

**FUNCTIONAL SERVICING AND STORMWATER
MANAGEMENT REPORT**

**CONSULATE DEVELOPMENT (ONTARIO) LTD.
TOWN OF COLLINGWOOD**

BRIDGEWATER AT GEORGIAN BAY

PREPARED BY:

**C.F. CROZIER & ASSOCIATES INC.
40 HURON STREET
COLLINGWOOD, ONTARIO
L9Y 4R3**

JULY 2018

CFCA FILE NO. 131-2543



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1.0 Introduction

CF Crozier & Associates Inc. ("Crozier") has been retained by Consulate Developments (Ontario) Inc. ("Consulate") to prepare a Functional Servicing and Stormwater Management Report to support a Zoning Bylaw Amendment for a proposed residential development located in the west end of Collingwood. The Subject Development is referred to as Bridgewater on Georgian Bay, and is bounded by Princeton Shores Boulevard and Bartlett Boulevard to the north, Princeton Shores Boulevard to the east, lands also owned by the applicant to the west and Highway 26 to the south. The 37.2 ha (92 acre) parcel is legally described as Part of Lots 48, 49, and 50, Concession 11, Town of Collingwood, County of Simcoe ("Subject Lands"). Consulate also owns property to the west of the Subject Lands that are legally described as Part of Lots 49, 50, and 51, Concession 12, Town of Collingwood, County of Simcoe ("west lands"). The consolidated land holdings are referred to herein as "Consulate lands". Refer to Figure 1 for Site Location Plan.

The Subject Lands include an approximately 12ha area of developable lands surrounded by Environmental Protection areas, as well as an approximately 1ha block of future high density development adjacent to Highway 26. Within these developable lands, Consulate intends to develop a medium density residential development. At full buildout, the vision for Bridgewater on Georgian Bay includes 655 townhouse and apartment units, a series of private roadways, a stormwater management block, a flood conveyance channel, a sewage pumping station and a number of open space environmental blocks. The proposed Concept Plan for the development is shown in Figure 2.

Consulate has assembled a multi-disciplinary consulting team to assist with the technical studies in support of this development. The consulting team includes Guthrie Muscovitch Architects (concept design and architecture), Azimuth Environmental Consulting (environmental), Travis and Associates (planning) and CF Crozier & Associates Inc. (engineering). This report should be read in conjunction with the studies, plans and reports previously prepared by of other members of the development team.

This report has been prepared to provide information concerning the servicing (water, sewer, utilities and roads) and stormwater management of the development with regards to the updated unit yield and intensification. Contained within this report is a background discussion (Section 2.0); a description of the existing site conditions (Section 3.0); the recommended sanitary sewage, water distribution, road network and public utilities (Section 4.0, 5.0, 6.0 and 7.0, respectively); the proposed stormwater management strategy (Section 8.0); and conclusions & recommendations (Section 9.0).

2.0 Background

The Subject Lands are currently zoned as Residential, Environmental Protection, Recreation, and Deferred Zone under the Collingwood Zoning Bylaw (2010). A successful appeal was previously made by Consulate to the Ontario Municipal Board to amend prior Environmental Protection designations in portions of the Subject Lands. Draft Plan Approval under a previous Draft Plan was granted through OMB Decision/Order 2517, September 14, 2007. Recently, an extension to the draft approval of the Plan of Subdivision was granted on January 29, 2018.

The servicing and stormwater management strategy for the Subject Lands was previously presented within the following reports:

- "Preliminary Servicing & Stormwater Management Report", East Lands - Consulate Development (Ontario) Inc. (Crozier, February 2007)
- "Floodline Analysis Report", East Lands - Consulate Development (Ontario) Inc. (Crozier, February 2007)
- "Traffic Impact Study", East Lands - Consulate Development (Ontario) Inc. (Crozier, February 2007)
- "Natural Hazard Assessment" West Lands – Consulate Development (Ontario) Inc. (Crozier, August 2008)
- Master Servicing Plan – Consulate Development (Ontario) Inc. (Crozier, March 2012)

The overall servicing and stormwater strategy of these previous reports and subsequent materials produced through OMB proceedings is largely maintained while report findings and conclusions have been updated to reflect the new unit yield.

3.0 Site Description

The Subject Property consists of a mixture of open fields, forested areas and wetlands. The property is relatively flat with portions of low-lying areas surrounding an upland area found in the core of the property. Elevations across the property range from approximately 177 m to 181 m (asl). The natural environment of the site has previously been investigated in detail by Azimuth and Savanta, including a 2018 environmental investigation by Azimuth. These investigations have included the delineation of a Provincially Significant Wetland (PSW) known as the Silver Creek Wetland Complex.

Based on the Soil Survey map of Simcoe County (1962), the site is underlain by grey-brown podzolic soils. A review of MOECP well records describes the soils as dark brown sand or brown sandy loam with mottled grey sand and clay.

An on-site geotechnical investigation has occurred on the property. In 2004, Peto MacCallum completed boreholes across the site which confirmed the presence of sandy soils overlying a silt till and indicated a variable range of bedrock depths. In January 2007, further field work was completed as part of the Phase 2 Environmental Site Assessment program by Peto MacCallum and the hydrogeologic investigation by Azimuth. This supplementary field data provided Azimuth and Peto MacCallum more information to characterize the subsurface conditions and make determinations on the groundwater regime.

Several intermittent tributaries of the Silver Creek watershed traverse the Subject Lands. A fisheries assessment of these intermittent watercourses has been undertaken by Azimuth. According to their assessment, some of these tributaries and agricultural drains support various fish habitat while others have no habitat potential. The fish habitat assessment of the on-site tributaries has been described in more detail in the 2007 Environmental Impact Study previously prepared by Azimuth (under separate cover).

The main branch of Silver Creek is located west of the Subject Property, on other lands held by Consulate. With a tributary watershed exceeding 26 km² upstream of Highway 26, Silver Creek experiences flooding conditions on occasion. In 1989, a study entitled "Floodline Mapping Study of Silver Creek, Spring Creek, & Village of Angus" (Cumming Cockburn Limited) was prepared under the auspices of the Federal Provincial Flood Damage Reduction Program for the Nottawasaga Valley Conservation Authority. The study delineated limits of the Silver Creek floodplain and concluded that flood spill conditions occur at Highway 26 and Silver Creek.

Since 1989, further studies have been undertaken with regard to the Silver Creek spill effects. A study of relevance to the Subject Lands entitled "Town of Collingwood Cranberry Resorts Links Floodplain

Mapping" (CC Tatham & Associates Limited, 1993) confirmed the magnitude of spill from Silver Creek and the elevation of water surface profiles on lands south of Highway 26, east of Silver Creek. Additionally, Crozier (2006) re-evaluated the spill floodlines south of Highway 26 in support of the Silver Glen Preserve residential development. With respect to the Subject Development, further analysis was completed by Crozier to determine the spill floodlines occurring north of Highway 26 which influence the Consulate property. A report entitled "Floodline Analysis Report for The Preserve at Georgian Bay" and supplemental OMB expert witness testimony has previously been submitted under separate cover (Crozier, 2007).

4.0 Road Standard

Access to the development is proposed to be provided through an entrance roadway located directly opposite to the existing Silver Glen Boulevard. This roadway is proposed to be constructed in conformance with the Town of Collingwood Development Standards. The initial section of this roadway will be contained within a 26m wide road corridor in order to accommodate proposed landscaping, signage features and turn lanes / tapers required per the updated Traffic Impact Study (Crozier, 2018 under separate cover). The width of the road allowance for the remaining section of the entrance roadway will be reduced to 20.0m per the "Local Street - 20m Urban Standard Cross-Section", consisting of curb and gutter, 8.5m of asphalt road surface and landscaped boulevards. Refer to Appendix A for copy of Detail STD-201. A watercourse crossing will also be provided along this entrance roadway.

Design criteria for the entrance will meet MTO and municipal guidelines as well as the applicable sections from the Ontario Building Code (i.e. fire routes). The reader is directed to the Traffic Impact Study (2018) prepared by Crozier under separate cover.

Internal roadways of the development will remain under private ownership, and any future maintenance will be the responsibility of the future Condominium Corporation. Preliminary design envisions a 7.2m wide road section with roadside parking / pedestrian facilities. Further refinement of the internal roadway section will be refined at the detailed design stage.

A secondary emergency access (6m width) to the development will also be provided to Bartlett Boulevard along the alignment of the proposed Greenland Channel which is discussed in subsequent sections of this report. This secondary access will be utilized only for the purposes of maintenance or emergency access to the site, and is not to be traversed by regular traffic associate with the development.

5.0 Sanitary Sewage System

The following section provides an analysis of the servicing strategy for the proposed sanitary sewage system at the development.

Waste Water Treatment Plant Capacity

The existing waste water treatment plant (WWTP) is located north of First Street between Beech and Birch Streets. The plant treats sewage and discharges the treated effluent to Georgian Bay. As of 2015, the plant was operating at approximately 55% of this design capacity (Collingwood Wastewater Treatment Plant 2015 Annual Compliance Report).

Existing Infrastructure

The existing sewage infrastructure at or near the development includes the following:

- 350mm and 750mm diameter municipal trunk sanitary sewer on the north side of Hwy 26 east of Princeton Shores.
- Cranberry Sewage Pump Station (Public)
- 200mm diameter forcemain along the south side of Hwy 26 conveying flow from Cranberry station.
- Silver Glen Preserve Sewage pump station (Private)
- 150mm and 250mm diameter forcemains on the north side of Hwy 26 along the frontage of the development site. These lines have been installed to convey flow from Silver Glen Station and future development in the area to the trunk sewer.

Proposed Servicing Strategy

Sanitary servicing for the development will be supplied by way of connection to the existing Town of Collingwood sanitary sewer collection network with flows emanating from the site ultimately receiving treatment within the Collingwood wastewater treatment plant.

Due to the flat gradients of the Subject Lands as well as surrounding service area, sewage from the proposed development will need to be pumped to the existing municipal sanitary sewer system. A sewage pumping station (SPS) is proposed to be constructed at the intersection of the entrance road and Highway 26. The SPS is proposed to be initially operated as a private facility owned and operated by the condominium corporation. Future improvement / conversion to a Municipal SPS could be completed should development in the adjacent service area require. It is proposed to utilize the existing 250mm forcemain located on the north side of Highway 26 connecting to the municipal trunk sewer east of Princeton Shores Drive.

Estimates of sanitary flows from the development indicate that the development subject to a total of 655 units will contribute peak design flows of approximately 40.9L/s upon full buildout. See Appendix B for sanitary flow calculations. Allowances for future flows from the adjacent west lands and adjacent high density block will be incorporated in the design of the pumping station, ensuring adequate capacity is provided.

Internal sanitary servicing for the development will be provided by gravity sewer following the proposed internal roadway network with individual service connections to each building draining to the pumping station. The condominium corporation(s) will own and maintain all sewers within the development, and sewers will be sufficiently deep to drain units with basements. The depth of the pumping station will be sufficient to receive gravity flow from the entire development lands. The General Servicing Plan including proposed sanitary layout is shown on Figure 3.

It is understood that the Town of Collingwood has recently commissioned a town wide sewer system model. Capacity of downstream infrastructure to accommodate sanitary discharges from the Subject Lands will be confirmed through modelling by the Town, and as such, any required improvements as the development builds out will be identified.

6.0 Water Servicing

Potable water for the development will be supplied by the Town of Collingwood municipal water distribution system.

Existing Water Infrastructure

The existing water distribution infrastructure at or near the development includes the following:

- 300mm dia. trunk watermain on the north side of Highway 26 along the frontage of the site.
- 150mm dia. watermains on Princeton Shores and Bartlett Boulevards.

Proposed Infrastructure

The development will be serviced by connecting to the trunk watermain on Highway 26 and extending local mains through the development to the existing line at the west limits of Bartlett Boulevard. This second connection to the municipal network will satisfy the Town and Ministry of the Environment requirement for a looped water distribution system as well as ensuring a safe, second source of potable water for the development. Based on the current Concept Plan there are no identified potential dead-end watermains and therefore, there also should be no issue with respect to providing adequate water circulation and preventing the potential for stagnant potable water. Since this site is located at the edge of the existing distribution network, it is reasonable to expect a sampling station will need to be installed within the site, presumably at the northwest corner in the vicinity of the looped watermain.

Local watermains will be constructed following the alignment of the local condo road right-of-ways. Fire hydrants will be spaced as required to provide the necessary fire protection. Required domestic water flows have been calculated to be 48.1L/s. Additionally, preliminary fire suppression flow calculations have been completed, indicated that a conservative estimate of 150L/s will be required to meet OBC. These calculations are available in Appendix C.

Internal watermain sizing will be subject to the Town completing a distribution analysis and updating their municipal model during detailed design. However, given our previous experience in this area, issues with available pressures or flows are not anticipated at this time. The proposed watermain distribution network is reflected on Figure 3.

7.0 Utilities

Bridgewater on Georgian Bay will be serviced with natural gas, telephone, cable TV and hydro. All such utilities are available along Hwy 26 and the surrounding public streets.

8.0 Stormwater Management and Site Drainage

The management of stormwater and site drainage for the proposed development must comply with the policies and standards of the various agencies including the Town of Collingwood, NVCA, and Ministry of Environment, Conservation and Parks.

The stormwater management criteria that will be met with the development of Bridgewater on Georgian Bay are as follows:

- Water Quality Control
 - "Enhanced Protection" given Georgian Bay as ultimate receiver.
- Erosion Control
 - Use of source control and extended detention.

- Development Standard
 - Urban cross section complete with roadside pedestrian facilities and / or curb & gutter;
 - Lot grading at 2% optimum; and,
 - Minor and major drainage system to convey frequent and infrequent rainfall/runoff events, respectively.

Given the proximity of the Subject Property to Georgian Bay, water quantity controls are not recommended. It will be necessary however to upgrade the conveyance system between the Subject Lands and Georgian Bay, which are contained on public property. This is discussed in detail in Section 8.2.2.

In meeting the applicable policies and standards of the aforementioned agencies, the development will also be required to meet the following criteria.

- Manage the internal stormwater by safely conveying peak flows to suitable outlets and provide the necessary water quality controls as specified in this section.
- Manage external drainage entering the site by providing safe conveyance across the Subject Development and discharge to Georgian Bay.
- Ensuring the development lands are not susceptible to flood inundation during all storm events, including spill flow from Silver Creek.

8.1 Drainage Conditions

The existing drainage patterns on the site are reflected in Figure 4. During rainfall/runoff events, drainage from the central upland area of the site radiates as overland sheet flow toward the surrounding low-lying areas. Within the low-lying areas are intermittent watercourses which outlet beneath the existing perimeter roadways (Princeton Shores Boulevard and Bartlett Boulevard) via culverts subsequently draining to Georgian Bay.

As illustrated in Figure 4, the "Southern Watercourse" and Tributaries 1 and 2 collect runoff from the south and east portion of the site and convey flow through the PSW, before passing beneath Princeton Shores Boulevard via a 1.9 m by 0.9 m concrete box culvert. This watercourse appears to be a natural channel. Downstream of Princeton Shores Boulevard, drainage is conveyed in an existing watercourse located on the Town of Collingwood tennis court property before discharging to Georgian Bay. The channel between Princeton Shores Boulevard and Georgian Bay is approximately 100 m long.

The "Eastern Drain" is located on the west side of Princeton Shores Boulevard. It conveys flow from the road allowance and external lands south of Highway 26 to a confluence point with the Southern Watercourse upstream of Princeton Shores Boulevard.

The "Northern Drain" is located on the north half of the site. It appears to be a manmade channel approximately 3 m in width likely constructed as an agricultural drain during the time the property was farmed. It conveys runoff from the north and west portion of the site. Runoff conveyed in this watercourse passes through the existing PSW before reaching a 900 mm diameter CSP culvert at Bartlett Boulevard, before ultimately draining to Georgian Bay.

A further watercourse is located along the west property line of the Subject Lands and is referred to as the "Western Drain". It is also a manmade channel which appears to have been constructed for drainage purposes some time ago.

The Western Drain is overgrown with trees and brush. It collects drainage from external lands south of Highway 26 and portions of Consulate lands on the east and west side of the channel. Drainage flows in a northerly direction passing along the west side of the Bartlett Boulevard road allowance before flowing to Georgian Bay. This watercourse is subject to proposed improvements to facilitate flood mitigation for the Subject Development and surrounding residences as presented in the "Floodline Analysis Report for The Preserve at Georgian Bay" (Crozier, 2007) and in the following sections.

8.1.1 Existing External Drainage

Three external drainage areas are located south of Highway 26 and shown on Figure 4. They have been determined after review of local topographic information and previous reports for surrounding developments including "Silver Glen Preserve Stormwater Management Implementation Report" (Crozier, January 2006) and "Final Stormwater Management Report for Cranberry Development Block 4" (Tatham, 2004).

The first external area (EX1) is approximately 29 ha and consists of undeveloped rural lands extending south of the Georgian Trail. The outlet for this drainage area is a 1.6 m x 5.5 m concrete box culvert located beneath Highway 26. Downstream of this culvert, runoff is conveyed to the Western Drain. As noted above, the Western Drain conveys runoff directly to Georgian Bay.

The second external drainage area (EX2) is approximately 20.6 ha. Drainage from this area enters the Subject Lands via a 1.0 m by 1.55 m concrete box culvert located beneath Highway 26 that discharges to Tributary 2 before reaching the Southern Watercourse. This external drainage area is comprised of existing Silver Glen subdivision and undeveloped land. The drainage system for Silver Glen Preserve subdivision includes a stormwater management facility which controls peak flow to pre-development rates and treats runoff for water quality purposes.

The third external drainage area (EX3) is approximately 30 ha and is comprised of the existing residential subdivisions, the Cranberry Resort and Golf Course and Georgian Manor Resort. Drainage from this area enters the Subject Lands via a 1.9 m by 1.5 m concrete box culvert beneath Highway 26 located at the intersection of Highway 26 and Princeton Shores Boulevard. Runoff from the Cranberry Links and Briarwood condominiums and Georgian Manor Resort is conveyed through the Ninth Fairway Pond which provides water quality and quantity control prior to discharging to the Subject Lands via the aforementioned culvert. After runoff enters the Subject Lands, it is conveyed within the Eastern Drain before combining with the Southern Watercourse.

During extreme flood conditions, flows from Silver Creek spill eastward from the main channel and enter the Subject Lands. The magnitude and hydraulic characteristics of the spill flow across the entire Consulate lands have been analyzed in detail in the "Floodline Analysis Report for The Preserve at Georgian Bay" and subsequent OMB materials (Crozier, 2007). The reader is directed to this report for further information.

8.1.2 Proposed External Drainage Management

An element of the proposed stormwater plan for the Subject Development will be the management of external flows traversing the site.

As reported by CCL (1989), Tatham (1993), and Crozier (2006, 2007) spill waters make their way from the main channel of Silver Creek and inundate portions of the Subject Lands during flooding conditions. The report prepared under separate cover by Crozier entitled "Floodline Analysis Report for The Preserve at Georgian Bay" and subsequent OMB materials determine the flood susceptible

areas of the Subject Lands and that of surrounding properties. This work has concluded that during Regional Storm conditions, floodwaters from Silver Creek will result in overtopping of Princeton Shores Boulevard and Bartlett Boulevard causing flood waters to enter the private properties on the lake side of these roadways and render a number of properties at risk of flood damages.

The work of Crozier (2007) recommended several flood mitigation measures to address these potential flood damages. These measures have been adapted to meet the needs of the new concept plan, and are summarized in Figure 5. The individual mitigative measures are detailed as follows:

- 12.0m x 1.0m culvert at Princeton Shores Boulevard replacing the existing 0.9m x 1.9m box culvert;
- Proposed channel improvements downstream of said box culvert providing suitable outlet to Georgian Bay; and
- Greenland Flood Channel following alignment of existing Western Drain.

Given the undersized culvert system that exists beneath Princeton Shores Boulevard, the replacement of the existing culvert at the South Watercourse with the 12.0m x 1.0m box culvert will provide the hydraulic relief to prevent Princeton Shores Boulevard and Bartlett Boulevard from overtopping during the Regional Storm. Under normal circumstances, local roads of this nature are designed to overtop during severe storm events. The issue in the case of the subject road network is that there is no defined sag along over the roadways to allow for a controlled relief of flow. Consequently, it is necessary to direct the Regional flow beneath the roadway to an outlet channel discharging to Georgian Bay.

Downstream of the box culvert, the existing Southern Watercourse will be reconstructed within a trapezoidal open channel. See Appendix D for the preliminary design.

The other flood mitigation measure proposed is the Greenland Channel along the west limit of the development. Currently, there exists an overgrown ditch (Western Drain) that traverses the west limit of the site. The proposed Greenland Channel will follow the same general alignment of the Western Drain. The proposed Greenland Channel will provide the effective flood conveyance route of Silver Creek spill flows to Georgian Bay and reduce the magnitude of the spill flows reaching the residences along Bartlett Boulevard and Princeton Shores Boulevard. Design of the Greenland Channel was completed through the proceedings the previous OMB appeal. Details of this design are available in Appendix D.

The array of flood mitigation measures as presented above will significantly reduce the existing flood damage risks that face the properties along Princeton Shores Boulevard and Bartlett Boulevard from Silver Creek spill flows.

The entrance roadway to the development will be required to traverse across the floodplain. This area of the site is also subject to spill water from Silver Creek, however the magnitude of spill water entering this area of the site will be reduced considerably because of the proposed Greenland Channel. Subject to detailed design, a 900mm diameter CSP culvert will be constructed along the proposed entrance roadway at Tributary No. 1 of the Southern Watercourse.

Previous design supporting the development of this site confirmed the capacity of these culverts to convey flows during the Regional event. Therefore safe ingress and egress to the site will be satisfied according to NVCA policies.

8.1.3 Proposed Internal Drainage System

A dual drainage system will be implemented to ensure adequate conveyance of runoff. The minor drainage system will consist of storm sewers with a minimum 5-year return capacity and the major system which will consist of the road network.

Internal flows from approximately 8.6ha of the development site will be directed via both the minor and major systems to outlet into a stormwater treatment facility in the northeast corner of the development. This facility will consist of a linear constructed wetland complete with sediment forebays and extended detention capability and will outlet to the Southern Watercourse.

A smaller portion of the developable land (approximately 1.7 ha) will be directed to the northwest of the site, where treatment will be provided via an OGS unit prior to discharge to the Greenland Channel.

Stormwater quantity control will not be required for the development due to its proximity to Georgian Bay and conveyance capacity of the receiving system after the site is developed.

8.2 Stormwater Quality & Erosion Control

It will be necessary to implement stormwater management practices to address the water quality and the erosion control requirement of the regulatory agencies. Since Georgian Bay is the ultimate receiver of drainage from the Subject Lands, the development will incorporate measures to provide "enhanced protection" per the MOECP (2003) guidelines.

Previous evaluation of stormwater management strategies led to the decision to implement an extended detention stormwater wetland. This "end-of-pipe" measure is suitable given the size of the drainage catchment (exceeding 5 ha), the proximity of bedrock and groundwater levels on-site and the lack of topographic relief on the site.

The current wetland design, established through proceedings with the Ontario Municipal Board, provides a permanent pool volume of approximately 1,210m³. Based on an estimated imperviousness of 65% for the development lands contributing to the SWM facility, the interpolated minimum water quality storage volume for a stormwater wetland is 115 m³/ha (MOECP, 2003). The minimum water quality volume consists of 75 m³/ha permanent pool volume and 40 m³/ha extended detention.

Current site grading facilitates the drainage of approximately 8.6ha of the site to the pond. The remainder of the development area is proposed to drain to an oil/ grit separator unit located in the northwest of the site. Table 1 below presents a summary of the water quality considerations of the pond, and demonstrates that the provided volumes are sufficient to treat the contributing area.

Table 1: Linear Wetland Characteristics -Water Quality

Linear Wetland Characteristics -Water Quality			
	Criteria	Volume Required	Volume Provided
Permanent Pool	75 m ³ /ha	645 m ³	1210 m ³
Extended Detention	40 m ³ /ha	344 m ³	5430 m ³

The proposed stormwater wetland will be located within a portion of the 30m buffer strip separating the development from the northerly wetland on the site. The length of the wetland will be approximately 400m. Two sediment forebays are proposed to capture larger sediment from facility influent.

Erosion control will be accomplished primarily through the extended detention runoff entering the Stormwater Management Facility. 24 hour detention of the 25mm Chicago event will be provided. An outlet control structure is proposed near the southeast of the SWMF to drain to the Southern Watercourse. Design of the outlet structure and determination of stage storage discharge characteristics will be determined at a future stage of detailed design.

9.0 Conclusions and Recommendations

Based on the foregoing, we conclude that the proposed Bridgewater on Georgian Bay development can be adequately serviced.

1. Access to the site will be provided from Highway 26 opposite to Silver Glen Boulevard. An emergency access point along the proposed Greenland Channel is proposed to Bartlett Boulevard.
2. The subdivision will be fully serviced by way of water and sewer. The sanitary conveyance system will be privately owned and maintained and includes the requirement for a sewage pumping station located on-site.
3. The domestic water supply will be provided by a looped system with connections to the existing watermains at Bartlett Boulevard and Highway 26.
4. Utilities including power, gas, telephone and cable services are available to service the Subject Lands.
5. Stormwater management controls will be implemented for the development to treat runoff for water quality purposes and erosion control. A stormwater management wetland facility will treat runoff for the majority of the development prior to discharging to the existing South Watercourse. Portions of the development will utilize an OGS unit to treat water prior to discharge to the Greenland Channel. Stormwater quantity control is not recommended given the proximity to Georgian Bay and the improvements which are proposed to the existing drainage outlet to Georgian Bay.
6. Spill flows from Silver Creek during extreme storm events will be managed through proposed conveyance improvements such as the Greenland Channel and Princeton Shores Culvert expansion and outlet channel. These measures will eliminate the existing flood risk facing many properties on Princeton Shores Boulevard and Bartlett Boulevard.

Based on the above, we recommend approval of the Planning Applications for the Subject Lands from the perspective of engineering servicing requirements.

Respectfully Submitted,

C.F. Crozier & Associates Inc.



Jon Proctor, P.Eng
Associate

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APPENDICES

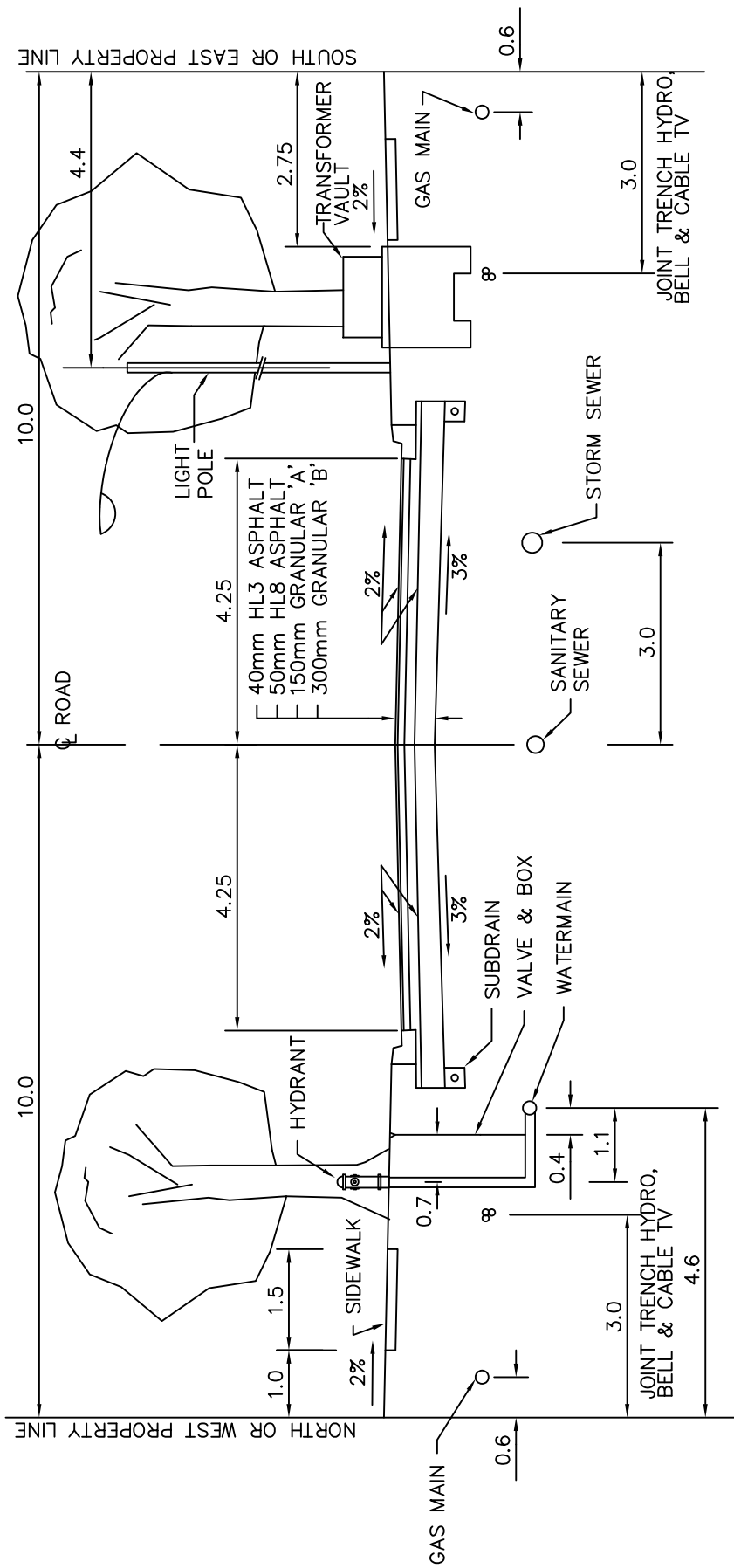
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APPENDIX A

Entrance Roadway Standard- Detail STD-201



NOTES:

1. COVER ON STORM, SANITARY AND WATERMAIN AS PER DESIGN CRITERIA.
2. UTILITY CORRIDOR, SHALL HAVE A MINIMUM COVER OF 0.9m.
3. MINIMUM PAVEMENT AND ROAD STRUCTURE DESIGN AS PER TOWN DESIGN CRITERIA OR AS PER GEOTECHNICAL INVESTIGATION RECOMMENDATION.
4. TREES TO BE PLACED IN LOCATIONS AS PER APPROVED LANDSCAPE PLAN.
5. ACTIVELY GROWING NURSERY SOD TO BE LAID ON 100mm OF TOPSOIL PROPERLY GRADED AND ROLLED.
6. HYDRANTS AND WATERMANS TO BE ON OPPOSITE SIDE OF ROAD FROM ELECTRICAL TRANSFORMER.
7. SUBDRAINS TO BE INSTALLED AS PER OPSD 216.021.
8. ALL SERVICE LOCATIONS SHOWN ARE FOR GUIDELINE PURPOSES ONLY AND MAY DEVIATE AS PER THE DIRECTION OF THE TOWN WHEN STANDARD LOCATION CANNOT BE ACHIEVED.
9. WHERE ONE SIDEWALK IS CONSTRUCTED IT SHALL BE ON THE SOUTH AND EAST SIDE OF THE ROAD.
10. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SHOWN.

NO.	REVISION	APR'D	DATE	TOWN OF COLLINGWOOD		APR'D: EDH	DATE: JAN/03
						DRAWN:	SCALE: NTS
				URBAN – LOCAL RESIDENTIAL		STD. No. 201	
				20.0m ROAD ALLOWANCE			
				8.5m ASPHALT SURFACE			

APPENDIX B

Sanitary Flow Calculations



File: 131-2543
Date: March 7, 2018
By: BP
Check By:

Bridgewater at Georgian Bay - Sanitary Design Flows

Developed Site Area	11.6	ha
Number of Residential Units		
Townhouse	539	units
Apartment	116	units
	TOTAL:	655 units
Person Per Townhouse Residential Unit	3.50	persons/unit
Person Per Apartment Residential Unit	1.43	persons/unit
	Per DC Background Study (Watson & Associates, 2014)	
Residential Population	2,052	Persons

Unit Sewage flows

Residential	450	L/C-day
Infiltration (typical)	0.23	L/s/ha

Total Design Sewage Flows

Infiltration/Inflow Residential	2.67	L/sec
Average Daily Residential Flow	10.69	L/sec
Residential Peak Factor	(Harmon Formula)	3.6
Total Peak Daily Flow	40.90	L/sec

APPENDIX C

Domestic Water Demand Calculations & Fire Suppression Demand Calculations



File: 131-2543

Date: March 20, 2018

By: BP

Check By:

Bridgewater at Georgian Bay - Domestic Design Flows

Developed Site Area	11.6	ha
Number of Residential Units		
Townhouse	539	units
Apartment	116	units
Persons Per Unit		
Townhouse	3.5	persons/unit
Apartment	1.43	persons/unit
Per DC Background Study (Watson & Associates, 2014)		
Residential Population	2,052	persons

Domestic Water Design Flows

Residential Design Flow Rate	450	L/C-day
------------------------------	-----	---------

Total Domestic Water Design Flows

Average Residential Daily Flow	10.69	L/sec
--------------------------------	-------	-------

Max Day Peak Factor	2.25	
---------------------	------	--

Max Day Demand Flow	24.05	L/sec
----------------------------	--------------	--------------

Peak Hour Factor	4.50	
------------------	------	--

Peak Hour Flow	48.10	L/sec
-----------------------	--------------	--------------

OBC Fire Suppression Design Flow

Required Fire Suppression Flow	150	L/sec
--------------------------------	-----	-------

Total Water Demands

198.10	L/sec
---------------	--------------

Bridgewater at Georgian Bay- Apartment Building
Fire Protection Volume Calculation
CFCA File: 131-2543

July 26, 2018

Page 1

*Based on 2018.03.02 Draft Plan

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

$$F = 220 * C * \sqrt{A}$$

where

- F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

5790 sq.m. total floor area
Ordinary Construction
1.0 C

Therefore F= 17,000 L/min (rounded to nearest 1000 L/min)

Fire flow determined above shall not exceed:
30,000 L/min for wood frame construction
30,000 L/min for ordinary construction
25,000 L/min for non-combustible construction
25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Burning	25%
Combustible	No Charge		

Low Contents Fire Hazard/ Limited Combustibility 15% reduction
2,550 L/min reduction

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 1 above may be reduced by up to 50% for complete automatic sprinkler protection.

NFPA Conformance Sprinklers: 30% reduction
5,100 L/min reduction

Bridgewater at Georgian Bay- Apartment Building
Fire Protection Volume Calculation
CFCA File: 131-2543

*Based on 2018.03.02 Draft Plan

Page 2

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

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

Exposed buildings

Name		Distance	Charge	
North	B/B Townhouses	25.2	10%	1700
South	N/A	0	0%	0
East	B/B Townhouses	22.7	10%	1700
West	B/B Townhouses	24.2	10%	1700
5,100 L/min Surcharge				

Determine Required Fire Flow

No.1	17,000
No. 2	2,550 reduction
No. 3	5,100 reduction
No. 4	<u>5,100</u> surcharge

Required Flow: 14,450 L/min
Rounded to nearest 1000l/min: 14,000 L/min or 233.3 L/s
 3,698 USGPM

Determine Required Fire Storage Volume

Flow from above 14,000 L/min
 Required duration 3.00 hours
 Therefore: 2,520,000 Litres or
 2,520 cu.m. is the required fire storage volume.

Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

Bridgewater at Georgian Bay- Apartment Building
Fire Protection Volume Calculation
CFCA File: 131-2543

Page 3

Calculation Check

Office of the Fire Marshall - Fire Protection Water Supply Guideline for Part 3 in the OBC (October 2006)

$$Q = KVS_{TOT}$$

Q = minimum supply of water in litres (L)

K = water supply coefficient

V = total building volume in cubic metres

S_{TOT} = total of spatial coefficient values from property line exposures on all sides

K = 23 Group C building with combustable construction , floors are fire separations but building has not fire resistance rating(Table 1)

V = 46320 (3m per storey, 4 storey building with footprint of 3860sq. m)

S_{TOT} = 2 S_{TOT} Need Not Exceed 2.0

$$Q = 2130720 \text{ L}$$

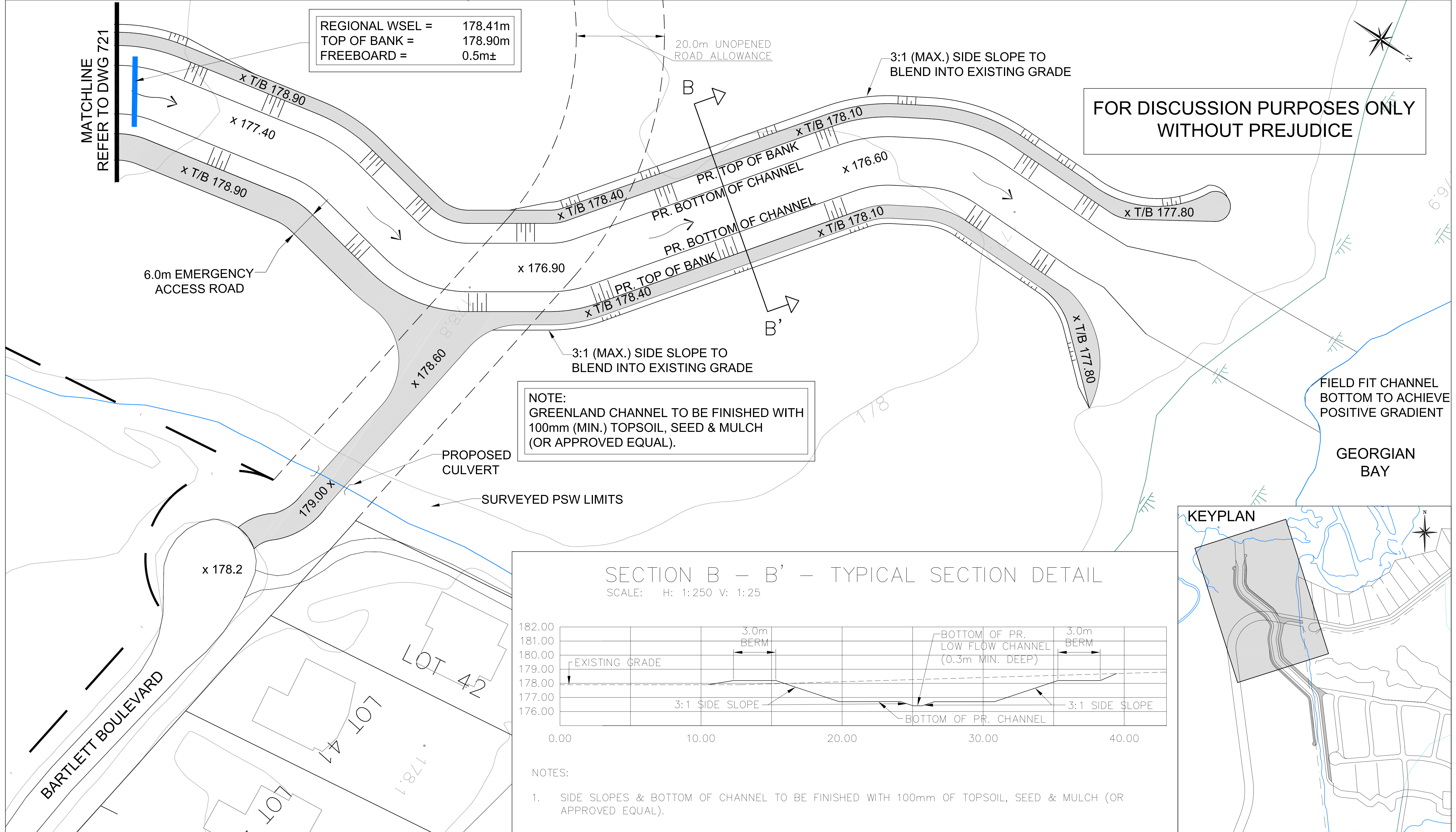
Based on ranges listed in Table 2, the required minimum water supply flow rate is

9000 L/min

150 L/s

APPENDIX D

Greenland Channel Design & Southern Watercourse Outlet Channel Detail



SCALE: H: 1:250 V: 1:25



1. SIDE SLOPES & BOTTOM OF CHANNEL TO BE FINISHED WITH 100mm OF TOPSOIL, SEED & MULCH (OR APPROVED EQUAL).

NOTE:
GREENLAND CHANNEL TO BE FINISHED WITH
100mm (MIN.) TOPSOIL, SEED & MULCH
(OR APPROVED EQUAL).

ADJACENT LAND OWNED
BY APPLICANT (WEST LANDS)

MATCHLINE
REFER TO DWG 722

SURVEYED PSW LIMITS

WEST PROPERTY LINE

(FUTURE
GREENLAND CHANNEL)
WESTERN DRAIN

REAR LOTS TO MATCH PROPOSED TOP OF BANK GRADE

6.0m EMERGENCY
ACCESS ROAD

3:1 (MAX.) SIDE SLOPE TO
BLEND INTO EXISTING GRADE

EX. WESTERN DRAIN

SURVEYED
PSW LIMITS

REGIONAL WSEL =	179.37m
TOP OF BANK =	179.85m
FREEBOARD =	0.5m±

KEYPLAN

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5. All existing underground utilities to be verified in the field by the contractor prior to construction.

TEMPORARY BENCHMARKS

	Town
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[illegible]

Engineer

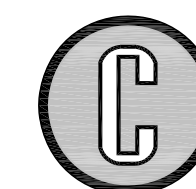
Engineer

	Project
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THE PRESERVE AT GEORGIAN BAY
TOWN OF COLLINGWOOD

Drawing

GREENLAND CHANNEL
SOUTH PLAN



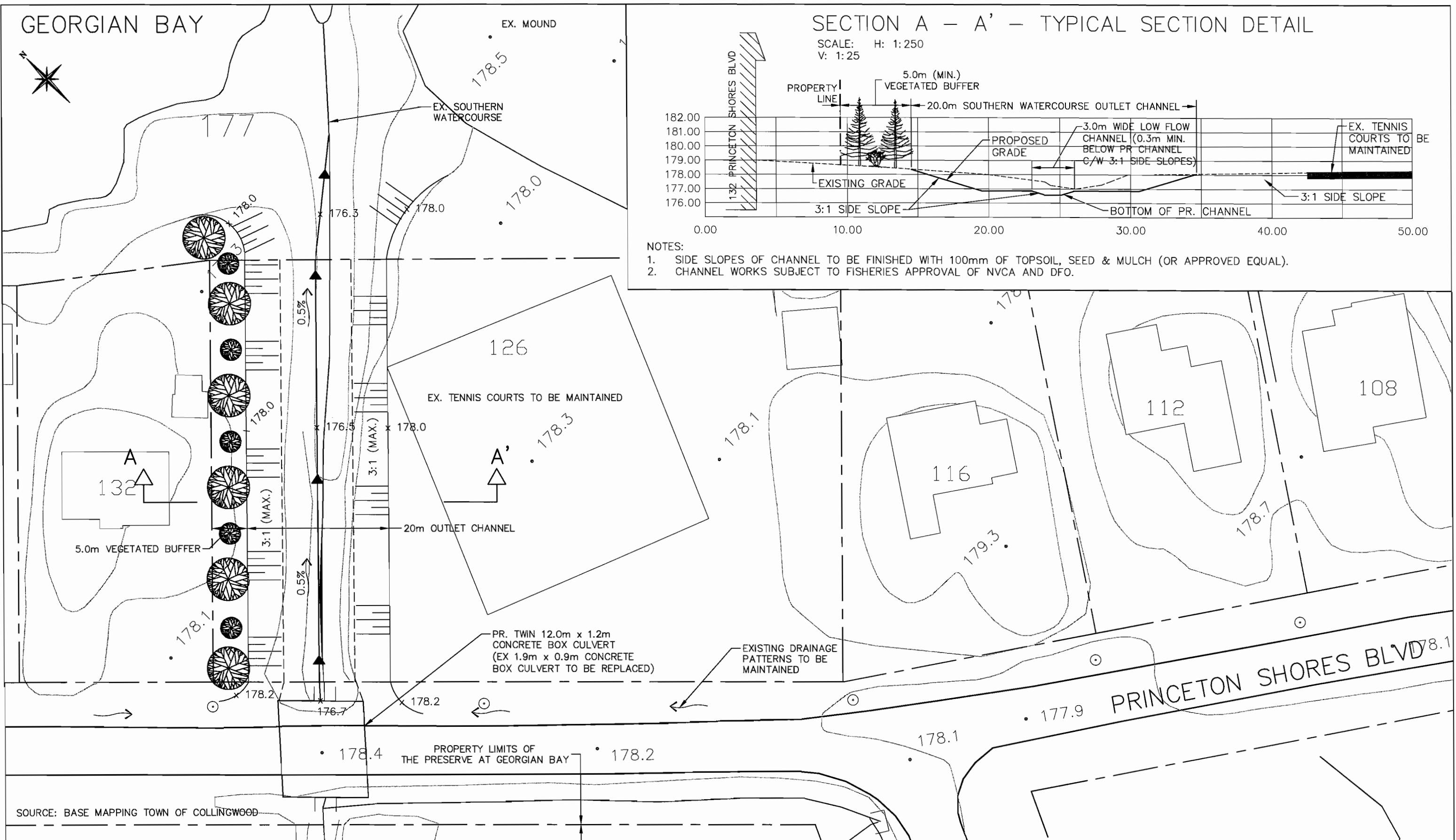
CF CROZIER & ASSOCIATES INC
LAND DEVELOPMENT ENGINEERS

110 PINE STREET
COLLINGWOOD ON
L9Y 2N9
T. 705-446-3510
F. 705-446-3520
CFCROZIER.CA

Drawn By	J.R.S. & R.C.G.
Scale	1:800

Check By	N.M.
Date	06/20/2007

Project No.	131-2543-721
Drawing No.	FIG. 2



SOURCE: BASE MAPPING TOWN OF COLLINGWOOD

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TEMPORARY BENCHMARKS

	Town
--	------

[illegible]

Engine

Engine

	Project
--	---------

THE PRESERVE AT GEORGIAN BAY
TOWN OF COLLINGWOOD

Drawn

SOUTHERN WATERCOURSE
OUTLET CHANNEL DETAIL



CF CROZIER & ASSOCIATES INC
LAND DEVELOPMENT ENGINEERS

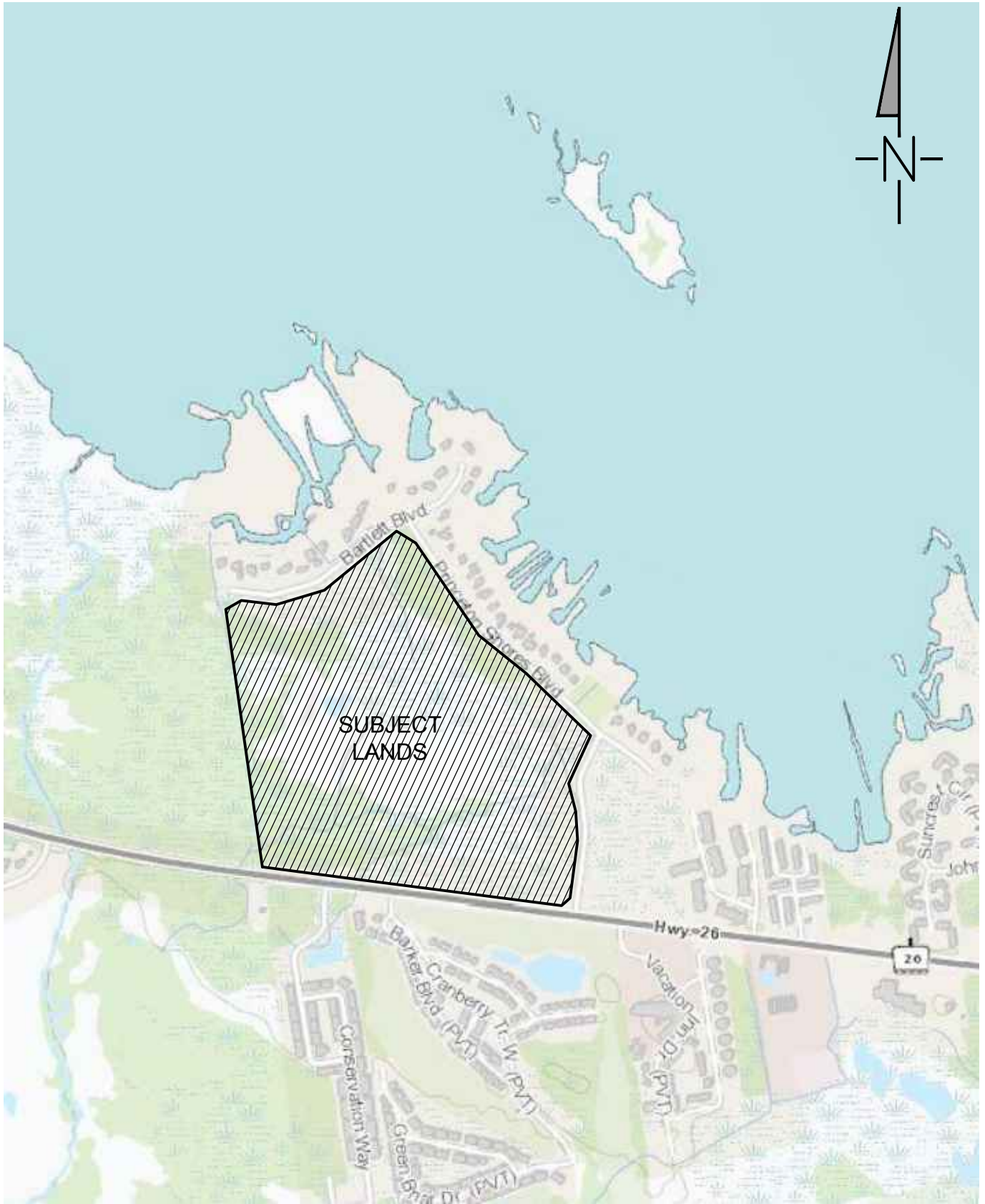
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COLLINGWOOD ON
L9Y 2N9

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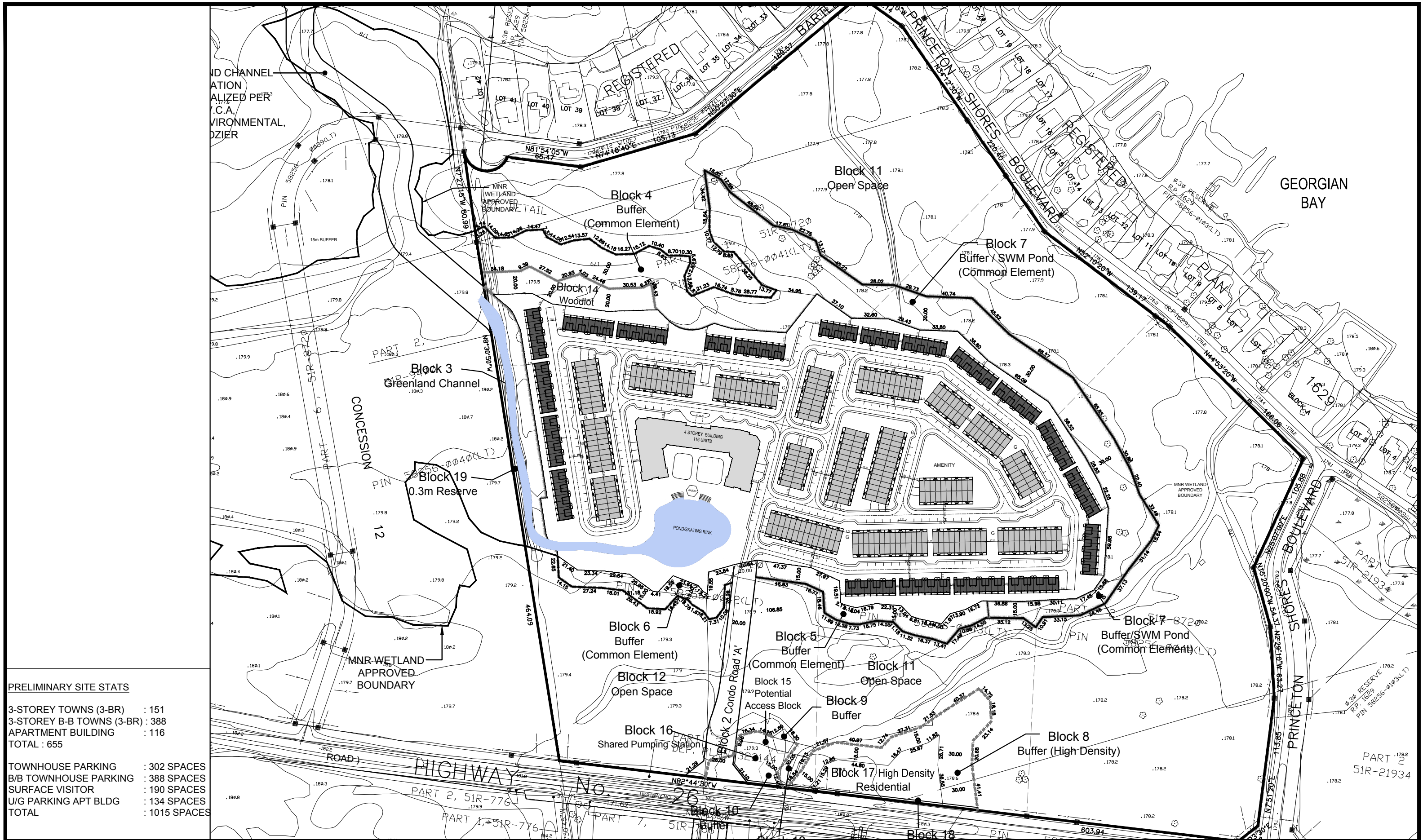
Drawn By	R.C.G.	Check By	N.M.	Project No.	131-2543-205
Scale	1:500	Date	02/16/07	Drawing No.	FIG 7

FIGURES

Figure 1:	Site Location Plan
Figure 2:	Concept Plan
Figure 3:	General Servicing Plan – Water & Sanitary Sewer
Figure 4:	Existing Drainage Conditions
Figure 5:	Flood Mitigation Plan
Figure 6:	Preliminary Grading and Stormwater Management Plan



Legend = SUBJECT LANDS	Project BRIDGEWATER AT GEORGIAN BAY TOWN OF COLLINGWOOD	CROZIER & ASSOCIATES Consulting Engineers THE HARBOUREDGE BUILDING, 40 HURON STREET, SUITE 301, COLLINGWOOD, ON L9Y 4R3 705 446-3510 T 705 446-3520 F WWW.CFCROZIER.CA INFO@CFCROZIER.CA Drawn By L.W. Design By L.W. Project 131-2543 Scale N.T.S. Date 07/24/2018 Check By J.P. Drawing FIG. 1
	Drawing SITE LOCATION	



PRELIMINARY SITE STATS

3-STOREY TOWNS (3-BR)	: 151
3-STOREY B-B TOWNS (3-BR)	: 388
APARTMENT BUILDING	: 116
TOTAL	: 655
TOWNHOUSE PARKING	: 302 SPACES
B/B TOWNHOUSE PARKING	: 388 SPACES
SURFACE VISITOR	: 190 SPACES
U/G PARKING APT BLDG	: 134 SPACES
TOTAL	: 1015 SPACES

GUTHRIE MUSCOVITCH
ARCHITECTS

Tel:(416) 252-5679 Fax: (416) 252-9637
770 Brown's Line, Toronto, Ontario M8W 3W2

CONCEPT SITE PLAN

THE PRESERVE AT GEORGIAN BAY

PROJECT #: 17.102
CLIENT: CONSULATE DEVELOPMENT GROUP

June 26, 2018.
SCALE 1:3000



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TBM#2—
TBM#3—

Town

No.	ISSUE	DATE: MM/DD/YYYY
0	ISSUED FOR 1st SUBMISSION	MM/DD/YYYY

Engineer

Engineer

Project

BRIDGEWATER AT GEORGIAN BAY
TOWN OF COLLINGWOOD

Drawing

GENERAL SITE SERVICING PLAN

CROZIER

CONSULTING ENGINEERS

THE HARBOUREDGE BUILDING,
40 HURON STREET, SUITE 301,
COLLINGWOOD, ON L9Y 4R3
705 446-3510 T
705 446-3520 F
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INFO@CFCROZIER.CA

Drawn By

L.W.

Design By

L.W. / B.P.

Project

131-2543

Check By

J.P.

Scale

1:2000

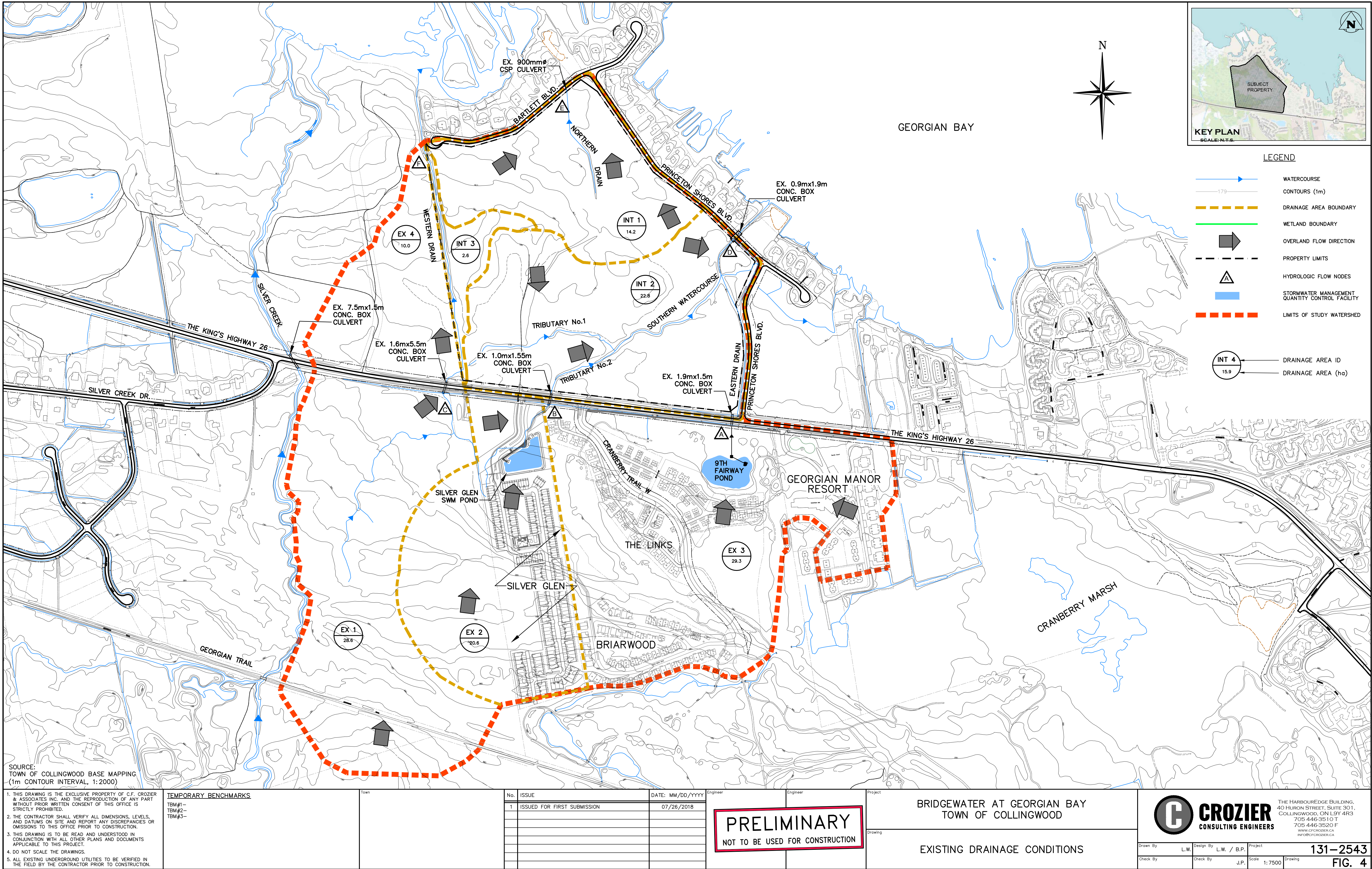
Drawing

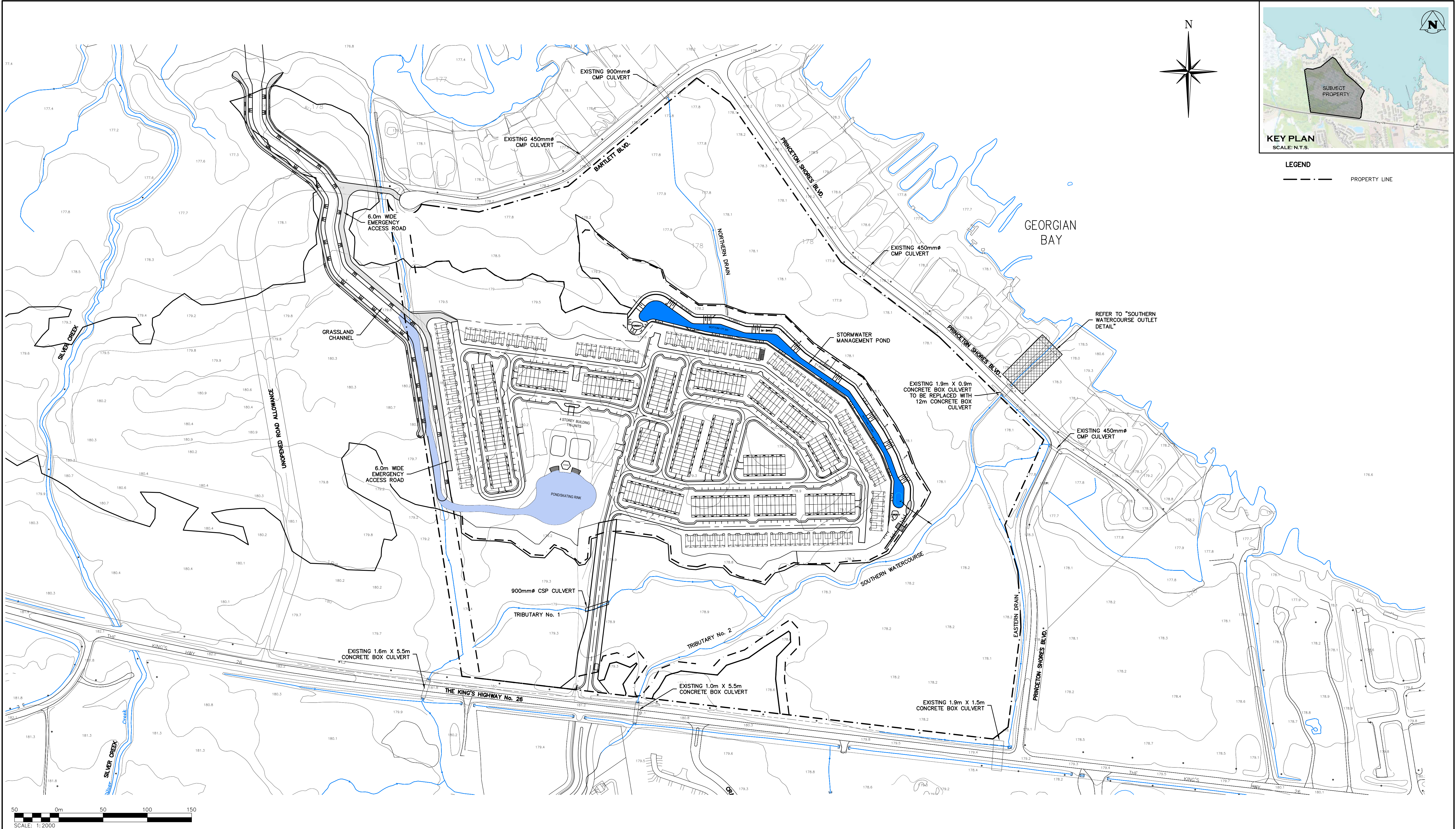
FIG. 3

PRELIMINARY

NOT TO BE USED FOR CONSTRUCTION

J:\100\131 - Consulate Development (Ontario) Inc\2543\Cad\CIVIL\Sheets\2543_710-7xx.dwg, FIG. 3, 7/26/2018 2:50:37 PM, lwaters





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TBM#2—
TBM#3—

Town

No.	ISSUE	DATE: MM/DD/YYYY
0	ISSUED FOR 1st SUBMISSION	MM/DD/YYYY

Engineer

Engineer

Project

BRIDGEWATER AT GEORGIAN BAY
TOWN OF COLLINGWOOD

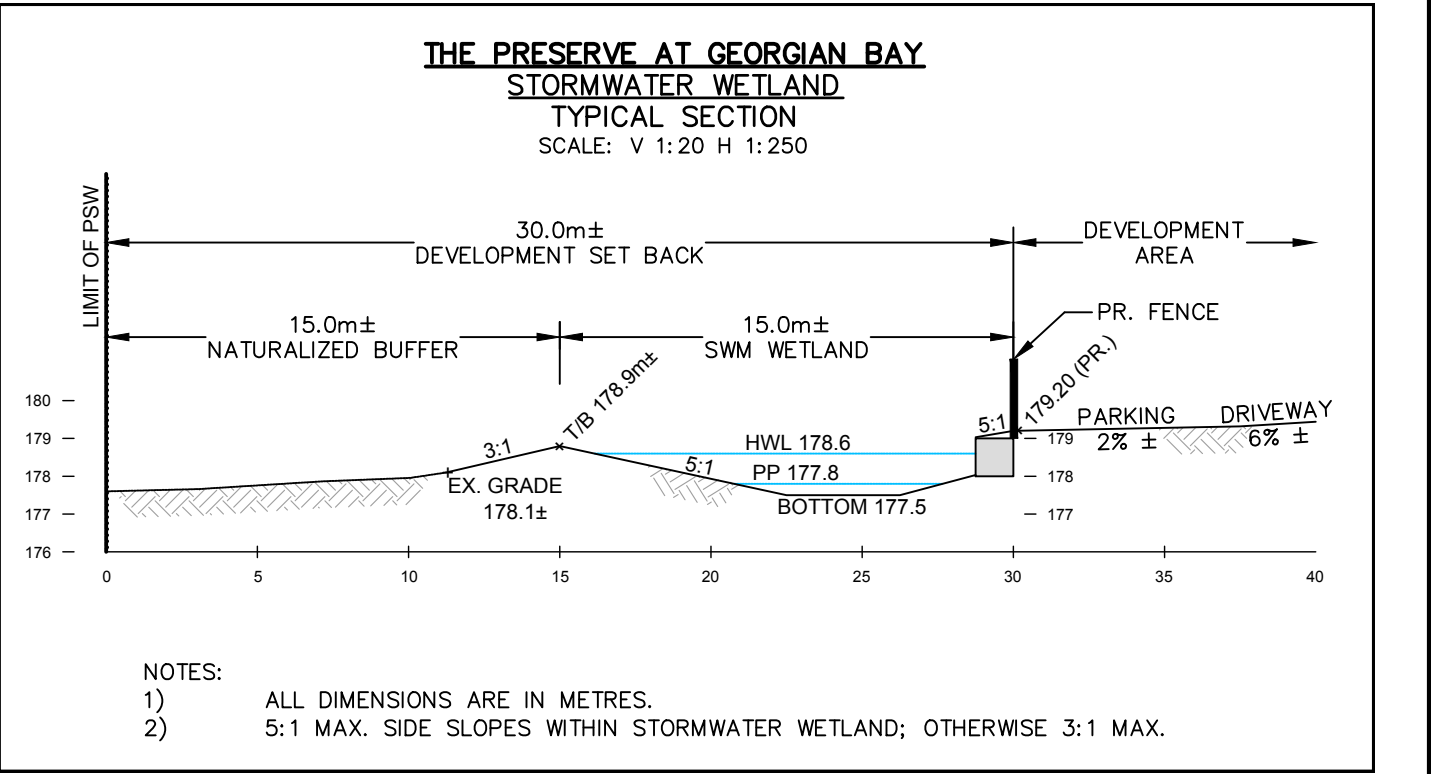
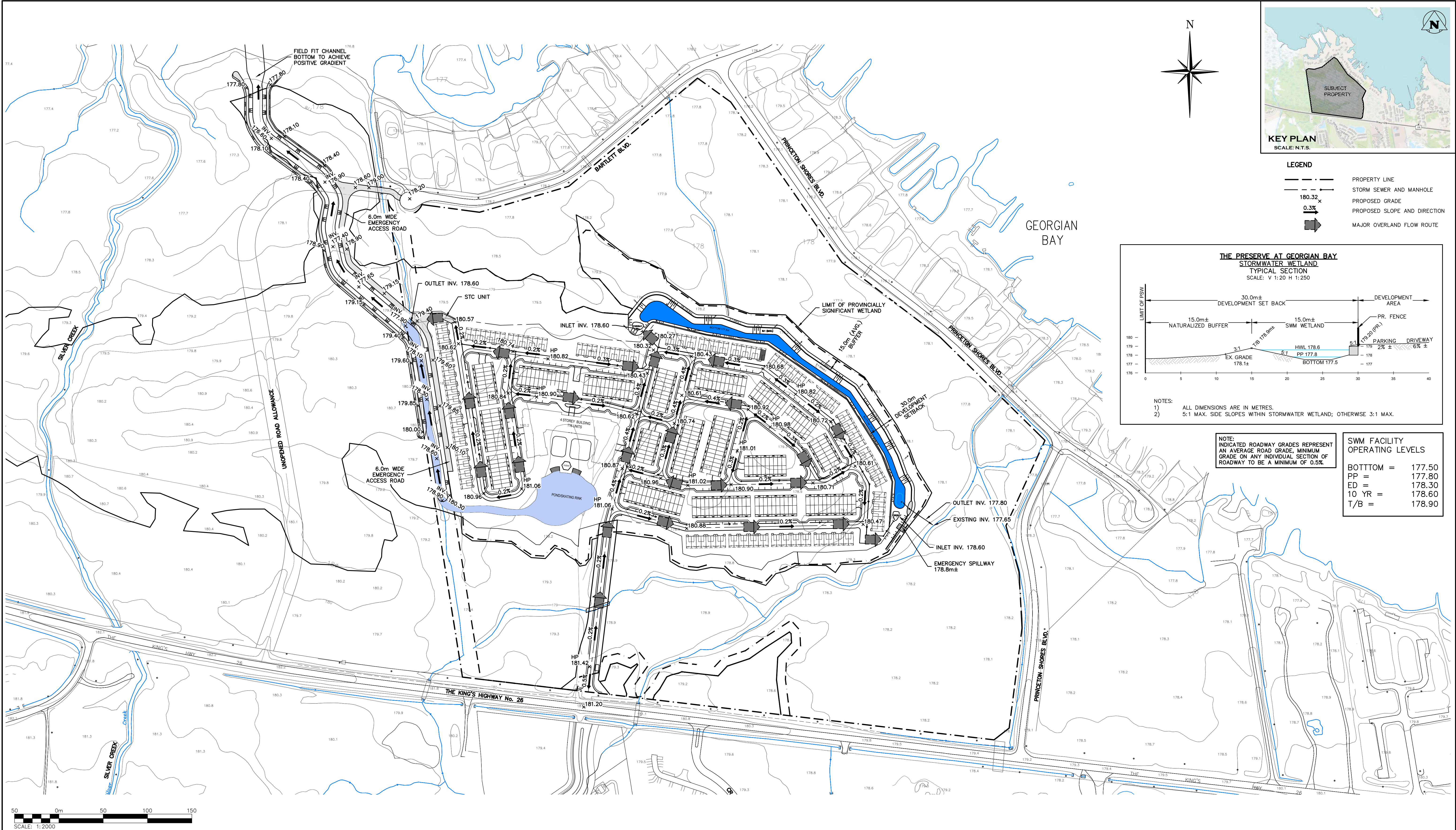
Drawing

FLOOD MITIGATION PLAN



THE HARBOUREDGE BUILDING,
40 HURON STREET, SUITE 301,
COLLINGWOOD, ON L9Y 4R3
705 446-3510 T
705 446-3520 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	L.W.	Design By	L.W. / B.P.	Project	131-2543
Check By		Check By	J.P.	Scale	1:2000
				Drawing	FIG. 5



NOTE: INDICATED ROADWAY GRADES REPRESENT AN AVERAGE ROAD GRADE. MINIMUM GRADE ON ANY INDIVIDUAL SECTION OF ROADWAY TO BE A MINIMUM OF 0.5%.

SWM FACILITY OPERATING LEVELS	
BOTTOM =	177.50
PP =	177.80
ED =	178.30
10 YR =	178.60
T/B =	178.90

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TEMPORARY BENCHMARKS

TBM#1—
TBM#2—
TBM#3—

Town

No.	ISSUE	DATE: MM/DD/YYYY
0	ISSUED FOR 1st SUBMISSION	MM/DD/YYYY

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Engineer

Project

Drawing

BRIDGEWATER AT GEORGIAN BAY
TOWN OF COLLINGWOOD

PRELIMINARY GRADING AND
STORMWATER MANAGEMENT PLAN

CROZIER
CONSULTING ENGINEERS

THE HARBOUREDGE BUILDING,
40 HURON STREET, SUITE 301,
COLLINGWOOD, ON L9Y 4R3
705 446-3510 T
705 446-3520 F
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Drawn By L.W. Design By L.W. / B.P. Project 131-2543
Check By J.P. Scale 1:2000 Drawing FIG. 6