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SECTION 6.0: WATER SUPPLY & DISTRIBUTION SYSTEM

6.1 GENERAL

The water distribution system is to be designed as a network system to meet the water demand for each area or development under consideration. To ensure reliability, a looped system must be provided to the satisfaction of the Town and InnServices.

6.2 CONFIRMATION OF AVAILABLE CAPACITY

Prior to the commencement of any design, the developer and/or designer must contact the Town and InnServices and confirm that there is adequate system capacity to accommodate the proposed project.

6.3 SERVICE AREA

The system shall be designed to service all areas within the development to their maximum future capacity in accordance with the Town's Official Plan. Allowance shall be made for connection to appropriate watermains in adjacent developments or future growth areas. The exact location for these connections shall be approved by the Town.

6.4 DESIGN FLOWS

The estimated populations and development areas shall be by the Town's Official Plan.

The design population shall be derived using the proposed Plan of Subdivision and the following densities:

Single Detached and Semi-Detached Dwellings	3.36 ppu
Townhouses	2.70 ppu
Apartments	1.90 ppu

In the absence of detailed information, populations should be estimated based on proposed land uses identified in the Town's Official Plan or in the applicable Master Servicing Studies.

Watermains shall be designed to meet the greater of the maximum day demand plus fire flows or peak hour demand.

The average daily demand shall be:

Future Residential = 250 litres/capita/day

Existing Residential = 275 litres/capita/day

Commercial and Industrial – Site Specfic Calculation (210m^3/ha/day if specific use is unknown) (or site specific calculations)

Institutional = Historical water use data at the subject site or a similar site (covering at least 2 years) of the facility or other similar facilities can be used to calculate average institutional daily demand. Where historical water use data is not available, the unit values for institutional water demand listed in the MECP Design Guidelines ca be used. The designer shall use professional judgement to select appropriate flow rate within the range.

Average daily demand for elementary and secondary schools shall be calculated using 30 L/student/day.

The maximum daily demand factor shall be determined from the current MECP design guidelines; however, a minimum of 1.8 is to be used.

Peak demands for land use other than residential shall be determined on an individual basis and approved by InnServices.

In general, the following minimum fire flow demands shall be used, unless the Fire Underwriters Survey (FUS) calculations require a higher fire flow:

Land Use	Required Fire Flow (L/s)
Residential – Single Family	100
Residential – Townhouse	135
Institutional – School	150
Institutional – Community (community services and facilities such as hospitals, churches or community recreational centres)	200
High Rise/Downtown/Mixed Use	200
Commercial – Small Businesses	125
Commercial	250
Industrial	325

The above noted requirements do not take into consideration any reductions that could reduce fire flow needs. Specific fire flow demand shall be calculated according to the latest published requirements of the Water Supply for Public Fire Protection (Fire Underwriters Survey (FUS)). Proposed fire flows (eg. For submitted site servicing plans) that are less than standard recommended would require approval by the Town of Innisfil and InnServices.

Where existing municipal infrastructure cannot meet the updated fire flow requirements, alternate methods should be reviewed to meet the level of service for fire protection required (e.g., sprinkler systems, fire rated materials, or additional on-site fire storage and pumping facilities). Fire flow requirements for new development in existing settlement areas should be reviewed on a case-by-case basis. Newly developed areas shall comply with the above fire flow requirements.

Fire flow requirements would also be subject to the fire protection requirements of the Ontario Building Code.

6.5 WATERMAIN SIZING

The Hazen-Williams formula shall be used for computing friction losses and subsequently sizing the watermains.

For new mains, the Hazen-Williams factors, “C”, shall be as follows:

C = 100 for 150 mm diameter
C = 110 for 200 mm and 250 mm diameter
C = 120 for 300 mm diameter and greater

The minimum size of watermain shall be 150 mm diameter in residential developments, except beyond last hydrant on cul-de-sacs where the minimum diameter of watermains shall be 50mm. The minimum size of watermain shall be 200 mm diameter in industrial, commercial, and institutional developments.

For distribution systems that are not designed to provide fire protection, the minimum diameter of the watermain line shall be 75mm.

A hydraulic network analysis of the water distribution system shall be carried out by InnServices Modelling Engineer based upon the information received from the designer.

6.6 WATERMAIN PRESSURE

The minimum pressure during maximum daily demand (MDD) shall be 345 kPa (50 psi)
The minimum pressure during the peak hourly demand (PHD) shall be 275 kPa (40 psi).

The minimum pressure when the system is tested under fire flow conditions in conjunction with the maximum daily demand shall be 140 kPa (20 psi).

The maximum pressure under static load or during the minimum hourly demand shall be 550 kPa (80 psi).

6.7 OVERSIZING

Oversizing of watermains will be provided as required to provide for adjacent areas where service is expected to be extended, and to provide fire flow requirements including oversizing of hydrants, openings and leads as required.

6.8 WATERMAIN LAYOUT

Watermains shall generally be located as per the typical road cross-section.

When watermains are located within the boulevards, standard positions being on north and west side of the street. It is preferred to locate watermain on the opposite side of the road from the hydro distribution system. Refer to typical road cross-section for general guidance.

When watermains are located in easements, the easement width shall be 6.0 metres minimum. However, the Town will review alternative easement widths on an individual basis in certain circumstances such as the utilization of a joint trench or installation of a sewer at a depth which is substantially greater than standard.

6.9 MINIMUM DEPTH OF COVER

For urbanized roads a minimum depth of cover of the 1.7 m below finished ground surface or 1.9 m below road centreline, whichever is greater, is required.

Along open ditches, or unimproved roads, an increased cover may be requested by the Town to allow for future road improvements or lowering of road profile when urbanization occurs.

The maximum height of fill is not to exceed OPSD 808.010 unless pipe strength design calculations are provided for approval by the Town.

In zones where minimum cover cannot be provided design of pipe insulation must be submitted by the Engineer for approval by the Town.

The as-built elevations should be shown at every bend, tee, and every 20m on straight sections on the as-built plans.

6.10 PIPE CLEARANCE

Minimum clearances between other types of services (i.e. sanitary/storm) shall be provided in accordance with MECP guidelines.

Under normal conditions, watermains shall cross above sewers with a minimum of 0.5m vertical separation to allow for proper bedding and structural support of the watermain and sewer main. When it is not possible for the watermain to cross above the sewer, the design shall refer to MECP guidelines and Section 6.13 below.

6.11 BEDDING AND BACKFILL

All watermain and appurtenances are to be installed with bedding and embedment (well-graded sand, which is free of stones, unless otherwise approved by InnServices) and backfill in accordance with OPSD 802.010 or 802.030 to 802.032, as applicable.

Compaction shall be to a minimum of 95% SPMDD and increased to 98% SPMDD within 1m of the road subgrade or as indicated in the approved Geotechnical Report.

In soft or wet conditions, additional Geotechnical investigation and testing may be necessary to determine the appropriate bedding and backfill measures.

All water services shall be embedded in well-graded sand, which is free of stones, 150mm above and below the service pipe, per TOISD 705.

6.12 RESTRAINING

All joints are to be mechanically restrained in fill areas, as per manufacturer's recommendations.

Concrete thrust blocking shall be installed at all tees, vertical and horizontal bends, hydrants, ends of watermain and connections 100 mm and larger, as per OPSD 1103.010 and OPSD 1103.020, in addition to restraining glands at mechanical joints.

All watermain and thrust restraints shall be designed to withstand the maximum operating pressure, plus the transient pressure to which it will be subjected. The value of transient pressure will not be less than the pressure surge that would be created by immediate stoppage of water column moving at 0.6m/s. The design pressure shall not be less than 150psi (1034kPa) in any case.

6.13 LOWERING OF WATERMAIN FOR CROSSINGS

If it is necessary to lower a watermain to avoid a conflict with other infrastructure, the designer shall refer to TOISD 727.

The maximum permissible vertical bend shall be 45° and the minimum length of the deflected watermain shall be 1.5 m.

Using 90° horizontal bends should be avoided where alternatives exist.

All fittings installed along watermains should not be located under any under service line, utility line, concrete curb or any other element restricting direct access to the pipe.

6.14 SUPPORTING OF WATERMAIN

Where crossing an existing watermain, if more than 0.9 m of the watermain will be exposed, the designer will be required to provide detailed drawings showing how the watermain will be supported during construction for approval by the Town.

6.15 TERMINATION OF WATERMAIN

Design proposal for the watermain system shall ensure that adequate water quality requirements are met. Water distribution systems should be designed without any dead-end pipes. Sizing of watermain in cul-de-sacs shall be done as described in Section 6.5 and engineering calculation for the size of looping pipe must be submitted for review.

Where dead-end watermain pipe is allowed, it must be terminated with a valve and hydrant, both in locations approved by InnServices. The use of blow-offs may be permitted at the discretion of InnServices.

6.16 FIRE HYDRANTS

Hydrants shall be installed in accordance with TOISD 703, complete with thrust blocks and mechanical restrainers. Driveway hydrants shall be installed in accordance with TOISD 725.

Hydrants shall be installed on all watermains with a maximum allowable spacing along the watermain of 120m in single family residential areas and 90m in industrial, commercial, institutional, townhouse and multi-residential areas land uses, or as required by the Town and InnServices.

Hydrants shall be located as per the typical road cross-section and generally on projections of lot lines, at the end of all cul-de-sacs, and at dead ends. Hydrant locations shall be at the discretion of the Town and InnServices. On rural cross-sections, hydrant access behind the ditch, complete with culvert, is to be provided. Refer to Appendix C for minimum clearances from other above grade features.

Hydrant flanges shall be set such that the final elevation is 100 mm maximum above finished grade. The as-constructed elevation of the top of flange should be labelled in the set of as-recorded drawings. Hydrant extensions are not allowed unless approval is given by InnServices.

In areas where the water table is known to be high, the Town and InnServices may request that the drain holes of the hydrant be internally plugged. Yellow stripe to be painted on hydrant if drain port is plugged as per TOISD 703.

Hydrants are to be fixed with anti-tampering devices at the discretion on the Town and InnSerivces

All hydrants are to be fixed with hydrant markers.

Paint specifications are subject to Town approval. Refer to Section 6.27.3 for testing and painting requirements.

Refer to Appendix B for a list of approved materials and specifications.

6.17 VALVES

The size of main line valves shall be equivalent to the size of the watermain.

Valves shall be located as required to meet spacing and intersection requirements, or as required by InnServices.

Generally, four (4) valves shall be placed at cross-intersections and three (3) valves at tee intersections, such that sections can be isolated without jeopardizing flow to other sections. Possibility to eliminate some of the valves will be confirmed during early stage of review of the engineering drawings.

Valves shall be spaced such that no more than forty (40) dwelling units are isolated at one time. In addition, the maximum permissible spacing between valves shall be 300 m for distribution/servicing watermains, and 400 m for trunk supply watermains.

All valves 450 mm diameter or greater shall be installed in a concrete valve chamber.

Air release valves on watermains up to and including 250mm diameter to follow TOISD 713 or to be direct bury installation, at significant high point locations where a fire hydrant is not located at the highpoint. For watermains 300mm or larger, air release valves to follow TOISD 713 or TOISD 715 and shall be provided at significant high points and, where possible, installed together with valves in valve chambers. Further, where possible, fire hydrants shall be located at all highpoints to minimize the negative impacts of trapped air.

Drain valves shall be provided at low points of all trunk watermains and, where possible, installed together with valves in valve chambers. Drain Chambers should be connected to a storm sewer maintenance hole, or to another technically feasible outlet point.

Where confirmed by the water modelling calculations, a pressure reducing valve shall be installed in an enclosure complete with an internal watermain bypass. Enclosures shall be sized appropriately to accommodate the pressure reducing valve, watermain bypass and all appurtenances to the satisfaction of InnServices. Detailed requirements will be confirmed by InnServices at the time of completion of the water modelling report.

A waterproofing membrane or petrolatum tape shall be applied externally around all joints of chambers and is to be overlapped halfway up the structure frame. The membrane shall be installed as per manufacturers specifications and protected during backfill operations.

Watermains crossing creeks, railways and provincial highways shall have a valve on each side of the crossing.

6.18 WATER SERVICES

Single 25 mm diameter water services with a curb stop at 0.3 m in front the property line is to be installed to each residential property.

Water services to commercial, industrial, institutional, and multiple use shall be sized for the specific land use and approved by the Town.

Single services for a residential lot shall be located in accordance with TOISD Division 600. The location of a water service for commercial, institutional, or industrial use will be considered on an individual basis.

Water services shall be located at a minimum depth of cover of 1.7 m with the curb stop being at least 1.0 m away from the future driveway. If a three (3) car garage is allowed by the zoning By-Law, and may be constructed on a lot, water services and curb stop should be installed with offset to accommodate such options. Any curb stop/water service must be relocated if found to be within the driveway or at unacceptable separation during the construction stage. If a curb stop cannot be relocated, InnServices Water Operations must be notified and contacted for an inspection before the driveway is paved to ensure a frost collar has been installed.

When the water service line is in conflict with any main service pipe (typically storm sewer main), the water service must be installed below the storm sewer with separation as required by MECP. Creation of high points along water service line is not allowed, with exception of a vertical goose neck, established near main stops for residential sized copper water services.

Where minimum pressure rates cannot be met, use of house-based water booster pump maybe allowed. Such system may be allowed as temporary solution after consultations with the Town.

6.19 WATER SAMPLING

Water sampling stations shall be provided where directed by the Town. In general, one (1) sampling station is required at a rate of one (1) per three-hundred (300) units. Sampling Station should be located within municipal ROW or in a corner area of municipal blocks (e.g. parks, parkettes). Locations in the intersection areas are not allowed.

6.20 FIRE DEPARTMENT CONNECTIONS

Fire department connections may be required for industrial, commercial, or institutional developments. Configuration of the fire and domestic water service connection is to be confirmed by the Town during pre-submission consultations.

6.21 FIRE SERVICE BACKFLOW PREVENTION

On private property, where a private fire service main is installed with private fire hydrant(s), a testable backflow prevention device shall be installed on the private fire service main to provide premise isolation to guard against possible cross-contamination of the municipal water system.

The selected backflow prevention device shall be determined by the Owners Consultant Engineering based on CSA B64.10 series standards, AWWA Canadian Cross-Connection Control Manual, Ontario Building Code and be in accordance with NFPA 24.

If determined by the Owners Consultant Engineer that a Reduced Pressure Principle (RP) backflow preventer is required, such backflow preventer shall be installed in an above ground enclosure and follow the requirements listed in Section 26 - Backflow Prevention.

If determined by the Owners Consultant Engineer that a Double Check Valve Assembly (DCVA) is acceptable, the DCVA shall be installed in an above ground enclosure or an underground chamber.

If installed in an underground chamber, the chamber housing the DCVA shall adhere to the following as a minimum:

- The chamber shall be located on private property, 0.3m minimum from property line.
- The chamber shall be located in a grassed area, not permitted in a driveway or laneway.

- To protect the valve and piping from freezing, the chamber shall have 50mm rigid insulation on the underside of top cap, on the interior walls to a minimum depth of 1.2m below grade and the access riser shall have a 50mm of removable rigid insulation.
- The chamber shall be designed to ensure a dry condition is maintained.
    - Gravity drain to storm system complete with check valve (preferred) or a permanently installed sump pump.
    - Precast concrete joints to have watertight gaskets, and to be externally wrapped with waterproofing membrane.
    - Internal frost straps shall be non-penetrating, anchored in the internal chamber wall as per pre-cast chamber manufacturer recommendations. To be factory cast inserts (pre-fabricated fastener sleeves).
- Clearances around the DCVA meet CSA B64.10 series standards.
- All test cocks on the DCVA device shall be plugged using a mean that is watertight.
- Chamber design shall be subject to the approval of InnServices and the Town.

The property Owner shall be fully responsible for private fire service main, enclosure or chamber, backflow preventer, hydrant(s) and all appurtenances, including but not limited to, all maintenance, inspection, testing, repair or replacement.

6.22 WATER METERS

A water meter is required for each water service. The water meter will be sized by InnServices using the peak instantaneous flow provided by the designer.

6.23 TRACER WIRE

Tracer wire shall be installed on all watermains, services, and hydrant laterals, except where such service is of copper material.

For open cut installations, tracer wire shall be #12 AWG (0.0808" in diameter) high strength copper clad steel conductor (HS-CCS), insulated with a 30 mm high density polyethylene (HDPE) insulation rated for direct burial use at 30 volts. Tracer wire shall not be wrapped around bolts or components along mainline and shall not be placed under any pipe or appurtenance. Tracer wire shall be laid flat and securely affixed with mastic tape to the top of the watermain at 5.0 m intervals.
For trenchless installations, tracer wire shall be extra-high strength copper-clad steel. A minimum of four (4) wires to be pulled during installation.

Breaks or cuts in the tracer wire are only permitted at the following prescribed locations:

- hydrant laterals,
- fireline water services,
- tees and crosses.

Tracer wire shall be looped at each hydrant such that the tracer wire is brought above ground in a 1" rigid PVC conduit placed at the back of the hydrant and looped back down the hydrant lead to the mainline. The looped wires are to be tightly taped together and left untouched in a hydrant Three Terminal Test Station, which is to be installed at the back of each hydrant and bolted at the flange.

Tracer wire shall not be brought up any mainline or secondary valves.

For PEX water services, tracer wire shall run between the shoulder set screw on the main stop to the shoulder set screw on the curb stop. Tracer wire for the PEX water service is not to connect to the watermain tracer wire. A grounding anode shall be installed at each main stop location by clamping the wire running from the anode to the main shop shoulder set screw. Profiling mastic and petrolatum tape to be applied at shoulder set screw locations as per TOISD 705-B.

In areas where more than one watermain exists on a single street, such as a transmission main and a distribution main, the tracer wire must be brought up at intervals of no greater than 350 m using a test station when no other connection points are available. Tracer wire running from the mainline to a connection post shall be in a 1" rigid PVC conduit. The test station shall be installed 1.0 to 1.2 meters above grade and shall be colour coded blue.

Refer to Appendix B for a list of approved materials and specifications.

6.24 CORROSION PROTECTION

All watermain fittings, valves and restrainers in chambers or direct bury shall have protective coatings applied. The protective coating shall be a petrolatum tape system consisting of a petrolatum primer paste, petrolatum molding mastic, and cold wrapped petrolatum tape applied in accordance with manufacturer guidelines.

In addition to the protective coating, sacrificial caps are to be provided on every bolt of all mechanical joints and restrainers. The bolt lengths shall be sufficient to accommodate the caps.

Sacrificial zinc anodes (5.4kg) shall be connected to copper water services, wire attached with ground clamp and installed in accordance with OPSS 442 and OPSD 1109.010 & 1109.011.

At their discretion, the Town or InnServices may also require a sacrificial zinc anode (10.8 kg) connected to hydrant boot, wire attached with thermite weld and installed in accordance with OPSS 442 and OPSD 1109.010 & 1109.011. Exposed weld to be protected in thick coat of mastic.

At their discretion, the Town or InnServices may also require other corrosion protection measures.

6.25 CAUTION TAPE

When the watermain or water service has been installed in non-standard locations, blue caution tape is to be installed, along its length, between 0.3 m and 0.5 m above the watermain or service.

6.26 BACKFLOW PREVENTION

Backflow prevention devices must be installed and maintained on all existing and/or proposed water services to industrial, commercial, institutional and multi-residential buildings to prevent the flow of contaminants into the municipal drinking water system in accordance with the Town of Innisfil Backflow Prevention By-Law.

Where a private water system is connected to the municipal water system, the municipal water system shall be protected through premise isolation of the private system by installation of a backflow prevention device in an aboveground enclosure or underground chamber. Additional consultation with InnServices is required for the use of an underground chamber to house a backflow preventer device and bulk water meter. Aboveground enclosures are to follow TOISD 726.

Backflow prevention devices must be installed downstream of the property's water meter, or in the case of a fire protection system, where the fire protection system enters the building.
Aboveground enclosures or underground chambers are to be located on private property, as close to the property line as possible, with adequate clearance around the enclosure for access during testing and maintenance.

Enclosures and chambers shall be sized to accommodate the selected backflow preventer and water meter as applicable and to the satisfaction of InnServices. Enclosures shall be prefabricated, insulated and heated to maintain temperatures above freezing and in accordance with ASSE 1060 Standards.

All backflow prevention devices, appurtenances and enclosures must be selected and maintained in accordance with the manufacturer's specifications, and the guidelines set out in the most recent version as well as AWWA, Canadian Cross Connection Control Manual, CSA Standards, Ontario Building Code and applicable Provincial Regulations.

6.27 TESTING AND DISINFECTION

The following testing requirements apply to all new sections of watermain. Any sections which fail to meet the requirements shall be repaired or replaced at the direction of the Town and InnServices.
A temporary bypass connection is to be installed to permit testing of the system.

6.27.1 Watermain Commissioning

All watermains and service pipes 100mm diameter or greater are to follow InnServices Watermain Connection and Commissioning Standards Manual, which outlines the requirements for swabbing, flushing, hydrostatic pressure testing, disinfection, microbiological testing and final connection. Refer to Appendix H for InnServices Watermain Connection and Commissioning Standards Manual.

6.27.2 Continuity Testing

A continuity test for the tracer wire must be conducted by an independent third party. The Contractor has the option to perform the continuity test themselves, provided that a representative from the Town or InnServices is present to witness the procedure.

The test must be conducted using locating equipment that is approved by InnServices and operating with a maximum output of 50% and a frequency of 512Hz.

Continuity tests are to be conducted after the final connections between new and existing watermains have been completed, but before the certification and acceptance of the underground works, unless otherwise specified in the Contract Documents. An additional continuity test is required prior to the placement of the surface course asphalt, unless the surface course asphalt layer is completed within the same calendar year as the initial continuity test.

In the case of a continuity test failure, the Contractor is responsible for troubleshooting all faults, completing necessary repairs, and arranging a subsequent continuity test, all at no cost to the Owner.

6.27.3 Fire Hydrant Flow Testing

Hydrants are to be flow tested, by an organization approved by InnServices, to determine performance while maintaining a minimum residual system pressure of 140 kPa (20 psi), in

accordance with NFPA Standard 291. Tests shall follow InnServices Hydrant Flow Testing Protocol (Refer to Appendix I)

All hydrants are to be painted as follows:

a) Body – Tremclad fire engine red
b) Font Nozzle – Tremclad black
c) Top and side nozzle caps – as per the results of the flow testing noted below

CLASS	CAPACITY	COLOUR
Class AA	> 5680 L/min (>95 L/sec)	Tremclad - Safety Light Blue
Class A	3785 L/min to 5675 L/min (63 L/sec to 95 L/sec)	Tremclad – John Deere Green
Class B	1900 L/min to 3780 L/min (32-63L/sec)	Tremclad - Safety Orange
Class C	< 1900 L/min (<32 L/sec)	Tremclad - Safety Red

Flow testing shall be coordinated with InnServices.

6.28 MATERIALS

Refer to Appendix B for a list of approved materials and specifications