

Preliminary Stormwater Management Report

Draft Plan of Subdivision

2004 Hamilton Road, London, Ontario

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Prepared For:

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Statement of Qualifications and Limitations

This report has been prepared for Kreative Development Inc. (Owner) based upon currently available information, to support the Draft Plan of Subdivision application to be filed for the proposed commercial/industrial development. This report has been prepared for the sole use of the Owner and any reliance upon this information by any third party is made at the risk of that party. Development Engineering (London) Limited assumes no liability for any injury, loss or damage suffered by any third party based upon decisions made or actions that arise due to that party's reliance upon or interpretation of the contents of this report.

This Statement of Qualifications and Limitations is attached to and forms part of the report; any use of the report is subject to the terms contained herein.

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1.0 Introduction

Development Engineering (London) Limited (DevEng) has been retained by Kreative Development Inc. (the owner) to prepare a Preliminary Stormwater Management (SWM) Report in support of the proposed Draft Plan of Subdivision located at the northwest corner of Veterans Memorial Parkway (VMP) and Hamilton Road, known as M.N. 2004 Hamilton Road.

The proposed Draft Plan of Subdivision as prepared by DevEng (April 2025) covers an area of 45.55 ha with 7.61 ha of the proposed site to be developed through the Plan of Subdivision. The proposed subdivision includes five (5) industrial/commercial blocks (6.80 ha) and two (2) rights-of-ways (0.81 ha) to be developed while the balance of the development includes two (2) open space blocks (33.96 ha), natural heritage buffers (1.61 ha), compensation area (0.99 ha), and road widening dedications of (1.38 ha). Refer to Appendix A for the proposed Draft Plan of Subdivision.

Less than 20% of the proposed site is developable due to the existing Natural Heritage Features, Natural Hazards, the existing drainage feature that runs from south to north bisecting the developable portion of the site, and the associated compensation blocks and buffers. Most of the site is covered by existing vegetation and Natural Heritage features aside from approximately 300m of the southerly portion of the site from Hamilton Road. The existing drainage feature (formerly the Fekete Drain, abandoned under the Drainage Act) which bisects the developable portion of the site will remain in its existing location with minor proposed improvements to remove an accumulation of sediment immediately downstream of Hamilton Road and to provide a Municipal Road crossing over the existing watercourse.

The on-site crossing over the drain is required due to access restrictions imposed on the site, access is prohibited along the entire frontage of VMP, and will not be permitted within 300m of the centerline of the VMP right-of-way, as such, establishes the site access on the west side of the existing drain – refer to the Floodline Delineation Study as prepared by DevEng for additional details regarding pre-development and post-development floodline modeling and delineation, and preliminary sizing of the drain crossing.

The proposed development limits have been established based on a combination of studies to delineate the existing Natural Heritage Features, Natural Hazards, updated Floodlines, crossing requirements, and appropriate buffers and compensation blocks to protect the features and hazards.

The purpose of this preliminary SWM report is to demonstrate an effective SWM strategy that supports the proposed Draft Plan of Subdivision. The report outlines the existing conditions of the site, identifies the SWM constraints and targets for quality and quantity controls, and presents the overall SWM strategy for the proposed development. The report includes preliminary designs for minor and major stormwater flow conveyance systems and provides the supporting modelling outputs for the design.

2.0 Background Information

2.1 Previous Consultations

The consultation comments from the Initial Proposal Report (IPR) submission were originally received in May 2023 but have since been updated with additional comments provided in September 2024, due to the 1-year lapse date from the initial consultation meeting. The SWM Strategy as outlined in this Preliminary SWM Report has considered the comments received from the City of London in September 2024. The updated comments and the associated responses are included in Appendix A of this report.

2.2 Concurrent Studies and Reports

The following studies and reports were reviewed for the development of the SWM design and the preparation of this report:

- Geotechnical Investigation, Project No. GE-00519 – (LDS Consultants Inc., Aug. 13, 2021)
- Draft Plan of Subdivision for 2004 Hamilton Road – (DevEng, April, 2025)
- Flood Delineation Study – (DevEng, May 2025)
- Plan of Survey, Plan No.8-L-6364-Z – (AGM Ltd., Nov. 6, 2024)
- Environmental Impact Assessment Report - (NRSI, May 2025)
- Geomorphic Assessment - (Momentum Earth, May 2025)
- Geotechnical Investigation & Hydrogeological Assessment - (Stonecairn, May 2025)
- Transportation Impact Study- (Paradigm, May 2025)
- Final Proposal Report - Planning, (MHBC, May 2025)

2.3 Previous Studies and Related Design Specifications

- Thames Valley Areas Study, Reference 6540 – (Aquafor Beech Ltd., Mar. 16, 1995)
- City of London (CoL) Design Specifications & Requirements Manual (DSRM) – (Updated January 2025).
 - DSRM Section 6.9: Permanent Private Stormwater Systems

3.0 Approval Agencies

3.1 City of London

The Draft Plan of Subdivision, the associated Design Studies, detailed design drawings, design reports, and future building permit submissions are subject to approval by the City of London. City of London Consolidated Linear Infrastructure Environmental Compliance Approval (CLI-ECA) applications will be required for the proposed stormwater management works within the proposed right-of-ways which will be assumed by the City. The individual blocks are subject to direct ECA submission to the MECP due to the industrial designation of the blocks.

3.2 Upper Thames River Conservation Authority (UTRCA)

Portions of the site are located within the UTRCA Regulated Area due to downstream sections of the former Fekete Drain and the Hudson Drain running through the site. The Fekete Drain runs from south to north, then heads west towards the south branch of the Thames River dividing the southerly portion of the property into two separate development areas on the east and west of the existing drain. The downstream section of the former Hudson Drain outlets to the Fekete Drain north of the proposed development block on the east side of the site.

There is a proposed municipal road crossing over the former Fekete Drain to connect the east and west portions of the site to be developed since the site will be restricted to a single access connecting to Hamilton Road on the west side of the former Fekete Drain per the City of London consultation comments. The Consulting Team's work includes review of the existing floodlines established by the UTRCA and provide recommended refinements of the floodlines based on the proposed development. The Team's work will also include

identification of existing natural hazard features with recommended setbacks. The development of the subject property is subject to approval under Section 28 of the Conservation Authorities Act.

4.0 Existing Conditions

The existing site is undeveloped (0% imperviousness / $C=0.20$) and previously contained a residential lot (now removed), surrounded by mix of wooded area and grassed open space. This site features two former municipal drains, the Fekete Drain and the Hudson Drain (1981), which converge near the western boundary of the property and ultimately flow into the Thames River (South Branch). The site is bound by the Thames River to the north, Veterans Memorial Parkway to the east, Hamilton Road to the south, and an existing equestrian facility along with agricultural lands to the west. The Plan of Survey referenced in Section 2.2 designates the property as part of Lot 5, Concession 1, in the City of London (Geographic Township of Westminster).

Refer to existing site conditions model discussion under Section 5.6.1 and Summary of Peak Flows in Appendix B Table 2.

4.1 Site Topography and Drainage

Southwestern Ontario Orthophotography (SWOOP) topographic data was utilized, and three detailed topographic surveys were conducted to evaluate the existing conditions of the site and its surrounding area. The surveys were completed by Development Engineering (London) Ltd. on April 30, 2021; October 10, 2024; and November 21, 2024, focusing on the southern half of the development area, the former Fekete Drain, and the Hamilton Road right-of-way, respectively.

Within the south and central portions of the site, comprising approximately 30.93 ha, the topography generally slopes towards northwest toward the former Fekete and Hudson municipal (abandoned under Drainage Act) drains, with an average slope of approximately 1.5%. Geodetic elevations in this area range from approximately ± 262.00 m at the south property boundary to ± 253.00 m at the bottom of the Fekete channel along the west limit of the site.

There is a topographic ridge running east-west, that divides the remaining 14.62 ha northly portion of the site comprising natural heritage lands. This area drains northward towards the Thames River with geodetic elevations in this area range from approximately ± 259.00 m along the to ± 242.00 m.

4.2 Soil Conditions

A geotechnical investigation was completed by LDS Consultants Inc. (LDS) on August 13, 2021 including the analysis of nine (9) boreholes (denoted as BH1 through BH9), ranging in excavation depths from 5.0m to 8.1m below existing grade. Additionally, monitoring wells were installed in boreholes BH1, BH3, and BH9, for the monitoring of the stabilized groundwater level within the development area.

Surficial topsoil thickness across the site was found to vary, ranging between approximately 200mm to 450mm. Results from the borehole logs note underlying soils to be a mix of silty sand/ sandy silt, silt till (predominant), sand & gravel, and sand. Stabilized groundwater observations were conducted from June 7, 2021 to July 14, 2021: 1.22m to 1.20m of groundwater depth was recorded in BH1/MW, 3.13m to 3.20m of groundwater depth was recorded in BH3/MW, and 0.75m to 0.40m of groundwater depth was recorded in BH9/MW. Given the

largely low-permeability silt till subsoils across the site, infiltration opportunities are anticipated to be fairly constrained, and at best, limited to specific areas to be confirmed through future detailed design stages.

An updated Geotechnical and Hydrogeological Report was prepared by Stonecairn Consulting Inc. and will be included in the future detailed design to support slope stability analysis, overall site water balance and identify any feature-based recharge components along the channel.

5.0 Proposed Conditions

The application for Draft Approval will be supported by requisite planning documents/reports including a Zoning Bylaw Amendment (ZBA).

Development will occur within 7.61 ha of the 45.55 ha site, comprising of the industrial/commercial blocks, utility easement, and right-of-way blocks. The open space, natural heritage buffer, and compensation area blocks, totaling 37.94 ha, will remain undeveloped due to containing natural heritage features.

5.1 Roads

A road network has been defined through draft plan concept development. Future right-of-way (ROW) access will be available from Hamilton Road, due to the development area's proximity to the road: An interim primary access connection (Street B) has been proposed from the south, ± 300 m from the centerline of Veteran's Memorial Parkway. The ultimate site access (Street A) will be available west from the adjacent property (Municipal Number 1918 Hamilton Rd.), as part of a future ROW extension and connection to Venture Gate. The internal street network provides access to the Industrial/Commercial blocks throughout the development area.

Proposed Street A crossing the former Fekete Drain will include a box culvert, sized to convey the Regional Storm Event (250-year), which will be integrated with local storm sewer outlets.

5.2 Grading

As outlined in Section 4.1, the topography of the southern development lands generally slopes toward the existing municipal drains, with an average gradient of approximately 1.5%. A ridge divides the drainage of the 33.33 ha Open Space Block 12, resulting in approximately 14.62 ha draining north and the remaining 18.71 ha draining into the Hudson Drain South. In total, about 30.93 ha of the development area is tributary to the former Fekete and Hudson Drains.

The proposed grading will adhere to the existing topographical features and drainage patterns and will be carried out in accordance with the City of London *DSRM*. The design aims to optimize the cut and fill balance where feasible. However, preliminary assessments indicate that fill will be necessary throughout the proposed developable lands.

Grading will be conducted in a way that facilitates the collection of stormwater from internal sites and ensures the conveyance of runoff through a proposed storm sewer system. During major storm events, overland flow will be managed along the internal roadways, ultimately directing runoff into the Fekete channel via a dedicated spillway located along the eastern side of the Street A drain crossing.

5.3 Proposed Storm Sewers and Local Drainage

The development area is proposed to be serviced locally through two (2) short storm sewer runs along the rights-of-way as shown on Figure 2 in Appendix B, to provide conveyance capacity for the eastern and western development areas during the minor storm events. The eastern storm sewer will provide conveyance for Block's 4 and 5, with an estimated post-development tributary area of 5.39 ha. The western storm sewer will provide conveyance for Block's 1 to 3, with an estimated post-development tributary area of 1.40 ha. As noted, the sewers will outlet to the Fekete channel in the vicinity of the proposed Street A culvert crossing and be integrated with the overall culvert works design.

The storm sewer system will be designed to manage runoff from minor storm events through one of two storm sewer runs along Street A, serving the development areas located east and west of the Fekete channel. The total development outflow will be controlled using two low-level (2) orifice plates with 450mm overflow pipes (peak-shaving in addition to on-site PPS controls), to help achieve an allowable outflow target of the 25mm predevelopment event, prior to discharging into the Fekete channel from one of two headwall outlets.

Major overland flow routes would be designed for storm events exceeding the 5-year design storm. The roadway profiles would be designed to facilitate major overland flow conveyance through one of two dedicated overland flow routes (OFRs), converging into a dedicated spillway and ultimately outletting into the Fekete channel, downstream of the proposed Street A culvert crossing. Suitable scour protection will be included in the future detailed design.

5.4 SWM Design Approach

As noted, the preliminary SWM design provided in the following sections and related appendices is proposed to support Draft Plan approval of the subdivision. The intent of this preliminary SWM design is to layout the overall SWM strategy and outline provisions for various quantity/quality controls proposed to be implemented across the subject development. This SWM design outlines the approach to managing minor and major flow conveyance, stormwater quality and quantity control, water balance, long-term erosion control/scour in the channel, as well as temporary erosion control measures during construction. Details of these SWM systems as well as inspection & maintenance requirements are deferred to future detailed engineering design stage, once the subject approach is approved. Given the various topographic and spatial constraints across the site and layout of the development on either side of the channel (outlet), there is no opportunity for a centralized SWM (quality) treatment facility (i.e. a wet-pond) that would typically be proposed for a subdivision.

The 7.62 ha development area, which currently drains into the former Fekete Drain, increases in imperviousness compared to pre-development conditions (0% impervious). The total impervious percentage in the tributary areas of the Fekete channel will increase to approximately 19% ($C=0.34$). To mitigate impacts from development, SWM quality and quantity control is proposed primarily through permanent private systems (PPS) to be implemented for each industrial/commercial block. The aim is to responsibly manage (reduce) peak runoff rates/volumes and remove suspended solids from stormwater prior to discharging from the sites into the Fekete channel. These measures will be primarily relied upon to manage and attenuate peak flows from the developed portions of the subdivision to the upper reach of the channel, as there is limited opportunity for additional SWM controls outside of the blocks given the proximity to the drain.

5.5 SWM Targets

The following SWM criteria were acquired from consultation with the City of London, review of the *Thames Valley Areas Study (1995, Aquafor Beech)*, Innovation Park Subdivision Functional SWM Report (2008, AECOM) and the current City of London *DSRM (2025, Chapter 6)*:

- As best management practice, match or reduce post-development peak discharge rates to those of the pre-development condition for all design storm events from the 25mm storm event, up to and including the 100-year return period while safely conveying the 250-year storm event.
 - The allowable outflow control to the 25mm design storm event is required to meet the erosion storage attenuation volume specifications of 150m³/ha, noted below.
- Provide safe and adequate conveyance of overland flow to mitigate local flooding risk to nearby properties and the City rights-of-way.
- As a tributary of the South Thames Subwatershed, a 'Normal' level (70% TSS removal) quality control will be required for the subdivision (per City of London Table 6.1 Subwatershed Quality – *supersedes earlier 1995 'Enhanced' Level 1 requirements per Thames Valley Study*), as defined by the Ministry of Environment, Conservation, and Parks (MECP) to mitigate increases in suspended contaminant loads;
- Erosion Control storage volumes of 150m³/ha were identified (per AECOM 2008) for the former Fekete Drain using the Simplified Design Approach for channels (MECP) which supersedes earlier erosion storage values from the 1995 study (110m³/ha, contingent on implementation of infiltration measures).
- Provide infiltration for 20 mm of roof runoff where permeable soil conditions permit.
 - Subject to further works confirming feasibility at area plan/site plan stage, and water balance mitigation strategy.
- Each block within the proposed commercial subdivision will be subject to City of London Permanent Private Stormwater Systems (PPS; Section 6.9 in City of London DSRM) Case 3b: If an approved ditch is established, but there is no downstream SWMF, in which the requirements are as follows:
 - i. Ensure that peak flow from the site does not exceed pre-development conditions;
 - ii. The major flows and site grading are to be controlled on site up to the 100yr major storm event with safe/suitable routing of the 250yr; and,
 - iii. 100% of quality (Normal Level 2) and erosion controls are to be provided for the lands to be developed, as per the applicable Subwatershed requirements (DSRM): additionally 150m³/ha of erosion storage volume is to be provided for runoff attenuation during the 25mm design storm event.

5.6 SWM Modeling

The SWM analysis was completed with the PCSWMM hydrologic modelling software using the City of London IDF parameters as outlined in Chapter 6 of the City of London *DSRM*.

The geotechnical investigation describes the native subsoils identified in Section 4.2 to generally consist of interlayered sand and silt till deposits. These subsoils were estimated to be classified as hydrological soil group D (clay loam, silty clay loam, sandy clay, silty clay, or clay). As such, the PCSWMM subcatchments were assigned a pervious runoff Curve number (CN) of 83, based on the hydrological condition, cover type, and vegetation coverage as per the USDA's *TR-55* (Table 2-2c). It is noted that this soil type is not conducive to infiltration. Refer to Appendices C & D for the respective Existing and Proposed conditions PCSWMM model schematics, inputs, and outputs.

5.6.1 Existing Conditions Model

An existing conditions model has been developed to determine the target peak outflows as outlined in Section 5.5. This model includes five (5) subcatchments that drain into the former Fekete Drain and one (1) subcatchment that drains to the north, into the South Thames River. The total area of the subcatchments tributary to the Fekete channel is 31.67 ha, which consists of 30.93 ha of existing site area and 0.74 ha of adjacent external area. These subcatchments have an impervious percentage of 1% (runoff coefficient of $C=0.20$). The subcatchment tributary to the north has an area of 14.62 ha and an impervious percentage of 0% (runoff coefficient of $C=0.20$) and is included for completeness only. Refer to Appendix C for the Existing Conditions Drainage Schematic.

5.6.2 Proposed Conditions Model

A proposed conditions model has been completed to assess the performance of the quantity control measures. The proposed development will consist of sixteen (16) subcatchments that drain into the former Fekete Drain, along with one (1) subcatchment that drains to the north. The subcatchments that flow into the Fekete channel cover a total area of 31.67 ha, which includes 30.44 ha of proposed site area and 1.23 ha of external area. These subcatchments have an impervious percentage of 19% (runoff coefficient $C= 0.34$). The subcatchment tributary to the north has an area of 14.62 ha, with an impervious percentage of 0% (runoff coefficient $C=0.20$). Refer to Appendix C for the Proposed Conditions Drainage Schematic.

Each of the proposed blocks have been modeled with a storage node and outlet configuration containing an orifice control (75mm). This preliminarily represents the storage volume/control required for each block (to be confirmed under future SPA PPS design) to meet the total site (45.55 ha) pre-development peak runoff rates. A summary of the approximate volumes utilized for the blocks is in the following section within Table 2.

5.7 Quantity Control

In accordance with the SWM targets outlined in Section 5.5, the overall proposed discharge rates should not exceed the existing conditions flow rates for all storm events up to and including the 100-year design storm event. Stormwater quantity control will be required for the 31.67 ha of proposed development area tributary to the former Fekete Drain. As previously noted, there is approximately 14.62 ha of existing natural heritage lands, forming part of the subdivision draft plan extent, which sheet flows to the north as per existing conditions. This area will be excluded from the analysis as it will remain undeveloped and is not part of the proposed SWM system. Refer to Table 1 and Table 2 for the summary of existing and proposed flows, and estimated peak stormwater attenuation volume requirements, respectively.

For discharge flow rates, targeting pre-development conditions is proposed for the overall site, as development flows (with SWM control) are introduced along the upper reach of the main channel, before undeveloped portions of the site drain uncontrolled (per existing conditions) further downstream. These flows are all routed through the various channel reaches before the combined flow leaves the site and continue northwest along the drain. Specific velocity and flow dispersion measures are anticipated to be included

Table 1: Summary of Existing and Proposed Development Flows

Design Storm Event	Peak Allowable Overall Outflow Rate to Fekete Channel (L/s)	Post-Development Overall Routed Peak Outflow Rate to Fekete Channel (L/s)
25mm	54	54
2-year	185	157
5-year	502	395
10-year	824	630
25-year	1,301	1,009
50-year	1,715	1,524
100-year	2,182	2,176
250-year	-	3,280

Quantity control will be primarily implemented at the site-level, necessitating stormwater volume attenuation and outflow restriction for each commercial/industrial block development per PPS requirements outlined in Section 5.5. Provision of additional quantity control volumes within the rights-of-way is significantly constrained, although low-flow flow restrictions (2 x 75mm orifice controls) with 450mm overflow pipes in the minor system are proposed (peak-shaving during the 25mm event) in addition to the PPS controls, to help attenuate stormwater prior to outletting through one of two controlled outlets designated for the eastern and western development areas. Major runoff in excess of the minor system capacity will be routed along defined surface routes and suitably outlet to the drain through an armoured spillway(s) section. Final sizing and specific configuration of these minor flow restrictions and any overflow piping is to be provided through the future detailed engineering stage in conjunction with the roadway and culvert crossing designs.

Table 2: Estimated Site-Level SWM Block control requirements

Subcatchment Area	Preliminary Max. Stormwater Storage Requirement (m ³)	100-Year Attenuated Peak Site Flows to ROW (L/s)
P1 – Block 1	282	77
P2 – Block 2	302	72
P3 – Block 3	21	17
P4 – Block 4	754	221
P5- Block 5	1,458	604
Total	2,817	991

Refer to Appendix B Tables 2 to 4 which provide further information on peak outflows and stormwater storage volume attenuations for the all other design storm events (25mm to 250yr).

5.8 Quality Control

As outlined in Section 5.5, stormwater quality control for the proposed 7.61 ha of development area tributary to the Fekete channel, will require a 'Normal' level of protection (70% TSS removal) per the City Table 6.1 (subwatershed target) as defined by the MECP.

Stormwater quality requirements will be primarily accommodated at site-level for blocks per PPS requirements (Case 3b) outlined in Section 5.5, treating site runoffs prior to discharging into the storm sewers within the receiving right-of-ways. Design of quality control measures for each block (PPS) is deferred to future SPA reviews; with a treatment-train as the preferred approach wherever practical for each block development. It is anticipated that at a minimum, a hydrodynamic (oil/grit) separator (HDS) will be required for paved driveway/parking areas on each site prior to discharge treated runoff to the municipal storm sewer collector along the roadway.

For the portion of the subdivision to be municipally assumed, given the very limited extent of municipal roadway on either side of the drain crossing (outlet), along with practical spatial constraints, only nominal inlet SWM quality measures (i.e. filterbags and sumps) are proposed in the municipal storm collection system. Further information on these specific (type/sizing) measures will be provided in future detailed engineering design submission(s).

5.9 Downstream Erosion and Scour Protection

The SWM system is anticipated to implement various features for erosion and scour protection of the Fekete channel. Erosion protection storage attenuation volume will be provided for the overall development. During the 25mm design storm event, approximately 153 m³/ha of attenuation will be provided which will meet the subwatershed target as outlined in Section 5.5. For specific requirements regarding erosion storage attenuation volume for each block, refer to Table 5 in Appendix B.

Scour protection will be largely a function of (peak) flow dispersion and bank stabilization for minor (piped) and major overland storm outlets into the Fekete channel. The outlets are anticipated to be incorporated into or adjacent the downstream wing-walls of the proposed culvert crossing, complete with flow dissipation measures (e.g. plunge pools or naturalized baffles). Where applicable, both the minor storm outlets and the proposed major overland flow outlets are also anticipated to feature rip-rap, permanent turf-reinforcement mat or cable concrete treatment to aid in energy dissipation and scour protection of the embankments prior to flows entering the Fekete channel. Details regarding critical flow velocities, flow depths, and the stone substrate sizing will be provided in the future as part of the detailed design. Further Geotechnical/Hydrogeological design coordination is required but deferred to the detailed engineering stage once the overall culvert design strategy is accepted.

5.10 Channel Geomorphic Recommendations

The strategy outlined in the previous section generally satisfies the erosion criteria and scour requirements of the geomorphic study. Quantity (i.e. peak flows) and quality measures on both the private blocks and along the municipal roadway will also be provided in a treatment-train approach (wherever practical). Refer to Section 5.8 for details.

Further natural channel design techniques will be applied upstream and downstream of the proposed crossing location to improve/remediate the current condition following cleanout of accumulated sediment with consideration for channel stability and in-stream hydraulics along identified reaches. This may include features

such as a plunge pool, flow dissipation strategies, substrate/embankment material improvements and aquatic habitat enhancements, although these are to be further outlined during the future detailed design stage. Refer to the Report by Momentum Earth for details.

5.11 EIS Recommendations

EIS recommendations (NRSI) have been primarily incorporated into the overall layout of the development (Draft Plan) including development setbacks, NHS buffers and delineation of key open space/compensation areas along the channel and other site features (wetland pockets).

However, with specific regard to SWM/drainage, NRSI will defer primarily to Momentum/DevEng on the minor storm outlet locations and practicalities related to the proposed culvert crossing. From an ecological perspective, it is understood the outlet(s) within the box culvert (wingwalls) would be the best approach, as it would eliminate the need for an additional disturbance of a separate headwall within the valley corridor. For discharge flow rates, targeting pre-development conditions is proposed for the overall site by incorporating SWM quantity control as applicable, with consideration for flow routing along the channel and water balance mitigation strategies for recharge to localised wetlands along the drain. Considerations for terrestrial and aquatic passage through the proposed culvert crossing design is to also be considered in conjunction with geomorphic recommendations Refer to the reports by NRSI and Momentum Earth for further details.

5.12 Water Balance / Low-Impact Development

Developments within the South Thames Subwatershed as outlined in the *Thames Valley Areas Study* in Section 2.2, outlines the criteria for 20 mm of roof runoff infiltration, subject to feasibility confirmation at the area plan/site plan stage. However, given the largely low-permeability silt-till subsoil, infiltration opportunities (recharge) across the site are anticipated to be constrained (as noted in Section 4.2). An overall water balance analysis has been completed by Stonecairn Consulting Inc. to review the infiltration deficit under post-development conditions. The summary table notes a slight decrease in the total site post-development infiltration component (79% of pre-development) without any recharge mitigation. A feature-based wetland water balance mitigation approach may be adopted to maintain post-development within 10% of pre-development conditions for specific wetland pockets flanking the drain. Refer to the report by Stonecairn for details of the water balance and proposed targets for localized recharge, considering the site soil conditions.

Where practical, infiltration measures will be implemented at site-level on a best-efforts basis for the purpose of maintaining groundwater discharge to the local streams, minimizing the impact to groundwater supply. This could be achieved through the routing of clean roof and landscaped area runoff into Low Impact Development (LID) measures and directed to key wetland pockets flanking the drain. The location, design and sizing of any LID system(s) to support the initiative is to be completed during the future detailed design stage. Furthermore, given the limited length of roadway, opportunities for incorporating any LID measure in the ROW's is also anticipated to be very constrained. However, review during detailed design will confirm practicalities of collecting and conveying storm drainage to the outlet and what, if any, opportunities for further recharge could be available along the ROWs. Recharge measures are not anticipated to be in the immediate vicinity of the proposed culvert crossing or have any impact on these works.

6.0 Temporary Erosion and Sediment Control

Complementary to the site servicing and grading design for the on-site development, erosion and sediment control (ESC) details will be included with the detailed Engineering design drawings. Temporary ESC measures will be designed to mitigate the offsite migration of sediments by incorporation of various best management practices and control measures. Typical control measures to be implemented on site include:

- Installation of silt control fencing (light duty/robust) around the site perimeter at down-gradient locations.
- Preventing silt or sediment laden runoff from entering inlets (catchbasins / catchbasin maintenance holes) by installing pre-fabricated temporary inlet filter bags and incorporating straw bale or rock dam flow checks.
- Temporary sediment traps/basins (dewatering stations where required).
- Sodding the invert of swales as soon as possible after being constructed to mitigate erosion and down cutting; in general, minimizing the duration of soil exposure in erosion prone areas by temporary vegetation coverage (i.e. hydro-seeding) is recommended.
- Maintaining sediment and erosion control structures in good repair (including periodic cleaning as required) until such time as the Engineer or the Municipality approves their removal.
- Incorporation of temporary measures at site construction entrances to minimize tracking of mud and debris onto municipal road allowances; and,
- Scheduling of critical conveyance works during forecasts of little to no precipitation.

Detailed ESC plans will be provided for review by the City of London at the detailed engineering stage and in particular for the roadway culvert crossing and any channel improvements (including in-water works and dewatering considerations). Across the development block areas, suitable perimeter ESC measures are anticipated to be incorporated initially through a Site Alteration stage for any cut/fill operations, followed by the subdivision servicing works and then maintained/adapted/enhanced as required through the subsequent Site Plan development stages by each proponent. A specific ESC Plan/Report will be completed prior to development.

7.0 Summary and Conclusions

Based on the preceding information, the following conclusions are provided with regards to the stormwater management design of subject subdivision development:

- Per the Draft Plan, the subject 45.55 ha subdivision includes 7.61 ha of proposed development comprising five (5) industrial/commercial blocks, a utility easement, and two (2) local rights-of-ways. The remaining 37.94 ha of open space, natural heritage buffer, and compensation area blocks will remain undeveloped due to containing natural heritage features.
- Proposed site grading shall conform to typical City standards while working with existing and proposed perimeter grades around the site. A local site culvert/roadway crossing is proposed on Street A across the drain for access.
- Local storm sewer networks will provide conveyance of the minor system discharge to one of two dedicated outlets into the former Fekete Drain (channel).
- Major overland flow will be conveyed through the ROWs, directing runoff in excess of the minor system capacity to the dedicated overland flow routes (spillways), discharging into the Fekete channel.

- The preliminary SWM design is proposed to outline the approach to meeting SWM requirements (targets) for the site, which is proposed to be primarily provided through on-site (development blocks) controls given various topographic and spatial constraints relative to the channel (outlet).
- A preliminary SWM model was completed using PCSWMM to establish peak stormwater outflow targets and site-level volume attenuation requirements for the proposed development area.
 - The proposed preliminary SWM design can suitably reduce overall routed site post-development peak discharge rates to below pre-development rates.
 - Approximately 2,817m³ of storage (combined) is proposed across all development blocks for control up to the 100yr event and safe conveyance of the 250yr event, to attenuate flow before discharge to the adjacent ROW storm sewer.
 - Flow restrictions (75mm orifice controls) for the municipal storm systems are also proposed along with 450mm overflow pipes. Detail and final sizing of this storm system are deferred to the detailed engineering stage along with the roadway and culvert crossing designs.
- Stormwater quality treatment is anticipated to be accommodated by future PPS site-level controls and ROW inlet controls, to provide a 'Normal' level of protection for the proposed development. Wherever practical a treatment-train approach should be used for quality control.
- Details of the various site SWM and roadway storm conveyance systems including the proposed culvert crossing are to be completed during future detailed engineering design stage (City of London). The proposed development of the subject property will also require submission to the UTRCA for a Section 28 Permit.
- Erosion and Scour protection proposed to mitigate long-term impact to the downstream channel. Approximately 153m³/ha of erosion storage attenuation is to be provided during the 25mm design storm event along with flow dispersion for scour protection at the outlets.
- Channel Geomorphic (Momentum) and EIS recommendations (NRSI) have been considered in the preliminary SWM design.
- A Water Balance analysis (Stonecairn) has been completed to assess the reduction in overall infiltration across the subject lands (79% of pre-development). Given low-permeability silty till subsoils opportunities for recharge is limited. However, where practical infiltration from clean (roof/landscape) sources is proposed on development blocks to mitigate infiltration reduction, primarily for localized wetland pockets flanking the channel.
- Temporary Erosion and Sediment Control Measures should be implemented to help mitigate potential sediment transport and erosion resulting from construction activities. Details of these are proposed to be deferred to a future ESC Plan/Report to be completed during future detailed engineering design stage as part of a Site Alteration Plan and Subdivision Servicing works. Additional ESC measures for each block development will be outlined in subsequent SPA designs.

We trust this report adequately addresses the outlined design constraints and proposed solutions related to stormwater management in support of the Draft Approval.

Development Engineering (London) Limited