Site Servicing, Grading and Drainage Plan – Stormwater Management Report / Brief Town of Oakville

In Compliance with Sentence B-9.14.6.1 of the Ontario Building Code, every site is to be graded so that stormwater will not accumulate at or near the building under construction and will not adversely affect any adjacent lots. The lot grading criteria has been primarily developed to provide guidance to residential development in subdivisions. The basic principles do however apply to lots under site plan development. It should be noted that the grading design for any residential buildings containing three or more dwelling units and for any development other than residential, shall be performed by a licensed professional engineer.

Where there is a landscape plan proposed as part of the site plan application, the professional engineer designing the site servicing, grading and drainage plan and the stormwater management shall review the landscape plan and shall provide the Town of Oakville with a declaration advising that the proposed landscape works are in conformance with the site servicing, grading and drainage plan and stormwater management report (or brief). Once construction is completed, the professional engineer designing the site servicing, grading and drainage plan and stormwater management report shall provide the Town of Oakville with a Final Lot Grading Certificate and any required Retaining Wall Certificates.

A detailed site servicing, grading and drainage plan and stormwater management reports (or brief) must accompany all building permit applications to the Town of Oakville. Building permits will not be issued until the Town of Oakville Development Services Department is satisfied with the proposed site servicing, grading and drainage plan and stormwater management report (or brief).

Prior to a site servicing, grading and drainage plan and stormwater management report submission, contact the following external authorities for specific design criteria should the subject lot abuts or contains:

- A watercourse/valley/creek block regulated by the Halton Region or Credit Valley Conservation Authority
- Ontario Hydro property
- CN Railway or CP Railway
- Pipelines or pipeline easements
- If a driveway is proposed on a municipal road within 180m of an intersection with a Provincial Highway (QEW, 403, 407)
- Frontage or access to Regional Roads (Region of Halton or Peel)
- Land adjacent to Lake Ontario (Ministry of Natural Resources and Halton Region Conservation Authority)

The lot grading of landscaped areas and parking lots shall provide a safe path for the stormwater drainage route to the surrounding Town of Oakville right of way during storms exceeding the design storm event.

Town of Oakville requires that all roof leader downspout locations are to be indicated on site servicing, grading and drainage plans. Roof leaders can not connect directly to the storm sewer and shall be located in accordance with Town of Oakville Standards.

Town of Oakville also requires that Landscape Plans and Tree Preservation Plan to be reviewed and approved by the consulting Engineer to ensure conformance with approved site servicing, grading and drainage plans and the stormwater management report. Site servicing, grading and drainage plans and stormwater management reports (or brief) shall be designed in accordance with Town of Oakville Development Engineering standards, including Town of Oakville Safe Side Slope requirements.

Town of Oakville Requirements for Site Servicing, Grading and Drainage Plan and Stormwater Management Report:

- Information Required on Site Servicing, Grading and Drainage Plan shall be submitted as one lot per letter or ledger sized sheet at a scale of 200:1.
- A key plan with north arrow is required in the upper right-hand corner of the sheet. Provide a title block with the name of builder / developer / subdivision, registered plan number, architect /designer company, scale of drawing and date of preparation.
- Provide the as-built location and elevation of storm, sanitary and water services, elevation of culverts, drainage ditches, sidewalks and location of approved erosion and sedimentation controls, location of sump pump, discharge point and any dry wells.
- Provide the existing elevations as per topographic survey indicating existing buildings, stormwater drainage patterns and finished first floor elevations for all buildings on adjacent lots.
- Indicate the stormwater drainage for all adjacent and proposed lots using arrows to show the direction of stormwater drainage and swale locations, length and slope percentage.
- Indicate the house type and elevations of the finished first floor, top of foundation wall, basement floor, underside of the footings and service lateral invert at lot line.
- Indicate the elevations at the lot corners, landings, garage slab and all entrances (indicating the number of risers), the existing roads and catchbasins. Refer all elevations to a geodetic Town of Oakville benchmark.
- Indicate the location, length and percent slope of proposed driveways
- Provide complete details of proposed retaining walls and noise/privacy fencing.

All site servicing, grading and drainage plans must include:

- Erosion and sediment controls
- Town of Oakville bench mark description and elevation
- All abutting streets, right-of-ways, easements

- All utilities on existing roads including storm, sanitary, water, Bell, hydro and gas
- All proposed services to the building (note that all services including Bell and hydro must be provided underground from the existing source to the building)
- Tree Inventory/Arborist Report and Tree Removal/Tree Preservation plan
- Existing grades of abutting roads and proposed grades through new entrances, elevations on a grid throughout the site including lot corners, and a minimum 15m external to the site so that stormwater drainage patterns may be evaluated
- All surface stormwater drainage routes including swales, ditches, watercourses and their invert elevations and stormwater flow direction (flood plain limits)
- The overall surface stormwater drainage pattern on the lot is to be shown by flow arrows
- Location of on-site storm sewers, manholes and catchbasins including size and class of pipe and grades
- Ground floor elevations of the building and ground elevation at all building corners, entrances, catchbasins, tops and bottoms at slopes and other locations as required to establish the surface stormwater drainage system
- Location of roof downspouts and details of roof hoppers (stormwater flow controls)
- Location and size of driveways and culverts
- A legend detailing all symbols used (i.e. catchbasins, retaining walls, road, property line, building line, existing and proposed elevations)

Information regarding the design criteria and standard for sanitary and water servicing must be obtained from the Region of Halton Public Works Department.

The following Town of Oakville design criteria applies to overall residential subdivision stormwater drainage control and lot/site specific stormwater drainage design.

- Lot specific elevations shall conform with the Town of Oakville approved subdivision control plan.

- All swales shall have a minimum depth of 150mm and a minimum slope of 2% for a maximum length of 60m before outfall to sewer, creek or Town of Oakville/Region of Halton road/block.
- In general, where an upper lot of drains stormwater onto a lower lot, an interceptor swale shall be located on the lower lot, adjacent to the rear lot line in such a manner as to divert the stormwater drainage to the side yard swales of the lower lot.
- Window wells, where required, shall be indirectly connected to the weeping tile system using 100mm drainpipe filled with 19mm clear stone.
- All downspouts shall discharge onto approved sodded areas using splash pads for erosion control. Direct connection of the downspouts to the storm system must have prior approval from the Town of Oakville (high density). The location of the discharge is not to interfere with access or pose a safety hazard.
- Where sump pumps are required, pumps must discharge directly to a storm sewer or a Town of Oakville/ Region of Halton drainage ditch. Discharge of a sump pump to a side yard is not acceptable.

Town of Oakville Lot Grading & Stormwater Management Criteria

All yard surfaces front and rear shall have a minimum slope of 2%. Rear yards are to have a maximum grade of 5% for a minimum apron length of 5m distance from the rear face of the dwelling. The maximum slope allowed on any yard surface side, front and rear shall be 3 parts horizontal to 1 part vertical (3:1). Driveway slopes shall be a minimum of 1% and a maximum of 7%. There shall be a 0.6m wide path at a 2% slope away from the foundation around one side of the building, except where side yard setbacks from lot lines do not permit. This flat area allows for a walkway to access the rear of the house.

On-site storm water quantity controls are required where storm water drainage restrictions are established or post-to-pre runoff control is warranted.

Stormwater Management Design Criteria of Town of Oakville requires the development flowrate is to be controlled to the five (5)-year target flow.

Modified rational method calculations or equivalent using the Town of Oakville's intensity-duration-frequency (IDF) data is required to determine the maximum stormwater storage required during each storm event for the storm water management analysis of simple sites. OTTHYMO/INTERHYMO Stormwater modeling may be required for Stormwater Management Analysis where warranted or another Model may be dictated by the Watershed Study.

Stormwater Flow control devices shall be installed on the upstream side of stormwater control manholes located on the street line; preferred method is a two-piece adjustable diamond orifice. Orifice openings must have a diameter of no less than 75 mm in order to prevent clogging of the opening. Storm connections from the building roof and foundation drains must be made downstream of the manhole and/or catchbasin inlet controls. Roof drains should be selected to provide the required flows to obtain the designed detention storage of stormwater.

Pond limits and available stormwater storage are to be depicted on the site servicing, grading and drainage plan drawings. Maximum ponding depth of stormwater in parking areas is not to exceed 250mm, and no ponding of stormwater shall be in a fire route. No five-year storm ponding (nuisance) on pavement: use landscaped areas, roofs or underground structures. Lots are to be designed to contain all stormwater runoff with major overland spills diverted to approved channels or municipal right-of-ways. External stormwater drainage shall be accepted without upstream impacts. An overland stormwater drainage route shall be clearly marked on drawings.

The grading of landscaped areas and parking lots shall provide a safe path for the overland stormwater drainage route to the surrounding municipal right of way during storms exceeding the design storm event.

If the existing topography requires a soakaway (infiltration gallery) to manage the stormwater for a proposed development, the Town of Oakville requires a geotechnical report to support a soakawy design brief.

On sites suitable for underground stormwater infiltration practices, there are a variety of facility design options to consider, such as soakaway, infiltration trench and infiltration chamber. Soakaway is rectangular or circular excavations lined with geotextile fabric and filled with clean granular stone or other void forming material, that receive runoff from a perforated pipe inlet and allow it to infiltrate into the native soil. They typically service individual lots and receive only roof and walkway runoff but can also be designed to receive overflows from rainwater harvesting systems. Soakaway can also be referred to as infiltration gallery, dry well or soakaway pit. Infiltration trench is rectangular trench lined with geotextile fabric and filled with clean granular stone or other void forming material and typically service an individual lot and receive only roof and walkway runoff. This design variation on soakaway is well suited to sites where available space for infiltration is limited to narrow strips of land between buildings or properties, or along road rights-of-way.

Infiltration chamber is another design variation on soakaway. Infiltration chamber includea a range of proprietary manufactured modular structures installed underground, typically under parking or landscaped areas that create large void spaces for temporary storage of stormwater runoff and allow it to infiltrate into the underlying native soil. Infiltration chamber typically has open bottom, perforated side walls and optional underlying granular stone reservoir. Infiltration chamber can be installed individually or in series in trench or bed configurations. Infiltration chamber can infiltrate roof, walkway, parking lot and road runoff with adequate pretreatment. Due to the large volume of underground void space Infiltration chamber creates in comparison to a soakaway of the same dimensions, and the modular nature of its design, Infiltration chamber is well suited to sites where available space for other types of BMPs is limited, or where it is desirable for the facility to have little or no surface footprint (e.g., high density development contexts). Infiltration chamber can also be referred to as infiltration tank.

Stone reservoir: Soakaway and infiltration trench should be filled with uniformly graded, washed stone that provides 30 to 40% void space. Granular material should be 50 mm clear stone.

Geotextile: A non-woven needle punched, or woven monofilament geotextile fabric should be installed around the stone reservoir of soakaway and infiltration trench with a minimum overlap at the top of 300 mm.

Woven slit film and non-woven heat bonded fabrics should not be used as they are prone to clogging. The primary function of the geotextile is separation between two dissimilar soils. When a finer grained soil overlies a coarser grained soil or aggregate layer (e.g., stone reservoir), the geotextile prevents clogging of the void spaces from downward migration of soil particles. When a coarser grained aggregate layer (e.g., stone reservoir) overlies a finer grained native soil, the geotextile prevents slumping from downward migration of the aggregate into the underlying soil. Geotextile may also enhance the capacity of the facility to reduce petroleum hydrocarbons in runoff, as microbial communities responsible for their decomposition tend to concentrate in geotextile fabrics. Specification of geotextile fabrics in soakaway and infiltration trench should consider the apparent opening size (AOS) for non-woven fabrics, or percent open area (POA) for woven fabrics, which affect the long term ability to maintain water flow. Other factors that need consideration include maximum forces to be exerted on the fabric, and the load bearing ratio, texture (i.e., grain size distribution) and permeability of the native soil in which they will be installed.

The depth of the soakaway or infiltration trench is dependent on the native soil infiltration rate, porosity (void space ratio) of the gravel storage layer media (i.e, aggregate material used in the stone reservoir) and the targeted time period to achieve complete drainage between storm events.

The maximum allowable depth of the stone reservoir for designs without an underdrain can be calculated using the following equation:

dr max = i * ts / Vr Where:

dr max = Maximum stone reservoir depth (mm)

i = Infiltration rate for native soils (mm/hr)

Vr = Void space ratio for aggregate used (typically 0.4 for 50 mm clear stone)

ts = Time to drain (design for 48 hour time to drain is recommended)

The value for native soil infiltration rate (i) used in the above equation should be the design infiltration rate that incorporates a safety correction factor based on the ratio of the mean value at the proposed bottom elevation of the practice to the mean value in the least permeable soil horizon within 1.5 metres of the proposed bottom elevation. On highly permeable soils (e.g., infiltration rate of 45 mm/hr or greater), a maximum stone reservoir depth of 2 metres is recommended to prevent soil compaction and loss of permeability from the mass of overlying stone and stored water. For designs that include an underdrain, the above equation can be used to determine the maximum depth of the stone reservoir below the invert of the underdrain pipe.

Once the depth of the stone reservoir is determined the water quality volume, computed using the methods in the relevant CVC and TRCA stormwater management criteria documents can be used to determine the footprint needed using the following equation:

Af = WQV / (dr * Vr) Where:

Af= Footprint surface area (m2)

WQV = Water quality volume (m3)

dr= Stone reservoir depth (m)

Vr= Void space ratio for aggregate used (typically 0.4 for 50 mm clear stone)

The ratio of impervious drainage area to footprint surface area of the practice should be between 5:1 and 20:1 to limit the rate of accumulation of fine sediments and thereby prevent clogging.

Infiltration chambers are typically proprietary designs with material specifications provided by the manufacturers.

Inlet/Overflow Pipe

Pipe should be continuously perforated, smooth interior, HDPE or equivalent material, with a minimum inside diameter of 100 millimetres. Perforated pipe inlet/outlet should run lengthwise through the facility. Non-perforated pipe should be used for conveyance to the facility.

Stone

The facility should be filled with 50 mm clear stone with a 40% void ratio.

Geotextile Material specifications should conform to Ontario Provincial Standard Specification (OPSS) 1860 for Class II geotextile fabrics. Should be woven monofilament or non-woven needle punched fabrics. Woven slit film and non-woven heat bonded fabrics should not be used as they are prone to clogging.

Primary considerations are: - Suitable apparent opening size (AOS) for non-woven fabrics, or percent open area (POA) for woven fabrics, to maintain water flow even with sediment and microbial film build-up; - Maximum forces that will be exerted on the fabric (i.e., what tensile, tear and Based on the volume of the facility.

Apparent Opening Size (AOS; max. average roll value) or Percent Open Area (POA)For fine grained soils with more than 85% of particles smaller than 0.075 mm (passing a No. 200 sieve): AOS ≤ 0.3 mm (non-woven fabrics)

For fine grained soils with 50 to 85% of particles smaller than 0.075 mm (passing a No. 200 sieve):
AOS ≤ 0.3 mm (non-woven fabrics) POA ≥ 4% (woven fabrics)

For coarser grained soils with 5 to 50% of particles smaller than 0.075 mm (passing a No. 200 sieve):
AOS ≤ 0.6 mm (non-woven fabrics) POA ≥ 4% (woven fabrics)

For coarse grained soils with less than 5% of particles smaller than 0.075 mm (passing a No. 200 sieve):
AOS ≤ 0.6 mm (non-woven fabrics) POA ≥ 10% (woven fabrics)

Hydraulic Conductivity (k, in cm/sec)
k (fabric) > k (soil)

Permittivity (in sec^{-1})Where, Permittivity = k (fabric)/thickness (fabric):

For fine grained soils with more than 50% of particles smaller than 0.075 mm (passing a No. 200 sieve), Permittivity should be 0.1 sec^{-1}

For coarser grained soils with 15 to 50% of particles smaller than 0.075 mm (passing a No. 200 sieve), Permittivity should be 0.2 sec^{-1}.

For coarse grained soil with less than 15% of particles smaller than 0.075 mm (passing a No. 200 sieve), Permittivity should be 0.5 sec^{-1}.

Before site work begins, locations of facilities should be clearly marked. Only vehicular traffic used for construction of the infiltration facility should be allowed close to the facility location.

Infiltration practices should never serve as a sediment control device during construction. Construction runoff should be directed away from the proposed facility location. After the site is vegetated, erosion and sediment control structures can be removed. Infiltration facilities are particularly vulnerable to failure during the construction phase for two reasons. First, if the construction sequence is not followed correctly, construction sediment can clog the pit. In addition, heavy construction can result in compaction of the soil, which can then reduce the soil's infiltration rate. For this reason, a careful construction sequence needs to be followed. This includes:

1. Heavy equipment and traffic should avoid traveling over the proposed location of the facility to minimize compaction of the soil.

2. Facilities should be kept “off-line” until construction is complete. They should never serve as a sediment control device during site construction. Sediment should be prevented from entering the infiltration facility using super silt fence, diversion berms or other means
3. Upland drainage areas need to be properly stabilized with a thick layer of vegetation, particularly immediately following construction, to reduce sediment loads.
4. The facility should be excavated to design dimensions from the side using a backhoe or excavator. The base of the facility should be level or nearly level.
5. The bottom of the facility should be scarified to improve infiltration. An optional 150 mm of sand could be spread for the bottom filter layer. The monitoring well should be anchored, and stone should be added to the facility in 0.3 metre lifts.

Geotextile fabric should be correctly installed in the soakaway or infiltration trench excavation. Large tree roots should be trimmed flush with the sides of the facility to prevent puncturing or tearing of the fabric during subsequent installation procedures. When laying out the geotextile, the width should include sufficient material to compensate for perimeter irregularities in the facility and for a 150 mm minimum top overlap. Voids may occur between the fabric and the excavated sides of the facility. Natural soils should be placed in any voids to ensure fabric conformity to the excavation sides.

As with all infiltration practices, these facilities require regular inspection to ensure they continue to function. Maintenance typically consists of cleaning out leaves, debris and accumulated sediment caught in pretreatment devices, inlets and outlets annually or as needed. Inspection via an monitoring well should be performed to ensure the facility drains within the maximum acceptable length of time (typically 72 hours) at least annually and following every major storm event (>25 mm).

If the time required to fully drain exceeds 72 hours, drain via pumping and clean out the perforated pipe underdrain, if present. If slow drainage persists, the system may need removal and replacement of granular material and/or geotextile fabric.

The expected lifespan of infiltration practices is not well understood, however, it can be expected that it will vary depending on pretreatment practice maintenance frequency, and the sediment texture and load coming from the catchment. Soakaways have been observed to continue to function well after more than 30 years of operation.

All existing services, utilities and abutting lots are to be shown in dotted lines. All proposed services shall be shown with the solid line. The locations of all service connections shall be shown on the site servicing, grading and drainage plan. The Town of Oakville requires stamped engineering on-site storm water management report and stamped engineering site servicing, grading and drainage plan drawings for site plan approval and to issue building permit.

All retaining walls are to be constructed of a minimum material being pressure treated wood conforming to CAN/CSA-080.1-M89. Retaining walls may also be constructed of poured in place concrete, pre-cast concrete or stone. Retaining walls exceeding 1m in height are required to have plans submitted to the Town of Oakville Development Services Section stamped by a professional engineer and showing the proposed retaining wall construction. Fences or rails will be required on all retaining walls that exceed 0.6m in height. The fence must be a minimum height of 1.2m. All retaining walls are to have the face of the wall placed on the lot line in such a manner that any tiebacks etc. are located entirely within the upper lot.

The Town of Oakville requires one tree must be planted for every healthy tree removed. A $300 security deposit is required by the Town of Oakville for each tree to be planted. Replacement trees must be planted on the same property as those removed. Where it is not possible to properly grow replacement trees on the lot, the security deposit may be donated to the Town of Oakville to plant on nearby Town of Oakville lot. The minimum tree replacement size is a 30-mm caliper (3 cm width) deciduous tree, or a 150-cm high coniferous tree in a five-gallon container, balled in burlap, or in a wire basket.

Final lot grading certificates signed by a registered professional engineer must be submitted to the Town of Oakville upon completion of the lot grading.

Peak regulated post-development storm water flow must not exceed pre-development conditions of the storm water flow. The site servicing, grading and drainage and the stormwater management should be designed such that the post-development site stormwater run-off is equal to or less than the pre-development site stormwater run-off. If the project will increase the impervious area of a lot, then more stormwater is likely to runoff from the site than before. To prevent this extra stormwater runoff, a filtration-retention device large enough to retain/detain the added stormwater runoff shall be designed and installed. Site servicing, grading and drainage plan incorporating appropriate stormwater management shall safely convey the site drainage from the Regulatory Storm (defined as the larger of the 100-year storm or the Regional Storm), without causing flood damage and with minimum inconvenience. The minimum on-site stormwater runoff retention requires to retain all stormwater runoff from a small design rainfall event - typically 5 mm through infiltration, evapotranspiration & rainwater reuse. All erosion and sediment control plans shall be designed in accordance with the Town of Oakville, Region of Halton and Credit Valley / Halton Region conservation authority guidelines for Erosion & Sediment Control.

We prepare engineered Site Servicing, Grading, Drainage & Erosion/Sediment Control Plans and Stormwater Management Reports (or brief) that would fulfill all engineering requirements of the Town of Oakville, Region of Halton and/or Credit Valley/Halton Region Conservation Authority. Having vast experience in municipal engineering design, we offer effective, innovative and cost-efficient Engineered Site Servicing, Grading and Drainage Plans, Erosion & Sediment Control Plan, and Stormwater Management Plan to our clients. Our licensed professional engineers' proficiency in conceptualizing municipal engineering designs and plana in accordance with our clients' requirements has made us very successful.

Our licensed professional engineers prepare thorough, detailed, and clear "Engineered Site Servicing, Grading and Drainage Plan, Erosion & Sediment Control Plan, and Stormwater Management Reports" to suit our client's needs while also adhering to engineering design requirements of the Town of Oakville, Halton Region, and/or Credit Valley / Halton Region Conservation Authority and submit to the Town of Oakville for review and approval to obtain site plan approvals and building permits. Site Servicing, grading and drainage plan incorporating applicable Erosion & Sediment Control Plan and Stormwater Management Report (or Brief) as per applicable Town of Oakville and Region of Halton Engineering Guidelines/lot grading requirements prepared and stamped by our Licensed Professional Engineers would be ready in 10 business days upon receipt of all the required information and documents. It is important to note that many assumptions, methodologies require varying degrees of engineering judgement that may, or may not, be easily adopted by the reviewing public agencies through their critical review of our reports, plans and drawings. No additional charges for required revisions & changes to our drawings and plans due to the comments from the authorities upon reviewing the drawings prepared by us. Following supporting documents may be required to prepare the required site servicing, grading and drainage plan:

- CAD drawing of the site plan showing the following details:
  - Proposed building location, including porches and steps/stairs
  - Proposed/existing road layout including curbs, sidewalks
  - Proposed /existing fencing including acoustical, privacy and flankage fencing
- CAD drawing of the topographic survey showing the elevations of the following:
  - Spot elevations within the project site, minimum 5 m outside the lot boundaries including curbs, sidewalks and centre line of the road and at reasonable intervals within the lot and along the boundaries including driveway, lot corners, intermediate points of grade change, the door step elevation and finished floor elevations of adjacent lots
  - Lateral invert elevations of water, sanitary, storm service connections at the street line.
  - Grate and invert elevations of all catchbasins
    - Elevations of any existing swales, ditches, culverts, creeks, watercourses, ravines, and drainage easements/routes complete with inverts.

•Architectural & Structural Drawings showing

- Proposed elevations including finished first floor, basement floor, top of foundation wall, underside of footing and garage entrance.
- Engineered fill and extended footing information, where required
- Sill elevations at side entrances where elevation differs from the finished first floor
- The number of risers at each entrance
- Proposed roof downspout locations
- Proposed Retaining Walls

•Arborist Report & Landscape Architect Drawings Showing

- Existing trees to be preserved
- Proposed locations for all tree protection zones

•Plan-profile drawings of municipal Sanitary Sewers, Storm Sewers and Watermains

•Record of locates from Ontario One Call (On1Call) for existing utilities.

•If applicable, Location of well(s) and septic system(s) with offsets from the proposed development.

•If applicable, locations of any regulatory flood lines or development limit lines (i.e. setback and slope stability limits from the Credit Valley / Halton Region Conservation Authority).

For Additional Information Contact:

Edgar Labuac, P.Eng - Principal Municipal Engineer

Joo Min Park, M.Eng - Senior Municipal Engineer

Building Experts Canada Ltd

Call Anytime (416) 332 1743

buildingexpertscanada@yahoo.com

Text Message: (416) 727 8336