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PROPOSED INDUSTRIAL DEVELOPMENT
3054 Homestead Drive

City of Hamilton

FUNCTIONAL SERVICING REPORT

Prepared For:

Fengate Homestead Holdings LP

February 6, 2023

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EXECUTIVE SUMMARY

Odan/Detech was retained by FENGATE HOMESTEAD HOLDINGS LP to propose a servicing scheme for the industrial development located at 3054 Homestead Drive, Hamilton, Ontario. A draft plan of subdivision has been proposed which will introduce 141,600.92 m2 of ICI (industrial/commercial/institutional) space to the Hamilton Airport area. The following is a summary of the findings listed per type of service.

Sanitary Service:

The development of 3054 Homestead Drive will generate a population of approximately 656 persons. This is within the allowance provided for this property at the English Church Sanitary Pump Station (HC019) which is 950 persons/jobs. A discussion regarding the properties employment, based on land use, can be found in Section 2.0. The existing site has no existing sanitary drainage pattern, and it is proposed to service the development through two sanitary connections. A 375mm sanitary sewer at a slope of 0.5% (minimum) will convey the proposed developments sanitary flow to Airport Road and Homestead Drive. See the Conceptual Servicing Plan (Drawing 1) in Appendix E.

Water Service:

A 300mm looped watermain system is proposed within the subject site. Connections will be made to the existing 400mm watermains on Airport Road and Homestead Drive, respectively. The watermain configuration is suitable for the development for full build out or in a Phased condition. See Section 3.0 for the water supply and distribution discussion.

Storm & SWM Service:

The Stormwater management strategy for the site will follow the requirement outlined in the AEDG Subwatershed Study & SWMP Implementation Document. The proposed development site is situated across a drainage boundary for Twenty Mile Creek and the Welland River.

Figure 4 in Appendix C outlines the existing drainage boundary divide across the site and the existing storm outlets towards Homestead Dr and Airport Rd. A portion of the Hamilton Airport lands to the west drains into the site at the west boundary into the existing wetlands within the north end of the site. Storm flow from the Hamilton Airport lands will be diverted thought the site within an open swale ultimately to the existing north-west storm outlet to Homestead Rd.

As a result of the existing drainage divide, the site's stormwater management strategy will incorporate three separate storm outlets, each with separate allowable flow criteria. The post development flow rate to the northern storm outlet proposed to drain toward Homestead Rd will be based on matching the pre-development flow rates. Stormwater flow that will outlet towards Airport Rd will need to match the 100-year predevelopment flow rate allocated to the Lancaster Heights SWM Pond. New storm sewers will need to be constructed off-site along Airport Rd to provide the necessary storm water outlet conveyance

to the receiving storm sewer. The post development flow rate to the southern storm outlet proposed to drain toward Homestead Rd will control the 100-year release rate to pre-development 5-year levels.

To control stormwater runoff on-site to their respective flow rates, on site storm water management will be required. This will be achieved through roof top control drains allowing flow attenuation from building roof areas, as well as on site surface ponding at catchbasins and underground storage chambers. Additional control will be achieved by incorporating infiltration galleries to achieve water balance targets while also providing runoff retention and lower overall runoff volume from the site.

The site will require quality control which will be achieved by various oil/grit separator units and LID measures.

Site Grading:

Under the new development there will be several grading constraints for this development to match. The constraints are matching both the existing overland flow route and grades along the north property line, as it is also being developed. The post-development overland flow has been modified form the pre-development and a detailed discussion can be found in Section 6. At a later date, coordination with the adjacent landowner will determine the grades to match along the north property line.

1. INTRODUCTION

1.1 Background

The Odan/Detech Group was retained by Fengate Homestead Holdings LP to complete the functional servicing study for the proposed industrial draft plan of subdivision located at 3054 Homestead Drive in the Mount Hope community in the City of Hamilton. This report will evaluate the serviceability of the site with respect to sanitary, water and storm servicing and also evaluate the stormwater management (SWM) strategy that will be implemented to meet the SWM requirements set out by regulatory agencies.

1.2 Site Description

The property under study is a 30.3 hectare (ha) (75 acre) site located south-east of the John C. Munro Hamilton International Airport in the City of Hamilton within the Airport Employment Growth District (AEGD) lands. The site is bounded by the following:

- To the north: there are existing agricultural lands, which are in the application process to be developed by Rice Group.
- To the east: there are single family dwellings which front onto Homestead Drive.
- To the south: there are single family dwellings which front onto Airport Road.
- To the west: there is East Cargo Road and John C. Hamilton International Airport.

An aerial view of the site can be found in Appendix A.

The subject site is currently vacant consisting of mostly cultivated lands. A watercourse cuts through the north end of the site draining the westerly airport lands to Homestead Drive and is surrounded by meadow marsh vegetation. The topography of the site has a high point spanning east/west through the center of the site wherefrom the lands generally slope towards Airport Road to the south and the existing watercourse to the north. Please refer to the topographic survey prepared Nanfara & Ng Surveyors Inc. for detailed topography of the existing site conditions.

The site is located within two watershed boundaries. Areas of the site draining northward are within the Twenty Mile Creek watershed and ultimately drain east across Homestead Drive through Willow Valley Golf Course. Areas draining to the south are within the Welland River watershed. One of the two southern outlets drains across Airport Rd towards a newly built SWM pond within Lancaster Heights Subdivision, while the other outlet drains through Homestead Drive to a channel located at the intersection of Homestead Drive and Provident Way. Both watersheds are within the jurisdiction of the Niagara Peninsula Conservation Authority.

1.3 Proposed Development

The proposed development will consist of four industrial buildings, a right-of-way and a natural heritage compensation area. The proposed road allowance will extend from Airport Road to a proposed cul-de-sac at the north east edge of the site. Please refer to the proposed Draft Plan of Subdivision in Appendix A prepared by Urban Solutions for layout of the proposed development.

On the adjacent lands to the north, the Rice Group is currently working on a development proposal that is proposing a road allowance aligned with Street A cul-de-sac. Should the Rice Group construct the connecting road allowance at the same time or prior to the road proposed within the subject site, the proposed cul-de-sac design for this site will be omitted from the design.

A Concept Plan of the site dated January 16, 2023 of the proposed site can be found in Appendix A. For further information regarding the proposed plan and specific land use, refer to the Draft Planning Justification Report prepared by Urban Solutions.

2. SANITARY SERVICING

2.1 Existing Sanitary Sewer Infrastructure

The proposed development is abutting two existing sanitary sewers to the east and south on Airport Rd and Homestead Dr. respectively. There is 450mm sewer on Airport Rd that flows easterly to the intersection of Airport Rd and Homestead Dr, where it discharges to Homestead Drive's 675mm trunk sewer which drains northward passing the site's eastern frontage access. This sewer ultimately discharges to the downstream English Church Sanitary Pump Station (SPS) (Ref No. HC019) located at 2844 Upper James St.

A capacity allowance has been made at the English Church SPS (HC019) for the subject property, based on a growth of approximately 950 jobs.

As the site consists of existing agricultural lands, there is currently no connection to the existing sanitary sewers abutting the site.

2.2 Proposed Sanitary Servicing

Wastewater from the subject lands is intended to be directed to the existing English Church SPS (HC019) through gravity sewer connections to Homestead Dr and Airport Road, via Street A. Building D's sanitary discharge is proposed to outlet to the proposed 375mm sanitary sewer beneath Street A, which will discharge to the existing 450mm diameter sewer beneath Airport Road. Building's A, B and C are proposed to discharge to the 675mm sanitary sewer beneath Homestead Drive.

For the sewer connection to Homestead Dr, a municipal sewer is proposed to connect from Street A through Block 1 to Homestead Dr. which will require a municipal servicing easement/corridor over top of the main sewers through Block 1. For a layout of the proposed sanitary servicing layout of the site please refer to the Conceptual Site Servicing Plan in Appendix E.

In the event the Rice Group lands to the north of the site, 2876 Upper James Street, is constructed prior to the subject development, an alternate outlet has been contemplated for Buildings A, B and C through the neighbouring property along Street A which would eliminate the need for a municipal sewer easement through Block 1. Refer to the Alternative Water and Sanitary Outlet Figure 3 in Appendix B.

Phasing of the site has been considered which involves the construction of Building D only, and Street A from Airport Rd to a Building C in the first phase. This first phase would require a relatively short municipal sanitary sewer run on Street A from Airport Rd to Building D as shown on Figure 3, thereby deferring the Homestead Dr sanitary connection and improving the opportunity to connect the new municipal sanitary sewer on Street A to the future development at 2876 Upper James St should the construction schedules align between both developments.

2.2.1 Sanitary Sewer Design Considerations

The equivalent population for this development will follow the population densities established within AEGD Water and Wastewater Master Plan and as shown in the following Table 1 from the study.

Table 1 – Updated AEGD area and population projection

Land Use		Area (ha)	Employment Density (emp/ha)	Projected Employees
ASI	Airside Industrial	87	36	3,123
ARB	Airport Related Business	16.0	81	1,299
IND	Light Industrial	150.1	23	3,451
PBP	Prestige Business Park	397.7	39	15,509
Institutional*	Institutional*	41.0	11	451
Total		**692**		**23,843**
**Includes church, college lands, and secondary school uses at areas of 8.2, 24.6, and 8.2 net ha respectively.*				

In determining the total population for the subject site, the AEGD population employment densities will be used for light industrial. The following table 2 shows the population of the site based on the population density (person/ha) count method.

Only the total developable site area will be considered for inclusion in the sanitary flows.

Table 2 – Employment Population Based on Employment Density

Unit Type	Site Area (ha.)	Employment Density (persons/ha)	Total Population
Light Industrial	28.5	23	656

The total population/employment for the subject site is 656 people, which is less than the 950 people this development has allocated to the English Church SPS (HC019). Therefore, this development can be serviced by this sanitary pump station with no upgrades to the SPS.

Currently the English Church SPS ultimately outlets to the Twenty Rd SPS. It has been noted by the City of Hamilton that the sanitary flow from this area (including flow from the English Church SPS) is intended to be diverted to a future trunk sewer on Dickenson Rd East as proposed in the Master Servicing Strategy for the AEGD lands. Before the trunk sewer has been completed, the City is requiring that the development apply for and obtain written permission from the Director of Growth Management Division to secure sanitary capacity allocation in the future trunk sewer.

The total expected sanitary flow from the proposed development was calculated as follows in Table 3 based on the total population determined above. The peaking factor was calculated using the Babbitt formula as outlined in the City of Hamilton Comprehensive Development Guidelines and Financial Policies Manual, 2019.

Table 3 – Summary of Sanitary Sewer Design Flow

Outlet Location	Area (ha)	Population[1]	Average Dry Weather Flow (L/s)[2]	Peak Factor[3]	Infiltration Allowance (L/s)[4]	Design Flow (L/s)[5]
Homestead Dr	19.76	454	1.79	5	7.50	**16.48**
Airport Rd.	8.74	202	0.84	5	3.50	**7.68**

[1]Population: Refer to Table 2
[2]Average Dry Weather Flow = 360 L/cap/day x population
[3]Peak Factor, M (Babbitt Formula) = $5 \div (P/1000)^{0.2}$ ($2 < M < 5$), P is number of Persons in thousands
[4]Infiltration Allowance = Infiltration Factor (0.4L/s/ha) X Sanitary Tributary Area
[5]Design Flow = Average Dry Weather Flow X Peak Factor + Infiltration Allowance

It should be noted that at the site plan stage, waste water generation will be evaluated by estimating flows using the Ontario Building Code. Given that the sanitary flow for the proposed building types will be calculated by the number of loading bays and limited office space rather than population, a preliminary OBC calculation was completed to compare anticipated flow generation to preliminary flow shown in Table 3. An average dry weather flow rate of 0.67 l/s was calculated which is 82% lower than by the population method (refer to Appendix B for the OBC calculation breakdown) which suggests that sanitary flows will most likely be lower than the flows summarized in Table 2. In addition, the sanitary sewers to do not span a large portion of the site, therefore the calculated infiltration rate is likely inflated. Given the relatively low flows generated from a relatively large site, the City has requested that a sanitary monitoring plan be implemented to ensure that site flows do not exceed the allocated flow for the site. The details of this plan will be reviewed with the City at the detailed design stage.

2.2.2 Sanitary Sewer Design & Downstream Pipe Capacity

The sanitary sewer design for the site will follow the City of Hamilton's servicing standards and requirements. All proposed municipal sanitary sewers are to be 375mm diameter with a minimum slope of 0.5%. Proposed sanitary sewers for the development were evaluated using the sanitary sewer calculation sheet in Appendix B to determine the capacity of the proposed sanitary system. Please refer to the conceptual sanitary sewer pipe layout and sanitary tributary plan shown on Figure 1 in Appendix B as a reference for the sanitary sewer calculation sheet.

The proposed site will drain to the existing 675mm diameter sanitary sewer (at slope of 0.20%) on Homestead Dr and a 450mm diameter sanitary sewer (at slope of 0.20%) on Airport Rd, which has a total capacity of 376 L/s and 127 L/s respectively.

3. WATER SUPPLY AND DISTRIBUTION

3.1 Existing Water Supply and Distribution

The subject site is located adjacent to two available municipal watermains for servicing purposes. To the south there is a 400mm watermain beneath Airport Road which the site has access to. To the East, there is a 400mm watermain beneath Homestead Drive that is accessible from the area of the site that fronts onto Homestead Dr. The site is within the City Pressure District 6 (PD6) pressure zone.

3.2 Proposed Water Supply

The City of Hamilton has recently adopted a new policy regarding requirements for providing water to new developments. This was made effective January 1, 2020 and is as follows;

Water Main Fire Flow Requirements Design Guidelines require that fire flows be based on the greater of the required fire flow calculated using the Ontario Building Code (OBC) method and a City Target Available Fire Flow based on land use, and not the Fire Underwriters Survey (FUS) approach.

The following Table identifies City of Hamilton Target Available Fire Flows based on Land Use.

Land Use	Target AFF (L/s)
Commercial	150
Small ICI (<1800m3)	100
Industrial	250
Institutional	150
Residential Multi (greater than 3 units)	150
Residential medium (three or less units)	125
Residential Single	75
Residential Single (dead end)	50

The Odan/Detech Group has been working closely with the City of Hamilton in the AEGD area and it is known that the available fire flow in the area of the subject site is below 250 L/s. This has been confirmed by a hydraulic assessment of the existing watermain system completed by WSP under a separate cover for the subject site. To mitigate this issue on recent development sites with similar sized industrial buildings adjacent to the site, the City has acknowledged that upon detailed design of the buildings, the OBC caps the required fire flow at 150 L/s once all code requirements and sprinkler systems have been considered. We anticipate that the buildings within the subject development will undergo similar concessions to allow the development to proceed.

3.2.1 Domestic Water Demand

The estimated domestic water demand for the site has been calculated based on the Ontario Ministry of Environment's "Design Guidelines for Drinking-Water Systems". Table 3 summarizes the domestic water demand from the proposed development.

Table 4 – Summary of Domestic Water Demand

Population[1]	Average Day Demand (L/s)[2]	Max. Day Factor[3]	Peak Hour Factor[4]	Max. Day Demand[5]	Peak Hour Demand[6]
656	2.73	2.5	3.75	6.8	10.2

[1]Population: Refer to Table 2
[2]Average Day Demand = 360 L/cap/day x population
[3]Max Day Peaking Factor = 2.5
[4]Peak Hour Peaking Factor = 3.75
[5]Maximum Day Demand = Average Day Demand x Max. Day Peaking Factor
[6]Peak Hour Demand = Average Day Demand x Peak Hour Peaking Factor

At the final design stage actual domestic demand for each building will be determined using the AWWA Manual M22 Modified Fixture Value method.

3.2.2 Fire Flow Demand

According to MOE (2008), the water distribution system requires to maintain a minimum residual pressure of 20 psi (140 kPa) when subject to Maximum Day + Fire Flow demands, and the pressure in the distribution system must not exceed 100 psi (700 kPa) nor fall below 40 psi (275 kPa) during normal demand periods.

The fire flow demand of each building within the proposed development will be confirmed at the building permit stage. As mentioned above it is anticipated that the fire flow demand will not exceed 150 L/s when determined by the OBC method. To confirm available fire flow within the development, a separate watermain hydraulic analysis was completed by WSP and submitted under a separate cover.

The site's watermain was analysed based on the layout shown on the Conceptual Servicing Plan in Appendix E which shows the watermain looping from Airport Rd through Street A and connecting to Homestead Dr through Block 1. In addition, an analysis was completed by WSP to evaluate the available fire flow in the Phase 1 condition described in Section 2.2, whereby only Building D would be constructed and the watermain would be installed from Airport Rd to midway of Building C.

By phasing the site, the remainder of the watermain loop connecting to Homestead Rd would be deferred which would potentially allow for the watermain to be connected to the future watermain proposed to abut the north end of the site from the Rice Group lands should their construction schedule align with the second phase of the subject site. Please refer to Figure 3 in Appendix B for the potential alternative watermain layout showing the watermain looped to Homestead through the Rice Group lands. Please note that this scenario was not evaluated by WSP as the Rice Group schedule is unknown at this time.

From WSP's analysis it is shown that the available fire flow to the site under the ultimate build-out and Phase 1 condition ranges from 188-255 L/s and 155-253 respectively at hydrants within the site. These flows are sufficient to meet the anticipated 150 L/s demand criteria for the site under the OBC. In addition the max day pressures exceeded 275 kpa under the ultimate build-out and Phase 1 scenarios with ranges yielding 349-427kpa and 354-395 kpa respectively. Based on these results the proposed watermain layout for the full build-out and Phase 1 conditions are able to sufficiently service the fire and domestic water demands of the site.

4. STORMWATER MANAGEMENT

4.1 Design Criteria

As previously mentioned the subject site drains to two watersheds, Twenty Mile Creek and Welland River, and three separate storm outlets will be required to maintain pre-development storm runoff. All outlets will follow the SWM criteria set out by the City of Hamilton Airport Employment Growth District (AEGD) Subwatershed Study & Stormwater Master Plan (SWMP) Implementation Document (Final Report, dated April 2017, Version 2.2) as prepared by Aquafor Beech Limited.

For the area of site within the Welland River Tributary draining toward Airport Rd, reference will be made to recent SWM modelling included in the Stormwater Management Report for Lancaster Heights Subdivision prepared by the Odan/Detech Group Inc. These areas have been modelled as part of the Lancaster SWM pond and storm conveyance infrastructure up to Airport Rd which has been sized to drain this area of the subject site.

A summary of the stormwater management criteria applicable to the site are as follows:

Quantity Control: Quantity control measures for the site are applied on a per outlet basis. The site's post-development stormwater release rate to Airport Road must be less than or equal to the 100-year flow rate allocated from the subject development to the Lancaster Heights SWM Pond. The site's proposed south eastern outlet to Homestead Drive must control the 100-year release rate to the pre-development 5-year level. The site's post-development north eastern outlet to Homestead Drive must control the 2 through 100-year release rates to pre-development levels. The Regional event will also be considered in subsequent evaluations for flood management purposes at the detailed design stage.

Quality Control: Quality control measures are to be designed to provide Enhanced Protection - long term average removal of 80% of Total Suspended Solids (TSS) on an annual loading basis from all runoff leaving the proposed development site and to infiltrate the AEGD minimum target of 10mm of rainfall over the site's asphalt surfaces. A train treatment approach using Low Impact Design (LID) features is the preferred method to achieve quality control within the AEGD area. Wet ponds are discouraged as they attract birds that have an impact on airport safety. Source control to contain spills within industrial lands will be required.

Runoff Conveyance: The minor and major storms are to be controlled on site and outlet to designated storm outlet sewers. Flows within the proposed road allowance will flow uncontrolled to road side ditches and ultimately into sewers sized for the 5-year storm, while the major overland system is to be designed for the 100 year event.

Ground Water Recharge: The AEGD has established water balance targets based on soil types to match pre-development infiltration targets to promote groundwater recharge and maintain pre-development runoff volume. The site is within a type C-D soil therefore the infiltration targets range from 6-8mm depending on the land use. The AEGD SWMP (April 2017 -Table 2.9.6.2) requires that a minimum of 10mm of infiltration is required for the site's asphalt surfaces.

4.2 Existing Conditions and Drainage Patterns

The existing drainage pattern for the site is divided into three quadrants. There is a high point along the site spanning east-west, which directs surface runoff to the north and south direction. The south portion of the property is separated with a high point spanning north-south, which directs surfaces runoff to the south west and south east directions. The existing drainage areas of the site are presented in the Pre-Development Storm Tributary Plan, Figure 4 in Appendix C and are summarized below in the following Table 5.

Table 5 – Summary of Pre-Development Tributary Areas

Area ID	Discharge Location	Area (ha)	Watershed
A	Airport Rd/ Lancaster Heights	12.55	Welland River
B	Existing Watercourse/ Homestead Dr.	13.80	Twenty Mile Creek
C	Homestead Dr.	5.03	Welland River

Area A sheet flows overland toward Airport Rd through the existing residential lots fronting Airport Rd. Flow from this area is conveyed along lot lines towards the ditch/culvert system along Airport Rd. There is visible channeling towards Airport Rd between 9158/9166 Airport Rd and 9100/9110 which is intercepted by culverts draining across to the south side of Airport Rd at Mt. Hope Public School and Marion St, ultimately to the temporary dry pond at Spitfire Dr pond which will be decommissioned in the near future. It is planned for the subject lands to be intercepted into the newly built 900mm storm sewers at Airport Rd and Provident Way to convey flow to the new Lancaster Heights SWM pond located Hwy 6 and White Church Rd.

Area B sheet flows overland to an existing watercourse that drains from the neighbouring Hamilton Airport through the north part of the site towards the intersection of Homestead Dr and Upper James St through 2918 Upper James St (Hwy No. 6). An existing 900mm x 1200mm culvert crossing Homestead Drive conveys drainage to the east side of Upper James St into a vegetated watercourse that ultimately drains westward to Willow Valley Golf Course. A small area at the north end of the site drains toward the northerly lands to another watercourse that also drains to the same downstream golf course via another culvert crossing further north on Upper James St.

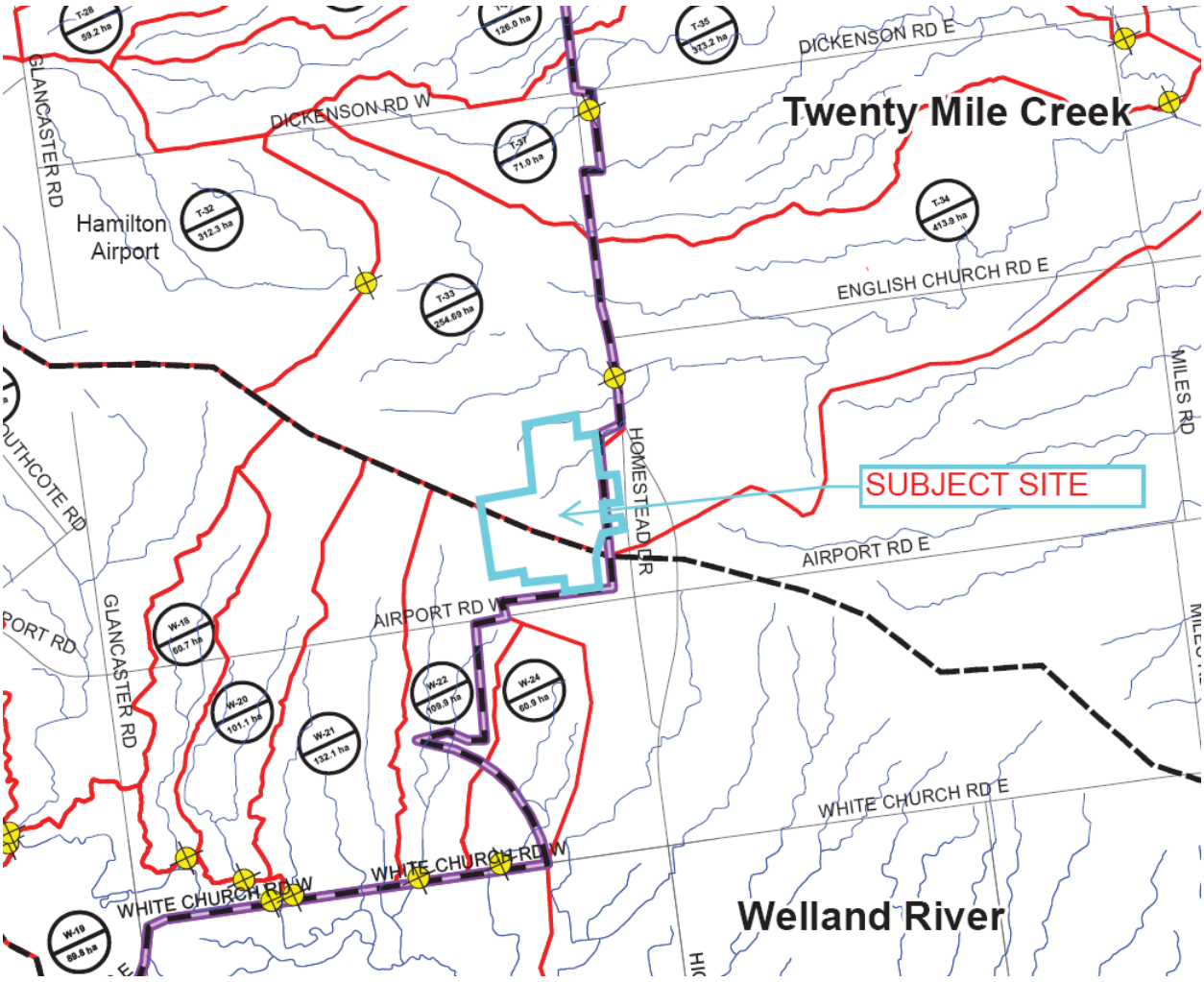
Area C sheet flows overland toward the Airport Rd and Homestead Dr intersection through the existing residential lots fronting Airport Rd. Flow from this area is conveyed through a series of sewers beneath Homestead Drive flowing southerly before discharging to a channel near the intersection of Homestead Drive and Provident Way.

Drainage from the Hamilton Airport entering the subject lands through the existing watercourse is controlled by a dry pond located within the Airport lands. Drainage and sewer records were obtained from the Hamilton Airport and it was determined that a total upstream area of 18.77ha drains to this

watercourse from the Airport lands. Please refer to Figure 6 in Appendix D for a plan of the upstream storm tributary area draining to the watercourse and the accompanying Internal Storm Drainage Plan for the Hamilton International Airport. It is proposed to reroute the watercourse through the site around the north side of Building A. This is described in further detail in Section 4.6 of this report.

Within the Hamilton AEGD SWMP, the drainage areas to each watershed were subdivided into hydrological subcatchments which are shown in Figure 2.7 of the Hamilton AEGD SWMP and is also located in Appendix C. The subject site is located within subcatchments identified as T-33 and W-22 that have a total area of 254.69ha and 109.9ha respectively as shown below in Exhibit 1. Area T-33 drains toward Twenty Creek and W-22 towards the Welland River. The subject site's pre-development catchment area C does not fall within the AEGD hydrological subcatchments.

Exhibit 1 – Subject Site within AEGD Boundaries



4.3 Pre-development/Allowable Flow Rates

The allowable stormwater flows from the site will be separated into three parts for each outlet draining to their respective watershed.

Welland River Watershed (Catchment A)

The area of the site draining toward Airport Rd has been accounted for in the design of the SWM pond within the southerly Lancaster Heights Subdivision under pre-development conditions. Please refer to Figure 3B in Appendix C for the Lancaster Heights post development storm tributary plan denoting Area EX 1 (10.22ha) and EX 2 (6.83ha) which includes Area A of the subject site and residential lots fronting Airport Rd. Areas west of EXT 1, denoted as Area 201, drain to a storm bypass sewer on Airport Rd that diverts flow to a watercourse west of Lancaster Heights.

In order to have no negative impact to the downstream SMW pond and receiving storm sewers at Provident Way, the post development flows from the site must be controlled to pre-development levels determined in the Lancaster Heights SWM model. As per the Lancaster Heights Storm Sewer Design Sheet shown in Appendix C, the total flow at the intersection of Airport Road West and Provident Way must be equal to or less than 897 L/s. Please note that "Mountaingate Road" on Figure 3B was a preliminary name for the street and it has since been renamed and constructed as Provident Way.

Twenty Mile Creek Watershed (Catchment B)

The target storm discharge rates for Area B will be controlled to pre-development levels. The 2-100 year 24 hour SCS storms, the 5 and 100-year 4 hour Chicago storm and the Hurricane Hazel rain event have been used for analysis. Visual OTTHYMO 2.3.2. has been used to model and determine the site's pre-development flow rate to Twenty Mile Creek. The Nash unit hydrograph is used for rural areas and required a time to peak. The time to peak (Tp) was derived from the time of concentration (Tc), which is calculated using the Airport method. Airport method was used for the site as it provides a better estimate of the time of concentration for relatively flat land; this method was developed for airfields. The Tc and Tp for Catchment B were calculated as follows:

$$Tc = \frac{3.26(1.1 - c)L^{0.5}}{S^{1/3}}$$

Table 6 – Pre-Development Catchment B Time of Concentration			
Runoff Coefficient (c)	**Length (m)**	**Slope (%)**	**Tc**
0.25	523	1.5	**55**

$$Tp = 0.66(Tc) = 36.3min = 0.61hr$$

The visual OTTHYMO Model and parameter summary for Catchment B is shown below.

Exhibit 2 – Pre-Development Catchment B OTTHYMO Model

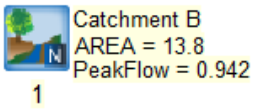


Table 7 – Pre-Development Catchment B Visual OTTHYMO Parameters				
Catchment	Area (ha)	Hydrograph Method	CN for Pervious Area	Time to Peak (hr)
Catchment B	13.8	NasHyd	75	0.61hr

The following table is a summary of the pre-development peak flows

Table 8 – Pre-Development Catchment B Flow Rate						
Storm Distrtibution	2-Year Flow Rate (m3/s)	5-Year Flow Rate (m3/s)	10-Year Flow Rate (m3/s)	25-Year Flow Rate (m3/s)	50-Year Flow Rate (m3/s)	100-Year Flow Rate (m3/s)
24 hour SCS	0.268	0.462	0.604	0.797	0.947	1.099
4 Hour Chicago	-	0.339	-	-	-	0.942
Hurricane Hazel	-	-	-	-	-	1.449

Welland River Watershed (Catchment C)

The target storm discharge rates for Area C will control the post-development 100-year release rate to be equal to or less than pre-development 5-year level. The 5-year 24 hour SCS storm and the 5-year 4 hour Chicago storm have been used for analysis. Visual OTTHYMO 2.3.2. will be used to model and determine this outlet's pre-development flow rate. The Nash unit hydrograph is used for rural areas and required a time to peak. The time to peak (Tp) was derived from the time of concentration (Tc). Airport method was used for the site as the Airport method provides a better estimate of the time of concentration for relatively flat land; this method was developed for airfields. The Tc and Tp for Catchment C were calculated as follows:

$$tc = \frac{3.26(1.1 - c)L^{0.5}}{S^{1/3}}$$

Table 9 – Pre-Development Catchment C Time of Concentration			
Runoff Coefficient (c)	**Length (m)**	**Slope (%)**	**Tc**
0.25	347	0.57	**62**

$$Tp = 0.66(Tc) = 40.9min = 0.68hr$$

The visual OTTHYMO Model and parameter summary for Catchment C is shown below.

Exhibit 3 – Pre-Development Catchment C OTTHYMO Model

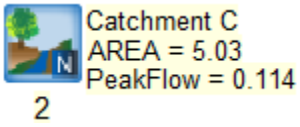


Table 10 – Pre-Development Catchment B Visual OTTHYMO Parameters				
Catchment	Area (ha)	Hydrograph Method	CN for Pervious Area	Time to Peak (hr)
Catchment C	5.03	NasHyd	75	0.68hr

The following table is a summary of Catchments C's allowable post-development stormwater release rate, which is taken from the pre-development 5-year storm.

Table 11 – Catchment C Post-Development Stormwater Release Rate	
Storm Distribution	100-Year Flow Rate (m3/s)
24-hour SCS	0.155
4-Hour Chicago	0.114

4.4 Post Development Drainage Pattern

For the purposes of post-development analysis, the post-development storm tributary areas of the subject site have been identified as shown on Figure 4 in Appendix C. As denoted in the pre-development drainage plan, post development areas denoted with the letter A represent areas draining to the Welland Creek watershed. Post development areas denoted with the letter B drain to Twenty Mile Creek and areas denoted with the letter C drain to the Welland Creek watershed through existing storm sewers beneath Homestead Drive. The areas outside of the site draining to Airport Rd that are captured in Areas EX1 and EX2 on Figure 3B have been included in catchments 5A-1 to 5A-4 on the post-development tributary plan.

Welland River Watershed (Catchment A)

Since the existing site does not abut storm servicing infrastructure to convey the proposed development to the Provident Way storm sewers, it is proposed to install 900mm storm sewer at 0.3% slope from the subject site to the existing storm pipe roughly 150m east of the intersection of Airport Road and Provident Way, via the proposed right-of-way (R.O.W.). Please see the Conceptual Servicing Plan (drawing 1 of 3) in Appendix E for the layout of the proposed off-site storm connection to Airport Road.

The proposed storm sewer beneath the R.O.W. is designed to service the road's ditch inlets as well as the subject site. The proposed storm sewer beneath Airport Road accounts for the Catchment area A noted on Figure 4.

A summary of the post-development tributary areas from the site contributing to the Welland River Watershed are as follows in Table 12 below and as shown on Figure 4. Catchments A1 and A2 are modelled using visual OTTHYMO and therefore their percent impervious is shown on the post-development catchment plan. All other catchments are calculated using the rational method and therefore their runoff coefficient is shown on the catchment plan.

Table 12 – Post-Development Tributary Area Description – Catchment A

Tributary Area ID	Area Description	Area (ha)	Imperviousness (%)	Runoff Coefficient
A1	Building Roof E	3.330	99	-
A2	Driveways/Loading/Parking	7.070	90	-
A3	Street A	0.230	-	0.6
A4	Street A	0.210	-	0.6
A5	Street A	0.270	-	0.6
A6	Street A	0.270	-	0.6
A7	Street A	0.270	-	0.6
A8	Street A	0.430	-	0.6
Total Area from Site to Welland River Watershed		**12.08**		
Ex 5A-1	Airport Road &	0.404	-	0.62
Ex 5A-2	Airport Road/Residential Properties	0.960	-	0.61
Ex 5A-3	Airport Road/Residential Properties	1.910	-	0.50
Ex 5A-4a	Airport Road/Residential Properties	0.690	-	0.54
Ex 5A-4b	Airport Road/Landscaping	3.790	-	0.41
Ex 5A-5	Airport Road	0.330	-	0.85
Ex 5A-6	Airport Road	0.080	-	0.85
Ex 5A-7	Airport Road	0.120	-	0.85

Please note the on-site catchment area A of proposed development will convey 12.08ha of storm runoff to the Welland River Watershed, which is 0.47ha less than the pre-development area of 12.55ha.

Twenty Mile Creek Watershed (Catchment B)

All areas of the proposed site draining towards Twenty Mile Creek are proposed to outlet towards the existing watercourse at the north-east corner of the site. The existing meadow marsh lands and watercourse will be removed and new natural heritage compensation area will be created at the north-east corner of the site that will be oriented in a north-south direction, east of Street A. The proposed storm sewers within the site draining tributary Area B1-B15 will outlet to the surface upstream of the new natural heritage compensation area allowing for a new naturalized watercourse to drain through the area into the existing watercourse at the north-east corner.

Along Street A, drainage will be diverted to road side ditches that will be intercepted by catch basins or ditch inlets draining to proposed municipal storm sewers within the road allowance. This storm sewer will distribute to each of the building sites where the private storm sewer systems will connect to. The site's storm servicing has been designed to allow for a future splitting of the site into separate blocks.

The storm tributary areas of the site draining to Homestead Dr have been divided according to building roof area, loading/driveway areas and the road allowance. The natural heritage feature has also been separated and also includes set back areas. It is intended to control all storm flow up to the outlet draining to the natural heritage feature to meet the pre-development flow targets. Quality control will be achieved upstream of the natural heritage outlet therefore it will not be a component of the on-site quality control not withstanding it will add to the train treatment of the storm runoff from the site.

A summary of the post-development tributary areas from the site contributing to the Twenty Creek Watershed are as follows in Table 13 below and as shown on Figure 4

Table 13 – Post-Development Tributary Area Description – Catchment B			
Tributary Area ID	**Description**	**Area (ha)**	**Imperviousness (%)**
B1	Building Roof B (Partial)	1.46	99
B2	Driveway/Loading/Parking	2.10	60
B3	Natural Heritage Area (incl. Buffer)	2.01	N/A
B4	Street A	0.33	56
B5	Street A	0.29	56
B6	Street A	0.29	56
B7	Street A	0.23	56
B8	Street A	0.16	56
B9	Street A	0.26	56
B10	Street A	0.26	56
B11	Street A	0.20	56
B12	Street A	0.10	56
B13	Street A	0.24	56
B14	Building A	3.31	99
B15	Driveway/Loading/Parking	2.98	86
	Total Area	**14.22**	

Please note that the proposed development will convey 14.22ha of storm runoff to the Twenty Mile Creek Watershed, which is 0.42ha more than the pre-development area of 13.80ha.

Welland River Watershed (Catchment C)

The rooftops proposing to drain toward the Welland River Watershed (Catchment C) will connect to the storm sewers beneath Homestead Dr, flowing southernly. It should be noted that the on-site storm servicing to Building C will be shared with Building B as this is required to match the pre-development drainage pattern. A summary of the post-development tributary areas from the site contributing to the Welland River Watershed are as follows in Table 14 below and as shown on Figure 4.

Table 14 – Post-Development Tributary Area Description – Catchment C			
Tributary Area ID	**Description**	**Area (ha)**	**Imperviousness (%)**
C1	Partial Building B	1.20	99
C2	Building C	3.83	99
	Total Area	**5.03**	

Please note that the proposed development will convey 5.03ha of storm runoff to the Welland River Watershed Watershed, which matches the pre-development area.

4.5 Post Development Modelling

To meet allowable flow targets for the three storm outlets, on-site controls will be required. On-site controls will be restricted to the privately owned development blocks, as no controls will take place beneath the proposed right-of-way or the natural heritage area. In order to control the post-development flows from the site to the pre-development peak flow rates, the site will require rooftop detention, above grade and/or underground storage, and pipe storage. Infiltration galleries will also be used for water recharge purposes and can provide storage however at this stage they will not be modelled for conservative design purposes and due to unknown soil percolation rates at this time.

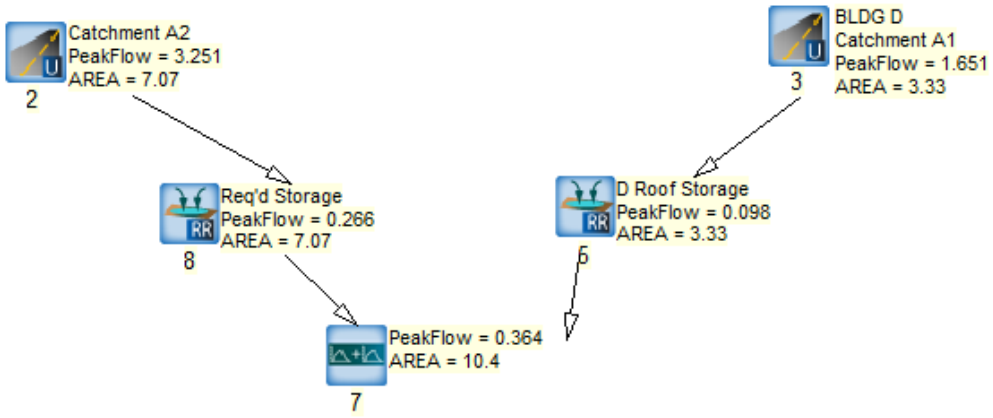
Visual OTTHYMO 2.3.2. was used to model and determine the detention volume required throughout the site. OTTHYMO is accomplished using the "Standhyd" and "Nashhyd" method. The "Stanhyd" method is used in urban watersheds to simulate runoff by combining two parallel standard unit hydrographs resulting from the effective rainfall intensity over the pervious and impervious surfaces. For pervious surfaces, losses are calculated using the SCS modified CN method. A CN value of 80 has been conservatively used for the post-development with a pervious area depression storage of 5mm. The "Nashhyd" method is used for rural areas and required a time to peak, which is derived from the time of concentration.

Welland River Watershed (Catchment A)

To match Catchment A's allowable release rate, determined in Section 4.3 of this report, the 100-year flow rate from the proposed right-of-way and the airport road has been calculated using storm sewer design sheets, shown in Appendix C. The remainder of catchment A was calculated using Visual OTTHYMO and the results were inputted to the storm sewer design sheets.

To control the 100-year flows to the allowable release rate, rooftop storage is required for building D and a 245mm orifice plate is required on catchment A2's outlet, with corresponding underground/surface storage. Refer to Appendix C for the rooftop control stage storage and underground/surface stage storage. A schematic diagram of the visual OTTHYMO model for Catchment A is as follows:

Exhibit 4 – Post-Development OTTHYMO Model (Catchment A)



A summary of the quantity control volumes required for Catchment A are as follows:

Table 15 – Quantity Control Required Volume – Catchment A

Catchment	Required Storage (m3)	Provided Underground Storage (m3)	Provided Surface Ponding (m3)	Total Provided Surface (m3)
Catchment A1	**1230**	-	2498	**2498**
Catchment A2	**2235**	3200	14000	**4600**

The 100-year post-development release rate to Street A, from catchment A1 and A2 is 364 L/s. Therefore the 100-year post-development flow rate at the intersection of Airport Road and Provident Way is 845L/s.

Table 16 – Summary of Storm Flow from Catchment A

Catchment ID	Allowable 100-year Flow Rate (L/s)	Provided 100-year Flow Rate (L/s)
Catchment A	**896**	**845**

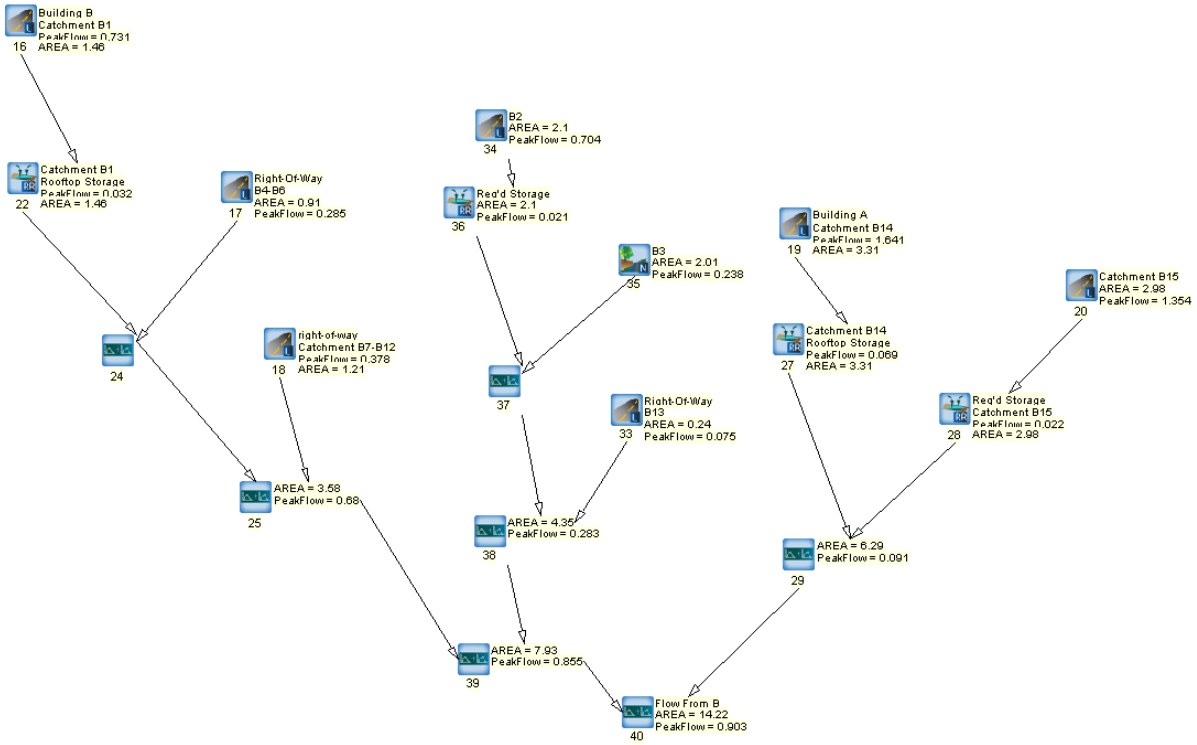
As demonstrated above in Table 16, with the inclusion of the external areas directing storm flow to Airport Rd, the post-development peak flow is controlled below the allowable flow for the 100-year storms. The existing downstream 900mm sewers beneath Provident Way are designed to convey the 100-year storm within the pipe therefore there will be no impact to the receiving storm sewer system downstream.

Twenty Mile Creek Watershed (Catchment B)

Visual OTTHYMO was used to model the storm tributary areas draining to the Twenty Mile Creek Watershed (Catchment B). To control flows to the allowable release rate, rooftop storage is required for building A and B. A 75mm orifice plate with corresponding underground/surface storage is required for both catchment B2 and B15. Refer to Appendix C for the rooftop control stage storage and underground/surface stage storage details.

Catchment B3 is modelled using the nash unit hydrograph and the time to peak was calculated to be 0.52hr (c = 0.25, L = 180m, S = 0.5%). A schematic diagram of the visual OTTHYMO model for Catchment B is as follows:

Exhibit 5 – Post-Development OTTHYMO Model (Catchment B)



The following Table 17 summarizes the post development modelled peak flows to the Twenty Mile Creek Watershed compared to the allowable flow. The storm sewer design sheet for Street A can be found in Appendix C.

Table 17 – Summary of Storm Flow from Catchment B		
Storm Event	**Allowable Flow (m3/s)**	**Peak flow (m3/s)**
2 Year 24 hour SCS	0.268	0.337
5 Year 24 hour SCS	0.462	0.501
10 Year 24 hour SCS	0.604	0.625
25 Year 24 hour SCS	0.797	0.777
50 Year 24 hour SCS	0.947	0.892
100 Year 24 hour SCS	1.099	1.007
5 Year 4 hour Chicago	0.339	0.543
100 year 4 hour Chicago	0.942	0.903
Hurricane Hazel	1.449	0.791

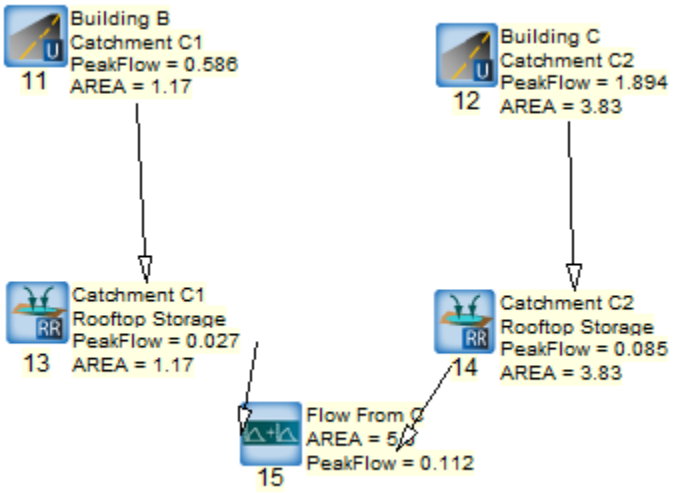
As demonstrated above, the post-development peak flow is equal to or less than the allowable flow for all storms, with the exceptions of the 2-year, 5-year & 10-year storms. It is expected that as the model is updated to incorporate infiltration galleries and soil percolation rates, the lower end storms will have decreased runoff due to storage in infiltration galleries and flow diversion due to groundwater recharge. The above modelled flow demonstrates that the target flows can be achieved with the provided on-site storage requirements listed in the following Table 18 at each storage node.

Table 18 – Quantity Control Required Volume – Catchment A					
Catchment	**Required Storage (m3) 100-Year, 4 hour Chicago**	**Required Storage (m3) 100-Year, 24 hour SCS**	Provided Underground Storage (m3)	Provided Surface Ponding (m3)	**Total Provided Surface (m3)**
Catchment B1	1038	**1077**	-	1095	**1095**
Catchment B2	1345	**1469**	1100	420	**1520**
Catchment B14	2375	**2467**		2482	**2482**
Catchment B15	2308	**2563**	2000	660	**2660**

Welland River Watershed (Catchment C)

Visual OTTHYMO was used to model the storm tributary areas draining to the Welland River Watershed (Catchment C). To control flows to the allowable release rate, rooftop storage is required for building B and C. Refer to Appendix C for the rooftop control stage storage details. A schematic diagram of the visual OTTHYMO model for Catchment C is as follows:

Exhibit 6 – Post-Development OTTHYMO Model (Catchment C)



The following Table 19 summarizes the post development modelled peak flows to the Twenty Mile Creek Watershed compared to the allowable flow.

Table 19 – Summary of Storm Flow from Catchment C		
Storm Event	**Allowable Flow (m3/s)**	**Peak flow (m3/s)**
100 Year, 24 Hour SCS	0.155	0.116
10- Year, 4 Hour Chicago	0.114	0.112

As demonstrated above, the post-development 100-year peak flows are less than the pre-development 5-year level. The target flows are achieved with the provided on-site storage requirements listed in the following Table 20 at each storage node.

Table 20 – Quantity Control Required Volume – Catchment A					
Catchment	**Required Storage (m3) 100-Year, 4 hour Chicago**	**Required Storage (m3) 100-Year, 24 hour SCS**	Provided Underground Storage (m3)	Provided Surface Ponding (m3)	**Total Provided Surface (m3)**
Catchment C1	823	**847**	-	878	**878**
Catchment C2	2715	**2809**	-	2870	**2870**

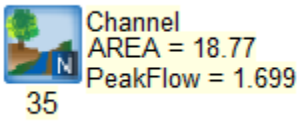
4.6 External Flow Runoff via Proposed Conveyance Swale

As mentioned previously in section 4.2, storm runoff from 18.77ha of land to the west of the subject site is being conveyed to the Twenty Mile Creek via a water course through the subject site. It is proposed to relocate the watercourse to the site's north property line, via a conveyance swale, and provide a 10.0m building setback from the 100-Year water level within the swale. See Figure 6 in Appendix D.

The proposed conveyance swale is designed to convey the larger of the 100-year storm event or the regional storm event flows to the 900mm x 1200mm culvert/outlet beneath Homestead Drive. The maximum flow rate is calculated below, using Visual OTTHYMO 2.3.2. The following parameters were used when modelling the Nash hydrograph shown in Exhibit 7.

Table 21 – Proposed Conveyance Swale Visual OTTHYMO Parameters	
Area (ha)	18.77
Time Step (min)	5
CN Procedure Curve Number	78
Pervious Area Depression Storage (mm)	7.2
Number of Linear Reservoirs	3
Time to Peak of Unit Hydrograph (hr)	1.24

Exhibit 7 – Proposed Conveyance Swale Visual OTTHYMO Model



As shown below, the regional storm event (Hurricane Hazel) results in the largest flow rate through the conveyance swale, 1.699m3/s.

Table 22 – Design Flow for Proposed Conveyance Swale			
Storm Event	**100-Year 4 hour Chicago**	**100-Year 24 hour SCS**	**Hurricane Hazel**
Flow Rate (m3/s)	0.850	0.981	**1.699**

The conveyance swale was sized using the Hurricane Hazel Regional storm as follows.

Exhibit 8 – Hydraulic Toolbox Conveyance Swale Sizing Parameters

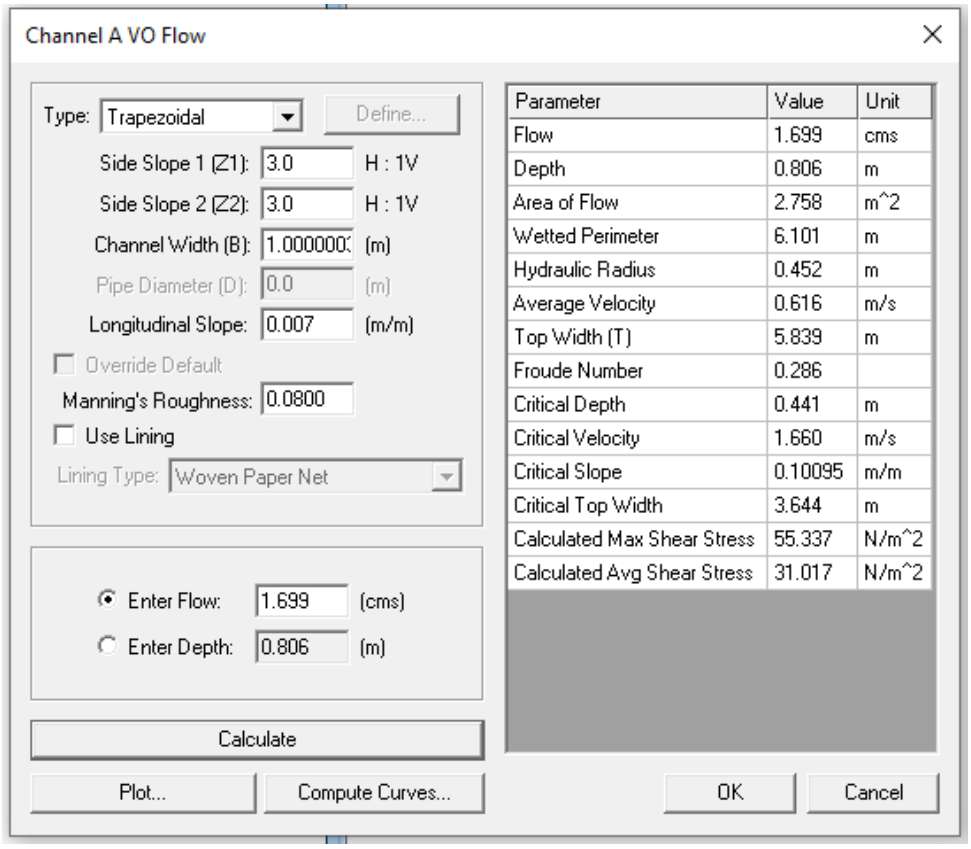
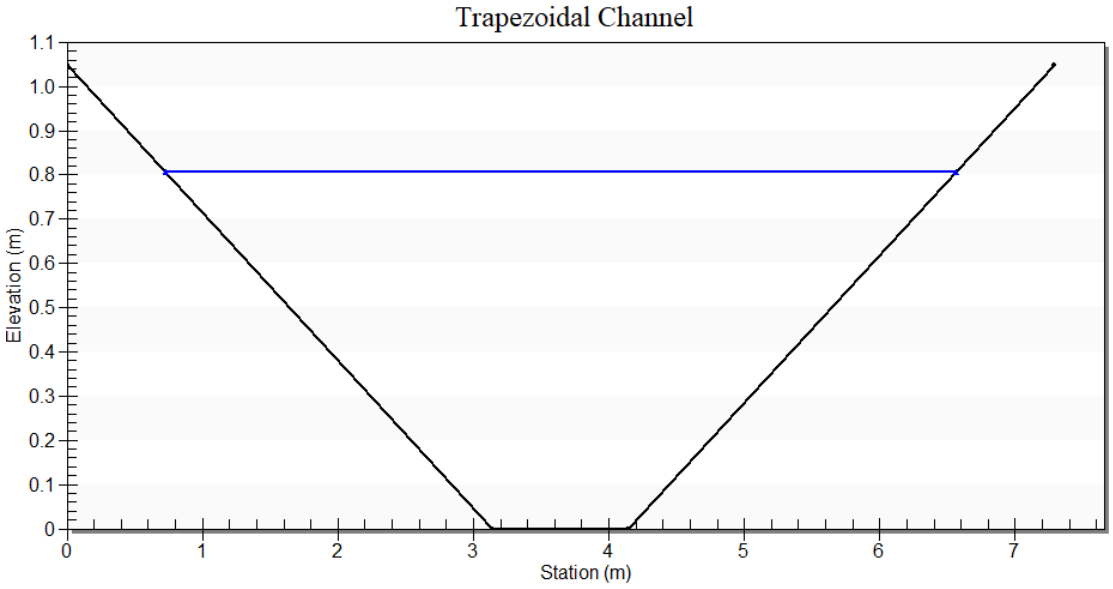


Exhibit 9 – Hydraulic Toolbox Conveyance Swale Section



To convey the 100-Year and Regional flow from the neighbouring Hamilton Airport lands through the site, a swale with a 1.0m base and 3:1 side slope is required. The 100-Year water level is at a 0.81 m depth at full flow, resulting in a minimal required swale width of 6.1m. At the west end the swale, drainage flow will need to be entombed through the proposed cul-de-sac of Street A and outlet into proposed Natural Heritage Area. A 1050mm dia. concrete culvert at 0.4% (capacity 1.72 m^3/s) is proposed beneath the Street A cul-de-sac which will convey the flow from the swale to the site's north eastern outlet.

A HEC-RAS model was also completed to evaluate the hydraulic grade line of the Hurricane Hazel regional design storm through the conveyance swale. The model and results of the HEC-RAS evaluation are shown in Appendix D which demonstrate that the conveyance swale and the proposed 1050mm storm pipe beneath Street A are adequately sized to prevent overtopping of Street A during the Regional event.

Figure 2.8.1. of the AEGD Stormwater Master Plan, shown in Appendix D, shows the floodplain mapping from the 2yr-100yr storms does not reach the subject site. In referencing the topographic elevations of the area, the floodplain on Homestead Drive reaches a maximum elevation of roughly 224.3m, which is 3.0m below the lowest elevation on the subject site. Therefore, the existing watercourse/ditches through the site are not used for storage in large storm events and the relocated swale is only required to convey the pre-development flow through the site.

4.7 Water Quality

The AEGD Subwatershed Study & SWMP Implementation Document establishes the required guidelines for implementing stormwater quality for the proposed development. The requirements for Water quality are as follows within Table 2.9.5 of the AEGD SS & SWMP.

2011 Groundwater Plan Implementation.
"Control pollutant loadings in accordance with current MOE guidelines. Enhanced Level 1 protection as defined in the 2003 Stormwater Management Planning & Design Manual – reduce average long term annual load of suspended sediment by 80% or better. Accomplish through the use of LID source and conveyance controls."

Amended, Supported, or Superseded by:
"These controls shall be amended, supported or superseded by the Low Impact Development Stormwater Management Guidance Manual (Pending 2017) is anticipated to support or supersede the 2011 Plan. Minimum on-site control targets will be required."

"Stormwater Source Control Policy for Industrial, Commercial and Institutional (ICI) Land Uses (February, 2014)"

Environmental Criteria and Minimum targets are provided in Section 2.9.6.2. The generalized target is Enhanced Level 1 Protection of 80% removal of total suspended solids and the AEGD minimum target is the infiltration of 10 mm of rainfall (over asphalt areas).

In order to achieve the required water quality for each area of the development the following methods can be considered at the detailed design stage for each storm system. The following provides values established and generally accepted throughout the province for use of various TSS removal techniques.

Total Suspended Solid Removal Method & Removal Efficiency	
Removal Method	**Removal Efficiency**
Rooftop	*80%*
Grassed Swale (with Perforated Pipe)	*80%*
Grass Swale (no perforated Pipe)	*50%*
Soakaway & Infiltration Systems	*70-90%*
Chambers (with Infiltration)	*70-90%*
Bio retention	*80%*
Dry Swale	*80%*
Permeable Pavers (with Storage Bed)	*80%*
OGS (Oil/Grit Separator)	*50%-80%*
CB Shield	** 50%*

* - Based on Design Table provided by Manufacturer.

The typical TSS removal of a vegetated swale is approximately 50%. Bio retention facilities can provide approximately 80% TSS removal. Rooftop flow is considered clean and therefore is acceptable at 80% or Level 1 when not combined with the storm sewer system. As the proposed developments are located adjacent to existing water courses, options to direct storm connection from rooftop directly to the watercourses can be considered as it will allow for clean water to enter the naturalized system directly without the need for additional treatment.

In order to achieve water quality for the development the use of various methods for water quality should be considered. As these developments are largely warehouse space the methods to obtain water quality may be limited and vary in nature throughout each site. This may be due to constraints such as limited landscape space available throughout the site for implementing LID's, underlying soils conditions and conductivity to LID's, groundwater conditions and other factors that can limit the use of LID's. All reasonable attempts should be made during the detailed design stage to provide for the use of LID's to enhance water quality measures.

In order to ensure the removal of oils, each outlet will require an oil grit separator or method of removing oil spills prior to discharging to the downstream outlet and receiving water course.

For the site's proposed right-of-way, road side ditches are proposed as part of the typical 30m AEGD road cross-section that will convey storm runoff through grassed swales with perforated pipes which will achieve the target TSS removal before entering the downstream natural heritage lands. The new road section was recently developed by the City of Hamilton in conjunction with other engineering consultant teams working in the AEDG area. Please refer to typical section detail shown on the conceptual grading plan in Appendix E.

To provide 10mm rainwater retention over asphalt areas the site's retention features are summarized as follows. Refer to the 10mm retention figure in Appendix C.

Table 23 – SWM Water Quality Summary

Area ID	Impervious Parking Area (m^2)	Infiltration Volume Required (m^3)	Infiltration Volume Provided* (m^3)	Treatment Method	TSS Removal Efficiency
Area 1	7,812	78.12	80	Bioretention Swale	80
Area 2	26,104	261.04	265	Bioretention Swale	80
Area 3	15,685	156.85	157	Bioretention Swale	80
Area 4	7,285	72.85	73	Infiltration Gallery	80
Area 5	12,538	125.38	130	Bioretention Swale	80
Area 6	15,143	151.43	152	Infiltration Gallery	80
Area 7	8,679	86.79	138	Bioretention Swale	80
Total	93,246	932.46	995	-	80

**The provided infiltration volume is to be detailed at the SPA stage.*

5. WATER BALANCE

The AEGD Subwatershed Study & SWMP Implementation Document establishes the required guidelines for implementing water balance for the proposed development. The requirements for Water balance are as follows within Table 2.9.5 of the AEGD SS & SWMP.

2011 Groundwater Plan Implementation (in Table 2.9.5 of the AEGD SS & SWMP)

As part of the development of the required Stormwater Management Plans as part of the development approval process, a water budget approach is required to maintain the existing hydrologic cycle in newly developed areas. As part of the stormwater management plan development, proponents will be required to maintain groundwater recharge per the pre-development water balance. Because much of the lands in the study area have a low potential for infiltration, innovative source and conveyance control measures will be necessary. Infiltration targets are to be met using infiltration based LID source and conveyance controls.

This is in keeping with the eco-industrial development concept being considered for these lands. This is also consistent with a "comprehensive urbanization approach" recommended in the City of Hamilton's Stormwater Management Strategy (Aquafor Beech, 2007).

Environmental Criteria and Minimum targets are provided in Section 2.9.6.4, Table 2.9.6.4 and Capture Targets per soil type and land use within Table 2.9.6.5 (shown on the following page).

The proposed development is located in sub watersheds T-33 and W-22 of Twenty Mile Creek and Welland River tributary as identified the AEGD SS & SWMP. The predominant soil types within the proposed development area are classified as Hydrologic Soil Groups C and D. Based on the Table 2.9.6.5 (below), infiltration target for the site and roads are **6mm and 7mm**, respectively.

For the site's proposed right-of-way, road side ditches are proposed as part of the typical road cross-section which will convey storm runoff through grassed swales with perforated pipes which will achieve the 7mm water capture target.

Table 2.9.6.5: LID Capture Target (m^3/impervious ha served) for Proposed Conditions Land uses

Scenario (See **Figure 2.9.6.** and **Figure 2.9.7** for soil types)	LID Facility Design Capture Target		Assumed % Imperviousness of future conditions land use
	(mm)	(m^3 / imp ha)	
Roads AB Soils	9	90	70
Roads BC Soils	8	80	70
Roads CD Soils	7	70	70
Prestige Business Park / Airport Related Business AB Soils	10	100	70
Prestige Business Park / Airport Related Business BC Soils	8	80	70
Prestige Business Park / Airport Related Business CD Soils	6	60	70
Airside Industrial / Light Industrial AB Soils	13	130	80
Airside Industrial / Light Industrial BC Soils	11	110	80
Airside Industrial / Light Industrial CD Soils	8	80	80

Along with the 10mm water retention measures proposed in the impervious parking areas within the site, infiltration galleries will be utilized to achieve the remaining 6mm capture target throughout the property. The remaining water balance target volume is as follows:

Table 24 – Water Balance Retention Volume Requirements

	Initial Abstraction (mm)	Area (m^2)	Volume (m^3)
6mm Required Volume Whole Site	**6**	**313,800**	**1,883**
Less 7mm Volume Right-of-way	7	39,000	273
Less 10mm Volume Impervious Parking Area	5	93,246	995
Required Retention Volume			***615***

Infiltration galleries will be utilized to retain the remaining 615m3 of water required for the site. The required retention volume has been divided to each building equally. The required retention volume per building is as follows:

Table 25 – Infiltration Gallery Summary

Building	Area (m2)	% of Total Building's Area	Required Retention Volume (m3)
Building A	33,326	0.253	155.5
Building B (Catchment B1)	14,600	0.111	68.3
Building B (Catchment C1)	12,000	0.091	56.0
Building C	38,269	0.291	179.0
Building D	33,469	0.254	156.2

The proposed infiltration gallery characteristics are summarized as follows:

Table 26 – Infiltration Gallery Summary

Tributary Area ID	Description	Length (m)	Width (m)	Depth (m)	Volume (m^3)
Catchment B14	Building A	132	8	0.6	200.0
Catchment B1	Building B	50	8	0.6	87.6
Catchment C1 Catchment & C2	Building B & C	2598m2		0.6	301.6
Catchment A1	Building D	150	8	0.6	200.8

As shown below in Table 22, the total capture of 2,058m3 exceeds the annual target volume of 1,883m3 therefore , the water balanced target will be achieved on-site.

Table 27 – Total Site Retention Volume

	Initial Abstraction (mm)	Area (m^2)	Volume (m^3)
6mm Required Volume Whole Site	**6**	**313,800**	**1,883**
Less 7mm Volume Right-of-way	7	39,000	273
Less 10mm Volume Impervious Parking Area	10	93,246	995
6mm Building A (infiltration gallery)	6	33,326	200
6mm Building B (infiltration gallery)	6	14,600	87.6
6mm Building B & C (infiltration gallery)	6	50,269	301.6
6mm Building D (infiltration gallery)	6	33,469	200.8
Provided Retention Volume	***6.6***	***313,800***	***2,058***

6. GRADING CONSIDERATIONS

The proposed grading of the site generally follows the predevelopment topography. Due to the large building areas that are proposed, stepping of the site grading will need to occur with gradual lowering of building elevations from west to east, with the lowest areas being towards the north-east corner where the proposed natural heritage area is located. Refer to the Conceptual Grading Plan and Site Sections (Drawing 2 and 3) included in Appendix E for additional detail. Grading for of the site will be detailed at the Site Plan stage of development.

The proposed Street A terminates with a cul-de-sac at the property line at the north end of the site. It is anticipated that the road allowance will eventually connect north into the neighbouring lands thereby eliminating the need for a cul-de-sac. The grading of the cul-de-sac is currently proposed higher than the existing property line grade and slopes down to match the existing elevations. The higher road elevation allows for the by-pass drainage swale to be entombed beneath the road and allows for a stepped transition between the natural heritage area and the Building A site.

Along the perimeter of the site where it abuts residential lands, a landscaped buffer to provide room for a noise berm has been provided. The berm height will be maximized depending on the elevation difference between the existing property line grade and the proposed internal grades. A noise wall will be erected at the peak of the berm to maximize the barrier height for noise attenuation.

7. EROSION AND SEDIMENT CONTROL

Erosion and sediment controls for the site will be implemented according to the Golden Horseshoe Area Conservation Authorities' Erosion and Sediment Control Guidelines for Urban Construction and City of Hamilton's Guidelines. A detailed erosion control plan will be prepared upon final design.

8. CONCLUSIONS

The proposed site is serviceable with respect to sanitary, water and storm by connecting to the existing infrastructure surrounding the site.

Sanitary servicing for the site will connect to the existing infrastructure on Airport Rd and Homestead Drive. Generated sanitary flow from the site has been allocated to the existing English Church Sanitary Pump Station (SPS) (Ref No. HC019) located at 2844 Upper James St.

Watermain servicing will connect to the existing watermain on Airport Rd and Homestead Drive which will provide a watermain loop through the site providing sufficient flow to meet the water demand for the site. A hydraulic analysis has been completed by WSP under a separate cover demonstrating the available water flow and pressure to the site meets the site domestic and fire water demands.

Storm servicing for the proposed development will drain to three separate outlets draining to different watersheds (Twenty Mile Creek & Welland River). The area of the site draining to Twenty Mile Creek will drain to an existing watercourse and will match pre-development flow rates. Drainage towards the Welland River will connect to the new sewers on Airport Rd and Provident Way which ultimately drains to the new SWM pond within Lancaster Heights subdivision. Drainage from the site has been allocated to the pond at the pre-development flow rate therefore on-site SWM control is proposed to match target flow rates. Drainage to the Homestead storm sewer will match pre-development flow rates.

Stormwater quality control target (Enhanced Protection – 80% TSS removal) will be achieved by using oil grit separators and infiltration galleries as stormwater management treatment train measures. Proposed infiltration galleries have also been proposed to meet the water balance targets for the site to allow for sufficient ground water recharge throughout the site.

From our site investigation and preliminary analysis, the site is favourable to service the proposed industrial development as detailed in this report.

Respectfully Submitted:
The Odan Detech Group Inc.

Paul Hecimovic, P.Eng

Mitchell Bufalino, E.I.T.

9. REFERENCES

1. City of Hamilton (2019). Comprehensive Development Guidelines and Financial Policies Manual. City of Hamilton, Ontario.

2. GGHA CAs (December, 2006). Erosion and Sediment Control Guideline for Urban Construction, Greater Golden Horseshoe Area Conservation Authorities, Ontario.

3. Ontario Ministry of the Environment (March, 2003). Stormwater Management Planning and Design Manual. Ministry of the Environment, Ontario. ISBN 0-7794-2969-9.

4. Ontario Ministry of the Environment (2008). Design Guidelines for Drinking-Water Systems. Ministry of Environment, Ontario. ISBN 978-1-4249-8517-3.

5. Ontario Ministry of the Environment (2008). Design Guidelines for Sewage Works. Ministry of Environment, Ontario. ISBN 978-1-4249-8438-1.

6. Stantec (December 22, 2017). Water Balance for iConnect Residential Lands. Stantec, Ontario.

7. Soil-Mat (December 13, 2017). Geotechnical Investigation and Preliminary Hydrological Assessment Proposed Residential Development. Soil-Mat Engineers and Consultants Ltd, Ontario.

8. SLA (February, 2019). Functional Servicing and Stormwater Management Report, iConnect North. S. Llewellyn & Associates Limited, Burlington, Ontario.

9. Fire Underwriter Survey (1999). Water Supply for Public Fire Protection. CGI Group Inc., Ontario.

10. City of Hamilton (2019). Development Charges Background Study. City of Hamilton, Ontario.

11. L C G (July, 2006). Stormwater Management Report, Flamborough Business Park, Highway 6 & Dundas Street, City of Hamilton. Lamarre Consulting Group Inc., Hamilton, Ontario.

12. IBI (2013). Drainage and Stormwater Management Report for Highway 5 & Highway 6 Interchange, submitted to Ministry of Transportation. IBI Group, Toronto, Ontario.

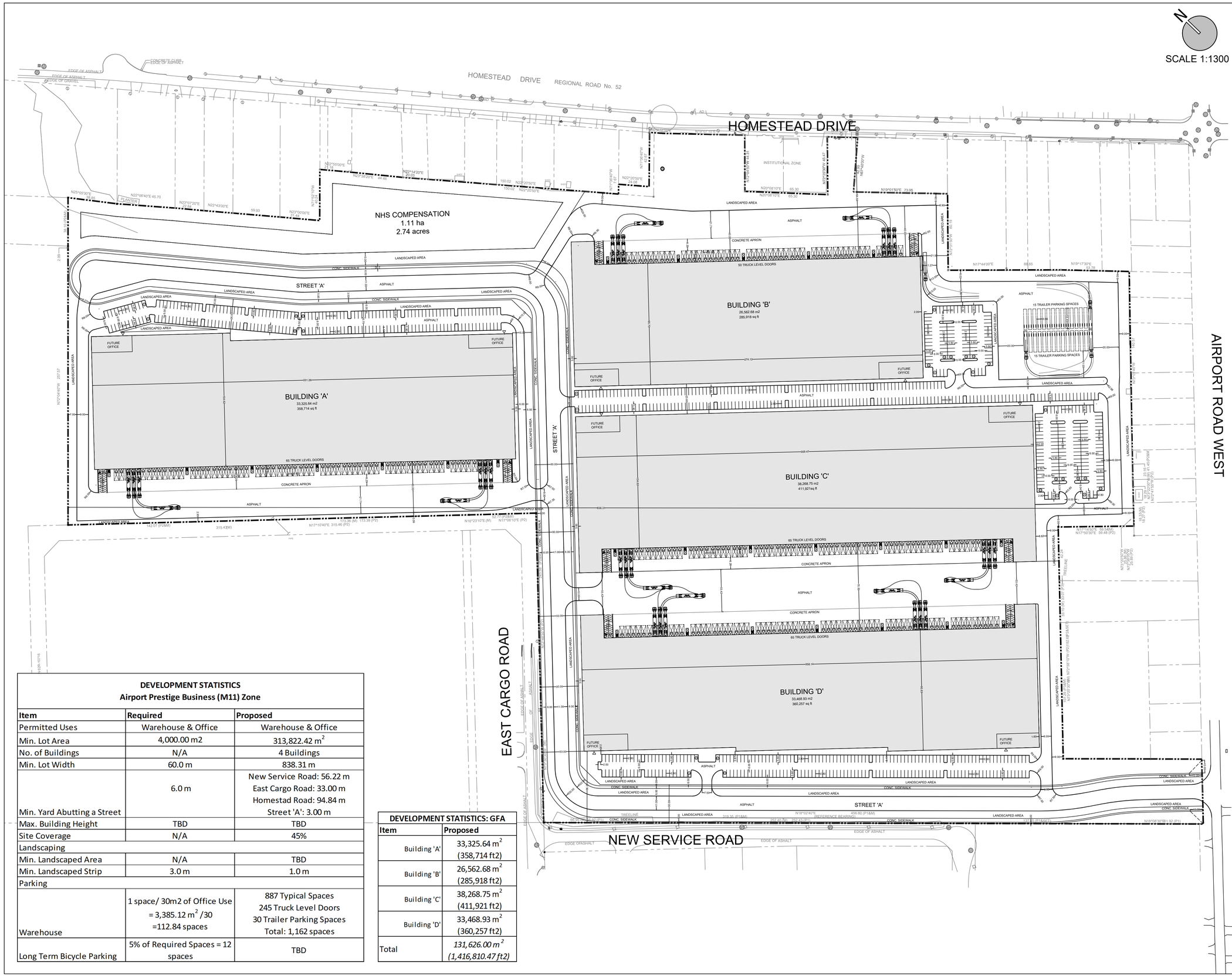
13. AMEC (2012). Waterdown North Master Drainage Plan Addendum. AMEC Environment and Infrastructure, Burlington, Ontario.

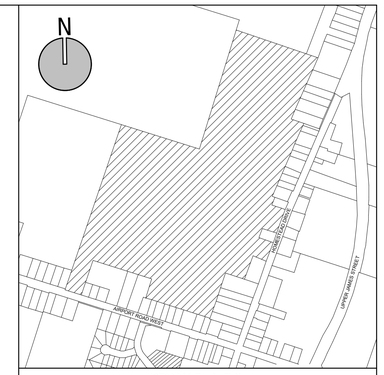
14. Totten (1985). Borer's Creek Drainage Design, Phase II, Town of Flamborough. Totten Sims Hubicki Associates Consultants, Scarborough, Ontario.

APPENDIX A

Aerial Photo of Existing Site
Draft Plan of Subdivision By Urban Solutions
Site/Concept Plan By Urban Solutions

Aerial Photo of Existing Site





SCALE: 1:1300

0 50 100 150m

LEGEND:

- SUBJECT LANDS
- EXISTING PROPERTY LINES
- PROPOSED BUILDING
- MAN DOOR
- OVERHEAD DOOR

DEVELOPMENT STATISTICS
Airport Prestige Business (M11) Zone

Item	Required	Proposed
Permitted Uses	Warehouse & Office	Warehouse & Office
Min. Lot Area	4,000.00 m2	313,822.42 m^2
No. of Buildings	N/A	4 Buildings
Min. Lot Width	60.0 m	838.31 m
Min. Yard Abutting a Street	6.0 m	New Service Road: 56.22 m East Cargo Road: 33.00 m Homestad Road: 94.84 m Street 'A': 3.00 m
Max. Building Height	TBD	TBD
Site Coverage	N/A	45%
Landscaping		
Min. Landscaped Area	N/A	TBD
Min. Landscaped Strip	3.0 m	1.0 m
Parking		
Warehouse	1 space/ 30m2 of Office Use = 3,385.12 m^2 /30 =112.84 spaces	887 Typical Spaces 245 Truck Level Doors 30 Trailer Parking Spaces Total: 1,162 spaces
Long Term Bicycle Parking	5% of Required Spaces = 12 spaces	TBD

DEVELOPMENT STATISTICS: GFA

Item	Proposed
Building 'A'	33,325.64 m^2 (358,714 ft2)
Building 'B'	26,562.68 m^2 (285,918 ft2)
Building 'C'	38,268.75 m^2 (411,921 ft2)
Building 'D'	33,468.93 m^2 (360,257 ft2)
Total	*131,626.00 m^2 (1,416,810.47 ft2)*

DESIGN BY: S. McKAY	CHECKED BY: S. MANCHIA
DRAWN BY: L. DRENNAN	DATE: JANUARY 16, 2023

URBAN SOLUTIONS
PLANNING & LAND DEVELOPMENT
3 STUDEBAKER PLACE, UNIT 1
HAMILTON, ON L8L 0C8
905-546-1087 URBANSOLUTIONS.INFO

PROJECT:

3054 HOMESTEAD DRIVE
City of Hamilton

CLIENT:

FENGATE HOMESTEAD HOLDINGS LP

TITLE:

CONCEPT PLAN

U/S FILE NUMBER:	SHEET NUMBER:
413-21	1

SCALE 1:1300

HOMESTEAD DRIVE
(OLD HIGHWAY No.6 - ESTABLISHED BY PLAN 529 MISC.)
(FORMERLY HAMILTON & PORT DOVER PLANK ROAD)

BLOCK 5
0.3 METRE (1 FOOT) RESERVE
0.0008 ha (0.001 ac)

BLOCK 6
NATURAL HERITAGE OFFSETTING COMPENSATION
1.99 ha (4.93 ac)

STREET 'A'

BLOCK 9
TEMPORARY CUL-DE-SAC
(FUTURE INDUSTRIAL)
0.05 ha (0.13 ac)

BLOCK 2
INDUSTRIAL
6.21 ha (15.36 ac)

BLOCK 1
INDUSTRIAL
12.40 ha (30.66 ac)

BLOCK 7
TEMPORARY CUL-DE-SAC
(FUTURE INDUSTRIAL)
0.05 ha (0.13 ac)

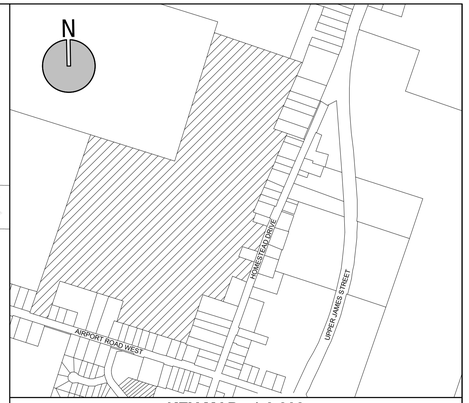
BLOCK 8
0.3 METRE (1 FOOT) RESERVE
0.0189 ha (0.0467 ac)

BLOCK 4
INDUSTRIAL
6.65 ha (16.44 ac)

BLOCK 3
INDUSTRIAL
0.075 ha (0.18 ac)

CONCESSION 5

AIRPORT ROAD WEST



KEY MAP - 1:9,000

DRAFT PLAN OF SUBDIVISION

PART OF LOT 5 CONCESSION 4
CITY OF HAMILTON

3054 HOMESTEAD DRIVE

SCALE: 1:1300

0 50 100 150m

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51 SUB SECTION 17 OF THE PLANNING ACT, R.S.O. 1990, C.P. 13

(A) AS SHOWN ON DRAFT PLAN
(B) AS SHOWN ON DRAFT PLAN
(C) AS SHOWN ON DRAFT PLAN
(D) AS SHOWN ON DRAFT PLAN
(E) AS SHOWN ON DRAFT PLAN
(F) AS SHOWN ON DRAFT PLAN
(G) AS SHOWN ON DRAFT PLAN
(H) MUNICIPAL WATER SUPPLY
(I) TBC
(J) AS SHOWN ON DRAFT PLAN
(K) FULL MUNICIPAL SERVICES TO BE PROVIDED
(L) AS SHOWN ON DRAFT PLAN

LAND USE SCHEDULE

DESCRIPTION	LOTS/BLOCKS	AREA (ha)
INDUSTRIAL	BLOCKS 1-3 & 4	25.33 ha
TEMP. CUL-DE-SAC (FUTURE INDUSTRIAL)	BLOCK 9 & 7	0.1 ha
0.3 M RESERVE	BLOCK 5 & 8	0.0197 ha
NATURAL HERITAGE	BLOCK 6	1.99 ha
STREET 'A'		3.90 ha
TOTAL	**9**	**31.38 ha**

OWNER'S AUTHORIZATION

I AUTHORIZE URBANSOLUTIONS PLANNING AND LAND DEVELOPMENT CONSULTANTS INC. (URBANSOLUTIONS) TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE CITY OF HAMILTON FOR APPROVAL.

OWNER, FENGATE HOMESTEAD HOLDINGS LP — DATE

9174 AIRPORT NOMINEE INC. — DATE

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES ARE OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

ROBERT MCLAREN, O.L.S.
A.T.MCLAREN LIMITED. — DATE

No.	DATE	BY	DESCRIPTION
2	JAN 23	LD	REVISED AS PER NEW ROAD LAYOUT & BLOCK 4, 7 & 8
1	DEC 21	LD	REVISED TO INCLUDE BLOCK 9

PREPARED BY:

URBAN SOLUTIONS
PLANNING & LAND DEVELOPMENT

3 Studebaker Place, Unit 1
Hamilton, ON L8L 0C8
905 546 1087 x
UrbanSolutions.info

DRAWN BY: **L. DRENNAN** | CHECKED BY: **S.MANCHIA** | DATE: **SEPTEMBER 20, 2021** | U/S FILE NUMBER: **413-21**

APPENDIX B

Figure 1: Post-Development Sanitary Tributary Plan (Population)
Table B1: Sanitary Sewer Design Sheet (Population)
Figure 2: Post-Development Sanitary Tributary Plan (OBC)
Table B2: Sanitary Sewer Design Sheet (OBC)
Figure 3: Alternative Water and Sanitary Outlet to Rice Group Property

UPPER JAMES ST.

SANITARY PUMPING STATION
ENGLISH CHURCH SPS (HC019)

EX 675mm SAN

HOMESTEAD DRIVE

EX 675mm SAN

PROP SAN MH

EX 450mm SAN

LONGVIEW DR

NHS COMPENSATION
1.11 ha
2.74 acres

PROP 375mm SAN @ 0.66%

B | 454
19.76ha

A | 202
8.74ha

AIRPORT ROAD

Mt Hope Public School

PROP 375mm SAN @ 0.50%

EX 450mm SAN

Mohawk College
Aviation Campus

LEGEND

A | 10 — TRIBUTARY ID, EMPLOYEES
5.0ha — TRIBUTARY AREA (HA)

CATCHMENT AREA

PROPERTY LINE

EX SAN SEWER

PROP SAN SEWER

DRAWING :
FIGURE 1
POST-DEVELOPMENT SANITARY TRIBUTARY PLAN (POPULATION)

DATE:	PROJ. NO.:	SCALE:
SEPT 2021	21218	1:4000

PROJECT :
PROPOSED INDUSTRIAL DEVELOPMENT
3054 HOMESTEAD DRIVE
HAMILTON, ON

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

ODAN·DETECH
CONSULTING ENGINEERS

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F: (905) 632-3363
5230, SOUTH SERVICE ROAD, UNIT 107
BURLINGTON, ONTARIO, L7L 5K2
www.odandetech.com

Sanitary Sewer Calculations - 375mm sanitary sewer

PROJECT: ***Fengate Asset Management***
3054 Homestead Drive

Table B1

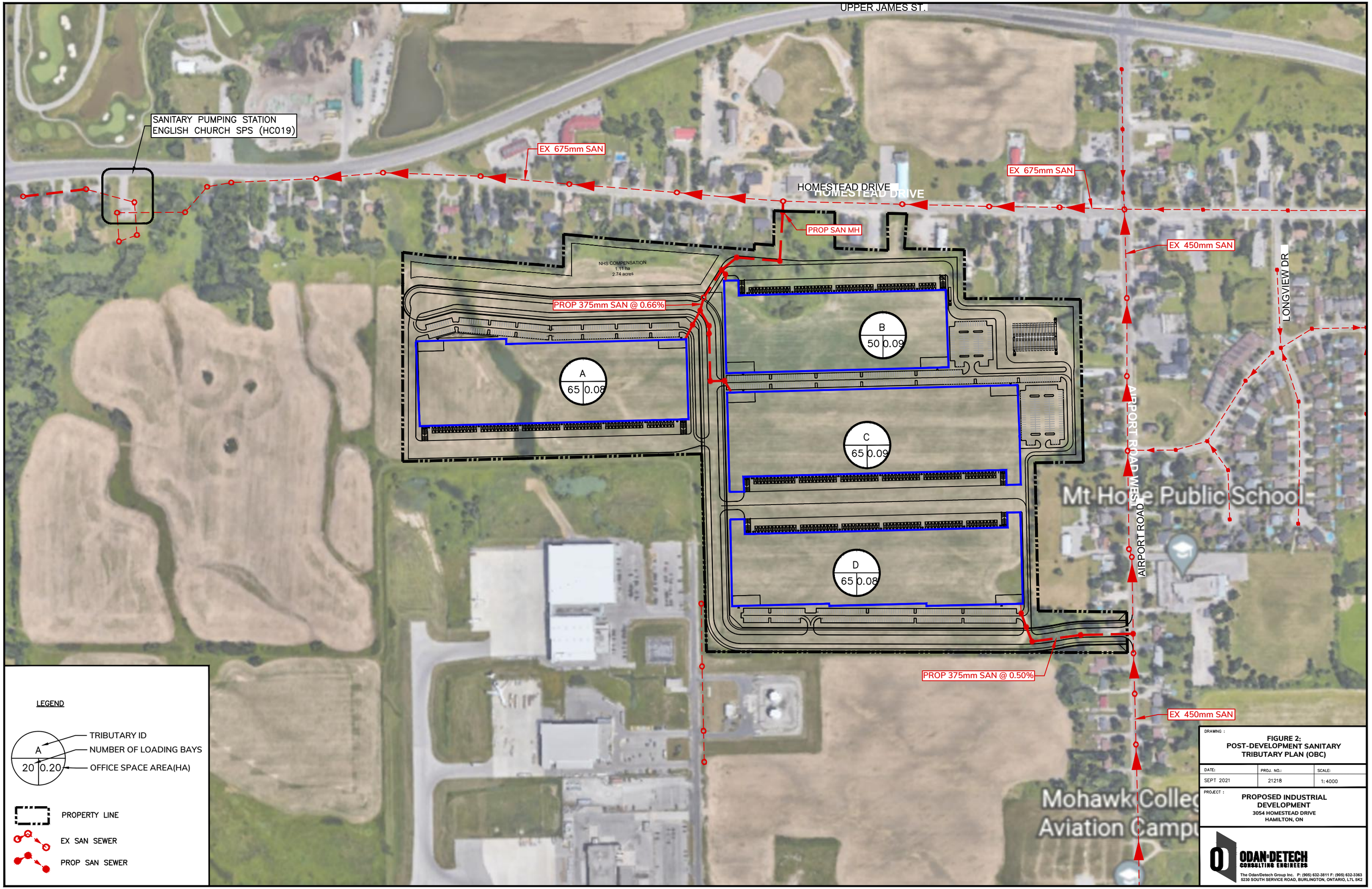
CLIENT: Fengate Asset Management
DATE: 1/27/23
PROJECT No.: 21218
DRAWING REF.: Post-Dev San Trib Plan (Population)

PLEASE ENTER THE INFILTRATION MULTIPLIER: ----> **0.4**

Catchment Name	FROM MANHOLE	TO MANHOLE	POP. DENSITY	AREA (hect.)	CUM. AREA (hect.)	POP. INCR.	CUM. POP.	PEAKING FACTOR	Q. AVG L.P.S.	Q. PEAK L.P.S.	Q. INFILT. L.P.S.	TOTAL FLOW L.P.S.	DIAMETER (mm)	GRADE PER CENT	CAPACITY L.P.S	VELOCITY M.P.S.	% OF CAP USED
Catchment A	15A	Ex 1A	23	8.7	8.7	201	201	5.00	0.84	4.18	3.50	7.68	375	0.50	107.45	0.97	7.15
Catchment B	2A	1A	23	18.8	18.8	431	431	5.00	1.79	8.97	7.50	16.48	375	0.50	107.45	0.97	15.34
Total	EX 4A	EX 3A	23	28.5	28.5	656	656	5.00	2.73	13.63	11.40	25.03	375	0.50	107.45	0.97	23.30

Notes:

PEAKING FACTOR,	$M = 5 / (P/1000)^{0.2}$, $2<M<5.0$	Where P = Population
AVERAGE DAILY PER CAPITA FLOW,	q = 360 L / Cap. Day	
UNIT OF PEAK EXTRANEOUS FLOW,	I = 0.4 L / Sec. / ha	
PEAK POPULATION FLOW,	Q (p) = 360 P M / 86400 L / Sec.	
PEAK EXTRANEOUS FLOW,	Q(i) = I A L / Sec.	Where A = area in hectares
PEAK DESIGN FLOW,	Q(d) = Q(p) + Q(i) L / Sec.	
PIPE ROUGHGNESS,	n = 0.015 For Manning's Equation	



DRAWING :

FIGURE 2:
POST-DEVELOPMENT SANITARY TRIBUTARY PLAN (OBC)

DATE:	PROJ. NO.:	SCALE:
SEPT 2021	21218	1: 4000

PROJECT :

PROPOSED INDUSTRIAL DEVELOPMENT
3054 HOMESTEAD DRIVE
HAMILTON, ON

ODAN-DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
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CONSULTING ENGINEERS

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BURLINGTON, ONTARIO, L7L 5K2
www.odandetech.com

Sewage System Design Flows (OBC 8.2.1.3)

PROJECT: ***Fengate Asset Management***
3054 Homestead Drive

Table B2

CLIENT: Fengate Asset Management
DATE: 1/27/23
PROJECT No.: 21218
DRAWING REF.: Post-Dev San Trib Plan (OBC)

	A	B	C	D	E	F	G	H	I	J	K
	Floor Area (sq.ft.)	**Floor Area (sq.m.)**	**Establishment Type (OBC 8.2.1.3.B.)**	**Based on Floor Area**	**Volume (litres)**	**Total Volume (litres)**	**Number of Units (G)**	**Establishment Type (OBC 8.2.1.3.B.)**	**Based on Employees/Service Chairs/Patrons (ea.)**	**Volume (litres) (J)**	**Volume (litres) (G x I x J)**
3054 Homestead Drive		**#DIV/0!**									
Warehouse A,B & C							180	Per loading Bay		150	*27000*
Office A, B & C	27976	2600	Office	per 9.3m^2 floor area	75	*20968*					
Warehouse D							65	Per loading Bay		150	*9750*
Office D	1018831	800	Office	per 9.3m^2 floor area	75	*6452*					
Total Floor Area	***27976***	***2600***	***Total Based on office Floor Area***			**20968**	***Total Based on Loading Bay***				**36750**
Total Volume (Average per day)											***57718***
Total Average Flow (L/sec)											***0.67***

UPPER JAMES ST.

HOMESTEAD DRIVE

LONGVIEW DR

CONSTRUCTION NORTH

EX 675mm SAN

EX 675mm SAN

EX 450mm SAN

EX 450mm SAN

PROP 300mm W/M (BY RICE GROUP)

SAN MH
RIM ELEV 231.359
SW INV EL 226.31
N INV EL 226.28

PROP STM CULVERT

SAN MH 03
(BY RICE GROUP)
RIM ELEV 226.42

PROP 89.69m 375mmø SAN @ 1.00%

SAN MH 4
(BY RICE GROUP)
RIM ELEV 227.32

PROP 59.10m 375mmø SAN @ 1.00%

SAN MH
(BY RICE GROUP)
RIM ELEV 227.07
N INV EL 225.36
S INV EL 225.39

NHS COMPENSATION

PROP 300mm W/M

PROP 89.83m 375mmø PVC SAN @ 1.00%

PROP 90.00m 375mmø PVC SAN @ 1.00%

PROP 90.00m 375mmø PVC SAN @ 1.00%

PROP 89.35m 375mmø PVC SAN @ 1.00%

SAN MH
RIM ELEV 233.18
SW INV EL 229.13
N INV EL 229.10
W INV EL 229.16

PROP 42.03m 375mmø PVC SAN @ 1.00%

PROP 71.03m 375mmø PVC SAN @ 1.00%

SAN MH
RIM ELEV 233.70
E INV EL 230.29
S INV EL 230.35

BUILDING 'A'
33,325.64 m2
358,714 sq ft

BUILDING 'B'
26,562.68 m2
285,918 sq ft

BUILDING 'C'
38,268.75 m2
411,921sq ft

BUILDING 'D'
33,468.93 m2
360,257 sq ft

PROP 300mm W/M

SAN MH
RIM ELEV 233.02
E INV EL 228.66
S INV EL 228.63

SAN MH
RIM ELEV 233.03
N INV EL 227.36

PROP 18.94m 300mmø PVC SAN @ 1.00%

PROP 60.26m 300mmø PVC SAN @ 1.00%

PROP 64.65m 300mmø PVC SAN @ 1.00%

Mt Hope Public School

Mohawk College Aviation Campus

LEGEND

- PROPERTY LINE
- EX SAN SEWER
- PROP SAN SEWER
- PROP SAN SEWER BY RICE GROUP
- PROP WATERMAIN
- PROP WATERMAIN BY RICE GROUP

DRAWING :

FIGURE 3
ALTERNATIVE WATER & SANITARY OUTLET TO RICE GROUP PROPERTY

DATE:	PROJ. NO.:	SCALE:
JAN 2023	21218	1: 4000

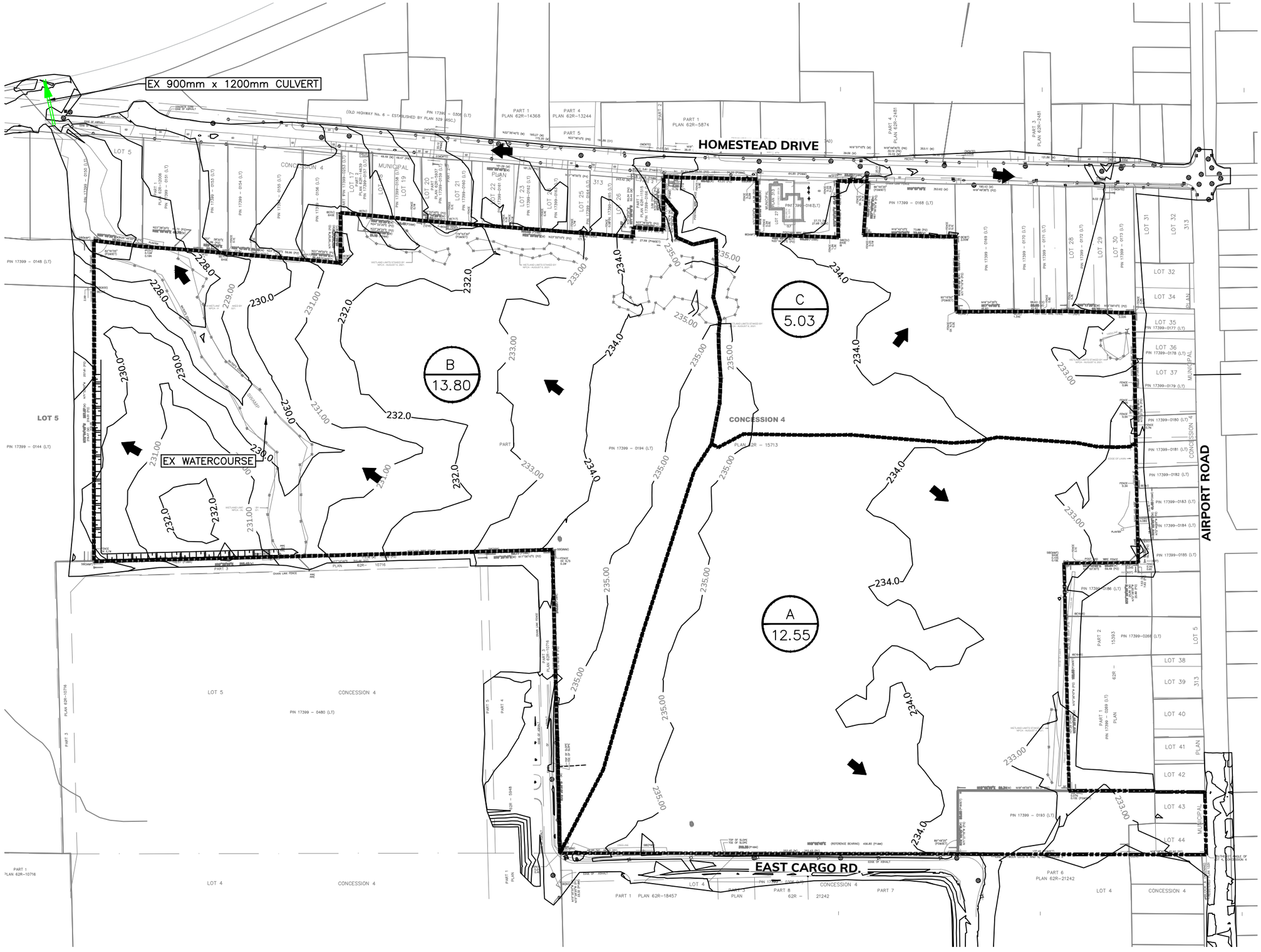
PROJECT :

PROPOSED INDUSTRIAL DEVELOPMENT
3054 HOMESTEAD DRIVE
HAMILTON, ON

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

APPENDIX C

Figure 4: Pre-Development Storm Tributary Area Plan
Figure 3B: Lancaster Heights Post-Development Tributary Plan
Hamilton AEGD Subwatershed Plan
Hamilton AEGD Hydrologic Analysis for Twenty Mile Creek Watershed Table
Lancaster Heights Subdivision – External Airport Road Storm Sewer Design Sheet
Figure 5: Post-Development Storm Tributary Area Plan
Figure 6: Phase 1 Storm Catchment Plan
Rooftop Control Stage Storage
Underground and Surface Stage Storage
Storm Sewer Design Sheet – Catchment A
Storm Sewer Design Sheet – Catchment B
Figure 7: 10mm Stormwater Retention Plan
Infiltration Gallery/ Soakaway Pit Tables
Visual OTTHYMO Output – Catchments A, B and C



CONSTRUCTION NORTH

LEGEND:

- EXISTING OVERLAND FLOW
- PRE-DEVELOPMENT CATCHMENT BOUNDARY
- PROPERTY LINE
- A / 10.0ha — TRIBUTARY ID / TRIBUTARY AREA (HA)

DRAWING :

FIGURE 4:
PRE-DEVELOPMENT STORM TRIBUTARY AREA PLAN

DATE:	PROJ. NO.:	SCALE:
SEPT 2021	21218	1: 5000

PROJECT :

PROPOSED INDUSTRIAL DEVELOPMENT
HOMESTEAD DRIVE & AIRPORT ROAD
HAMILTON, ON

ODAN•DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

CONSTRUCTION NORTH

KEY PLAN
Scale : N.T.S.

SUBJECT LANDS

AIRPORT RD
HIGHWAY 6
WHITE CHURCH RD
HOMESTEAD DR
UPPER JAMES ST

WHITE CHURCH ROAD WEST

PROPOSED WEST SWM POND
BLOCK 366

51 1.46 0.32

52 4.56 0.26

50 0.90 0.24

49 2.37 0.44

HIGHWAY No.6 (MTO)

PROPOSED EAST SWM POND

EX. CULVERT

EX. DITCH

EX. 900mmø CULVERT

SEE DRAWING 301 FOR INTERNAL STORM DRAINAGE AREA PLAN

NEIGHBOURHOOD PARK (BLOCK 360)

RESIDENTIAL CONDOMINIUM (BLOCK 352)

COMMERCIAL (BLOCK 354)

INSTITUTIONAL OR RESIDENTIAL CONDOMINIUM (BLOCK 353)

SERVICING CORRIDOR (BLOCK 357)

OPEN SPACE (BLOCK 356)

MOUNTAINGATE ROAD

ROAD WIDENING (BLOCK 355)

STREET A
STREET B
STREET C
STREET D
STREET E
STREET F

ROSEBURY WAY

SIGNIFICANT WOODLAND

EXISTING SCHOOL (MOUNT HOPE ELEMENTARY SCHOOL)

EXISTING RESI-DENTIAL

PROPOSED FUTURE CONNECTION

EXISTING SOUTH HAMPTON SUBDIVISION

AIRPORT ROAD WEST

47-2 0.09 0.50
40-2 0.04 0.50
33-2 0.09 0.50
32-1 0.23 0.50
21-1 0.07 0.50
22-3 0.58 0.25
22-1 0.16 0.50

EX 1 10.22 0.24
EX 2 6.83 0.27
EX 3 0.96 0.50
EX 4 3.65 0.38
EX 5 9.42 0.48
EX 6 6.37 0.65
EX 7 37.37 0.50

201 11.72 0.25
5A-7 0.12 0.85
5A-6 0.08 0.85
5A-5 0.33 0.85
5A-4 0.44 0.85
5A-3 0.45 0.85
5A-2 0.45 0.85
5A-1 0.20 0.85

FUT 75.39m 900mmø CONC STM @ 0.30%
FUT 120.00m 900mmø CONC STM @ 0.30%
FUT 120.00m 750mmø CONC STM @ 0.30%
FUT 120.00m 675mmø CONC STM @ 0.30%
FUT 53.78m 525mmø CONC STM @ 0.30%

PROP 4.55m 1200mmø CONC STM @ 0.65%
PROP 12.75m 1200mmø CONC STM @ 0.65%
EX STM CAP

LEGEND:

- PROPOSED STORM MANHOLE
- PROPOSED CATCH BASIN MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED DOUBLE CATCH BASIN
- PROPOSED STORM SEWER
- EXISTING CONTOUR
- PROPERTY LINE
- TRIBUTARY AREA ID NO.
- LABEL BORDER: SOLID LINE (PROPOSED) DASHED LINE (EXISTING)
- RUNOFF COEFFICIENT
- TRIBUTARY AREA (HA)
- PROPOSED MAJOR STORM OVERLAND FLOW
- EXISTING MAJOR STORM OVERLAND FLOW

FIGURE 3B

DATE:	PROJ. NO.:	SCALE:
MAY 2019	11208	1 : 2500

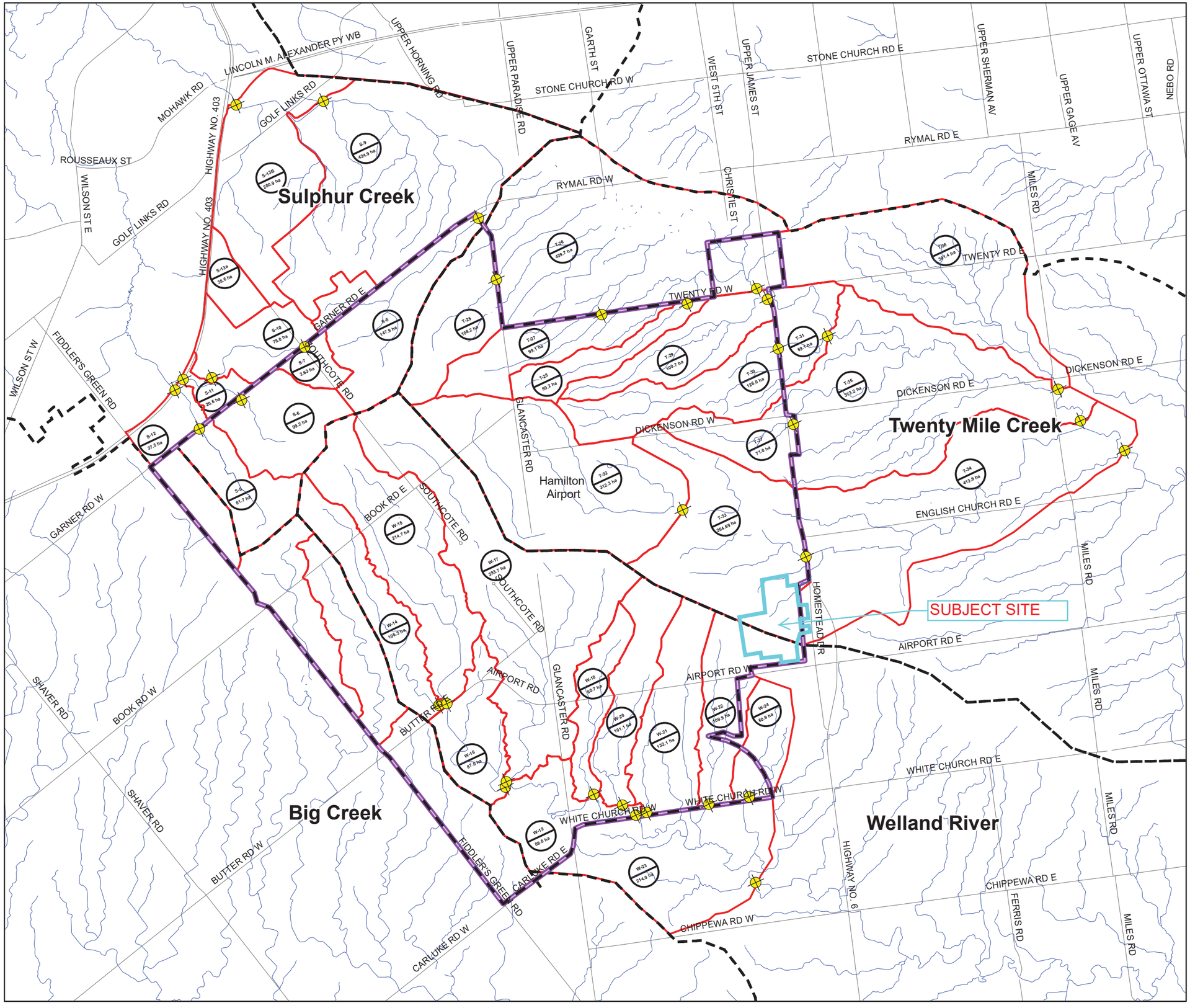
DRAWING : POST-DEVELOPMENT STORM TRIBUTARY AREA PLAN (EXTERNAL)

PROJECT : LANCASTER HEIGHTS SUBDIVISION HWY. NO. 6 AND WHITE CHURCH ROAD HAMILTON, ONTARIO

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3361
3230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

Hamilton AEGD Study
Subwatershed Plan

HYDROLOGICAL SUBCATCHMENTS
Figure 4.0



Legend

- Flow Node Location
- Study Area
- Hydrologic Catchments

Meters

0 355 710 1,420 2,130

Map Created By: AS
Map Checked By: BH
Date Created: October 5, 2009
Date Modified:
File Path: L:\Dillon\64758 Hamilton Airport\GIS\MXD\

BUILDING A STRONG FOUNDATION HAMILTON

Hamilton
Planning & Economic Development Department

Table 4.3: Hydrologic Analysis for Twenty Mile Creek Watershed

Catchment ID #	Contributing Catchments	Drainage Area (ha)	Surface Runoff Flows (m^3/s) Generated by the Hydrologic Model SWMHYMO											
			2 Year Storm		5 Year Storm		10 Year Storm		25 Year Storm		50 Year Storm		100 Year Storm	
			Existing Land use	Future No SWM	Existing Land use	Future No SWM	Existing Land use	Future No SWM	Existing Land use	Future No SWM	Existing Land use	Future No SWM	Existing Land use	Future No SWM
Twenty Mile Creek Watershed														
T-25		108.2	1.10	6.34	1.90	10.13	2.47	13.17	3.24	16.53	3.83	19.10	4.42	22.89
T-26		439.7	3.27-16.76	16.76	5.55-27.37	27.38	7.22-36.77	36.77	9.43-47.31	47.31	11.15-55.55	55.55	12.89-67.50	67.50
T-27		99.1	1.57	6.41	2.57	10.17	3.28	12.60	4.21	15.77	4.90	19.23	5.61	21.81
T-28		59.2	0.42	4.64	0.72	6.95	0.94	8.51	1.24	10.95	1.46	12.60	1.69	15.03
Sum	At outlet of s/c 26	706.2	6.40-17.02	37.34	11.02-28.13	59.93	14.39-37.78	80.68	18.65-48.81	102.90	21.91-57.45	121.02	25.20-69.80	143.67
T-29		100.7	0.77	6.31	1.34	9.66	1.76	12.43	2.31	15.54	2.73	17.96	3.16	21.50
T-30		126.0	1.16	6.99	2.02	11.34	2.65	14.87	3.48	18.73	4.12	21.70	4.78	26.16
T-31		59.1	0.68	No Change	1.21	No Change	1.59	No Change	2.12	No Change	2.52	No Change	2.93	No Change
Sum	At outlet of s/c 31	992.0	7.88-16.38	43.15	13.64-27.33	68.94	17.80-35.99	91.90	23.12-46.80	116.96	27.20-55.23	135.92	31.31-66.51	157.73
T-32		312.3	2.83	18.37	4.74	29.11	6.10	36.00	7.91	47.38	9.28	54.72	10.67	63.46
T-33		255.0	1.35	2.99	2.36	4.73	3.10	5.95	4.09	7.51	4.85	8.69	5.63	9.87
Sum	T32 + T33	567.3	4.01	19.10	6.75	29.47	8.7	36.13	11.34	46.40	13.34	53.03	15.41	60.50
T-34		413.9	1.19	No Change	3.29	No Change	4.30	No Change	5.64	No Change	6.67	No Change	7.73	No Change
Sum	T32 + T33 + T34	981.2	5.24	18.64	8.63	29.14	11.19	35.89	14.49	44.90	17.14	51.20	19.82	56.93
T-35		373.2	1.55	No Change	2.70	No Change	3.55	No Change	4.67	No Change	5.54	No Change	6.43	No Change
T-36		301.4	2.18	No Change	3.64	No Change	4.69	No Change	6.07	No Change	7.12	No Change	8.19	No Change
T-37		71.0	1.17	5.09	1.98	7.71	2.57	10.14	3.34	12.66	3.93	14.57	4.53	16.48
Sum	At outlet of s/c 35	1,737.6	9.57-15.26	43.79	16.30-24.93	68.19	21.33-31.99	87.67	28.12-41.51	112.35	33.39-48.86	131.69	38.78-56.35	154.48
Sum	All Twenty Mile Catchments	2,718.8	14.72-14.82	55.89	24.69-26.94	87.14	32.18-35.17	112.31	42.13-46.35	144.45	49.99-59.03	169.20	58.00-68.89	195.25

ODAN·DETECH
CONSULTING ENGINEERS

STORM SEWER DESIGN-SECONDARY SYSTEM

RAINFALL: 5 YEAR MOUNT HOPE STORM $i = 1049.5/(Tc+8)^{0.803}$

100 YEAR MOUNT HOPE STORM $i = 2317.4/(Tc+11)^{0.836}$

PROJECT: LANCASTER HEIGHTS SUBDIVISION - EXTERNAL - AIRPORT ROAD
PROJECT No.: 11208
LOCATION: AIRPORT ROAD
MUNICIPALITY: CITY OF HAMILTON

DESIGN BY: F.W.B,
CHECKED BY: S.A.
DATE: September 30, 2019

Vmin = 0.90m/s Vmax = 3.65m/s Tc min= 10 minutes

SEWER DESIGN: 0.013

% of Full Flow: Peak Flow / Full Flow Capacity
(MAX 85% 5 YEAR, 100% 100 Year))

LOCATION				STORMWATER ANALYSIS Mountaingate Subdivision										STORM SEWER DATA								
Tributary ID No.	STREET NAME	From Manhole	To Manhole	A Area (ha)	C Runoff Coeff.	A*C	Accumulated A*C	Time of Concentration (min)	Acc. Time of Concentration (min)	5 Yr Rainfall Intensity (mm/hr)	5 Yr Peak Flow (L/s)	100 Yr Rainfall Intensity (mm/hr)	100 Yr Peak Flow (L/s)	Flow Time (min)	Pipe Length (m)	Pipe Height/ Diameter (mm)	Pipe Width (mm)	Pipe Slope (%)	Pipe Full Flow Capacity (l/s)	Pipe Full Flow Velocity (m/s)	Percent of Full Flow Capacity (5yr)	Percent of Full Flow Capacity (100yr)
EX 5A-1	Airport Road	1 EXT	2 EXT	0.20	0.85	0.170	0.170	10.00	10.82	103.04	49	181.81	86	0.82	53.8	525		0.3	236	1.09	21%	36%
EX 5A-2+EX 2	Airport Road	2 EXT	3 EXT	7.28	0.31	2.227	2.397	56.10	57.65	37.16	248	68.84	459	1.55	120.0	675		0.3	460	1.29	54%	100%
EX 5A-3	Airport Road	3 EXT	4 EXT	0.45	0.85	0.383	2.779	57.65	59.10	36.45	282	67.54	522	1.45	120.0	750		0.3	610	1.38	46%	86%
EX 5A-4+EX 1	Airport Road	4 EXT	5 EXT	10.66	0.27	2.827	5.606	76.80	78.08	29.68	463	54.98	857	1.28	120.0	900		0.3	992	1.56	47%	86%
EX 5A-5	Airport Road	5 EXT	6 EXT	0.33	0.85	0.281	5.886	78.08	79.37	29.33	480	54.32	889	1.28	120.0	900		0.3	992	1.56	48%	90%
EX 5A-6	Airport Road	6 EXT	7 EXT	0.08	0.85	0.068	5.954	79.37	80.17	28.98	480	53.68	889	0.81	75.4	900		0.3	992	1.56	48%	90%
EX 5A-7	Airport Road	7 EXT	1	0.12	0.85	0.102	6.056	80.17	80.98	28.77	484	53.28	897	0.81	75.4	900		0.3	992	1.56	49%	90%

EX 900mm x 1200mm CULVERT

HOMESTEAD DRIVE

B2 | 60% | 2.10ha

B3 | 0% | COMPENSATION 11.11a" acres | 2.01ha

PROP 1050mm ⌀ @ 0.4% STORM CULVERT

CATCHMENT EX 2
(FROM LANCASTER SUBDIVISION SWM POND TRIBUTARY PLAN)

B13 | 0.6 | 0.24ha

B12 | 0.6 | 0.10ha

B11 | 0.6 | 0.20ha

B10 | 0.6 | 0.26ha

B9 | 0.6 | 0.26ha

B8 | 0.6 | 0.16ha

B14 | 99% | 3.31ha

EX WATERCOURSE

BUILDING 'A'
33,325.64 m2
358,714 sq ft

B15 | 86% | 2.98ha

B1 | 99% | 1.46ha

BUILDING 'B'
26,562.68 m2
285,918 sq ft

C1 | 99% | 1.20ha

50 TRUCK LEVEL DOORS

15 TRAILER PARKING SPACES

B7 | 0.6 | 0.23ha

BUILDING 'C'
38,268.75 m2
411,921sq ft

C2 | 99% | 3.83ha

A2 | 90% | 7.07ha

65 TRUCK LEVEL DOORS

B6 | 0.6 | 0.29ha

B5 | 0.6 | 0.29ha

B4 | 0.6 | 0.33ha

BUILDING 'D'
33,468.93 m2
360,257 sq ft

A1 | 99% | 3.33ha

AIRPORT ROAD

MH1 EXT

FUT 53.79m 450mm⌀ PVC STM @ 0.30%

MH2 EXT

FUT 120.00m 525mm⌀ CONC STM @ 0.30%

MH3 EXT

FUT 120.00m 675mm⌀ CONC STM @ 0.30%

MH4 EXT

PROP STM MH 6

EX STM STRUC

MH6 EXT

EX 75.42m 900mm⌀ CONC STM @ 0.30%

MH 2

EX 64.75m 900mm⌀ CONC STM @ 0.32%

MH 1

5A-1 | 0.62 | 0.404ha

5A-2 | 0.61 | 0.96ha

5A-3 | 0.50 | 1.91ha

5A-4A | 0.54 | 0.69ha

5A-4B | 0.41 | 3.79ha

5A-5 | 0.85 | 0.33ha

5A-6 | 0.85 | 0.08ha

5A-7 | 0.85 | 0.12ha

EAST CARGO RD.

A8 | 0.6 | 0.43ha

A7 | 0.6 | 0.27ha

A6 | 0.6 | 0.27ha

A5 | 0.6 | 0.27ha

A4 | 0.6 | 0.21ha

A3 | 0.6 | 0.23ha

CATCHMENT EX 1
(FROM LANCASTER SUBDIVISION SWM POND TRIBUTARY PLAN)

PROVIDENT WAY

CONSTRUCTION NORTH

LEGEND:

- PROPOSED STORM MANHOLE
- EXISTING STM MANHOLE
- PROPOSED CATCH BASIN
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- PROPOSED OVERLAND FLOW
- CATCHMENT BOUNDARY
- PROPERTY LINE

A | 10 | 10.0ha

- TRIBUTARY ID
- PERCENT IMPERVIOUS/ RUNOFF COEFFICIENT
- TRIBUTARY AREA (HA)

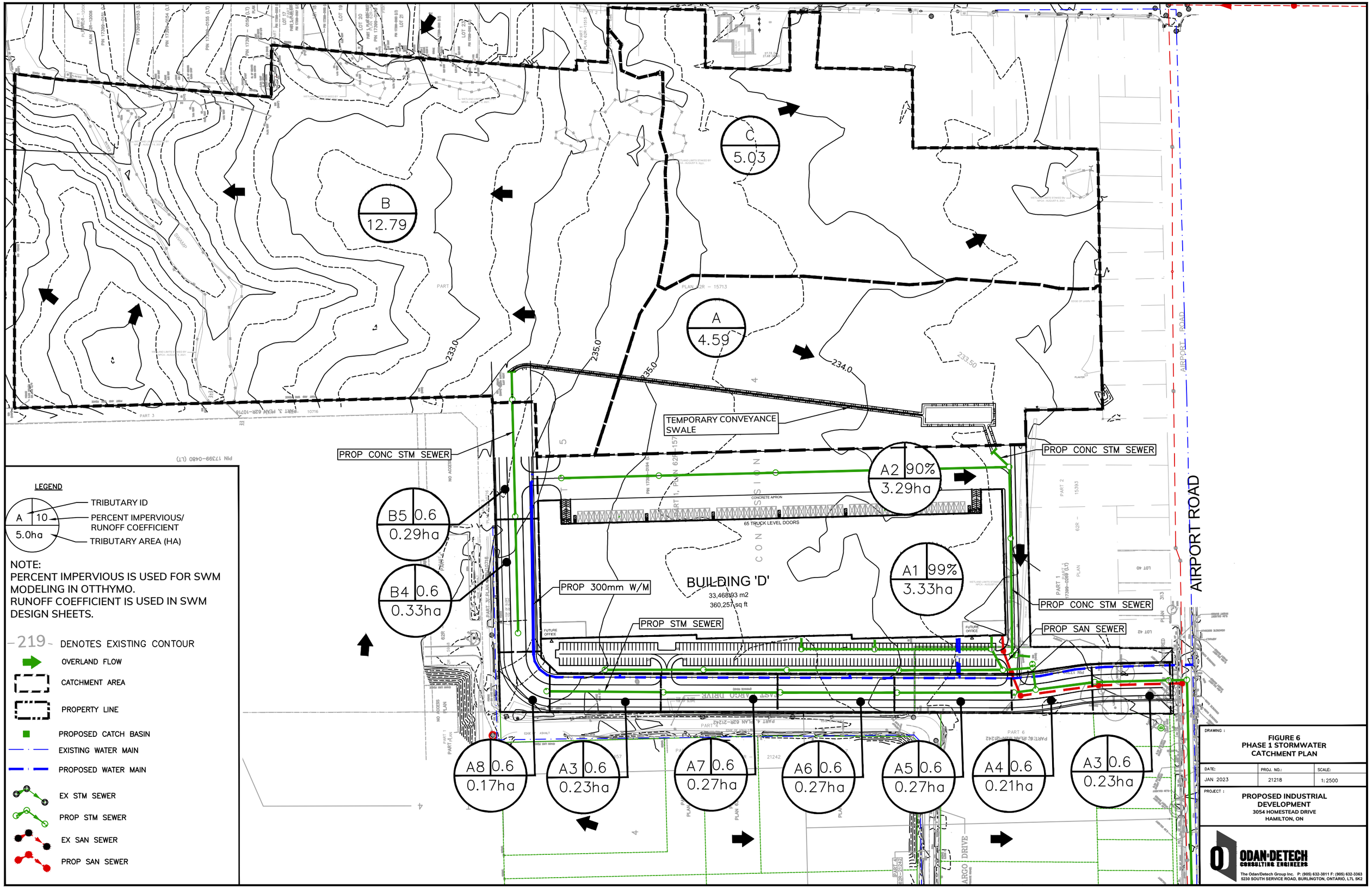
NOTE:
PERCENT IMPERVIOUS IS USED FOR SWM MODELLING IN OTTHYMO.·
RUNOFF COEFFICIENT IS USED IN SWM DESIGN SHEETS.

FIGURE 5:
POST-DEVELOPMENT STORM TRIBUTARY AREA PLAN

	PROJ. NO.:	SCALE:
SEPT 2021	21218	1: 2000

PROPOSED INDUSTRIAL DEVELOPMENT
HOMESTEAD DRIVE & AIRPORT ROAD
HAMILTON, ON

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2



LEGEND

A | 10 — TRIBUTARY ID
5.0ha — PERCENT IMPERVIOUS/ RUNOFF COEFFICIENT
TRIBUTARY AREA (HA)

NOTE:
PERCENT IMPERVIOUS IS USED FOR SWM MODELING IN OTTHYMO.
RUNOFF COEFFICIENT IS USED IN SWM DESIGN SHEETS.

219 DENOTES EXISTING CONTOUR
OVERLAND FLOW
CATCHMENT AREA
PROPERTY LINE
PROPOSED CATCH BASIN
EXISTING WATER MAIN
PROPOSED WATER MAIN
EX STM SEWER
PROP STM SEWER
EX SAN SEWER
PROP SAN SEWER

DRAWING :
FIGURE 6
PHASE 1 STORMWATER CATCHMENT PLAN

DATE:	PROJ. NO.:	SCALE:
JAN 2023	21218	1: 2500

PROJECT :
PROPOSED INDUSTRIAL DEVELOPMENT
3054 HOMESTEAD DRIVE
HAMILTON, ON

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

Project Number : 21218
Project Name :

Date :
Designed by :
Reviewed by :

Subject : **Rating Curve for Rooftop Control Devices**

ODAN·DETECH CONSULTING ENGINEERS

Building A B14

Area of Roof = 33100 m^2
Number of Weirs = 32
Number of Drains = 18

Head (m)	Volume (m^3)	Discharge (m^3/s)
0	0.0	0.0000
0.05	827.5	0.0239
0.1	1655.0	0.0479
0.15	2482.5	0.0718

Building B (Partial Catchment B1) B1

Area of Roof = 14600 m^2
Number of Weirs = 15
Number of Drains = 17

Head (m)	Volume (m^3)	Discharge (m^3/s)
0	0.0	0
0.05	365.0	0.0112
0.1	730.0	0.0224
0.15	1095.0	0.0337

0.08275
0.1655
0.24825

Building B (Partial Catchment C1) C1

Area of Roof = 11700 m^2
Number of Weirs = 13
Number of Drains =

Head (m)	Volume (m^3)	Discharge (m^3/s)
0	0.0	0
0.05	292.5	0.0097
0.1	585.0	0.0194
0.15	877.5	0.0292

Building C (C2)

Area of Roof = 38269 m^2
Number of Weirs = 40
Number of Drains =

Head (m)	Volume (m^3)	Discharge (m^3/s)
0	0.0	0
0.05	956.7	0.0299
0.1	1913.4	0.0598
0.15	2870.2	0.0898

Building D D

Area of Roof = 33300 m^2
Number of Weirs = 49
Number of Drains =

Head (m)	Volume (m^3)	Discharge (m^3/s)
0	0.0	0.0000
0.05	832.5	0.0367
0.1	1665.0	0.0733
0.15	2497.5	0.1100

0.0833
0.1665
0.2498

Example calculation:

Ponding Volume = Head x Area of Roof x 0.5 (reduced by 50% for roof slope)
= 0.15 x 11500 x 0.5 m^3
= 862.50 m^3

Discharge = No of weirs x Head (m) x {(Weir Discharge/25.4) *1000)} L/sec
= No of weirs x Head (m) x (Weir Discharge/25.4)) m^3/s
= 7 x 0.15 x 0.38/25.4 m^3/s ***[1 notch per roof drain = 0.38 l/sec per 25.4 mm of Head]***
= 0.0157 m^3/s

SWM INFORMATION FOR ORIFICE CONTROLED STORM TRIBUTARY AREAS

Tributary Area No. A2 **Tributary Area** 7.07 ha

INLET CONTROL DEVICE (ICD) INFORMATION

Location of ICD	Upstream of Ex CBMH 3	
Type of ICD	Plate	
Surface Elevation	233.87	m
Orifice Invert Elevation	229.80	m
Orifice Size	245.00	mm
Orifice Coefficient	0.62	

STORM WATER STORAGE INFORMATION

Underground Pipe Storage	3200.00	m
Area of Ponding	14000.00	m2

270

STAGE/DISCHARGE/VOLUME RELATIONSHIP

Stage Description	Elevation (m)	Head (m)	Discharge (m^3/s)	Volume (m^3)	Volume (ha·m)
Orifice	229.92	0.00	0.0000	0.0	0.00000
Rim	233.87	3.95	0.2572	3200.0	0.32000
0.1 ponding	233.97	4.05	0.2605	3251.8	0.32518
0.2 ponding	234.07	4.15	0.2637	3614.4	0.36144
0.3 ponding	234.17	4.25	0.2668	4600.0	0.46000

SWM INFORMATION FOR ORIFICE CONTROLED STORM TRIBUTARY AREAS

Tributary Area No. B2 **Tributary Area** 2.1 ha

INLET CONTROL DEVICE (ICD) INFORMATION

Location of ICD	-	
Type of ICD	Plate	
Surface Elevation	234.53	m
Orifice Invert Elevation	231.70	m
Orifice Size	75.00	mm
Orifice Coefficient	0.62	

STORM WATER STORAGE INFORMATION

Underground Pipe Storage	1100.00	m
Area of Ponding	4200.00	m2

100

STAGE/DISCHARGE/VOLUME RELATIONSHIP

Stage Description	Elevation (m)	Head (m)	Discharge (m^3/s)	Volume (m^3)	Volume (ha·m)
Orifice	231.74	0.00	0.0000	0.0	0.00000
Rim	234.53	2.79	0.0203	1100.0	0.11000
0.1 ponding	234.63	2.89	0.0206	1115.5	0.11155
0.2 ponding	234.73	2.99	0.0210	1224.3	0.12243
0.3 ponding	234.83	3.09	0.0213	1520.0	0.15200

SWM INFORMATION FOR ORIFICE CONTROLED STORM TRIBUTARY AREAS

Tributary Area No. B15 **Tributary Area** 2.98 ha

INLET CONTROL DEVICE (ICD) INFORMATION

Location of ICD	-	
Type of ICD	Plate	
Surface Elevation	231.30	m
Orifice Invert Elevation	228.20	m
Orifice Size	75.00	mm
Orifice Coefficient	0.62	

STORM WATER STORAGE INFORMATION

Underground Pipe Storage	2000.00	m
Area of Ponding	6600.00	m2

STAGE/DISCHARGE/VOLUME RELATIONSHIP

Stage Description	Elevation (m)	Head (m)	Discharge (m^3/s)	Volume (m^3)	Volume (ha·m)
Orifice	228.24	0.00	0.0000	0.0	0.00000
Rim	231.30	3.06	0.0212	2000.0	0.20000
0.1 ponding	231.40	3.16	0.0216	2024.4	0.20244
0.2 ponding	231.50	3.26	0.0219	2195.4	0.21954
0.3 ponding	231.60	3.36	0.0222	2660.0	0.26600

ODAN·DETECH
CONSULTING ENGINEERS

STORM SEWER DESIGN

Catchment A

5YEAR Mount Hope Storm $i = 1049.5/(Tc+8)^{0.803}$

RAINFALL: 100 YEAR Mount Hope Storm $i = 2317.4/(Tc+11)^{0.836}$

DESIGN BY:
CHECKED BY:
DATE:

TC= 10 min

Vmin = 0.90m/s Vmax = 3.65m/s

n = 0.013

SEWER DESIGN: PIPE ROUGHNESS: n = 0.013 For Manning's Equation

% of Full Flow: Peak Flow / Full Flow Capacity (MAX 85%)

PROJECT No.: 21218 Proposed Industrial Development

LOCATION: 3054 Homestead Dr.

MUNICIPALITY: CITY OF HAMILTON

LOCATION				STORMWATER ANALYSIS										STORM SEWER DATA						
Tributary ID No.	STREET NAME	From Manhole	To Manhole	A Area (ha)	C Runoff Coeff.	A*C	Accumulated A*C	Time of Concentration (min)	Flow Time (min)	5-yr-Rainfall Intensity (mm/hr)	5-yr-Peak Flow (l/s)	100-yr-Rainfall Intensity (mm/hr)	100-yr-Peak Flow (l/s)	Pipe Length (m)	Pipe Size (mm)	Pipe Slope (%)	Pipe Full Flow Capacity (l/s)	Pipe Full Flow Velocity (m/s)	5-yr.-Percent of Full Flow Capacity (%)	100-yr.-Percent of Full Flow Capacity (%)
A8	STREET A	1	2	0.430	0.60	0.258	0.258	10.00	1.53	103.03	74	182	130	90.0	450	0.3	156	0.98	47%	84%
A7	STREET A	2	3	0.270	0.60	0.162	0.420	11.53	1.53	96.50	113	171	200	90.0	450	0.3	156	0.98	72%	128%
A6	STREET A	3	4	0.270	0.60	0.162	0.582	13.06	1.38	90.84	147	162	263	90.0	525	0.3	236	1.09	62%	111%
A5	STREET A	4	5	0.270	0.60	0.162	0.744	14.43	1.38	86.33	179	155	320	90.0	525	0.3	236	1.09	76%	136%
	STREET A	5	6	0.055	0.60	0.033	0.777	15.81	0.26	82.29	178	148	320	17.0	525	0.3	236	1.09	75%	136%
A1 & A2	From other Tributary Areas							**145.00**			**233**		**364**						**VOH**	
A4	STREET A	6	7	0.155	0.60	0.093	0.870	145.00	0.60	18.48	278	34	446	46.0	675	0.3	460	1.29	60%	97%
A3	STREET A	7	8	0.230	0.60	0.138	1.008	145.60	0.74	18.42	285	34	459	57.0	675	0.3	460	1.29	62%	100%
	STREET A	8	**Pr. MH9**				1.008	146.33	0.18	18.35	284	34	**459**	14.0	675	0.3	460	1.29	62%	100%
							1.008	**146.52**		18.33	**284**	34	**459**							
5A-1	Airport Rd.	1 EXT	2 EXT	0.404	0.62	0.250	0.250	**15.00**	0.92	84.62	59	152	106	54.0	450	0.3	156	0.98	38%	68%
5A-2	Airport Rd.	2 EXT	3 EXT	0.964	0.61	0.588	0.839	15.92	1.55	82.01	191	148	344	120.0	675	0.3	460	1.29	42%	75%
5A-3	Airport Rd.	3 EXT	4 EXT	1.916	0.50	0.958	1.797	17.47	1.36	77.96	389	141	704	120.0	825	0.3	786	1.47	50%	90%
5A-4A	Airport Rd.	4 EXT	Pr. MH9	0.690	0.54	0.373	2.169	18.83	0.74	74.77	451	136	818	69.0	900	0.3	992	1.56	45%	82%
								19.57												
5A-4B	Airport Rd.	**PR. MH9**	5 EXT	3.790	0.41	1.554	3.723	**146.52**	0.83	18.33	474	34	808	78.00	900	0.3	992	1.56	48%	81%
5A-5	Airport Rd.	5 EXT	6 EXT	0.330	0.85	0.281	4.004	147.35	0.96	18.25	488	34	832	90.00	900	0.3	992	1.56	49%	84%
5A-6	Airport Rd.	6 EXT	MH 2	0.080	0.85	0.068	4.072	148.31	0.80	18.16	490	33	837	75.00	900	0.3	992	1.56	49%	84%
5A-7	Airport Rd.	MH 2	MH 1	0.120	0.85	0.102	4.174	149.11	0.80	18.09	494	33	845	75.00	900	0.3	992	1.56	50%	85%

Note:

The runoff coefficients for Airport Road tributary areas (5A-1 to 5A4A) are calculated as a composite runoff coefficient based on two areas.

Example:

Tc= Tp -from VOH 145 min.

Tributary ID No. : 5A-1

Total area= 0.404 ha

C= 0.4 for an area 0.204 ha, C= 0.85 for an area 0.20 ha

Composite C = (0.4*0.204) / (0.85*0.2) =0.62

ODAN·DETECH
CONSULTING ENGINEERS

STORM SEWER DESIGN

Catchment B

RAINFALL: 5YEAR Mount Hope Storm $i = 1049.5/(Tc+8)^{0.803}$

100 YEAR Mount Hope Storm $i = 2317.4/(Tc+11)^{0.836}$

DESIGN BY:
CHECKED BY:
DATE:

TC= 10 min

Vmin = 0.90m/s Vmax = 3.65m/s

n = 0.013

SEWER DESIGN: PIPE ROUGHNESS: n = 0.013 For Manning's Equation

% of Full Flow: Peak Flow / Full Flow Capacity (MAX 85%)

PROJECT No.: 21218 Proposed Industrial Development

LOCATION: 3054 Homestead Dr.

MUNICIPALITY: CITY OF HAMILTON

LOCATION				STORMWATER ANALYSIS										STORM SEWER DATA						
Tributary ID No.	STREET NAME	From Manhole	To Manhole	A Area (ha)	C Runoff Coeff.	A*C	Accumulated A*C	Time of Concentration (min)	Flow Time (min)	5-yr-Rainfall Intensity (mm/hr)	5-yr-Peak Flow (l/s)	100-yr-Rainfall Intensity (mm/hr)	100-yr-Peak Flow (l/s)	Pipe Length (m)	Pipe Size (mm)	Pipe Slope (%)	Pipe Full Flow Capacity (l/s)	Pipe Full Flow Velocity (m/s)	5-yr.-Percent of Full Flow Capacity (%)	100-yr.-Percent of Full Flow Capacity (%)
B4	STREET A	1	2	0.330	0.60	0.198	0.198	10.00	1.73	103.03	57	182	100	90.0	375	0.3	96	0.87	59%	104%
B5	STREET A	2	3	0.290	0.60	0.174	0.372	11.73	1.53	95.73	99	170	176	90.0	450	0.3	156	0.98	63%	113%
B6	STREET A	3	4	0.290	0.60	0.174	0.546	13.25	1.38	90.16	137	161	245	90.0	525	0.3	236	1.09	58%	104%
B1											17		32				VOH			
B7	STREET A	4	5	0.230	0.60	0.138	0.684	14.63	1.10	85.73	180	154	325	72.0	525	0.3	236	1.09	76%	138%
B8	STREET A	5	6	0.160	0.60	0.096	0.780	15.73	0.67	82.51	**196**	149	354	44.0	525	0.3	236	1.09	83%	150%
B9	STREET A	6	7	0.260	0.60	0.156	0.156	10.00	1.73	103.03	45	182	79	90.0	375	0.3	96	0.87	47%	82%
B10	STREET A	7	8	0.260	0.60	0.156	0.312	11.73	1.53	95.73	83	170	148	90.0	450	0.3	156	0.98	53%	95%
B11	STREET A	8	9	0.200	0.60	0.120	0.432	13.25	1.15	90.16	108	161	194	68.0	450	0.3	156	0.98	69%	124%
B12	STREET A	9	10	0.100	0.60	0.060	0.492	14.41	0.61	86.41	118	155	212	36.0	450	0.3	156	0.98	76%	136%
B14&15											50		91				VOH			
B13	STREET A	10	11	0.240	0.60	0.144	0.636	15.02	0.78	84.57	**200**	152	360	51.0	525	0.3	236	1.09	85%	153%

EX 900mm x 1200mm CULVERT

HOMESTEAD DRIVE

AREA 5 RETENTION SWALE
PROV'D VOLUME = 130 CU.M.

AREA 5 ASPHALT/CONCRETE
AREA =12,538 SQ.M.
10mm RETENTION VOLUME = 125 CU.M.

NHS COMPENSATION
1.11 ha
2.74 acres

STM MH

PROP STM

AREA 6
INFILTRATION GALLERY
PROVIDE RETENTION
VOLUME = 151 CU.M.

AREA 7 RETENTION SWALE
LINEAR AREA =0.3m2/m
PROV'D VOLUME = 138 CU.M.

STM CBMH

AREA 7 ASPHALT/CONCRETE
AREA = 8,679 SQ.M.
10mm REQ'D VOLUME = 87 CU.M.

BUILDING 'A'
33,325.64 m2
358,714 sq ft

65 TRUCK LEVEL DOORS
CONCRETE APRON

FUTURE OFFICE

BUILDING 'B'
26,562.68 m2
285,918 sq ft

50 TRUCK LEVEL DOORS

AREA 3 ASPHALT/CONCRETE
AREA = 15,685 SQ.M.
10mm REQ'D VOLUME = 157 CU.M.

AREA 3 RETENTION SWALE
PROV'D VOLUME = 170 CU.M.

AIRPORT ROAD

AREA 4 ASPHALT/CONCRETE
AREA = 7,285 SQ.M.
10mm REQ'D VOLUME = 73 CU.M.

AREA 4 INFILTRATION
GALLERY
PROVIDE RETENTION
VOLUME = 73 CU.M.

BUILDING 'C'
38,268.75 m2
411,921sq ft

AREA 6 ASPHALT/CONCRETE
AREA = 15,143 SQ.M.
10mm REQ'D VOLUME = 151 CU.M.

AREA 2 ASPHALT/CONCRETE
AREA = 26,104 SQ.M.
10mm RETENTION VOLUME = 261 CU.M.

AREA 1 RETENTION SWALE
PROV'D VOLUME = 80 CU.M.

BUILDING 'D'
33,468.93 m2
360,257 sq ft

AREA 1 ASPHALT/CONCRETE
AREA = 7,812 SQ.M.
10mm REQ'D VOLUME = 78 CU.M.

AREA 2 RETENTION SWALE
PROV'D VOLUME = 265 CU.M.

EAST CARGO RD.

CONSTRUCTION NORTH

LEGEND:

- DENOTES PROPOSED STORM MANHOLE
- DENOTES FUTURE STORM SEWER
- DENOTES EXISTING STORM SEWER
- DENOTES PROPOSED STORM SEWER
- PROPERTY LINE

DRAWING :

FIGURE 7: 10mm STORMWATER RETENTION PLAN

DATE:	PROJ. NO.:	SCALE:
JAN 2023	21218	1:3000

PROJECT :

PROPOSED INDUSTRIAL DEVELOPMENT
HOMESTEAD DRIVE & AIRPORT ROAD
HAMILTON, ON

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

Infiltration Gallery/Soakaway Pit Tables

SOAK-AWAY PIT CALCULATION TEMPLATE

PROJECT: Industrial Development, 3054 Homestead Drive

PROJECT No. : 21218

Location of soak-away pit: Area 4 (Figure 7)

					DESCRIPTION
					A = 1,000V / (PnΔt)
	d = PΔt/1000			UNIT	
			P=	18 mm/hr	Where:
			Δt =	48 hr	
d =	0.86	m			A = Filter bed surface area (m2)
			n=	0.40 -	V = Water volume (m3)
					Δt = time to drain (hr)
					n = void space ratio for aggregate used
V=	72.9	m3	Atrib	7285 m2	(note: void space ratio of 0.4 to be used)
			runoff	10 mm	
					d = PΔt/1000
					Where:
					d = maximum soak-away depth (m)
A =	1,000V / (PnΔt)				P= infiltration rate for native soils (mm/hr)
					Δt = time to drain (hr)
Af=	211				
Af provided =	500	m2			Vpit req'd = V/n
					Vpit provided = L x W x d
Vpit req'd =	182	m3			
			L =	10 m	L = length of pit (m)
Vpit provided =	**400**	m3	W =	50 m	W = width of pit (m)
			d =	0.8 m	d = depth of pit (m)

SOAK-AWAY PIT CALCULATION TEMPLATE

PROJECT: Industrial Development, 3054 Homestead Drive

PROJECT No. : 21218

Location of soak-away pit: Area 6 (Figure 7)

						DESCRIPTION
				UNIT		A = 1,000V / (PnΔt)
	d = PΔt/1000		P=	18	mm/hr	Where:
			Δt =	48	hr	
d =	0.86	m				A = Filter bed surface area (m2)
			n=	0.40	-	V = Water volume (m3)
						Δt = time to drain (hr)
						n = void space ratio for aggregate used
V=	151.4	m3	Atrib	15143	m2	(note: void space ratio of 0.4 to be used)
			runoff	10	mm	
						d = PΔt/1000
						Where:
						d = maximum soak-away depth (m)
A =	1,000V / (PnΔt)					P= infiltration rate for native soils (mm/hr)
						Δt = time to drain (hr)
Af=	438					
Af provided =	500	m2				Vpit req'd = V/n
						Vpit provided = L x W x d
Vpit req'd =	379	m3				
			L =	10	m	L = length of pit (m)
Vpit provided =	**400**	m3	W =	50	m	W = width of pit (m)
			d =	0.8	m	d = depth of pit (m)

SOAK-AWAY PIT CALCULATION TEMPLATE

PROJECT: Industrial Development, 3054 Homestead Drive

PROJECT No. : 21218

Location of soak-away pit: Building A

						DESCRIPTION
				UNIT		A = 1,000V / (PnΔt)
	d = PΔt/1000		P=	15	mm/hr	Where:
			Δt =	48	hr	
d =	0.72	m				A = Filter bed surface area (m2)
			n=	0.40	-	V = Water volume (m3)
						Δt = time to drain (hr)
						n = void space ratio for aggregate used
V=	200.0	m3	Atrib	33326	m2	(note: void space ratio of 0.4 to be used)
			runoff	6	mm	
						d = PΔt/1000
						Where:
						d = maximum soak-away depth (m)
A =	1,000V / (PnΔt)					P= infiltration rate for native soils (mm/hr)
						Δt = time to drain (hr)
Af=	694					
Af provided =	1056	m2				Vpit req'd = V/n
						Vpit provided = L x W x d
Vpit req'd =	500	m3				
			L =	132	m	L = length of pit (m)
Vpit provided =	**634**	m3	W =	8	m	W = width of pit (m)
			d =	0.6	m	d = depth of pit (m)

SOAK-AWAY PIT CALCULATION TEMPLATE

PROJECT: Industrial Development, 3054 Homestead Drive

PROJECT No. : 21218

Location of soak-away pit: Building B (Catchment B1)

					DESCRIPTION
					A = 1,000V / (PnΔt)
			UNIT		
	d = PΔt/1000	P=	15	mm/hr	Where:
		Δt =	48	hr	
d =	0.72 m				A = Filter bed surface area (m2)
		n=	0.40	-	V = Water volume (m3)
					Δt = time to drain (hr)
					n = void space ratio for aggregate used
V=	87.6 m3	Atrib	14600	m2	(note: void space ratio of 0.4 to be used)
		runoff	6	mm	
					d = PΔt/1000
					Where:
					d = maximum soak-away depth (m)
A =	1,000V / (PnΔt)				P= infiltration rate for native soils (mm/hr)
					Δt = time to drain (hr)
Af=	304				
Af provided =	400 m2				Vpit req'd = V/n
					Vpit provided = L x W x d
Vpit req'd =	219 m3				
		L =	50	m	L = length of pit (m)
Vpit provided =	**240** m3	W =	8	m	W = width of pit (m)
		d =	0.6	m	d = depth of pit (m)

SOAK-AWAY PIT CALCULATION TEMPLATE

PROJECT: Industrial Development, 3054 Homestead Drive

PROJECT No. : 21218

Location of soak-away pit: Building B & C (Catchment C1 & C2)

					DESCRIPTION
				UNIT	A = 1,000V / (PnΔt)
	d = PΔt/1000		P=	15 mm/hr	Where:
			Δt =	48 hr	
d =	0.72	m			A = Filter bed surface area (m2)
			n=	0.40 -	V = Water volume (m3)
					Δt = time to drain (hr)
					n = void space ratio for aggregate used
V=	301.6	m3	Atrib	50269 m2	(note: void space ratio of 0.4 to be used)
			runoff	6 mm	
					d = PΔt/1000
					Where:
					d = maximum soak-away depth (m)
A =	1,000V / (PnΔt)				P= infiltration rate for native soils (mm/hr)
					Δt = time to drain (hr)
Af=	1047				
Af provided =	2598	m2			Vpit req'd = V/n
					Vpit provided = L x W x d
Vpit req'd =	754	m3			
			a=	2598 m2	L = length of pit (m)
Vpit provided =	**1559**	m3		1 m	W = width of pit (m)
			d =	0.6 m	d = depth of pit (m)

SOAK-AWAY PIT CALCULATION TEMPLATE

PROJECT: Industrial Development, 3054 Homestead Drive

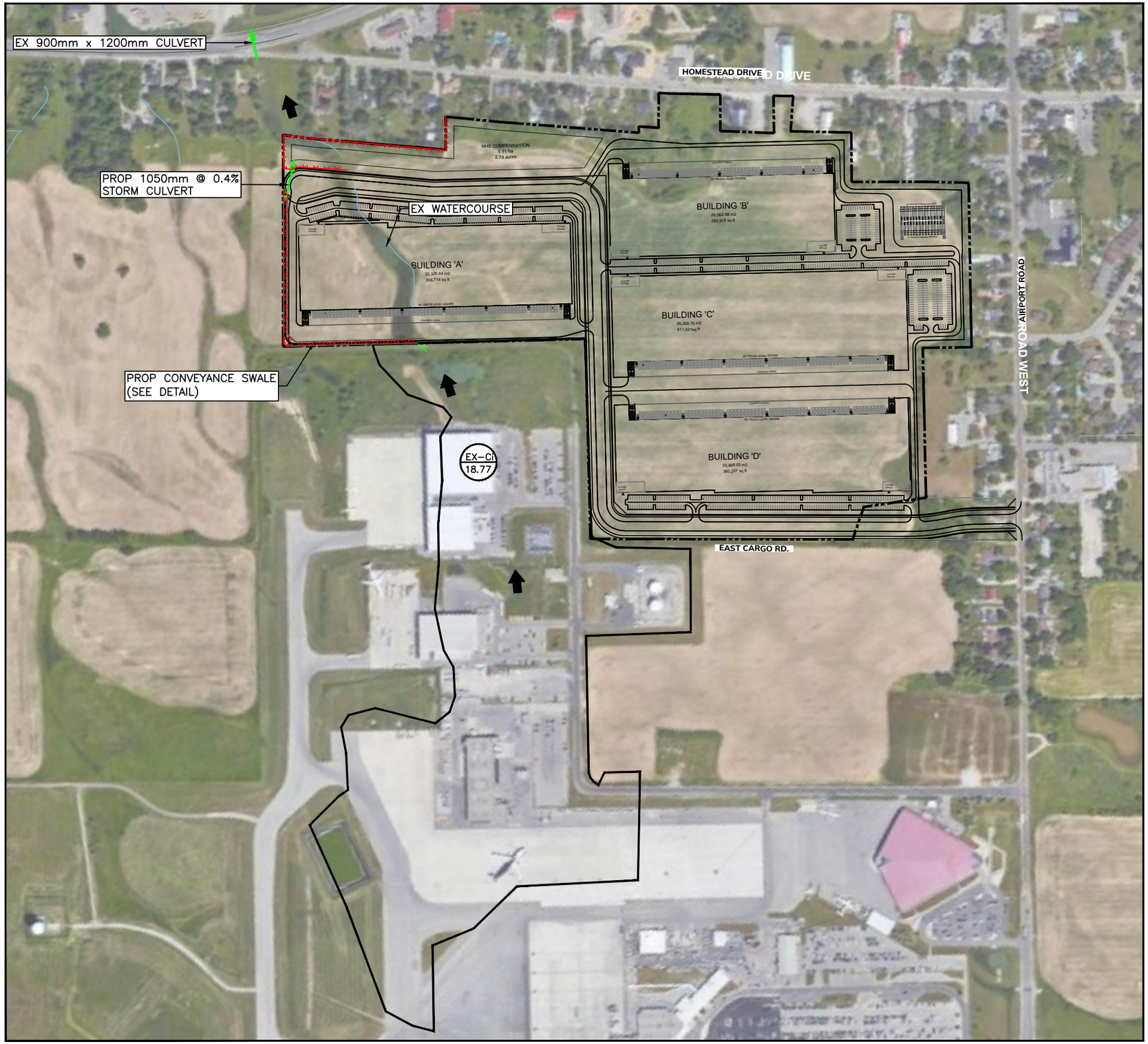
PROJECT No. : 21218

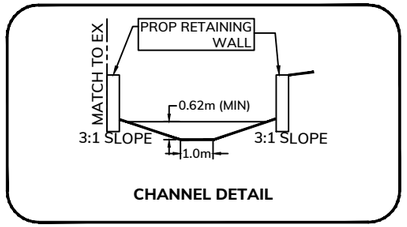
Location of soak-away pit: Building D (Catchment A1)

						DESCRIPTION
				UNIT		A = 1,000V / (PnΔt)
	d = PΔt/1000		P=	15	mm/hr	Where:
			Δt =	48	hr	
d =	0.72	m				A = Filter bed surface area (m2)
			n=	0.40	-	V = Water volume (m3)
						Δt = time to drain (hr)
						n = void space ratio for aggregate used
V=	200.8	m3	Atrib	33469	m2	(note: void space ratio of 0.4 to be used)
			runoff	6	mm	
						d = PΔt/1000
						Where:
						d = maximum soak-away depth (m)
A =	1,000V / (PnΔt)					P= infiltration rate for native soils (mm/hr)
						Δt = time to drain (hr)
Af=	697					
Af provided =	1200	m2				Vpit req'd = V/n
						Vpit provided = L x W x d
Vpit req'd =	502	m3				
			L =	150	m	L = length of pit (m)
Vpit provided =	**720**	m3	W =	8	m	W = width of pit (m)
			d =	0.6	m	d = depth of pit (m)

APPENDIX D

Figure 8: Conveyance Channel Catchment
Hamilton International Airport Internal Storm Drainage Plan No. 8
AEGD Figure 2.8.1. Aquatic Resources
HEC-Ras Model Output
Visual Otthymo Model Input and Output





CHANNEL DETAIL

CONSTRUCTION NORTH

LEGEND:

- EXISTING OVERLAND FLOW
- CATCHMENT BOUNDARY
- PROPERTY LINE
- A / 10.0 — CATCHMENT ID / CATCHMENT AREA (ha)

DRAWING :

FIGURE 8
CONVEYANCE CHANNEL CATCHMENT

DATE:	PROJ. NO.:	SCALE:
SEPT 2021	21218	1:5000

PROJECT :

PROPOSED INDUSTRIAL DEVELOPMENT
HOMESTEAD DRIVE & AIRPORT ROAD
HAMILTON, ON

ODAN•DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

SEE DWG. No. 6

SEE DWG. No. 9

SEE DWG. No. 12

I-18

O-3 O-6 O-7 O-8 O-9 O-10 O-11

UPPER JAMES ST.

ENGLISH CHURCH RD. E.

HOMESTEAD DR.

UPPER JAMES ST.

LOCALIZER

142.63 (5)

1.46 (6)

0.82 (6)

7.76 (6)

18.77 (1)

PARCEL D UNDEVELOPED AREA

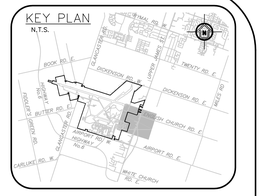
PARCEL C UNDEVELOPED AREA

RESERVOIR AREA

WJ CJ CJ

PROPERTY LINE

KEY PLAN
N.T.S.



LEGEND

- LIMIT OF AIRPORT LANDS
- EXISTING GROUND CONTOUR
- EXISTING CREEK, RIVER, & WATERCOURSE
- EXISTING EXTERNAL STORM DRAINAGE BOUNDARY
- EXISTING STORM DRAINAGE BOUNDARY
- I-1 EXISTING STORM INLET LOCATION
- O-1 EXISTING STORM OUTLET LOCATION
- 5.00 (1) EXISTING STORM DRAINAGE AREA ID. # / EXISTING STORM DRAINAGE AREA (ha.)

BENCHMARK:-

(BM. 1)

HAMILTON-WENTWORTH INDEX No. 75U159
ELEVATION: 228.625

DESCRIPTION: AIRPORT ROAD CONCRETE BOX CULVERT OVER CREEK, 1.6 KM. WEST OF INTERSECTION WITH HIGHWAY No. 6, 0.2 KM EAST OF ENTRANCE TO HAMILTON AIRPORT, TABLET IN TOP AT NORTH END OF CULVERT, 27 CM SOUTH AND 15 CM EAST OF NORTHWEST CORNER OF CULVERT, 2.4 M BELOW ROAD LEVEL.

(BM. 2)

HAMILTON-WENTWORTH INDEX No. 75U163
ELEVATION: 234.370

DESCRIPTION: HAMILTON AIRPORT, PIPER TRANS AIRCRAFT COMPANY BUILDING, AT END OF ENTRANCE DRIVEWAY TO AIRPORT, 0.3 KM NORTH OF AIRPORT ROAD, TABLET IN EAST CONCRETE BASE OF PILLAR BETWEEN TWO LARGE GARAGES, 40.5 M FROM SOUTHEAST CORNER OF BUILDING, 6 CM BELOW ASBESTOS SIDING.

REVISIONS

No.	Revision	Date	By	Approved

CITY OF HAMILTON

HAMILTON INTERNATIONAL AIRPORT

STORM DRAINAGE STUDY

INTERNAL STORM DRAINAGE PLAN No.8

WESLAKE
a division of Trow Associates Inc.
CIVIL ENGINEERS, MUNICIPAL AND ENVIRONMENTAL PLANNERS
80 BANCROFT STREET HAMILTON, ONTARIO L8E 2W5
446 GREY STREET UNIT No. 105 BRANTFORD, ONTARIO N3S 7L6

15 0 60
METRES

SCALE: HORIZ 1:1,500

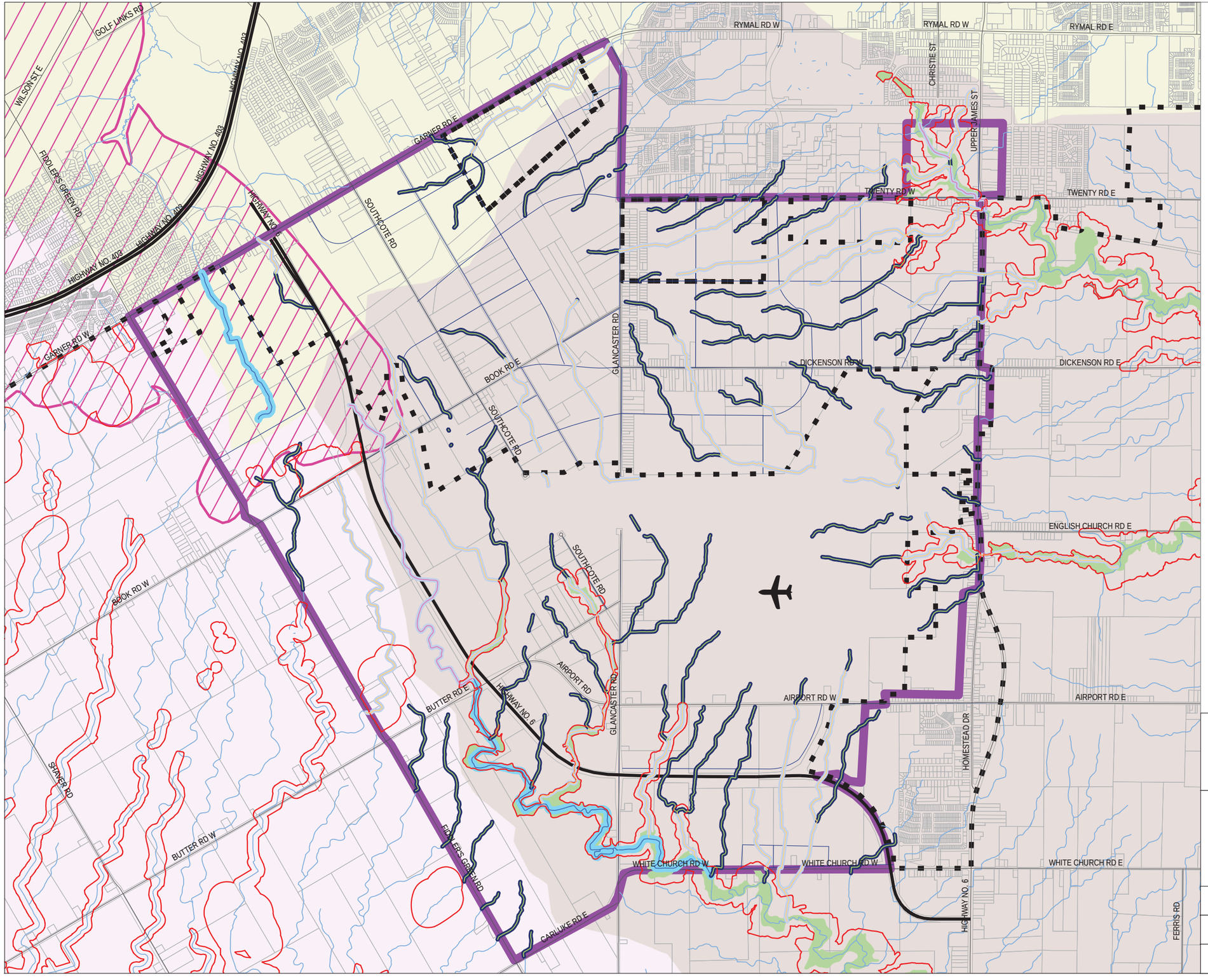
DRAWN BY: M.G. | PROJECT No. 2000

DESIGNED BY: M.G.

CHECKED BY: G.P.B. | DRAWING No. 10

DATE: JAN. 2009

NOT FOR CONSTRUCTION UNTIL SIGNED, STAMPED AND DATED



Fish Community Type
- Cool/Cold
- Seasonal
- Support/Indirect Fish Habitat
- Warm

MNRF Fish Habitat Buffers
- Support/Indirect Fish Habitat (30m)*†
- Seasonal/Warmwater Habitat (30m)†
- Coldwater Habitat (60m)‡

Conservation Authority Jurisdiction
- Grand River Conservation Authority
- Hamilton Conservation Authority
- Niagara Peninsula Conservation Authority

Other Features
- High Recharge potential
- Floodplain
- Generic Regulation Lines**
- Airport Employment Growth District Study Boundary
- Urban Boundary

Notes:
* If watercourse is retained as an enhanced feature.
** Generic regulations include a 30 m buffer on all watercourses. Not all features regulated by the relevant Conservation Authority are mapped.
† Buffer based on 15m from each bank
‡ Buffer based on 30m from each bank

Figure 2.8.1
Airport Employment Growth District
Aquatic Resources

N

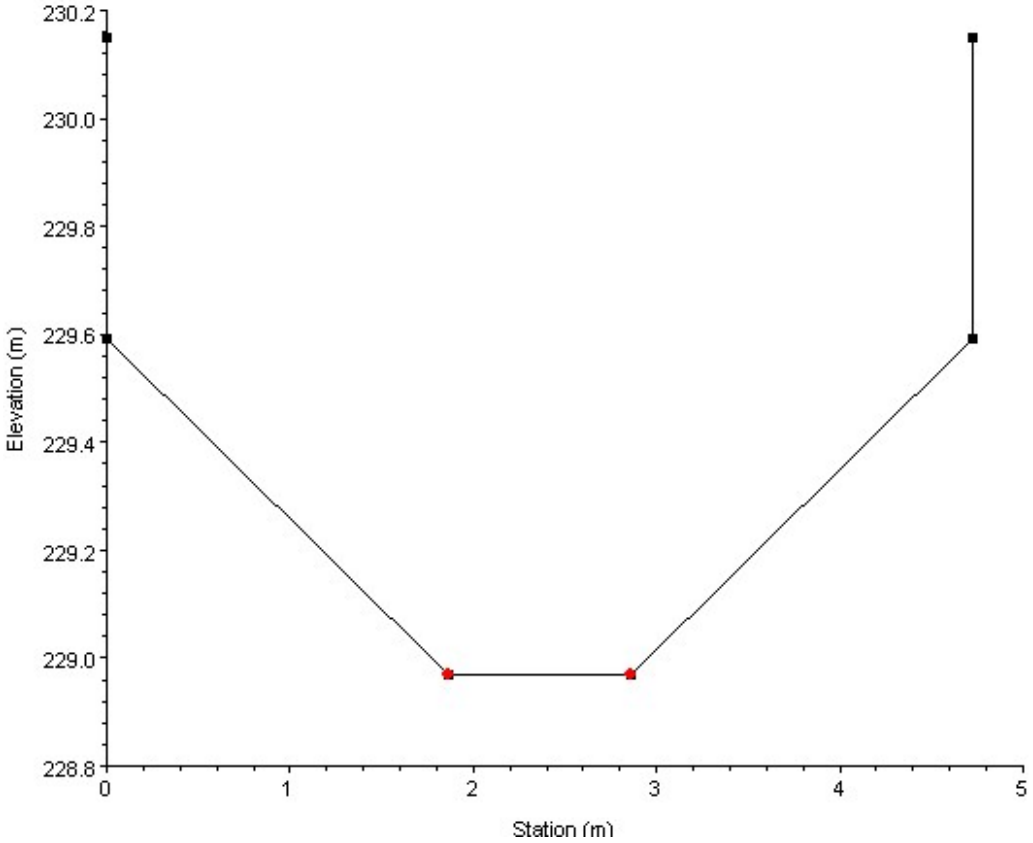
0 250 500 750 m

Hamilton

April 2017

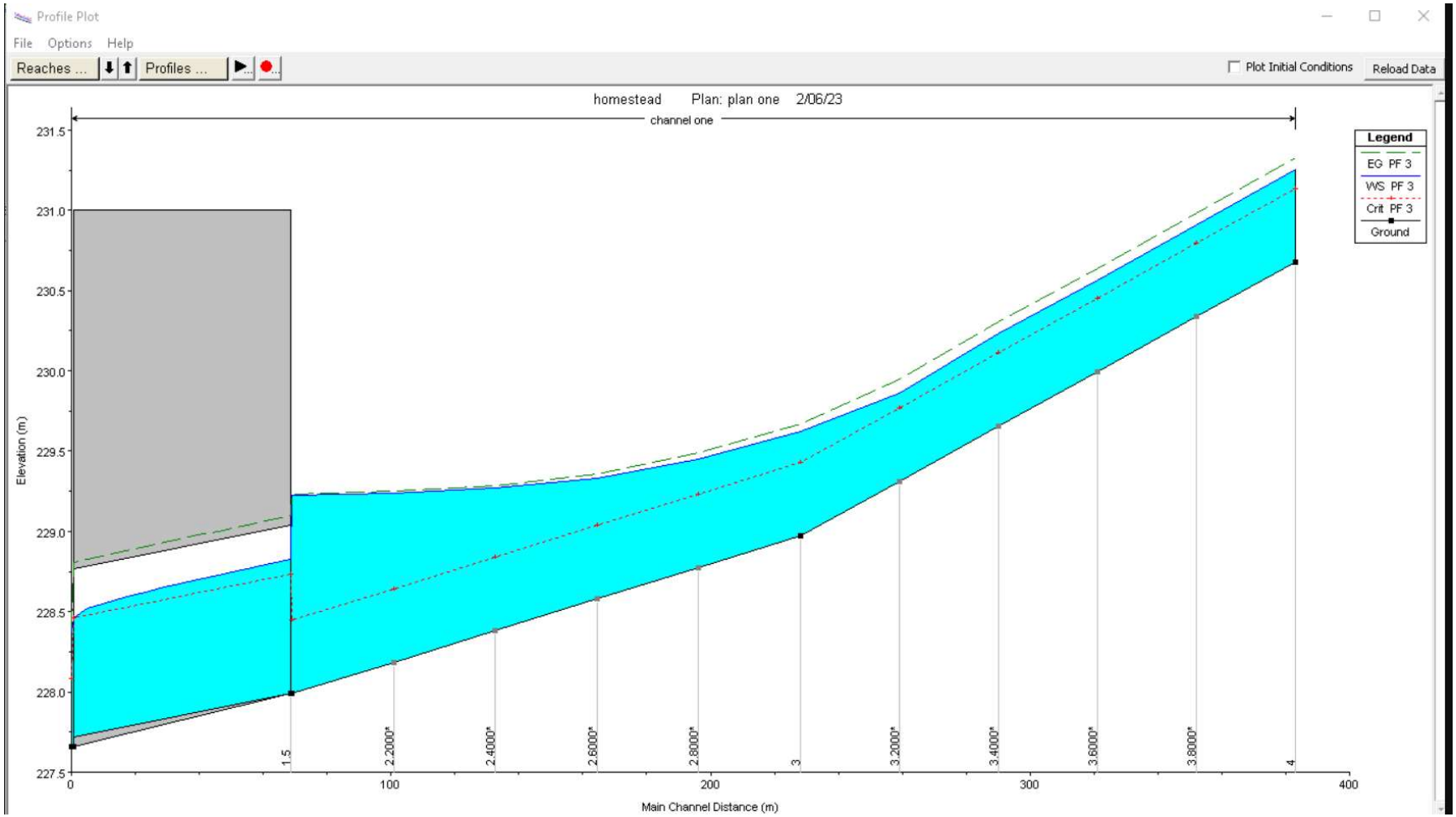
Planning and Economic Development Department

HEC-Ras Model Output



HEC-RAS Plan: P1 River: channel Reach: one Profile: PF 3

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
one	4	PF 3	1.70	230.68	231.25	231.14	231.33	0.010941	1.45	1.56	4.45	0.61
one	3.8000*	PF 3	1.70	230.34	230.91	230.80	230.98	0.011024	1.45	1.56	4.44	0.61
one	3.6000*	PF 3	1.70	230.00	230.57	230.45	230.64	0.011274	1.46	1.55	4.42	0.62
one	3.4000*	PF 3	1.70	229.65	230.24	230.11	230.30	0.010337	1.42	1.60	4.49	0.59
one	3.2000*	PF 3	1.70	229.31	229.86	229.77	229.95	0.012984	1.53	1.47	4.31	0.66
one	3	PF 3	1.70	228.97	229.62	229.43	229.67	0.006045	1.17	1.93	4.72	0.46
one	2.8000*	PF 3	1.70	228.77	229.45	229.23	229.49	0.005209	1.11	2.03	4.72	0.43
one	2.6000*	PF 3	1.70	228.58	229.33	229.04	229.36	0.003194	0.93	2.40	4.72	0.34
one	2.4000*	PF 3	1.70	228.38	229.27	228.84	229.29	0.001583	0.73	3.03	4.72	0.25
one	2.2000*	PF 3	1.70	228.19	229.24	228.64	229.25	0.000800	0.59	3.81	4.72	0.18
one	2	PF 3	1.70	227.99	229.22	228.45	229.23	0.000443	0.48	4.66	4.72	0.14
one	1.5		Culvert									
one	1	PF 3	1.70	227.66	228.37	228.08	228.40	0.004001	0.74	2.30	4.72	0.34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File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
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channel one
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Elevation (m)
231.5
231.0
230.5
230.0
229.5
229.0
228.5
228.0
227.5
1.5
2.2000*
2.4000*
2.6000*
2.8000*
3
3.2000*
3.4000*
3.6000*
3.8000*
4
0
100
200
300
400
Main Channel Distance (m)

Visual OTTHYMO Model Output (100-Year Storm)

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

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
         V  V   I      SS   U   U  A   A  L
          VV    I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO

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                  *****  D E T A I L E D   O U T P U T *****


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Airport Trib.out
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Airport Trib.sum


DATE: 2021-12-06                          TIME: 4:59:22 PM

USER:


COMMENTS: _____________________________________________________________

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  ***************************
  ** SIMULATION NUMBER:   1 **
  ***************************


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|    READ STORM    |    Filename: C:\Users\Mitchell Bufalino\Deskto
|                  |              p\OTTHYMO\21218  WIP\Channel\
|                  |              100yr24hrSCSMtHope.stm
| Ptotal=122.89 mm |    Comments: 100 yr/24 hr SCS
--------------------
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .17    1.35 |  6.17    2.46 | 12.17   17.70 | 18.17    2.21
                 .33    1.35 |  6.33    2.46 | 12.33   17.70 | 18.33    2.21
                 .50    1.35 |  6.50    2.46 | 12.50   17.70 | 18.50    2.21
                 .67    1.35 |  6.67    2.46 | 12.67    9.09 | 18.67    2.21
                 .83    1.35 |  6.83    2.46 | 12.83    9.09 | 18.83    2.21
                1.00    1.35 |  7.00    2.46 | 13.00    9.09 | 19.00    2.21
                1.17    1.35 |  7.17    2.46 | 13.17    1.72 | 19.17    2.21
                1.33    1.35 |  7.33    2.46 | 13.33    1.72 | 19.33    2.21
                1.50    1.35 |  7.50    2.46 | 13.50    1.72 | 19.50    2.21
                1.67    1.35 |  7.67    2.46 | 13.67   10.08 | 19.67    2.21
                1.83    1.35 |  7.83    2.46 | 13.83   10.08 | 19.83    2.21
                2.00    1.35 |  8.00    2.46 | 14.00   10.08 | 20.00    2.21
                2.17    1.60 |  8.17    3.32 | 14.17    3.69 | 20.17    1.47
                2.33    1.60 |  8.33    3.32 | 14.33    3.69 | 20.33    1.47
                2.50    1.60 |  8.50    3.32 | 14.50    3.69 | 20.50    1.47
                2.67    1.60 |  8.67    3.32 | 14.67    3.69 | 20.67    1.47
                2.83    1.60 |  8.83    3.32 | 14.83    3.69 | 20.83    1.47
                3.00    1.60 |  9.00    3.32 | 15.00    3.69 | 21.00    1.47
                3.17    1.60 |  9.17    3.93 | 15.17    3.69 | 21.17    1.47
                3.33    1.60 |  9.33    3.93 | 15.33    3.69 | 21.33    1.47
                3.50    1.60 |  9.50    3.93 | 15.50    3.69 | 21.50    1.47
                3.67    1.60 |  9.67    4.42 | 15.67    3.69 | 21.67    1.47
                3.83    1.60 |  9.83    4.42 | 15.83    3.69 | 21.83    1.47
                4.00    1.60 | 10.00    4.42 | 16.00    3.69 | 22.00    1.47
                4.17    1.97 | 10.17    5.65 | 16.17    2.21 | 22.17    1.47
                4.33    1.97 | 10.33    5.65 | 16.33    2.21 | 22.33    1.47
                4.50    1.97 | 10.50    5.65 | 16.50    2.21 | 22.50    1.47
                4.67    1.97 | 10.67    7.62 | 16.67    2.21 | 22.67    1.47
                4.83    1.97 | 10.83    7.62 | 16.83    2.21 | 22.83    1.47
                5.00    1.97 | 11.00    7.62 | 17.00    2.21 | 23.00    1.47
                5.17    1.97 | 11.17   11.80 | 17.17    2.21 | 23.17    1.47
                5.33    1.97 | 11.33   11.80 | 17.33    2.21 | 23.33    1.47
                5.50    1.97 | 11.50   11.80 | 17.50    2.21 | 23.50    1.47
                5.67    1.97 | 11.67   51.13 | 17.67    2.21 | 23.67    1.47
                5.83    1.97 | 11.83   93.40 | 17.83    2.21 | 23.83    1.47
                6.00    1.97 | 12.00  135.68 | 18.00    2.21 | 24.00    1.47
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| CALIB            |
| NASHYD    (0001) |   Area     (ha)=  18.77   Curve Number    (CN)= 78.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   7.20   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.24

    Unit Hyd Qpeak  (cms)=    .578

    PEAK FLOW       (cms)=    .934 (i)
    TIME TO PEAK    (hrs)=  13.167
    RUNOFF VOLUME    (mm)=  71.442
    TOTAL RAINFALL   (mm)= 122.887
    RUNOFF COEFFICIENT   =    .581

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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FINISH
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APPENDIX E

Drawing 1: Conceptual Servicing Plan
Drawing 2: Conceptual Grading Plan
Drawing 3: Conceptual Section Plan

EXISTING 900mm x 1200mm CULVERT
EX 675mm SAN @ 0.10%
EX 675mm SAN @ 0.20%
EX FIRE HYDRANT
EXISTING SWALE
EX 400mm W/M
EX 675mm SAN @ 0.20%
SAN MH RIM ELEV 235.20 S INV EL 225.36 N INV EL 225.36 W INV EL 225.93
EX FIRE HYDRANT
SAN MH RIM ELEV 235.04 W INV EL 226.00 E INV EL 225.97
EX FIRE HYDRANT
HOMESTEAD DRIVE
STM CTRL MH RIM ELEV 233.31 NW INV EL 232.40 E INV EL 232.40
EX 400mm W/M
SAN MH RIM ELEV 234.12 S INV EL 225.65 N INV EL 225.65
EX 675mm SAN @ 0.21%
EX 675mm SAN @ 0.21%
EX 400mm W/M
EX FIRE HYDRANT
EX FIRE HYDRANT
PROP 72.64m 450mmø STM @ 0.30%
PROP 53.21m 375mm SAN @ 0.50%
PROP 24.04m 375mm SAN @ 0.50%
SAN MH RIM ELEV 234.40 NE INV EL 226.36 E INV EL 226.30
PROP 46.44m 450mmø STM @ 0.30%
STM CTRL MH RIM ELEV 234.34 E INV EL 232.60 S INV EL 232.66
PROP 10.0m SERVICING EASEMENT
PROP 68.63m 450mmø STM @ 0.30%
PROP 89.27m 450mmø STM @ 0.30%
STM CTRL MH RIM ELEV 234.14 W INV EL 233.23 N INV EL 233.17
EX 450mm SAN @ 0.20%
PROP LIMIT OF 3:1 SLOPE
10m SETBACK
NHS COMPENSATION 1.11 ha 2.74 acres
10m SETBACK
10m SETBACK
CABLE CONCRETE MAT (2.5m x 5.0m)
OUTLET INV EL 227.71
PROP HW2
PROP 40.81m 375mm SAN @ 0.50%
PROP 9.0m SERVICING EASEMENT
PROP 75mm ORIFICE PLATE
PROP CULTEC CHAMBERS STORAGE 3
PROP 89.93m 450mmø STM @ 0.30%
CONCRETE APRON
50 TRUCK LEVEL DOORS
PROP 55.38m 450mmø STM @ 0.30%
PROP 10.88m 450mmø STM @ 0.30%
PROP 67.78m 1050mmø STM CULVERT @ 0.40%
PROP 66.29m 450mmø STM @ 0.30%
PROP 90.00m 450mmø STM @ 0.30%
PROP 74.63m 375mmø STM @ 0.36%
PROP 75mm ORIFICE PLATE
STM MH RIM ELEV 233.44 W INV EL 229.47 NE INV EL 229.42
STM CTRL MH RIM ELEV 234.11 S INV EL 232.35 E INV EL 232.27 N INV EL 232.35
PROP 47.03m 450mmø STM @ 0.30%
BUILDING 'B'
26,562.68 m2
285,918 sq ft
PROP 6.0m SERVICING EASEMENT
15 TRAILER PARKING SPACES
15 TRAILER PARKING SPACES
INLET INV EL 227.98
PROP HW1
STM MH RIM ELEV 232.42 W INV EL 230.09 S INV EL 230.03
PROP INFILTRATION GALLERY (AREA 7) 14.0m X 40.0m X 0.7m
STM MH RIM ELEV 232.45 N INV EL 229.87 SW INV EL 229.01 E INV EL 228.85
PROP 72.55m 300mmø PERFORATED PIPE
PROP INFILTRATION GALLERY (BLDG A) 122.0m X 8.0m X 0.6m
PROP 19.05m 250mmø PVC SAN @ 2.00% INV @ BLDG 227.69
STM MH RIM ELEV 233.88 W INV EL 229.02 E INV EL 228.91
PROP 10.90m 300mmø PVC STM @ 1.15% INV @ BLDG 229.34
PROP 72.16m 525mmø STM @ 0.30%
PROP 58.53m 375mm SAN @ 0.50%
PROP 77.32m 450mmø STM @ 0.30%
PROP 89.66m 450mmø STM @ 0.30%
PROP 89.93m 450mmø STM @ 0.30%
PROP 10m SETBACK
PROP 0.56m MAX RETAINING WALL
PROP 3.55m MAX RETAINING WALL
PROP 62.51m 525mmø STM @ 0.30%
BUILDING 'A'
33,325.64 m2
358,714 sq ft
PROP 83.52m 600mmø STM @ 0.29%
SAN MH RIM ELEV 233.70 E INV EL 227.72 S INV EL 227.78
PROP 14.82m 250mmø PVC SAN @ 2.00% INV @ BLDG 228.23
STM CTRL MH RIM ELEV 234.51 S INV EL 232.70
PROP INFILTRATION GALLERY (BLDG B) 50.0m X 8.0m X0.6m
PROP INFILTRATION GALLERY (BLDG C & B) 2598m2 X 0.6m
PROP INFILTRATION GALLERY (AREA 3) 7.0m X 45.0m X 0.6m
STM MH RIM ELEV 234.88 W INV EL 231.27 N INV EL 231.33 E INV EL 231.37
PROP CULTEC CHAMBERS STORAGE 1
PROP 58.28m 525mmø STM @ 0.31%
EX 450mm SAN @ 0.24%
FUT 53.79m 450mmø STM @ 0.30%
EX FIRE HYDRANT
FUT 120.00m 675mmø STM @ 0.30%
PROPOSED CONVEYANCE SWALE @ 0.6% (5m WIDTH) SEE DETAIL ON THIS SHEET
PROP 76.88m 525mmø STM @ 0.19%
STM MH RIM ELEV 232.76 S INV EL 230.39 E INV EL 230.45
PROP CULTEC CHAMBERS STORAGE
65 TRUCK LEVEL DOORS
CONCRETE APRON
PROP 74.51m 450mmø STM @
PROP 90.13m 450mmø STM @ 0.30%
PROP 90.00m 450mmø STM @ 0.30%
PROP 90.00m 450mmø STM @ 0.30%
PROPOSED CONVEYANCE SWALE @ 1.1% (5m WIDTH) SEE DETAIL ON THIS SHEET
STM MH RIM ELEV 233.59 N INV EL 229.76
PROP 90.00m 450mmø STM @ 0.30%
PROP 250mm SAN @ 0.50%
PROP 90.00m 525mmø STM @ 0.30%
PROP CULTEC CHAMBERS STORAGE 1
PROP 90.00m 525mmø STM @ 0.30%
65 TRUCK LEVEL DOORS
CONCRETE APRON
STM MH RIM ELEV 234.36 S INV EL 231.95
PROP 75.13m 450mmø STM @ 0.30%
PROP 90.00m 450mmø STM @ 0.30%
PROP 90.00m 450mmø STM @ 0.30%
PROP 90.00m 525mmø STM @ 0.30%
STM MH RIM ELEV 234.08 N INV EL 230.82 W INV EL 230.76 E INV EL 230.79
EX FIRE HYDRANT
CONCRETE APRON
65 TRUCK LEVEL DOORS
PROP 54.96m 600mmø STM @ 0.30%
PROP FIRE HYDRANT
EX FIRE HYDRANT
EX 250mm PVC W/M
PROP 90.00m 375mmø STM @ 0.30%
PROP 89.97m 600mmø STM @ 0.30%
EX 450mm SAN @ 0.20%
FUT 120.00m 825mmø STM @ 0.30%
BUILDING 'D'
33,468.93 m2
360,257 sq ft
PROP INFILTRATION GALLERY (BLDG D) 150.0m X 8.0m X 0.6m
STM MH RIM ELEV 235.25 E INV EL 230.94
STM CBMH RIM ELEV 234.76 S INV EL 231.16
STM MH RIM ELEV 235.17 S INV EL 233.00 E INV EL 233.30
PROP 64.20m 525mmø STM @ 0.30%
SAN MH RIM ELEV 234.19 E INV EL 231.29 W INV EL 231.20
STM MH RIM ELEV 234.42 W INV EL 233.25 N INV EL 233.00 E INV EL 233.30
STM MH RIM ELEV 233.87 E INV EL 230.30 S INV EL 230.24
OUTLET 1
PROP 19.15m 375mmø PVC SAN @ 1.00%
PROP 245mm ORIFICE PLATE
PROP 86.34m 525mmø STM @ 0.30%
FUT 68.70m 900mmø STM @ 0.30%
PROP 56.94m 675mmø STM @ 0.30%
STM MH RIM ELEV 232.63 S INV EL 228.83 N INV EL 228.86
STM MH RIM ELEV 234.66 W INV EL 228.73 N INV EL 228.79 E INV EL 228.82
SAN MH RIM ELEV 0.00 N INV EL 227.50
PROP 64.65m 375mmø PVC SAN @ 0.50%
EX FIRE HYDRANT
PROP 78.58m 900mmø STM @ 0.30%
PROP 90.00m 450mmø STM @ 0.30%
PROP 90.00m 450mmø STM @ 0.30%
PROP 90.00m 525mmø STM @ 0.30%
PROP 90.03m 525mmø STM @ 0.30%
STM MH RIM ELEV 235.03 S INV EL 230.57
EX 250mm PVC W/M
STM MH RIM ELEV 234.41
STM MH RIM ELEV 233.12 N INV EL 229.40 S INV EL 229.34
SAN MH RIM ELEV 232.55 E INV EL 228.22 S INV EL 228.16
SAN MH RIM ELEV 229.22 W INV EL 227.46 E INV EL 227.35
PROP 60.49m 375mmø PVC SAN @ 0.50%
SAN MH RIM ELEV (N/A) W INV EL 227.35 E INV EL -1.30
PROP 90.00m 900mmø STM @ 0.30%
EX MH6 EXT
EX FIRE HYDRANT
EX 75.42m 900mmø CONC STM @ 0.30%
AIRPORT ROAD
CONSTRUCTION NORTH

LEGEND:

- PROPOSED STORM MANHOLE
- EXISTING STM MANHOLE
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- EXISTING HYDRANT
- PROPOSED HYDRANT
- EXISTING SANITARY MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED SANITARY SEWER
- EXISTING SANITARY SEWER
- PROPOSED VALVE CHAMBER
- EXISTING WATER MAIN
- PROPOSED WATER MAIN
- PROPERTY LINE

DRAWING TITLE:

CONCEPTUAL SERVICING PLAN

PROJECT No.:	SCALE:	DRAWING No.:
21218	1:1500	1

PROJECT:

PROPOSED INDUSTRIAL DEVELOPMENT

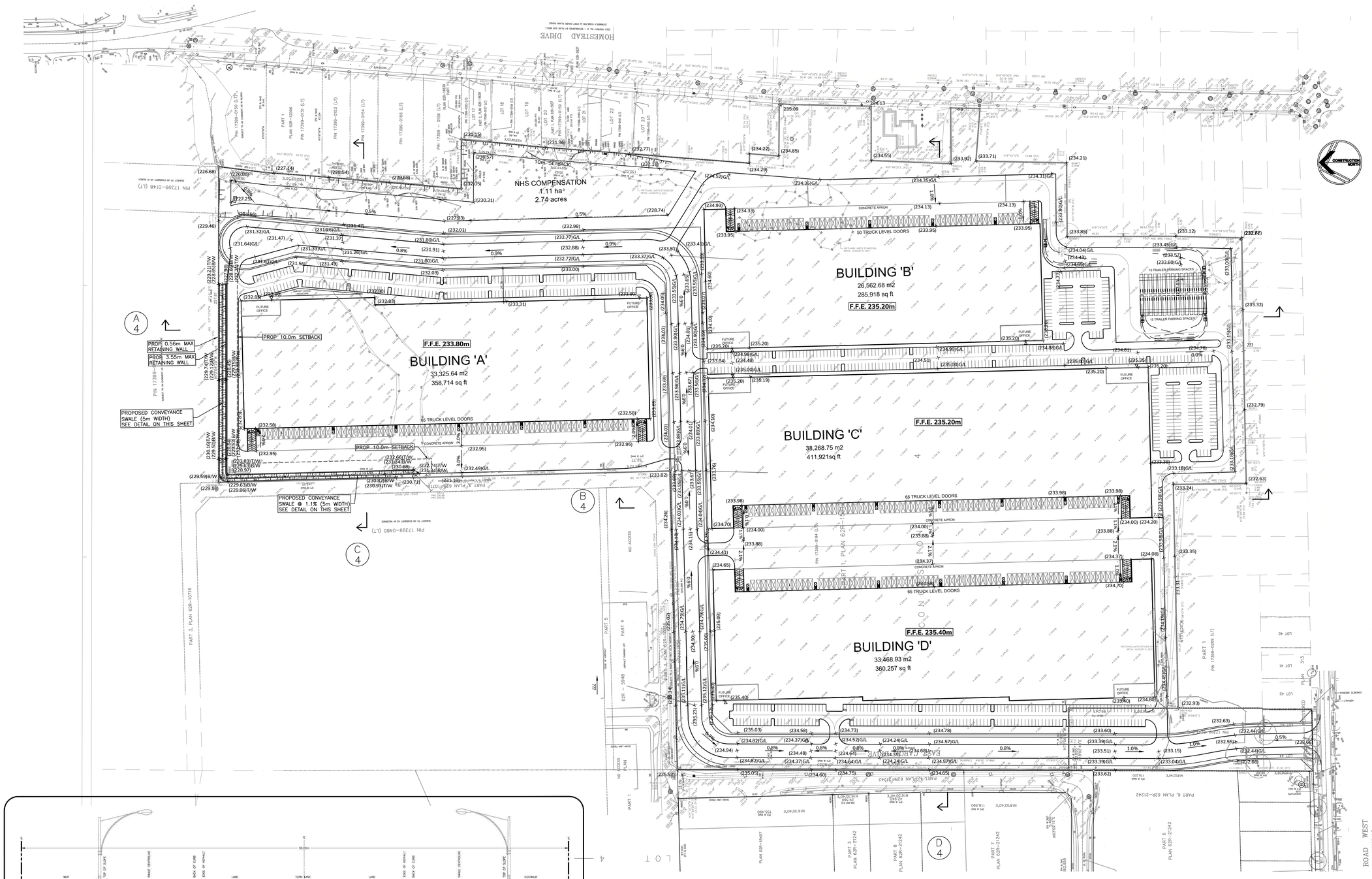
3054 HOMESTEAD DRIVE
HAMILTON, ON

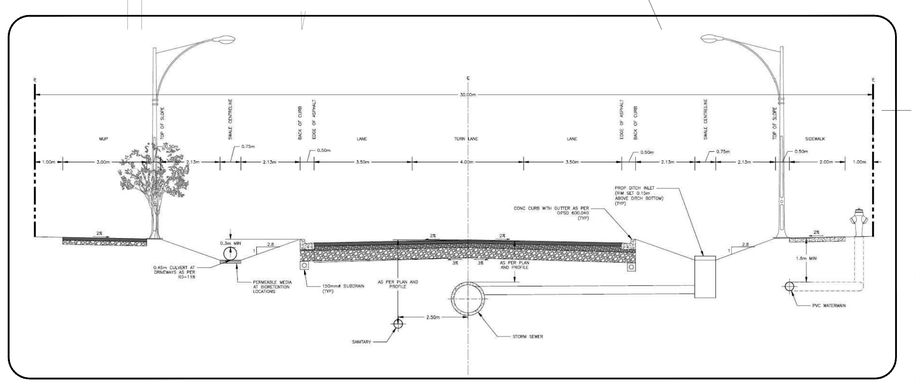
CLIENT:

FENGATE ASSET MANAGEMENT

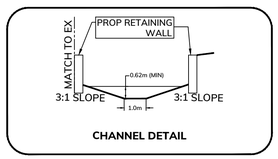
ODAN·DETECH CONSULTING ENGINEERS

The Odan/Detech Group Inc. P: (905) 632-3811 F:(905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2





STREET A TYPICAL 30m CROSS SECTION
N.T.S.



CHANNEL DETAIL

LEGEND:

EXISTING STORM MANHOLE	PROPOSED WATER VALVE & BOX	1.0%	PROPOSED FLOW ARROW AND SLOPE
PROPOSED STORM MANHOLE	EXISTING VALVE CHAMBER		PROPOSED FLOW ARROW
EXISTING CATCH BASIN MANHOLE	PROPOSED VALVE CHAMBER		PROPOSED EMERGENCY OVERLAND FLOW
PROPOSED CATCH BASIN MANHOLE	× *100.00* EXISTING SPOT ELEVATION	195.50	EXISTING CONTOUR
PROPOSED STORMCEPTOR	× (100.00) PROPOSED ELEVATION		EXTENT OF MAX. PONDING
EXISTING CATCH BASIN	× (100.00)TC PROPOSED TOP OF CURB ELEVATION		PROPOSED RETAINING WALL
PROPOSED CATCH BASIN	× (100.00)GL PROPOSED GUTTER LINE ELEVATION		PROPOSED CONCRETE SIDEWALK
EXISTING SANITARY MANHOLE	× (100.00)HP PROPOSED HIGH POINT		PROPOSED SLOPE (3:1 OR HIGHER)
PROPOSED SANITARY MANHOLE	× (100.00)LP PROPOSED LOW POINT		PROPOSED RIP RAP
EXISTING HYDRANT	× (100.00) PROPOSED SWALE INVERT ELEVATION		PROPERTY LINE
PROPOSED HYDRANT	× [100.00] INTERIM ELEVATION		LIMIT OF CONSTRUCTION
EXISTING WATER VALVE & BOX	(100.00) PROPOSED APRON ELEVATION		

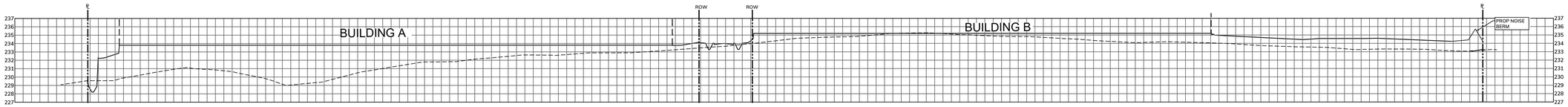
DRAWING TITLE:
CONCEPTUAL GRADING PLAN

PROJECT No.:	SCALE:	DRAWING No.:
21218	1:1500	2

PROJECT:
PROPOSED INDUSTRIAL DEVELOPMENT
3054 HOMESTEAD DRIVE
HAMILTON, ON

CLIENT:
FENGATE ASSET MANAGEMENT

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F3(905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2



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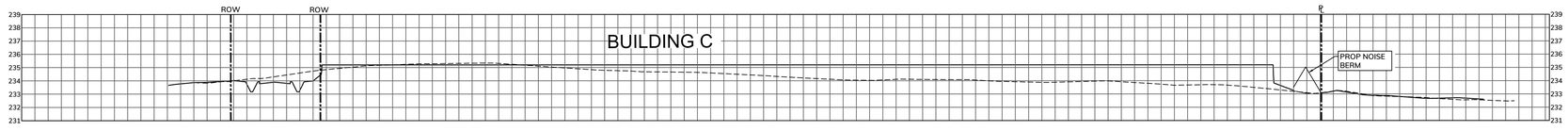

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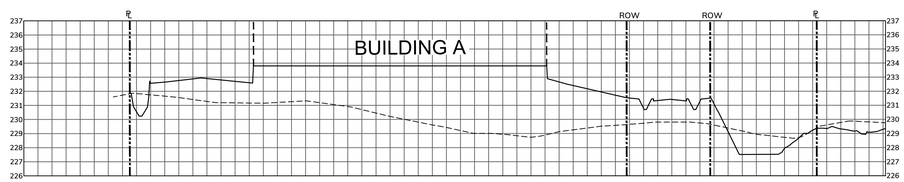
SCALE 1:1000



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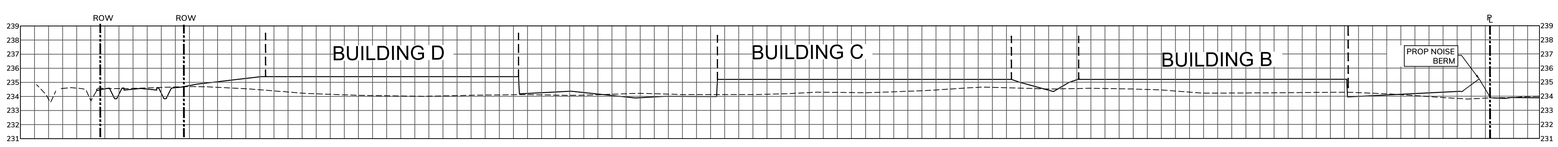
SCALE 1:1000



SECTION D:
SCALE 1:1000

DRAWING TITLE:
CONCEPTUAL SECTION PLAN

PROJECT No.:	SCALE:	DRAWING No.:
21218	AS NOTED	3

PROJECT:
PROPOSED INDUSTRIAL DEVELOPMENT
3054 HOMESTEAD DRIVE
HAMILTON, ON

CLIENT:
FENGATE ASSET MANAGEMENT

ODAN·DETECH
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