrograph Input in terms of flow per unit area

Total Drainage Area 6.34 Hectares

Number of Subcatchments 15

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

Simulation Details - Surface Runoff - 15 Subareas

count Subarea

1	AS20A
2	AS20B
3	AS20C
4	AS20D
5	AS20E
6	AS107
7	AS106A
8	AS106B
9	AUNIT3
10	AS105A
11	AS105B
12	AUNIT1
13	AUNIT2
14	AS104
15	AREVERA

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

Simulation Details - Major System - 19 Segments/Outlets

count	order	segment	time step (min.)	No. of time steps	Max. flow (cms)	Max. depth (cm)
1	1	S20A	0.56	323	0.01	2.03
2	2	S20B	0.42	427	0.02	2.30
3	3	S20C	0.38	477	0.03	2.30
4	4	S20D	0.25	726	0.02	2.44
5	5	S20E	0.62	293	0.03	3.06
6	6	S107	0.51	355	0.03	3.04
7	7	S106A	0.38	472	0.02	3.41
8	8	S106B	0.61	293	0.02	2.56
9	10	S105A	0.32	560	0.02	2.35
10	12	UNIT1	4.57	40	0.14	7.55
11	11	S105B	0.64	281	0.00	1.76
12	14	S104	2.01	89	0.02	2.74
13	15	D1	2.01	89	0.00	0.00
14	16	REVERA	8.41	22	0.29	9.86
15	13	UNIT2	2.44	74	0.07	5.66
16	9	UNIT3	4.38	41	0.13	7.41

17	19	OUT3	0.00
18	18	OUT2	0.00
19	17	OUT1	0.00

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

EXTRAN Interface File Information
=================================

Inlet flows are stored at the following 6 inlets (EXTRAN nodes):

CBMH20 107 106 105 104 PDUM

DDSWMM-EXTRAN Connectivity

EXTRAN Inlet	DDSWMM Inlets (Major System Segments)			
CBMH20	S20A	S20B	S20C	S20D
107	S20E	S107		
106	S106A	S106B		
105	UNIT3	S105A	S105B	
104	UNIT1	UNIT2	S104	REVERA
PDUM	D1			

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S20A

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.001	0.001	0.000	0.000	0.2	0.00
0:50	0.000	0.003	0.003	0.001	0.002	0.7	0.00

1: 0	0.000	0.015	0.015	0.003	0.011	2.0	0.00
1:10	0.000	0.012	0.012	0.003	0.009	1.9	0.00
1:20	0.000	0.002	0.002	0.001	0.003	0.5	0.00
1:30	0.000	0.003	0.003	0.001	0.002	0.6	0.00
1:40	0.000	0.002	0.002	0.000	0.002	0.4	0.00
1:50	0.000	0.001	0.001	0.000	0.001	0.3	0.00
2: 0	0.000	0.001	0.001	0.000	0.001	0.3	0.00
2:10	0.000	0.001	0.001	0.000	0.001	0.2	0.00
2:20	0.000	0.001	0.001	0.000	0.001	0.2	0.00
2:30	0.000	0.001	0.001	0.000	0.001	0.2	0.00
2:40	0.000	0.001	0.001	0.000	0.001	0.2	0.00
2:50	0.000	0.001	0.001	0.000	0.001	0.1	0.00
3: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
Maximum	0.000		0.015	0.003	0.011	2.0	0.00
Time (h:min)	0: 0		1: 0	1: 1	1: 1		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S20B

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.001	0.001	0.000	0.000	0.2	0.00
0:50	0.002	0.002	0.005	0.001	0.003	1.0	0.00
1: 0	0.011	0.010	0.021	0.005	0.016	2.3	0.00
1:10	0.009	0.007	0.016	0.004	0.012	2.1	0.00
1:20	0.003	0.001	0.004	0.001	0.004	0.9	0.00
1:30	0.002	0.002	0.004	0.001	0.003	0.8	0.00
1:40	0.002	0.001	0.002	0.001	0.002	0.5	0.00
1:50	0.001	0.001	0.002	0.000	0.002	0.5	0.00
2: 0	0.001	0.001	0.002	0.000	0.001	0.4	0.00
2:10	0.001	0.001	0.001	0.000	0.001	0.3	0.00
2:20	0.001	0.001	0.001	0.000	0.001	0.3	0.00
2:30	0.001	0.000	0.001	0.000	0.001	0.3	0.00
2:40	0.001	0.000	0.001	0.000	0.001	0.2	0.00
2:50	0.001	0.000	0.001	0.000	0.001	0.2	0.00
3: 0	0.000	0.000	0.000	0.000	0.001	0.1	0.00
Maximum	0.011		0.021	0.005	0.017	2.3	0.00
Time (h:min)	1: 1		1: 1	1: 1	1: 1		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)

IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S20C

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.001	0.001	0.000	0.000	0.2	0.00
0:50	0.003	0.002	0.006	0.001	0.004	1.0	0.00
1: 0	0.016	0.010	0.026	0.006	0.019	2.3	0.00
1:10	0.012	0.007	0.019	0.004	0.015	2.1	0.00
1:20	0.004	0.001	0.005	0.001	0.005	0.9	0.00
1:30	0.003	0.002	0.005	0.001	0.004	0.8	0.00
1:40	0.002	0.001	0.003	0.001	0.003	0.6	0.00
1:50	0.002	0.001	0.003	0.001	0.002	0.5	0.00
2: 0	0.001	0.001	0.002	0.000	0.002	0.4	0.00
2:10	0.001	0.001	0.002	0.000	0.001	0.3	0.00
2:20	0.001	0.001	0.002	0.000	0.001	0.3	0.00
2:30	0.001	0.000	0.001	0.000	0.001	0.3	0.00
2:40	0.001	0.000	0.001	0.000	0.001	0.2	0.00
2:50	0.001	0.000	0.001	0.000	0.001	0.2	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.1	0.00
Maximum	0.017		0.026	0.006	0.020	2.3	0.00
Time (h:min)	1: 1		1: 1	1: 1	1: 1		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S20D

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)

0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.000	0.001	0.000	0.000	0.2	0.00
0:50	0.004	0.001	0.005	0.001	0.004	1.1	0.00
1: 0	0.019	0.005	0.024	0.005	0.018	2.4	0.00
1:10	0.015	0.003	0.018	0.004	0.014	2.2	0.00
1:20	0.005	0.000	0.005	0.001	0.004	1.1	0.00
1:30	0.004	0.001	0.004	0.001	0.003	1.0	0.00
1:40	0.003	0.000	0.003	0.001	0.002	0.6	0.00
1:50	0.002	0.000	0.002	0.001	0.002	0.5	0.00
2: 0	0.002	0.000	0.002	0.000	0.002	0.4	0.00
2:10	0.001	0.000	0.002	0.000	0.001	0.4	0.00
2:20	0.001	0.000	0.002	0.000	0.001	0.3	0.00
2:30	0.001	0.000	0.001	0.000	0.001	0.3	0.00
2:40	0.001	0.000	0.001	0.000	0.001	0.3	0.00
2:50	0.001	0.000	0.001	0.000	0.001	0.2	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.2	0.00
Maximum	0.020		0.025	0.006	0.019	2.4	0.00
Time (h:min)	1: 1		1: 1	1: 2	1: 2		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S20E

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.001	0.001	0.000	0.000	0.3	0.00
0:50	0.004	0.002	0.006	0.001	0.004	1.8	0.00
1: 0	0.018	0.009	0.028	0.007	0.019	3.0	0.00
1:10	0.014	0.007	0.021	0.006	0.016	2.6	0.00
1:20	0.004	0.001	0.006	0.002	0.005	1.8	0.00
1:30	0.003	0.002	0.005	0.001	0.004	1.6	0.00
1:40	0.002	0.001	0.003	0.001	0.003	1.1	0.00
1:50	0.002	0.001	0.003	0.001	0.002	0.9	0.00
2: 0	0.002	0.001	0.002	0.001	0.002	0.7	0.00
2:10	0.001	0.001	0.002	0.001	0.001	0.6	0.00
2:20	0.001	0.001	0.002	0.000	0.001	0.5	0.00
2:30	0.001	0.000	0.002	0.000	0.001	0.5	0.00
2:40	0.001	0.000	0.001	0.000	0.001	0.4	0.00
2:50	0.001	0.000	0.001	0.000	0.001	0.4	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.2	0.00

Maximum	0.019		0.028	0.008	0.021	3.1	0.00
Time (h:min)	1: 2		1: 2	1: 2	1: 2		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S107

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.001	0.001	0.000	0.000	0.2	0.00
0:50	0.004	0.002	0.006	0.001	0.004	1.8	0.00
1: 0	0.019	0.008	0.027	0.007	0.019	3.0	0.00
1:10	0.016	0.006	0.021	0.006	0.016	2.7	0.00
1:20	0.005	0.001	0.006	0.002	0.005	1.8	0.00
1:30	0.004	0.001	0.005	0.001	0.004	1.6	0.00
1:40	0.003	0.001	0.003	0.001	0.003	1.1	0.00
1:50	0.002	0.001	0.003	0.001	0.002	0.9	0.00
2: 0	0.002	0.001	0.002	0.001	0.002	0.7	0.00
2:10	0.001	0.000	0.002	0.001	0.002	0.6	0.00
2:20	0.001	0.000	0.002	0.000	0.001	0.5	0.00
2:30	0.001	0.000	0.002	0.000	0.001	0.5	0.00
2:40	0.001	0.000	0.001	0.000	0.001	0.4	0.00
2:50	0.001	0.000	0.001	0.000	0.001	0.4	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.2	0.00
Maximum	0.021		0.028	0.008	0.020	3.0	0.00
Time (h:min)	1: 2		1: 2	1: 3	1: 3		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S106A

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.000	0.000	0.000	0.000	0.2	0.00
0:50	0.004	0.001	0.005	0.001	0.003	1.8	0.00
1: 0	0.019	0.003	0.022	0.006	0.016	3.3	0.00
1:10	0.016	0.003	0.018	0.005	0.013	3.0	0.00
1:20	0.005	0.001	0.006	0.002	0.005	1.9	0.00
1:30	0.004	0.001	0.004	0.001	0.003	1.8	0.00
1:40	0.003	0.000	0.003	0.001	0.002	1.4	0.00
1:50	0.002	0.000	0.002	0.001	0.002	1.1	0.00
2: 0	0.002	0.000	0.002	0.001	0.001	0.9	0.00
2:10	0.002	0.000	0.002	0.000	0.001	0.8	0.00
2:20	0.001	0.000	0.002	0.000	0.001	0.7	0.00
2:30	0.001	0.000	0.001	0.000	0.001	0.6	0.00
2:40	0.001	0.000	0.001	0.000	0.001	0.5	0.00
2:50	0.001	0.000	0.001	0.000	0.001	0.5	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.3	0.00
Maximum	0.020		0.023	0.007	0.017	3.4	0.00
Time (h:min)	1: 3		1: 3	1: 3	1: 3		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S106B

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.000	0.000	0.000	0.000	0.1	0.00
0:50	0.003	0.001	0.005	0.001	0.003	1.2	0.00
1: 0	0.016	0.007	0.023	0.005	0.016	2.5	0.00
1:10	0.013	0.007	0.021	0.005	0.016	2.4	0.00
1:20	0.005	0.002	0.007	0.002	0.006	1.7	0.00
1:30	0.003	0.001	0.005	0.001	0.004	1.2	0.00
1:40	0.002	0.001	0.003	0.001	0.003	0.9	0.00
1:50	0.002	0.001	0.003	0.001	0.002	0.7	0.00
2: 0	0.001	0.001	0.002	0.001	0.002	0.6	0.00

2:10	0.001	0.001	0.002	0.000	0.001	0.5	0.00
2:20	0.001	0.001	0.002	0.000	0.001	0.4	0.00
2:30	0.001	0.000	0.001	0.000	0.001	0.4	0.00
2:40	0.001	0.000	0.001	0.000	0.001	0.3	0.00
2:50	0.001	0.000	0.001	0.000	0.001	0.3	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.2	0.00
Maximum	0.017		0.024	0.006	0.018	2.6	0.00
Time (h:min)	1: 3		1: 3	1: 4	1: 4		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment UNIT3

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.007	0.007	0.000	0.000	2.3	0.00
0:50	0.000	0.029	0.029	0.010	0.000	4.1	0.00
1: 0	0.000	0.135	0.135	0.080	0.000	7.4	0.01
1:10	0.000	0.121	0.121	0.108	0.000	7.1	10.66
1:20	0.000	0.030	0.030	0.108	0.000	4.1	6.74
1:30	0.000	0.025	0.025	0.021	0.000	3.9	0.00
1:40	0.000	0.018	0.018	0.033	0.000	3.5	0.00
1:50	0.000	0.014	0.014	0.008	0.000	3.1	0.00
2: 0	0.000	0.012	0.012	0.024	0.000	2.8	0.00
2:10	0.000	0.010	0.010	0.002	0.000	2.6	0.00
2:20	0.000	0.009	0.009	0.020	0.000	2.5	0.00
2:30	0.000	0.008	0.008	-0.001	0.000	2.3	0.00
2:40	0.000	0.007	0.007	0.017	0.000	2.3	0.00
2:50	0.000	0.007	0.007	-0.002	0.000	2.2	0.00
3: 0	0.000	0.000	0.000	0.017	0.000	0.0	0.00
Maximum	0.000		0.135	0.108	0.000	7.4	10.66
Time (h:min)	0: 0		1: 0	1:10	3: 0		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S105A

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.000	0.000	0.000	0.000	0.1	0.00
0:50	0.003	0.001	0.004	0.004	0.000	0.9	0.00
1: 0	0.016	0.005	0.021	0.020	0.000	2.3	0.00
1:10	0.016	0.004	0.020	0.020	0.000	2.2	0.00
1:20	0.006	0.001	0.007	0.007	0.000	1.5	0.00
1:30	0.004	0.001	0.005	0.005	0.000	1.0	0.00
1:40	0.003	0.001	0.003	0.003	0.000	0.7	0.00
1:50	0.002	0.000	0.003	0.003	0.000	0.6	0.00
2: 0	0.002	0.000	0.002	0.002	0.000	0.5	0.00
2:10	0.001	0.000	0.002	0.002	0.000	0.4	0.00
2:20	0.001	0.000	0.002	0.002	0.000	0.3	0.00
2:30	0.001	0.000	0.001	0.001	0.000	0.3	0.00
2:40	0.001	0.000	0.001	0.001	0.000	0.3	0.00
2:50	0.001	0.000	0.001	0.001	0.000	0.3	0.00
3: 0	0.001	0.000	0.001	0.001	0.000	0.2	0.00
Maximum	0.018		0.022	0.022	0.000	2.3	0.00
Time (h:min)	1: 4		1: 4	1: 4	1: 4		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S105B

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.000	0.000	0.000	0.000	0.1	0.00
0:50	0.000	0.001	0.001	0.000	0.001	0.4	0.00
1: 0	0.000	0.005	0.005	0.001	0.003	1.8	0.00

1:10	0.000	0.004	0.004	0.001	0.003	1.5	0.00
1:20	0.000	0.001	0.001	0.000	0.001	0.4	0.00
1:30	0.000	0.001	0.001	0.000	0.001	0.3	0.00
1:40	0.000	0.001	0.001	0.000	0.001	0.2	0.00
1:50	0.000	0.000	0.000	0.000	0.000	0.2	0.00
2: 0	0.000	0.000	0.000	0.000	0.000	0.2	0.00
2:10	0.000	0.000	0.000	0.000	0.000	0.1	0.00
2:20	0.000	0.000	0.000	0.000	0.000	0.1	0.00
2:30	0.000	0.000	0.000	0.000	0.000	0.1	0.00
2:40	0.000	0.000	0.000	0.000	0.000	0.1	0.00
2:50	0.000	0.000	0.000	0.000	0.000	0.1	0.00
3: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
Maximum	0.000		0.005	0.001	0.003	1.8	0.00
Time (h:min)	2:20		1: 0	1: 1	1: 1		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment UNIT1

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.008	0.008	0.000	0.000	2.3	0.00
0:50	0.000	0.031	0.031	0.009	0.000	4.2	0.00
1: 0	0.000	0.142	0.142	0.081	0.000	7.5	0.00
1:10	0.000	0.127	0.127	0.134	0.000	7.3	0.01
1:20	0.000	0.032	0.032	0.082	0.000	4.2	0.00
1:30	0.000	0.027	0.027	0.032	0.000	3.9	0.00
1:40	0.000	0.019	0.019	0.025	0.000	3.6	0.00
1:50	0.000	0.015	0.015	0.018	0.000	3.2	0.00
2: 0	0.000	0.013	0.013	0.015	0.000	2.9	0.00
2:10	0.000	0.011	0.011	0.012	0.000	2.7	0.00
2:20	0.000	0.009	0.009	0.011	0.000	2.5	0.00
2:30	0.000	0.008	0.008	0.009	0.000	2.4	0.00
2:40	0.000	0.008	0.008	0.008	0.000	2.3	0.00
2:50	0.000	0.007	0.007	0.008	0.000	2.2	0.00
3: 0	0.000	0.000	0.000	0.008	0.000	0.0	0.00
Maximum	0.000		0.142	0.140	0.000	7.5	0.01
Time (h:min)	0: 0		1: 0	1: 5	3: 0		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment UNIT2

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.004	0.004	0.001	0.000	1.8	0.00
0:50	0.000	0.014	0.014	0.010	0.000	3.1	0.00
1: 0	0.000	0.067	0.067	0.050	0.000	5.7	0.93
1:10	0.000	0.062	0.062	0.050	0.000	5.5	8.97
1:20	0.000	0.016	0.016	0.050	0.000	3.3	6.72
1:30	0.000	0.013	0.013	0.016	0.000	2.9	0.00
1:40	0.000	0.009	0.009	0.009	0.000	2.5	0.00
1:50	0.000	0.007	0.007	0.010	0.000	2.3	0.00
2: 0	0.000	0.006	0.006	0.005	0.000	2.1	0.00
2:10	0.000	0.005	0.005	0.008	0.000	2.0	0.00
2:20	0.000	0.005	0.005	0.003	0.000	2.0	0.00
2:30	0.000	0.004	0.004	0.006	0.000	1.9	0.00
2:40	0.000	0.004	0.004	0.002	0.000	1.8	0.00
2:50	0.000	0.003	0.003	0.006	0.000	1.8	0.00
3: 0	0.000	0.000	0.000	0.001	0.000	0.0	0.00
Maximum	0.000		0.067	0.050	0.000	5.7	8.97
Time (h:min)	0: 0		1: 0	1:10	3: 0		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S104

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00

0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.000	0.000	0.000	0.000	0.2	0.00
0:50	0.001	0.002	0.002	0.001	0.000	1.1	0.00
1: 0	0.003	0.011	0.014	0.011	0.000	2.6	0.00
1:10	0.003	0.013	0.016	0.015	0.000	2.7	0.00
1:20	0.001	0.005	0.006	0.008	0.000	1.9	0.00
1:30	0.001	0.003	0.004	0.004	0.000	1.7	0.00
1:40	0.001	0.002	0.003	0.003	0.000	1.2	0.00
1:50	0.000	0.002	0.002	0.002	0.000	0.9	0.00
2: 0	0.000	0.001	0.002	0.002	0.000	0.8	0.00
2:10	0.000	0.001	0.001	0.002	0.000	0.6	0.00
2:20	0.000	0.001	0.001	0.001	0.000	0.6	0.00
2:30	0.000	0.001	0.001	0.001	0.000	0.5	0.00
2:40	0.000	0.001	0.001	0.001	0.000	0.4	0.00
2:50	0.000	0.001	0.001	0.001	0.000	0.4	0.00
3: 0	0.000	0.000	0.000	0.001	0.000	0.1	0.00
Maximum	0.003		0.016	0.016	0.000	2.7	0.00
Time (h:min)	1: 1		1:10	1:12	3: 0		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment D1

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:50	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1:40	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1:50	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2:40	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2:50	0.000	0.000	0.000	0.000	0.000	0.0	0.00
3: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00

Maximum	0.000		0.000	0.000	0.000	0.0	0.00
Time (h:min)	3: 0		3: 0	0: 0	0: 0		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment REVERA

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.016	0.016	0.000	0.000	3.3	0.00
0:50	0.000	0.063	0.063	0.000	0.000	5.6	0.00
1: 0	0.000	0.287	0.287	0.025	0.000	9.9	0.00
1:10	0.000	0.249	0.249	0.252	0.000	9.4	4.32
1:20	0.000	0.060	0.060	0.241	0.000	5.5	0.01
1:30	0.000	0.053	0.053	0.076	0.000	5.3	0.00
1:40	0.000	0.038	0.038	0.085	0.000	4.5	0.00
1:50	0.000	0.030	0.030	0.017	0.000	4.1	0.00
2: 0	0.000	0.025	0.025	0.060	0.000	3.8	0.00
2:10	0.000	0.021	0.021	0.002	0.000	3.7	0.00
2:20	0.000	0.018	0.018	0.049	0.000	3.5	0.00
2:30	0.000	0.016	0.016	-0.006	0.000	3.3	0.00
2:40	0.000	0.015	0.015	0.044	0.000	3.2	0.00
2:50	0.000	0.014	0.014	-0.010	0.000	3.0	0.00
3: 0	0.000	0.000	0.000	0.046	0.000	0.0	0.00
Maximum	0.000		0.287	0.252	0.000	9.9	4.32
Time (h:min)	0: 0		1: 0	1:10	3: 0		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM

SUMMARY OF SIMULATION RESULTS

No.	Segment	Peak	Peak	Max.	Max.	Inlet	D/S	Max.
		Flow	Time	Depth	Capture	Restriction	Pipe	

Storage		(cms)	(hr:min.)	(cm)	(l/s)	(?)	
(cu.m.)							
0.00	1 S20A	0.015	1: 0	2.03	3.34	NO	CBMH20
0.00	2 S20B	0.021	1: 1	2.30	4.80	NO	CBMH20
0.00	3 S20C	0.026	1: 1	2.30	5.83	NO	CBMH20
0.00	4 S20D	0.025	1: 1	2.44	5.58	NO	CBMH20
0.00	5 S20E	0.028	1: 2	3.06	7.59	NO	107
0.00	6 S107	0.028	1: 2	3.04	7.51	NO	107
0.00	7 S106A	0.023	1: 3	3.41	6.51	NO	106
0.00	8 S106B	0.024	1: 3	2.56	5.98	NO	106
10.66	9 UNIT3	0.135	1: 0	7.41	107.99	N/A	105
0.00	10 S105A	0.022	1: 4	2.35	22.46	NO	105
0.00	11 S105B	0.005	1: 0	1.76	1.31	NO	105
0.01	12 UNIT1	0.142	1: 0	7.55	139.84	N/A	104
8.97	13 UNIT2	0.067	1: 0	5.66	49.99	N/A	104
0.00	14 S104	0.016	1:10	2.74	15.57	N/A	104
0.00	15 D1	0.000	3: 0	0.00	0.00	-	PDUM
4.32	16 REVERA	0.287	1: 0	9.86	251.99	N/A	104

*** SIMULATION ENDED NORMALLY ***
♀

```
*************************************************************
*                                                           *
*    Simulation Starting Date      March     29, 18         *
*                        Time      13:25:50.85              *
*                                                           *
*    Simulation Ending   Date      March     29, 18         *
*                        Time      13:25:53.69              *
*                                                           *
*    Duration of Simulation          0.05 Minutes           *
*                                                           *
*************************************************************
```

Data Files

Input Data File Name   37923-3CHI2.DAT

Ouput File Name   37923-3CHI2.OUT

EXTRAN Interface (ASCII) File Name   37923-3CHI2.TXT

```
*****************************************************
*             D D S W M M (release 2.1)             *
*  The Dual Drainage Storm Water Management Model  *
*                     Copyright                     *
*                     ---------                     *
*         AMK Associates International Ltd.        *
*****************************************************
                                      August, 2004
             IBI Group
             Ottawa, Ontario
             (S/N DM00691207)
```

This release of DDSWMM will run with a maximum of

```
  500 minor system segments (pipes), including outlets
  500 major system (street) segments, including outlets
  500 subcatchments
   30 storage units for the minor system
   30 storage units for the major system
  300 computational time steps
  300 increments for rainfall hyetograph
   50 storm inlet types
   20 points describing the inlet capture curve
   50 major system segment types
    5 street segments discharging into a street junction
    5 pipes discharging into a pipe junction
    5 subcatchments discharging into a major system segment
    5 inlet groups discharging into a pipe
   30 unit area hydrographs
```

For other program constraints, please refer to the users manual

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

RUN CONTROL PARAMETERS

```
Measuring units                                  Metric

Time increment for calculation           10.00  minutes

Number of computational steps               19

Default limiting capacity of inlets   ********  l/s

Total simulation time                     3: 0  (hrs:mins)

Interval between printout                    1
```

Calculation for the minor system is not included in this simulation

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

```
         Example

         DUAL DRAINAGE SIMULATION


           RAINFALL DATA                                   Initial Julian Date
10015
                                                           Initial Time
0.00 hours
         Time      Rainfall                                Rainfall intensity
(mm/hr)
       (hr:min)    (mm/hr)
                                                    0.00E+00  0.36E+02  0.71E+02
0.11E+03  0.14E+03   0.18E+03
I---------I---------I---------I---------I----------I
          0: 0       0.00                           I*
                I
          0:10       6.05                           I**
                I
          0:20       7.54                           I***
                I
          0:30      10.16                           I***
                I
          0:40      15.97                           I*****
                I
          0:50      40.65                           I************
                I
          1: 0     178.56
I**************************************************I
          1:10      54.05                           I****************
                I
          1:20      27.32                           I********
                I
          1:30      18.24                           I******
                I
          1:40      13.74                           I****
                I
          1:50      11.06                           I****
                I
          2: 0       9.28                           I***
                I
          2:10       8.02                           I***
                I
          2:20       7.08                           I**
                I
          2:30       6.35                           I**
                I
          2:40       5.76                           I**
                I
          2:50       5.28                           I**
                I
          3: 0       4.88                           I**
                I

I---------I---------I---------I---------I----------I
                                                    0.00E+00  0.36E+02  0.71E+02
0.11E+03  0.14E+03   0.18E+03


     Rainfall duration   3:10 (hrs:mins.)
```

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
1	4.00	0.030	15.0	0.0130	0.009	0.030	0.0250	35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.00	0.58
3.50	0.02	1.17
5.25	0.07	1.75
7.00	0.16	2.33
8.75	0.28	2.92
10.50	0.46	3.50
12.25	0.69	4.00
14.00	0.98	4.00
15.75	1.33	4.25
17.50	1.72	4.83
19.25	2.16	5.42
21.00	2.67	6.00
22.75	3.23	6.58
24.50	3.85	7.17
26.25	4.54	7.75
28.00	5.30	8.33
29.75	6.12	8.92
31.50	7.01	9.50
33.25	7.97	10.08
35.00	9.01	10.67

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
2	4.00	0.030	15.0	0.0130	0.013	0.030	0.0250	35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.00	0.58
3.50	0.03	1.17
5.25	0.09	1.75
7.00	0.18	2.33
8.75	0.33	2.92
10.50	0.54	3.50
12.25	0.82	4.00
14.00	1.17	4.00
15.75	1.57	4.25
17.50	2.03	4.83
19.25	2.56	5.42
21.00	3.16	6.00
22.75	3.82	6.58
24.50	4.56	7.17
26.25	5.37	7.75
28.00	6.27	8.33
29.75	7.24	8.92
31.50	8.29	9.50
33.25	9.43	10.08
35.00	10.66	10.67

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement	Pavement	Height	Manning	Long.	Shoulder	Shoulder	Maximum

Maximum Flow Depth (cm)	Width (m)	Cross Slope (m/m)	of Curb (cm)	(n)	Slope (m/m)	Cross Slope (m/m)	Roughness (n)
3 35.0	4.00	0.030	15.0	0.0130	0.020	0.030	0.0250

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.01	0.58
3.50	0.04	1.17
5.25	0.11	1.75
7.00	0.23	2.33
8.75	0.41	2.92
10.50	0.67	3.50
12.25	1.01	4.00
14.00	1.43	4.00
15.75	1.92	4.25
17.50	2.49	4.83
19.25	3.14	5.42
21.00	3.87	6.00
22.75	4.69	6.58
24.50	5.59	7.17
26.25	6.59	7.75
28.00	7.68	8.33
29.75	8.88	8.92
31.50	10.17	9.50
33.25	11.57	10.08
35.00	13.07	10.67

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type Maximum Flow Depth (cm)	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)
4	4.00	0.030	15.0	0.0130	0.030	0.030	0.0250

35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.01	0.58
3.50	0.04	1.17
5.25	0.13	1.75
7.00	0.28	2.33
8.75	0.50	2.92
10.50	0.82	3.50
12.25	1.23	4.00
14.00	1.75	4.00
15.75	2.35	4.25
17.50	3.05	4.83
19.25	3.84	5.42
21.00	4.73	6.00
22.75	5.73	6.58
24.50	6.84	7.17
26.25	8.06	7.75
28.00	9.40	8.33
29.75	10.85	8.92
31.50	12.43	9.50
33.25	14.14	10.08
35.00	15.99	10.67

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
5	4.00	0.030	15.0	0.0130	0.040	0.030	0.0250	35.0

RATING CURVE

Depth Flow Spread

(cm)	(cms)	(m)
0.00	0.00	0.00
1.75	0.01	0.58
3.50	0.05	1.17
5.25	0.15	1.75
7.00	0.32	2.33
8.75	0.58	2.92
10.50	0.94	3.50
12.25	1.42	4.00
14.00	2.02	4.00
15.75	2.72	4.25
17.50	3.53	4.83
19.25	4.44	5.42
21.00	5.48	6.00
22.75	6.63	6.58
24.50	7.91	7.17
26.25	9.32	7.75
28.00	10.87	8.33
29.75	12.55	8.92
31.50	14.38	9.50
33.25	16.36	10.08
35.00	18.49	10.67

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
6	4.00	0.030	15.0	0.0130	0.060	0.030	0.0250	35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.01	0.58
3.50	0.06	1.17
5.25	0.18	1.75
7.00	0.39	2.33
8.75	0.71	2.92

10.50	1.16	3.50
12.25	1.74	4.00
14.00	2.47	4.00
15.75	3.33	4.25
17.50	4.32	4.83
19.25	5.44	5.42
21.00	6.71	6.00
22.75	8.12	6.58
24.50	9.69	7.17
26.25	11.42	7.75
28.00	13.31	8.33
29.75	15.37	8.92
31.50	17.61	9.50
33.25	20.04	10.08
35.00	22.65	10.67

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
7	4.00	0.030	15.0	0.0130	0.005	0.030	0.0250	35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.00	0.58
3.50	0.02	1.17
5.25	0.05	1.75
7.00	0.11	2.33
8.75	0.21	2.92
10.50	0.33	3.50
12.25	0.50	4.00
14.00	0.71	4.00
15.75	0.96	4.25
17.50	1.25	4.83
19.25	1.57	5.42
21.00	1.94	6.00
22.75	2.34	6.58

24.50	2.80	7.17
26.25	3.30	7.75
28.00	3.84	8.33
29.75	4.44	8.92
31.50	5.08	9.50
33.25	5.78	10.08
35.00	6.54	10.67

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM RATING CURVE

Type	Pavement Width (m)	Pavement Cross Slope (m/m)	Height of Curb (cm)	Manning (n)	Long. Slope (m/m)	Shoulder Cross Slope (m/m)	Shoulder Roughness (n)	Maximum Flow Depth (cm)
8	4.00	0.030	15.0	0.0130	0.000	0.030	0.0250	35.0

RATING CURVE

Depth (cm)	Flow (cms)	Spread (m)
0.00	0.00	0.00
1.75	0.00	0.58
3.50	0.00	1.17
5.25	0.01	1.75
7.00	0.02	2.33
8.75	0.03	2.92
10.50	0.05	3.50
12.25	0.07	4.00
14.00	0.10	4.00
15.75	0.14	4.25
17.50	0.18	4.83
19.25	0.22	5.42
21.00	0.27	6.00
22.75	0.33	6.58
24.50	0.40	7.17
26.25	0.47	7.75
28.00	0.54	8.33
29.75	0.63	8.92
31.50	0.72	9.50
33.25	0.82	10.08
35.00	0.92	10.67

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

STORM INLET DATA

1 Normal Inlet

Inlet Identification No. 1

No. of Points on Capture Curve 3

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
10.00	10.00
99999.00	99999.00

2 Normal Inlet

Inlet Identification No. 2

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
71.00	16.00
104.00	24.00
148.00	31.50
270.00	45.50
470.00	57.00
690.00	67.50
1000.00	67.50

3 Normal Inlet

Inlet Identification No. 3

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Inlet

Flow (l/s)	Flow (l/s)
0.00	0.00
78.00	17.50
111.00	24.50
161.00	32.00
296.00	45.00
510.00	57.00
780.00	66.50
1000.00	66.50

4 Normal Inlet

Inlet Identification No. 4

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
50.00	13.50
71.00	20.00
102.00	26.50
195.00	41.00
330.00	55.00
510.00	65.50
1000.00	65.50

5 Normal Inlet

Inlet Identification No. 5

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
36.00	10.00
52.00	15.50
74.00	20.50
135.00	34.50
230.00	50.00
350.00	62.00
1000.00	62.00

6 Normal Inlet

Inlet Identification No. 6

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
62.00	15.50
88.00	23.00
122.00	30.00
230.00	44.00
400.00	57.00
620.00	67.00
1000.00	67.00

7 Normal Inlet

Inlet Identification No. 7

No. of Points on Capture Curve 8

Inlet Capture Relationship

Approach Flow (l/s)	Inlet Flow (l/s)
0.00	0.00
36.00	10.00
52.00	15.50
74.00	20.50
135.00	34.50
230.00	50.00
350.00	62.00
1000.00	62.00

8 Storage Inlet

Inlet Identification No. 8

Maximum Storage 280.00 cu.m.

No. of Points on Storage-Capture Curve 3

Storage-Inlet Capture Relationship

Storage Volume (cu.m)	Inlet Flow (l/s)
0.00	0.00
0.01	107.99
280.00	108.00

9 Storage Inlet

Inlet Identification No. 9

Maximum Storage 125.00 cu.m.

No. of Points on Storage-Capture Curve 3

Storage-Inlet Capture Relationship

Storage Volume (cu.m)	Inlet Flow (l/s)
0.00	0.00
0.01	196.99
125.00	197.00

10 Storage Inlet

Inlet Identification No. 10

Maximum Storage 140.00 cu.m.

No. of Points on Storage-Capture Curve 3

Storage-Inlet Capture Relationship

Storage Volume (cu.m)	Inlet Flow (l/s)
0.00	0.00
0.01	49.99
140.00	50.00

11 Storage Inlet

Inlet Identification No. 11

Maximum Storage 6.52 cu.m.

No. of Points on Storage-Capture Curve 3

Storage-Inlet Capture Relationship

Storage Volume (cu.m)	Inlet Flow (l/s)
0.00	0.00
0.01	87.99
6.52	88.00

12 Storage Inlet

Inlet Identification No. 12

Maximum Storage 540.00 cu.m.

No. of Points on Storage-Capture Curve 3

Storage-Inlet Capture Relationship

Storage Volume (cu.m)	Inlet Flow (l/s)
0.00	0.00
0.01	251.99
540.00	252.00

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DATA

	Street Segment	D/S Segment	Length (m)	Type	No. of C.B.	Inlet Type		Limiting Inlet Capture (l/s)	Connecting Pipe/EXTRAN Inlet	Flow History (?)
1	S20A	S20B	38.0	5	2	2	*	6.00	CBMH20	YES
2	S20B	S20C	31.0	5	2	2	*	6.00	CBMH20	YES
3	S20C	S20D	34.0	6	2	3	*	6.00	CBMH20	YES
4	S20D	S20E	19.0	5	2	2	*	6.00	CBMH20	YES
5	S20E	S107	39.0	3	2	4	*	6.00	107	YES
6	S107	S106A	32.0	3	2	4	*	6.00	107	YES
7	S106A	S106B	18.0	1	2	5	*	6.00	106	YES
8	S106B	S105A	42.0	4	2	6	*	6.00	106	YES
9	UNIT3	OUT1	252.0	7	2	8	***	108.00	105	YES
10	S105A	S105B	24.0	5	2	1	*	12.50	105	YES
11	S105B	S104	23.0	2	2	7	*	6.00	105	YES
12	UNIT1	S104	266.0	7	2	9	***	197.00	104	YES
13	UNIT2	OUT2	117.0	7	2	10	***	50.00	104	YES
14	S104	D1	81.0	1	2	11	***	88.00	104	

```
YES
   15  D1           REVERA          26.0   8      0      1 *       0.00   PDUM
YES
   16  REVERA       OUT3           585.0   7      2     12 ***   252.00   104
YES


     *    Normal Inlet.
     **   Storage Inlet with linear relationship between Storage and Inlet Capture.
     ***  Storage Inlet with user-specified relationship between Storage and Inlet
Capture.


     Total Number of Street segments                16

     Total Length of Major System              1627.00     m

     Total Number of Inlet C.B.                     30

     Average Distance Between Inlets            108.47     m

            Outlets From Major System

                   Outlet I.D.

                   OUT1
                   OUT2
                   OUT3

          Total Number of Outlets from Major System =    3


          No. of Detention Structures     0
 ♀
     Dual Drainage Storm Water Management Model (DDSWMM 2.1)
     IBI Group, Ottawa, Ontario

         Example

         DUAL DRAINAGE SIMULATION


                                            SUB-CATCHMENT/SURFACE RUNOFF DATA
                                            ---------------------------------

     Infiltration Parameters
     -----------------------

     Max. Infiltration Rate           76.20  mm/hr
     Min. Infiltration Rate           13.20  mm/hr
     Decay Rate                    0.001150  1/sec.


     Unit Area Hydrograph (UAH) Data
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     No Unit Area Hydrograph Data
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SUB-CATCHMENT DATA

No.	Subarea	Street Segment	Area (Ha.)	Imp. (%)	Manning (N) (Imp.)	Manning (N) (Perv.)	Slope (m/m)	Width (m)	Dep. Storage Imp. (mm)	Dep. Storage Perv. (mm)	Flow History (?)
1	AS20A	S20A	0.18	50.	0.0130	0.2500	0.020	20.	1.500	4.670	NO
2	AS20B	S20B	0.13	43.	0.0130	0.2500	0.020	25.	1.500	4.670	NO
3	AS20C	S20C	0.13	43.	0.0130	0.2500	0.020	20.	1.500	4.670	NO
4	AS20D	S20D	0.06	43.	0.0130	0.2500	0.020	20.	1.500	4.670	NO
5	AS20E	S20E	0.11	50.	0.0130	0.2500	0.020	15.	1.500	4.670	NO
6	AS107	S107	0.09	50.	0.0130	0.2500	0.020	15.	1.500	4.670	NO
7	AS106A	S106A	0.02	100.	0.0130	0.2500	0.020	5.	1.500	4.670	NO
8	AS106B	S106B	0.05	100.	0.0130	0.2500	0.020	5.	1.500	4.670	NO
9	AUNIT3	UNIT3	1.12	79.	0.0130	0.2500	0.020	126.	1.500	4.670	NO
10	AS105A	S105A	0.03	100.	0.0130	0.2500	0.020	6.	1.500	4.670	NO
11	AS105B	S105B	0.03	100.	0.0130	0.2500	0.020	5.	1.500	4.670	NO
12	AUNIT1	UNIT1	1.18	79.	0.0130	0.2500	0.020	133.	1.500	4.670	NO
13	AUNIT2	UNIT2	0.52	86.	0.0130	0.2500	0.020	58.	1.500	4.670	NO
14	AS104	S104	0.09	100.	0.0130	0.2500	0.020	5.	1.500	4.670	NO
15	AREVERA	REVERA	2.60	71.	0.0130	0.2500	0.020	292.	1.500	4.670	NO

* Inflow Hydrograph Input Directly
** Inflow hydrograph Input in terms of flow per unit area

Total Drainage Area 6.34 Hectares

Number of Subcatchments 15

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Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

Simulation Details - Surface Runoff - 15 Subareas

count Subarea

1	AS20A
2	AS20B
3	AS20C
4	AS20D
5	AS20E
6	AS107
7	AS106A
8	AS106B
9	AUNIT3
10	AS105A
11	AS105B
12	AUNIT1
13	AUNIT2
14	AS104
15	AREVERA

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

Simulation Details - Major System - 19 Segments/Outlets

count	order	segment	time step (min.)	No. of time steps	Max. flow (cms)	Max. depth (cm)
1	1	S20A	0.42	424	0.04	3.06
2	2	S20B	0.31	588	0.06	3.64
3	3	S20C	0.27	659	0.07	3.67
4	4	S20D	0.18	1008	0.07	3.94
5	5	S20E	0.45	398	0.09	4.81
6	6	S107	0.36	500	0.10	5.04
7	7	S106A	0.27	663	0.09	5.67
8	8	S106B	0.41	438	0.10	4.62
9	10	S105A	0.21	849	0.10	4.33
10	12	UNIT1	3.55	50	0.38	10.93
11	11	S105B	0.31	577	0.08	5.16
12	14	S104	1.20	150	0.10	5.82
13	15	D1	1.20	150	0.00	0.00
14	16	REVERA	5.84	31	0.76	14.33
15	13	UNIT2	1.90	95	0.18	8.20
16	9	UNIT3	3.41	53	0.36	10.74

17	19	OUT3	0.00
18	18	OUT2	0.00
19	17	OUT1	0.00

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Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

EXTRAN Interface File Information
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Inlet flows are stored at the following 6 inlets (EXTRAN nodes):

CBMH20 107 106 105 104 PDUM

DDSWMM-EXTRAN Connectivity

EXTRAN Inlet	DDSWMM Inlets (Major System Segments)			
CBMH20	S20A	S20B	S20C	S20D
107	S20E	S107		
106	S106A	S106B		
105	UNIT3	S105A	S105B	
104	UNIT1	UNIT2	S104	REVERA
PDUM	D1			

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S20A

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.002	0.002	0.000	0.001	0.4	0.00
0:40	0.000	0.003	0.003	0.001	0.002	0.8	0.00
0:50	0.000	0.008	0.008	0.002	0.006	1.8	0.00

1: 0	0.000	0.040	0.040	0.009	0.030	3.1	0.00
1:10	0.000	0.037	0.037	0.008	0.029	3.0	0.00
1:20	0.000	0.013	0.013	0.003	0.011	1.9	0.00
1:30	0.000	0.011	0.011	0.003	0.009	1.9	0.00
1:40	0.000	0.007	0.007	0.002	0.005	1.5	0.00
1:50	0.000	0.005	0.005	0.001	0.004	1.1	0.00
2: 0	0.000	0.004	0.004	0.001	0.003	0.8	0.00
2:10	0.000	0.003	0.003	0.001	0.002	0.6	0.00
2:20	0.000	0.002	0.002	0.000	0.002	0.5	0.00
2:30	0.000	0.002	0.002	0.000	0.001	0.4	0.00
2:40	0.000	0.002	0.002	0.000	0.001	0.3	0.00
2:50	0.000	0.001	0.001	0.000	0.001	0.3	0.00
3: 0	0.000	0.000	0.000	0.000	0.001	0.0	0.00
Maximum	0.000		0.040	0.009	0.031	3.1	0.00
Time (h:min)	0: 0		1: 0	1: 0	1: 0		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S20B

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.001	0.002	0.003	0.000	0.002	0.6	0.00
0:40	0.002	0.002	0.005	0.001	0.003	1.0	0.00
0:50	0.006	0.005	0.011	0.002	0.009	1.9	0.00
1: 0	0.030	0.028	0.057	0.012	0.044	3.6	0.00
1:10	0.029	0.027	0.056	0.012	0.044	3.6	0.00
1:20	0.011	0.009	0.020	0.005	0.017	2.3	0.00
1:30	0.009	0.008	0.017	0.004	0.013	2.1	0.00
1:40	0.005	0.004	0.009	0.002	0.007	1.8	0.00
1:50	0.004	0.003	0.007	0.002	0.006	1.6	0.00
2: 0	0.003	0.002	0.005	0.001	0.004	1.1	0.00
2:10	0.002	0.001	0.004	0.001	0.003	0.8	0.00
2:20	0.002	0.001	0.003	0.001	0.002	0.6	0.00
2:30	0.001	0.001	0.002	0.001	0.002	0.5	0.00
2:40	0.001	0.001	0.002	0.000	0.002	0.5	0.00
2:50	0.001	0.001	0.002	0.000	0.002	0.4	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.2	0.00
Maximum	0.031		0.058	0.012	0.046	3.6	0.00
Time (h:min)	1: 0		1: 0	1: 1	1: 1		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)

IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S20C

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.002	0.001	0.003	0.001	0.002	0.5	0.00
0:40	0.003	0.002	0.006	0.001	0.004	1.0	0.00
0:50	0.009	0.005	0.014	0.003	0.010	1.9	0.00
1: 0	0.044	0.027	0.071	0.012	0.057	3.6	0.00
1:10	0.044	0.026	0.070	0.012	0.058	3.6	0.00
1:20	0.017	0.009	0.026	0.006	0.022	2.3	0.00
1:30	0.013	0.008	0.021	0.005	0.017	2.1	0.00
1:40	0.007	0.004	0.012	0.003	0.009	1.8	0.00
1:50	0.006	0.003	0.009	0.002	0.007	1.6	0.00
2: 0	0.004	0.002	0.006	0.001	0.005	1.1	0.00
2:10	0.003	0.002	0.005	0.001	0.004	0.8	0.00
2:20	0.002	0.001	0.003	0.001	0.003	0.6	0.00
2:30	0.002	0.001	0.003	0.001	0.002	0.5	0.00
2:40	0.002	0.001	0.003	0.001	0.002	0.5	0.00
2:50	0.002	0.001	0.002	0.001	0.002	0.4	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.2	0.00
Maximum	0.046		0.073	0.012	0.061	3.7	0.00
Time (h:min)	1: 1		1: 1	1: 1	1: 1		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S20D

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)

0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.002	0.001	0.003	0.001	0.002	0.6	0.00
0:40	0.004	0.001	0.005	0.001	0.004	1.2	0.00
0:50	0.010	0.003	0.013	0.003	0.010	2.0	0.00
1: 0	0.057	0.014	0.071	0.012	0.058	3.9	0.00
1:10	0.058	0.013	0.071	0.012	0.059	3.9	0.00
1:20	0.022	0.004	0.026	0.006	0.021	2.5	0.00
1:30	0.017	0.003	0.020	0.005	0.016	2.2	0.00
1:40	0.009	0.001	0.011	0.002	0.009	1.9	0.00
1:50	0.007	0.001	0.008	0.002	0.006	1.8	0.00
2: 0	0.005	0.001	0.006	0.001	0.004	1.2	0.00
2:10	0.004	0.001	0.004	0.001	0.003	0.9	0.00
2:20	0.003	0.001	0.003	0.001	0.003	0.7	0.00
2:30	0.002	0.000	0.003	0.001	0.002	0.6	0.00
2:40	0.002	0.000	0.002	0.001	0.002	0.5	0.00
2:50	0.002	0.000	0.002	0.001	0.002	0.5	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.2	0.00
Maximum	0.061		0.075	0.012	0.063	3.9	0.00
Time (h:min)	1: 1		1: 1	1: 1	1: 1		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S20E

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.002	0.001	0.003	0.001	0.002	1.0	0.00
0:40	0.004	0.002	0.006	0.002	0.004	1.8	0.00
0:50	0.010	0.005	0.015	0.004	0.010	2.3	0.00
1: 0	0.058	0.025	0.083	0.012	0.068	4.7	0.00
1:10	0.059	0.023	0.083	0.012	0.071	4.7	0.00
1:20	0.021	0.008	0.028	0.008	0.023	3.1	0.00
1:30	0.016	0.007	0.022	0.006	0.017	2.7	0.00
1:40	0.009	0.004	0.012	0.004	0.010	2.1	0.00
1:50	0.006	0.003	0.009	0.003	0.007	2.0	0.00
2: 0	0.004	0.002	0.006	0.002	0.005	1.8	0.00
2:10	0.003	0.002	0.005	0.001	0.004	1.5	0.00
2:20	0.003	0.001	0.004	0.001	0.003	1.2	0.00
2:30	0.002	0.001	0.003	0.001	0.002	1.0	0.00
2:40	0.002	0.001	0.003	0.001	0.002	0.9	0.00
2:50	0.002	0.001	0.003	0.001	0.002	0.8	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.3	0.00

Maximum	0.063		0.088	0.012	0.076	4.8	0.00
Time (h:min)	1: 1		1: 1	1: 2	1: 2		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S107

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.002	0.001	0.003	0.001	0.002	0.9	0.00
0:40	0.004	0.002	0.006	0.002	0.004	1.8	0.00
0:50	0.010	0.004	0.015	0.004	0.010	2.3	0.00
1: 0	0.068	0.021	0.089	0.012	0.074	4.8	0.00
1:10	0.071	0.019	0.090	0.012	0.079	4.9	0.00
1:20	0.023	0.006	0.029	0.009	0.023	3.1	0.00
1:30	0.017	0.006	0.022	0.006	0.016	2.7	0.00
1:40	0.010	0.003	0.012	0.004	0.010	2.1	0.00
1:50	0.007	0.002	0.009	0.003	0.007	2.0	0.00
2: 0	0.005	0.002	0.006	0.002	0.005	1.8	0.00
2:10	0.004	0.001	0.005	0.001	0.004	1.5	0.00
2:20	0.003	0.001	0.004	0.001	0.003	1.2	0.00
2:30	0.002	0.001	0.003	0.001	0.002	1.0	0.00
2:40	0.002	0.001	0.003	0.001	0.002	0.9	0.00
2:50	0.002	0.001	0.003	0.001	0.002	0.8	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.4	0.00
Maximum	0.076		0.097	0.012	0.085	5.0	0.00
Time (h:min)	1: 2		1: 2	1: 2	1: 2		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S106A

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.002	0.000	0.002	0.001	0.001	1.0	0.00
0:40	0.004	0.001	0.005	0.001	0.003	1.8	0.00
0:50	0.010	0.002	0.012	0.003	0.008	2.4	0.00
1: 0	0.074	0.008	0.083	0.012	0.069	5.5	0.00
1:10	0.079	0.005	0.084	0.012	0.072	5.5	0.00
1:20	0.023	0.001	0.024	0.007	0.019	3.5	0.00
1:30	0.016	0.001	0.018	0.005	0.013	2.9	0.00
1:40	0.010	0.001	0.010	0.003	0.008	2.3	0.00
1:50	0.007	0.001	0.008	0.002	0.006	2.1	0.00
2: 0	0.005	0.001	0.005	0.002	0.004	1.9	0.00
2:10	0.004	0.000	0.004	0.001	0.003	1.8	0.00
2:20	0.003	0.000	0.003	0.001	0.002	1.5	0.00
2:30	0.002	0.000	0.003	0.001	0.002	1.3	0.00
2:40	0.002	0.000	0.002	0.001	0.002	1.1	0.00
2:50	0.002	0.000	0.002	0.001	0.002	1.0	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.5	0.00
Maximum	0.085		0.092	0.012	0.080	5.7	0.00
Time (h:min)	1: 2		1: 2	1: 2	1: 2		

♀
Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S106B

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.001	0.001	0.002	0.000	0.001	0.6	0.00
0:40	0.003	0.002	0.005	0.001	0.004	1.3	0.00
0:50	0.008	0.004	0.012	0.003	0.009	2.0	0.00
1: 0	0.069	0.018	0.087	0.012	0.072	4.4	0.00
1:10	0.072	0.015	0.088	0.012	0.076	4.4	0.00
1:20	0.019	0.003	0.022	0.007	0.020	2.5	0.00
1:30	0.013	0.003	0.016	0.004	0.012	2.2	0.00
1:40	0.008	0.002	0.010	0.003	0.008	1.9	0.00
1:50	0.006	0.002	0.007	0.002	0.006	1.8	0.00
2: 0	0.004	0.001	0.005	0.001	0.004	1.4	0.00

2:10	0.003	0.001	0.004	0.001	0.003	1.1	0.00
2:20	0.002	0.001	0.003	0.001	0.003	0.9	0.00
2:30	0.002	0.001	0.003	0.001	0.002	0.8	0.00
2:40	0.002	0.001	0.003	0.001	0.002	0.7	0.00
2:50	0.002	0.001	0.002	0.001	0.002	0.6	0.00
3: 0	0.001	0.000	0.001	0.000	0.001	0.2	0.00
Maximum	0.080		0.098	0.012	0.086	4.6	0.00
Time (h:min)	1: 2		1: 2	1: 3	1: 3		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment UNIT3

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.3	0.00
0:30	0.000	0.015	0.015	0.002	0.000	3.2	0.00
0:40	0.000	0.032	0.032	0.019	0.000	4.2	0.00
0:50	0.000	0.075	0.075	0.050	0.000	5.9	0.00
1: 0	0.000	0.356	0.356	0.108	0.000	10.7	42.27
1:10	0.000	0.311	0.311	0.108	0.000	10.2	173.46
1:20	0.000	0.069	0.069	0.108	0.000	5.7	258.02
1:30	0.000	0.067	0.067	0.108	0.000	5.7	265.35
1:40	0.000	0.042	0.042	0.108	0.000	4.7	237.95
1:50	0.000	0.032	0.032	0.108	0.000	4.2	201.24
2: 0	0.000	0.026	0.026	0.108	0.000	3.9	157.00
2:10	0.000	0.021	0.021	0.108	0.000	3.7	108.53
2:20	0.000	0.019	0.019	0.108	0.000	3.5	57.23
2:30	0.000	0.017	0.017	0.108	0.000	3.4	4.08
2:40	0.000	0.015	0.015	-0.060	0.000	3.2	0.00
2:50	0.000	0.014	0.014	0.091	0.000	3.0	0.01
3: 0	0.000	0.000	0.000	-0.063	0.000	0.0	0.00
Maximum	0.000		0.356	0.108	0.000	10.7	265.35
Time (h:min)	0: 0		1: 0	1:30	3: 0		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S105A

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.001	0.001	0.002	0.001	0.000	0.4	0.00
0:40	0.004	0.001	0.005	0.005	0.000	1.0	0.00
0:50	0.009	0.003	0.011	0.011	0.000	1.9	0.00
1: 0	0.072	0.012	0.084	0.025	0.057	4.1	0.00
1:10	0.076	0.008	0.085	0.025	0.060	4.1	0.00
1:20	0.020	0.001	0.021	0.023	0.000	2.3	0.00
1:30	0.012	0.002	0.015	0.015	0.000	2.0	0.00
1:40	0.008	0.001	0.009	0.009	0.000	1.8	0.00
1:50	0.006	0.001	0.007	0.007	0.000	1.5	0.00
2: 0	0.004	0.001	0.005	0.005	0.000	1.1	0.00
2:10	0.003	0.001	0.004	0.004	0.000	0.9	0.00
2:20	0.003	0.001	0.003	0.003	0.000	0.7	0.00
2:30	0.002	0.001	0.003	0.003	0.000	0.6	0.00
2:40	0.002	0.001	0.003	0.003	0.000	0.6	0.00
2:50	0.002	0.000	0.002	0.002	0.000	0.5	0.00
3: 0	0.001	0.000	0.001	0.001	0.000	0.3	0.00
Maximum	0.086		0.097	0.025	0.072	4.3	0.00
Time (h:min)	1: 3		1: 3	1: 3	1: 3		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S105B

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.001	0.001	0.000	0.000	0.2	0.00
0:40	0.000	0.001	0.001	0.000	0.001	0.4	0.00
0:50	0.000	0.003	0.003	0.001	0.002	1.0	0.00
1: 0	0.057	0.012	0.069	0.012	0.055	4.7	0.00

1:10	0.060	0.009	0.069	0.012	0.057	4.7	0.00
1:20	0.000	0.002	0.002	0.002	0.005	0.6	0.00
1:30	0.000	0.002	0.002	0.001	0.001	0.8	0.00
1:40	0.000	0.001	0.001	0.000	0.001	0.5	0.00
1:50	0.000	0.001	0.001	0.000	0.001	0.4	0.00
2: 0	0.000	0.001	0.001	0.000	0.001	0.3	0.00
2:10	0.000	0.001	0.001	0.000	0.001	0.3	0.00
2:20	0.000	0.001	0.001	0.000	0.000	0.2	0.00
2:30	0.000	0.001	0.001	0.000	0.000	0.2	0.00
2:40	0.000	0.001	0.001	0.000	0.000	0.2	0.00
2:50	0.000	0.000	0.000	0.000	0.000	0.2	0.00
3: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
Maximum	0.072		0.083	0.012	0.071	5.2	0.00
Time (h:min)	1: 3		1: 3	1: 3	1: 3		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment UNIT1

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.3	0.00
0:30	0.000	0.016	0.016	0.002	0.000	3.3	0.00
0:40	0.000	0.033	0.033	0.019	0.000	4.3	0.00
0:50	0.000	0.079	0.079	0.050	0.000	6.0	0.00
1: 0	0.000	0.376	0.376	0.197	0.000	10.9	18.00
1:10	0.000	0.328	0.328	0.197	0.000	10.4	105.50
1:20	0.000	0.073	0.073	0.197	0.000	5.8	125.00
1:30	0.000	0.070	0.070	0.197	0.000	5.8	88.11
1:40	0.000	0.044	0.044	0.197	0.000	4.8	9.71
1:50	0.000	0.034	0.034	-0.065	0.000	4.3	0.00
2: 0	0.000	0.027	0.027	0.138	0.000	4.0	0.01
2:10	0.000	0.022	0.022	-0.080	0.000	3.7	0.00
2:20	0.000	0.020	0.020	0.128	0.000	3.6	0.01
2:30	0.000	0.018	0.018	-0.087	0.000	3.5	0.00
2:40	0.000	0.016	0.016	0.123	0.000	3.3	0.01
2:50	0.000	0.014	0.014	-0.090	0.000	3.1	0.00
3: 0	0.000	0.000	0.000	0.119	0.000	0.0	0.01
Maximum	0.000		0.376	0.197	0.000	10.9	125.00
Time (h:min)	0: 0		1: 0	1:20	3: 0		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment UNIT2

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.1	0.00
0:30	0.000	0.007	0.007	0.003	0.000	2.3	0.00
0:40	0.000	0.016	0.016	0.012	0.000	3.3	0.00
0:50	0.000	0.037	0.037	0.030	0.000	4.5	0.01
1: 0	0.000	0.176	0.176	0.050	0.000	8.2	29.55
1:10	0.000	0.151	0.151	0.050	0.000	7.7	98.49
1:20	0.000	0.031	0.031	0.050	0.000	4.2	133.50
1:30	0.000	0.031	0.031	0.050	0.000	4.2	131.00
1:40	0.000	0.020	0.020	0.050	0.000	3.6	117.38
1:50	0.000	0.016	0.016	0.050	0.000	3.3	99.63
2: 0	0.000	0.013	0.013	0.050	0.000	2.9	78.95
2:10	0.000	0.011	0.011	0.050	0.000	2.7	56.59
2:20	0.000	0.009	0.009	0.050	0.000	2.5	33.09
2:30	0.000	0.008	0.008	0.050	0.000	2.4	8.78
2:40	0.000	0.008	0.008	-0.004	0.000	2.3	0.00
2:50	0.000	0.007	0.007	0.019	0.000	2.2	0.00
3: 0	0.000	0.000	0.000	-0.007	0.000	0.0	0.00
Maximum	0.000		0.176	0.050	0.000	8.2	133.50
Time (h:min)	0: 0		1: 0	1:20	3: 0		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S104

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00

0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.001	0.001	0.000	0.000	0.5	0.00
0:40	0.001	0.002	0.003	0.002	0.000	1.4	0.00
0:50	0.002	0.006	0.008	0.007	0.000	2.1	0.00
1: 0	0.055	0.029	0.084	0.074	0.000	5.5	0.01
1:10	0.057	0.029	0.086	0.088	0.000	5.5	3.66
1:20	0.005	0.008	0.013	0.039	0.000	2.5	0.00
1:30	0.001	0.006	0.007	-0.004	0.000	2.0	0.00
1:40	0.001	0.004	0.005	0.019	0.000	1.9	0.00
1:50	0.001	0.003	0.004	-0.009	0.000	1.8	0.00
2: 0	0.001	0.003	0.003	0.017	0.000	1.5	0.00
2:10	0.001	0.002	0.003	-0.010	0.000	1.3	0.00
2:20	0.000	0.002	0.003	0.016	0.000	1.1	0.00
2:30	0.000	0.002	0.002	-0.011	0.000	1.0	0.00
2:40	0.000	0.002	0.002	0.015	0.000	0.9	0.00
2:50	0.000	0.001	0.002	-0.011	0.000	0.8	0.00
3: 0	0.000	0.000	0.000	0.015	0.000	0.1	0.00
Maximum	0.071		0.100	0.088	0.000	5.8	3.66
Time (h:min)	1: 3		1: 3	1:10	3: 0		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment D1

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:40	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:50	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1:40	0.000	0.000	0.000	0.000	0.000	0.0	0.00
1:50	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2:20	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2:30	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2:40	0.000	0.000	0.000	0.000	0.000	0.0	0.00
2:50	0.000	0.000	0.000	0.000	0.000	0.0	0.00
3: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00

Maximum	0.000		0.000	0.000	0.000	0.0	0.00
Time (h:min)	3: 0		3: 0	0: 0	0: 0		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment REVERA

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.001	0.001	0.000	0.000	0.6	0.00
0:30	0.000	0.034	0.034	0.000	0.000	4.3	0.00
0:40	0.000	0.067	0.067	0.014	0.000	5.7	0.00
0:50	0.000	0.158	0.158	0.049	0.000	7.9	0.00
1: 0	0.000	0.761	0.761	0.252	0.000	14.3	15.90
1:10	0.000	0.677	0.677	0.252	0.000	13.7	228.48
1:20	0.000	0.169	0.169	0.252	0.000	8.1	447.19
1:30	0.000	0.157	0.157	0.252	0.000	7.8	511.52
1:40	0.000	0.096	0.096	0.252	0.000	6.5	468.12
1:50	0.000	0.073	0.073	0.252	0.000	5.8	394.13
2: 0	0.000	0.056	0.056	0.252	0.000	5.4	297.36
2:10	0.000	0.045	0.045	0.252	0.000	4.9	187.66
2:20	0.000	0.039	0.039	0.252	0.000	4.6	69.37
2:30	0.000	0.035	0.035	0.070	0.000	4.3	0.00
2:40	0.000	0.031	0.031	0.008	0.000	4.2	0.00
2:50	0.000	0.029	0.029	0.062	0.000	4.0	0.00
3: 0	0.000	0.000	0.000	0.012	0.000	0.0	0.00
Maximum	0.000		0.761	0.252	0.000	14.3	511.52
Time (h:min)	0: 0		1: 0	1:30	3: 0		

♀

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

Example

DUAL DRAINAGE SIMULATION

MAJOR SYSTEM

SUMMARY OF SIMULATION RESULTS

No.	Segment	Peak Flow	Peak Time	Max. Depth	Max. Capture	Inlet Restriction	D/S Pipe	Max.

		(cms)	(hr:min.)	(cm)	(l/s)	(?)		Storage (cu.m.)
1	S20A	0.040	1: 0	3.06	8.95	NO	CBMH20	0.00
2	S20B	0.058	1: 0	3.64	12.00	YES	CBMH20	0.00
3	S20C	0.073	1: 1	3.67	12.00	YES	CBMH20	0.00
4	S20D	0.075	1: 1	3.94	12.00	YES	CBMH20	0.00
5	S20E	0.088	1: 1	4.81	12.00	YES	107	0.00
6	S107	0.097	1: 2	5.04	12.00	YES	107	0.00
7	S106A	0.092	1: 2	5.67	12.00	YES	106	0.00
8	S106B	0.098	1: 2	4.62	12.00	YES	106	0.00
9	UNIT3	0.356	1: 0	10.74	108.00	N/A	105	265.35
10	S105A	0.097	1: 3	4.33	25.00	YES	105	0.00
11	S105B	0.083	1: 3	5.16	12.00	YES	105	0.00
12	UNIT1	0.376	1: 0	10.93	197.00	N/A	104	125.00
13	UNIT2	0.176	1: 0	8.20	50.00	N/A	104	133.50
14	S104	0.100	1: 3	5.82	88.00	N/A	104	3.66
15	D1	0.000	3: 0	0.00	0.00	-	PDUM	0.00
16	REVERA	0.761	1: 0	14.33	252.00	N/A	104	511.52

```
 *** SIMULATION ENDED NORMALLY ***
 ♀
   ***********************************************************
   *                                                         *
   *    Simulation Starting Date      March     29, 18       *
   *                        Time      13:26:25.59            *
   *                                                         *
   *    Simulation Ending   Date      March     29, 18       *
   *                        Time      13:26:28.49            *
   *                                                         *
   *    Duration of Simulation          0.05 Minutes         *
   *                                                         *
   ***********************************************************
```

Data Files

Input Data File Name   37923-3CHI100.DAT

Ouput File Name   37923-3CHI100.OUT

EXTRAN Interface (ASCII) File Name   37923-3CHI100.TXT

```
===============================================================================

  SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999   999    =========
  S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9 9   9
  SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9 9   9    Ver  4.05
      S  W W    M   M  H   H    Y    M   M  O   O       9999  9999    Sept 2011
  SSSSS  W W    M   M  H   H    Y    M   M   OOO           9     9    =========
                                                       9   9 9   9    # 3699242
       StormWater Management HYdrologic Model           999   999     =========

 ******************************************************************************
 ***************************** SWMHYMO Ver/4.05 ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors     *********
 *********                 OTTHYMO-83 and OTTHYMO-89.                  *********
 ******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa, Ontario: (613) 836-3884            *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 ******************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Cumming Cockburn Limited                    +++++++++
 +++++++++                Ottawa                 SERIAL#:3699242      +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************
 *********          ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********          Maximum value for ID numbers :     10             *********
 *********          Max. number of rainfall points: 105408            *********
 *********          Max. number of flow points    : 105408            *********
 ******************************************************************************


 *********************  D E T A I L E D   O U T P U T  *********************
 ******************************************************************************
 *        DATE: 2018-03-29      TIME: 12:41:26     RUN COUNTER: 000315        *
 ******************************************************************************
 * Input   filename: C:\SWMHYMO\37923\37923VxD.DAT                            *
 * Output  filename: C:\SWMHYMO\37923\37923VxD.out                            *
 * Summary filename: C:\SWMHYMO\37923\37923VxD.sum                            *
 * User comments:                                                             *
 * 1:_________________________________________________________________________*
 * 2:_________________________________________________________________________*
 * 3:_________________________________________________________________________*
 ******************************************************************************

-------------------------------------------------------------------------------
001:0001-----------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name:  Example             Project Number: [J:\37923-RiversidePropert
*#  Date        :  DUAL DRAINAGE SIMULATION
*#  Modeller    :
*#  Company     :  P.Deir
*#  License #   :  March 2018
*#*****************************************************************************
*
*
*#                  JOB #J:\37923-RiversideProperty\5.7 Calculations\5.7.4 SWM\1S
*#*********************************************************************
*#
*#
*#*********************************************************************
*
*
-------------------
| START             |  Project  dir.: C:\SWMHYMO\37923\
-------------------    Rainfall dir.: C:\SWMHYMO\37923\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-------------------------------------------------------------------------------
001:0002-----------------------------------------------------------------------
*
*
*#============================================================
*# ====              100YR DESIGN STORM                  ====
*# ====          3HR CHICAGO (10min TIME STEP)           ====
*# ====            ON-SITE DETENTION ANALYSIS            ====
*#============================================================
*
-------------------
| CHICAGO STORM    |     IDF curve parameters: A=1735.685
| Ptotal= 71.66 mm |                           B=   6.014
-------------------                            C=    .820
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =   .33

                     The CORRELATION coefficient is = .9997109

                      TIME        ENTERED              COMPUTED
                     (min)        (mm/hr)               (mm/hr)
                        5.         242.60                242.70
                       10.         179.00                178.56
                       15.         146.80                142.89
                       30.          91.90                 91.87
                       60.          53.20                 55.89
                      120.          31.50                 32.89
                      360.          14.50                 13.72
                      720.           8.00                  7.83
                     1440.           4.30                  4.45

               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .17   6.046 |   1.00 178.559 |   1.83  11.059 |   2.67   5.760
                .33   7.542 |   1.17  54.048 |   2.00   9.285 |   2.83   5.280
                .50  10.159 |   1.33  27.319 |   2.17   8.024 |   3.00   4.879
                .67  15.969 |   1.50  18.240 |   2.33   7.080 |
                .83  40.655 |   1.67  13.737 |   2.50   6.347 |

-------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------
*
*
*#=============================================
*# DUMMY AREA
*#=============================================
*
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=    2.00
| 01:000210 DT= 2.00 |   Total Imp(%)=   65.00   Dir. Conn.(%)=   65.00
----------------------
                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=        1.30           .70
     Dep. Storage      (mm)=         .80          1.50
     Average Slope      (%)=         .50          2.00
     Length             (m)=      250.00         40.00
     Mannings n            =        .013          .250

     Max.eff.Inten.(mm/hr)=       178.56         71.07
                over (min)          4.00         12.00
     Storage Coeff.  (min)=         4.32 (ii)    12.41 (ii)
     Unit Hyd. Tpeak (min)=         4.00         12.00
     Unit Hyd. peak  (cms)=          .27           .09
                                                                 *TOTALS*
     PEAK FLOW       (cms)=          .58           .09            .622 (iii)
     TIME TO PEAK    (hrs)=         1.00          1.17           1.000
     RUNOFF VOLUME    (mm)=        70.86         33.71          57.861
     TOTAL RAINFALL   (mm)=        71.66         71.66          71.665
     RUNOFF COEFFICIENT   =          .99           .47            .807
      *** ERROR: XIMP cannot be larger than TIMP.
                 XIMP was forced to equal TIMP.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
001:0004-----------------------------------------------------------------------
*
*# Area S20A
*#===========================================================2
*# 4.00% Slope
*#===========================================================
*
-------------------
| ROUTE CHANNEL     |     Routing time step (min) =  1.00
|  IN> 01:000210    |     Number of SEGMENTS =  3
| OUT< 02:000154    |     Slopes (%), CHANNEL=4.0000  FLOODPLAIN=4.0000
-------------------                     LENGTH =   60.00    (m)

                <------ DATA FOR SECTION (   1.0) ------>
                Distance      Elevation       Manning
                    .00           .18          .0250
                   1.45           .15      .0250 / .0130  Main Channel
                   1.50           .00          .0130      Main Channel
                   5.50           .12          .0130      Main Channel
                   9.50           .00          .0130      Main Channel
                   9.55           .15      .0130 / .0250  Main Channel
                  11.00           .18          .0250

   <---------------------------- TRAVEL TIME TABLE -------------------------->
    DEPTH     ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
     (m)       (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)      (min)    (m2/s)
     .009     .009  .178E+00  .347E-03      .001      .425       2.35     .004
     .019     .019  .710E+00  .277E-02      .008      .674       1.48     .013
     .028     .028  .160E+01  .936E-02      .024      .884       1.13     .025
     .038     .038  .284E+01  .222E-01      .051     1.070        .93     .040
     .047     .047  .444E+01  .433E-01      .092     1.242        .81     .058
     .056     .056  .639E+01  .749E-01      .149     1.403        .71     .079
     .066     .066  .870E+01  .119E+00      .225     1.554        .64     .102
     .075     .075  .114E+02  .178E+00      .322     1.699        .59     .127
     .084     .084  .144E+02  .253E+00      .440     1.838        .54     .155
     .094     .094  .178E+02  .347E+00      .583     1.972        .51     .185
     .103     .103  .215E+02  .462E+00      .752     2.101        .48     .217
     .112     .112  .256E+02  .599E+00      .949     2.226        .45     .250
     .122     .122  .300E+02  .762E+00     1.186     2.372        .42     .289
     .131     .131  .345E+02  .945E+00     1.498     2.602        .38     .341
     .141     .141  .392E+02  .115E+01     1.838     2.821        .35     .397
     .150     .150  .436E+02  .136E+01     2.205     3.031        .33     .455
     .160     .160  .488E+02  .163E+01     2.630     3.234        .31     .517
     .170     .170  .545E+02  .193E+01     3.090     3.400        .29     .578
     .180     .180  .608E+02  .228E+01     3.586     3.536        .28     .637

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                    <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.    MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 1:000210     2.00     .622    1.00 57.861      .096      2.000
   OUTFLOW: ID= 2:000154     2.00     .615    1.02 57.861      .095      1.992


-------------------------------------------------------------------------------
001:0005-----------------------------------------------------------------------
*
*
*# Area S20B
*#===========================================================2
*# 6.00% Slope
*#===========================================================
*
-------------------
| ROUTE CHANNEL     |     Routing time step (min) =  1.00
|  IN> 01:000210    |     Number of SEGMENTS =  3
| OUT< 02:000154    |     Slopes (%), CHANNEL=6.0000  FLOODPLAIN=6.0000
-------------------                     LENGTH =   60.00    (m)

                <------ DATA FOR SECTION (   1.0) ------>
                Distance      Elevation       Manning
                    .00           .18          .0250
                   1.45           .15      .0250 / .0130  Main Channel
                   1.50           .00          .0130      Main Channel
                   5.50           .12          .0130      Main Channel
                   9.50           .00          .0130      Main Channel
                   9.55           .15      .0130 / .0250  Main Channel
                  11.00           .18          .0250

   <---------------------------- TRAVEL TIME TABLE -------------------------->
    DEPTH     ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
     (m)       (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)      (min)    (m2/s)
     .009     .009  .178E+00  .231E-03      .002      .520       1.92     .005
     .019     .019  .710E+00  .185E-02      .010      .826       1.21     .015
     .028     .028  .160E+01  .624E-02      .029     1.082        .92     .030
     .038     .038  .284E+01  .148E-01      .062     1.311        .76     .049
     .047     .047  .444E+01  .289E-01      .113     1.521        .66     .071
     .056     .056  .639E+01  .499E-01      .183     1.718        .58     .097
     .066     .066  .870E+01  .793E-01      .276     1.904        .53     .125
     .075     .075  .114E+02  .118E+00      .394     2.081        .48     .156
     .084     .084  .144E+02  .169E+00      .539     2.251        .44     .190
     .094     .094  .178E+02  .231E+00      .714     2.415        .41     .226
     .103     .103  .215E+02  .308E+00      .921     2.573        .39     .265
     .112     .112  .256E+02  .399E+00     1.162     2.727        .37     .307
     .122     .122  .300E+02  .508E+00     1.452     2.905        .34     .354
     .131     .131  .345E+02  .630E+00     1.834     3.186        .31     .418
```

```
         .141     .141  .391E+02  .764E+00      2.251      3.455        .29      .486
         .150     .150  .436E+02  .909E+00      2.701      3.712        .27      .557
         .160     .160  .488E+02  .108E+01      3.222      3.961        .25      .634
         .170     .170  .545E+02  .129E+01      3.784      4.164        .24      .708
         .180     .180  .608E+02  .152E+01      4.392      4.331        .23      .780

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                         <---- hydrograph ---->  <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.    MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 1:000210      2.00     .622    1.00 57.861       .089     2.325
   OUTFLOW: ID= 2:000154      2.00     .615    1.02 57.861       .088     2.317


 ---------------------------------------------------------------------------------
 001:0006-------------------------------------------------------------------------
 *
 *
 *# Area S20C
 *#============================================================2
 *# 4.00% Slope
 *#===========================================================
 *
 -------------------
 | ROUTE CHANNEL     |      Routing time step (min) =  1.00
 |  IN> 01:000210    |      Number of SEGMENTS =  3
 | OUT< 02:000154    |      Slopes (%), CHANNEL=4.0000  FLOODPLAIN=4.0000
 -------------------                  LENGTH =   60.00    (m)

                   <------ DATA FOR SECTION (    1.0) ------>
                   Distance       Elevation        Manning
                       .00            .18           .0250
                      1.45            .15       .0250 / .0130  Main Channel
                      1.50            .00           .0130      Main Channel
                      5.50            .12           .0130      Main Channel
                      9.50            .00           .0130      Main Channel
                      9.55            .15       .0130 / .0250  Main Channel
                     11.00            .18           .0250

      <--------------------------- TRAVEL TIME TABLE -------------------------->
     DEPTH    ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
      (m)      (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)     (min)    (m2/s)
      .009     .009  .178E+00  .347E-03      .001      .425       2.35      .004
      .019     .019  .710E+00  .277E-02      .008      .674       1.48      .013
      .028     .028  .160E+01  .936E-02      .024      .884       1.13      .025
      .038     .038  .284E+01  .222E-01      .051     1.070        .93      .040
      .047     .047  .444E+01  .433E-01      .092     1.242        .81      .058
      .056     .056  .639E+01  .749E-01      .149     1.403        .71      .079
      .066     .066  .870E+01  .119E+00      .225     1.554        .64      .102
      .075     .075  .114E+02  .178E+00      .322     1.699        .59      .127
      .084     .084  .144E+02  .253E+00      .440     1.838        .54      .155
      .094     .094  .178E+02  .347E+00      .583     1.972        .51      .185
      .103     .103  .215E+02  .462E+00      .752     2.101        .48      .217
      .112     .112  .256E+02  .599E+00      .949     2.226        .45      .250
      .122     .122  .300E+02  .762E+00     1.186     2.372        .42      .289
      .131     .131  .345E+02  .945E+00     1.498     2.602        .38      .341
      .141     .141  .391E+02  .115E+01     1.838     2.821        .35      .397
      .150     .150  .436E+02  .136E+01     2.205     3.031        .33      .455
      .160     .160  .488E+02  .163E+01     2.630     3.234        .31      .517
      .170     .170  .545E+02  .193E+01     3.090     3.400        .29      .578
      .180     .180  .608E+02  .228E+01     3.586     3.536        .28      .637

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                         <---- hydrograph ---->  <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.    MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 1:000210      2.00     .622    1.00 57.861       .096     2.000
   OUTFLOW: ID= 2:000154      2.00     .615    1.02 57.861       .095     1.992


 ---------------------------------------------------------------------------------
 001:0007-------------------------------------------------------------------------
 *
 *
 *# Area S20D
 *#============================================================2
 *# 2.00% Slope
 *#===========================================================
 *
 -------------------
 | ROUTE CHANNEL     |      Routing time step (min) =  1.00
 |  IN> 01:000210    |      Number of SEGMENTS =  3
 | OUT< 02:000154    |      Slopes (%), CHANNEL=2.0000  FLOODPLAIN=2.0000
 -------------------                  LENGTH =   60.00    (m)

                   <------ DATA FOR SECTION (    1.0) ------>
                   Distance       Elevation        Manning
                       .00            .18           .0250
                      1.45            .15       .0250 / .0130  Main Channel
                      1.50            .00           .0130      Main Channel
                      5.50            .12           .0130      Main Channel
                      9.50            .00           .0130      Main Channel
                      9.55            .15       .0130 / .0250  Main Channel
                     11.00            .18           .0250

      <--------------------------- TRAVEL TIME TABLE -------------------------->
     DEPTH    ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
      (m)      (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)     (min)    (m2/s)
      .009     .009  .178E+00  .694E-03      .001      .300       3.33      .003
      .019     .019  .710E+00  .555E-02      .006      .477       2.10      .009
      .028     .028  .160E+01  .187E-01      .017      .625       1.60      .018
      .038     .038  .284E+01  .444E-01      .036      .757       1.32      .028
      .047     .047  .444E+01  .867E-01      .065      .878       1.14      .041
      .056     .056  .639E+01  .150E+00      .106      .992       1.01      .056
      .066     .066  .870E+01  .238E+00      .159     1.099        .91      .072
      .075     .075  .114E+02  .355E+00      .228     1.201        .83      .090
      .084     .084  .144E+02  .506E+00      .311     1.300        .77      .110
      .094     .094  .178E+02  .694E+00      .413     1.394        .72      .131
      .103     .103  .215E+02  .923E+00      .532     1.486        .67      .153
      .112     .112  .256E+02  .120E+01      .671     1.574        .64      .177
      .122     .122  .300E+02  .152E+01      .838     1.677        .60      .204
      .131     .131  .345E+02  .189E+01     1.059     1.840        .54      .241
      .141     .141  .391E+02  .229E+01     1.300     1.995        .50      .280
      .150     .150  .436E+02  .273E+01     1.559     2.143        .47      .321
      .160     .160  .488E+02  .325E+01     1.860     2.287        .44      .366
      .170     .170  .545E+02  .386E+01     2.185     2.404        .42      .409
      .180     .180  .608E+02  .456E+01     2.536     2.501        .40      .450

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                         <---- hydrograph ---->  <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.    MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 1:000210      2.00     .622    1.00 57.861       .109     1.542
   OUTFLOW: ID= 2:000154      2.00     .615    1.02 57.861       .109     1.537


 ---------------------------------------------------------------------------------
 001:0008-------------------------------------------------------------------------
 *
 *
 *# Area S20E
 *#============================================================2
 *# 2.00% Slope
 *#===========================================================
 *
 -------------------
 | ROUTE CHANNEL     |      Routing time step (min) =  1.00
 |  IN> 01:000210    |      Number of SEGMENTS =  3
 | OUT< 02:000154    |      Slopes (%), CHANNEL=2.0000  FLOODPLAIN=2.0000
 -------------------                  LENGTH =   60.00    (m)

                   <------ DATA FOR SECTION (    1.0) ------>
                   Distance       Elevation        Manning
                       .00            .18           .0250
                      1.45            .15       .0250 / .0130  Main Channel
                      1.50            .00           .0130      Main Channel
                      5.50            .12           .0130      Main Channel
                      9.50            .00           .0130      Main Channel
                      9.55            .15       .0130 / .0250  Main Channel
                     11.00            .18           .0250

      <--------------------------- TRAVEL TIME TABLE -------------------------->
     DEPTH    ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
      (m)      (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)     (min)    (m2/s)
      .009     .009  .178E+00  .694E-03      .001      .300       3.33      .003
      .019     .019  .710E+00  .555E-02      .006      .477       2.10      .009
      .028     .028  .160E+01  .187E-01      .017      .625       1.60      .018
      .038     .038  .284E+01  .444E-01      .036      .757       1.32      .028
      .047     .047  .444E+01  .867E-01      .065      .878       1.14      .041
      .056     .056  .639E+01  .150E+00      .106      .992       1.01      .056
      .066     .066  .870E+01  .238E+00      .159     1.099        .91      .072
      .075     .075  .114E+02  .355E+00      .228     1.201        .83      .090
      .084     .084  .144E+02  .506E+00      .311     1.300        .77      .110
      .094     .094  .178E+02  .694E+00      .413     1.394        .72      .131
      .103     .103  .215E+02  .923E+00      .532     1.486        .67      .153
      .112     .112  .256E+02  .120E+01      .671     1.574        .64      .177
      .122     .122  .300E+02  .152E+01      .838     1.677        .60      .204
      .131     .131  .345E+02  .189E+01     1.059     1.840        .54      .241
      .141     .141  .391E+02  .229E+01     1.300     1.995        .50      .280
      .150     .150  .436E+02  .273E+01     1.559     2.143        .47      .321
      .160     .160  .488E+02  .325E+01     1.860     2.287        .44      .366
      .170     .170  .545E+02  .386E+01     2.185     2.404        .42      .409
      .180     .180  .608E+02  .456E+01     2.536     2.501        .40      .450

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                         <---- hydrograph ---->  <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.    MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 1:000210      2.00     .622    1.00 57.861       .109     1.542
   OUTFLOW: ID= 2:000154      2.00     .615    1.02 57.861       .109     1.537


 ---------------------------------------------------------------------------------
 001:0009-------------------------------------------------------------------------
 *
 *
 *# Area S107
 *#============================================================2
 *# 0.90% Slope
 *#===========================================================
 *
 -------------------
 | ROUTE CHANNEL     |      Routing time step (min) =  1.00
 |  IN> 01:000210    |      Number of SEGMENTS =  3
 | OUT< 02:000154    |      Slopes (%), CHANNEL= .9000  FLOODPLAIN= .9000
 -------------------                  LENGTH =   60.00    (m)

                   <------ DATA FOR SECTION (    1.0) ------>
                   Distance       Elevation        Manning
                       .00            .18           .0250
                      1.45            .15       .0250 / .0130  Main Channel
                      1.50            .00           .0130      Main Channel
                      5.50            .12           .0130      Main Channel
                      9.50            .00           .0130      Main Channel
                      9.55            .15       .0130 / .0250  Main Channel
                     11.00            .18           .0250

      <--------------------------- TRAVEL TIME TABLE -------------------------->
     DEPTH    ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
      (m)      (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)     (min)    (m2/s)
      .009     .009  .178E+00  .154E-02      .001      .201       4.96      .002
      .019     .019  .710E+00  .123E-01      .004      .320       3.13      .006
      .028     .028  .160E+01  .416E-01      .011      .419       2.39      .012
      .038     .038  .284E+01  .986E-01      .024      .508       1.97      .019
      .047     .047  .444E+01  .193E+00      .044      .589       1.70      .028
      .056     .056  .639E+01  .333E+00      .071      .665       1.50      .037
      .066     .066  .870E+01  .529E+00      .107      .737       1.36      .048
      .075     .075  .114E+02  .789E+00      .153      .806       1.24      .060
      .084     .084  .144E+02  .112E+01      .209      .872       1.15      .074
      .094     .094  .178E+02  .154E+01      .277      .935       1.07      .088
      .103     .103  .215E+02  .205E+01      .357      .997       1.00      .103
      .112     .112  .256E+02  .266E+01      .450     1.056        .95      .119
      .122     .122  .300E+02  .339E+01      .562     1.125        .89      .137
      .131     .131  .345E+02  .420E+01      .710     1.234        .81      .162
      .141     .141  .391E+02  .509E+01      .872     1.338        .75      .188
      .150     .150  .436E+02  .606E+01     1.046     1.438        .70      .216
      .160     .160  .488E+02  .723E+01     1.248     1.534        .65      .245
      .170     .170  .545E+02  .858E+01     1.466     1.613        .62      .274
      .180     .180  .608E+02  .101E+02     1.701     1.677        .60      .302

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                         <---- hydrograph ---->  <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.    MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
   INFLOW : ID= 1:000210      2.00     .622    1.00 57.861       .126     1.167
   OUTFLOW: ID= 2:000154      2.00     .615    1.02 57.861       .125     1.161


 ---------------------------------------------------------------------------------
 001:0010-------------------------------------------------------------------------
 *
 *
 *# Area S106A
 *#============================================================2
```

```
*# 2.99% Slope
*#=============================================================
*
--------------------
| ROUTE CHANNEL     |     Routing time step (min) =  1.00
|  IN> 01:000210    |     Number of SEGMENTS =  3
| OUT< 02:000154    |     Slopes (%), CHANNEL=2.9900  FLOODPLAIN=2.9900
--------------------                      LENGTH =   60.00    (m)

                 <------ DATA FOR SECTION (   1.0) ------>
                 Distance      Elevation       Manning
                      .00            .18         .0250
                     1.45            .15     .0250 / .0130  Main Channel
                     1.50            .00         .0130      Main Channel
                     5.50            .12         .0130      Main Channel
                     9.50            .00         .0130      Main Channel
                     9.55            .15     .0130 / .0250  Main Channel
                    11.00            .18         .0250

    <--------------------------- TRAVEL TIME TABLE -------------------------->
      DEPTH     ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
       (m)       (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)     (min)    (m2/s)
      .009      .009  .178E+00  .464E-03      .001      .367      2.72      .003
      .019      .019  .710E+00  .371E-02      .007      .583      1.72      .011
      .028      .028  .160E+01  .125E-01      .020      .764      1.31      .021
      .038      .038  .284E+01  .297E-01      .044      .925      1.08      .035
      .047      .047  .444E+01  .580E-01      .079     1.074       .93      .050
      .056      .056  .639E+01  .100E+00      .129     1.213       .82      .068
      .066      .066  .870E+01  .159E+00      .195     1.344       .74      .088
      .075      .075  .114E+02  .238E+00      .278     1.469       .68      .110
      .084      .084  .144E+02  .338E+00      .381     1.589       .63      .134
      .094      .094  .178E+02  .464E+00      .504     1.705       .59      .160
      .103      .103  .215E+02  .617E+00      .650     1.816       .55      .187
      .112      .112  .256E+02  .802E+00      .820     1.925       .52      .217
      .122      .122  .300E+02  .102E+01     1.025     2.051       .49      .250
      .131      .131  .345E+02  .126E+01     1.295     2.249       .44      .295
      .141      .141  .391E+02  .153E+01     1.589     2.439       .41      .343
      .150      .150  .436E+02  .182E+01     1.906     2.621       .38      .393
      .160      .160  .488E+02  .218E+01     2.274     2.796       .36      .447
      .170      .170  .545E+02  .258E+01     2.672     2.940       .34      .500
      .180      .180  .608E+02  .305E+01     3.100     3.057       .33      .550

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                        <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 1:000210      2.00     .622    1.00 57.861      .101     1.794
   OUTFLOW: ID= 2:000154      2.00     .615    1.02 57.861      .101     1.784


-------------------------------------------------------------------------------
001:0011-----------------------------------------------------------------------
*
*
*# Area S106B
*#=============================================================2
*# 4.00% Slope
*#=============================================================
*
--------------------
| ROUTE CHANNEL     |     Routing time step (min) =  1.00
|  IN> 01:000210    |     Number of SEGMENTS =  3
| OUT< 02:000154    |     Slopes (%), CHANNEL=4.0000  FLOODPLAIN=4.0000
--------------------                      LENGTH =   60.00    (m)

                 <------ DATA FOR SECTION (   1.0) ------>
                 Distance      Elevation       Manning
                      .00            .18         .0250
                     1.45            .15     .0250 / .0130  Main Channel
                     1.50            .00         .0130      Main Channel
                     5.50            .12         .0130      Main Channel
                     9.50            .00         .0130      Main Channel
                     9.55            .15     .0130 / .0250  Main Channel
                    11.00            .18         .0250

    <--------------------------- TRAVEL TIME TABLE -------------------------->
      DEPTH     ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
       (m)       (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)     (min)    (m2/s)
      .009      .009  .178E+00  .347E-03      .001      .425      2.35      .004
      .019      .019  .710E+00  .277E-02      .008      .674      1.48      .013
      .028      .028  .160E+01  .936E-02      .024      .884      1.13      .025
      .038      .038  .284E+01  .222E-01      .051     1.070       .93      .040
      .047      .047  .444E+01  .433E-01      .092     1.242       .81      .058
      .056      .056  .639E+01  .749E-01      .149     1.403       .71      .079
      .066      .066  .870E+01  .119E+00      .225     1.554       .64      .102
      .075      .075  .114E+02  .178E+00      .322     1.699       .59      .127
      .084      .084  .144E+02  .253E+00      .440     1.838       .54      .155
      .094      .094  .178E+02  .347E+00      .583     1.972       .51      .185
      .103      .103  .215E+02  .462E+00      .752     2.101       .48      .217
      .112      .112  .256E+02  .599E+00      .949     2.226       .45      .250
      .122      .122  .300E+02  .762E+00     1.186     2.372       .42      .289
      .131      .131  .345E+02  .945E+00     1.498     2.602       .38      .341
      .141      .141  .391E+02  .115E+01     1.838     2.821       .35      .397
      .150      .150  .436E+02  .136E+01     2.205     3.031       .33      .455
      .160      .160  .488E+02  .163E+01     2.630     3.234       .31      .517
      .170      .170  .545E+02  .193E+01     3.090     3.400       .29      .578
      .180      .180  .608E+02  .228E+01     3.586     3.536       .28      .637

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                        <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 1:000210      2.00     .622    1.00 57.861      .096     2.000
   OUTFLOW: ID= 2:000154      2.00     .615    1.02 57.861      .095     1.992


-------------------------------------------------------------------------------
001:0012-----------------------------------------------------------------------
*
*
*# Area S105A
*#=============================================================2
*# 1.33% Slope
*#=============================================================
*
--------------------
| ROUTE CHANNEL     |     Routing time step (min) =  1.00
|  IN> 01:000210    |     Number of SEGMENTS =  3
| OUT< 02:000154    |     Slopes (%), CHANNEL=1.3300  FLOODPLAIN=1.3300
--------------------                      LENGTH =   60.00    (m)

                 <------ DATA FOR SECTION (   1.0) ------>
                 Distance      Elevation       Manning
                      .00            .18         .0250
                     1.45            .15     .0250 / .0130  Main Channel
                     1.50            .00         .0130      Main Channel
                     5.50            .12         .0130      Main Channel
                     9.50            .00         .0130      Main Channel
                     9.55            .15     .0130 / .0250  Main Channel
                    11.00            .18         .0250

    <--------------------------- TRAVEL TIME TABLE -------------------------->
      DEPTH     ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
       (m)       (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)     (min)    (m2/s)
      .009      .009  .178E+00  .104E-02      .001      .245      4.08      .002
      .019      .019  .710E+00  .834E-02      .005      .389      2.57      .007
      .028      .028  .160E+01  .282E-01      .014      .509      1.96      .014
      .038      .038  .284E+01  .667E-01      .029      .617      1.62      .023
      .047      .047  .444E+01  .130E+00      .053      .716      1.40      .034
      .056      .056  .639E+01  .225E+00      .086      .809      1.24      .045
      .066      .066  .870E+01  .358E+00      .130      .896      1.12      .059
      .075      .075  .114E+02  .534E+00      .186      .980      1.02      .073
      .084      .084  .144E+02  .760E+00      .254     1.060       .94      .089
      .094      .094  .178E+02  .104E+01      .336     1.137       .88      .107
      .103      .103  .215E+02  .139E+01      .434     1.211       .83      .125
      .112      .112  .256E+02  .180E+01      .547     1.284       .78      .144
      .122      .122  .300E+02  .229E+01      .684     1.368       .73      .167
      .131      .131  .345E+02  .284E+01      .864     1.500       .67      .197
      .141      .141  .391E+02  .344E+01     1.060     1.627       .61      .229
      .150      .150  .436E+02  .410E+01     1.272     1.748       .57      .262
      .160      .160  .488E+02  .489E+01     1.517     1.865       .54      .298
      .170      .170  .545E+02  .581E+01     1.782     1.960       .51      .333
      .180      .180  .608E+02  .686E+01     2.068     2.039       .49      .367

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                        <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 1:000210      2.00     .622    1.00 57.861      .118     1.328
   OUTFLOW: ID= 2:000154      2.00     .615    1.02 57.861      .117     1.324


-------------------------------------------------------------------------------
001:0013-----------------------------------------------------------------------
*
*
*# Area S105B
*#=============================================================2
*# 1.00% Slope
*#=============================================================
*
--------------------
| ROUTE CHANNEL     |     Routing time step (min) =  1.00
|  IN> 01:000210    |     Number of SEGMENTS =  3
| OUT< 02:000154    |     Slopes (%), CHANNEL=1.0000  FLOODPLAIN=1.0000
--------------------                      LENGTH =   60.00    (m)

                 <------ DATA FOR SECTION (   1.0) ------>
                 Distance      Elevation       Manning
                      .00            .18         .0250
                     1.45            .15     .0250 / .0130  Main Channel
                     1.50            .00         .0130      Main Channel
                     5.50            .12         .0130      Main Channel
                     9.50            .00         .0130      Main Channel
                     9.55            .15     .0130 / .0250  Main Channel
                    11.00            .18         .0250

    <--------------------------- TRAVEL TIME TABLE -------------------------->
      DEPTH     ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
       (m)       (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)     (min)    (m2/s)
      .009      .009  .178E+00  .139E-02      .001      .212      4.71      .002
      .019      .019  .710E+00  .111E-01      .004      .337      2.97      .006
      .028      .028  .160E+01  .374E-01      .012      .442      2.26      .012
      .038      .038  .284E+01  .888E-01      .025      .535      1.87      .020
      .047      .047  .444E+01  .173E+00      .046      .621      1.61      .029
      .056      .056  .639E+01  .300E+00      .075      .701      1.43      .039
      .066      .066  .870E+01  .476E+00      .113      .777      1.29      .051
      .075      .075  .114E+02  .710E+00      .161      .850      1.18      .064
      .084      .084  .144E+02  .101E+01      .220      .919      1.09      .078
      .094      .094  .178E+02  .139E+01      .292      .986      1.01      .092
      .103      .103  .215E+02  .185E+01      .376     1.050       .95      .108
      .112      .112  .256E+02  .240E+01      .474     1.113       .90      .125
      .122      .122  .300E+02  .305E+01      .593     1.186       .84      .145
      .131      .131  .345E+02  .378E+01      .749     1.301       .77      .171
      .141      .141  .391E+02  .458E+01      .919     1.410       .71      .198
      .150      .150  .436E+02  .546E+01     1.103     1.516       .66      .227
      .160      .160  .488E+02  .651E+01     1.315     1.617       .62      .259
      .170      .170  .545E+02  .773E+01     1.545     1.700       .59      .289
      .180      .180  .608E+02  .913E+01     1.793     1.768       .57      .318

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                        <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 1:000210      2.00     .622    1.00 57.861      .124     1.206
   OUTFLOW: ID= 2:000154      2.00     .615    1.02 57.861      .123     1.200


-------------------------------------------------------------------------------
001:0014-----------------------------------------------------------------------
*
*
*# Area UNIT1
*#=============================================================2
*# 1.00% Slope
*#=============================================================
*
--------------------
| ROUTE CHANNEL     |     Routing time step (min) =  1.00
|  IN> 01:000210    |     Number of SEGMENTS =  3
| OUT< 02:000154    |     Slopes (%), CHANNEL=1.0000  FLOODPLAIN=1.0000
--------------------                      LENGTH =   60.00    (m)

                 <------ DATA FOR SECTION (   1.0) ------>
                 Distance      Elevation       Manning
                      .00            .18         .0250
                     1.45            .15     .0250 / .0130  Main Channel
                     1.50            .00         .0130      Main Channel
                     5.50            .12         .0130      Main Channel
                     9.50            .00         .0130      Main Channel
                     9.55            .15     .0130 / .0250  Main Channel
                    11.00            .18         .0250

    <--------------------------- TRAVEL TIME TABLE -------------------------->
      DEPTH     ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
       (m)       (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)     (min)    (m2/s)
```

```
      .009      .009  .178E+00  .139E-02       .001      .212      4.71      .002
      .019      .019  .710E+00  .111E-01       .004      .337      2.97      .006
      .028      .028  .160E+01  .374E-01       .012      .442      2.26      .012
      .038      .038  .284E+01  .888E-01       .025      .535      1.87      .020
      .047      .047  .444E+01  .173E+00       .046      .621      1.61      .029
      .056      .056  .639E+01  .300E+00       .075      .701      1.43      .039
      .066      .066  .870E+01  .476E+00       .113      .777      1.29      .051
      .075      .075  .114E+02  .710E+00       .161      .850      1.18      .064
      .084      .084  .144E+02  .101E+01       .220      .919      1.09      .078
      .094      .094  .178E+02  .139E+01       .292      .986      1.01      .092
      .103      .103  .215E+02  .185E+01       .376     1.050       .95      .108
      .112      .112  .256E+02  .240E+01       .474     1.113       .90      .125
      .122      .122  .300E+02  .305E+01       .593     1.186       .84      .145
      .131      .131  .345E+02  .378E+01       .749     1.301       .77      .171
      .141      .141  .391E+02  .458E+01       .919     1.410       .71      .198
      .150      .150  .436E+02  .546E+01      1.103     1.516       .66      .227
      .160      .160  .488E+02  .651E+01      1.315     1.617       .62      .259
      .170      .170  .545E+02  .773E+01      1.545     1.700       .59      .289
      .180      .180  .608E+02  .913E+01      1.793     1.768       .57      .318

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                   <---- hydrograph ---->  <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 1:000210     2.00     .622    1.00 57.861      .124     1.206
   OUTFLOW: ID= 2:000154     2.00     .615    1.02 57.861      .123     1.200


 ----------------------------------------------------------------------------------
 001:0015--------------------------------------------------------------------------
 *
 *
 *
 *# Area S104
 *#==============================================================2
 *# 0.50% Slope
 *#=============================================================
 *
 -------------------
 | ROUTE CHANNEL    |      Routing time step (min) =  1.00
 |  IN> 01:000210   |      Number of SEGMENTS =  3
 | OUT< 02:000154   |      Slopes (%), CHANNEL= .5000  FLOODPLAIN= .5000
 -------------------                     LENGTH =   60.00    (m)

                <------ DATA FOR SECTION (    1.0) ------>
                Distance      Elevation       Manning
                     .00           .18          .0250
                    1.45           .15      .0250 / .0130  Main Channel
                    1.50           .00          .0130      Main Channel
                    5.50           .12          .0130      Main Channel
                    9.50           .00          .0130      Main Channel
                    9.55           .15      .0130 / .0250  Main Channel
                   11.00           .18          .0250

   <--------------------------- TRAVEL TIME TABLE -------------------------->
    DEPTH    ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
     (m)      (m)   (cu.m.)   (cu.m.)     (cms)     (m/s)      (min)    (m2/s)
      .009      .009  .178E+00  .277E-02       .000      .150      6.66      .001
      .019      .019  .710E+00  .222E-01       .003      .238      4.19      .004
      .028      .028  .160E+01  .749E-01       .008      .312      3.20      .009
      .038      .038  .284E+01  .178E+00       .018      .378      2.64      .014
      .047      .047  .444E+01  .347E+00       .032      .439      2.28      .021
      .056      .056  .639E+01  .599E+00       .053      .496      2.02      .028
      .066      .066  .870E+01  .951E+00       .080      .550      1.82      .036
      .075      .075  .114E+02  .142E+01       .114      .601      1.66      .045
      .084      .084  .144E+02  .202E+01       .156      .650      1.54      .055
      .094      .094  .178E+02  .277E+01       .206      .697      1.43      .065
      .103      .103  .215E+02  .369E+01       .266      .743      1.35      .077
      .112      .112  .256E+02  .479E+01       .335      .787      1.27      .089
      .122      .122  .300E+02  .609E+01       .419      .839      1.19      .102
      .131      .131  .345E+02  .756E+01       .530      .920      1.09      .121
      .141      .141  .391E+02  .916E+01       .650      .997      1.00      .140
      .150      .150  .436E+02  .109E+02       .780     1.072       .93      .161
      .160      .160  .488E+02  .130E+02       .930     1.143       .87      .183
      .170      .170  .545E+02  .155E+02      1.092     1.202       .83      .204
      .180      .180  .608E+02  .183E+02      1.268     1.250       .80      .225

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                   <---- hydrograph ---->  <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 1:000210     2.00     .622    1.00 57.861      .138      .978
   OUTFLOW: ID= 2:000154     2.00     .614    1.02 57.861      .138      .972


 ----------------------------------------------------------------------------------
 001:0016--------------------------------------------------------------------------
 *
 *
      FINISH
 ----------------------------------------------------------------------------------
 **********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
  001:0003 CALIB STANDHYD
      *** ERROR: XIMP cannot be larger than TIMP.
                 XIMP was forced to equal TIMP.
    Simulation ended on 2018-03-29     at 12:41:27
 ==================================================================================
```

Velocity x Depth Calculation - Riverside Park

Iteration equation:

Velocity:

$$v_x = v_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}} (v_{\max} - v_{\min})$$

Depth:

$$d_x = d_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}} (d_{\max} - d_{\min})$$

100 Year 3 Hour Chicago Storm																				
					SWMHYMO (34731vxd.out)					Calculation Sheet: Overflow for Typical Road Ponding Area					SWMHYMO (34731vxd.out)			Velocity x Depth	Maximum Static Ponding Depth	Total Dynamic Depth
Area ID (Dummy Segment, if applicable)	Road ROW Section	Longitudinal Slope (%)	Overflow Flowrate		Flowrate (cms)		Velocity (m/s)			Flowrate (cms)		Depth (m)			Depth (m)					
			Qx (l/s)	Qx (cms)	Qmin	Qmax	vmin	vmax	vx	Qmin	Qmax	dmin	dmax	dx	dmin	dmax	dx	(m^2/s)	(m)	(m)
S20A	11	4.00	**31**	0.031	0.024	0.051	0.884	1.070	**0.932**	0.029	0.037	0.055	0.060	**N/A**	0.028	0.038	**0.031**	**0.029**	0.00	0.031
S20B	11	6.00	**46**	0.046	0.029	0.062	1.082	1.311	**1.200**	0.029	0.037	0.055	0.060	**N/A**	0.028	0.038	**0.033**	**0.040**	0.00	0.033
S20C	11	4.00	**61**	0.061	0.051	0.092	1.070	1.242	**1.112**	0.056	0.067	0.070	0.075	**N/A**	0.038	0.047	**0.040**	**0.045**	0.00	0.040
S20D	11	2.00	**63**	0.063	0.036	0.065	0.757	0.878	**0.870**	0.054	0.065	0.070	0.075	**N/A**	0.038	0.047	**0.046**	**0.040**	0.00	0.046
S20E	11	2.00	**76**	0.076	0.065	0.106	0.878	0.992	**0.909**	0.065	0.078	0.075	0.080	**N/A**	0.047	0.056	**0.049**	**0.045**	0.00	0.049
S107	11	0.90	**85**	0.085	0.071	0.107	0.665	0.737	**0.693**	0.075	0.088	0.080	0.085	**N/A**	0.056	0.066	**0.060**	**0.042**	0.00	0.060
S106A	11	2.99	**80**	0.080	0.079	0.129	1.074	1.213	**1.077**	0.078	0.091	0.080	0.085	**N/A**	0.047	0.056	**0.047**	**0.051**	0.00	0.047
S106B	11	4.00	**86**	0.086	0.051	0.092	1.070	1.242	**1.217**	0.080	0.094	0.080	0.085	**N/A**	0.038	0.047	**0.046**	**0.056**	0.00	0.046
S105A	11	1.33	**72**	0.072	0.053	0.086	0.716	0.809	**0.770**	0.065	0.078	0.075	0.080	**N/A**	0.047	0.056	**0.052**	**0.040**	0.00	0.052
S105B	11	1.00	**71**	0.071	0.046	0.075	0.621	0.701	**0.690**	0.063	0.075	0.075	0.080	**N/A**	0.047	0.056	**0.055**	**0.038**	0.00	0.055
S104	11	0.50	**0**	0	0	0.001	0	0.15	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.15	0.150

STORM HYDRAULIC GRADE LINE CALCULATION SHEET
RIVERSIDE PARK
CITY OF OTTAWA
TAGGART REALTY MANAGEMENT

JOB #: 37923 5.7
DATE: MARCH 2018
DESIGN: PD
FILE: CCS_storm_2018-03-26.xls
REV #:

FROM EXMH 3 TO CBMH20

FRICTION LOSS	FROM MH	TO MH	PIPE ID
	EXMH3	**MH98**	
INVERT ELEVATION (m)	77.039	77.183	
OBVERT ELEVATION (m)	78.014	78.158	
DIAMETER (mm)			975
LENGTH (m)			71.78
FLOW (l/s)			726
HGL (m) ***	**78.014**	**78.089**	**0.075**
MANHOLE COEF K= 0.75	LOSS (m)	0.036	
TOTAL HGL (m)		**78.126**	
MAX. SURCHARGE (mm)		**-32**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.9750	0.75	3.06	0.080	0.24	1.34	1001.721396

HYDRAULIC SLOPE 0.16 %
DESIGN FLOW TO FULL FLOW RATIO (0.725
DESIGN FLOW DEPTH = 0.614

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 0.97 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
	98	**99**	
INVERT ELEVATION (m)	77.183	77.420	
OBVERT ELEVATION (m)	78.158	78.395	
DIAMETER (mm)			975
LENGTH (m)			118.68
FLOW (l/s)			766
HGL (m) ***	**78.158**	**78.296**	**0.139**
MANHOLE COEF K= 0.05	LOSS (m)	0.003	
TOTAL HGL (m)		**78.299**	
MAX. SURCHARGE (mm)		**-96**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.9750	0.75	3.06	0.130	0.24	1.34	1001.721396

HYDRAULIC SLOPE 0.12 %
DESIGN FLOW TO FULL FLOW RATIO (0.764
DESIGN FLOW DEPTH = 0.634

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 1.03 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
	99	**100**	
INVERT ELEVATION (m)	78.695	81.137	
OBVERT ELEVATION (m)	79.595	82.037	
DIAMETER (mm)			900
LENGTH (m)			56.15
FLOW (l/s)			770
HGL (m) ***	**79.595**	**79.697**	**0.102**
MANHOLE COEF K= 1.50	LOSS (m)	0.112	
TOTAL HGL (m)		**81.407**	
MAX. SURCHARGE (mm)		**-630**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.9000	0.64	2.83	0.100	0.23	5.94	3773.789142

HYDRAULIC SLOPE 3.23 %
DESIGN FLOW TO FULL FLOW RATIO (0.204
DESIGN FLOW DEPTH = 0.270

Head loss in manhole simplified method p. 71 (MWDM)
flow at 90, assume cons. K_L 1.50
Velocity = Flow / Area = 1.21 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
	100	**101**	
INVERT ELEVATION (m)	87.577	87.801	
OBVERT ELEVATION (m)	88.477	88.701	
DIAMETER (mm)			900
LENGTH (m)			74.5
FLOW (l/s)			794
HGL (m) ***	**88.477**	**88.621**	**0.143**
MANHOLE COEF K= 0.75	LOSS (m)	0.060	
TOTAL HGL (m)		**88.681**	
MAX. SURCHARGE (mm)		**-20**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.9000	0.64	2.83	0.200	0.23	1.56	991.0358306

HYDRAULIC SLOPE 0.27 %
DESIGN FLOW TO FULL FLOW RATIO (0.801
DESIGN FLOW DEPTH = 0.603

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 1.25 m/s
HL = K_L * V^2/ 2g

STORM HYDRAULIC GRADE LINE CALCULATION SHEET
RIVERSIDE PARK
CITY OF OTTAWA
TAGGART REALTY MANAGEMENT

JOB #: 37923 5.7
DATE: MARCH 2018
DESIGN: PD
FILE: CCS_storm_2018-03-26.xls

FRICTION LOSS	FROM MH	TO MH	PIPE ID
	101	102	
INVERT ELEVATION (m)	88.576	88.730	
OBVERT ELEVATION (m)	89.476	89.630	
DIAMETER (mm)			900
LENGTH (m)			51.24
FLOW (l/s)			812
HGL (m) ***	89.476	89.579	0.103
MANHOLE COEF K= 0.75	LOSS (m)	0.062	
TOTAL HGL (m)		89.641	
MAX. SURCHARGE (mm)		12	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.9000	0.64	2.83	0.160	0.23	1.56	991.07

HYDRAULIC SLOPE 0.32 %
DESIGN FLOW TO FULL FLOW RATIO (0.819
DESIGN FLOW DEPTH = 0.612

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 1.28 m/s
$HL = K_L * V^2/ 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
	102	103	
INVERT ELEVATION (m)	88.730	88.929	
OBVERT ELEVATION (m)	89.630	89.829	
DIAMETER (mm)			900
LENGTH (m)			66.48
FLOW (l/s)			835
HGL (m) ***	89.641	89.783	0.142
MANHOLE COEF K= 1.50	LOSS (m)	0.132	
TOTAL HGL (m)		89.915	
MAX. SURCHARGE (mm)		86	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.9000	0.64	2.83	0.120	0.23	1.56	991.04

HYDRAULIC SLOPE 0.41 %
DESIGN FLOW TO FULL FLOW RATIO (0.843
DESIGN FLOW DEPTH = 0.630

Head loss in manhole simplified method p. 71 (MWDM)
flow at 90, assume cons. K_L 1.50
Velocity = Flow / Area = 1.31 m/s
$HL = K_L * V^2/ 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
	103	104	
INVERT ELEVATION (m)	88.929	89.183	
OBVERT ELEVATION (m)	89.829	90.083	
DIAMETER (mm)			900
LENGTH (m)			84.57
FLOW (l/s)			868
HGL (m) ***	89.915	90.109	0.195
MANHOLE COEF K= 0.05	LOSS (m)	0.005	
TOTAL HGL (m)		90.114	
MAX. SURCHARGE (mm)		31	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.9000	0.64	2.83	0.100	0.23	1.56	991.05

HYDRAULIC SLOPE 0.24 %
DESIGN FLOW TO FULL FLOW RATIO (0.876
DESIGN FLOW DEPTH = 0.648

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 1.37 m/s
$HL = K_L * V^2/ 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ACCESS ROAD	104	105	
INVERT ELEVATION (m)	89.408	89.525	
OBVERT ELEVATION (m)	90.083	90.200	
DIAMETER (mm)			675
LENGTH (m)			58.51
FLOW (l/s)			279
HGL (m) ***	90.114	90.179	0.065
MANHOLE COEF K= 0.75	LOSS (m)	0.023	
TOTAL HGL (m)		90.202	
MAX. SURCHARGE (mm)		2	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.6750	0.36	2.12	0.100	0.17	1.05	375.73

HYDRAULIC SLOPE 0.15 %
DESIGN FLOW TO FULL FLOW RATIO (0.743
DESIGN FLOW DEPTH = 0.432

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 0.78 m/s
$HL = K_L * V^2/ 2g$

IBI GROUP

STORM HYDRAULIC GRADE LINE CALCULATION SHEET
RIVERSIDE PARK
CITY OF OTTAWA
TAGGART REALTY MANAGEMENT

JOB #: 37923 5.7
DATE: MARCH 2018
DESIGN: PD
FILE: CCS_storm_2018-03-26.xls

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ACCESS ROAD	**105**	**106**	
INVERT ELEVATION (m)	90.459	91.756	
OBVERT ELEVATION (m)	90.834	92.131	
DIAMETER (mm)			375
LENGTH (m)			64.88
FLOW (l/s)			86
HGL (m) ***	**90.834**	**90.990**	**0.156**
MANHOLE COEF K= 1.50	LOSS (m)	0.046	
TOTAL HGL (m)		**91.906**	
MAX. SURCHARGE (mm)		**-225**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.3750	0.11	1.18	0.650	0.09	2.25	247.83

HYDRAULIC SLOPE 1.65 %
DESIGN FLOW TO FULL FLOW RATIO (0.346
DESIGN FLOW DEPTH = 0.150

Head loss in manhole simplified method p. 71 (MWDM)
flow at 90, assume cons. K_L 1.50
Velocity = Flow / Area = 0.78 m/s
$HL = K_L * V^2 / 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ACCESS ROAD	**106**	**107**	
INVERT ELEVATION (m)	91.831	92.064	
OBVERT ELEVATION (m)	92.131	92.364	
DIAMETER (mm)			300
LENGTH (m)			11.64
FLOW (l/s)			83
HGL (m) ***	**92.131**	**92.216**	**0.085**
MANHOLE COEF K= 0.75	LOSS (m)	0.000	
TOTAL HGL (m)		**92.232**	
MAX. SURCHARGE (mm)		**-132**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.3000	0.07	0.94	0.200	0.08	1.93	136.69

HYDRAULIC SLOPE 0.87 %
DESIGN FLOW TO FULL FLOW RATIO (0.604
DESIGN FLOW DEPTH = 0.168

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 1.17 m/s
$HL = K_L * V^2 / 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ACCESS ROAD	**107**	**CBMH20**	
INVERT ELEVATION (m)	92.114	97.874	
OBVERT ELEVATION (m)	92.364	98.124	
DIAMETER (mm)			250
LENGTH (m)			120
FLOW (l/s)			75
HGL (m) ***	**92.364**	**94.277**	**1.913**
MANHOLE COEF K= 0.37	LOSS (m)	0.044	
TOTAL HGL (m)		**98.009**	
MAX. SURCHARGE (mm)		**-115**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2500	0.05	0.79	0.650	0.06	2.65	130.22

HYDRAULIC SLOPE 4.70 %
DESIGN FLOW TO FULL FLOW RATIO (0.576
DESIGN FLOW DEPTH = 0.135

Head loss in manhole simplified method p. 71 (MWDM)

Figure 1.7.: Qu	Qo	Qu/Qo	KL
75	83	0.909098	0.32

Velocity = Flow / Area = 1.53 m/s
$HL = K_L * V^2 / 2g$

Ministry of the Environment | Ministère de l'Environnement

Ontario

RECEIVED FEB 13 2002

AMENDMENT TO CERTIFICATE OF APPROVAL
MUNICIPAL AND PRIVATE SEWAGE WORKS
NUMBER 3-0842-87-006
Notice No. 1

Claridge Homes (Briar Ridge) Inc.
210 Gladstone Avenue, No. 201
Ottawa, Ontario
K4B 1H9

Site Location: Riverwalk Park Subdivision
Kimberwick Crescent
Ottawa City,

You are hereby notified that I have amended Certificate of Approval No. 3-0842-87-006 issued on December 28, 1988 for construction of stormwater management facilities consisting of a primary settling pond and secondary marsh treatment pond, as follows:

modification to raise the height of the overflow weir to an elevation of approximately 76.75 metres;

all in accordance with the application for approval dated December 12, 2001, and supporting information and documentation prepared by Novatech Engineering Ltd., Consulting Engineers and Planners.

This Notice shall constitute part of the approval issued under Certificate of Approval No. 3-0842-87-006 dated December 28, 1988

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

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

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

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

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 53, *Ontario Water Resources Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

* **Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 7th day of February, 2002

THIS NOTICE WAS MAILED
ON Feb 11, 2002
JC
(Signed)

Mohamed Dhalla, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

AM/
c: District Manager, MOE Ottawa
Greg MacDonald, Novatech Engineering Consultants Ltd. √

2072 P

AS-BUILT FINAL

NOTES: GENERAL

1. ALL WORK TO BE COMPLETED IN ACCORDANCE WITH CITY OF OTTAWA STANDARDS AND OPS DRAWINGS AND SPECIFICATIONS, UNLESS OTHERWISE NOTED.

2. CONTRACTOR IS TO PROCURE COPIES OF THE STANDARDS AND KEEP ON SITE.

3. DIMENSIONS AND LAYOUT INFORMATION SHALL BE CONFIRMED PRIOR TO COMMENCEMENT OF CONSTRUCTION.

4. THE ORIGINAL TOPOGRAPHY AND GROUND ELEVATIONS, SERVICING AND SURVEY INFORMATION SHOWN ON THIS PLAN ARE SUPPLIED FOR INFORMATION PURPOSES ONLY. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE ACCURACY OF ALL INFORMATION OBTAINED FROM THIS PLAN.

5. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.

6. BEFORE COMMENCING CONSTRUCTION, PROVIDE PROOF OF COMPREHENSIVE ALL RISK AND OPERATIONAL LIABILITY INSURANCE INCLUDING BLASTING. INSURANCE POLICY TO NAME THE OWNER, ENGINEER, MUNICIPALITY AND THE COUNTY AS CO-INSURED. AMOUNT OF INSURANCE TO BE SPECIFIED BY OWNER'S AGENT.

7. PRIOR TO ANY ROCK EXCAVATION, CONTRACTOR IS REQUIRED TO COMPLETE A PRE-CONSTRUCTION SURVEY.

8. DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME ALL RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THESE DRAWINGS.

9. OBTAIN AND PAY FOR ALL NECESSARY PERMITS AND APPROVALS FROM THE CIT OF OTTAWA BEFORE COMMENCING CONSTRUCTION.

10. RESTORE ALL SURFACE FEATURES TO EXISTING CONDITIONS OR BETTER AND TO THE SATISFACTION OF THE CITY OF OTTAWA.

11. ALL ELEVATIONS ARE GEODETIC AND UTILIZE METRIC UNITS.

12. SIDE SLOPES FOR ALL EXCAVATIONS ARE TO BE IN ACCORDANCE WITH THE OCCUPATIONAL HEALTH AND SAFTY ACT (ONTARIO REGULATION 213/91).

13. THE OWNER AGREES TO PREARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CITY OF OTTAWA, APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS AND DURING ALL PHASES OF THE SITE PREPARATION AND CONSTRUCTION IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL SUCH AS BUT NOT LIMITED TO INSTALLING FILTER CLOTHS ACROSS MH & CBS TO PREVENT SEDIMENT FROM ENTERING STRUCTURES AND INSTALL AND MAINTAIN A LIGHT DUTY SILT FENCE BARRIER AS REQUIRED.

NOTES: GRADING

1. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER.

2. GRADE AND/OR FILL WHERE REQUIRED.

3. MATCH EXISTING ELEVATIONS UNLESS OTHERWISE NOTED.

4. ENSURE POSITIVE DRAINAGE FROM SHORELINE AND BERM INTO STORMWATER PONDWHETHER INDICATED OR NOT.

5. MINIMUM OF 0.5% AND MAXIMUM OF 8% GRADE FOR ALL GRASS AREAS UNLESS OTHERWISE NOTED.

6. MAXIMUM TERRACING GRADE IS 3:1.

NOTES: SOIL ANALYSIS

1. SOIL MATRIX INVESTIGATION - RIVERWALK STORM WATER FACILITY KIMBERWICK CRESCENT. OTTAWA, ONTARIO

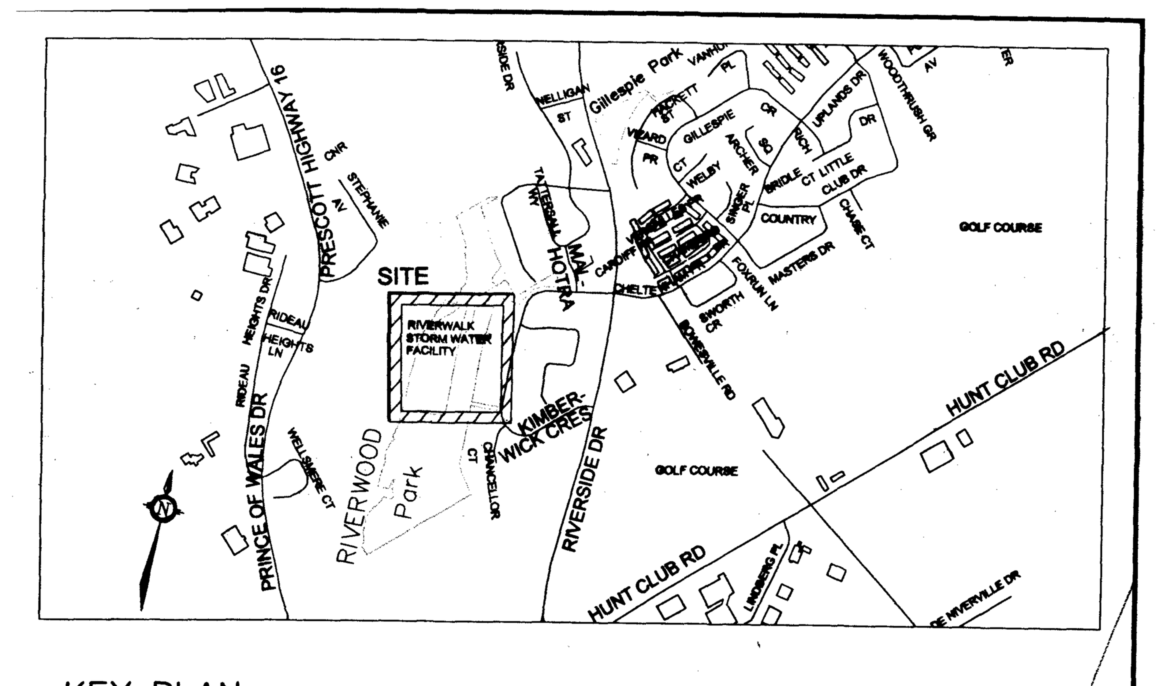
- ACCUTEST: REP.# 2709961. MAY, 2007.

SITE BENCHMARK:

EXISTING FIRE HYDRANT - TOP OF FLANGE. EAST SIDE OF MALHOTRA CRESCENT, SIX HOUSES NORTH OF CUL-DU-SAC.

DERIVED FROM:

NOVATECH ENGINEERING AS-BUILTS
PLAN 95023 P2. RIVERWOOD
LANDINGS (STA 1+400 TO 1+503.93)



KEY PLAN:
N.T.S.

LEGEND

(arrow)	℄ BREECH AND DIRECTION OF FLOW
(double arrow)	GENERAL POND FLOW DIRECTION
(headwall)	EXISTING CONCRETE HEADWALL
○	EXISTING STORM MANHOLE
●	EXISTING SANITARY MANHOLE
(sideslopes)	SIDESLOPES
□	GABIONS

SURVEY - MAY,2007

× 76.81 TBERM	EXISTING TOP OF BERM ELEVATION
× 76.14 WL	EXISTING POND WATER LINE
× 75.92 CLD	EXISTING CENTRE LINE OF BREECH
× 76.05 CLD 1	EXISTING CENTRE LINE OF CONCRETE FLOOR OF HEAD WALL
× 77.57 TPILE	EXISTING TOP OF SEDIMENT STOCK PILE
× 77.57 BPILE	EXISTING BOTTOM OF SEDIMENT STOCK PILE
× 76.21 TWATER	EXISTING WATER LEVEL - TOP
× 75.62 BWATER	EXISTING WATER LEVEL - BOTTOM
× 77.87 THW	EXISTING TOP OF HEAD WALL
× 78.87 CPT 1	SURVEY CONTROL POINT

SURVEY - NOVEMBER,2007 (POST POND CLEAN-OUT)

× 76.81 TS	EXISTING TOP OF SLOPE/BERM
× 76.81 OG	EXISTING ORIGINAL GROUND
× 76.81 BS	EXISTING BOTTOM OF SLOPE
× 76.81 WL	EXISTING WATER LINE
× 76.81 BWater	EXISTING BOTTOM OF WATER
× 76.81 THW	EXISTING TOP OF HEAD WALL
× 76.81 CULV CONC	EXISTING CONCRETE CULVERT
× 76.81 OCULV	EXISTING OBVERT OF CONCRETE CULVERT
× 76.81 TS POND	EXISTING POND TOP OF SLOPE

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

CLARIDGE HOMES

Ottawa

No.	REVISION	DATE	BY
2	ISSUED FOR FINAL APPROVAL AND TAKE OVER BY CITY	JAN, 08	GMacD
1	ISSUED FOR SWF TAKE OVER BY CITY	JUN , 07	GMacD

LICENSED PROFESSIONAL ENGINEER
G.J. MacDONALD
PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M IP6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

DESIGN	GMacD
CHECKED	GMacD
DRAWN	MWC
CHECKED	GMacD
APPROVED	GMacD

SCALE
1 : 300

CITY OF OTTAWA
RIVER WALK STORM WATER - FACILITY (Kimberwick Cres.)

GRADING AND SERVICING PLAN:
CLEAN OUT AND BERM REPAIRS, 2007

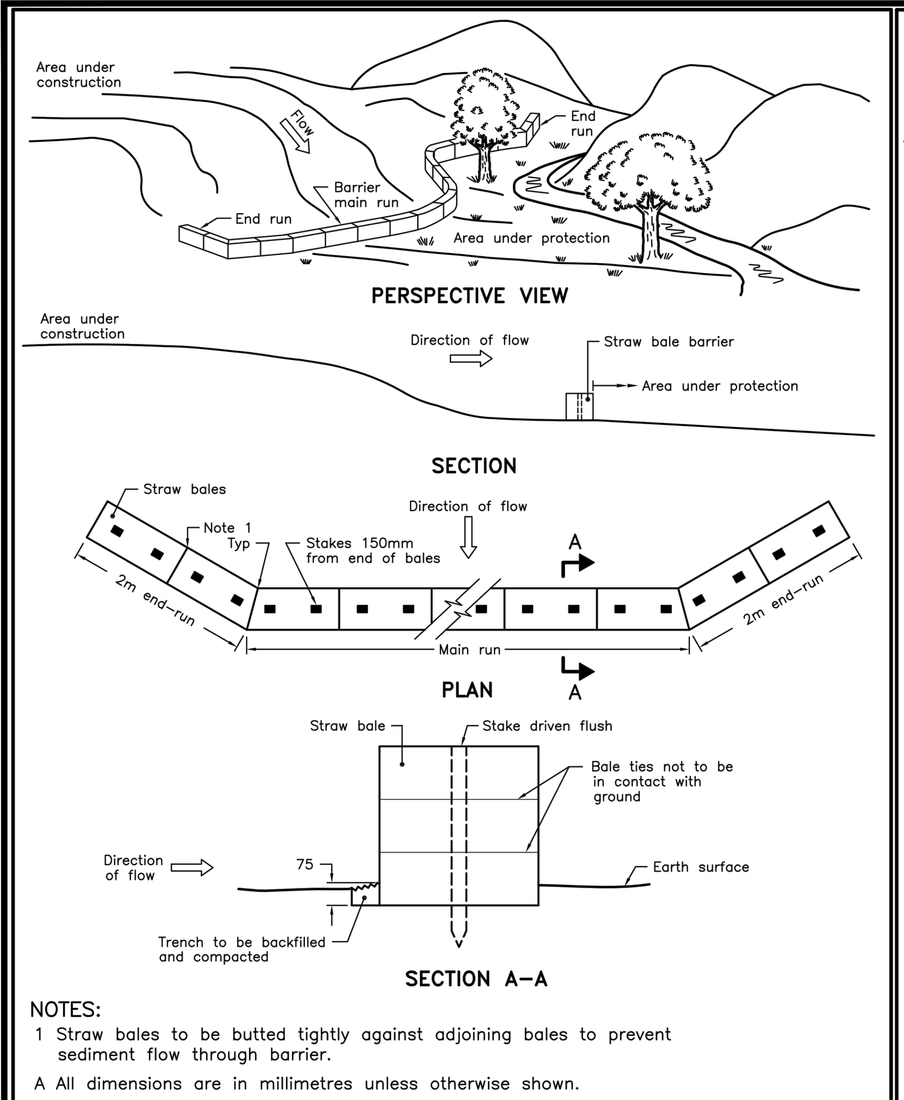
PROJECT No.	95023SWF
DATE	MAY, 2007
DRAWING No.	95023SWF-GS

PLANBLDWG - 1000mmX707mm

2072 P

Drawing: M:\1995\95023\2007Riverwalk\RiverWalkSWF-GR.dwg Layout: GS-300 Updated NOV 7, 2007 at 9:28am by mconnolly

APPENDIX D

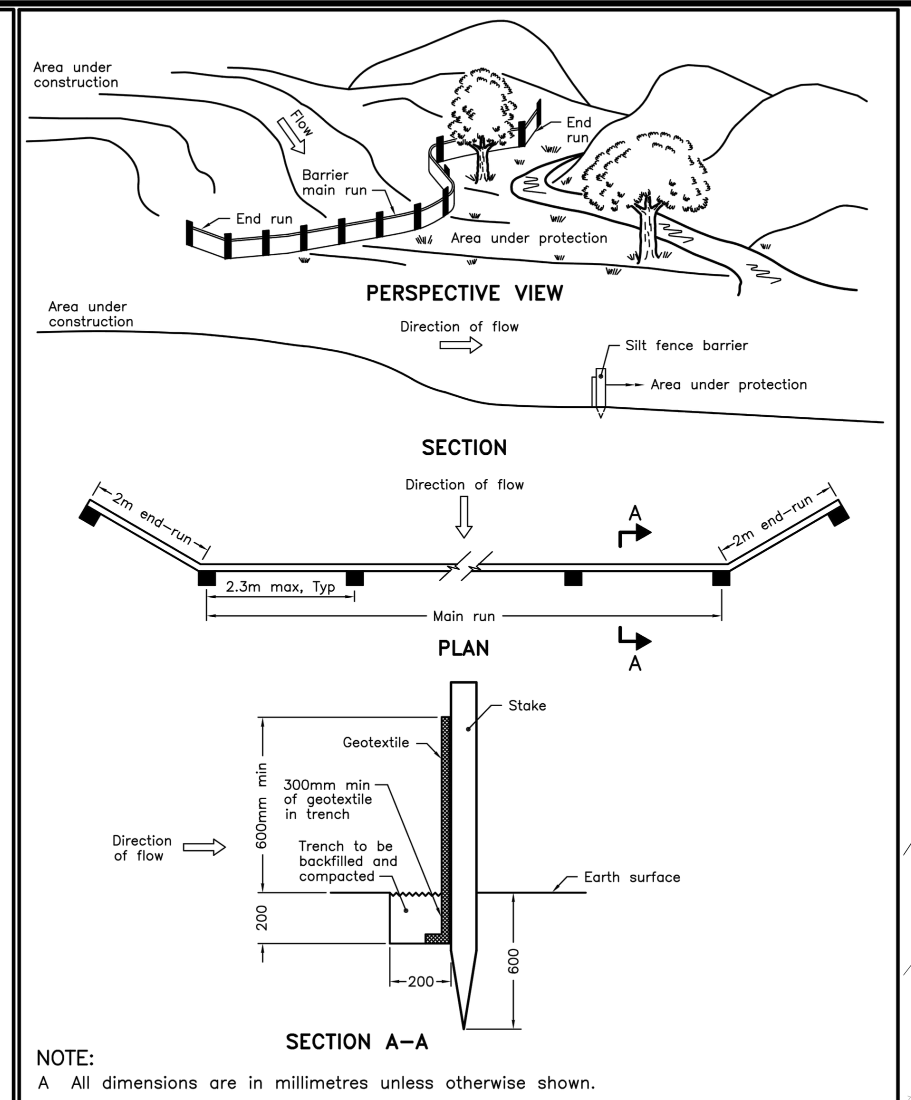


NOTES:
1 Straw bales to be butted tightly against adjoining bales to prevent sediment flow through barrier.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2006 | Rev 1

LIGHT-DUTY STRAW BALE BARRIER

OPSD 219.100



NOTE:
A All dimensions are in millimetres unless otherwise shown.

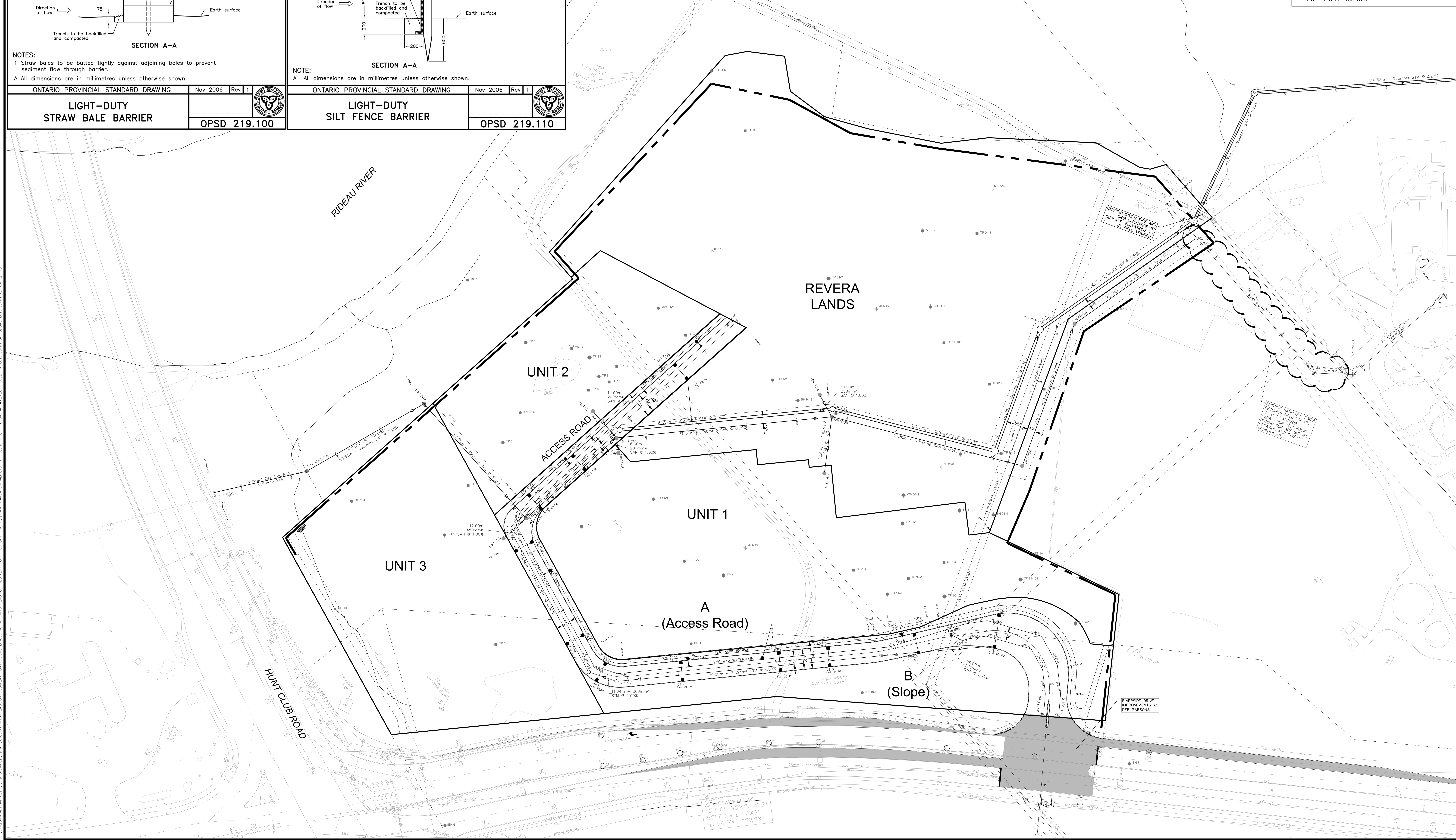
ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2006 | Rev 1

LIGHT-DUTY SILT FENCE BARRIER

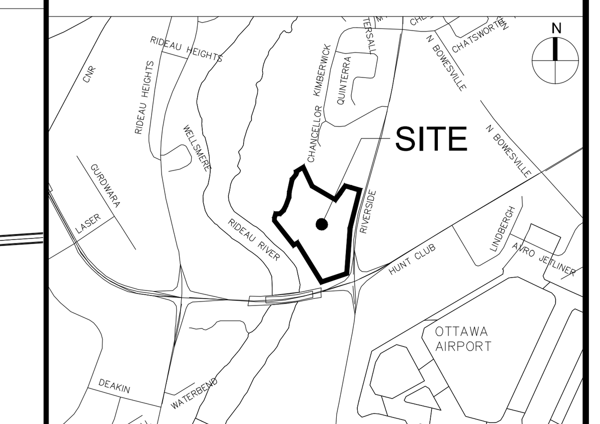
OPSD 219.110

NOTES:

1. SILT FENCE TO BE ERECTED PRIOR TO EARTH WORKS BEING COMMENCED. SILT FENCE TO BE MAINTAINED UNTIL VEGETATION IS ESTABLISHED OR UNTIL START OF SUBSEQUENT PHASE.
2. STRAW BALE SEDIMENT TRAPS TO BE CONSTRUCTED IN EXISTING ROAD SIDE DITCHES. TRAPS TO REMAIN AND BE MAINTAINED UNTIL VEGETATION IS ESTABLISHED.
3. GEOTEXTILE FABRIC TO BE PLACED UNDER COVER OF ALL CATCHBASINS. GEOTEXTILE FABRIC IN STREET CB'S TO REMAIN UNTIL BASE COURSE ASPHALT IS LAID. GEOTEXTILE FABRIC IN RYCB'S TO REMAIN UNTIL VEGETATION IS ESTABLISHED. ALL CATCHBASINS TO BE REGULARLY INSPECTED AND CLEANED, AS NECESSARY, UNTIL SOD AND CURBS ARE CONSTRUCTED.
4. CONTRACTOR TO PROVIDE DETAILS ON LOCATION(S) AND DESIGN OF DEWATERING TRAP(S) PRIOR TO COMMENCING WORK. CONTRACTOR ALSO RESPONSIBLE FOR MAINTAINING TRAP(S) AND ADJUSTING SIZE(S) IF DEEMED REQUIRED BY THE ENGINEER DURING CONSTRUCTION.
5. CONTRACTOR TO PROTECT EXISTING CATCHBASINS WITH FILTER CLOTH UNDER THE COVERS TO TRAP SEDIMENTATION. REFER TO IDENTIFIED STRUCTURES.
6. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.



NOTES:
1. SEE DETAIL DRAWING C-010 FOR ADDITIONAL DETAILS AND NOTES.
2. SITE BENCHMARK TO BE OBTAINED FROM LEGAL SURVEYOR ANNIS, O'SULLIVAN, VOLLEBEKK LTD.



No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2			
1	ISSUED FOR CITY APPROVAL	T.R.B.	2018:04:03

TAGGART
REALTY MANAGEMENT

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title
RIVERSIDE PARK

LICENSED PROFESSIONAL ENGINEER
T. R. BRULE
18/03/28
PROVINCE OF ONTARIO

N

Drawing Title
EROSION AND SEDIMENTATION CONTROL PLAN

Scale
1:750

Design: J.E.B.	Date: MAR 2018
Drawn: D.D.	Checked: T.R.B.
Project No.: 37923	Drawing No.: C-900

CITY PLAN No. ####

CITY FILE No. ####

APPENDIX E

From: Oram, Cody [mailto:Cody.Oram@ottawa.ca]
Sent: Monday, May 02, 2016 10:55 AM
To: O'Connor, Ann
Subject: 3860/3930 Riverside Dr_Pre-Consult_Engineering follow up

Hi Ann,

I've summarized the engineering submission requirements below;

1. Servicing and SWM

   Water – See attached Water.PNG for approximate location of existing public infrastructure adjacent to the site. Water frontage fee's apply to Riverside Dr. The current watermain frontage rate is $190/m, for the entire length of the property that will front onto Riverside Drive.

   Storm – The City of Ottawa Kimberwick SWF (SWF 1612) is located north of the site, west of Quinterra subdivision. The Kimberwick SWF was designed to receive runoff from 6.0 ha of the site at a runoff coefficient C=0.7. See attached the Certificate of Approval for the Storm Pond, Storm Pond Design Report, design and as-built plans of the pond. The site will need to control the 100 year storm event to a 5 year event using a C=0.7. The City is not aware of the storm pipe leading south towards the site. The pipe may have been proposed and not actually built; this will need to be verified in the field.

   Sanitary – The development is to be serviced by extending the existing 525mm dia. sanitary sewer from north of the site (Chancellor Crt.), see attached Sanitary.PNG for approximate location of sanitary sewer. The sanitary sewer is to be extended through the site to the south property line and designed to service approximately 47.3 hectares of land south of the Hunt Club Rd. The Servicing Study will need to clearly demonstrate that the sanitary sewer is capable of servicing the subject site as well as the land's south of Hunt Club Rd. The previous report submitted in 2008, prepared by IBI Group did not include information on the 610 mm watermain crossing at Hunt Club. Hunt Club watermain plans will be forwarded under a separate email to the civil consultant. The functional design plan and profile of the sanitary sewer to be extended south of the property will need to be revised to include the watermain and submitted for review.
2. Geotechnical Investigation and Slope Stability Study
   - Discussion on sanitary sewer easement width and location to be included.
3. Noise Study
4. Phase I Environmental Site Assessment, Phase II ESA if required.
5. Plans required;
   a. Site Servicing Plan (Plan and Profile's for all services requiring MOE ECA)
   b. Grade Control and Drainage Plan
   c. Erosion and Sediment Control Plan

Additional Information;

- The Servicing Study Guidelines for Development Applications are available at the following address: http://ottawa.ca/en/development-application-review-process-0/servicing-study-guidelines-development-applications
- Servicing and site works shall be in accordance with the following documents:
  - ⇨ Ottawa Sewer Design Guidelines (October 2012)
  - ⇨ Ottawa Design Guidelines – Water Distribution (2010)

- ⇨ Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
- ⇨ City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)
- ⇨ City of Ottawa Environmental Noise Control Guidelines (January, 2016)
- ⇨ City of Ottawa Park and Pathway Development Manual (2012)
- ⇨ City of Ottawa Accessibility Design Standards (2012)
- ⇨ Ottawa Standard Tender Documents (latest version)
- ⇨ Ontario Provincial Standards for Roads & Public Works (2013)

- Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455).
- Water Boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide the following information:

  i. Location of service
  ii. Type of development and the amount of fire flow required (as per FUS, 1999).
  iii. Average daily demand: ___ l/s.
  iv. Maximum daily demand: ___l/s.
  v. Maximum hourly daily demand: ___ l/s.

- An MOECC Environmental Compliance Approval (Private Sewage Works) will be required for the proposed development. Please contact Ontario Ministry of the Environment and Climate Change, Ottawa District Office to arrange a pre-submission consultation:
  - For residential applications: Charlie Primeau, (613) 521-3450, ext. 251, Charlie.Primeau@ontario.ca
  - For I/C/I applications: Emily Diamond, (613) 521-3450, ext. 238, Emily.Diamond@ontario.ca

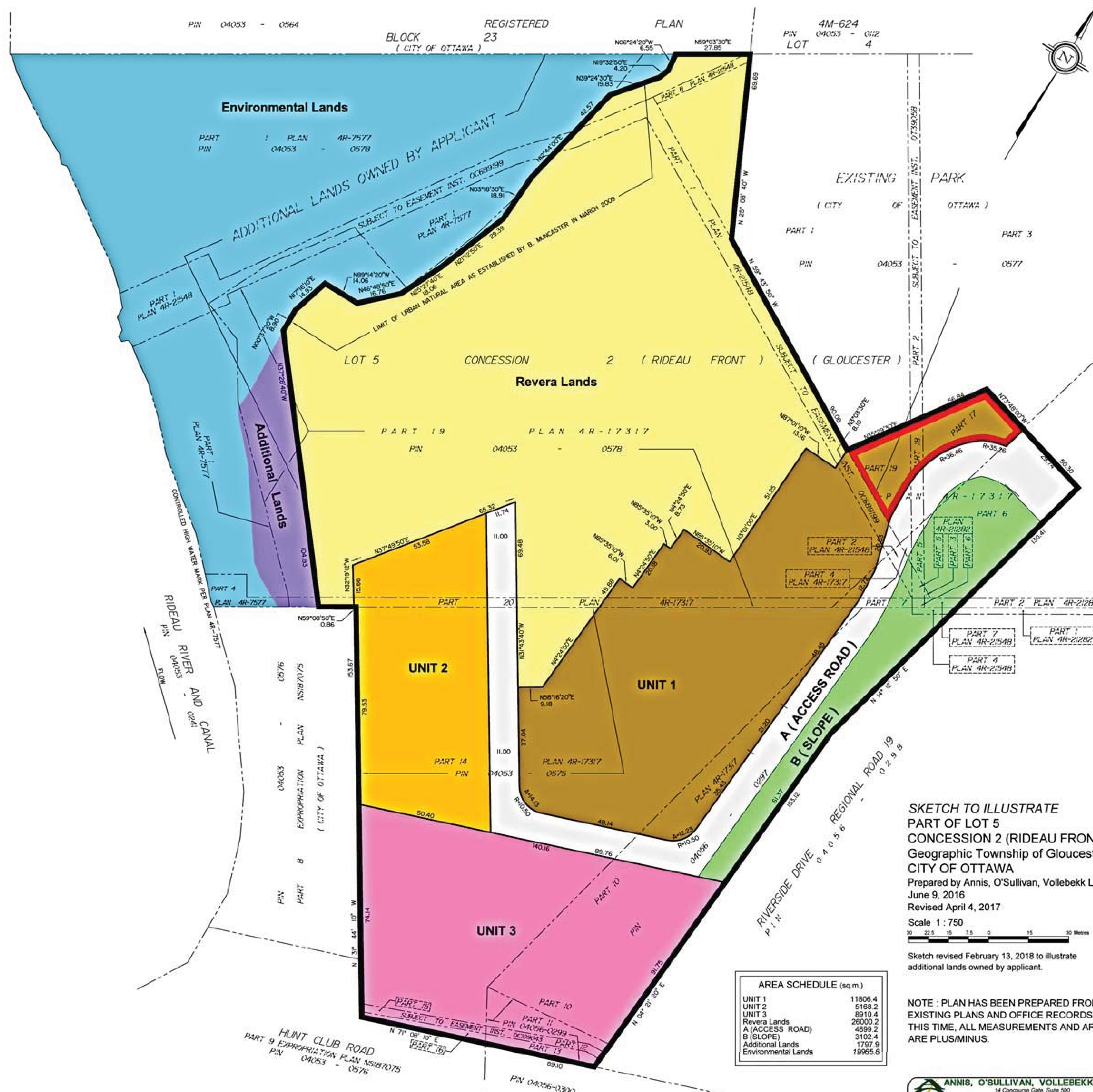
If you have any questions please don't hesitate to call or email.

Regards,

Cody

Cody Oram, P.Eng.
Project Manager, Development Review
(Urban Services) Outer
Gestionnaire de projets
(Secteur urbain) Exterieur
PLANNING AND GROWTH MANAGEMENT
URBANISME ET GESTION DE LA CROISSANCE
City of Ottawa | ville d'Ottawa
613.580.2424 ext/poste 13422

APPENDIX F



SKETCH TO ILLUSTRATE
PART OF LOT 5
CONCESSION 2 (RIDEAU FRONT)
Geographic Township of Gloucester
CITY OF OTTAWA
Prepared by Annis, O'Sullivan, Vollebekk Ltd
June 9, 2016
Revised April 4, 2017

Scale 1 : 750

Sketch revised February 13, 2018 to illustrate additional lands owned by applicant.

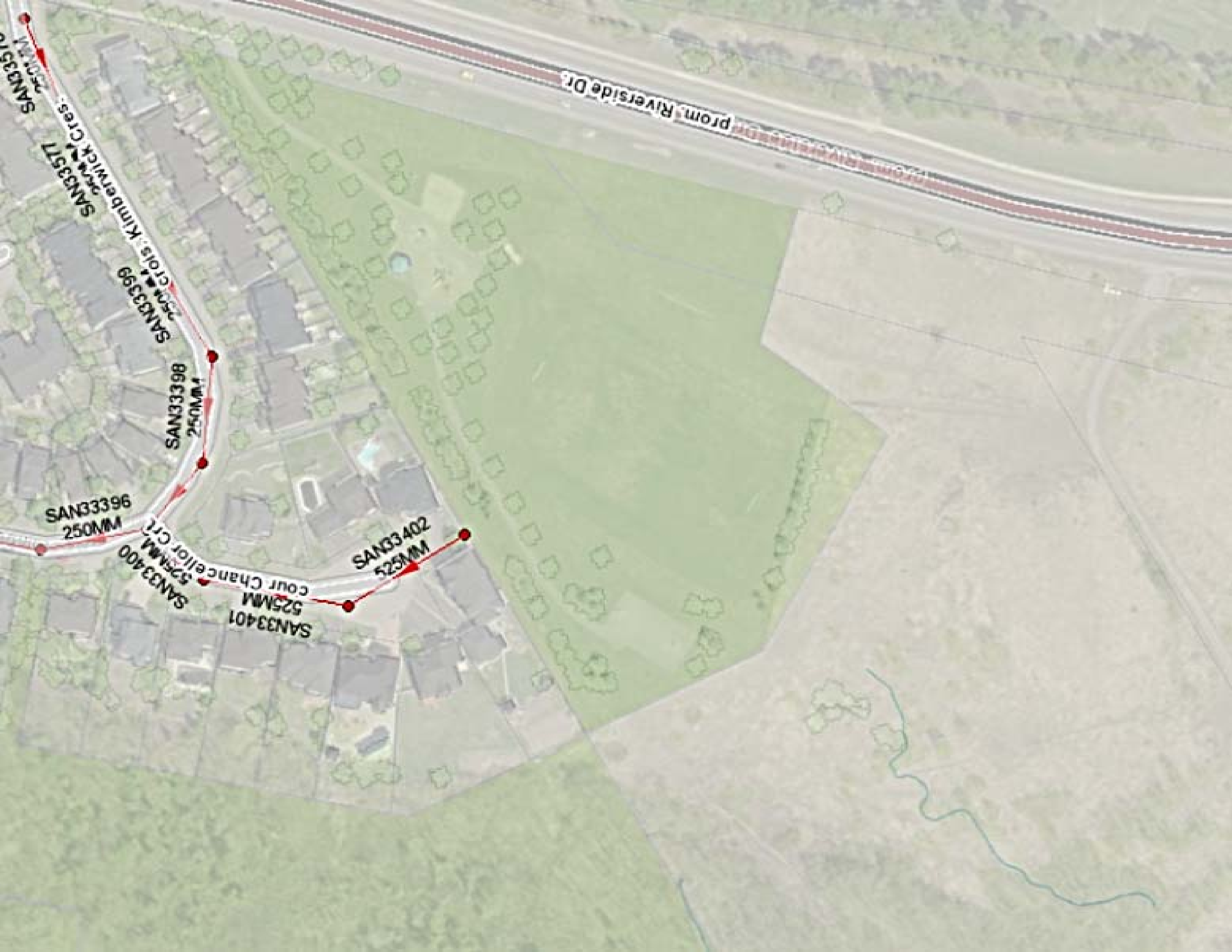
NOTE : PLAN HAS BEEN PREPARED FROM EXISTING PLANS AND OFFICE RECORDS. AT THIS TIME, ALL MEASUREMENTS AND AREAS ARE PLUS/MINUS.

AREA SCHEDULE (sq.m.)

UNIT 1	11806.4
UNIT 2	5168.2
UNIT 3	8910.4
Revera Lands	26000.2
A (ACCESS ROAD)	4899.2
B (SLOPE)	3102.4
Additional Lands	1797.9
Environmental Lands	19965.6

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Ontario Land Surveyors


WAT12339
406mm
prom. Riverside Dr
Riverside Dr
WAT05446
152mm
305mm
© 2016 - City Of Ottawa/Ville d'Ottawa, © Teranet Enterprises Inc.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Kimberwick Cres.
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SAN33401
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cour Chancellor Crt