CITY OF WHITEHORSE
ENGINEERING GUIDELINES FOR COMPLEX DEVELOPMENTS

Whitehorse

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1 PURPOSE

The objective of this guideline document is to help private developers and their consultants understand and anticipate the requirements for compiling a complete Engineering Package to be submitted as part of the Development Permit application process for Complex Developments.

This document will:

- Describe the City's review process for *Complex Developments*;
- Describe, and provide rationale for, information required to prepare a complete Engineering Package which forms part of a complete Development Permit application for a Complex Development;
- Outline the City's minimum design criteria for Complex Developments;
- Provide examples of components of an Engineering Package as described in this document.

2 DEFINITIONS

Available Flow:	*Available flow* is the maximum existing flow available on a given point in the City's water network under minimum residual pressure of 140 KPa.
Complex Development:	**Complex Developments consist of** Multiple Housing, Commercial, Industrial, and Institutional developments; including projects that involve a new Gross Floor Area or substantial changes to an existing site design on existing complex developments.
Development Agreement:	As defined in the Subdivision Control Bylaw, a *Development Agreement* is a binding agreement between the owner of the land that is the subject of an application for subdivision and the approving authority with respect to the requirements or limitations of the conditional approval. Said agreements are to be registered in the Land Titles Office and shall have the force and effect of a restrictive covenant running with the land. Where a discrepancy exists between **this definition and the bylaw, the bylaw shall prevail.**
Development Permit Agreement	As described in the Zoning Bylaw, a *Development Permit Agreement* is an agreement that may be required as a condition of Development Permit approval containing conditions, as may be considered reasonable, required as a result of the proposed development. A *Development Permit Agreement* may be registered as a caveat against the title of the subject lands at the Land Titles Office.
Drainage Plan:	A *Drainage Plan* is a plan produced and sealed by the *Engineer of Record* that establishes the design for grading and storm water management for the proposed development along with the relationship between the design and: • Proposed contiguous development;

- Surrounding existing development; and
- The City's storm water network.

Engineer of Record: The *Engineer of Record* is a professional engineer licensed to practice in the Yukon that has been engaged by the developer to undertake the design (or portion of the design) for a development. The *Engineer of Record* engaged to carry out design of the civil works is also responsible for production of *Record Drawings*.

Engineering Package: The *Engineering Package* is the submission made to the City as part of a complete Development Permit application for a *Complex Development*. The *Engineering Package* is reviewed by the Engineering Services Department and is comprised of all engineering design information, including reports and calculations required to demonstrate that the design is sound and complete.

Fire Flow: *Fire flow* is the required flow rate of a water service to adequately provide fire protection to a proposed development. The *fire flow* is calculated based on the formula outlined in the Fire Underwriters Survey document 'Water Supply for Public Fire Protection' and is expressed in l/sec.

Positive Drainage: *Positive drainage* is provision of a continuous downward slope away from structures and other design features that are not to be subjected to standing water.

Private Water Network: A *private water network* is a water supply network located on private property and connected to the City's municipal distribution network that services multiple buildings separately.

Record Drawing: *Record Drawings* are drawings compiled under the supervision of the *Engineer of Record* that are intended to verify that construction has been carried out in accordance with the final design, including all design changes authorized by the *Engineer of Record* over the course of the project. The *Engineer of Record* is responsible for the content of *Record Drawings* and responsible for ensuring that they have spent an adequate amount of time on-site to provide assurance on the correctness of the information indicated on the plans. The *Engineer of Record* is required to provide authentication on the *Record Drawings* in the form of the *Engineer of Record's* seal.

Servicing Plan: A *Servicing Plan* is a plan produced and sealed by the *Engineer of Record* that establishes the design of storm sewer, sanitary sewer and water supply networks for the proposed development along with the relationship between the design and:

- Proposed shallow utilities;

- Proposed contiguous development; and
- Surrounding existing development.

Subdivision Grading Plan: The *Subdivision Grading Plan* is provided to the City by the subdivision developer and indicates the drainage pattern and final design elevations for all lots within a new subdivision. All lots within the subdivision are to be graded to match design elevations indicated on the *Subdivision Grading Plan*.

Swale: A *swale* is a shaped depression sloped to direct surface drainage to an intended point of discharge.

3 ENGINEERING REVIEW PROCESS FOR COMPLEX DEVELOPMENTS

3.1 GENERAL

Refer to Appendix C for a Flow Chart identifying the City of Whitehorse Development Permit Review Process and the sections of the process involving review by the Engineering Services Department.

3.2 PRE-APPLICATION MEETING

The City of Whitehorse encourages developers to request a pre-application review for all *Complex Developments* prior to compilation of a complete *Engineering Package*.

A pre-application review provides the opportunity for early discussion between the developer and the City's Land and Building Services Department and Engineering Services Department to confirm that basic project information is satisfactory (e.g. basic servicing information), identify the City's requirements for submission of a complete application (especially whether anything more or less than standard checklist is required), and provide an opportunity for the applicant to ask questions and clarify the City's regulations/requirements prior to submission of a complete application.

To maximize the value derived from the pre-application review, the Developer is required to supply sufficient information on the proposed development. A request form (Form 0) including checklist for minimum information required for a pre-application review is provided on the City's website at https://www.whitehorse.ca/business-in-whitehorse/zoning/development-permits/permits-and-guides/.

A request for pre-application review must be submitted to a Development Officer in the Land and Building Services Department.

3.3 SUBMISSION OF ENGINEERING PACKAGE FOR DEVELOPMENT PERMIT

3.3.1 General

Development Permit applications are submitted to the City's Land and Building Services Department. The *Engineering Package* forms part of a complete Development Permit application. If the Development Permit application is deemed complete by the Development Officer, the application progresses through the City's technical review process. Checklists and forms are available on the City's website at https://www.whitehorse.ca/business-in-whitehorse/zoning/development-permits/permits-and-guides/

The Development Officer circulates the *Engineering Package* to the City's Engineering Services Department for technical review. If Engineering Services determines that the *Engineering Package* is incomplete or illegible, contains excessive errors and/or omissions and/or does not include required professional authentication, the applicant will be notified and the *Engineering Package* will not be reviewed until the deficiencies are corrected and resubmitted by the applicant.

3.3.2 Technical Review

All *Complex Development*s receive a preliminary review by Engineering Services in preparation for a coordinated review at a meeting of the Development Review Committee (DRC).

Engineering Services will carry out a detailed review of the Engineering Package subsequent to the coordinated review in the DRC meeting.

All comments generated by the Engineering review will be attached to the City's Technical Review Report provided to the applicant.

3.3.3 Subsequent Reviews

Comments generated from the technical review may require the developer to provide revisions or additional information and resubmit to the City for further review.

The Developer is to submit requested Engineering Package revisions and additions to the Development Officers in Land and Building Services at development@whitehorse.ca. The Development Officers then forward the revised Engineering Package to the Engineering Services Department and the Engineering Services Department will carry out a follow-up review of the submitted information.

If all comments have been sufficiently addressed, notification will be sent to the applicant and Development Officers that the plan has been accepted. The applicant is then required to contact a Development Officer in the Land and Building Services Department to address any outstanding requirements and proceed with processing of the Development Permit.

If the comments have not been sufficiently addressed, Engineering Services will provide further review comments to the Development Officer. The Development Officer will then forward Engineering Services comments to the applicant. This process will continue until all review comments have been addressed.

The Engineering Services Department is available throughout the review process to answer questions and provide guidance. It is not the role of Engineering Services to provide solutions or assist with designing a project.

Confirming completeness and correctness of information provided in the *Engineering Package* is essential in order to reduce time required to obtain a Development Permit.

The Engineering Services Department endeavors to complete *Complex Development* reviews on a timely basis. The typical turnaround time will depend on current volume of applications, the complexity of proposed development and the completeness of the *Engineering Package*. It is in the developer's best interest to ensure completeness of the revisions, in order to reduce the likelihood of requiring subsequent reviews.

3.4 OTHER PERMITS

Upon issuance of a Development Permit, a developer can proceed with application for the necessary Building/Plumbing Permits and Street Occupancy Permit (if required).

Once all the required permits are obtained, the applicant may start construction.

3.5 DEVELOPMENT PERMIT AGREEMENT AND DEVELOPMENT DESIGN AND CONSTRUCTION REVIEW COST CHARGE

A *Development Permit Agreement* (DPA) may be required when the project requires off-site infrastructure work within the City right-of-way, that will be owned by the City, with exception to the following:

- Standard installation of a water and sanitary servicing;
- Work related to abandoning existing water and sanitary servicing at the main; and
- Standard installation of a commercial crossing(s) to the subject property.

The *Development Permit Agreement* will outline work that will be subject to specified conditions including (but not limited to) inspection, completion of work, and warranty.

Development that requires a *Development Agreement* or *Development Permit Agreement* will be subject to the Development Design and Construction Review Charge.

The amount of the Development Design & Construction Review Cost Charge is calculated as set out in the City of Whitehorse Fees and Charges Bylaw and is to be based on a submitted Class A Engineer's Estimate or Tender Price for all off-site improvements included in the DPA.

If clarification is required, Engineering Services can provide guidance to the developer in relation to elements of the proposed work to be included in the estimate.

3.6 RECORD DRAWINGS

As a condition of Development Permit approval, the City may require that a Record Drawing Security be provided to ensure that *Record Drawings* are provided in a form acceptable to the City. The value of the security is $1,000 + $1/m^2 of lot area, and collected in accordance with Section 4.19 of the Zoning Bylaw.

Record Drawings are to be submitted to the Land and Building Services Department prior to release of the Record Drawing Security. *Record Drawings* must include all information indicated on the approved Development Permit drawings including all design changes authorized by the *Engineer of Record.*

The *Record* Drawing submission is to include:

- A pdf of the drawing complete with seal of the Engineer of Record; and
- An AutoCAD dwg file for addition of as-built data to the City's CAD base plan.

Refer to Appendix 1.K –and Appendix 2B – Symbols Legend in the City's Servicing Standards Manual for specifications related to as-built data submissions.

4 REQUIREMENTS FOR COMPLETE ENGINEERING PACKAGE

4.1 INFORMATION REQUIRED IN ALL *ENGINEERING PACKAGES*

The *Engineering Package* is to include all relevant information pertaining to the design of the proposed Development including, but not limited to;

- Design Drawing Set including
  - Drainage Plan,
  - Servicing Plan, and
  - Detail Plan(s), and
- Seal of the *Engineer of Record* applied to all drawings, details and calculations.

Note that a full *Engineering Package* will not be required for;

- Select industrial developments that are of a simple nature; (eg: not serviced by the municipal servicing network, falling under Part 9 of the NBCC, or involves only minor re-grading of a portion of a developed property).
- A project that involves new Gross Floor Area that has little to no impact on the servicing or grading of a site.

Please contact Engineering Services to discuss the details of proposed development and requirements for Development Permit submission for projects of the above listed nature.

4.1.1 Drainage Plan

Drainage Plans are to be prepared in a standard metric scale and are to include the following:

- Title describing purpose of plan (e.g. Drainage Plan);
- The date the plan was prepared and revision table;
- North arrow and drawing scale;
- Drawing legend;
- Legal property description including lot number, CLSR or LTO Plan numbers, and municipal address;
- Property lines, lot dimensions and all easements registered on title;
- Labels for all surrounding public thoroughfares (streets, roads, lanes, avenues, boulevards).
- Location of all existing surrounding surface features including (but not limited to) roadways, laneways, driveways, trails, sidewalks, fences, street lights, power poles, pedestals, transformers, mailboxes, hydrants, and all other surface features that may impact or be impacted by development of the subject property;
- Location of all existing and proposed principal and accessory buildings including all points of access/egress, decks, patios, stairs, canopies and ramps;
- Location of all site improvements, including driveways, drive aisles, parking spaces, street lights, power poles, pedestals, transformers, mailboxes, hydrants, walkways, fences, sidewalks, fuel tanks, waste management areas(s) and storage area(s).
- Location of all connections from on-site drive aisles and walkways to off-site roads and active transportation networks.
- Location of all drainage features such as swales, ditches, retaining walls, catch basins, exfiltration pits, and culverts.

- Extent of all surface treatments (e.g. paving, landscaping, or gravel);
- Location of all surface appurtenances related to underground servicing;
- Main floor elevation(s) for all buildings on site;
- Proposed spot elevations at building perimeter(s), edge of surface treatments, grade breaks, top of manholes and top and bottom of retaining walls, top and bottom of stairs and ramps and along drainage features (e.g.: swales).
- Direction of drainage (indicated by an arrow) along with calculated % slope;
- Location of downspouts or rainwater leaders and/or storm connections for discharge of roof drainage;
- All proposed off-site improvements related to subject development; and
- All additional information that is relevant to the development of the subject property.
- **For all Complex developments in a subdivision with a *Subdivision Grading Plan:***
    - Design elevations at lot corners and along property boundaries in accordance with *Subdivision Grading Plan*;
- **For all Complex developments in a subdivision without a *Subdivision Grading Plan*:**
    - Existing spot elevations at lot corners, grade breaks, corners of existing buildings located near property line on neighbouring lots and along adjacent roadways, curbs, sidewalks, lanes, paths, driveways and trails.
    - Existing spot elevations along the edge of surface features remaining on-site.
    - Existing spot elevations at existing building corners on subject property (if remaining on-site);
    - Spot elevations or contours indicating existing topography into adjacent properties complete with drainage arrows indicating direction of drainage (to establish existing grading pattern); and
    - Proposed elevations at lot corners and along shared property lines (if altered from existing).

All existing site information is to be collected by means of topographic survey. All topographic surveys are to be carried out using the same datum used to set proposed / design elevations.

All proposed elevations indicated on the *Drainage Plan* are to indicate top of drainage plane.

Refer to Appendix A for example Drawing Set that includes a *Drainage Plan*.

4.1.2 Servicing Plan

*Servicing Plan*s are to be prepared in a standard metric scale are to include the following:

- Title describing purpose of plan (e.g. Servicing Plan);
- The date the plan was prepared and revision table;
- North arrow and Drawing Scale;
- Drawing Legend;
- Legal property description including lot number, CLSR or LTO Plan numbers, and municipal address;
- Property lines, lot dimensions and all easements registered on title;
- Labels for all surrounding public thoroughfares (streets, roads, lanes, avenues, boulevards).

- Location of all existing surrounding surface features including (but not limited to) roadways, laneways, driveways, trails, sidewalks, fences, street lights, power poles, pedestals, transformers, mailboxes, hydrants, and all other surface features that may impact or be impacted by development of the subject property;
- Location of all existing and proposed principal and accessory buildings including all points of access/egress, decks, patios, stairs, canopies and ramps;
- Location of all site improvements, including driveways, drive aisles, parking spaces, street lights, power poles, pedestals, transformers, mailboxes, hydrants, trails, sidewalks fences, fuel tanks, waste management areas(s) and storage area(s).
- Location of all connections from on-site roads and sidewalks/trails to off-site roads and active transportation networks.
- Location of existing shallow utilities within close proximity to development;
- Location of proposed shallow utilities on site;
- Location, alignment, size and material of all existing servicing infrastructure to be removed or to be maintained that is related to the subject development (on-site or off-site);
- Location, alignment, size and material of all proposed water, sanitary and storm water servicing related to the subject development (on-site and off-site);
- Location of all proposed manholes, catch basins and hydrants related to subject development;
- Dimensions demonstrating all required clearances to deep utilities are maintained (refer to the City's Servicing Standards Manual for required clearances);
- Invert elevations of all existing and proposed sanitary and storm water infrastructure related to the subject development along with calculated slope of pipe;
- Location of all existing and proposed servicing related appurtenances (e.g. valves, curb cocks, cleanouts, sumps) related to subject development;
- Location and size of meter chambers along with proposed location of meter transmitter or readout;
- Hydrant coverage radius centered on hydrant(s) providing coverage for development;
- Location of Fire Department Connection;
- Fire department access route (demonstrating compliance with 3.2.5.6 of the National Building Code);
- All proposed off-site improvements related to subject development; and
- All additional information that is relevant to the development of the subject property.

All existing servicing information is to be collected by means of topographic survey. All Topographic surveys are to be carried out using the same datum used to set proposed / design elevations.

Upon request, the Engineering Services Department can provide a service card (if available) that provides information pertaining to existing services extended to the subject property.

Refer to Appendix A for example Drawing Set that includes a *Servicing Plan*.

4.1.3 Information to be included on any plan in the Development Permit submission

The following items are to be identified on a drawing in the submitted drawing package, but do not need to be indicated on a specific plan (e.g. can be included on Architectural or Civil drawings):

- All proposed directional and parking signage related to subject development; and
- Requirement for installation of fencing around perimeter of site for duration of construction activities (if required)

Additionally, it is preferred that Contractor Laydown Area is identified particularly for developments located in areas where space is tight, where laydown will likely be required offsite and where there is potential impact to street users.

4.1.4 Detail Plan(s)

The Detail Plan(s) are to provide construction details for proposed work.

City of Whitehorse Standard Details are available on the City's website at https://www.whitehorse.ca/business-in-whitehorse/zoning/engineering-standards/.

Where a City of Whitehorse Standard Detail does not exist for a proposed element of the project, a custom detail is to be provided.

An Engineer's seal is required for all details that are not pre-engineered products or are not covered by a City Standard Detail.

Refer to Appendix A for example Drawing Set that includes a Detail Plan.

4.2 ADDITIONAL INFORMATION

The Engineering Package may need to include additional information based on the nature, location and complexity of the proposed development.

Additional information includes (but is not limited to) the following:

4.2.1 Fire Flow Calculations

Fire flow calculations are to be submitted as part of a complete *Engineering Package* for all *Complex Development* with the exception to the following:

- Residential developments of three units or less; and
- Developments not serviced by the municipal servicing network.

The fire flow calculation indicates the amount of water required for fire protection, based on the specifics of the proposed development. This is referred to as the fire flow.

Fire flow calculations are to be carried out in accordance with the current version of the Fire Underwriters Survey document 'Water Supply for Public Fire Protection'. Calculations are to be sealed by the Engineer of Record.

The resulting fire flow is used to confirm hydrant coverage (refer to Hydrant Distribution Table included in FUS document). The hydrant coverage is indicated on the Servicing Plan in the form of a radius from the hydrant providing coverage.

The calculated fire flow is reviewed in relation to *available flow* to ensure adequate water supply is available for fire protection. There are two methods for demonstrating *available flow* depending on the nature of the proposed development:

- If an existing hydrant(s) is (are) intended to provide coverage to the development, *available flow* must be demonstrated by means of a recent hydrant flow test.
- If a new hydrant(s) is (are) required to provide coverage to the development, *available flow* must be demonstrated by means of a water model report.

Calculations must be accompanied by the seal of the Engineer of Record.

4.2.2 Geotechnical Report

A Geotechnical Report may be requested to:

- confirm existing geotechnical conditions of the site;
- confirm the land can be used safety for the intended use without undue risk of hazards or damage,
- identify all relevant
  - restrictions,
  - conditions,
  - limitations to the proposed development, and
- to make recommendations for
  - design,
  - construction, and
  - inspection of the development.

Recommendations required is to include (but not be limited to);

- foundation design and construction,
- frost protection, and
- site grading and drainage.

The Engineering Services Department will identify additional requirements to be addressed in the Geotechnical Report, if applicable.

The Geotechnical Report is to be prepared at the cost of the developer and produced by a professional engineer registered to practice in the Yukon with qualifications and experience in geotechnical engineering to prepare, sign and seal the Geotechnical Report.

4.2.3 Plan/Profile Drawing for existing and proposed servicing network;

A Plan/Profile Drawing is to be submitted if the proposed servicing network is complex in nature and/or requires notable coordination with surface features and/or existing underground utilities.

4.2.4 Storm Capacity Calculations

Capacity and Storage calculations are to be submitted for all proposed storm drainage features incorporated in the design, including underground storm water servicing and exfiltration pits or exfiltration trenches (if supported as part of the drainage design).

Please refer to Section 2.5 of the City of Whitehorse Servicing Standards Manual for more information regarding capacity calculations.

Calculations are to be accompanied by the seal of the *Engineer of Record*.

4.2.5 Hydrant Flow Test

A hydrant flow test is to be submitted when hydrant coverage for proposed development is provided by an existing City hydrant(s).

Please contact the Engineering Services Department to confirm if a recent hydrant flow test is available for the applicable hydrant.

If a recent flow test is not available, the developer is to contact the City's Water and Waste Department to request a flow test to be carried out by means of Work Order.

Refer to Appendix B for an example hydrant flow test.

4.2.6 Water Model Report

A water model report is to be submitted when a new hydrant is required to provide fire protection coverage to the development.

The water model report, derived from the City's current calibrated water model, is to demonstrate *available flow* along with resulting conditions on the water network.

The proposed network servicing the new hydrant is to be added to the water model. A report is to be generated demonstrating that the velocity, pressure and *available flow* meet the City's requirements at Maximum Daily Demand (MDD) plus *fire flow*.

Please refer to Section 2.3.1 of the City's Servicing Standards for requirements of water servicing networks.

The water model report is to be accompanied by the seal of the *Engineer of Record*.

4.2.7 Transportation Impact Assessment

A Transportation Impact Assessment (TIA) may be requested for developments that are likely to have a significant or adverse traffic or safety impact on the City's transportation network in the opinion of the City Engineer including but not limited to the following:

- Significant generation of vehicular trips to and from the proposed development.
- Potential to cause adverse impacts to traffic safety for all road users (pedestrians, cyclists, transit users, and drivers)
- Subject to significant community concern.
- Other transportation considerations that relate to the proposed development identified by the City Engineer including but not limited to on-site circulation, site access, active transportation connectivity, transit integration, and parking.

A TIA is required to:

- Identify the measures (both on-site and off-site) to be undertaken in order to adequately integrate and service the development with the City's overall transportation network before and after the development is built and operational;
- Be undertaken by a civil engineer with expertise in traffic operations, traffic engineering and licensed to practice in the Yukon.
- Be accompanied by the seal of the Engineer of Record.

Refer to the City of Whitehorse – Transportation Impact Assessment Guidelines for further information on the warrant, scope, necessity, and timing of a TIA.

4.2.8 Engineer's Estimate

When off-site civil works are required as part of proposed development, a Class A Engineer's estimate is to be submitted to the Engineering Services Department to facilitate calculation of the Development Design & Construction Review Cost Charge.

Refer to Section 3.5 of this document for more information on the Development Design & Construction Review Cost Charge.

4.2.9 Water Demand Calculations

In situations where it can be demonstrated that installation of new water servicing involves uncommon challenges, the City will consider accepting the continued use of an existing water service that doesn't meet the minimum requirements set out in the Servicing Standards Manual.

In this instance, Water Demand Calculations are to be submitted for review to demonstrate that the existing service size is adequate for proposed development.

The calculation method is to be in accordance with NPCC Table 2.6.3.2 A – Sizing of Water Distribution Systems.

If existing services are copper, continuity of heat trace is to be confirmed on site.

Calculations are to be accompanied by the seal of the Engineer of Record.

4.2.10 Sanitary Capacity Calculations and Video Camera Inspection

In situations where it can be demonstrated that installation of new sanitary servicing involves uncommon challenges, the City will consider accepting the continued use of an existing sanitary service that doesn't meet the minimum requirements set out in the Servicing Standards Manual.

In this instance capacity calculations are to be submitted, in conjunction with a video camera inspection, to demonstrate that the existing size and condition of the existing sanitary service is adequate for proposed development.

4.2.10.1 Capacity Calculations

Please refer to Section 2.4 of the City of Whitehorse Servicing Standards Manual for more information regarding capacity calculations.

Calculations are to be accompanied by the seal of the Engineer of Record.

4.2.10.2 Video Camera Inspection

A sewer video camera's rate of progress is to be uniform during inspection and is not to exceed 6 m/min.

A log is to be maintained during the inspection, showing location of leaks, faults, open joints, breaks, cracks, collapse, settlement, obstructions, infiltration or any other defects affecting the overall performance of the sewer service.

A digital copy of the video camera inspection is to be submitted to the City's Engineering Services Department for review.

Refer to Section 3.7.4.2 of the Servicing Standards Manual for equipment specifications.

4.2.11 Detail for Retaining Walls 1.0m or higher;

An engineered construction detail is to be submitted complete with seal of Engineer of Record if proposed retaining walls are 1.0 m or more in height.

Alternatively, catalogue cut sheets can be submitted for a pre-engineered retaining wall system.

Note that where a retaining wall is critical to the stability of building foundations, is supporting elements from basement stairwells, door access, or window wells the design will be reviewed for compliance with the National Building Code of Canada at time of application for Building Permit.

4.2.12 Vehicle Swept Path Analysis

A Vehicle Swept Path Analysis may be requested when the site design does not appear to provide adequate space for required vehicle maneuvers.

When requested, the swept path analysis is to be generated by Computer Aided Drafting (CAD) software intended for this purpose and is to be incorporated in the drawing package to demonstrate that required vehicle circulation is accommodated in the site design.

4.2.13 Erosion and Sediment Control Plan

An Erosion and Sediment Control Plan may be requested, if the nature and location of a proposed development is deemed to pose risk to an existing watercourse.

The sediment control plan is to existing site conditions, identify best management practices, outline concerns and related control measures and describe how required work will be implemented.

4.2.14 Pre-Design Report

If warranted by size and complexity of a proposed development, a Pre-Design Report may be requested.

The City's Engineering Services Department will assist developers in setting specific scope and content requirements for the Pre-Design Report.

In general, content of a typical Pre-Design Report would include (but not be limited to):

- Summary of proposed development;
- Geotechnical conditions and recommendations;
- Description of water system complete with water model. Note that water model to include resulting velocities and pressures on system when delivering MDD + fire flows;
- Description of sanitary system and capacity calculation sheets;
- Description of storm system and storm calculations. Note that total discharge flow to be identified;
- Description of road system with rationale for road structure complete with typical cross section of road structure;
- Description of shallow utilities and demonstration that coordination of shallow and deep utilities have been carried out;
- Fire Flow Calculations based on Fire Underwriters Survey document 'Water Supply for Public Fire Protection – 2020';

- Fire Department access route to be identified complete with intended FD vehicle movements and demonstration that the design meets requirements of the National Building Code of Canada 3.2.5.6.;
- Description and design rationale for all off-site work required as part of proposed development; and
- Description and design rationale for all other work required as part of proposed development.

5 DRAFTING STANDARDS

Drawings submitted as part of a complete Engineering Package are to be to be in pdf format (vector format) and drafted by means of a Computer Aided Drafting Software (CAD Software) using SI units (e.g. all dimensions to be provided in metric units).

Refer to Appendix A for an example Complex Development drawing set.

Text, symbols and linetypes are to comply with Appendix 2B of the City's Servicing Standards Manual. Minimum plotted text size is to be 2 mm and all linetypes are to be presented consistently on all sheets in drawing set.

Dimensions are to be indicated in a clear format eliminating misinterpretation.

Drawing size is to accommodate clarity and legibility of information. Typically, a standard A1 size (594 mm x 841 mm) is required for Complex Developments.

Care is to be exercised to ensure balanced distribution of detail throughout the drawing.

The City of Whitehorse standard template file (dwt) containing all standard blocks, linetypes and layers, along with a City of Whitehorse ctb file for use when plotting, is available on the Engineering Services webpage at https://www.whitehorse.ca/business-in-whitehorse/zoning/engineering-standards.

6 DRAINAGE DESIGN CRITERIA

Drainage designs for all Complex Developments are required to meet the current version of all applicable codes, regulations, bylaws and guidelines at the time of submission.

For development in a new subdivision, the drainage design is to be carried out in conformance with the *Subdivision Grading Plan*.

For development of an infill nature, the drainage design is to be carried out to match into existing conditions at the perimeter of the property.

Drainage Plans will be reviewed individually with consideration given to the specific conditions of each development.

However, all drainage designs are required to adhere to the following general design requirements:

6.1 GRADING AT PERIMETER OF BUILDINGS

Where achievable, a minimum elevation drop of 100 mm is to be provided from design main floor elevation to elevation on grade at exterior of building with exception to door and garage door locations. The intent of this requirement is to maintain a degree of freeboard if ponding occurs in proximity to the building.

Where achievable, a minimum elevation drop of 150 mm is to be provided from elevation on grade at the perimeter of the building to elevation at invert of shared or internal swales (where applicable). The intent of this requirement is to ensure storage is provided (particularly in narrow sideyard areas) during the spring thaw/freeze cycles when snow and ice accumulation can result in temporary ponding of snowmelt runoff.

Positive drainage is to be provided away from the perimeter of all existing and proposed buildings, including areas under steps, decks and patios.

The standard preferred grade for soft surface/landscaping is 10% for the first 1.5 m from the perimeter of the building.

Refer to Section 6.4 of this document for minimum site grades.

6.2 SURFACE TREATMENTS

All porous surface treatments (e.g. mulch, decorative rock, gravel) are to be placed proud of the drainage plane.

Hard surfacing and landscaping on private property is to be designed and installed in accordance with requirements set out in the City of Whitehorse Zoning Bylaw.

Hard surfacing and landscaping on City property is to be designed and installed in accordance with requirements set out in the Servicing Standards Manual.

All hard surfacing and landscaping is to be installed in a manner that does not impede the designed overland drainage pattern.

6.3 ROOF DRAINAGE

6.3.1 Discharged to surface

When downspouts or rainwater leaders are incorporated in the drainage design, they are to direct roof drainage away from all buildings and towards the street, rear yard, laneway or greenbelt (if a supported option) and are to be installed with an elbow and extension or splash pad to convey surface run-off away from the building foundation.

Where possible, runoff is to be directed through landscaped areas to promote absorption thereby reducing volume of runoff directed off-site.

Under no circumstances are downspouts or rainwater leaders to direct run-off onto neighbouring properties.

6.3.2 Discharged below grade

For requirements related to below grade discharge of roof drainage, refer to Section 7.3.4 of this document.

6.4 MINIMUM SITE GRADES

Notwithstanding minimum grades noted within this document, no proposed grade is to be:

- Less than 1.0% on hard surfaced areas at the perimeter of all buildings;
- Less than 2.0% for all landscaped areas at the perimeter of all buildings; and
- Less than 0.5% anywhere on the subject property.

6.5 NEIGHBOURING PROPERTIES

In all instances, grading is to be designed in a manner that does not convey surface drainage to neighbouring properties.

6.6 DRIVEWAY GRADES

Driveways and drive aisles are to be designed to achieve a minimum 2.0% grade and maximum 6% grade.

Steeper grades will be reviewed and considered where it can be demonstrated that it is difficult to achieve the maximum 6% grade.

6.7 BACKFILL AT BACK OF SIDEWALK OR PAVED LANES

To reduce water infiltration into the granular base of concrete walks and paved lanes, non-granular material must be placed to be level with the top of sidewalk or laneway surface in a manner that prevents ponding of surface drainage. At rough grading stage, this can be in the form of compacted native material. At final grading stage, this would be in the form of the final design surface.

6.8 RETAINING WALLS

When proposed retaining wall(s) are 1.0 m or greater in height, a construction detail is to be submitted complete with the seal of the Engineer of Record.

Alternatively, if the intention is to use a pre-engineered product (e.g. Lock-Block), product specifications (catalogue cut sheets) for the product are to be submitted (refer to Section 4.2.1.13 of this document). Installation of a pre-engineered retaining wall system is to be in strict accordance with manufacturer's instructions.

Note that it is not acceptable to use common property fences as retaining structures.

6.9 SWALES

Shared swales and internal swales are accepted methods for conveying site drainage to a designated location, particularly along narrow side-yards and shared property boundaries.

The minimum longitudinal grade for a drainage swale is:

- 1.5% for non-hard surfaced areas; and
- 0.75% for hard surfaced areas.

Swale grades are to be continuous between design elevations indicated on the Drainage Plan and are to be free from obstructions or low areas.

6.9.1 Shared Swales

Shared 'property line' swales are located along shared property lines and are commonly used in subdivision designs to direct runoff toward roadways, lanes or right of ways at the rear and/or front of properties.

The properties on either side of the shared swale are to be graded to allow positive drainage away from building perimeters to the property line.

It is essential that the grading design for shared swales is functional for both properties.

6.9.2 Internal Swales

Internal swales are common on larger multi-unit developments as a means to direct drainage on-site to intended discharge points.

Internal swales are to be built in locations where a shared swale cannot be constructed without negatively impacting the neighbouring property.

6.10 STORM WATER MANAGEMENT BY EXFILTRATION

When storm infrastructure is not available to tie into and if the development is located in an area of Whitehorse where exfiltration solutions are supported, an exfiltration pit (rock pit) or exfiltration trench may be acceptable.

It is highly recommended that developers discuss this design approach with the City early in the design process to confirm if an exfiltration solution would be supported.

If exfiltration pits or exfiltration trenches are supported as part of the drainage design, the City of Whitehorse requires that the developer provide capacity calculations and construction details complete with seal of Engineer of Record in conjunction with the Drainage Plan.

6.11 BASEMENT AND PARKADE DRAINAGE

Developments that incorporate development spaces below grade that cannot rely on surface drainage (e.g. basements and below-grade parkades) are required to demonstrate how drainage will be managed.

Often, to address drainage in below grade conditions, a design will incorporate a sump complete with pump complete with a connection to the City's storm infrastructure. When this is the case, the sump location along with size, location and material of the storm connection is to be included on the submitted Servicing Plan.

Alternative approaches are welcome and will be considered on a case by case basis.

6.12 OVERLAND DRAINAGE CONSIDERATIONS

The Engineer of Record is required to evaluate overland drainage implications of the drainage design. The drainage design is to establish overflow elevations that ensure ponding does not accumulate within close proximity to building structure.

If discharge by overland flow is a supported drainage option, an effort is to be made to direct surface runoff through landscaped areas to promote absorption thereby reducing volumes that are discharged to public property.

7 SERVICING DESIGN CRITERIA

Servicing designs for all *Complex Developments* are required to meet the current version (at the time of design) of all applicable codes, regulations and bylaws.

Servicing Plans will be reviewed individually with consideration given to the specific conditions of each development. However, all servicing designs are required to incorporate the following general design requirements.

7.1 WATER

7.1.1 General

Design, construction and commissioning standards for water servicing are outlined in the City of Whitehorse Servicing Standards Manual Sections 2, 3 and 4.

Only one water service is permitted per property within the City of Whitehorse in accordance with the City's Water Utility Bylaw.

7.1.2 Development not serviced by the municipal network

Water servicing for developments not connected to the municipal network are to meet all requirements of the Yukon Government's Health and Social Services Environmental Health Services Department and the National Building Code Advisory #8 – Water Supply for Firefighting.

7.1.3 Access

Site Design is to provide for continuously maintained and unobstructed access to all valves, curbcocks, hydrants, oil/grit separators, manholes, meters, meter chambers and meter chamber transmitters and readouts.

7.1.4 Water Service Connections

All water services are to be designed in accordance with Section 2.6 of the Servicing Standards Manual.

7.1.5 Water Distribution System

Water distribution systems are to be designed in accordance with Section 2.3 of the Servicing Standards.

7.1.6 Water Supply for Fire Protection

The *Engineer of Record* is to design the on-site water network to ensure that required *fire flows* are met by *available flow* while meeting all conditions on the water distribution system set out in the Servicing Standards Manual Section 2.3 – Water Distribution System.

Generally, *available flow* in new neighborhoods is adequate considering new standards for construction and design of water networks. In older neighborhoods, however, there are often challenges when dealing with old infrastructure and often there is less *available flow* than what a large complex development might require.

If information submitted indicates that the existing municipal water system is unable to supply adequate *fire flow* to a development, the developer has the following three options:

- The developer can undertake improvements to the municipal network, at their cost, in a manner that is acceptable to the City Engineer in order to supply required servicing to meet the needs of the proposed development;
- If the City has plans to reconstruct the infrastructure in the area, then the developer can wait for the City to complete the planned reconstruction work at the City's schedule; or
- The developer can change the building design to reduce the required fire flow to meet the *available flow*.

If the developer proposes improvements to municipal infrastructure, a Development Permit Agreement will be required.

7.1.7 Hydrant Locations

The *Engineer of Record* is to verify that the hydrant(s) intended to provide coverage for the development is (are) located in a manner that ensures:

- Access to all tenancies fall within hydrant coverage calculated based on the FUS document 'Water Supply for Public Fire Protection'; and
- All requirements of Section 3.2.5 of the National Building Code are met.

Note that the most stringent of the above criteria is to be met.

Bollards are to be provided for all hydrants that fall within 1.5m of drive aisles and parking spaces.

7.1.8 Valves and Curbcocks

A gate valve is to be provided off the main on all water services to Complex Developments over 50mm in diameter.

Curbcocks are to be provided within City property located 150mm from property line for all water services to Complex Developments 50mm or less in diameter.

Gate valves (on services over 50 mm in diameter) or curbcocks (on services 50 mm or less in diameter) are to be installed on both sides of the meter chamber on both supply and recirculation services .

7.1.9 Meter Chambers

The requirement for water meter chamber(s) will be reviewed on a project specific basis.

Generally, a meter chamber will be required when the servicing design includes a *private water network.*

As an alternative to a meter chamber, the meter can be located in a standalone, above ground, mechanical building when the design includes a *private water network*.

When the above conditions do not apply, then it is preferred to have the water meter within mechanical room of the building.

Water Meter Chambers are to be located entirely within the private property being developed and be located within 5 m of property line.

For more information on the City's requirements for Meter Chambers, refer to Standard Meter Chamber details located in Section 4 of the City's Servicing Standards Manual (SSM).

7.1.10 Water Meters

Water meters for services 50mm in diameter or less are to be installed complete with a transmitter. The transmitter can be placed on a post or on a building and must be placed within acceptable distance from the water meter in accordance with manufacturer's specifications. Transmitters are not permitted to be installed inside the building.

Water meters for services larger than 50mm in diameter are to be installed complete with a remote readout. The remote readout must be located within an insulated and heated space and can be located on a post or on the side of a building and must be placed within an acceptable distance from the water meter in accordance with manufacturer's specifications. Readouts are not permitted to be installed inside the building.

7.2 SANITARY SEWER

7.2.1 General

Design and construction standards for sanitary servicing are outlined in the City of Whitehorse Servicing Standards Manual Sections 2, 3 and 4.

Only one sanitary service is permitted per property within the City of Whitehorse in accordance with the City's Sewer and Storm Utility Bylaw.

Cleanouts are to be provided along sanitary services in accordance with Table 2.4.7.2 of the National Plumbing Code.

It is recommended that the engineer make an effort to keep the length of sanitary services as short as possible due to risk of long services freezing.

7.2.2 Development not serviced by the municipal network

Sanitary Servicing for developments not connected to the municipal network are to meet all requirements of the Yukon Government's Health and Social Services Environmental Health Services Department.

7.2.3 Access

Site Design is to provide for continuously maintained and unobstructed access to all sanitary manholes and cleanouts.

7.2.4 Sanitary Service Connections

All sanitary services are to be designed in accordance with Section 2.6 of the Servicing Standards Manual.

7.2.5 Sanitary Sewer System

All sanitary sewer systems are to be designed in accordance with Section 2.4 of the Servicing Standards Manual

7.3 STORM SEWER

7.3.1 General

Design and construction standards for storm sewer servicing are outlined in the City of Whitehorse Servicing Standards Manual Sections 2, 3 and 4.

7.3.2 Storm Sewer System

All storm sewer systems are to be designed in accordance with Section 2.5 of the Servicing Standards Manual.

7.3.3 Oil Grit Separators

In accordance with the Zoning Bylaw and the Sewer and Storm Utility Bylaw, developments that introduce a risk of contaminants entering the storm sewer sanitary sewer (e.g. service stations, commercial garages, large parking lots) are required to include an oil grit separator complete with effluent testing port.

7.3.4 Below grade building storm sewer connections

All storm leaders directing roof drainage or drainage from below grade areas of a building to the City's storm sewer system are to be installed complete with heat trace or heat tape.

7.3.5 Existing capacity of storm sewer infrastructure

Calculations are to be submitted to demonstrate capacity in downstream storm water infrastructure to support all large *Complex Developments* located within built-out areas of the City and whose design involves connection to the City's underground storm water network.

The calculations are to be sealed by the *Engineer of Record*.

7.4 SHALLOW UTILITIES

7.4.1 General

All *Complex Development* submissions are to demonstrate coordination between site design, all deep utilities and all shallow utilities.

The servicing design is to ensure all horizontal and vertical clearances required for shallow utilities are to be adhered to and noted on submitted drawings.

The developer is responsible for contacting the Utility Companies to:

- Confirm the location of all existing shallow utilities infrastructure on or near the subject development site;
- Confirm location of all proposed shallow utilities infrastructure on or near the subject development site; and
- Confirm Utility Company's clearance requirements to their infrastructure.

Please refer to the City's Servicing Standards Manual for the City's minimum clearance requirements to deep utilities.

8 SITE DESIGN CRITERIA

8.1 ACCESS

8.1.1 Location and number of site access points

Site access is to be designed in accordance with requirements set out in the City of Whitehorse Zoning Bylaw, the City's Servicing Standards Manual, and Transportation Association of Canada standards.

Site access is reviewed based on specific characteristics of a proposed development and surrounding transportation network.

Site access is to be designed and located in a way to ensure safe and accessible integration with the City's transportation network and is to be designed to:

- Minimize the overall number of access and traffic conflict points;
- Promote perpendicular access geometry with the roadway and minimize skew intersection/access unless the applicant can demonstrate that access cannot be oriented otherwise;
- Align access centerlines to minimize the potential for offset intersection/access arrangement; and
- Ensure adequate sight stopping distance and intersection sight distance between turning movements into and out of the site as per the Transportation Association of Canada sight distance parameters.

If a development is located on the corner of two streets of different classifications (e.g. collector street and arterial street), site access is to be located on the street with the lower classification.

Access location(s) may need to be supported as part of a Traffic Impact Assessment or Pre-Design Report (if requested).

Review of site access would ideally take place during a Pre-Application Review.

8.1.2 Driveway Interface with Pedestrian and Cycling Infrastructure

Driveway crossings are to be designed to minimize conflict exposure between vehicles and active transportation users.

Apron style driveway crossings are preferred to maintain sidewalk grade continuity and minimize disturbance to the pedestrian realm.

Intersection style driveway crossings (curb return) are not preferred and will not be accepted unless there is a demonstrable need or significant turning movements as demonstrated in a TIA.

8.1.3 Accessibility

The authoritative guidance for accessible requirements on private property is set out in the National Building Code of Canada and the City of Whitehorse Zoning Bylaw.

Where accessible accommodation and design is deemed a functional requirement of a Development, the City's Engineering Services Department will consider accessible design when reviewing site grading (e.g. maximum crossfall on accessible paths of travel, maximum slope for ramps or sidewalks).

Additional information regarding best practices for the accessible design in the built environment can be found in the following design guidance:

- CSA – Accessible Design for the Built Environment
- Transportation Association of Canada – Geometric Design Guide

8.1.4 Fire Department Access Route

Fire Department Access is to meet all requirements set out in 3.2.5 of the National Building Code of Canada.

When the site layout of a development requires an on-site Fire Department access route (to meet requirements of the National Building Code of Canada and hydrant coverage based on fire flow calculations), the Fire Department access route is to be identified on a drawing included in the Engineering Package complete with intended FD vehicle movements.

Vehicle Swept Path Analysis is not used for review of Fire Department Access to proposed development.

General review of Fire Department Access would ideally take place during a Pre-Application Review.

8.2 OFF-SITE IMPROVEMENTS

Typical off-site improvements requirements include (but are not limited to):

- Pedestrian access;
- Restoration of surface works disturbed as part of required off-site work;
- Extension of water, sewer and storm water mains;
- Installation of new infrastructure within City property (e.g. manholes, catch basins, hydrants);
- Installation of pedestrian crossings and traffic signals;
- Amendments to existing on-street parking configuration.

Proposed off-site improvements will be reviewed based on design considerations of the specific development.

If accepted, the off-site improvements will be subject to a Development Permit Agreement. Refer to Section 3.5 of this document for additional information regarding Development Permit Agreements.

Identification of off-site improvements required to support proposed development would ideally take place during a Pre-Application Review.

8.3 OTHER SITE DESIGN CONSIDERATIONS

Other site design elements subject to review are:

- Signage and pavement markings as they apply to the interface between private property and the City transportation network.
- Waste Collection area in relation to current Water and Waste Department requirements.
- Location of proposed Laydown Area where laydown will likely be required offsite and where there is potential impact to street users; and
- Existing or proposed easements applicable to subject development.

9 ADDITIONAL RESOURCES

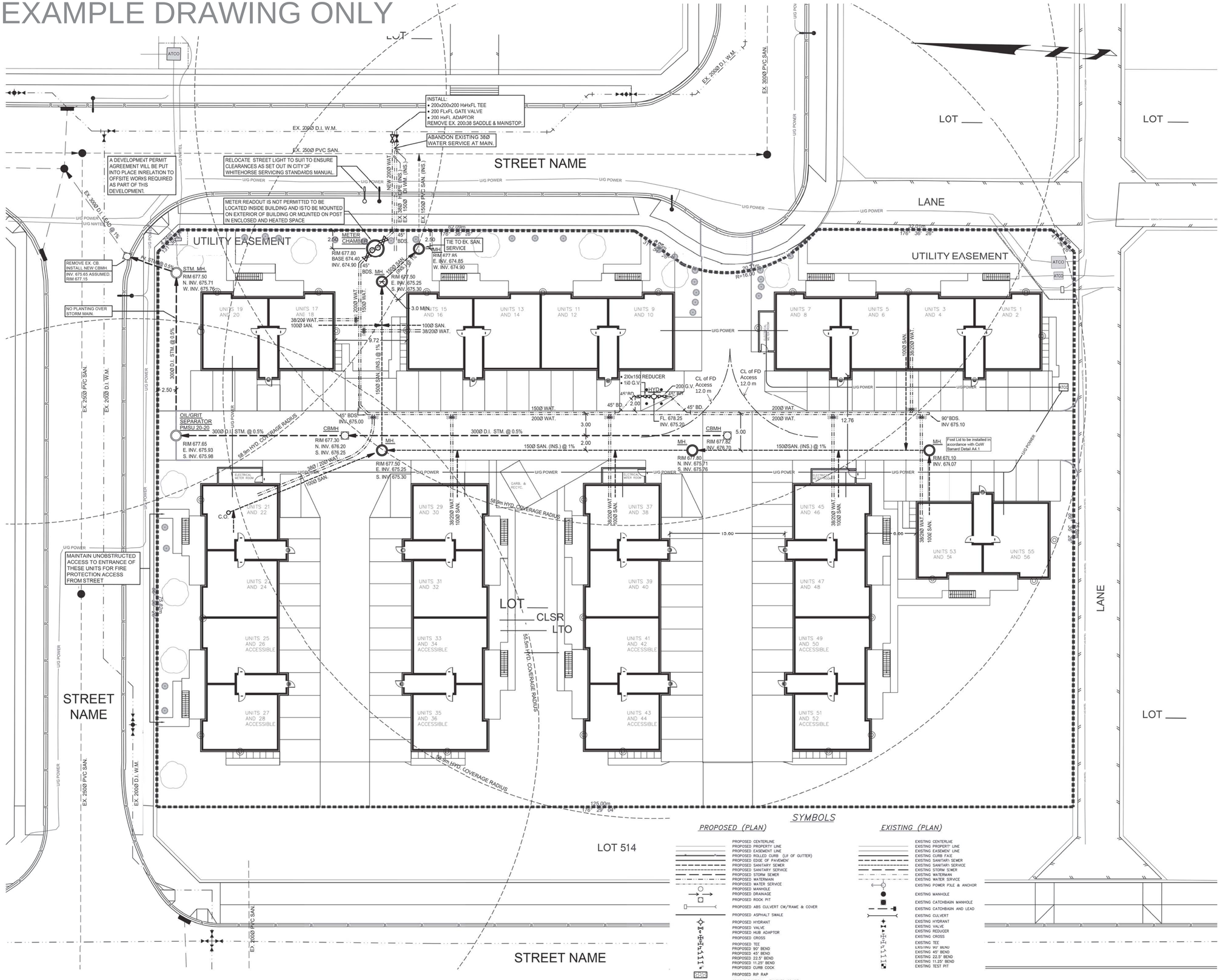
For more information on the City of Whitehorse permitting process visit the following link on the City's website:https://www.whitehorse.ca/business-in-whitehorse/zoning/development-permits/permits-and-guides/.
To access the City of Whitehorse Servicing Standards Manual, visit the following link on the City's website: https://www.whitehorse.ca/business-in-whitehorse/zoning/engineering-standards/.

To access City of Whitehorse bylaws, including the Zoning Bylaw, Subdivision Control Bylaw, Water Utility Bylaw, Sewer and Storm Utility Bylaw, and Fees and Charges Bylaw, visit the following link on the City's website: https://www.whitehorse.ca/our-government/bylaws-policies/.

If you have questions about the content of the *Complex Development Guidelines*, please contact Engineering Services at 668-8305.

10 APPENDIX A EXAMPLE COMPLEX DEVELOPMENT DRAWING SET

EXAMPLE DRAWING ONLY



SYMBOLS

PROPOSED (PLAN)

- PROPOSED CENTERLINE
- PROPOSED PROPERTY LINE
- PROPOSED EASEMENT LINE
- PROPOSED ROLLED CURB (LIF OF GUTTER)
- PROPOSED EDGE OF PAVEMENT
- PROPOSED SANITARY SEWER
- PROPOSED SANITARY SERVICE
- PROPOSED STORM SEWER
- PROPOSED WATERMAIN
- PROPOSED WATER SERVICE
- PROPOSED MANHOLE
- PROPOSED DRAINAGE
- PROPOSED ROCK PIT
- PROPOSED ABS CULVERT CW/RAME & COVER
- PROPOSED ASPHALT SWALE
- PROPOSED HYDRANT
- PROPOSED VALVE
- PROPOSED HUB ADAPTOR
- PROPOSED CROSS
- PROPOSED TEE
- PROPOSED 90° BEND
- PROPOSED 45° BEND
- PROPOSED 22.5° BEND
- PROPOSED 11.25° BEND
- PROPOSED CURB COCK
- PROPOSED RIP RAP
- SPOT ELEVATION — FINISHED GRADE

EXISTING (PLAN)

- EXISTING CENTERLINE
- EXISTING PROPERTY LINE
- EXISTING EASEMENT LINE
- EXISTING CURB FACE
- EXISTING SANITARY SEWER
- EXISTING SANITARY SERVICE
- EXISTING STORM SEWER
- EXISTING WATERMAIN
- EXISTING WATER SERVICE
- EXISTING POWER POLE & ANCHOR
- EXISTING MANHOLE
- EXISTING CATCHBAIN MANHOLE
- EXISTING CATCHBAIN AND LEAD
- EXISTING CULVERT
- EXISTING HYDRANT
- EXISTING VALVE
- EXISTING REDUCER
- EXISTING CROSS
- EXISTING TEE
- EXISTING 90° BEND
- EXISTING 45° BEND
- EXISTING 22.5° BEND
- EXISTING 11.25° BEND
- EXISTING TEST PIT

XREFS

GENERAL NOTES

1) All construction shall adhere to City of Whitehorse Servicing Standards.
2) Spacing between parallel water piping shall be as per currrent City of Whitehorse Standard Detail A6.3.
3) Mechanical and concrete thrust restraints at all water main hub fittings.
4) Tench backfill shall be compacted to 98% of standard proctor maximum dry density (as per ASTM D698) in maximum lifts of 300mm. Pipe bedding shall be backfilled and compacted in maximum lifts of 150mm.
5) SIRVICES: 38mm Supply c/w CC DR-11 HDPE (Insulated)
   20mm Return c/w CC DR-11 HDPE (Insulated)
   100mm San. DR-28 PVC (Insulated)
6) METER CHAMBER: 2400mm diameter concrete c/w frost cover.
7) SANITARY MANHOLE: 1200mm diameter concrete c/w frost cover.
8) OI/Grit Separator:
   CDS PMSU 20-20
9) Water Supply Loop:
   200/150 PVC C-900 (BARE)
10) Snitary Collector:
   150 PVC DR 28 (INSULATED)

11) FD Access Review:
- Min. Centerline radius of 12.0m met.
- Min. 6 m wide access met.
- Path of travel does not exceed 90m.

SEAL OF ENGINEER OF RECORD

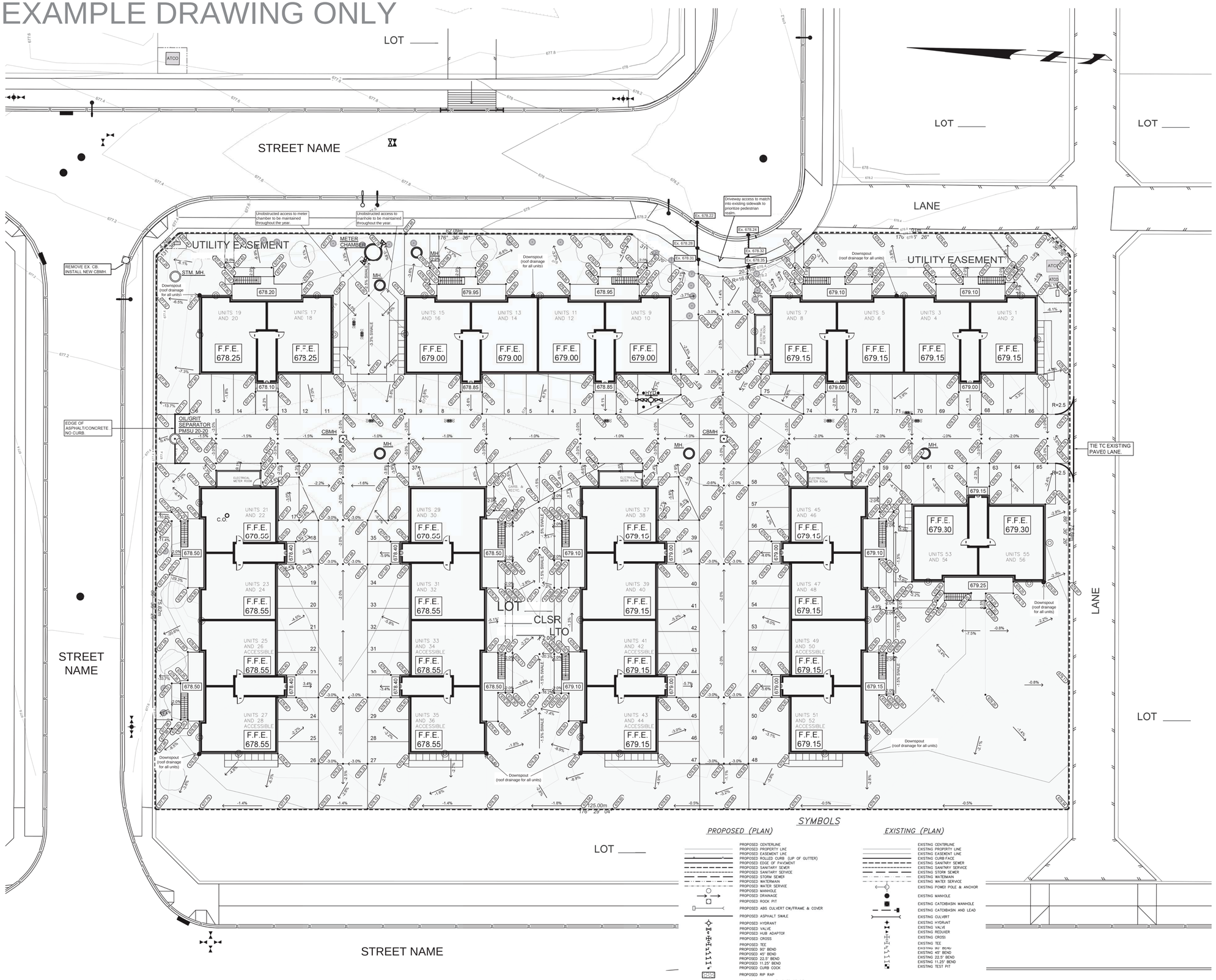
REVISIONS :

NO.	DATE	ENG.	DESCRIPTION

PROJECT TITLE

SERVICING PLAN

SCALE: H 1:250	DATE:
DESIGN:	PROJECT:
DRAWN:	
CHECKED:	SHEET NO.:
DWG. NO.:	REV.:



XREFS

GENERAL NOTES

1) Paved Parking lot structure and concrete sidewalk structure:
   - 50mm A.C./ 100mm concrete sidewalk
   - 150mm of 20mm crushed Gran A Basecourse Gravel
   - 300mm of 80mm Pit Run Base-Course
2) Transition between asphalt paving and sidewalk shall be flush.
3) Subgrade to be inspected and approved for suitability by a geotechnical engineer prior to placement of gravels.
4) Once subgrade is approved, sub-base and basecourse gravels to be placed, moisture conditioned and compacted to 98% of standard proctor maximum dry density (as per ASTM D698).
5) Imported fill material used under paved and concrete surfaces shall be non-frost susceptible and shall meet the gradation limits for pit run gravel.
6) Reuse of onsite material as fill shall be approved by a geotechnical engineer prior to use/placement.
7) Direct all roof drain leaders to landscaped areas (Typical).
8) Max. driveway asphalt grade to be 6% (Preferred).
9) Max. sideyard landscape grade to be 15%.
10) Min. drop from building to property line to be 0.15m
11) Install retaining walls & curbs as required to maintain maximum grades.
12) Contour Interval = 0.2m.
13) Elevations on this plan are at top of drainage plane.
14) Fencing is to be installed at perimeter of property for duration of construction activities.

SEAL OF ENGINEER OF RECORD

REVISIONS :

NO.	DATE	ENG.	DESCRIPTION

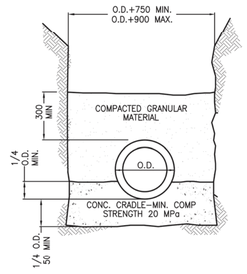
PROJECT
TITLE

DRAINAGE
PLAN

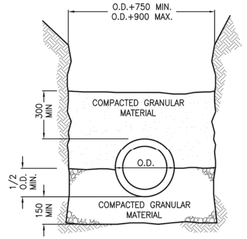
SCALE: H 1:250	DATE:
DESIGN:	PROJECT:
DRAWN:	
CHECKED:	SHEET NO.:
DWG. NO.:	REV.:

EXAMPLE DRAWING ONLY

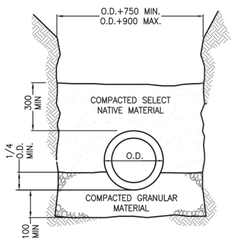
CLASS 'A' BEDDING



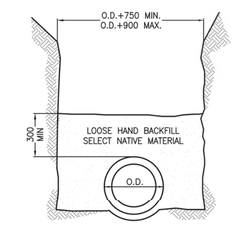
CLASS 'B' BEDDING



CLASS 'C' BEDDING



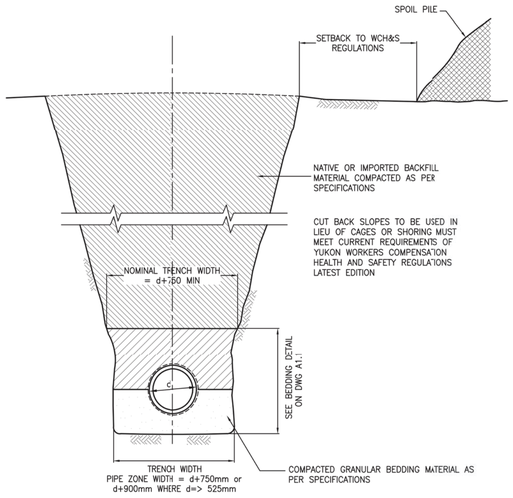
CLASS 'D' BEDDING



NOTE:
1. COMPACTION OF BEDDING AND PIPE ZONE BACKFILL SHALL BE AS PER SPECIFICATIONS.(MIN. 95% S.P.D.)
2. ALL DIMENSIONS ARE GIVEN IN MILLIMETRES

A1.1 – PIPE BEDDING DETAILS

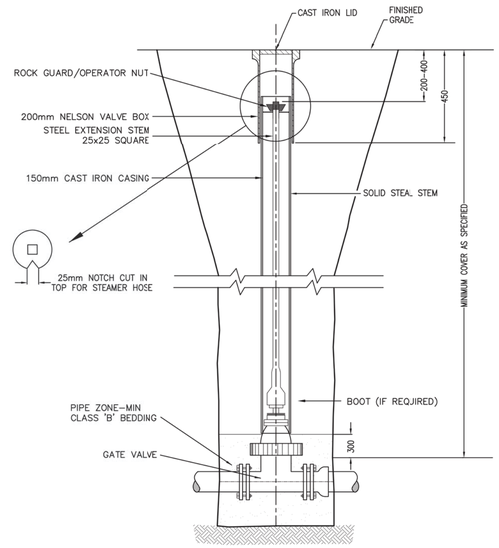
N.T.S



NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES
2. CONTRACTOR SHALL CONTACT YUKON WORKERS COMPENSATION HEALTH AND SAFETY BOARD TO DETERMINE CURRENT CUTBACK SLOPE REQUIREMENTS
3. d= PIPE OUTSIDE DIAMETER

A1.0 – TRENCHING WIDTHS

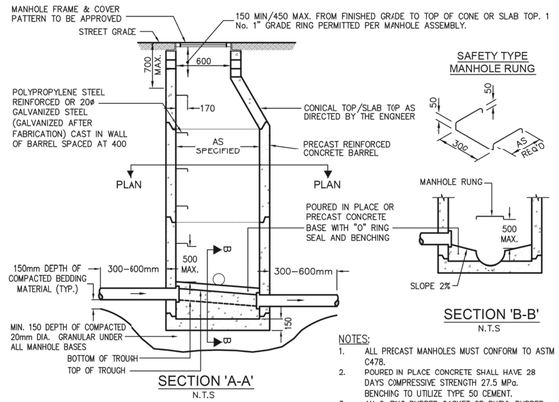
N.T.S



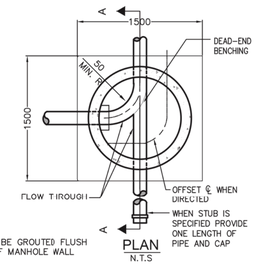
NOTES:
1. ALL DIMENSIONS GIVEN IN MILLIMETRES
2. VALVE TO BE ADEQUATELY PROTECTED AGAINST LATERAL MOVEMENT

A2.1 – STANDARD VALVE INSTALLATION DETAIL

N.T.S



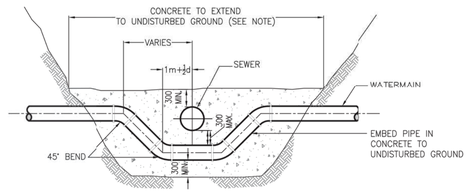
NOTES:
1. ALL PRECAST MANHOLES MUST CONFORM TO ASTM C478.
2. POURED IN PLACE CONCRETE SHALL HAVE 28 DAYS COMPRESSIVE STRENGTH 27.5 MPa. BENCHING TO UTILIZE TYPE 50 CEMENT.
3. AN O-RING RUBBER GASKET OR BUTYL RUBBER SEALAN' (OR RESPECTIVE APPROVED ALTERNATE) IS TO BE INSTALLED AT EACH BARREL JOINT IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
4. ALL BARREL JOINTS ARE TO BE MORTARED ON THE OUTSIDE.
5. FORM FLOW THROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
6. ALL DIMENSIONS GIVEN IN MILLIMETRES.
7. MAX. DIST FROM RIM TO TOP RUNG IS 700mm.
8. BACKFIL MANHOLE WITH SELECT NATIVE MATERIAL OR IMPORTED GRANULAR MATERIAL.
9. SLAB TOPS SHALL BE USED WHEN THE DISTANCE FROM THE BOTTOM OF THE RINGS TO THE MH BASE IS LESS THAN 2.2 m.
10. SAFETY PLATFORM REQUIRED IF MANHOLE OVER 6m DEEP.
11. IN SITUATIONS WHERE GRADE RINGS EXCEED MAX. 450mm, A BARREL SECTION IS TO BE USED.
12. ACCESS TO MANHOLE TO BE LOCATED OVER MAIN INLET.
13. FIRST SECTION OF PIPE (AT INTERFACE OF MANHOLE) TO BE 300-600mm IN LENGTH.



NOTE:
ALL PIPES TO BE GROUTED FLUSH WITH INSIDE OF MANHOLE WALL

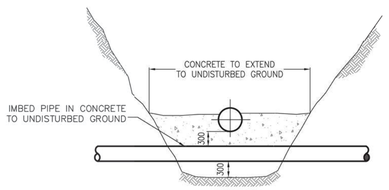
A4.0 – TYPICAL MANHOLE DETAIL

N.T.S



WATERMAIN VERTICAL OFFSET AROUND SEWER MAINS

N.T.S.



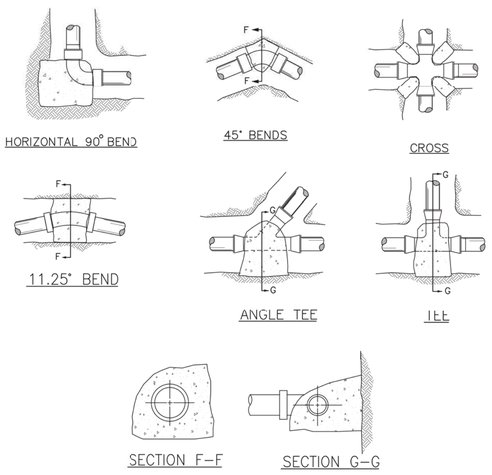
TYPICAL LINE CROSSING DETAIL

N.T.S.

NOTES:
1. MINIMUM WIDTH OF CONCRETE TO BE DIAMETER OF LARGEST PIPE + 300
2. ALL DIMENSIONS ARE IN MILLIMETRES
3. d = PIPE DIAMETER
4. ALL CONCRETE TO BE 20 MPa @ 28 DAYS.
5. SHOULD THE SEPARATION BETWEEN PIPES BE GREATER THAN 300, PIPE BEDDING COMPACTED TO 98% S.P.D. WILL BE REQUIRED.
6. RESTRAINT JOINTS TO BE USED TO TIE THE BENDS TOGETHER PRIOR TO POURING CONCRETE.

A2.3 – TYPICAL WATER & SEWER LINE CROSSING DETAILS

N.T.S.



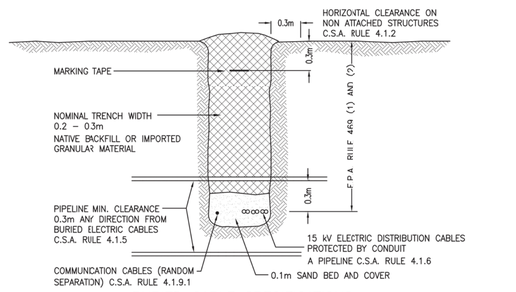
REQUIRED THRUST BLOCK BEARING AREA (sq.m)

FITTINGS \ PIPE DIA.	150	200	250	300	350	400	450	600
VALVES & DEAD END TEES	0.32	0.55	0.85	1.20	1.44	1.88	2.38	4.24
11.25° BENDS	0.10	0.11	0.17	0.24	0.29	0.38	0.48	0.85
22.5° BENDS	0.13	0.22	0.34	0.48	0.57	0.75	0.94	1.68
45° BENDS	0.25	0.42	0.65	0.92	1.11	1.44	1.82	3.25
90° BENDS	0.45	0.77	1.19	1.68	2.01	2.64	3.33	5.94

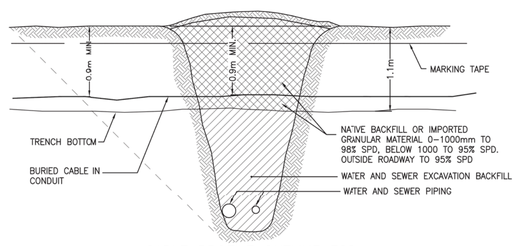
NOTES:
1. DESIGN ASSUMPTION
   a. HYDRAULIC PRESSURE 1035 KPa
   b. SOIL BEARING 72 KPa
2. TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER
3. CONCRETE SHALL BE 25 MPa AT 28 DAY STRENGTH
4. CONCRETE SHALL BE CLEAR OF BELLS AND PIPE AND UNDER ALL FITTINGS
5. ALL FITTINGS TO BE WRAPPED IN POLY PRIOR TO POURING

A2.2 – REACTION BLOCK DETAILS

– AS DIRECTED BY ENGINEER.
– ALL HUB FITTINGS TO BE RESTRAINED.



BURIED CABLE SPECIFICATIONS AND TRENCH DETAILS



CABLE PROFILE OUTLINE FOR CROSSING SERVICE EXCAVATIONS

NOTES:
1. ADOPTED FROM ATCO STANDARD DETAIL.
2. PIPE CROSSING UNDER ATCO DUCTS REQUIRE ONE WEEK NOTICE TO ATCO. WORK TO BE DONE UNDER ATCO DIRECTION

A7.0 – UNDERGROUND SERVICE CROSSING OF CABLE TRENCH DETAILS

N.T.S.

XREFS

GENERAL NOTES

SEAL OF ENGINEER OF RECORD

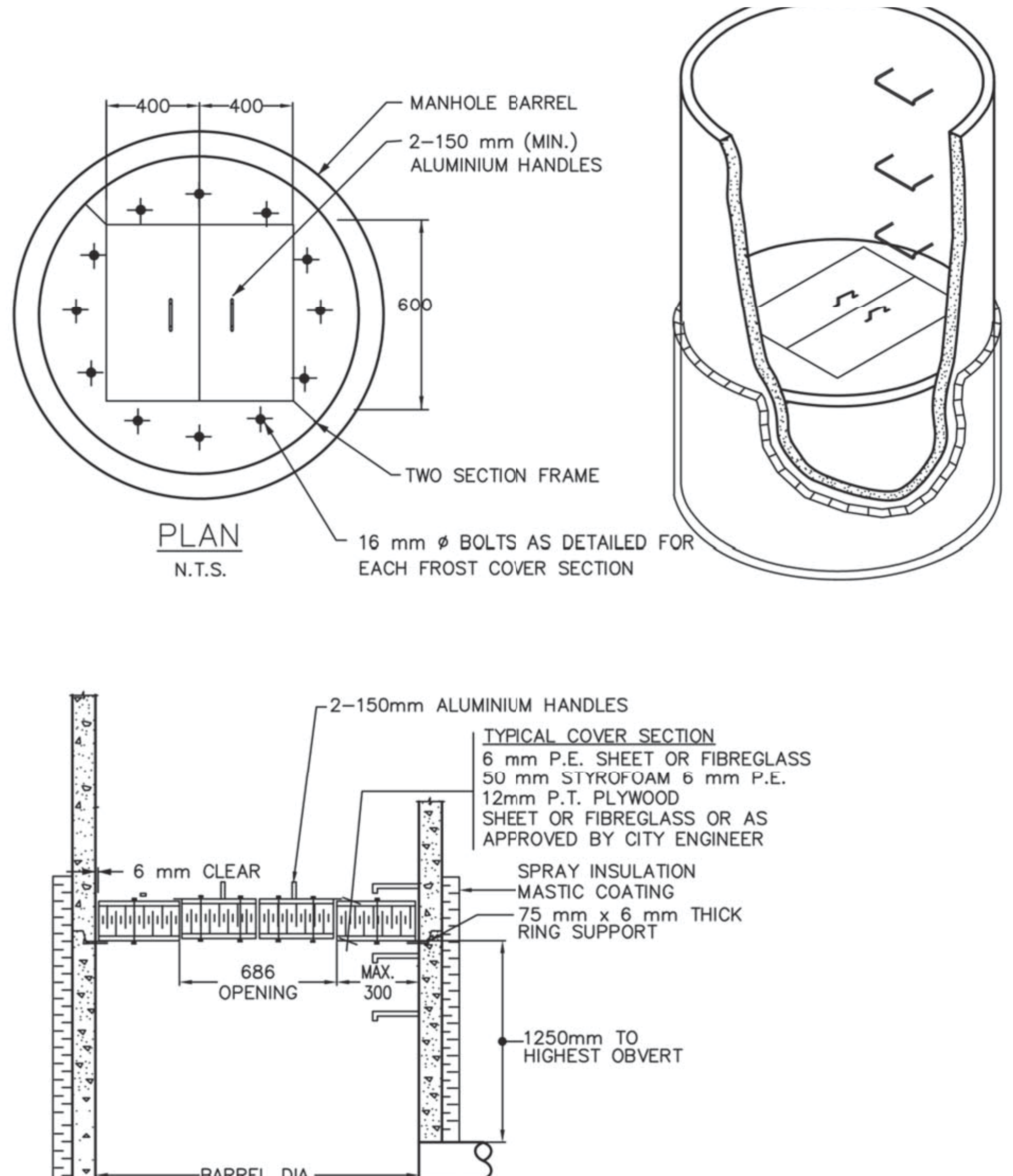
REVISIONS :			
NO.	DATE	ENG.	DESCRIPTION

PROJECT TITLE

DETAIL PLAN 1 0F 2

SCALE	DATE:
DESIGN:	PROJECT:
DRAWN:	
CHECKED:	SHEET NO.:
DWG. NO.:	REV.:

EXAMPLE DRAWING ONLY

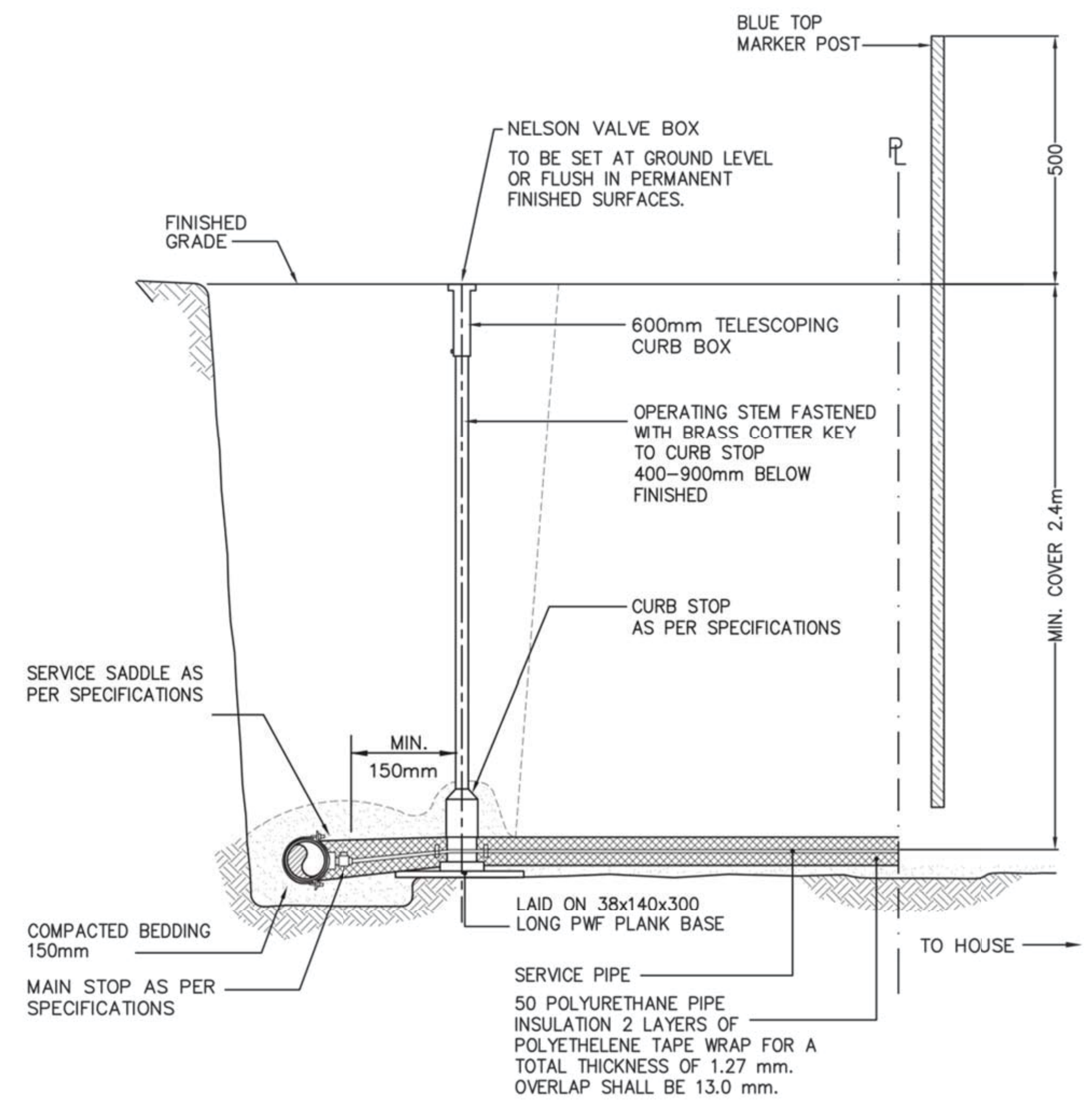


SECTION
N.T.S.

NOTES:
1. ALL DIMENSIONS SHOWN ARE IN MILLIMETRES.
2. ALL FITTINGS AND HARDWARE TO BE ALUMINUM.
3. FROST LID OPENING IS TO BE LOCATED OVER MAIN INLET.

A4.1 – MANHOLE FROST LID DETAIL

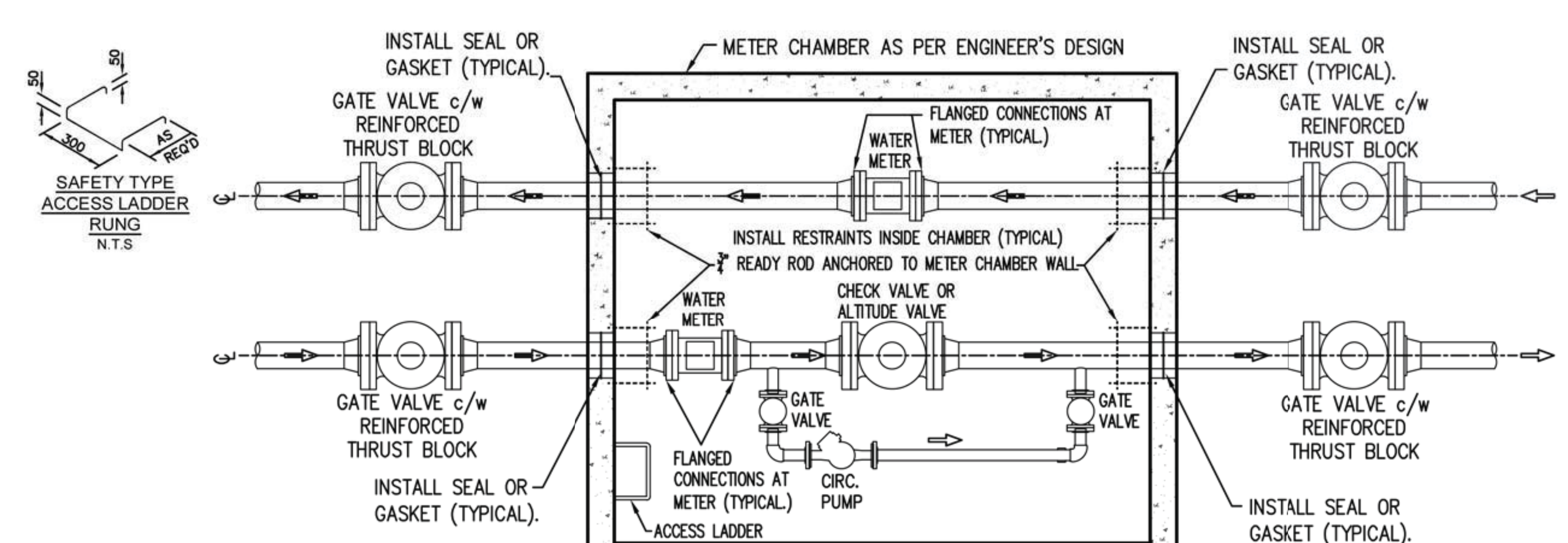
N.T.S



NOTES
1. ALL DIMENSIONS ARE GIVEN IN MILLIMETRES
2. INSULATION THICKNESS (50mm MIN) AND DEPTH OF COVER TO BE VERIFIED BY THERMAL ANALYSIS.
3. 50x100 MARKER POST TO EXTEND TO INVERT OF PIPE.
4. COMPACTION REQUIREMENTS AS PER DETAILED SPECIFICATIONS
5. INSTALL CC'S AT MAIN. WHERE CC'S FALL UNDER ROADWAYS INSTALL NELSON TYPE VALVE BOX OVER CC STEM FOR ADDITIONAL PROTECTION.
6. MIN. 150mm OVERLAP BETWEEN THE VALVE BOX AND THE STEM
7. COUPLINGS ARE NOT PERMITTED TO BE LOCATED IN THE ROADWAY
8. DO NOT TIGHTED CURB BOX AT FINAL INSTALL. CURB BOX TO BE MAINTAINED AT GRADE WITH COMPACTED FILL.

A6.0a – WATER SERVICE CONNECTION IN ASPHALT ROADWAYS

N.T.S



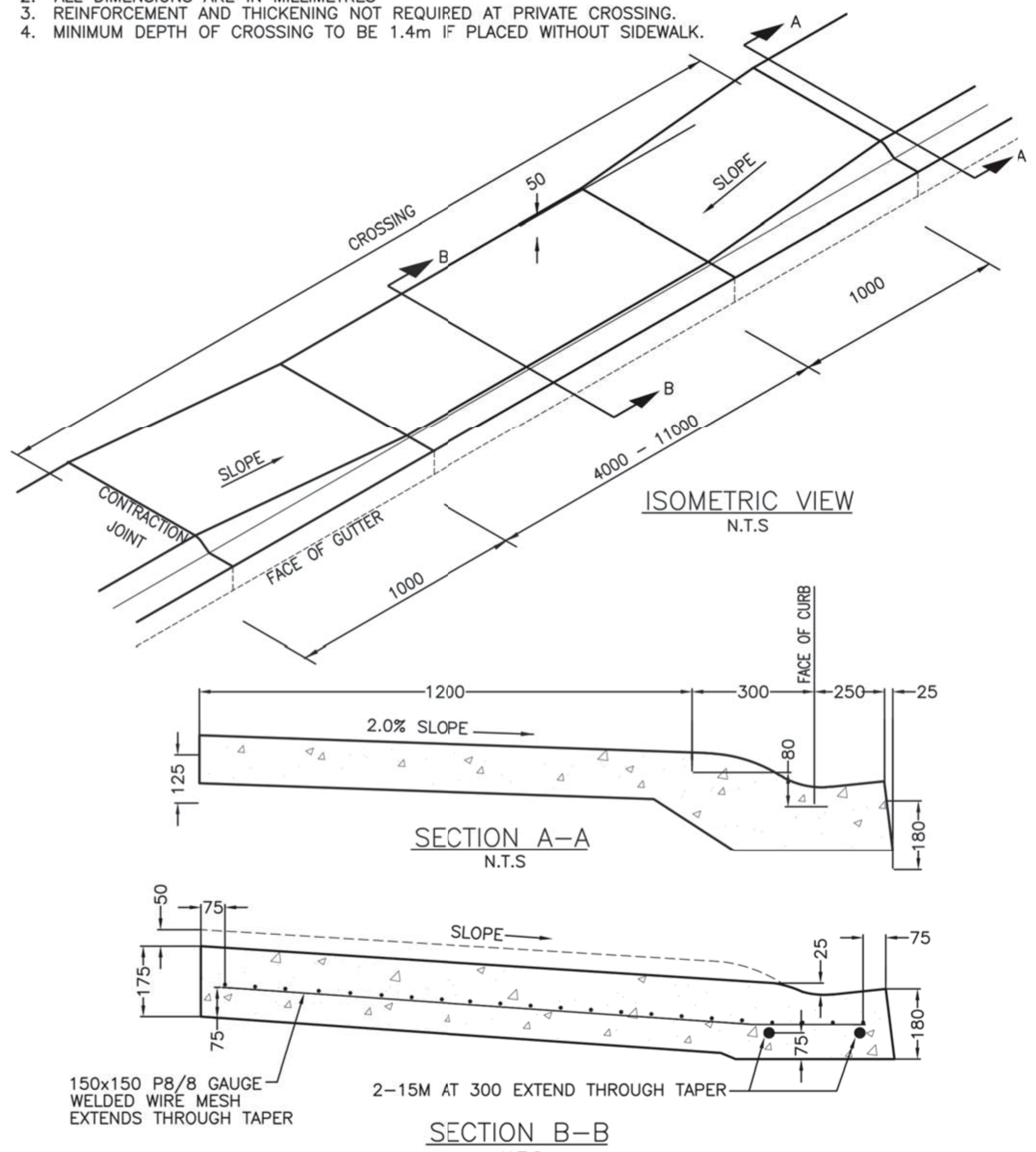
GENERAL NOTES

1) THE PURPOSE OF THIS DETAIL IS TO PROVIDE THE CITY'S MINIMUM REQUIREMENTS FOR DESIGN AND CONSTRUCTION OF METER CHAMBERS. THIS DETAIL DOES NOT REPLACE THE REQUIREMENT FOR AN ENGINEERED DESIGN. ALL METER CHAMBER DESIGNS ARE TO BE SEALED BY A PROFESSIONAL ENGINEER LICENSED TO PRACTICE IN THE YUKON.
2) WATER METER CHAMBERS ARE TO BE LOCATED ON PRIVATE PROPERTY NOT MORE THAN 5.0m FROM PROPERTY LINE.
3) WATER METER CHAMBERS ARE TO BE CONSTRUCTED TO BE WATER TIGHT AND ARE TO BE INSULATED.
4) FROST COVERS ARE TO BE INSTALLED IN ALL METER CHAMBERS. THE FROST COVER LOCATION IS TO BE COORDINATED WITH LOCATION OF ACCESS LADDER.
5) WATER METER IS TO BE SENSUS HYDROVERSES, ABB WATERMASTERS OR EQUIVALENT AND IS TO MEET IP68 SPECIFICATIONS.
6) WATER METER AND CIRCULATION PUMP ARE TO BE SUFFICIENTLY SIZED FOR DEVELOPMENT.
7) WATER METER IS TO BE INSTALLED IN A HORIZONTAL POSITION AND IN STRICT ACCORDANCE WITH ALL MANUFACTURER'S INSTALLATION INSTRUCTIONS INCLUDING (BUT NOT LIMITED TO) INSTALLATION OF GROUNDING (IF APPLICABLE), REQUIRED DISTANCE BETWEEN METER AND PIPE DEFLECTIONS AND REQUIRED DISTANCE BETWEEN METER AND ELBOWS, TEES, GATE VALVES AND ALL OTHER RELEVANT FITTINGS.
8) ALL SPLICES REQUIRED FOR METER INSTALL ARE TO BE PROPERLY SEALED.
9) METER READOUT TO BE PROTECTED FROM WEATHER AND VANDALISM AND LOCATED IN AN ENCLOSED HEATED BOX MOUNTED ON A PRESSURE TREATED 4"X4" POST A MINIMUM 1.0m IN HEIGHT. THE READOUT LOCATION IS TO BE AS INDICATED ON THE ACCEPTED DEVELOPMENT PERMIT DRAWINGS.
10) METER READOUT IS TO BE SETUP TO DISPLAY IN CUBIC METERS.
11) ADEQUATE PIPE SUPPORTS ARE TO BE PROVIDED IN METER CHAMBER AS DETERMINED BY ENGINEER.
12) ALL VALVES AND CONNECTIONS ARE TO BE SUFFICIENTLY RESTRAINED.
13) SIZE AND SHAPE OF THE METER CHAMBER TO BE IN ACCORDANCE WITH ENGINEER'S DESIGN. THE ENGINEER'S DESIGN IS TO ENSURE THE FOLLOWING:
   a) A MINIMUM CLEAR WORKING AREA OF 1m x 1m IS PROVIDED WITHIN THE CHAMBER;
   b) A MINIMUM CLEARANCE OF 400mm TO BE PROVIDED FROM PIPING AND EQUIPMENT TO ALL METER CHAMBER WALLS AND METER CHAMBER FLOOR;
   c) IF CIRCULAR IN SHAPE, THE MINIMUM SIZE OF THE METER CHAMBER IS 2.4m DIAMETER; AND
   d) THE SIZE OF THE METER CHAMBER ACCOMMODATES ALL MINIMUM CLEARANCES REQUIRED TO MAINTAIN EQUIPMENT AS PER MANUFACTURER'S SPECIFICATIONS.
13) ACCESS LADDER RUNGS ARE TO BE POLYPROPYLENE STEEL REINFORCED OR 20ø GALVANIZED STEEL (GALVANIZED AFTER FABRICATION) CAST IN WALL OF CHAMBER SPACED AT 400mm. LADDER TO BE LOCATED DIRECTLY UNDER ACCESS TO METER CHAMBER.
14) PHOTOGRAPHS OF THE METER CHAMBER INSTALLATION ARE TO BE SUBMITTED ALONG WITH THE SERVICE CARD FOR THE PROPERTY. PHOTOGRAPHS ARE TO INCLUDE ALL RELEVANT BELOW GRADE CONSTRUCTION LOCATED OUTSIDE OF METER CHAMBER INCLUDING (BUT NOT LIMITED TO) INSTALLATION OF PIPES, PIPE DEFLECTIONS, THRUST BLOCKS, RESTRAINTS, VALVES, AND SEALS/GASKETS.
15) METER CHAMBER CONSTRUCTION IS TO MEET ALL REQUIREMENTS OF CURRENT VERSIONS OF THE NBCC, CITY OF WHITEHORSE SERVICING STANDARDS MANUAL, CITY OF WHITEHORSE BYLAWS, OH&S REGULATIONS AND ALL OTHER APPLICABLE CODES AND REGULATIONS.

A4.8 – STANDARD METER CHAMBER DETAIL WITH SUPPLY MAIN AND RETURN MAIN

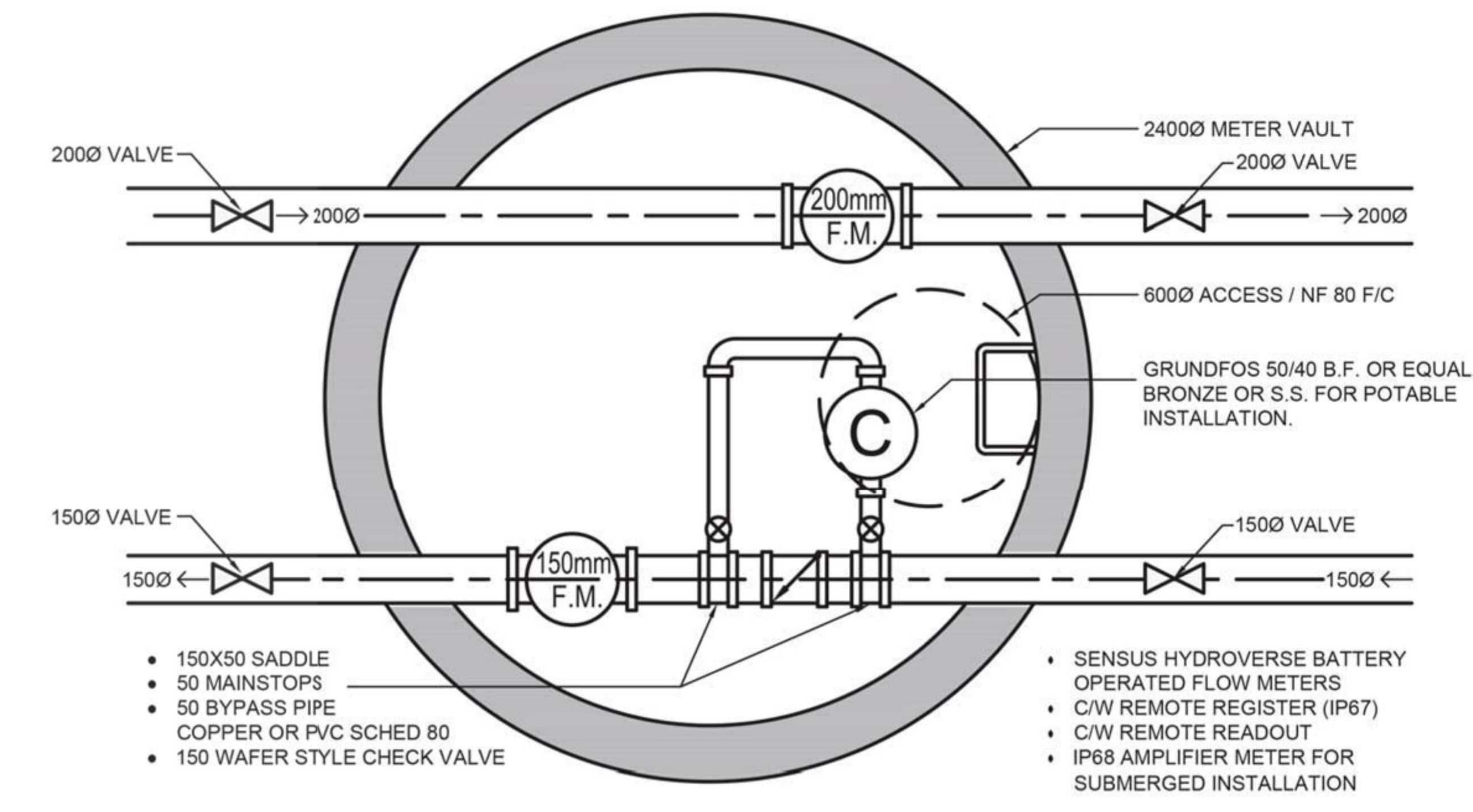
N.T.S

NOTES
1. MAINTAIN THICKENED DEPTH THROUGHOUT
2. ALL DIMENSIONS ARE IN MILLIMETRES
3. REINFORCEMENT AND THICKENING NOT REQUIRED AT PRIVATE CROSSING.
4. MINIMUM DEPTH OF CROSSING TO BE 1.4m IF PLACED WITHOUT SIDEWALK.

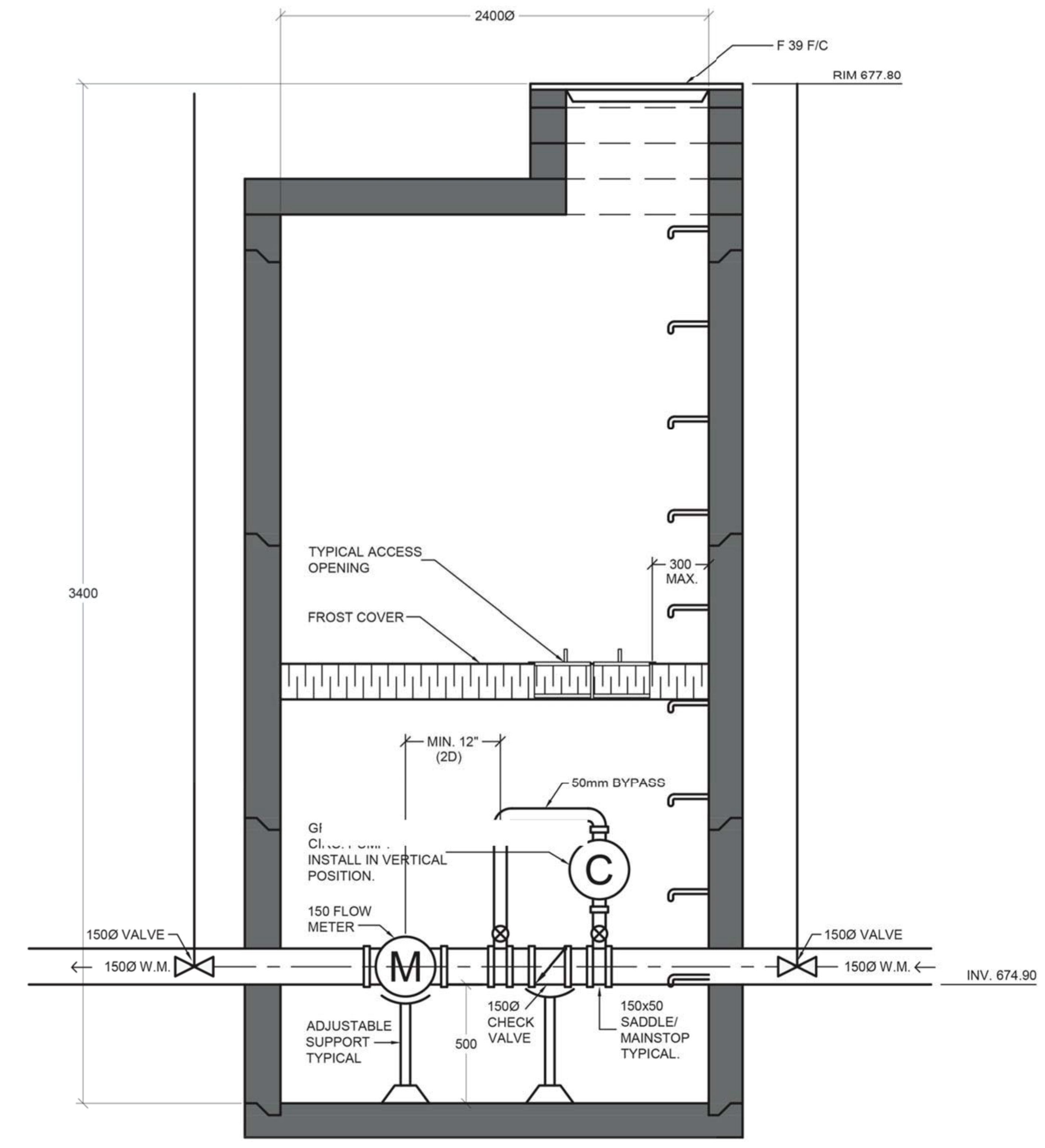


B4.0 – ROLLED MONOLITHIC CROSSING DETAILS COMMERCIAL, LANE & PRIVATE

N.T.S



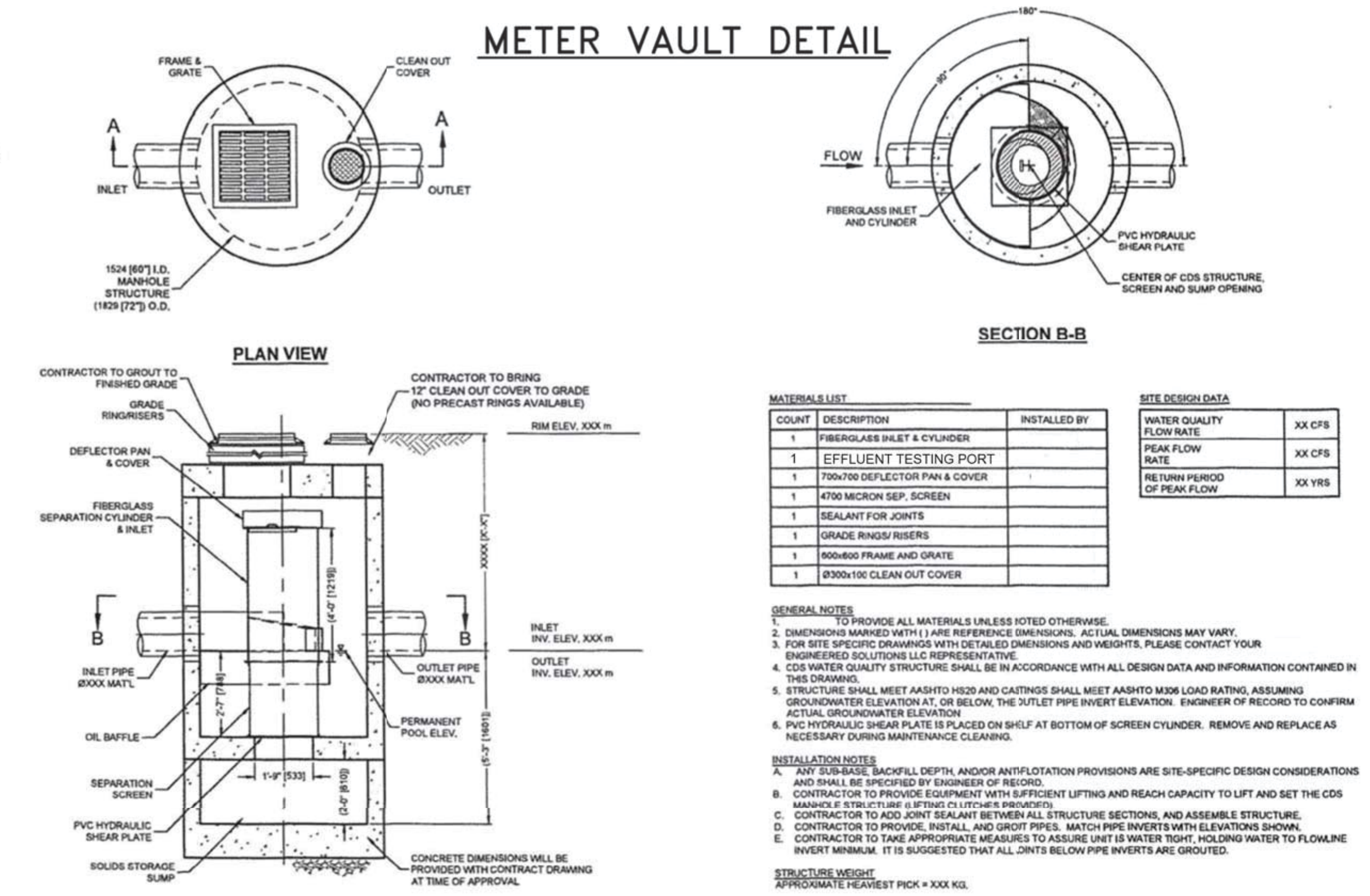
Plan View



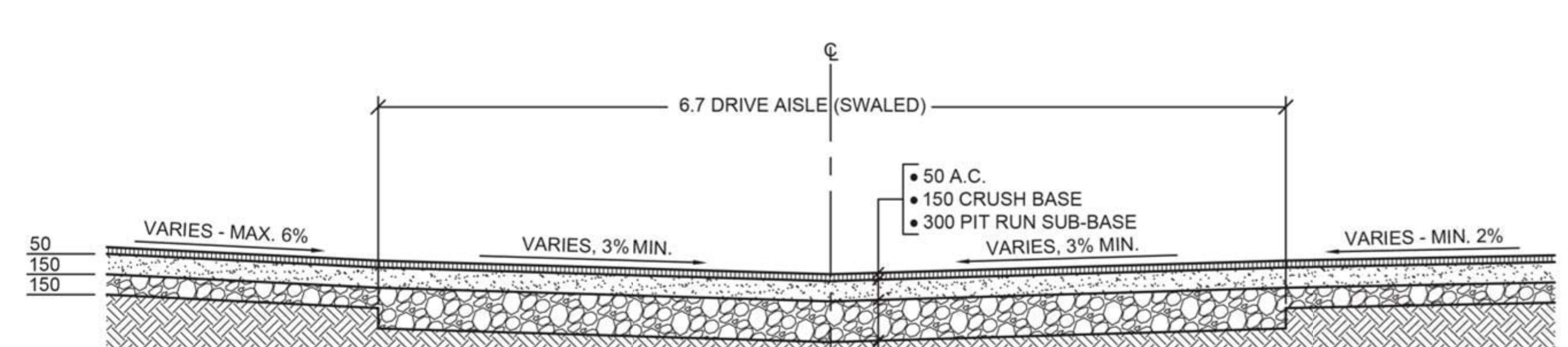
Section

NOTE:
INSTALL CIRC. PUMP UPSTREAM OF FLOW METER.

METER VAULT DETAIL



OIL /GRIT SEPARATOR



TYPICAL DRIVE AISLE DETAIL

XREFS

GENERAL NOTES

SEAL OF ENGINEER OF RECORD

REVISIONS :

NO.	DATE	ENG.	DESCRIPTION

PROJECT TITLE

DETAIL PLAN
2 0F 2

SCALE: DATE:
DESIGN: PROJECT:
DRAWN:
CHECKED: SHEET NO.:
DWG. NO.: REV.:

EXAMPLE DRAWING ONLY

STREET NAME

LANE

STREET NAME

MAYDAY TREE

GRAVEL

SHRUBS

DECORATIVE STONE

DOWNWARD FACING LED
DUSK TO DAWN LIGHT

GRASS

CONCRETE

XREFS

REVISIONS :

NO.	DATE	ENG.	DESCRIPTION

PROJECT TITLE

LANDSCAPING PLAN

SCALE: H 1:250	DATE:
DESIGN:	PROJECT:
DRAWN:	
CHECKED:	SHEET NO.:
DWG. NO.:	REV.:

11 APPENDIX B EXAMPLE HYDRANT FLOW TEST REPORT

Hydrant Number DT205

Subdivision	Location	Comments
DT	LOWE ST	

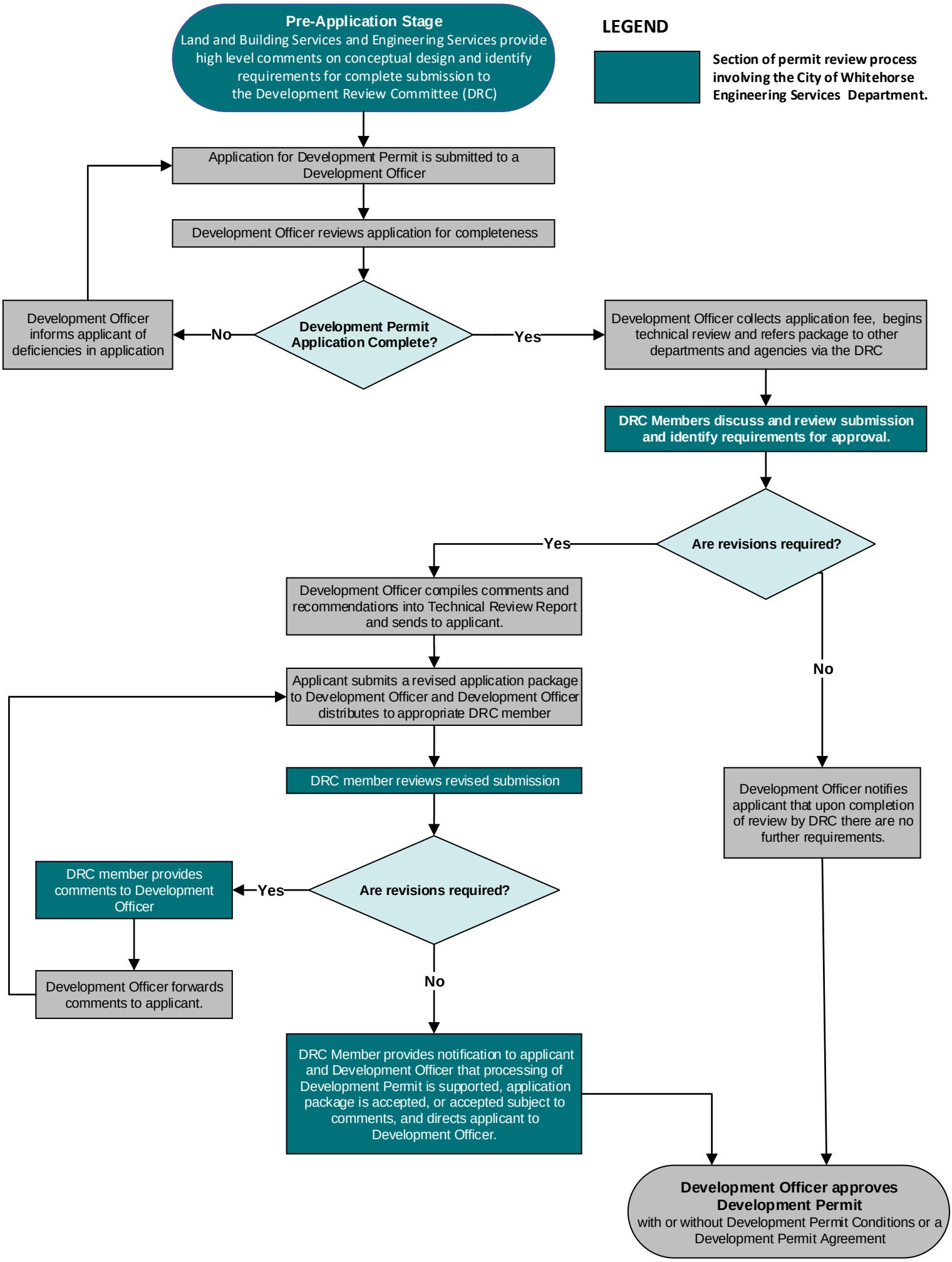
Nearest Parcel Address

Date of Testing:		
Diameter:		**1 to 21 cm**
Coefficent:		**0.7, 0.8, 0.9, 0.997**
Flow Pressure:		**KPa**
Static Pressure:		**>140 and <90 KPa**
Residual Pressure:		**>0 and <Static KPa**

Previous Testing Details

Test Date	Color	Diameter (cm)	Coefficent	Pressure (kPa)	Residual (kPa)	Static (kPa)	Total (Litres/min)	Flow @140
2022-06-07	Light Blue	9.525	0.9	145	393	441.3	6,558.16	16,379.79

12 APPENDIX C PERMIT REVIEW PROCESS FLOW CHART


Pre-Application Stage
Land and Building Services and Engineering Services provide high level comments on conceptual design and identify requirements for complete submission to the Development Review Committee (DRC)
LEGEND
Section of permit review process involving the City of Whitehorse Engineering Services Department.
Application for Development Permit is submitted to a Development Officer
Development Officer reviews application for completeness
Development Permit Application Complete?
No
Development Officer informs applicant of deficiencies in application
Yes
Development Officer collects application fee, begins technical review and refers package to other departments and agencies via the DRC
DRC Members discuss and review submission and identify requirements for approval.
Are revisions required?
Yes
Development Officer compiles comments and recommendations into Technical Review Report and sends to applicant.
Applicant submits a revised application package to Development Officer and Development Officer distributes to appropriate DRC member
DRC member reviews revised submission
Are revisions required?
Yes
DRC member provides comments to Development Officer
Development Officer forwards comments to applicant.
No
DRC Member provides notification to applicant and Development Officer that processing of Development Permit is supported, application package is accepted, or accepted subject to comments, and directs applicant to Development Officer.
No
Development Officer notifies applicant that upon completion of review by DRC there are no further requirements.
Development Officer approves Development Permit
with or without Development Permit Conditions or a Development Permit Agreement