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Chapter 9
Grading

Design Specifications & Requirements Manual

October 2003

Updated January 2026

City of London
Design Specifications and Requirements Manual

The design information contained in this manual is intended to provide guidance beyond legislative and standard design practices for use in the City of London (the City). There will be site specific situations where the design will depart from these practices as it is not possible nor is it the intention of the City to anticipate every situation. The City intends to review and revise the Manual from time to time. The City also acknowledges that other references such as the 'Standard Contract Documents for Municipal Construction Projects' are to be used in conjunction with this manual. The 2012 update of this manual incorporates design information from the City's former 'Subdivision & Development Guide Manual' to provide consistent and current design information for development projects.

The City of London maintains its right to accept or refuse any design submissions and requires an acceptable design for any given circumstance.

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9 Grading

9.1 Grading Requirements for Various Situations

Grading in a plan of subdivision, site plan (guidelines where applicable) and infill lots are to be designed by a Professional Engineer and certified by a designated professional (as per the Subdivision Agreement clauses, Drainage By-Law and Building By-Law) and are to be in accordance with the following standards:

9.1.1 Subdivisions

Developments created by a draft plan of subdivision shall conform to the following lot grading standards and will not adversely affect the abutting or adjacent properties.

9.1.2 Site Plans

Developments subject to site plan approval are to be graded and drained internally in compliance with the Drainage By-Law and should not adversely affect adjacent properties. The sites grading and drainage shall conform to the overall drainage pattern of the adjacent lands as certified by the design engineer at the time of the permit for each building. On site grading will also be subject to the Site Plan Control By-law.

9.1.3 Severances, Lifting of Part Lot Control & Infill Lots

Developments created by severance, lifting of Part Lot Control and infill lots for residential lots shall conform to the lot grading standards in a plan of subdivision and are not to adversely affect the abutting and/or adjacent properties.

9.1.4 Blocks

Development on blocks within registered plans of subdivision are subject to site plan approval (as above). Drainage and grading of such blocks shall conform to the accepted overall subdivision design and shall be certified by the site design engineer.

9.1.5 Capital Projects

When grading is required, the designer shall determine match points that appear to naturally blend proposed design grades with existing topography. Consideration shall be given to transitions with intersecting streets, driveway profiles, drainage, utilities, existing retaining walls, potential impacts on trees and other landscaping features. Wherever possible, the designer shall take every opportunity to eliminate or reduce the size of existing retaining wall owned and maintained by the City. Consideration should

also be given to maintenance and aesthetics of grassed areas such as lawns and boulevard areas.

Grades should not be altered around trees on the basis of 10cm of distance from the stem for each 1cm of trunk caliper at 30cm above ground.

While a 4:1 slope or greater is desirable from a maintenance perspective, a maximum 3:1 slope is acceptable.

Proposed driveway grades shall not exceed 10% unless approved by the City's Contract Administrator.

9.1.6 Parks and Open Space

Overall grading of Park and Open Space Blocks within new plans of subdivision shall conform to the master grading plan for the subdivision and must accommodate overland flow routes, etc. Detailed grading within Parks and Open Space areas will be according to **Chapter 11, Parks and Open Spaces**. Technical servicing requirements will be subject to the provisions of **Chapter 5, Storm Sewer Collection System.**

9.1.7 Variations / Modifications

There will be site specific situations where all the criteria may not apply. Proposed grading that does not conform to the appropriate grading requirements standards will be reviewed taking into account the mitigating circumstances that require the proposed variations or modifications.

9.2 Major / Minor Storm Design

As storm sewer systems (referred to as the minor system) are designed to accommodate storm runoff from a 5-year storm event, the lot grading design (referred to as the major storm system), must be designed to accommodate runoff from storm events that exceed the design capacity of the storm sewer system. These allowances, in the form of major overland flow routes, shall provide for the effective routing of major overland storm flow from residential areas to an acceptable overland flow outlet location.

When designing overland flow routes, the following criteria shall apply:

- The Major overland flow routes are generally to follow low areas in subdivision grading and be in compliance with an accepted stormwater management report.
- In order of preference, overland flow routes should be directed along:
    1. Expressway
    2. Rapid Transit Boulevard

3. Urban Thoroughfare
4. Civic Boulevard
5. Main Street
6. Neighbourhood Connector
7. Neighbourhood Street
8. Parks, open spaces
9. Dedicated municipal easement - Refer to **Chapter 6, Stormwater Management Requirements**.

- The conveyance of major overland flows up to the 100-year storm event should be contained within the municipal right-of-way or dedicated easement(s) and the major storm flows safely conveyed.
- In addition to the above, the adequate conveyance capacity of major overland flow routes must be demonstrated for the proposed design of raised intersections and/or raised crosswalks and shall also comply with **Section 5.16.6.**
- The conveyance of major overland flow between adjacent buildings on private property/properties must be avoided. For example, major overland flow from an upstream catchment should not be conveyed between residential houses.
- The maximum allowable ponding at gutters on roads is 300mm.
- Building opening elevations adjacent to overland flow routes on roadways shall be at least 300mm above the road centreline elevation.
- For buildings abutting overland flow routes, the major storm elevation should be identified and must be safely conveyed (i.e., ground elevations and any window openings must be higher than the major storm). For small rear yard drainage catchments (maximum 4 lots), a minimum freeboard of 225mm must be provided between the ‘spill point’ and the ground elevation of the abutting buildings.
- The maximum ponding permitted at rear yards catch basins is 450mm.
- The maximum ponding permitted at parking areas in Multi-family, commercial and institutional blocks is 300mm.
- Accommodate all overland flow routes into a stormwater management pond (if applicable).
- Show existing and proposed major overland flow route directional arrows on all grading drawings.

9.3 Grading Requirements Along Proposed / Existing Roads

9.3.1 Major Roads

Please see **Figure 9.1**.

9.3.2 Other Situations

On all other streets not mentioned in **Section 9.3.1** above, the owner shall grade the property line and adjacent boulevards so that they blend with the proposed or existing street grades in accordance with the City of London Utility Coordinating Committee Standard Utility Locations, U.C.C.-1M and U.C.C.-2M, and to the specifications of the City Engineer. Refer to Section 1.1.3 a) for further UCC-1M design criteria and Section 1.1.3 b) for further UCC-2M design criteria.

9.4 Grading Standards

The following standards are to be considered when designing lot and adjacent boulevard grading:

9.4.1 Drainage

- The boulevard and a minimum 6.0m at the front of any residential lot must drain towards the abutting road.
- Show the location and direction of drainage along the rear and side lot lines.
- Show one drainage direction arrow for each change in grade for all lots.
- The drainage from single-family lots in the same subdivision may be drained between other single-family lots (from back to front).
- The drainage from impervious areas on lots in a new subdivision is not to flow across existing lots abutting the new subdivision.
- The drainage from single-family and semi-detached lots is not to drain onto multi-family, commercial or institutional blocks (with the exception of the overland flow routes).
- All multi-family, commercial and institutional block drainage is to be self-contained.
- Where a new subdivision abuts an existing development or undeveloped land, the existing ground elevations at the common property line are to remain

unchanged and existing drainage of abutting lands is not to be disturbed, or obstructed, unless written permission is granted by the affected land owner.

- Surface flow conveyance in the minor storm event over pathways is not recommended. It is expected that it does not create continually wet ground conditions and/or does not create any adverse effect upon pathways including but not limited to icing. Drainage and conveyance of these flows shall be designed to the satisfaction of the City.
- Localized surface drainage from abutting properties, to be developed in future, may be discharged onto the proposed lots in a subdivision.
- Identify existing vegetation and set grades to retain where possible.

9.4.2 Elevations

- Show existing elevations by contours. Contours are to extend a minimum of 30m beyond the limit of the site plan, or subdivision.
- Show existing spot elevations at all lot/block corners along the boundary of the development, and along all major overland flow routes.
- Show existing centreline of road elevations every 30m for existing, abutting and connecting streets.
- Show existing spot elevations around existing house/units and at house/unit openings for new proposed major overland flow routes through existing developments.
- Show proposed elevations on **all** corners of the proposed lots.
- Show finished ground elevations around house/unit.
- Show final centreline road elevations, every 30m as well as at break points and high and low points in the road profile. Identify (label) the break points, high/low points.
- Show proposed elevations at all high points or break points where the direction of drainage along rear and side lot lines changes.
- Show proposed bottom of swale elevations at pertinent intervals, and at property lines.
- Show proposed elevations at the top and bottom of all steep slopes (max 3H:1V).
- Show proposed top and bottom retaining wall elevations.
- Show proposed top and bottom noise barrier wall elevations.

9.4.3 Slopes

- Yard surfaces shall have a minimum slope of 2%.
- Front yard surfaces shall have a maximum slope of 10%.
- Rear yard/side yard (walkouts/back splits) surfaces including swale cross-falls shall have a maximum slope of 3H:1V.
- Berms shall have a maximum slope of 3H:1V.
- Road and boulevard surfaces shall have a minimum cross-fall grade of 2% and a maximum cross-fall grade of 4% in new subdivisions or developments.
- Driveway surfaces shall have a minimum grade of 2% and a maximum grade of 10%.
- Specify stepped foundations, side to side for lots fronting streets with a road grade of more than 3%.

9.4.4 Swales

- Drainage flows which are carried around houses are to be confined in defined swales, located as far from the house as possible.
- Minimum swale grade is 2%.
- Maximum of 4 lots draining to a rear yard swale, outletting to a rear yard catch basin.
- Maximum length of swales permitted is 50m or a maximum tributary drainage area of 3,700m^2, outletting to a rear yard catch basin.
- The maximum flow allowable in a side yard swale or a swale discharging across a boulevard onto a City Right-of-Way shall be that from 4 backyards.
- The side yard swale is to be a minimum of 150mm lower than the finished ground elevation at the house.
- The average rear yard swale depth is 225mm. The minimum swale depth allowed is 150mm. The maximum swale depth is variable but is dependent on location and safety considerations.
- Show the location and direction of flow in swales by means of arrows. Show at least one arrow at the rear of each lot.

9.4.5 Catch Basins

- The maximum length of swales permitted to drain to a catch basin is 50m or a tributary drainage area of 3,700m^2.

- A maximum of 4 lots draining to a rear yard catch basin is allowed.
- Front yard catch basins are not permitted, except in unusual circumstances where a rear yard catch basin cannot be provided.
- No surface ponding is allowed during a 5-year design storm event.
- Under a 100-year design storm event, 300mm surface ponding is allowed at catch basins within impervious catchment areas, and 450mm surface ponding is allowed at catchbasins within grassed catchment areas.
- Flat see-saw profiles (identical high and low points) will not be allowed in either road profile designs or rear yard swale designs. See-saw profiles must slope in a cascade that allows major storm flows (Overland Flows) to drain along the road or lots to an acceptable Overland Flow Outlet.
- In reconstruction projects within existing developed areas of the City, where the existing profile and driveway conditions cannot accommodate a cascading see-saw profile, the proposed profile must provide for adequate road drainage and be acceptable to the City Engineer.

9.5 Additional Information to be Shown on Plan

Grading Plans shall be designed in accordance with the standards listed above, and will contain the following information where applicable:

Table 9.1 Information to be shown on grading plans

Required Information	Where Applicable Information
• Standard City of London Title Block • North Arrow • P. Eng. Stamp • Street Names • Lot and Block Frontages • Lot and Block Numbers • 0.3m Reserves • Existing Features (trees, fences, houses, etc.) • Erosion & Sediment Control Measures • Delineation of Proposed Unit/House • Maintenance Holes • Fire Hydrants • Catch Basins	• Sidewalk Ramps • Sewer Easements and Widths • Building Setbacks for Rear Yard Catch Basin Leads • Steep Slope Lines (3:1 desirable) • Sidewalks to be Constructed • Headwalls (Inlets/Outlets) • Channels • Pedestrian Walkways (fencing, posts, width and driveways) • Noise Barrier Walls and Details • Natural Heritage System Components • Ecology Buffers

9.6 Grading Notes

The following notes are to be included on the Grading Drawings:

- Existing drainage of abutting lands is not to be disturbed.
- Localized surface drainage from abutting properties to be developed in future may be discharged onto the proposed lots in this subdivision.
- Basement openings to be minimum 300mm above the centreline of road unless otherwise approved by the City Engineer.
- Ground elevations at houses abutting overland flow routes are to be 225mm above overland flow route elevations.
- Retaining walls, 1.0m high or greater, are to be designed by and constructed to the specifications of a registered professional engineer in accordance with the Ontario Building Code.
- **For Subdivisions and Site Plans:** Sump pump discharge must be directed to the storm sewer via the storm private drain connection as per the Drainage By-Law Section 5.7(i) and 5.7(v).
- **For Other Cases:** Sump pump discharge must be directed away from driveways and sidewalks.

9.7 Erosion & Sediment Control

The City of London requires an Erosion & Sediment Control Plan (E&SC Plan) be designed for most Capital Works, Operational and Development Projects. The complexity of the E&SC Plan is determined by the sensitivity of the area that is to be protected.

For reconstruction or resurfacing of existing roads, or for infill sites less than 3.0ha in land area within existing urbanized areas, that are not in close proximity to an open watercourse, woodlands, ESA's, steep slopes or other natural area; an E&SC Plan is not required, unless otherwise directed by the City Engineer. Where an E&SC Plan is not required, all reasonable protective measures must be taken during construction to control sediment and prevent erosion from occurring.

For further information on the requirements of the E&SC Plan, please refer to **Chapter 10, Erosion and Sediment Control,** within this manual.

9.8 Standard Drawings for Grading Design
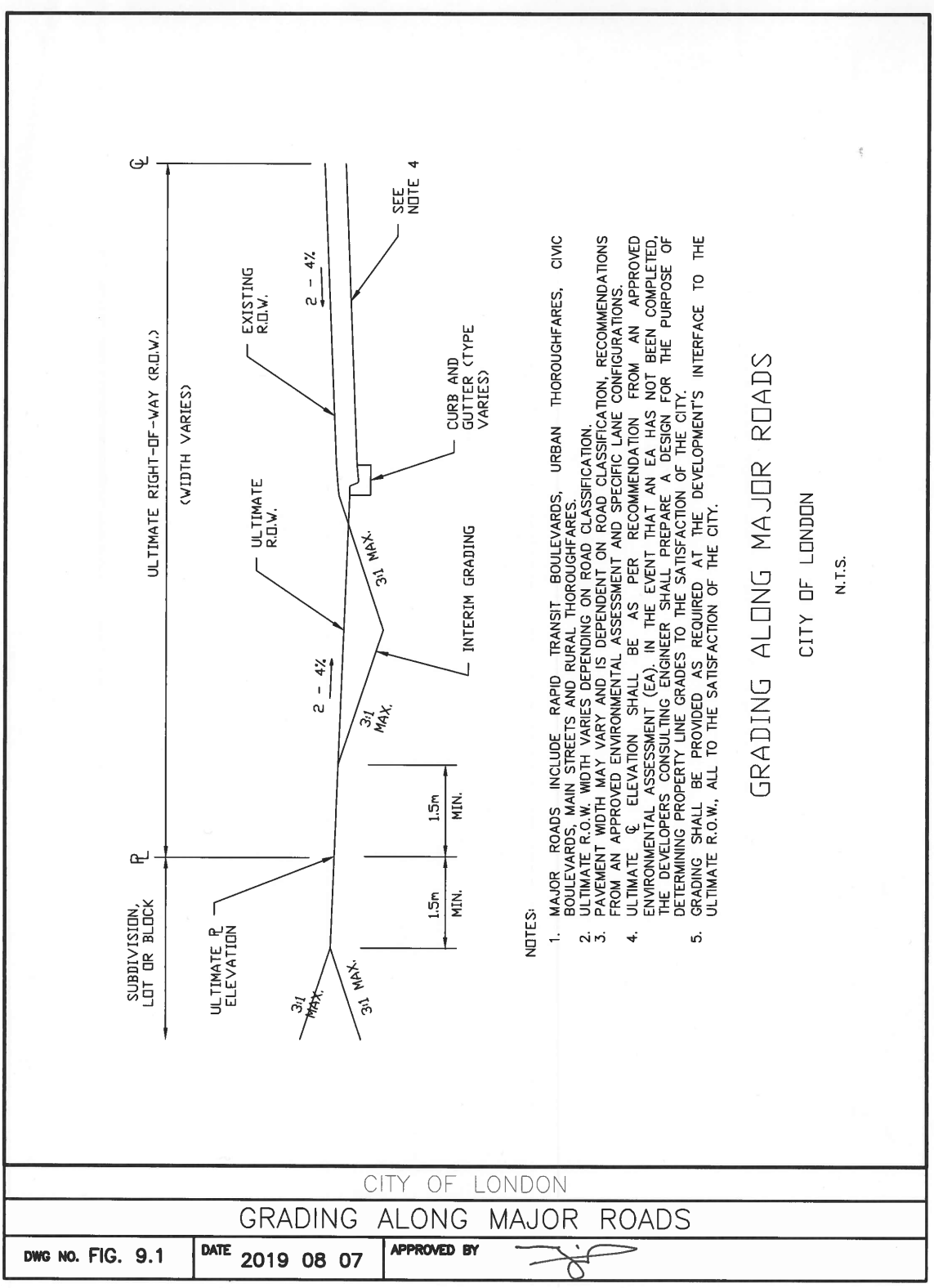
Figure 9.1 Grading along major roads