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Chapter 18

Drafting and Design Requirements

Design Specifications & Requirements Manual

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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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18 Drafting and Design Requirements

Except where identified as a specific requirement pertaining to subdivision or site plan, all drafting and design requirements noted herein are required for development submissions.

18.1. Basic Drawing Requirements

Drawings are to contain the following details:

- a) A list of “Construction Notes for Engineering Drawings”. Note, all required reports associated with the design and as per Council Conditions, Approval Authority Conditions and Ontario Municipal Boards Conditions are to be listed onto the details drawings;
- b) A general list of most common standards used [Ontario Provincial Standard Drawings (OPSD) & City of London]; and
- c) A typical road and sewer trench cross-section detail identifying road, boulevard, sidewalk, curb & gutter, subdrains, watermain, forcemain sanitary & storm sewers, trench zones/slopes, bedding, together with all applicable dimensions and construction notes for the above.

18.1.1. Transportation Drawing Requirements

- a) Road Plan Profiles

Road plan profiles are required for all roads constructed within or in conjunction with a plan of subdivision. As well, additional road profiles are required as follows:

60m Road Plan Profile of Adjoining Existing Street:

To ensure proper drainage is maintained and/or evaluated a profile extending into the existing subdivision is required.

120m Road Plan Profile of Adjoining Future Street:

To review future alignment extensions of existing ground and proposed finished ground.

- b) Typical Road Cross-section Detail

A typical road cross-section detail, identifying recommended pavement structure and subgrade information (minimum to City of London standards, and as recommended by a Geotechnical Engineer) is required in conjunction with the

typical sewer trench cross-section detail. Curb & gutter cross-sections to be incorporated into the typical combined road and sewer trench cross-section detail.

c) Driveway Locations (Subdivision Specific)

Driveway locations are to be identified where non-standard cul-de-sacs and curves in the roads are designed, adjacent to walkways, CICBs and the last lot on dead end streets.

d) Cul-de-sac Roads (Subdivision Specific)

- **General:** Minimum curb & gutter road grade around a cul-de-sac is 0.5%, and maximum road grade within the cul-de-sac is 3%.
- **Residential:** As per City of London Drawing Standard SR-5.0.
- **Industrial:** As per City of London Drawing Standard SR-5.1

e) Ultimate Road Profile

To achieve proper road design parameters on future/proposed major road networks. Limitations and designs are to be reviewed and accepted by Transportation Division.

Note: Existing abutting road plan & profiles are required for the full frontage of subdivision.

18.1.2. Sewer Design

a) Connections to Future Subdivisions

Sanitary and Storm sewers are to be extended to the edge of the subdivision limit for future servicing connections.

Note: All active sewers/stubs require a maintenance hole. If sewer/stub is not active, then maintenance hole is not required.

b) Plan & Profile Details

A plan & profile drawing is required for all sewer designs. A typical sewer trench cross-section and details are also required. This may be done in conjunction with the road cross section, if applicable and required when.

- For poured maintenance holes
- Unusual benching configurations within the maintenance holes

Note: Trench construction to be in accordance with the latest specifications regarding trench widths (Occupational Health and Safety Act – Regulation 213/91).

c) Steep Grades of Sewers

Note: Anchoring or concrete encased sewers are required for steep grades and/or velocities.

d) Consultants shall provide a table demonstrating adequate crossing clearances between services (sanitary/storm/water) on the engineering drawings for site plan applications or when otherwise requested by the City. All crossings clearances shall be in accordance with City standards, to the satisfaction of the City. The table shall generally conform to the example as provided below:

Example of sewer crossing chart

Sewer Crossing Chart						
CID	Pipe Under	Elev.	Pipe Over	Elev.	Clearance required (m)	Clearance provided (m)
C1	300 STM	XXX.XXX	50 WM	XXX.XXX	0.XX	0.XXX
C2	300 SAN	XXX.XXX	200 STM	XXX.XXX	0.XX	0.XXX
C3	100 WM	XXX.XXX	600 STM	XXX.XXX	0.XX	0.XXX

18.1.3. General

a) Drafting Standards

All capital, subdivision, and site plan drawings and calculations are to be completed in metric units and shall adhere to the City of London's Engineering Record Drawings - Drafting Standards (Revised February 2018) and templates (including title blocks, font sizes, and linetypes). Drawings submitted as part of the review process prior to record drawings, to be shown in colour. Refer to section 18.11, Standard Drawings for Drafting and Design for examples

b) Layout Information

For all fire hydrants, maintenance holes, catch basins, etc., layout information is required or alternatively a note indicating the use of UTM Coordinates

c) Temporary Measures

Temporary measures (i.e. DICB, ditches, maintenance holes, turning circles, grading, barricades, easements, etc.) may apply to some designs depending on the planning and future connections of the development, and where applicable, these guidelines are to be adhered to, unless otherwise approved by the City Engineer.

d) Example Drawings

Refer to section **18.11, Standard Drawings for Drafting and Design**

Note: Details for the above should be provided on all pertinent drawings.

18.1.4. Forestry

The following are to be shown on plan and profile drawings on existing streets and on the Tree Planting for new streets, as required by Forestry:

- a) Tree planting;
- b) Tree preservation; and
- c) Tree removal.

18.1.5. Parks Planning & Design Division

The following are to be shown on lot grading plans, tree preservation plans and/or detail drawings within lots/blocks and open space areas, as required by Parks Planning & Design Division:

- a) Tree planting;
- b) Tree preservation;
- c) Tree removal;
- d) Park grading;
- e) Pedestrian system;
- f) Park design; and
- g) Landscaping plan.

18.1.6. Other Nonstandard Drawing Requirements

For more complex requirements, details drawings are required for the following:

Table 18.1 Nonstandard design elements and drawing requirements

Design Elements	Drawing Requirements
Stormwater Management Details and Notes	• Longitudinal and lateral cross-sections of the stormwater management pond and sediment forebay and details; • Inlet/outlet cross-section and details; • Perforated riser cross-section and details; • Maintenance/pedestrian access cross-section and details; • Outlet swale/ditch plan & profile and cross-section details; • Orifice plate cross-section and details • 100-year & 250-year flood elevations
Poured Maintenance Hole Chambers	• Plan & profile; and • Frequent cross-sections and details
Noise Barrier Wall Details and Notes	• Typical profile view of noise barrier wall and footings; • Cross-section view of noise barrier wall and footings; • Cross-section view of brick pillars and footings; and • Cross-section view of wood posts and footings
Noise Barrier Berms	• Plan & profile; and • Frequent cross-sections, details and notes.
Retaining Wall Details and Notes	• Typical profile view of retaining wall and footings; • Profile required for relatively high (1.0m or greater) and long retaining walls; and • Cross-sections views of retaining wall.
Headwall Details	• A plan & profile detail is required for all headwall designs together with all pertinent details.
Traffic Calming Measures Details and Notes	• Plan & cross-section views of type of traffic calming measures and details; and • Curb cross-section details.
Access Roads Details and Notes	• Plan & profile of access road; and • Cross-section view of access road and details.
Abutting an existing or proposed major road	• Required where the common property line of the proposed development plan abuts an existing or proposed major road, as per City of London Standard “Grading Along Major Roads” (See Chapter 9 Figure 9.1.).
Construction Roads	• Plan & profile of construction road; and • Cross-section view of construction road.
Pedestrian Pathway Systems Details and Notes	• Plan & profile drawing and details; and • Cross-section view of pedestrian pathway systems.
Erosion & Sediment Control Measures	• Plan & profile of attenuation and sedimentation measures (i.e., basins, check dams, etc.); and • Cross-section of all pertinent measures
Other Non-standard Works or Services	• Plan & profile; and • Cross-section details; as required by the City Engineer.

18.2. Other Agency Approvals

18.2.1. Utilities Coordinating Committee (U.C.C.)

a) Works on Existing Assumed Streets:

U.C.C. is to be advised about all works on existing assumed streets other than lateral connections.

b) Non-Standard Service Locations:

U.C.C. approval is to be obtained for all proposed services which are to be constructed in non-standard locations on new or existing streets.

c) Sub-Standard Boulevard Widths and/or Non-Standard Road Widths:

Consultant is to notify all utilities regarding sub-standard boulevard widths, non-standard R.O.W. widths and utility easements required adjacent to sub-standard boulevards through U.C.C.

18.2.2. Board of Education

Board of Education approval is required for all services which are constructed on their lands. As well their approval is required for proposed services to a proposed/existing school block.

18.2.3. Conservation Authority

Review and approval from the local conservation authority is required, prior to the construction, of works, services and Erosion & Sediment Control measures within floodplain areas and in or adjacent to open watercourses, ravines and natural areas under the jurisdiction of the local conservation authority.

18.3. Temporary Measure Design Requirements

18.3.1. Temporary Turning Circles (Subdivision Specific)

Temporary turning circles are required if no intersecting street is within 45.0m of a dead end street as per City of London Drawing Standard SR-5.2.

18.3.2. Dead-End Street (Subdivision Specific)

If a temporary turning circle is not warranted, then a dead-end barricade is required, as per OPSD-973.130.

Note: A driveway for maintenance vehicles must be provided on the last lot of the dead-end street, but not adjacent to the development limit. Sufficient snow storage area must be provided at the end of a dead-end street without a temporary turning circle.

18.3.3. Work on Existing City Streets

When proposed works from a development are to extend and/or be constructed on existing City Streets, the following is required:

- a) limits of construction;
- b) sawcut/milling/steep milled joint;
- c) backfill & compaction specifications; and
- d) restoration details.

Note: Steeped milled joint is required for all proposed road widenings, and where proposed asphalt designs meet existing asphalt designs, as per City of London Drawing Standard SR-13.1.

18.4. Erosion Measures

See Chapter 6 Section 6.5.8, Erosion Measures. For temporary sediment and erosion control measures, see **Chapter 10 – Erosion and Sediment Control** for details.

18.5. Planning Related Design Requirements

18.5.1. Road Geometrics / Design

- a) Road Widening

Where a development abuts an existing City street, road widening may be required for future or present improvements to these streets. The City's Official Plan Transportation Map and the City of London's Zoning By-law Z-1 classifies roads throughout the City as Rapid Transit Boulevard, Urban Thorough, Civic Boulevard, Urban Thoroughfare/Civic Boulevard in Primary Transit Area, Main Street, Rural Thoroughfare or Neighbourhood Connector. All other roads are considered to be Neighbourhood Streets.

- b) 0.3 metre Reserves (Blocks)

0.3 meter reserves along block frontages and at the rear and/or flankage of lots which are adjacent to major roads, where applicable (outside of right-of-way) and are also required at the dead end of proposed road networks which abut future proposed road networks and where roads in a subdivision abut lands outside the subdivision.

18.5.2. Minimum Lot Frontages

In most cases the zoning by-law adequately satisfies requirements for minimum frontages for single-family and semi-detached lots. However, where bends in streets occur or on cul-de-sacs, lots must be designed such that when side lot lines are projected to the fronting curb, an adequate frontage is provided at the curb line to avoid conflicting driveway locations. These minimum frontages at the curb line are as follows:

- Single-family, 6.7m
- Semi-detached, 9.0m

18.5.3. Noise Barrier Walls

18.5.3.1. Noise Barrier Walls General

Noise barrier walls are required for residential developments which back onto or flank major roads, or as otherwise required in accordance with the draft plan of subdivision conditions and City practices.

All noise barrier wall designs are to comply with the accepted Noise report and meet the minimum requirements and specifications of the Ministry of Transportation noise barrier wall guidelines (MTO Environmental Guide for Noise).

Note: Noise barrier walls for uses other than along major roads are to comply with Ministry of the Environment “[Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning \(NPC-300\)](#)” (Aug 2013, or as otherwise amended) requirements and approved by Development Services.

18.5.3.2. Noise Study/Report

Required when the proposed subdivision or development is situated within certain design setbacks from a Provincial Highway or Railway, as per the Ministry of the Environment “[Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning \(NPC-300\)](#)” (Aug 2013) and/or as indicated in the draft plan conditions and/or subdivision agreement, all approved by Development Services.

All recommendations and details from noise barrier wall studies/reports are to be reflected on the servicing drawings.

18.5.3.3. Noise Wall Location

Major Roads:

- a) Masonry/Concrete:

Wall, posts and brick pillars are to be located on City property within the proposed 0.3m reserve and maintained by the City.

b) Wooden:

Wall, posts and brick pillars are to be located entirely on private property and maintained by the owner.

c) Other Situations:

Locations as per the approved Noise Study (i.e. berms/walls adjacent to railways, etc.).

18.5.3.4. Minimum Height

2.4m above ultimate centerline road profile design or as required by an accepted Noise Study.

18.5.3.5. Material Density

Ministry of Environment Criteria - Minimum surface density of 20 kg/sq.m (4lbs/sq.ft).

18.5.3.6. Materials

a) Masonry/Concrete:

Constructed of a concrete material with a surface density of 20kg/sq.m. (4lbs/sq.ft.). Previously accepted masonry/concrete walls: Durisol and bricked.

b) Wooden:

Constructed of a wood material with a surface density of 20kg/sq.m. (4lbs/sq.ft.). Previously accepted wooden walls: Western Red Cedar, Red Wood and Yellow Cyprus.

18.5.3.7. Noise Wall/Retaining Wall Combined

Where the property line along the road undulates requiring the use of retaining walls, the standard 2.4m wall can be reduced to a minimum of 1.1m wall in hill sections.

Note: the overall combined noise wall and retaining wall height, must be 2.4m above the ultimate centerline road profile design or as required in the accepted Noise Study.

18.5.3.8. Site Lines

Site lines to be maintained in accordance with Section 4.24 of Zoning By-Law Z-1.

18.5.3.9. Return End Walls

Required at the end of all proposed noise barrier walls which terminate at an abutting property which does not have an existing noise barrier wall present or where an opening is required (e.g. at a walkway).

18.5.3.10. Gaps/Holes

To be free of any holes or gaps within and at the bottom of all proposed noise barrier walls.

18.5.3.11. Drainage

Proper surface drainage to and away from the noise barrier wall is required for all proposed designs.

18.5.3.12. Overland Flow Routes Through Noise Barrier Walls

In exceptional situations, an adequately designed opening in the wall is required to allow overland flow route to pass through the wall, in conjunction with a toe wall or berm behind the opening in the wall to provide a supplemental noise attenuation measures at the opening.

18.5.3.13. Details

A typical profile view of the noise wall/footings is required together with cross-sections and details for any pertinent brick pillars/footings and wooden posts/footings, which are to comply with the Ontario Building Code.

18.5.4. Municipal Emergency Communication System

The Municipal Emergency Communication System is an integrated public safety radio system that moves voice and data communication between the tower locations, dispatch centres and user gear throughout the City. The system has two components; the interoperable radio network, and the microwave backhaul that connects the base stations to the core network. The microwave backhaul is based on “Line of Sight” (LOS) propagation, which requires that individual sites maintain visual contact between two or more points within the Emergency Communication System to ensure an unobstructed signal path transmission.

As a condition of development approval, the developer may be required to undertake a technical study — to be completed by a vendor deemed appropriate by the Director, Emergency Management and Security Service — to understand the impacts of a proposed development and identify associated mitigation measures.

Prior to entering into an agreement with the City, the mitigation measures to rectify impacts to the Municipal Emergency Communication System identified in the accepted technical study shall be implemented; this may be accomplished through the accepted drawings (e.g., adjusting the location of the building(s) on site) or included as provisions of the agreement to be registered on title of the property.

18.6. Storm Culvert

Refer to Chapter 6 **Section 6.5.5 – Storm Culverts** for details

18.7. Storm Channels

Refer to Chapter 6 **Section 6.5.6 – Storm Channels** for details

18.8. Storm Ditches

Refer to Chapter 6 **Section 6.5.7 – Storm Ditches** for details

18.9. Narrow Lot Servicing

In cases where the [Zoning By-law](#) permits for narrow freehold lots (e.g., Residential R4 Zone), the minimum frontage shall be 6.7 metres.

18.9.1. Narrow Lot Servicing Standard

The Narrow Lot Servicing Standards **Figure 18.1**, is intended, primarily, for use with street townhomes and shall be considered an applicable servicing strategy where the following criteria has been met:

- Dwelling and lot frontage are parallel to the property line and along a straight segment of the road.
- Narrow Lot Servicing Standard detail has been included within the drawing set.
- Drawings show each individual service to each narrow lot within the site.
- Setbacks are in accordance with current applicable zoning by-laws and are dimensioned on the drawings.
- All overland flow routes, rear-yard catch basin leads, utilities, hydrants, streetlights, etc. are adequately accommodated and will not be impacted by future excavation of the individual services (e.g., maintenance/repair).

18.9.2. Site Plan Requirements

If undertaking narrow lot servicing through the Subdivision process for lots that are subject to Site Plan Approval, the applicant shall initiate the Site Plan Application process prior to subdivision drawing acceptance to ensure that unit configurations are not required to change.

18.9.3. Deviations

Any deviation from the Narrow Lot Servicing Standard above will be subject to further examination through the drawing review process for adherence to all applicable standards.

18.10. Site Alteration Applications

The following information is provided to assist designers in preparing drawings to be submitted in conjunction with Site Alteration applications.

18.10.1. Environmental Protection Measures

- Indicate the location of all Environmental Protection Areas, as defined in the by-law, located on or adjacent to the site, and delineated with appropriate fencing.
- Show the location of all trees and shrubs, including the species, size of caliper, and any protection measures required in accordance with an accepted Tree Protection Plan.
- Refer to **Chapter 12, Tree Planting and Protection Guidelines**.
- Show any Natural Heritage features and buffers or setbacks required in accordance with an accepted Environmental Impact Study, and include a box note on all drawings stating, **“Ecological buffers are not to be used for construction staging or stockpiling.”**

18.10.2. Grading & Earthworks

- Show the proposed rough grade elevations of the site.
- Show all lotting details in zero line weight (ghost lines) if using the subdivision draft plan as the underlying plan.
- Indicate the location of all cut/fill areas.
- Where fill is involved, provide a description of the proposed fill.
- Where fill is involved, provide the proposed final elevations and drainage system to be used upon completion of the filling operation.

- Indicate the location and dimensions of all proposed land disturbing activities, including construction access road(s).
- Indicate the location and dimensions of all temporary soil or dirt stockpiles.

18.10.3. Drainage and Stormwater Management

- Indicate the location and dimensions of any existing and proposed stormwater drainage systems associated with the rough grading and natural drainage patterns on and within a minimum of thirty 30 metres beyond the site boundary.
- Indicate directions of existing, interim, and proposed (post-earthworks) overland flow routes.
- Include provisions for specific controls in locations where flows exit the site (e.g., rock check dams, sediment basins, etc.).
- Areas where future LIDs are proposed should be protected and isolated during construction using applicable fencing/barriers.
- Refer to **Chapter 6, Stormwater Management Requirements**.

18.10.4. Erosion & Sediment Controls

- Indicate the location, dimensions, design details and maintenance provisions for all dust suppressant, and erosion and sediment control measures necessary to meet the requirements of the City Engineer.
- Refer to **Chapter 10, Erosion and Sediment Control**.

18.10.5. Conservation Authority Lands

Acceptance of Site Alterations plans by the City of London does not include any lands regulated by the local Conservation Authority. Where the scope of the proposed site alteration works include or are directly adjacent to regulated lands, the following shall be included on all drawings:

- A boxed note shall be provided stating **“Site Alteration acceptance by the City of London excludes Conservation Authority lands. Any proposed works shown within Conservation Authority regulated lands are subject to Section 28 approval.”**
- Limit of the regulated lands shall be clearly labeled and delineated.
- The regulated lands shall be shaded/hatched to be visually distinct.

18.11. Drafting Standards and Submission Requirements

Engineering Record Drawings form an important part of the City of London's municipal infrastructure records, and the establishment of a drawing standard is designed to ensure all of the essential information is represented on the drawings in a clear and consistent manner. The Engineering Record Drawings represent the certified record of constructed works. These drawings provide a permanent record that supports GIS inventory maintenance, mapping and modelling, asset management programs, operational maintenance programs, and ultimately future replacement. The Engineering Record Drawings drafting standards and submission requirements have been designed to satisfy all of these needs.

These drawing standards cover both the cartographic aspects of plans as well as the digital format of the associated CAD files.

The drafting standards and Engineering Record Drawing review and approval are administered by the Geomatics Division and any questions can be submitted to the Geomatics Division by emailing geomatics@london.ca.

18.11.1. Scope of Engineering Record Drawings

This covers the City of London's Computer Assisted Drafting (CAD) standards and plan submission requirements that apply to Engineering Record Drawings reviewed and approved by the Geomatics Division.

The Engineering Record Drawings are required for engineering works that are owned or will be assumed by the Corporation of the City of London, including:

- a) All public works projects built under contract with the City of London including new or replacement linear infrastructure projects (e.g. water, sewer, streetlights, telecommunications installations) that are associated with capital road widening projects or infrastructure renewal projects.
- b) All public works built under Development Agreements including Subdivisions, Condominiums, and Site Plan servicing agreements that will be assumed by the City of London as new municipal infrastructure or when services connect to City of London owned infrastructure. See section 18.11.3.

18.11.2. Outside the Scope of Engineering Record Drawings

Except for the legal boundary survey requirement, these standards do not apply to Design Drawings for which the purpose is to obtain the necessary approvals for a construction project and guide the construction process.

These standards do not apply to legal survey, topographic, architectural drawings, or engineering drawings associated with facilities such as treatment plants, pump stations or bridges.

18.11.3. Applying Standards to Different Projects

The City recognizes that the complexity and scope of Engineering Record Drawings may vary based on the type of project whether the work is located within a congested urban area. Therefore, prior to commencing an engineering design project, it is recommended the Engineering Consultant review with Geomatics the Record Drawing requirements on a case-by-case basis.

Establishing the requirements for the Record Drawings early in the design process helps to alleviate any misunderstandings when the Record Drawings are later submitted to Geomatics for approval.

- a) Site Developments: In the case of site plans limited to water service and PDC installations, for example, the site servicing drawing may be accepted as a Record Drawing without modification.
- b) Subdivision Development: In the case where significant municipal infrastructure is being installed that will be assumed by the City, Record Drawings fully compliant with these standards will likely be needed.
- c) Municipal Infrastructure Projects: For municipal projects, the Consultant may be responsible for locating and showing municipal infrastructure on the Engineering Record Drawings that is unrelated to, but in the vicinity of the constructed works.

18.11.4. Role of Geomatics

Geomatics Division is responsible for Record Drawing review and approval. Geomatics will review the format and content of the Record Drawings to ensure compliance with the drawing standards and will ensure a timely response to submissions.

Geomatics will undertake a GPS field check of the newly built infrastructure. The Drawings may be returned to the Consultant for correction if significant discrepancies are found.

Any securities related to capital or development projects will be retained until all applicable requirements of the relevant Agreement in accordance with the City's Development Security Policy (as amended from time to time) have been satisfied. This includes, where required, the submission and acceptance of complete engineering as-constructed drawings in accordance

with the Design Specifications and Requirements Manual (DSRM), and acceptance by Geomatics

18.11.5. Complete Engineering Record Drawing Submission Package

- a) A complete Engineering Record Drawing submission includes PDF drawings and their associated AutoCAD Civil3D files.
- b) The drawing set may include some or all of the following:
 - Title page
 - Master plan of services
 - Drainage area plans
 - Water distribution plan
 - Grading plans
 - Plan and profiles
 - Notes and details
 - Sewer design sheets
 - Separate signalized intersection drawings set including traffic signal layout drawing (formerly “PHM”), underground, schematics and details
 - Separate streetlight drawing set including wiring notes and detail sheets
 - Separate Telecommunication drawing set
- c) Submissions must be complete and include all reference files, the CTB file, and any other supporting files needed to make full use of the data to support future use of the drawings.
- d) All drawings are to comply with the City’s CAD drawing standards.

18.11.6. Digital Standards

- a) PDFs should be created directly from the source AutoCAD DWG (DWG to PDF.pc3 for example). The PDFs should not include any data references (i.e.: layer information, hyperlinks, or bookmarks). The PDFs should use the “convert all text to geometry” option.
- b) The PDFs shall be generated such that when employing the “wipeout” command, the hard copy generation will not show blacked out boxes on text. (e.g. use true colour 255,255,255 for wipeouts within the DWG.)
- c) The PDF submission should be made as single file, multiple sheet set.

- d) Unless pre-approved by Geomatics, Record Drawings must be submitted in monochrome (B&W); colours are not permitted.
- e) DWG Design files must be capable of being opened by the current version of Autodesk Civil3D and are to be submitted as part of a complete Engineering Record Drawing package.
- f) The files must include an unrotated continuous full scale (1:1) plan view of the project related to the City's Universal Transverse Mercator (UTM) NAD83 (original) coordinate system (i.e. "Model Space" at ground scale) together with an associated continuous profile, as well as final as-constructed Engineering Record Drawing Sheets in "Paper Space" or their equivalent.
- g) Any use of digital topographic information from other sources must be converted, as necessary, to conform to these digital standards.
- h) All continuous line work (arc to line, line to line, etc.) must join precisely and the end point of one line segment must have the same coordinates as the starting point of the succeeding segment.
- i) Plan and Profile AutoCAD drawing scales must be one of the following:
 - 1 = 0.50 (1:500 scale), or
 - 1 = 0.25 (1:250 scale)

18.11.7. Legal Survey Required

The legal boundary limits for all public works projects must be surveyed and monumented by an Ontario Land Surveyor referenced to the City's control network. As part of this work, the surveyor shall perform a title search confirming the ROW limits and monument the project limits and identify and report any title anomalies to the City.

18.11.8. Mapping Coordinates, Datums and Scale Factors

- a) Engineering Drawings must be georeferenced to the City's horizontal and vertical Geographic Referencing systems. The City's horizontal reference system is the **NAD'83 (original) datum** and Universal Transverse Mercator (UTM) projection, Zone 17, and the City's vertical datum is based on the Canadian Geodetic Vertical Datum 1928 (CGVD28) incorporating the 1978 Southern Ontario Adjustment.
- b) Digital files are to be submitted at ground scale, with the project file scaled about the project control point. All dimensions on the plan are to be ground level distances and all elevations must be geodetic.
- c) Location sketches and values for horizontal control monuments and benchmarks can be obtained from the "Control Monuments" version of CityMap on the City's web site.

Note: See 18.11.20 for an example of how to calculate scale factors.

18.11.9. How to Submit

Submissions are to be emailed to geomatics@london.ca as flattened, unprotected PDF files and AutoCAD DWG files. Paper drawing submissions will not be accepted. If a drawing set is too large to be attached to a regular email, Geomatics will send a secure email invitation that will allow the drawings to be uploaded to the City's FTP server. (For security reasons, the City staff cannot access many external FTP sites.).

18.11.10. Use of Engineering Record Drawings

Engineering Consultants may use their own version of a disclaimer subject to approval from Geomatics.

a) Engineering Record Drawings to be Stamped and Signed

The final submission of the Engineering Record Drawings set must be electronically stamped and signed by the Managing Consulting Engineer or their designate prior to acceptance. Plan and Profile drawings updated to reflect the as-constructed condition must be re-stamped, dated and signed. Supporting drawings taken from the Design Drawings set do not need to be restamped unless they have been updated.

By stamping and signing the Record Drawings, the Consulting Engineer accepts full responsibility for all aspects of the newly constructed works shown on the plan in bold line work and listed in the "Constructed Services" schedule. The consultant shall ensure the "Existing Services" are shown to the record drawing in both plan and profile as required, but otherwise assumes no responsibility for them.

Engineering Record Drawings are intended to provide an official record of constructed works for inventory purposes. The City recognizes that Engineering Record Drawings may be required to include third party information to illustrate existing services as part of a single composite drawing. If the record drawings contain third party information that the Managing Consulting Engineer cannot accept responsibility for, an appropriate disclaimer may be used, such as:

This record document has been prepared from design and as-constructed measurements compiled from multiple sources on a best-efforts basis. The signing engineer assumes responsibility for works designed and constructed under their supervision but makes no warranties as to the content, completeness or accuracy of any information provided by others.

b) Permanent Record of Constructed Works Only

Engineering Record Drawings are intended to provide an official record of constructed works for inventory purposes. The City recognizes that Engineering Record Drawings include a different level of detail than may be found in issued for construction drawings. Additional features such topographical landmarks and private utility installations may not be captured in the record drawings. Engineering consultants may opt to include the following disclaimer.

Engineering Record Drawings are provided solely as a documentation of constructed works. These drawings are not intended for use in construction, the design of future projects, or as a basis for engineering decisions.

c) Digital Files are Subject to Distribution

Digital files submitted to the City may be distributed to others, re-used or otherwise modified for other purposes, but the Consulting Engineer is not responsible for any aspect of the derivative products. For further certainty, all documents released to third parties by Geomatics include the following disclaimer:

At your request, The Corporation of the City of London (the City) is providing you with the attached public services infrastructure documents. These documents may contain technical inaccuracies, typographical errors and/or omissions. The documents are provided on an “as is” basis, and the City disclaims all warranties of any kind, either expressed or implied. The City accepts no responsibility for any damages resulting from your decisions or actions based on these documents. You assume all risk in connection therewith, and any damages done or occasioned thereby shall be at your sole risk and expense. In using these documents, you agree to defend, indemnify, and hold harmless the City, its officers, directors, employees and agents, from and against any claims, actions or demands, including without limitation reasonable legal and accounting fees, alleging or resulting from your use of these documents. All rights reserved.

18.11.11. Detailed Plan and Profile Drawing Requirements

Engineering Record plan and profile drawings are to show all existing and newly constructed above and below ground municipal services within the project limits. This may require adding existing services to the drawings that are not part of the newly constructed project. The intent is to consolidate multiple sewer and water drawings into single composite drawing for ease of use going forward.

- a) Newly constructed services are to be shown in heavy line work and typeface on the plan and be listed in the “Constructed Services” schedule on each page. These are the services that the Consulting Engineer certifies when stamping and signing the drawing. These services are to be accurately represented in their true as-constructed location and condition.
- b) Existing municipal services (sewer, water, streetlight, traffic signal and telecommunications infrastructure) that were not part of the construction project but that lie within the project limits are to be represented by light line weights and typeface and listed in the “Existing Services” schedule on each page. Existing services information can be taken from existing Record Drawings or other information provided by the City (e.g. sewer sleuth reports) but should be field verified wherever possible. In cases where there are no records for an existing service the Consultant may be required to undertake additional field work to confirm the location and depth of the service. In such circumstances Geomatics will determine the level of detail needed for the Record Drawings.
- c) Private utilities (e.g. Bell Canada, Rogers Communications, London Hydro, Enbridge etc.) are not required to be shown but they can be left on the Record Drawing plan view portion (not in profile) provided the drawing is not overly congested.
- d) The example Plan & Profile drawing that is available graphically illustrates these standards. The standard border is based on a 22” x 34” page size with ½” margins top, bottom and left and 1” margin right. The plotted grid is 1 cm. square. The only two scales permitted are either 1:500 or 1:250. The City standard plan border, title blocks and schedules are not to be modified or relocated without Geomatics approval.
- e) Except for building outlines, most topographic features, grading, hatching, construction notes etc. are to be removed from Record Drawings. All references to “existing” and “proposed” are to be removed from the Record Drawings.
- f) Match lines are not permitted. Instead, drawing sheets shall overlap each other to some extent.
- g) Assessment parcels and addresses are to be shown, not lots or lot numbers. Municipal numbers shall be denoted “MN XXX”. This information is available from Locates CityMap and the City’s Open Data site.
- h) Plans should show easements with instrument numbers and their associated reference plan and part numbers if they relate to the constructed works. This information should be available from the supporting legal survey.
- i) Survey bearings and dimensions and lot frontages are not to be shown.
- j) The plan should be oriented such that the chainages run West to East or South to North and read left to right.

- k) All dimensions must be in metric in either metres or millimetres. Whole numbers (e.g. “300”) will indicate millimetres and decimal numbers (e.g. “25.4”) will indicate metres -- “m” or “mm” designators are not to be used.
- l) PDC chainages are to be shown to 1 decimal place. All other dimensions in metres are to be shown to 1 or 2 decimal places. All elevations including inverts are to be shown to 2 decimal places.
- m) Pipe lengths in the plan section shall be based on centre of the manhole pots. In the case of large chambers the outline of the chamber shall be shown along with location of the manhole lid(s).
- n) PDC Chainages shall run from 0+000 from the downstream manhole pot towards the upstream manhole pot. PDC’s require a second chainage at street line if the chainage deviates more than 1 metre from the sewer main chainage. PDC sizes should be labelled if other than the “typical” size per the notes.
- o) The water service pipe size is to be noted if other than the “typical” size stated in the notes.
- p) Each plan and profile sheet should include one set of “typical” street dimensions; i.e. measurements from Streetline → Inside Sidewalk Edge → Outside Sidewalk Edge → Back of Curb → Back of Curb → Outside Sidewalk Edge → Inside Sidewalk Edge → Streetline. Street dimensions are not required for every deviation from the “typical”.
- q) Profiles must show the centre-line stations and elevations as per the standard drawing:

Fourth line from bottom	- watermain centreline elevation
Third line from bottom	- storm sewer invert elevation
Second line from bottom	- sanitary sewer invert elevation
Bottom line	- centreline station

If line values are not required, the line should be left blank and not removed.

Centre of road elevations are to be shown within the profile area.

Profiles must include pipe size, material, class, and bedding.
- r) The street name should appear immediately above the profile. The names of side or intersecting streets should appear outside and parallel with the road allowance. The correct spelling and format of the street name must match the official street name shown on CityMap.
- s) Abandoned City services are to be shown on the plan view but not in the profile.
- t) Water valves are to be labeled with the size.
- u) Fire hydrants should include the class (if known).

- v) Manhole ID's must match the City's GIS Manhole ID's which are assigned after the design drawings are approved. Existing manhole ID's can be obtained from Locates CityMap at the start of the design process but new manhole ID's are assigned after the approved design drawings are entered into Sewer GIS. This necessitates updating the drawing set with the new manhole ID's prior to submitting the Record Drawings for review. The ID's must be correlated across plan and profiles sheets, area plans, drainage plans and design sheets.
- w) When transferring services information from existing drawings to the new drawings, the information on the existing drawings shall be transferred with the only changes being to convert the dimensions to metric, as needed, and to update the manhole ID's.
- x) LID drainage systems shall be identified on the plan portion of the drawing with a reference to a notes and details page.

18.11.12. Streetlight Drawing Requirements

Streetlight Drawings are typically provided as a separate sheet set

- a) Sheet set should include a title page if not part of the main Record Drawing set.
- b) Plans to show plan view only (maximum of two viewports/panes per sheet).
- c) Each luminaire must be identified by type with the accompanying details in the Street Lighting Data Chart (block name SL_CHART). The chart can either be located on the drawing pages or on a separate notes and details page. A sample of which can be found in the Supporting Resource Documents Zip file, (see section 18.11.18).
- d) Include any wiring notes and details as needed.

18.11.13. Signalized Intersection Drawing Requirements

Signalized intersections including signalized crosswalks shall be submitted as a drawing set.

- a) Sheet 1 is the traffic signal layout plan (formerly known as the PHM drawing).
- b) Sheet 2 is the layout and design plan for operation and maintenance.
- c) Sheet 3 is the Electrical Wiring Schematic for operation.
- d) Sheet 4 is for notes and details, if necessary.

18.11.14. Telecommunication Drawing Requirements

Applies only to new municipal Traffic Engineering or Information Technology telecommunications infrastructure.

- a) An example prototype Telecommunications Record Drawing is included in the library.
- b) The T-COM_CHART attributes table must be completed and shown on each drawing page. A sample of which can be found in the Supporting Resource Documents Zip file, (see section 18.11.18).

18.11.15. Regional Water Pipeline Drawing Requirements

The following specifications apply to all water transmission pipeline projects administered by the City's Regional Water Supply Division. All water pipeline drawings shall comply with the general standards laid out in this document with the following special notations and exceptions:

- a) The project shall be related to the NAD'83 (original) datum, UTM projection using a combined scale factor necessary to achieve an absolute real-world accuracy of 0.5 metres throughout the length of the project.
- b) Water pipeline sheet drawings shall be compiled in a similar manner and form as depicted by the sample "Any Pipeline" drawing at 1:500 scale.
- c) Where the water pipeline lies within an easement on private property, the easement limits established by an Ontario Land Surveyor shall be accurately shown on the drawings and the pipeline and all related infrastructure shall be accurately related to the easement limits with dimensions sufficient to enable the pipeline to be accurately located from the easement limits.
- d) Where the water pipeline is located within a road allowance the legal limits shall be established (but not monumented) by an Ontario Land Surveyor on the side of the road allowance nearest the pipeline and the pipeline and all related infrastructure shall be accurately related to the road allowance limit with dimensions sufficient to enable the pipeline to be accurately located from the legal limits.

18.11.16. Drainage Area Plan Requirements

- a) Minimum font size for tables (design sheets) must be 10 pt. (080 template) in paper space plotted to scale.
- b) Minimum line thickness for "catchment" or "drainage" area boundaries is 1.5mm.
- c) Required Layers include structures, roads, street names, railways & fences. Optional Layers include sidewalks, contours, driveways & water. No other layers are to be shown including trees, vegetation, spot elevations.

18.11.17. Shop Drawings for Watermain Infrastructure

- a) Watermains which are 400 mm in diameter and larger are required to have Construction Reports submitted by Pipe Manufacturers which include Shop Drawing Submittals.
- b) The Final Accepted Shop Drawing is to be included in the submission of the Record Drawings.

18.11.18. Supporting Resource Documents

Supporting resources can be obtained as a ZIP file by emailing geomatics@london.ca.

The ZIP file contains the following resources:

- The Engineering Drawing Standards Master excel spreadsheet lists all of the layers and details needed to ensure CAD files are compatible with City drafting standards.
- Civil3D support files:
 - CoL C3D Prototype.dwt (Prototype Plan and Profile AutoCAD drawing. This drawing contains all layers and blocks needed to support these standards)
 - CoverPage_Sample.dwt
 - Wave.shp
 - Wave.shx
 - Colstd.shp
 - Colstd.shx
 - Geomatics.ctb
- Example PDF drawings included:
 - Plan and Profile
 - Traffic Signal Layout
 - Traffic Signal Layout Design
 - Water Transmission Pipeline
 - Telecommunications

18.11.19. How to Calculate the Scale Factor

Simple Application of the Combined Scale Factor

For most projects it will be necessary to take into account the projection scale factor between UTM grid and ground. Since none of the civil/CAD software currently on the market fully supports mixing ground based calculations with grid coordinates, an acceptable work-around is to first scale the UTM base plan up to ground by applying a “Combined Scale Factor” (CSF), complete the design work at ground scale and then rescale the file back to UTM grid for submission to the City.

An inherent characteristic of the UTM projection is that the Combined Scale Factor continuously varies with the easting coordinate and height above the spheroid and the formulae for a precise determination of the CSF is presented below. But for the purposes of most engineering projects in the City a standard combined scale factor of 0.999565 is sufficient to provide accurate results for projects up to a few kilometres in length. (i.e. grid coordinate = ground coordinate x 0.999565).

When scaling digital files from grid to ground and vice-versa it is important to guard against a loss of precision. Since UTM coordinates contain up to 10 significant digits it is imperative that reciprocal scale factors also be computed to at least 10 significant digits. For example, if the standard CSF of 0.999565 was being used for a project, the scale factor of 1.0004351893 would have to be applied to precisely scale the project from UTM grid to ground.

In-depth Discussion of UTM Coordinates and Scale Factors

Note: This section is provided for reference only. In most cases the use of the average Combined Scale Factor of 0.999565 is sufficiently accurate for most engineering projects in the City of London.

- The Universal Transverse Projection used in Canada has the following properties: Zone width - 6 degrees
- Longitude of Origin - Central Meridian of each zone (81° W for London).
- Latitude of Origin - 0° (the equator)
- Easting of Origin = 500 000 metres
- Northing of Origin = 0 metres
- Scale Factor at Central Meridian = 0.9996

The mathematical spheroid used by the City is the World Geodetic Reference System / NAD83 datum.

The scale factor at the central meridian represents the distortion introduced by virtue of the fact that the projection is not tangent to the spheroid at the central meridian but cuts the spheroid along two arcs parallel to the central meridian resulting in a secant projection. This has the effect of limiting the distortion at great distances from the central meridian but does introduce appreciable distortion even when relatively close to the meridian as we are in London. The scale factor increases as progression is made east or west from the central meridian.

Because London has an average elevation of about 270 metres above mean sea level a further slight distortion is introduced between ground distances and distances along the spheroid.

Therefore, if distances computed from UTM coordinates are to be compared to measured (ground) distances with any precision, allowance must be made for both the scale factor and elevation factor.

For most engineering applications it will be satisfactory to use a combined factor of 0.999565. This will give an error of about 1.5 cm per km in the worst cases. The use of 6 significant figures in this approximate factor should not be construed as implying high precision. The possible values across the city range from 0.99957977 at an easting of 465000 m and elevation of 225 m to 0.99955105 at an easting of 493000 m and elevation of 315 m. For those who wish to use a more precise value, the method of calculating the factors is given below.

Precise calculation of Scale Factor

- **Scale factor** - compensates for scale error and is used to adjust the distance on the surface of the spheroid to the plane of the projection.
- **Elevation factor** - compensates for difference in height from Mean Sea Level and is used to adjust distance on the ground to distance on the surface of the spheroid.
- **Combined factor** - the algebraic product of scale factor and elevation factor.

The scale factor (SF) may be calculated as:

$$SF = 0.9996 \left(1 + \frac{x^2}{2R^2} \right)$$

Where: SF = Scale Factor.

x = distance from central meridian (in metres).

R = mean radius of the spheroid ($\approx 6,374,050$ metres).

The elevation factor (EF) may be calculated as:

$$EF = \frac{R}{R + h}$$

Where: EF = Elevation Factor.

h = elevation above mean sea level (in metres).

R = mean radius of the spheroid ($\approx 6,374,050$ metres).

The combined scale factor (CSF) may then be calculated as:

$$CSF = SF * EF$$

18.11.20. Scale Factor Example

Example: Given the following two points, determine the combined scale factor.

Point	Northing (m)	Easting (m)	Elevation (m)
1	4,761,515.6	482,912.2	269
2	4,761,347.0	482,427.4	261

Solution:

Determine the average easting.

$$\text{Average Easting} = \frac{(482,912.2 + 482,427.4)}{2} = 482,669.8$$

Determine the distance from the central meridian (x).

$$x = \text{Easting of Origin} - \text{Average Easting} = 500,000 - 482,669.8 = 17,330.2$$

Determine the scale factor (SF).

$$SF = 0.9996 \left(1 + \frac{x^2}{2R^2} \right) = 0.9996 \left(1 + \frac{(17,330.2)^2}{2 \times (6,374,050)^2} \right) = 0.99960368787$$

Determine the average elevation (h).

$$h = \frac{269 + 261}{2} = 265 \text{ metres}$$

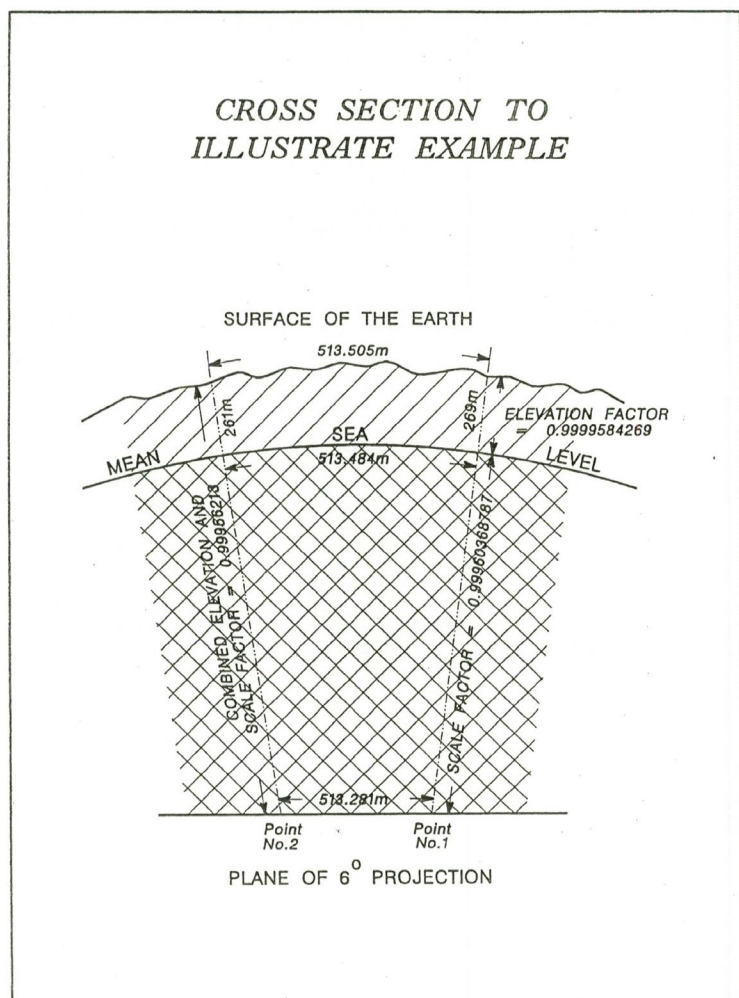
Determine the elevation factor (EF).

$$EF = \frac{R}{R + h} = \frac{6,374,050}{6,374,050 + 265} = 0.9999584269$$

Determine the combined scale factor (CSF).

$$CSF = SF \times EF = 0.99960368787 \times 0.9999584269 = \mathbf{0.99956213}$$

The figure below provides a cross-section to illustrate this example.



18.12. Standard Drawings for Drafting and Design

Figure 18.1 Narrow Lot Servicing (SW-7)

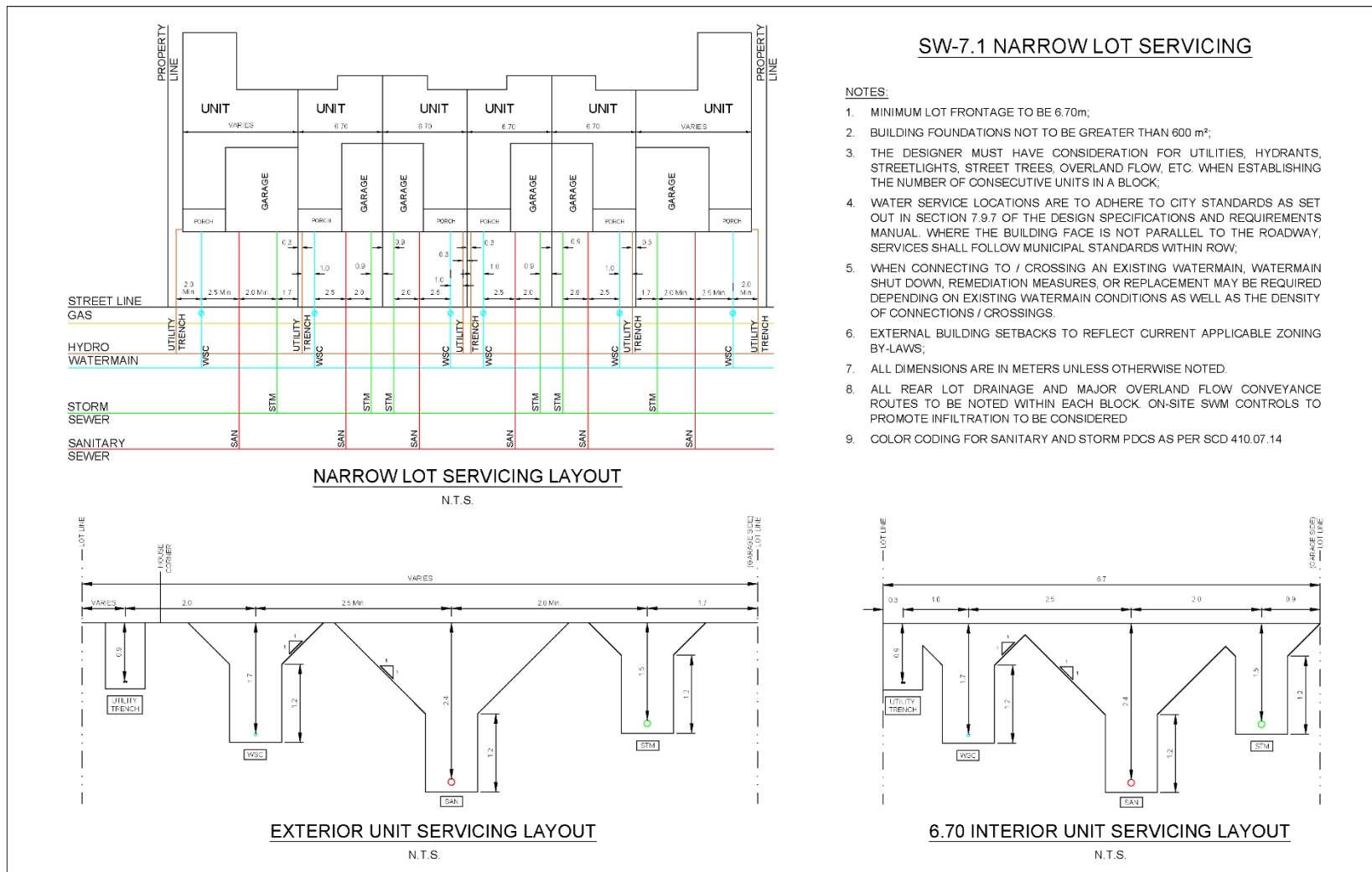


Figure 18.2 Cover Sheet

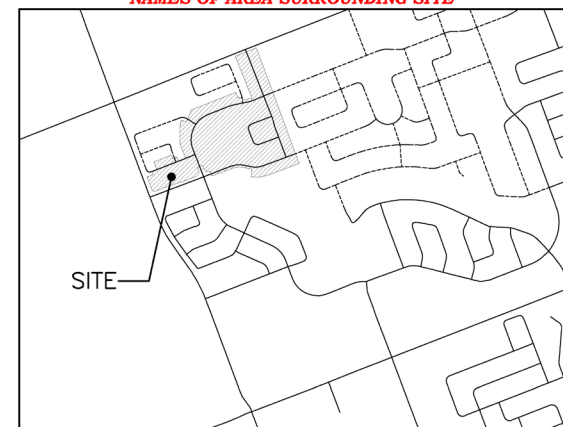
LIST OF DRAWINGS	
SHEET No.	DESCRIPTION
01	GENERAL NOTES AND DETAILS
02	MASTER PLAN OF SERVICES
03	STORM AREA PLAN
04	STORM DESIGN SHEET
05	SANITARY AREA PLAN
06	SANITARY DESIGN SHEET
07	WATER DISTRIBUTION PLAN
08	GRADING PLAN No. 1
09	STREET A FROM 1+000 TO STA. 1+500
10	MISCELLANEOUS DETAILS
11	PAVEMENT MARKINGS
12	SEDIMENT AND EROSION CONTROL PLAN
13	TRAFFIC MANAGEMENT PLAN
14	TYPICAL SECTIONS
15	STREET LIGHTING

EXAMPLE DRAWING SET

PROJECT TITLE
PHASE NUMBER
CLIENT NAME

Note: This drawing has been provided as an example to convey typical drafting layout information to designers. Refer to the appropriate sections of this manual for the City's full design standards and requirements.

SHOW EXISTING STREETS & STREET NAMES OF AREA SURROUNDING SITE



KEY PLAN
N.T.S.

FILE NUMBER
DATE OF SUBMISSION
CONSULTANT FILE NUMBER

CONSULTANT LOGO



Figure 18.2b Cover Sheet – Template B



London
CANADA

2025 LOCAL ROAD RECONSTRUCTION PROGRAM
STREET A, STREET B and STREET C



CITY OF LONDON
T2025-123

Sheet List Table		
Sheet Number	Sheet Description	
1	Front Cover	
2	Street A	New Construction
3	Street A	New Construction
4	Street A	New Construction
5	Street A	New Construction
6	Street B	New Construction
7	Street C	New Construction
8	Street C	New Construction
9	Street C	New Construction
10	Street A / Street B	Lane Markings & Signage
11	Street C	Lane Markings & Signage
12	Street A / Street B	Typical Sections
13	Street C	Typical Sections
14	Street A / Street B Street C	Notes & Details

COMPANY LOGO AND
CONTACT INFORMATION HERE

XXX, P. ENG
PROJECT MANAGER,
ACME ENGINEERING

Figure 18.3a Area Plans and Design Sheets (Master Plan of Services)

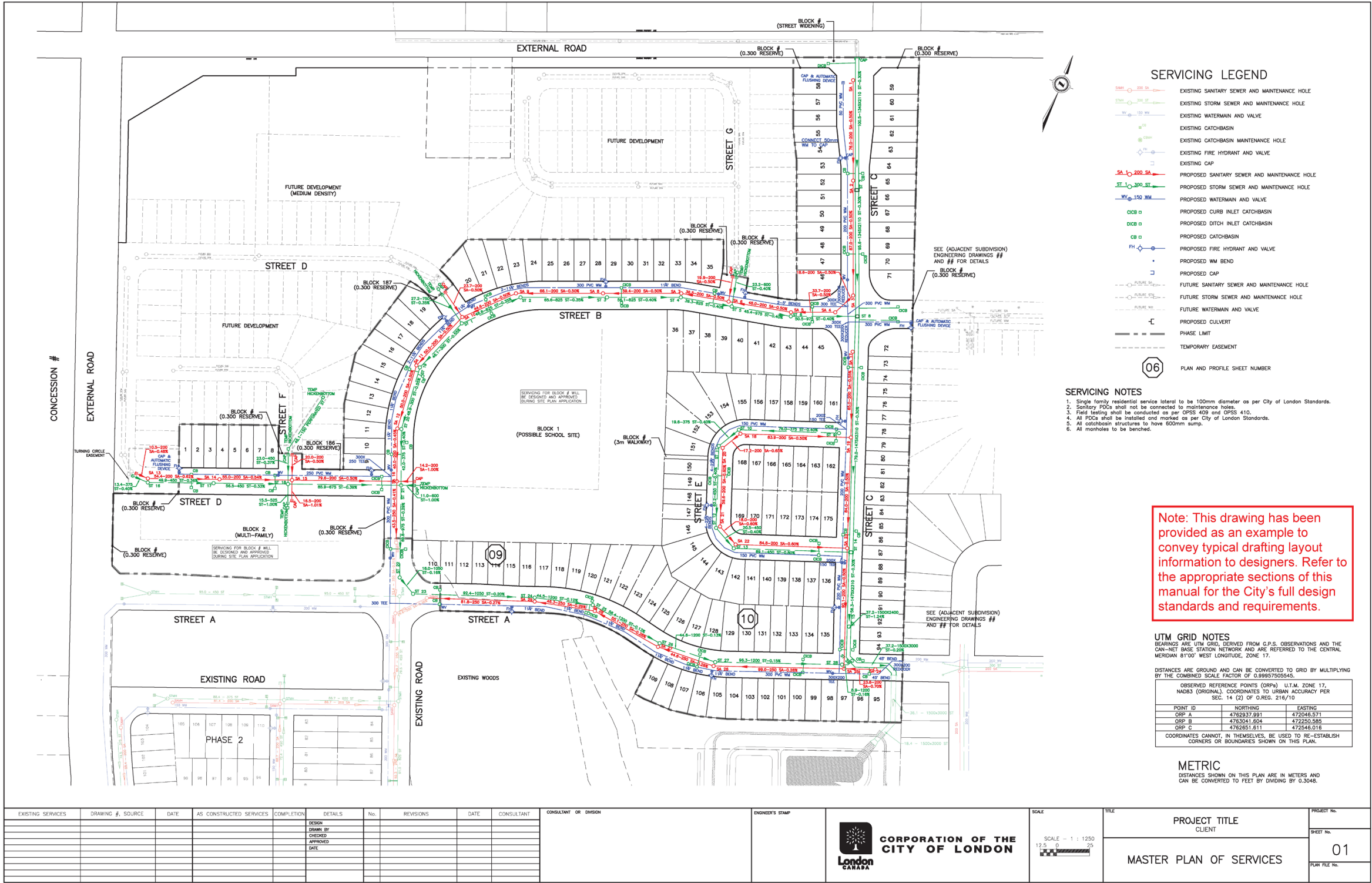
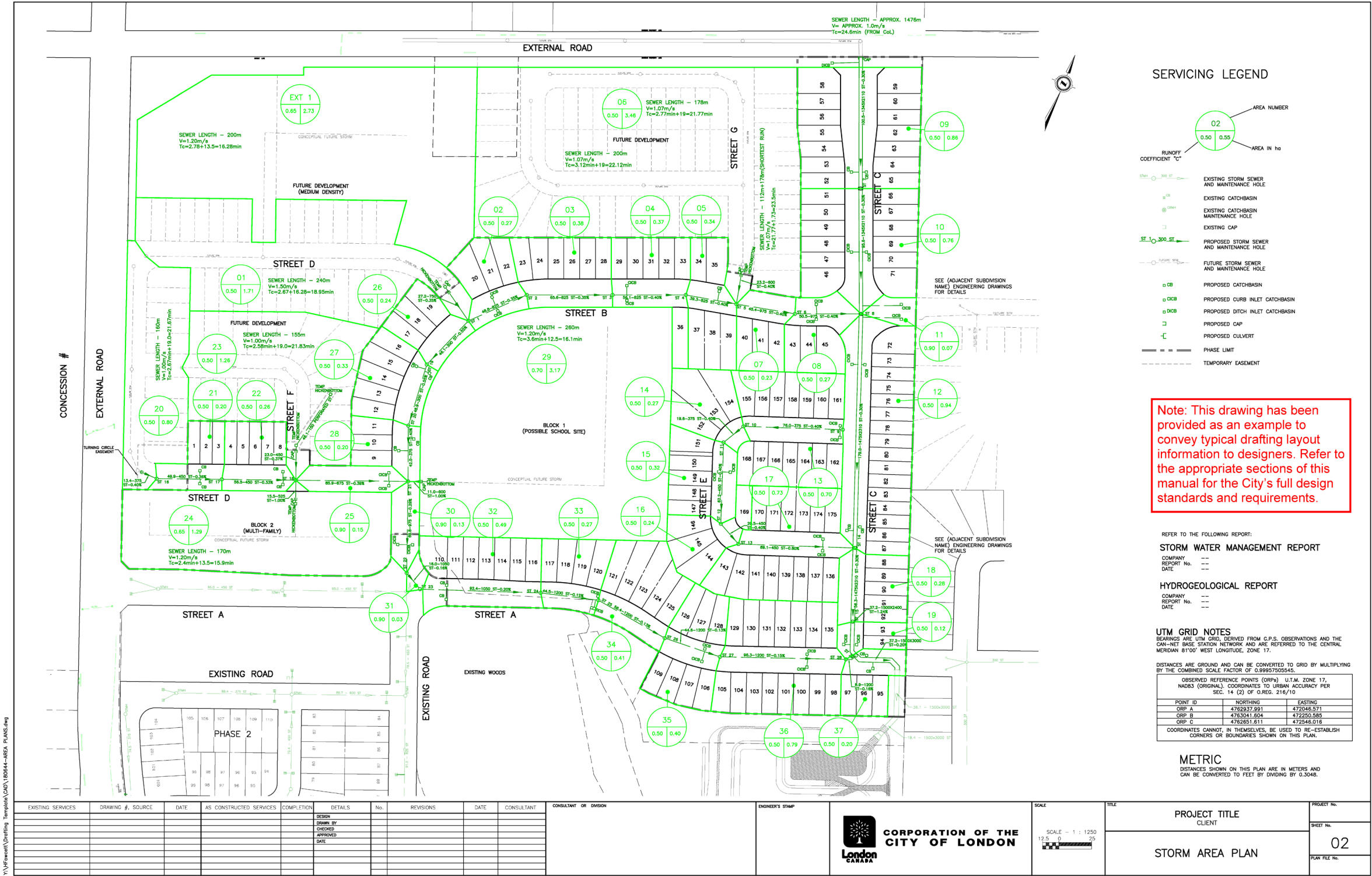


Figure 18.3b Area Plans and Design Sheets (Storm Area Plan)



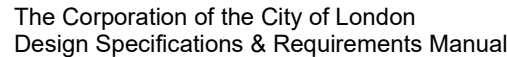


Figure 18.3d Area Plans and Design Sheets (Sanitary Area Plan)

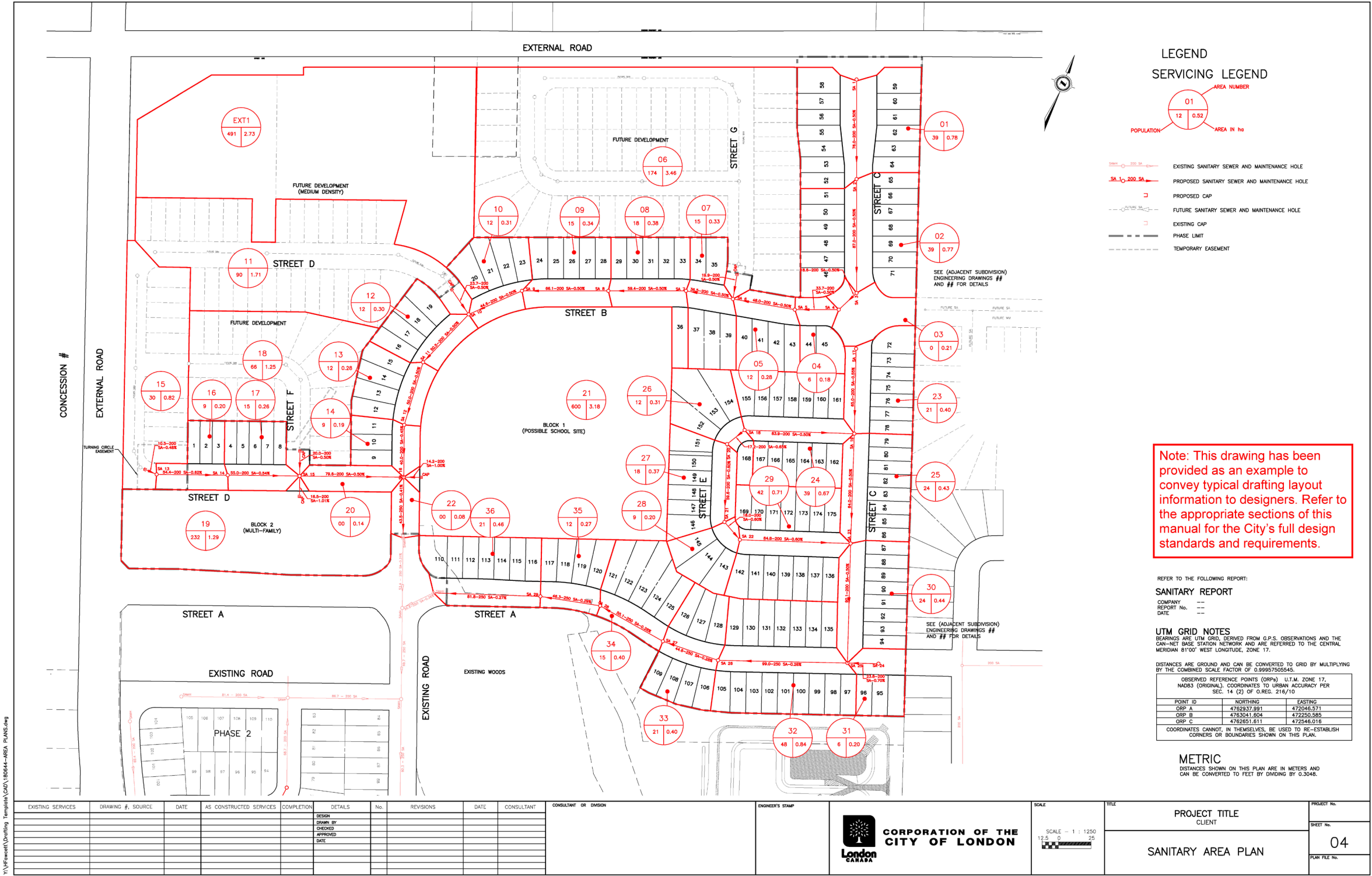


Figure 18.3e Area Plans and Design Sheets (Sanitary Design Sheet)

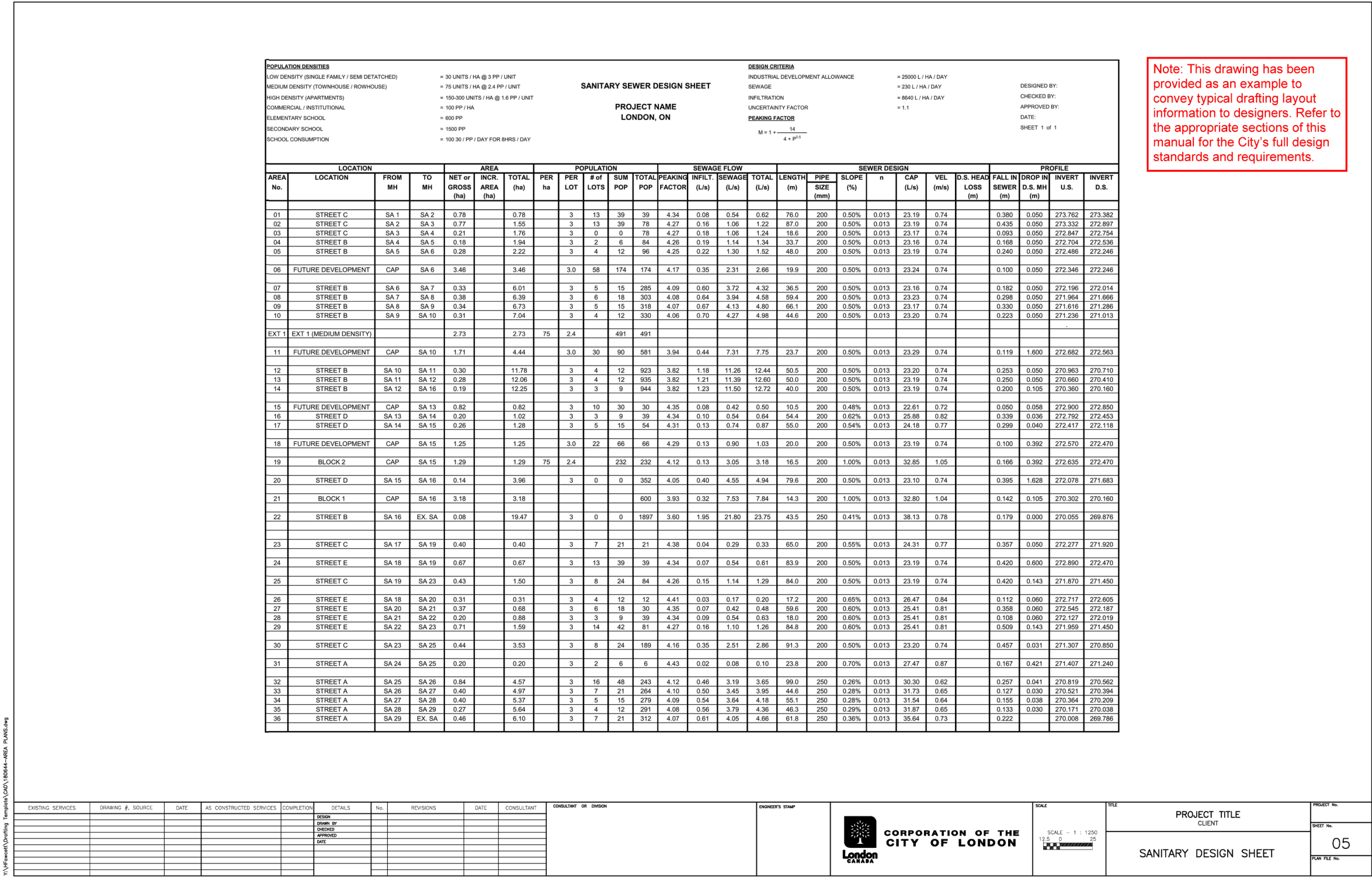


Figure 18.3f Area Plans and Design Sheets (Water Distribution Plan)

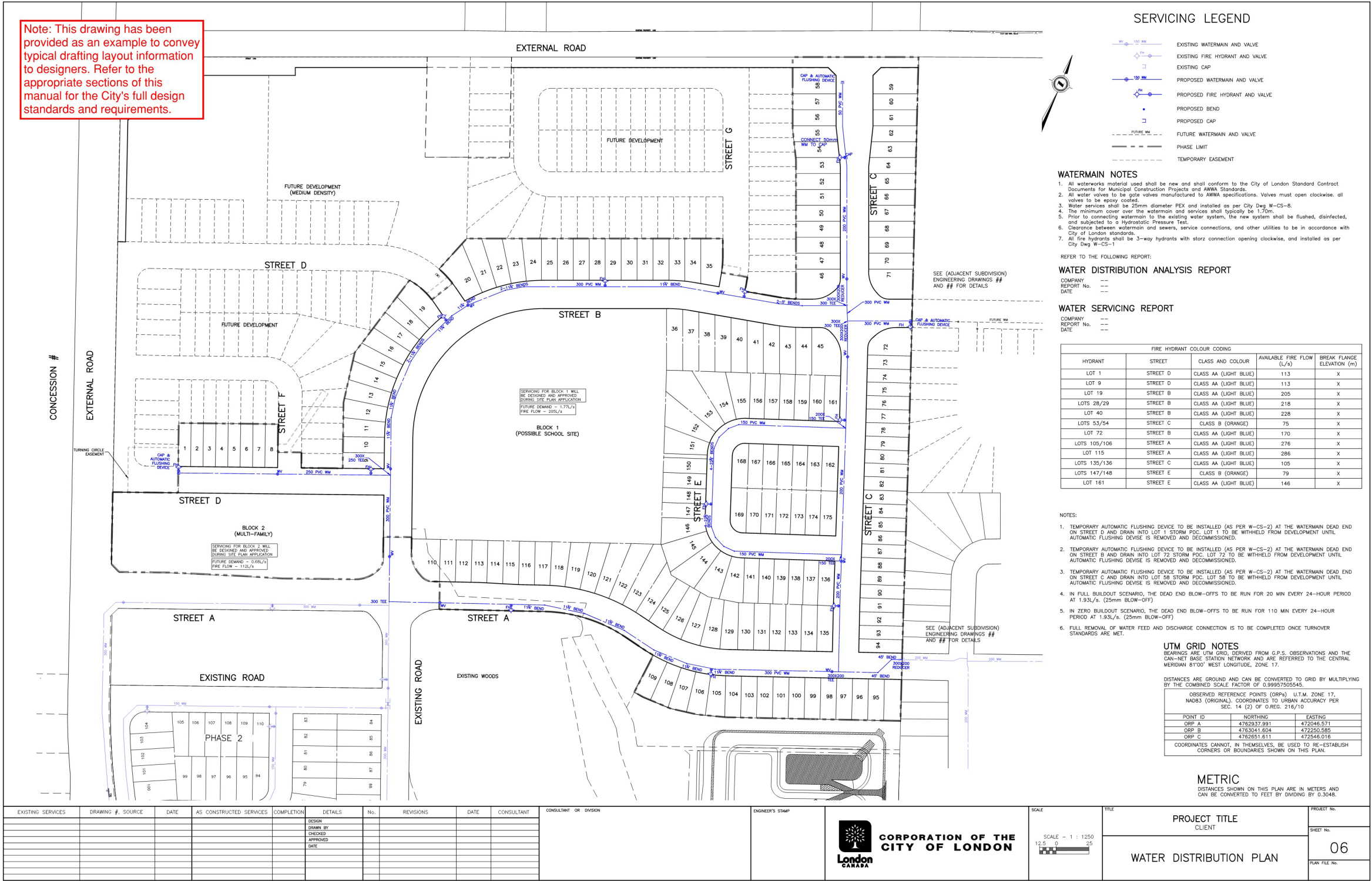


Figure 18.4a Grading Plan (Sheet 1)

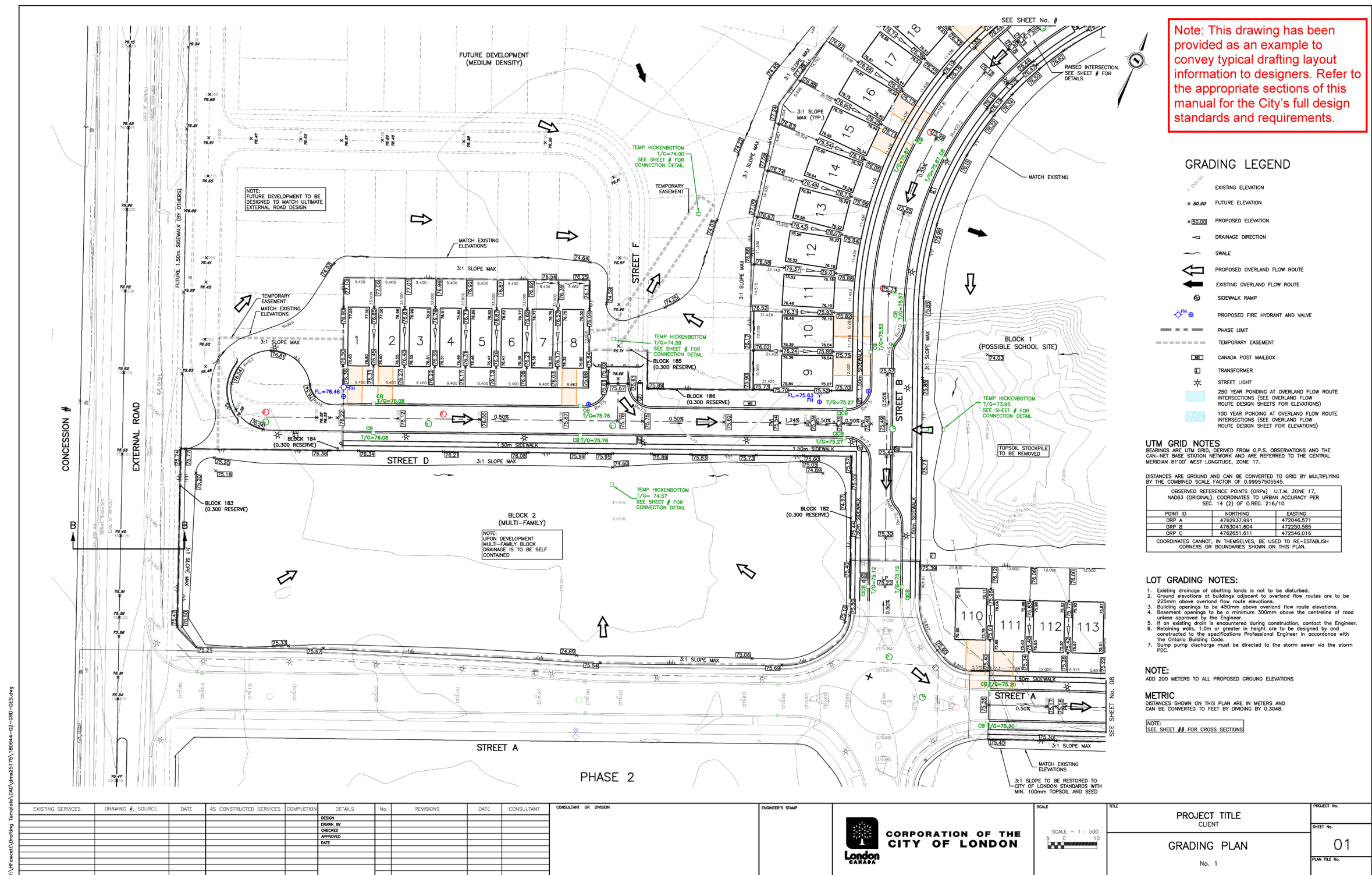


Figure 18.4b Grading Plan (Sheet 2)

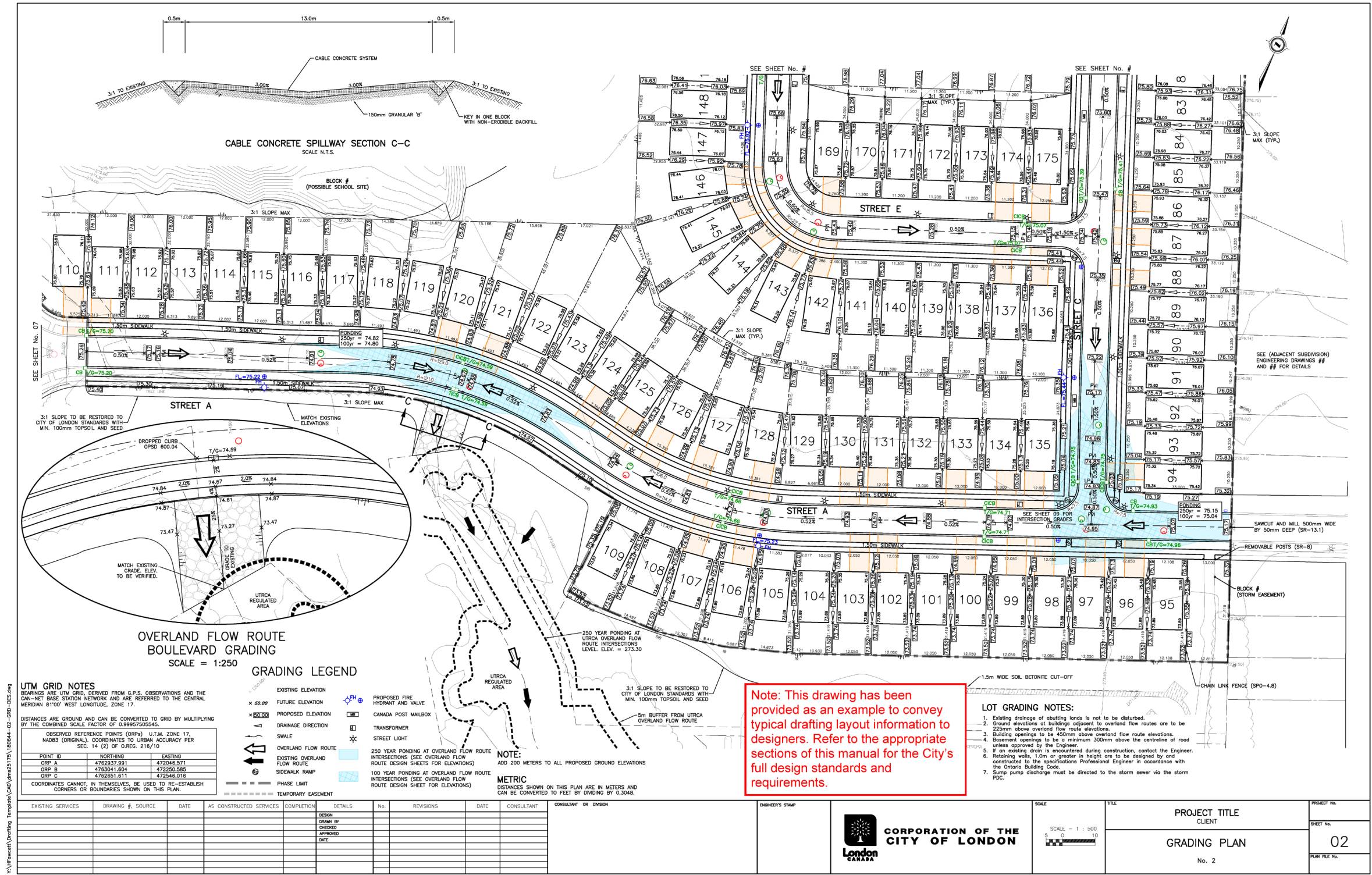


Figure 18.5a Plan and Profile (Sheet 1)

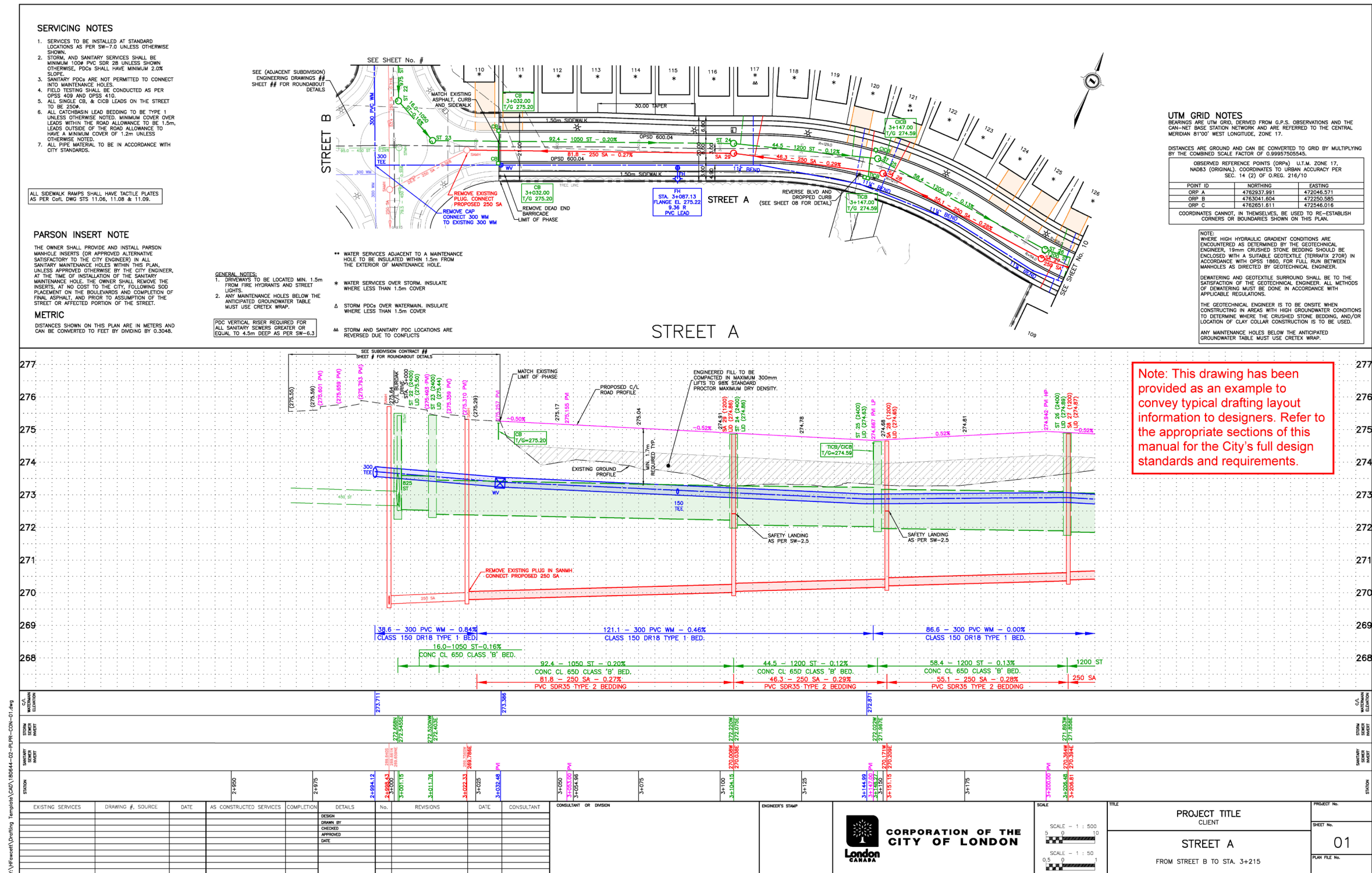


Figure 18.5b Plan and Profile (Sheet 2)

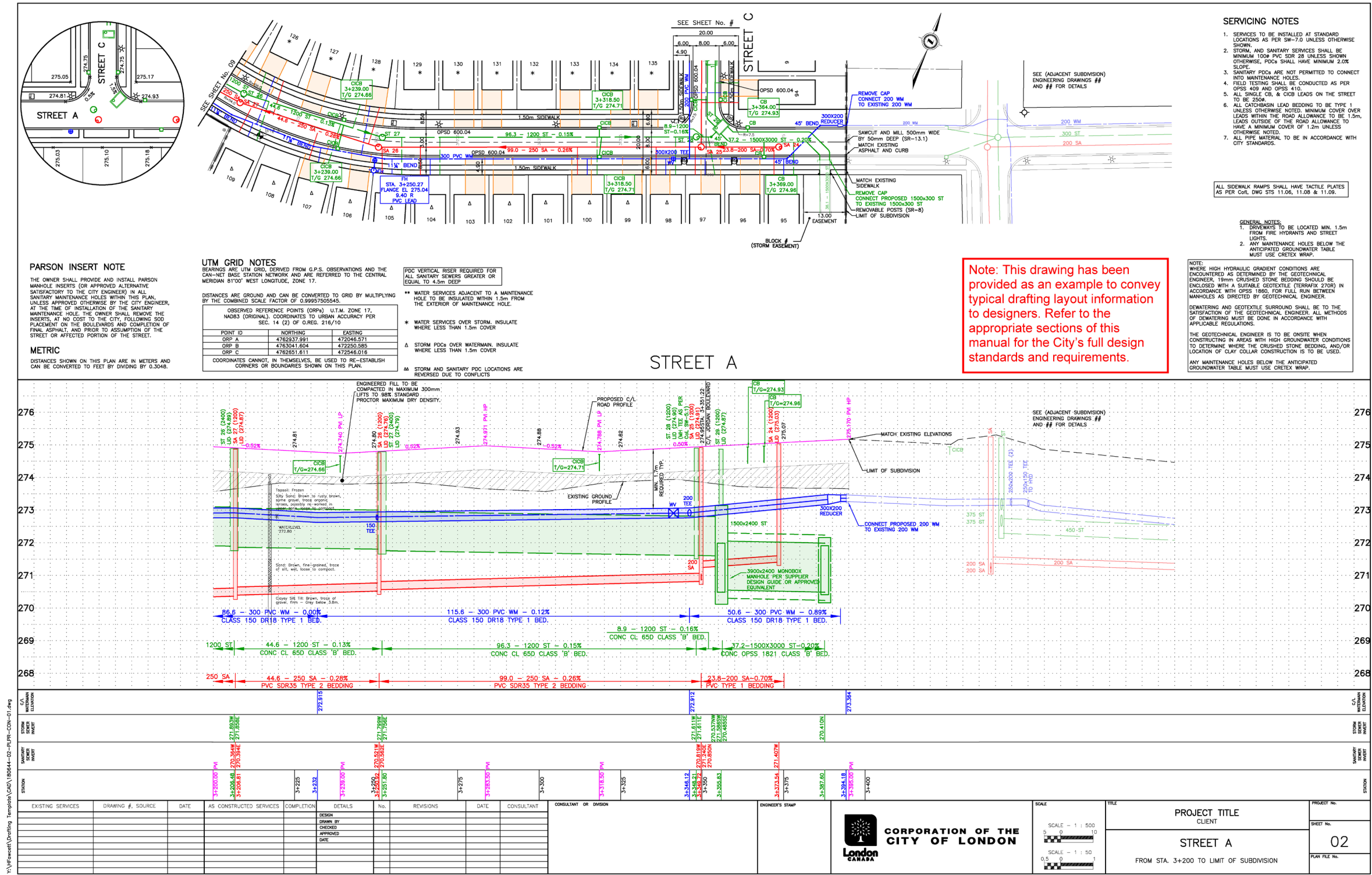


Figure 18.6 Park Plan

