

# APPENDIX D

## Stormwater Management and Drainage Assessment



# MEMO

**TO:** Jordan Frost, Jack Thompson  
**FROM:** Nicholas Krygsman  
**cc:** Paul MacLeod, Stephen Peck, Don McKinnon, Zahra Jaffer  
**DATE:** March 12, 2019  
**SUBJECT:** Casablanca Boulevard and GO Station Access Environmental Assessment –  
Drainage and Stormwater Management Strategy  
**OUR FILE:** 18-7650

---

## Introduction and Memo Purpose

---

In 2018, Niagara Region retained Dillon Consulting to provide consulting engineering services for the detailed transportation assessment and municipal class environmental assessment (EA) for Casablanca Boulevard and GO Station Access, in the Town of Grimsby (Town). The municipal class environmental assessment is being completed to develop and evaluate improvement options along the Casablanca Boulevard corridor north from Main Street to the North Service Road (a length of approximately 1.7 km), including interchange modifications at Casablanca and the Queen Elizabeth Way (QEW). It includes the section of the Livingston Avenue corridor between Casablanca Boulevard to west of Emily Street (a length of approximately 400 m) to provide for southern access options to the GO Station.

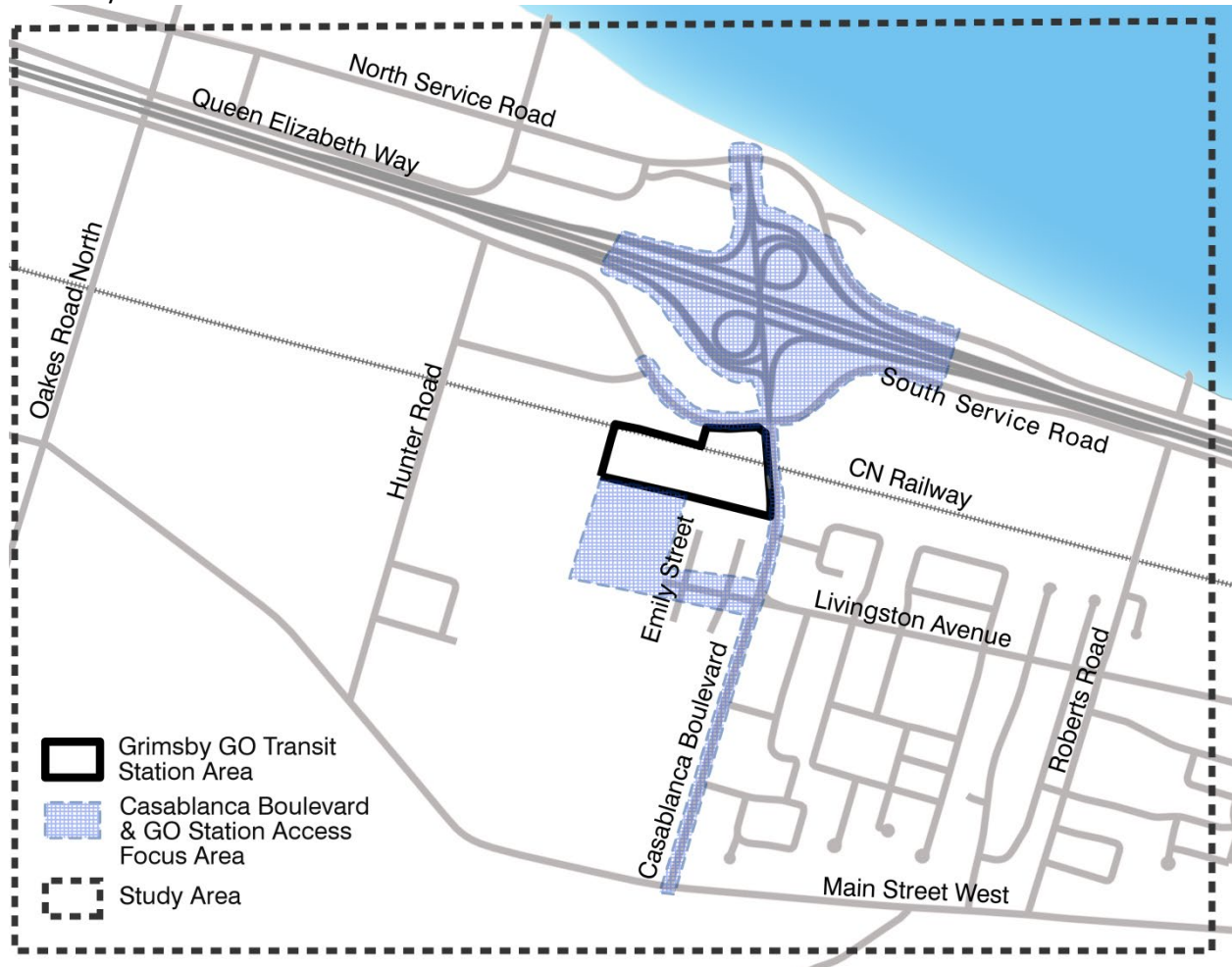
In support of future population and employment growth within the Town and the planned construction of the Grimsby GO Train Station in the southwest quadrant of the intersection of Casablanca Boulevard and South Service Road, Casablanca Boulevard will be widened with additional lanes, with active transportation facilities added and improvements will be carried out at the Main Street, Livingston Avenue and North/South Service Road intersections. The improvements will have direct and indirect impacts on the existing drainage and stormwater management systems within the corridor. The development of stormwater management options that complement the proposed transportation infrastructure improvements are documented within this memo, consistent with completing the preliminary design component for the overall project. This memo provides technical information for incorporation into the Environmental Study Report (ESR) for the project.

The purpose of this memo is to provide a summary of existing conditions, consolidate relevant design criteria, identify design constraints and document the drainage and stormwater management infrastructure requirements necessary to address the impacts caused by the proposed improvement work along Casablanca Boulevard and Livingston Avenue.

This stormwater management strategy memo was prepared as part of the overall preliminary design process and will be carried forward as background information during the preparation of the detailed design stormwater management report.

## Study Area Description and Existing Drainage Area Characterization

The Casablanca Boulevard and Livingston Ave study area is shown in the figure below. The study area was established early on in the Class EA process and includes approximately 1,700 m of Casablanca Boulevard extending from North Service Road to Main Street and includes the QEW interchange. Approximately 400 m of Livingston Avenue, from Casablanca to east of Emily Street is also included in the study area.



Casablanca Boulevard and the lands surrounding the north-south road corridor fall under the jurisdiction of the Niagara Peninsula Conservation Authority and within the Grimsby Watershed Planning Area. Within the study area there are several defined watercourses that convey surface water runoff in a south to north direction from the Niagara Escarpment towards Lake Ontario. The existing drainage features include a permanent unnamed watercourse that conveys a substantial drainage area through the QEW corridor, just west of the Casablanca Boulevard interchange. The unnamed watercourse, identified as Stream No. 136-10 in the Ministry of Transportation, Ontario QEW Stormwater Management Report (1995) has an extremely limited potential for fish habitat due to extensive alterations to the watercourse. A small portion of the drainage area associated with Stream No. 136-10 will be impacted as a result of minor modification to the South Service Road at Casablanca Boulevard.

The north-west and south-west quadrants of the Casablanca Boulevard/QEW interchange discharge to Lake Ontario through Stream No. 136-10 and QEW crossing No. 136-11 at an outlet identified as Outlet No. 9 in the Town of Grimsby's Stormwater Management Master Plan Strategy (2016). The north-east and south-east quadrants of the interchange, with exception to the area located between South Service Road and the S-E Ramp discharge to Lake Ontario through QEW crossing No. 136-12 at an outlet identified as Outlet No. 10. The drainage area associated with the Casablanca Boulevard and Livingston Avenue corridors are identified as discharging to Lake Ontario via Outlet No. 11 in the 2016 Town of Grimsby study. The 1995 MTO study identifies this unnamed watercourse as Stream No. 136-13 which crosses the QEW corridor east of Casablanca Boulevard near the end of the S-E Ramp terminal. Table 1 provides a summary of the drainage areas and outlets associated with the Casablanca Boulevard/Livingston Avenue study area

**TABLE 1: SUMMARY OF DRAINAGE AREAS AND OUTLETS**

<b>Stream No.</b>				
136-10	610A, 610B, 610C	256 Ha	Outlet No. 9	West of Casablanca, North of N. Service Rd
136-12	612	1.4 Ha	Outlet No. 10	Near North terminus of Casablanca North of N. Service Rd

\*Drainage Area from MTO QEW Stormwater Management Report (Upstream of QEW Corridor)

The drainage areas associated with the three affected surface water outlets are generally described as either falling within the intensely developed QEW corridor north of the CN Rail corridor or located within the 'Greenbelt' area south of the rail corridor. With exception to the lakefront property north of the North Service Road and east of Casablanca, and the Metrolinx property south of the South Service Road, a majority of the QEW corridor area is fully developed. Metrolinx is currently developing plans for the Casablanca Boulevard GO Station, including the design of a self-contained stormwater management system. The vacant lands that exist within the north portion of the study area are the undeveloped areas within the interchange ramps and a small parcel of property currently owned by the MTO between the S-E Ramp and South Service Road. South of the CN Rail corridor, within the defined 'Greenbelt' development opportunities are heavily restricted. The urban development that currently exists within the Outlet No. 11 drainage area, will remain undeveloped for the foreseeable future, with exception of some urban intensification on the properties fronting the westerly side of Casablanca Boulevard. The Region owns a parcel of property located between the Livingston Avenue road

easement west of Emily Street and south of the CN Rail corridor which is slated for development in conjunction with the proposed GO Station.

Confirmed with the Town of Grimsby during a coordination meeting held in mid-September 2018, a majority of the drainage and stormwater management systems within the north portion of the study have been designed on the basis of limited development occurring south of the CN Rail corridor. The engineered channel works along Outlet No. 9 have been designed to accommodate the ultimate build-out development scenario and the stormwater management systems put in place for development along South Service Road within the Outlet No. 11 drainage area have been designed to result in no-net impact on flow regime within the receiving water system.

In addition to the information noted, the Town of Grimsby provided a copy of the 'Casablanca North – Town of Grimsby Stormwater Management Report and a revised watershed area plan for the drainage area associated with Outlet No. 11. The Stormwater Management Report provides a summary of existing and proposed hydrologic modeling completed in support of infill development within the Outlet No. 11 watershed area upstream of the existing 1800mm CSP culvert crossing the CN rail corridor. The report notes the existing 1800mm CSP culvert provides conveyance of the 1:50-year design flows under non-surcharged conditions but the headwater depth would result in flooding of the residential area on Gage Street. It is estimated that flooding impacts would result from rainfall events exceeding the 1:25-year storm event. The revised Outlet No. 11 watershed area plan includes approximately 40 Ha of additional drainage area south of Woolverton Road.

### **Proposed Casablanca Boulevard/Livingston Avenue Roadway Improvement Design Components and General Stormwater Management Design Criteria**

---

The primary surface water outlet for the drainage areas associated with the Casablanca Boulevard and Livingston Avenue corridors south of the CN Rail crossing is an intermittent overland flow path that forms a defined drainage channel along the south side of the United Pentecostal Church of Grimsby property, west of Casablanca Boulevard. The drainage channel flows from west to east, crossing Casablanca Boulevard through an existing corrugated steel pipe culvert, continuing east along the rear-yards of residential properties on Vine Road and Walnut Street. The intermittent watercourse eventually crosses the CN Rail corridor approximately 200 m east of Casablanca Boulevard. From the rail corridor the watercourse flows north through the South Service Road Rona/Superstore commercial development, the QEW corridor and the undeveloped lake-front property north of North Service Road. The intermittent watercourse provides an outlet to several Town of Grimsby local storm sewer systems along Gage Street and Magnolia Crescent as well as the existing Casablanca Boulevard corridor.

In existing conditions, surface water drainage along Casablanca Road is facilitated by a system of open drainage ditches that flank the east and west side of the two-lane 'rural' cross-section. The ditches along the easterly side of the road receive surface water runoff (sheet flow) from the residential areas between Casablanca Boulevard and Fathy/George/Gage Street. The ditches along the westerly side of the road receive surface water runoff from the properties fronting Casablanca Boulevard and intercept a portion of the Outlet No. 11 drainage area south of Main Street up to Woolverton and Ridge Road. The ditches on both sides of the road convey surface water through private entrances with a series of small diameter culverts. The existing road side ditches discharge directly to the intermittent channel located along the rear-yards of the residential properties on Vine Road. The configuration of the existing

drainage ditches means that both major and minor system flows are conveyed to the Vine Road outlet channel from the Casablanca Road and external drainage areas associated with the road corridor. With exception to the benefits in the surface water runoff being conveyed through the existing well vegetated ditches, prior to discharging to the receiving water system, there are no existing stormwater management controls for surface water runoff from the Casablanca Boulevard and Livingston Avenue corridors.

North of the CN Rail crossing, Casablanca Boulevard forms the drainage divide between the east and west portions of the QEW interchange drainage areas. Surface water runoff from Casablanca Boulevard and the associated intersections and ramp drainage areas are collected and conveyed by small local storm sewer systems that discharge directly to the adjacent roadside ditches. The roadside ditches to the west of Casablanca convey surface water runoff from the interchange area to Outlet No. 9 and the roadside ditches to the east of Casablanca convey surface water to Outlet No. 10 and Outlet No. 11. With exception to the benefits of surface water runoff being conveyed through the existing roadside ditches within the interchange area, prior to discharging to the receiving water systems, there are no existing stormwater management controls for surface water runoff from the Casablanca Boulevard corridor in the north portion of the study area.

Based on the ongoing preliminary design efforts the proposed improvements to the Casablanca Boulevard and Livingston Avenue corridors impacting the components of existing drainage system are summarized as follows:

- Widening of Casablanca Boulevard from a 2-lane rural cross-section to a 4-lane plus auxiliary lane (in specific locations) and fully urban cross-section including grass boulevard areas and sidewalks/cycle allowances.
- Extension of Livingston Avenue from Casablanca Boulevard to west of Emily Street with an urban cross-section including general intersection improvements, the addition of auxiliary turn lanes, grass boulevards and sidewalks/cycle allowances.
- Intersection improvements at Casablanca Road and North/South Service Road, including the addition of grass boulevards and sidewalks.
- Reconfiguration of the Casablanca Boulevard QEW interchange bridge to accommodate ramp and speed-change-lane improvements with the addition of active transportation facilities.
- Elimination of roadside ditches flanking Casablanca Boulevard south of the CN Rail corridor and the installation of a storm sewer system capable of draining the proposed paved surfaces within the right-of-way and conveying external drainage area flows to the appropriate receiving water system.
- Provide provisions for a future, long-term grade separation at the CN Rail corridor which would be configured to take Casablanca Boulevard under the existing at-grade crossing, including consideration for a storm sewer crossing the rail corridor and the space for a potential stormwater pumping station if required by the grades within the subway portion of the roadway.

General stormwater management design criteria, related to the proposed improvements to Casablanca Boulevard and Livingston Avenue corridors, has been based on a review of available background documents including the MTO QEW Stormwater Management Report and the Town of Grimsby Stormwater Management Masterplan Strategy and site specific design constraints. The general project stormwater management design criterion includes:

1. The alteration of hydrologic characteristics, resulting from the increase in imperviousness within the Casablanca Boulevard and Livingston Avenue road corridors, should have no-net-impact on the rate of stormwater runoff discharged to any given receiving water system. This includes changes in flow regime for design flows up to and including the 'Major' storm event (100-year return period).
2. The proposed improvements should not increase the risk of flooding within any one of the receiving water systems, particularly the Vine Road intermittent drainage channel which has been previously identified as having limited capacity to convey 'Major' storm events.
3. Alteration of the hydrologic characteristics within the impacted road corridors should not result in a reduction in the level of service of existing MTO drainage infrastructure, specifically the freeboard and clearance of the QEW culverts that facilitate drainage to Outlet No. 9, 10 and 11 should not be negatively impacted.
4. Quality control and enhancement of stormwater runoff should be provided to meet the MOEE 'Normal' level of treatment prior to discharging to existing intermittent and permanent watercourse receiving water systems. Although the existing receiving water system have been identified as having limited fish and fish habitat resources, 'Enhanced' level of stormwater quality control treatment should be considered given the proximity of the study area to Lake Ontario.

Throughout the detailed design process, specific water quality and quantity control release rates and treatment levels will be established for critical locations and at specific receiving water systems within the project study area. Based on the degree of physical changes (increase in the level of imperviousness) proposed within the Casablanca Boulevard/QEW interchange area, significant stormwater management works are not anticipated for the associated drainage areas. The reconfiguration of the QEW underpass structure and alterations to the interchange ramps will have limited impact on the existing drainage and stormwater management systems currently in place.

## **Development of a Stormwater Management Strategy for the Southerly Portion of the Study Area and Preliminary Design Options**

---

As part of the preliminary design process several overall drainage and stormwater management strategies have been developed to address the change in hydrologic characteristics that will result from improvements within the Casablanca Boulevard/Livingston Avenue corridor south of the CN Rail corridor. The key drivers behind the development of the stormwater management strategy include:

- The need to effectively collect and convey stormwater runoff from the roadway corridor and direct runoff to an outlet with sufficient capacity for post-improvement design flows.
- The need to control post-improvement runoff rates to a level that does not worsen flooding concerns within the Vine Road rear-yard intermittent drainage channel, specifically in the areas that the drainage channel is located on private property.
- The need to convey major and minor flows in a way that does not negatively impact the level of service of the roadway during extreme rainfall events and accommodates the potential future grade separation at the CN Rail corridor. Considerations include the location of a storm sewer crossing the railway at a sufficient offset from the road so as not to impact the retaining wall systems associated with the possible future grade separation.
- Establishing a roadway profile on Casablanca Road that efficiently conveys major overland flow to a location that it can be controlled or conveyed to an appropriate outlet and minimizes the



drainage area associated with the final grade separation roadway drainage areas, therefore optimizing the size of a potential future stormwater pumping station.

- Accommodating future drainage improvements on the Region's property parcel located south of the proposed Metrolinx GO Station site.
- Developing an overall stormwater management strategy that is both cost effective and constructible considering development limitations with the 'Greenbelt' area, limited physical space within the existing Casablanca Boulevard road corridor and making the best use of green-space within the Casablanca Road/QEW interchange area.

In addition to the anticipated changes to the Casablanca Boulevard corridor south the of CN Rail corridor, the preliminary design includes minor changes to the configuration of the road network north of the railway, most notably the addition of traffic lanes on South Service Road. The changes to the roadway configuration are geared primarily towards accommodating additional capacity and dedicated turning movements. The anticipated changes to the lane configurations along Casablanca Boulevard and the Service Roads represent relatively small changes to the overall level of imperviousness within the interchange drainage areas, most notably the south-east quadrant. With targeted over-control of runoff from the southerly portion of the study area it is anticipated that the area north of the rail corridor will be allowed to drain without provisions for quantity control. Where possible roadside ditch enhancements, such as widening with 1-2 m flat bottoms, will be implemented to provide some additional storage of runoff within the conveyance system prior to discharging to respective receiving water systems. Final hydrologic modelling of the watershed area will demonstrate no-net increase in stormwater flows, particularly to the QEW culvert located along Outlet No. 11, the ultimate receiving water system for a majority of the Casablanca Boulevard study area.

Based on the key drivers identified for the study area, four stormwater management options have been developed. To assist in the evaluation of options, a Visual Otthymo hydrologic model was prepared as part of the preliminary design process. The Visual Otthymo model was developed to represent pre and post-improvement conditions within the Casablanca Boulevard and Livingston Ave corridors and allowed for the assessment of pre and post-improvement peak flows and runoff volumes. The Visual Otthymo model was developed based on the original hydrologic analysis completed as part of the MTO QEW expansion Drainage Impact Study (1995) with updates to land use and the Town of Grimsby's update to the overall drainage area contributing to Outlet No. 11.

## Stormwater Management Option A

---

Stormwater Management Option A has been developed using the general strategy referred to as 'end-of-pipe' stormwater management control. The improved Casablanca Boulevard corridor would be serviced with a new trunk storm sewer capable of conveying runoff generated by the corridor and external drainage areas for both major and minor storm events (See **Figure A** at end of memo).

The proposed trunk storm sewer would intercept surface water runoff from the residential areas directly adjacent to the road corridor (from the east and west) and the intermittent channel south of the United Pentecostal Church of Grimsby property. From a proposed profile sag located just south of Vine Road the proposed trunk storm sewer capacity would be increased to convey both major and minor flows 'around' the future CN Rail grade separation, crossing the rail corridor through a Town of Grimsby easement, continuing north to South Service Road. A traditional (end-of-pipe) stormwater management



facility, located in the green-space between South Service Road and the S-E interchange ramp, would provide both stormwater quality and quantity control of flows that would ultimately discharge to Outlet No. 11.

The note-worthy benefits of Stormwater Management Option A include:

- Diverts flow from the existing drainage outlet along Vine Road therefore eliminating flood risk to private properties located along the existing intermittent flow channel (identified as a key differentiator).
- Utilizes available green-space within the MTO corridor for an end-of-pipe stormwater management pond capable of controlling post-improvement flows to a rate equal or less than existing conditions.
- Can accommodate a future grade separation at the existing CN Rail at-grade crossing location.
- Does not require dedicated property for a stormwater management facility (development) within the 'Greenbelt' area south of the CN Rail corridor. Drainage infrastructure required to convey flows to proposed pond location would be limited to within the Casablanca Boulevard/Livingston Ave road right-of-way.
- At the time of preparation of this Casablanca Boulevard preliminary design the drainage and stormwater management needs of the Metrolinx development adjacent to the CN Rail corridor are not well defined. Option A provides a great deal of flexibility in that it could potentially provide a drainage outlet for the Metrolinx site and could accommodate necessary stormwater management controls for post-development flows from the site (if required) in addition to the Casablanca Boulevard stormwater management needs. At present it is assumed that Metrolinx will develop a fully independent stormwater management solution for the site.

Draw-backs of Stormwater Management Option A include:

- Potential effects on MTO lands within the Casablanca Boulevard/QEW interchange area that may impact the options for possible, future interchange maintenance/re-habilitation works and future uses of the property.
- MTO has indicated that they would not be supportive of a storm pond at this location.
- Requires a pipe crossing of the CN Rail corridor just east of Casablanca Road of suitably sized to convey both major and minor flows to the centralized stormwater management facility from the upstream drainage area.

As MTO was not supportive of a SWM pond on their property, this option was not considered further as the preferred stormwater management strategy for the improved Casablanca Boulevard corridor.

### **Stormwater Management Option B**

---

Stormwater Management Option B has been developed using a combination end-of-pipe and conveyance system stormwater management control strategies. Similar to Option A, the improved Casablanca Boulevard corridor would be serviced with a new trunk storm sewer capable of conveying runoff generated by the corridor and external drainage areas for both major and minor storm events (See **Figure B** at end of memo).

The proposed trunk storm sewer would again intercept surface water runoff from the residential areas directly adjacent to the road corridor. The trunk storm sewer would continue westerly on Livingston Avenue, intercepting the external drainage area flow conveyed by the existing undefined major overland

flow route, and would convey runoff to a stormwater management facility located on the Region's property parcel located south of the proposed Metrolinx GO Station. The proposed stormwater management facility located on the Region's property could consist of a traditional stormwater management pond, an underground stormwater management system located under the future parking lot facility, or a hybrid combination of the two facilities. **Note: The area shown for the storm pond on the figure is conceptual only.** It is expected that a facility can be designed so that it does not significantly impact on the future use of this property. It may be desirable to develop a temporary facility that can be modified when plans for the property are better defined.

The stormwater management facility would be designed to provide significant over-control of stormwater flows from the Casablanca Boulevard road corridor and external drainage areas so that flows could be released to the existing intermittent flow channel along Vine Road. Over-control of post-improvement flows would be necessary to address the limited conveyance capacity that exists within the intermittent flow channel and CN rail culvert further downstream. The over-control of flows would also be necessary to reduce the flood risk of private residences upon which the intermittent flow channel is located.

The note-worthy benefits of Stormwater Management Option B include:

- Utilizes Region owned property south of the rail corridor for an end-of-pipe stormwater management pond.
- Makes use of the existing drainage outlet along Vine Road while addressing flood risk by way of over-control of stormwater discharge from the stormwater management facility.
- Has minimal impact on MTO lands within the Casablanca Road/QEW interchange area.
- Can accommodate a future grade separation at the existing CN Rail at-grade crossing location and does not require a crossing of the existing rail corridor.
- Can accommodate future development of a parking/bus facility on the Region's property south of the rail corridor and provide the necessary stormwater management controls for post-development flows from the site.

Draw-backs of Stormwater Management Option B include:

- Additional storm sewer infrastructure required to convey Casablanca Boulevard road runoff to the stormwater management facility.
- Limited potential to integrate Metrolinx site stormwater management requirements into a 'centralized' stormwater management facility as presented in Option A, should that requirement be identified during the development of the Metrolinx stormwater management plan.
- Inherent flood risks associated with directing runoff from a Region stormwater management facility onto private properties along Vine Road and potential erosion protection enhancements within the intermittent flow channel (construction activities on private lands).

There is the potential for impact on access/parking for a future south side GO station access/transit facility depending on the chosen configuration of stormwater management facility. A traditional stormwater management pond would be most economical but would come at the expense of space for the parking lot. Underground storage could be integrated into the parking lot design but comes at a much higher capital cost compared to that of a traditional pond.

Neither the Region nor the Town of Grimsby have a defined drainage easement through the rear yards of the residential properties along Vine Road. Although Riparian Rights might suggest that since the Casablanca Boulevard corridor currently drains to this outlet now it can continue to do so in the future, the inherent flood risk and lack of access for long term maintenance significantly constrains the use of the existing channel for a drainage outlet for the corridor. The lack of capacity of the 1800mm CSP culvert crossing the CN rail corridor also complicates the potential use of this outlet. For the reasons noted this option is not considered the preferred stormwater management strategy for the improved Casablanca Boulevard corridor.

### Stormwater Management Option C

---

Stormwater Management Option C is an evolution of Option B in that it has been developed using a combination end-of-pipe and conveyance system stormwater management control strategies but in addition it incorporates a new storm sewer outlet that diverts surface water away from the Vine Road intermittent flow channel. Similar to Option A and B, the improved Casablanca Boulevard corridor would be serviced with a new trunk storm sewer capable of conveying runoff generated by the corridor and external drainage areas for both major and minor storm events (see **Figure C**).

The proposed trunk storm sewer would again intercept surface water runoff from the residential areas directly adjacent to the road corridor. The trunk storm sewer would continue westerly on Livingston Avenue, intercepting the external drainage area flow conveyed by the existing undefined major overland flow route, and would convey runoff to a stormwater management facility located on the Region's property parcel located south of the proposed Metrolinx GO Station. The stormwater management facility would be designed to provide significant over-control of stormwater flows from the Casablanca Boulevard road corridor and external drainage areas so that flows could be released to a storm sewer system that would convey flows to the north, along Casablanca Boulevard and then easterly down South Service Road, ultimately discharging to Outlet No. 11 just upstream of the QEW culvert. Similar to Option B, the Option C stormwater management facility could be in the form of a traditional stormwater management facility, and underground storage system integrated into the Region's parking facility or a hybrid combination of stormwater management facility types.

The Region/Town currently have an established 5 m wide municipal services easement along the United Pentecostal Church of Grimsby property. There are currently Bell utilities and a municipal water main occupying the 5 m width of easement which limits the size and depth of sewer infrastructure that can potentially be accommodated within it. For this reason a high degree of over-control of post-improvement flows will be required to minimize the physical size of the storm sewer system downstream of the facility. A large storage volume would allow for a small diameter storm sewer along the municipal easement and Casablanca Road to convey post-development flows to the ultimate outlet at the QEW culvert (just north of South Service Road). It is estimated that a storage volume of approximately 35,000 cubic meters would be required to reduce post-improvement flows to such a degree that discharge from the facility could be accommodated in 600 mm diameter pipe. As previously noted the 35,000 cubic meter storage volume could be provided in a traditional stormwater management facility, an underground storage system or a hybrid combination of the two stormwater management facility types.

The note-worthy benefits of Stormwater Management Option C include:

- Utilizes Region owned property south of the rail corridor for an end-of-pipe stormwater management pond or underground stormwater management facility.
- Diverts significant area from the existing drainage outlet along Vine Road addressing flood risk by way of removing stormwater discharge from the Casablanca Boulevard and shifting the outlet to a location downstream of the existing drainage channel located on private property.
- Has minimal impact on MTO lands within the Casablanca Road/QEW interchange area.
- Can accommodate a future grade separation at the existing CN Rail at-grade crossing location.
- Can accommodate future development of a parking/bus facility on the Region's property south of the rail corridor and provide the necessary stormwater management controls for post-development flows from the site.

Draw-backs of Stormwater Management Option C include:

- Additional storm sewer infrastructure required to convey Casablanca Boulevard road runoff to the stormwater management facility and to a location just north of South Service Road, discharging to a drainage channel within the MTO right-of-way that ultimately outlets to the QEW culvert.
- Limited potential to integrate Metrolinx site stormwater management requirements into a 'centralized' stormwater management facility, should that be required.
- Potential impact on access/parking for a future south side GO station access/transit facility. Design/mitigation options involving partially above and below ground SWM are available to minimize this impact.
- Requires the expansion of the existing 5 m wide municipal service easement along the United Pentecostal Church of Grimsby property to accommodate a 600 mm storm sewer outlet system from the proposed stormwater management facility on the Region's property.

Although there is an existing municipal service easement along the United Pentecostal Church of Grimsby property, the physical size of the easement is not wide enough to accommodate existing services and an additional storm sewer outlet system from the proposed stormwater management facility on the Region's property along Livingston Ave. The property implications related to the need to expand the existing easement, both in terms of cost and the time lines for expropriation, is a significant challenge for this project. For the reasons noted this option is not considered the preferred stormwater management strategy for the improved Casablanca Boulevard corridor.

### Stormwater Management Option D

---

Stormwater Management Option D has been developed using a conveyance system stormwater management control strategy in order to minimize the property implications along the Casablanca Boulevard corridor while incorporating a new storm sewer outlet that diverts surface water away from the Vine Road intermittent flow channel. Similar to the previous options, the improved Casablanca Boulevard corridor would be serviced with a new trunk storm sewer capable of conveying runoff generated by the corridor and external drainage areas for both major and minor storm events (see **Figure D**). Similar to previous options, the proposed trunk storm sewer would intercept surface water runoff from the residential areas directly adjacent to the road corridor. For Option D the trunk storm sewer would be extended westerly on Livingston Avenue, intercepting the external drainage area flow conveyed by the existing undefined major overland flow route and would convey runoff back to the Casablanca corridor. The trunk storm sewer would be oversized to provide control of stormwater flows, by way of storage and attenuation, from the Casablanca Boulevard road corridor. The 'Super-Pipe'

system would incorporate an outlet control system such that post-improvement peak runoff rates are reduced to pre-improvement levels and allow runoff to be discharged to Outlet No. 11 just upstream of the QEW culvert.

The 'Super-Pipe' system would provide online storage of surface water runoff either throughout its length or centralized in one (or several) key storage node(s) along the Casablanca Boulevard corridor. Similar to the other stormwater management options the degree of over-control of post-improvement flows is a balance of the capital cost of storage provided by the 'Super-Pipe' system and the system flows downstream of the online or centralized facility. A large storage volume would result in a significant reduction in overall system flows discharged to the QEW culvert, whereas minimal storage volumes would result in the need for a larger diameter storm sewer system to convey post-development flows to the ultimate outlet at the QEW culvert (just north of South Service Road) and only have a small influence on the overall system flows. The table below illustrates the relationship between storage volume and the net impact on system flows discharged to the Outlet No. 11 drainage channel upstream of the QEW culvert.

<b>Proposed System Flow (Casablanca Road Improvements)</b>			
7.43 cms	0	7.55 cms	+0.122 cms

As indicated in the table, an estimated 'Super-Pipe' storage volume of 2,500 cubic meters is sufficient to reduce post-improvement peak flows to approximately 1.0 cms below the estimated existing conditions flow at the QEW culvert. An approximate 1.0 cms reduction of flows was identified given that only limited modelling was undertaken north of the CN Rail corridor, and therefore this estimate would allow for some flexibility to discharge a portion of the drainage area, north of the CN rail corridor in an uncontrolled manner and still achieve no-net-increase in post-improvement flowrates. As a key objective of the drainage strategy is at minimum to achieve no-net-increase in post-improvement flowrates, the specific required storage volume to achieve this objective will be identified through the detailed design process with additional modelling to be undertaken. As previously noted the storage volume could be integrated into the overall conveyance system as a continuous 'Super-Pipe' or provided in an underground storage system located at one or more 'nodes' along the corridor. The parcel of property immediately east of Casablanca and south of South Service Road is considered an ideal location for a single storage node. Both fully online and a node-type stormwater management system will be considered as part of the detailed design of the Casablanca Boulevard and Livingston Avenue corridors.

The note-worthy benefits of Stormwater Management Option D include:

- Potential to integrate required stormwater management storage system into the design of the Casablanca Boulevard and Livingston Ave corridors, avoiding the need for additional property.
- Opportunity to utilize property (if available from Metrolinx) immediately north of the CN rail corridor for a single storage location making it considerably more cost-efficient than providing online storage.

- Diverts significant area from the existing drainage outlet along Vine Road addressing flood risk by way of removing stormwater discharge from the Casablanca Boulevard and shifting the outlet to a location downstream of the existing drainage channel located on private property.
- Has minimal impact on MTO lands within the Casablanca Road/QEW interchange area.
- Can accommodate a future grade separation at the existing CN Rail at-grade crossing location.
- Does not impact the Region's ability to develop a parking/bus facility on the Region's property south of the rail corridor.

Draw-backs of Stormwater Management Option D include:

- Additional storm sewer infrastructure required to convey external drainage area flows from Livingston to Casablanca Boulevard.
- Complexities in integrating 'Super-Pipe' system within the roadway cross-section in terms of required offsets to other underground utilities and potential conflicts with sanitary services.
- Limited potential to integrate Metrolinx site stormwater management requirements into a 'centralized' stormwater management facility, should that be required.
- Requires that the future south side GO station access/transit facility include a stand-alone site stormwater management system.

Although construction of a 'Super-Pipe' stormwater management system presents a range of challenges from a constructability standpoint, minimizing property impacts by implementing a corridor-based strategy has a significant benefit to the overall project schedule. For the reasons noted this option is considered the preferred stormwater management strategy for the improved Casablanca Boulevard corridor.

## Summary of Recommendations

---

Throughout the preliminary design process, the stormwater management strategy for the Casablanca Boulevard corridor has evolved considerably. During the early phases of preliminary design significant effort was undertaken to identify design constraints and opportunities to develop a holistic drainage strategy that would both meet the necessary environmental commitments of the overall project but also address existing drainage deficiencies along the existing corridor. Consideration was given to develop a holistic stormwater management solution for the corridor, the Region's future Go-Station related infrastructure along Livingston Ave, as well as the Metrolinx development site on the north side of the CN corridor, but coordination of all projects proceeding on different time lines meant that a 'stand-alone' solution had to be developed to address the needs of the Casablanca Boulevard widening and Livingston Ave improvement project.

Given the corridor constraints, particularly with respect to the lack of defined outlet for stormwater runoff generated south of the CN rail corridor and the need to mitigate impacts on the MTO's drainage infrastructure within the QEW corridor, Option D is recommended to be carried forward through detailed design. Consideration will be given to the location of online or node-based storage in order to optimize the configuration of the storm sewer crossing the CN rail corridor, accommodate the future grade separation at the railway, and make use of available lands immediately adjacent to the Casablanca Boulevard corridor. At the preliminary design phase, it is estimated that approximately 2,500 cubic meters of online or node-based storage is required to achieve the necessary reduction of post-improvement (widening) stormwater runoff rates. The diversion of stormwater runoff from the Vine Road drainage system addresses flooding concerns of the lands immediately upstream of the existing

1800 mm CSP crossing the CN rail corridor while the proposed storage volumes and resultant runoff rates will be equal or less than existing flow rates, therefore meeting the general stormwater management objectives identified for the project.



MEMO



FIGURE A STORMWATER MANAGEMENT OPTION A



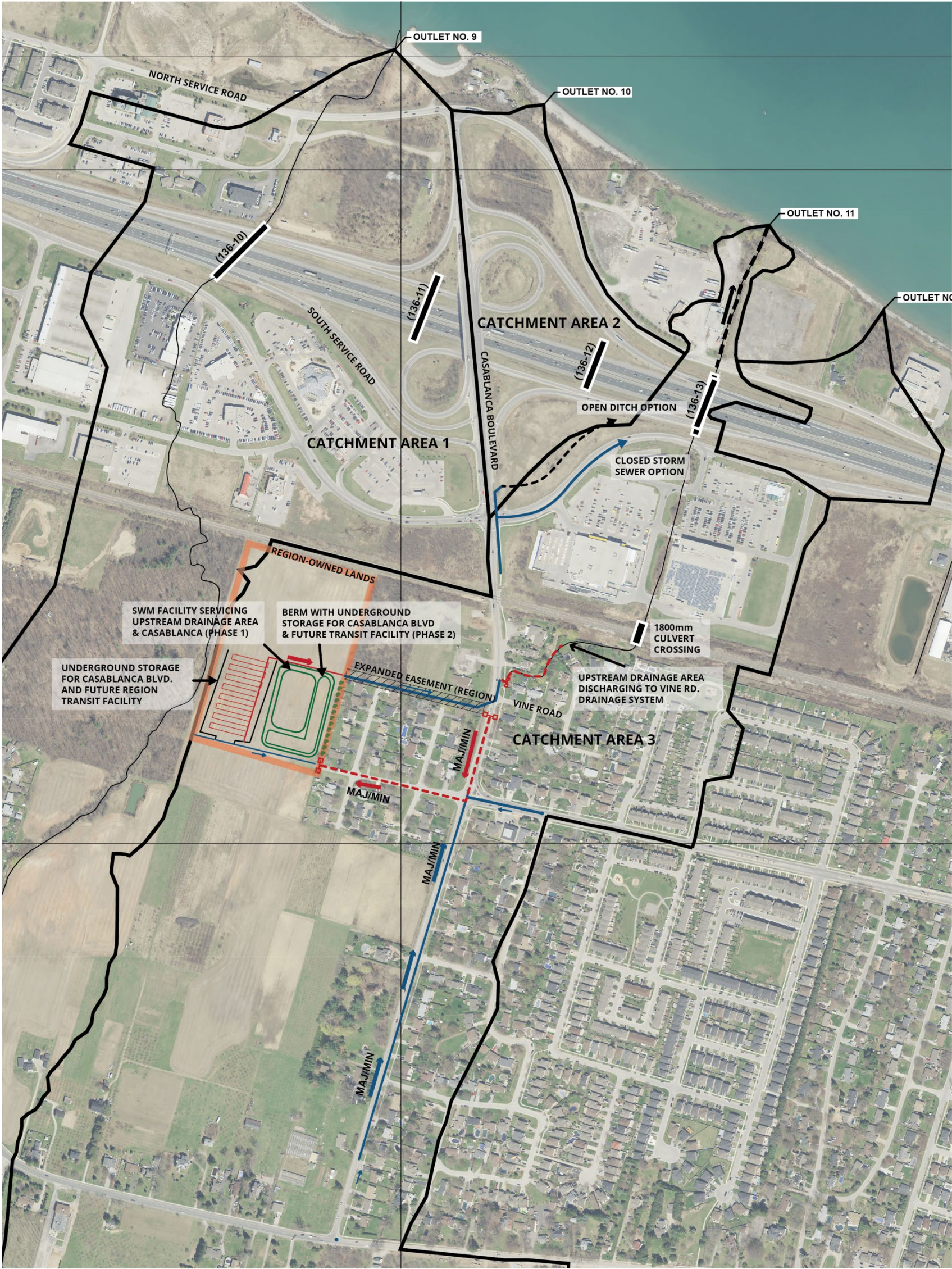


FIGURE B STORMWATER MANAGEMENT OPTION B



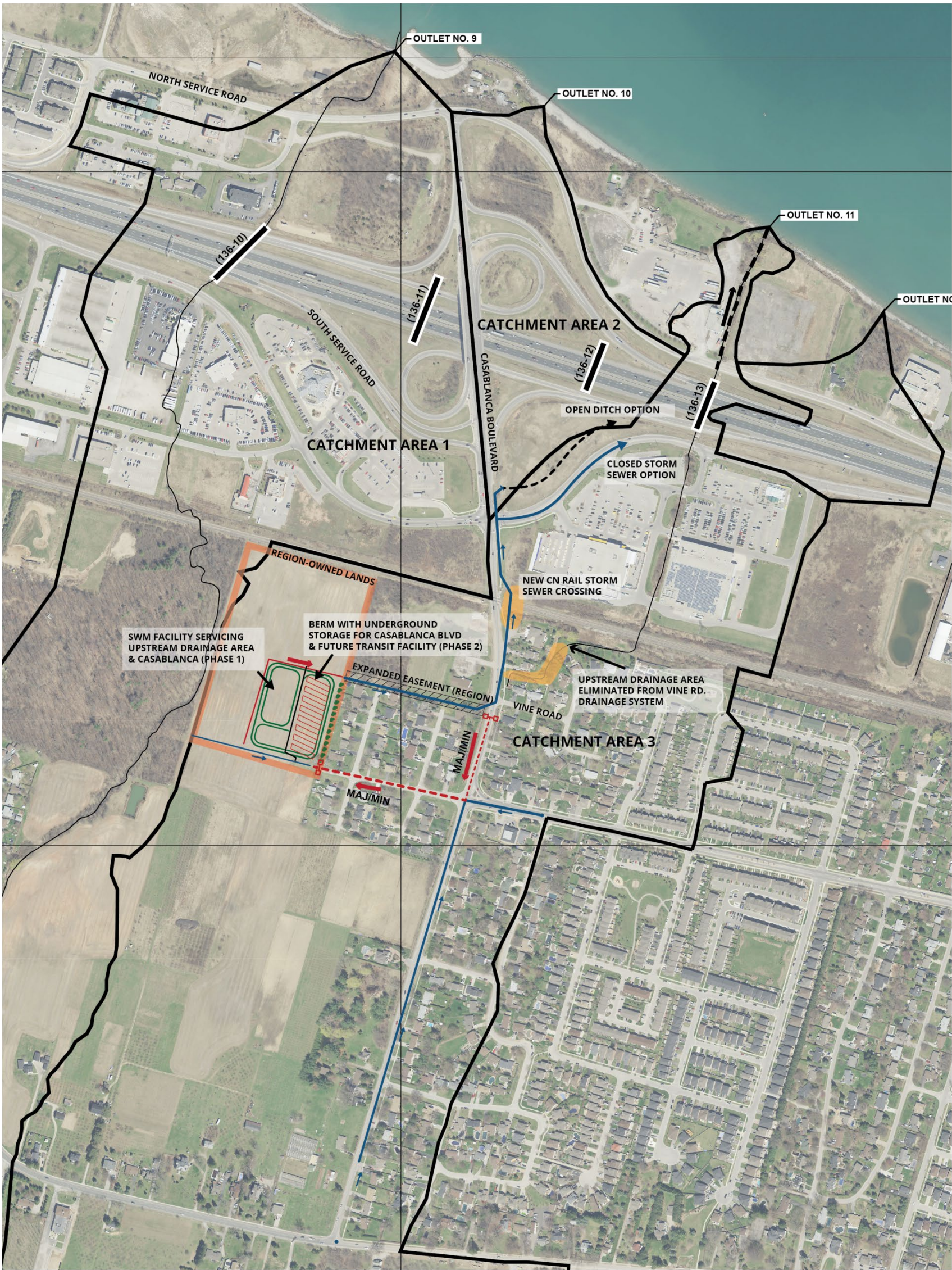


FIGURE C STORMWATER MANAGEMENT OPTION C





FIGURE D STORMWATER MANAGEMENT OPTION D