Town of Hawkesbury

Design Guidelines for Municipal Infrastructure

Prepared for:

Town of Hawkesbury

Prepared by:

Stantec Consulting Ltd.

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Abbreviations

AODA	shall mean the “Accessibility for Ontarians with Disabilities Act”
AWWA	Shall mean the “American Water Works Association”
CCTV	Shall mean “Closed-Circuit Television” inspection of sewers
Chief Building Official (CBO)	Shall mean the senior officer of the Construction Division of the Planning Department or his/her designate
CA	Conservation Authority
Council	Council of the Corporation of the Town of Hawkesbury
Developer	the person or company undertaking the proposed work
DFO	Department of Fisheries and Oceans Canada
DG	Design Guidelines
ECA	Environmental Compliance Approval
ESA	Environmental Site Assessment/Ecological Site Assessment
Engineer	a professional, qualified as a civil engineer in the province of Ontario, having current accreditation to practice in the profession and valid professional liability.
FN	First Nations
MNRF	Ontario Ministry of Natural Resources and Forestry
MOE/MOECC	Ontario Ministry of the Environment, also referred to as Ministry of the Environment and Climate Change.
MTO	Ontario Ministry of Transportation
NMS	National Master Specification
ON	Province of Ontario
OPSD	shall mean “Ontario Provincial Standard Drawings” as published by the MTO (latest edition) available online at: http://www.raqsa.mto.gov.on.ca/techpubs/OPS.nsf/OPSHomepage

OPSS	shall mean "Ontario Provincial Standard Specifications" as published by the MTO (latest edition) available online at: http://www.raqsa.mto.gov.on.ca/techpubs/OPS.nsf/OPSHomepage
OTM	shall mean "Ontario Traffic Manual" as published by the MTO (latest edition) available online at: http://www.mto.gov.on.ca/english/publications/mto-research- library-online-catalogue.shtml
OWNER	To be used interchangeably with Developer in most situations, although the Developer and Owner of the land may be different entities.
OWRA	Ontario Water Resources Act
Project Manager, Civil Engineering	To be used interchangeably with Director of Engineering for the Town
Public Works Superintendent	To be used interchangeably with Director of Public Works for the Town
SNC	South Nation Conservation
Subdivision	refers to the division of a parcel of land into three or more lots
Town	Corporation of the Town of Hawkesbury
United Counties	United Counties of Prescott & Russell (UCPR)
Planner	To be used interchangeably with Director of Planning for the Town
Water Works Superintendent	To be used interchangeably with Director of Water and/or Wastewater for the Town
Works	Means those services, installations, structures, buildings, utilities, and other works listed in and required for the proposed development
WSIB	Shall mean "Workplace Safety and Insurance Board"

The above list represents the most commonly used abbreviations found in these Design Guidelines. A more comprehensive list of links to documents and technical abbreviations can be found in the Appendix B. While hyperlinks to external documents are listed within the text and again in Appendix B (and are current at the time of issuance of this document), they can be modified at any time by their respective owner. The Town shall update Appendix B list as required to keep it current.

1.0 ADMINISTRATION

1.1 SCOPE OF GUIDELINES

1.1.1 Use and Intent

The following design guidelines (DG) are issued for guidance to Planners, Developers, and Engineers to identify minimum design requirements of new developments and expansion/intensification of existing development within the Town of Hawkesbury. The intent is for these guidelines to provide clear direction to Developers and Engineers to assist with the preparation of an efficient design and identification of the Town's expectations during the review process.

The DG make reference to other publications including the Ontario Provincial Standard Specifications (OPSS) and Standard Drawings (OPSD), the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads and the Ministry of Transportation 'Geometric Design Standards for Ontario Highways', as well as other reference publications. Every effort must be made to ensure designs meet these standards.

The Town acknowledges that historical development has not likely been in accordance with many of the guidelines identified in this report. Where existing constraints make adherence to the requirements of the DG impractical, written requests to modify specifications will be considered by the Director of Engineering, provided the Town's best interests and sound engineering principles are maintained. The Director may consider accepting such variances based on details provided to the Director including the extent of the variation, the cause, and costs to correct the variation.

In addition to these guidelines, the Town has also prepared an Infrastructure Master Plan (IMP) (including water, wastewater and stormwater) which should assist with guidance in any design applications. Proposed work that deviates from the assumptions of the IMP may require additional supporting analysis to be undertaken during the design, as may be requested/identified by the Town during the consultation process.

In all cases, it is recommended that the Town be pre-consulted as soon as possible in the planning process and that the Town be consulted further during the design and construction if conditions change and the design guidelines need clarification.

Lastly, note that these guidelines are considered a living document and may be updated or modified as required.

1.2 PRESUBMISSION CONSULTATION

An Owner that wants to proceed with a development should contact the Director of Planning (DOP) so that a meeting can be arranged to review the proposal. At this initial contact, the Developer can present his proposed development in general terms - thus allowing the DOP to assess the scope of work involved and provide feedback as to what the Town's requirements are likely to be. Based on the initial discussion, the DOP would advise the Owner as to the approvals that are likely to be required by the Town. Section 2 of the DG discusses the requirements for various approvals (Official Plan amendment, Zoning amendment, Subdivision, Severance, Site Plan, various Provincial/Federal approvals/permits). As

some of the approvals may be with other agencies (provincial, federal, UCPR, Conservation Authority, Utilities), the DOP will advise the Owner to reach out to these agencies (if applicable) to confirm their requirements. Similarly, the DOP will seek information from the other departments within the Town on their requirements.

In most development proposals, the impact on the existing infrastructure need to be assessed. If an Owner makes the decision to proceed with a development, they will be required to provide documentation (design report and drawings) in the submission for an approval that identifies the demands placed on municipal infrastructure; these being transportation/roads, water supply (with or without fire protection), wastewater collection, stormwater treatment/drainage, and zoning requirements. The Town's existing infrastructure is shown in the following Figures (Appendix A) as follows;

Figure 1 Transportation Network

Figure 2-1 Existing Wastewater System

Figure 2-4 Existing Stormwater Network

Figure 5-1 Proposed Watermain Network

Figure 7-1 Existing Stormwater System Level of Service

To assist the Town's staff with the evaluation of impacts from a development, the Town may require hydraulic modeling of one or more of the above systems. The Town would advise the Owner if modeling is required for approval, as the cost for modeling would be borne by the Owner. The Town staff will coordinate the modeling with others. Hydraulic models exist for the water distribution system (Tanguay 2016) and for the wastewater and stormwater distribution systems (J.L. Richards 2018). Figure 7-1 identifies the sewers in the collection system some of which are interpreted to be combined (sanitary and storm).

Depending on the complexity of a development and the types of approvals required, the DOP may request a meeting with the Owner and his Engineer with the Town's technical staff reviewers and others (UCPR, CA, Town Consultant) to review drawings/reports at the conceptual stage. The purpose of this meeting is to ensure that all relevant information and potential issues have been identified and can be addressed before a formal application is made for approval(s).

1.3 DESIGN GUIDELINE EXCLUSIONS

The guidance provided in this DG is primarily directed to the standard engineering design practices for the water distribution system, wastewater collection system, stormwater collection system and roadway layout.

More complex undertakings that involve a thorough understanding of demands and water quantity/quality are usually incorporated into Master Plan Studies (Municipal Class Environmental Assessment – MCEA) and are beyond the scope of these DG. These undertakings require a more detailed assessment since it typically impacts a larger area than just one development. Such undertakings could include pumping stations for wastewater/stormwater, booster stations for water distribution, elevated storage and storage facilities for fire protection, water treatment facilities, wastewater treatment facilities, and stormwater treatment facilities.

1.4 ENGINEERING DRAWINGS

With most small developments within an urban setting or development with intensification, most of the documentation required for an approval can be presented on drawings. While the Town reviewers will cross check the recommendations contained in design reports against the drawings, details are to be presented in the drawings.

For most developments, the Town would anticipate three submissions from the Owner, these being;

- Initial submission – plans showing the conceptual development at approximately 30% design completion if presented at the pre-submission consultation would greatly assist Town staff with an understanding of the development scope. These plans could also be submitted later if the Owner would prefer to explore options with Town staff before submitting documentation. The Town would use this initial submission to circulate internally to other reviewers to obtain their input and advise if hydraulic modeling or other studies are required.

- Second submission – this submission at approximately 60& completion would show all components of the development. The Town would undertake a comprehensive review of this development, including review by external Consultants if required. The DOP would furnish the Owner with a written letter documenting the tabulation of review comments.

- Third submission – this submission is at approximately 90% completion and would show how previous comments have been satisfactorily addressed. Design reports should be final at this stage. If comments on this third review are minor, the DOP would provide correspondence to the Owner advising of acceptance of the drawings provided that any remaining minor comments are addressed in the final submission.

As each submission requires some coordination from the DOP, and participation from others (external Consultants, UCPR, other agencies), the submission of comprehensive/high quality drawings will provide for a timely review process.

The Town's expectations for drawings for a new subdivision are presented below in sections 1.4.1 through 1.4.10.

The intent of these Standards is to ensure that all Engineering Drawings are accurate and to ensure delivery of consistent digital Plans and other contractually required electronic data submittals.

These standards represent an effort at standardizing the drafting procedure, especially computer-aided-drafting. Drafting practices, especially standardized dimensioning, tolerance, and graphical representation such as line work, symbology, and other information, must be highly organized and standardized. The acceptable standard shall be AutoCAD drawing format (version 14 or later) or Civil 3D. All drawings must indicate development boundaries that are geo-referenced as per approved Town standards.

All drawings must be in metric units, and must incorporate a legend, a graphical scale and a north arrow. The preferred drawing size is Arch D (24"x36"). Electronic copies of all drawings is also to be provided in Adobe PDF format to allow for electronic distribution.

1.4.1 Cover Sheet & Legend/Index

The cover sheet shall include the name of the development, the Owner/Developer, the Engineer(s) and a plan showing the general extent of the development with respect to surrounding properties.

A Legend & Index sheet shall be provided listing all drawings being submitted, a key plan showing the boundaries of the development that includes existing and proposed street names, symbols being used to identify works and Notes to describe any assumptions or other relevant information.

1.4.2 General Site Plan, Site Phasing Plan, Erosion & Sediment Control Plan

An overall site plan(s) at a scale of 1:1,000 or less is required, showing the entire development and proposed aboveground & underground infrastructure. Phasing requirements (if applicable), such as temporary turning basins and temporary capping of underground infrastructure, shall also be shown on this drawing. Additional drawings may be provided to add clarity.

A separate drawing Erosion & Sediment Control Plan shall be provided to indicate how erosion and sediment control shall be achieved during the construction period. For more complex developments that can impact surface water and aquatic habitat, the Town may request that the developer consult with the South Nation Conservation for comments on the plan review.

1.4.3 Plans, Profiles and Site Servicing

Plans and profiles are required for all roadways, for all rear-yard catch basins and for all sewer outlets. In road cross-sections, a table (or similar format) with driveway culvert sizes shall be shown on this drawing. Road signs, line painting, easements, land to be dedicated and reserves are to be shown.

Plan and profiles (P&P) for the proposed sewers and proposed watermain and any necessary modifications to existing infrastructure to connect to the existing infrastructure shall be discussed with Town's Director of Engineering at the pre-consultation stage. The Town has developed hydraulic models for the storm, sanitary and water infrastructure and the additional loads created by the development on the existing infrastructure can be evaluated. The Owner's Engineer would provide the Town with the additional demands and the Town would undertake the evaluation. The Owner would be responsible for the costs associated with this evaluation.

The P&P drawings shall preferably be at a scale of 1:250 (horizontal) and 1:50 (vertical) and shall show the existing and proposed grade along the road centre line. All existing and proposed underground infrastructure (including utilities) shall be shown in both plan and profile. A horizontal scale of 1:500 may be acceptable to the Town for development in greenfield areas where there is minimal existing infrastructure.

All east-west streets shall be drawn so that the north arrows points to the top of the page, while north-south streets shall be drawn so that the north arrows points to the right of the page. Horizontal control data (beginning and end of curve, radius, length, etc.) shall be shown on appropriate General Plans and on Plan and Profile Drawings.

Plan and profile drawings shall include stationing, centerline grade of the roadway or surface (proposed and existing) and resulting slopes. Site servicing plans shall show top of watermain (where applicable), sanitary or storm sewer inverts (where applicable) and resulting slopes, and/or ditch elevations for both

the right and left ditch (where applicable) and resulting slopes. The standard abbreviations, pipe diameter, length, type and class of pipe, and the valves, services, hydrants and connections to the watermain and sewer shall be shown on appropriate Site Servicing Plans and on Plan and Profile Drawings. The depth to bedrock along the road profile should be shown as well as a reference in the Notes to the availability of a geotechnical report detailing bedrock strength/quality.

1.4.4 Grading and Drainage Plans

Detailed grading and drainage plans shall be prepared at a scale of 1:500 or less, and with enlargements as required for clarity, such as at intersections. At a minimum, existing grades and contours shall be shown. All elevations must be geodetic, and at least two temporary benchmarks shall be clearly indicated. Temporary benchmarks may also be shown on other drawings.

Grading plans shall include finished grades at all lot corners, at lot high points (if applicable), at centerline of swales, at top and bottom of terracing, and at buildings. Resulting slopes (in %) shall be shown on the grading plans.

Finished grades must also be shown along the centerline of the roadway and ditches (if applicable) at a maximum spacing of 25 m, as well as along curb radii. At a minimum, proposed grades shall be shown at both extremities of a curb radius and at any high or low point(s).

1.4.5 Storm and Sanitary Drainage Area Plans

Overall site plans showing boundaries of storm and sanitary catchment areas shall be provided, complete with area labels matching design spreadsheets. Area labels shall include the corresponding area in hectares, and the runoff coefficient (storm) or population (sanitary).

1.4.6 Details and Standard Drawings

At a minimum, drawings shall include all relevant details. It is strongly suggested that all relevant Ontario Provincial Standard Drawings (OPSDs) and municipal standard drawings be included for clarity and ease of construction.

1.4.7 Street Lighting

Street lighting drawing must be prepared as part of the design package and shall detail the type, size, proposed locations of street lights including wire size and routing and lighting calculations. These drawings shall also include all relevant details and be coordinated with the electrical servicing of the development.

1.4.8 Composite Utility Plan

A composite utility plan is required and shall utilize the base drawing of the subdivision (i.e. including underground services, lot lines, roads, ditches, etc.). The composite utility plan drawing shall also include the location of all proposed and existing utility poles, street lights, transformers, pedestals, conduits and buried utilities. A sign-off sheet from all utilities shall be submitted to the Town by the owner/developer.

1.4.9 "As-Built" Drawings

As construction progresses, the "Issued for Construction" drawings shall be updated to reflect the work. All "as-built" drawings shall be updated to reflect changes made during construction (such as through Site Instructions, Change Orders, etc.) and other information deemed important.

As a minimum, "as-built" drawings shall include the elevation of the roadway at every 25 meters, invert elevations of storm and sanitary sewers at all structures, obvert elevations of watermains at every 25 meters (where applicable), invert elevations at all culverts and along ditch bottom and top of slopes at every 25 meters. The location of all lateral connections to storm, sanitary and watermains shall be identified by GPS coordinates (for complex connections where numerous utilities are involved, documenting construction with photos is recommended). All horizontal and vertical bends and reducers are to be identified.

"As-built" grading plans shall be prepared based on rough lot grading. The as-built grading plan shall clearly denote that the grades verified consist of "rough lot grades" as opposed to "final lot grades". Furthermore, the temporary benchmarks shall be transferred to permanent structures during construction (i.e. fire hydrants) and shown on the "as-built" grading plans. All "as-built" plans shall be submitted to the Town in paper copies (x3 copies), PDF format and CAD format.

1.4.10 Engineering Surveys

All engineering surveys must be tied into the Ontario Horizontal Control Survey Network (Cosine) in accordance with Ontario specifications and guidelines and regulations under the Surveys Act (OS 79). In that regard, plans shall be provided in an AutoCAD (version 14 or Civil 3D), digital form and referred to the Horizontal Control Survey UTM NAD 83.

2.0 PLANNING

2.1 MUNICIPAL

The Town of Hawkesbury has an Official Plan and Zoning By-law that guide development within the community. The Town is the approval authority for applications for building permit; demolition permit; site plan; minor variance to the Zoning By-law, Zoning By-law Amendment and entranceway permits on to Town roads. The Town also provides comments to the United Counties of Prescott and Russell on applications for lot severance and plans of subdivision as the County is the approval authority.

All off-site improvements, relocations and extensions of existing infrastructure required to support the proposed development will be the responsibility of the Owner. The Developer shall pay the full cost of the required off-site improvements, relocations and/or infrastructure extensions. The Town and the developer to discuss these improvements at the pre-consultation meeting.

In some cases, oversizing of infrastructure may be required to accommodate future development, in which case cost-sharing may be possible. It is mandatory that the Town be pre-consulted to determine if any off-site improvements and/or infrastructure extensions will be required to support the proposed development.

The Town and/or UCPR may require background studies to be completed to better comprehend the development and its impact on the environment, and while each development is site-specific, pre-consultation with the Town is recommended so that the list of studies can be reviewed and a decision made by the Town/UCPR on the necessity to submit one or more for the review – these could include;

- Site Plan showing legal boundaries of the development
- Conceptual Design reports identifying infrastructure (water, sewage, storm) demands
- Traffic Impact Assessment
- Environmental Site Assessment (Phase 1 or a more detailed/intrusive investigation if contamination is suspected)
- Archaeological Assessment
- Environmental/Ecological Impact Study (wetlands, woodlots, significant habitats or threatened or endangered species)
- Geotechnical Assessment
- Hydrogeological Assessment
- Stormwater Management
- Drainage & Surface Water
- Cultural & Built Heritage

- Noise & Vibration Assessment
- Air Quality (Emissions and Odours)
- Socio-Economic Assessment

2.1.1 Official Plan

The Town of Hawkesbury Official Plan dated April 2010 is the document that manages future growth, development and change in the community for the next 20 years. It implements planning policy from the Province of Ontario as stated in the Provincial Policy Statement 2014 as well as the Official Plan of the United Counties of Prescott and Russell.

The Town's Official Plan may be found on the following website;
https://www.hawkesbury.ca/images/hotel_de_ville/reglements/by-laws-en/pdf/offical_plan_eng.pdf

The Counties Official Plan may be found on the following website;
http://www.en.prescott-russell.on.ca/services/planning_and_forestry/official_plan

Council's vision for the future is, "The Town of Hawkesbury is committed to balanced and sustainable growth to achieve a sense of place respectful of our municipality's unique historical, cultural and natural heritage where citizens can enjoy an unparalleled quality of life." A copy of the Town's vision is described in the report Strategic Plan Hawkesbury/Horizon 2030 which can be found at website;
https://www.hawkesbury.ca/en/town-hall/publications/vision-2030-strategic-plan

The policies of the Official Plan direct future residential and non-residential growth to within the Town's settlement area as a logical extension of the existing community. Slight increases in density and intensity of development through infill and redevelopment are anticipated. The Official Plan is organized into seven major policy areas which are applied to land within the Town on Schedule A: Downtown Core; Commercial Lands; Waterfront; Employment Lands; Sustainable Neighbourhoods; and the Environment. The Official Plan also addresses infrastructure and has policies for roads, water, waste water and stormwater services. Generally, all development shall occur on full municipal water and wastewater services.

Development Constraints are also addressed in the Official Plan. Natural heritage lands and land with development constraints are indicated on Schedule B. The constraint lands include areas with unstable slopes along the Ottawa River, fish habitat in watercourses and flood plain areas.

The Official Plan contains an implementation section that describes what tools the Town will use to ensure that growth occurs in accordance with the Official Plan policies. Development approval policies relating to plans of subdivision, consents, site plan control, compatible development and requirements for complete applications are described. The Plan provides enabling legislation to us holding provisions, temporary uses by-laws, interim control by-laws and development permit by-laws.

The Official Plan designates the entire Town as a Community Improvement Area. This enables the Town to create a Community Improvement Plan to encourage private sector investment while ensuring the maintenance and preservation of heritage buildings and existing housing stock; enabling the redevelopment of brownfield sites; upgrading municipal infrastructure and improving the overall visual appearance of the Town. In December 2017, Council passed By-Law 60-2017 to designate a Community

Improvement Project Area respecting the revitalization, re-development and enhancement of the Town of Hawkesbury and also By-Law 61-2017 to adopt a Community Improvement Plan (CIP). It is anticipated that the implementation of the CIP would begin in 2018 – further details shown on Notice of Decision provided on the website;
https://www.hawkesbury.ca/en/town-hall/urban-planning/community-improvement-plan

2.1.2 Zoning By-law

The Town of Hawkesbury Zoning By-law 20-2018 was passed on April 30, 2018. It implements the Official Plan by placing zoning designations on individual sites. Schedule A to the By-law shows the zoning designation of individual properties. Each zoning designation has a list of permitted uses and development standards to which owners of land must comply when they wish to alter their property by constructing buildings or structures or by constructing additions to existing development.

The Zoning By-law contains general provisions that apply to all land in the Town regardless of the zoning designation of a property; for example parking standards, accessory buildings, secondary suites and home occupations. A copy of the Zoning By-Law can be found at the following website;
https://www.hawkesbury.ca/images/hotel_de_ville/urbanisme/zoning_bylaw_no_20_2018.pdf

The By-law is organized into a series of zones. Each zone has a list of permitted uses and development standards. There are four Residential District Zones; a Future Development Zone; a Waterfront District Zone; a Trade and Industry District Zone; three Commercial Zones; an Open Space Zone; a Floodplain Hazard Zone and an Institutional Zone. Zoning classification for the properties can be found at the following website;
https://www.hawkesbury.ca/images/hotel_de_ville/urbanisme/zoning_bylaw_map.pdf

The Town's Director of Planning will advise the Owner as to the minimum requirements for their development during the pre-consultation meeting. If the development requires a change in the zoning for the property (that is not considered a minor variance), a public meeting with a mandated duration for receipt of comments is required under the Planning Act. Council's decision on the approval of the by-law amendment will take any public comments into consideration.

In addition, for any development requiring a change of zoning, a Phase I Environmental Site Assessment (Phase I ESA) may be required. A Phase I ESA is also required for all areas of the development identified by the Town as potentially contaminated due to previous or existing uses on or adjacent to the property for residential occupancy or conveyance as park land, roadway or stormwater management infrastructure. Generally, the Town will require that the proponent provide assurances that the environmental quality of the soils and groundwater within the lands intended for development are compatible with the intended land use as described within Ontario Regulation 153/04, as amended. The Phase I ESA shall be carried out in accordance with the regulation and shall be up to date. If the results of the Phase I ESA indicate a need for further investigation the Developer may be required to undertake follow-up studies (Phase II ESAs, Site Remediation Plans, etc.).

2.2 COUNTY

The United Counties of Prescott and Russell are the approval authority for applications for consent to sever; plans of subdivision and entranceway permits onto County roads. As described later, the Counties will advise the Owner at the time of application on the requirements for background studies to support the development request.

2.3 COUNTY OFFICIAL PLAN

The United Counties of Prescott and Russell Official Plan is dated December 2009. However, the office consolidation dated April 2016 contains an up to date version of the Plan as amended due to periodic comprehensive reviews and individual amendments on a site specific basis. It implements the Provincial Policy Statement 2012 as it applies to Prescott and Russell. The Official Plan applies to all eight municipalities, including the Town of Hawkesbury that comprise the United Counties.

The Official Plan is organized into eight parts:

Part 1 is an introduction that provides an overview of the planning area and outlines the political and administrative framework for land use planning in Ontario.

Part 2 addresses sustainable communities including both residential and non-residential development and infrastructure requirements to obtain long term stability. Population and employment forecasts by municipality are provided. For Hawkesbury, the Official Plan forecasts population growth from the year 2011 population of 10,974 to 12,857 by 2031 and to 13,282 by 2035. This represents an increase in dwelling units by 658 from 4,945 in 2011 to 5,602 by 2031 and by 743 units to 5,688 by 2035.

In terms of employment growth, Hawkesbury's 2011 employment of 7,891 is expected to rise to 8,235 by 2031 and to 8,392 by 2035. This represents about 25% of the number of jobs in the United Counties.

Schedule A to the Official Plan designates Hawkesbury as an Urban Policy Area. Areas so designated are intended to receive most of the growth in the United Counties as they are on municipal water and sewer systems. At a high level, policies to guide residential, commercial, industrial and development in the community core of local municipalities are contained in Section 2.

Part 3 addresses infrastructure to ensure adequate infrastructure is in place to support sustainable development. Infrastructure includes water, waste water, surface water, transportation, waste management, communication, energy and other required services.

Part 4 addresses sustainable use of agricultural lands and mineral aggregate extraction areas.

Part 5 contains policies to preserve and enhance natural heritage features including wetlands, woodlands and wildlife habitat.

Part 6 adresses public health and safety and related constraints to development such as floodplains and unstable slopes that could present a danger to humans.

Part 7 includes policies at a County-wide level related to development control, economic development, social policies, cultural heritage and administration.

Part 8 has four (4) schedules to the Official Plan that illustrate the land to which the policies apply;

1. Schedule A contains land use designations. Hawkesbury is designated as an Urban Policy Area.
2. Schedule B shows natural resources lands. The area between Hawkesbury and L'Orignal is shown as a Wildlife Travel Corridor.
3. Schedule C, Public Health and Safety shows, in Hawkesbury, the location of four closed waste disposal sites; a hydro station; railroad lines; an Intake Protection Zone Type 1 and Type 2 for the water supply.
4. Schedule D Transportation shows the hierarchy of roads in the County and the required width of rights-of-way for County Roads.

2.4 PROVINCIAL AND PROVINCIAL POLICY STATEMENT 2014 (PPS)

There are numerous Provincial Ministries that are involved with the land development process in Ontario. The PPS is the statement of the Provincial Government's policies on land use planning. Its goal is to promote strong communities, a strong economy, and a clean and healthy environment. Key issues that are addressed in the PPS include the efficient use and management of land and infrastructure; protection of the environment and resources; and, ensuring there are opportunities for employment and residential development, including support for a mix of land uses.

The Ministry of Municipal Affairs and Housing issues Provincial Policy Statements (PPS) that set out the Provincial Government's interests in land use planning. All decisions on applications under the *Planning Act* must be consistent with the PPS. The Town of Hawkesbury and the United Counties use the PPs as a resource in the preparation of their Official Plans. All decisions on land use planning matters by Council or by municipal staff where delegated authority has been issued, must be consistent with the PPS.

A summary of the current PPS 2014 is provided in this Section.

The Ministry of Natural Resources and Forestry are responsible for comments related to the *Endangered Species Act* for land development applications. The Ministry requires submission and approval of Environmental Impact Statements that ensure threatened and endangered species and their habitat is protected from adverse impact. They are also the issuer for permits for the removal or harm to butternut trees.

The Ministry of the Environment and Climate Change (MOECC) issues Environmental Compliance Approval for plans and reports for stormwater management ponds, sewage pumping stations and forcemains and sanitary/storm collection systems/sewers. They also approve municipally initiated infrastructure projects related to sewage treatment plans, water filtration plants, sanitary sewers, watermains and stormwater management ponds and waste disposal sites.

The Ministry of Tourism, Sport and Culture receives archaeological assessment of lands that meet Provincial criteria for determining areas of archaeological potential.

The Ministry of Transportation has the authority under *The Public Transportation and Highway Improvement Act* to regulate the placement of buildings, structures, fences and the development of lands adjacent to Provincial Highways. The Building and Land Use Policy dated June 2, 2009 establishes

corridors adjacent to Provincial Highways and sets out the requirements for where a permit is required by the Ministry for a proposed development.

Within Hawkesbury, provincial Highway 34 (McGill Street and Boulevard du Chenail) are connecting link roads that the Ministry of Transportation are responsible for. Any changes to the design of the road alignment/geometry or connections to infrastructure within the road ROW requires an approval/permit from the MTO.

3.0 FEDERAL AND OTHERS

3.1 FEDERAL AGENCIES/CROWN CORPORATIONS

Transport Canada has a Navigation Protection Program that applies to all navigable waters in Canada including the Ottawa River. For the construction of minor works such as docks and boathouses, boat ramps, slipways and launch ramps in the Ottawa River, a Minor Works Order must be approved by Transport Canada. Information and application forms are available on Transport Canada's website; https://www.tc.gc.ca/eng/programs-621.html under Marine Transportation Programs, Navigation Protection Program.

Department of Fisheries and Oceans (DFO) enforce the Fisheries Act which requires that projects avoid serious harm to fish unless authorized by the Minister. This applies to work that is being conducted in or near to waterbodies that support fish that are a part of or that support a commercial, recreational or Aboriginal fishery. To protect fish and fish habitat, efforts should be made to avoid causing harm, mitigate any harm that may be caused and offset harm that is caused. There is a project self-assessment that determines whether or not DFO need to review a project. Information on the self-assessment process is found on the DFO website at http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html under "on the water" projects near water –authorizations.

Canada Post provides postal service to all addresses in Hawkesbury. The agency is implementing a community mailbox system in new developments. Subdivision applications are circulated to Canada Post to their Delivery Planning Department in Ottawa who arrange for the installation of community mailboxes. New civic addresses are provided by the Town to Canada Post as part of the building permit issuance process.

3.2 CONSERVATION AUTHORITIES

3.2.1 South Nation Conservation

South Nation Conservation enforces Part 8 – Sewage Systems of the Ontario Building Code on behalf of the Town of Hawkesbury. An application is required for approval for a new home or building that does not have municipal services; or where a home renovation is occurring where more plumbing fixtures are added or the finished floor area will be expanded by more than 15% of the current footprint; or where an existing system is being replaced. As the Town's OP requires that all new developments be serviced from municipal infrastructure, the Owner is not likely to be subject to an approval for a septic system.

The Conservation Authority is responsible for implementing Natural Hazards, and Natural Heritage policies of the Provincial Policy Statement 2014. In this regard, the Conservation Authority is responsible for the review and approval of Ecological Site Assessment (ESA) Reports and plans.

3.2.2 Raisin South Nation Source Water Protection

The Raisin-South Nation Source Protection Plan under the *Clean Water Act, 2006* became effective on April 1, 2015. As the Town of Hawkesbury treats water from the Ottawa River as its source of potable water for the community, it is important to ensure the drinking water source is protected. The area in

immediate proximity to the intake of the water treatment plan is rated Intake Protection Zone 1 meaning the area is highly vulnerable. Other lands in the Town, mostly shoreline properties upstream from the intake location, are rated Intake Protection Zone 2, meaning that most land uses are permitted and some limitations may apply. Implementation of the Source Protection Plan requires the Town's Official Plan and Zoning By-law to be amended, where appropriate, to limit the range of land uses permitted in these areas. A web-based map of Intake Protection Zones is available at the link below. Maps are to be included with development applications and Building Permit applications.

https://www.gisapplication.lrc.gov.on.ca/SourceWaterProtection/Index.html?viewer=SourceWaterProtection.SWPViewer&locale=en-US

3.3 UTILITIES AND OTHERS

The following subsections identify utilities and other parties that have an interest in the Town's growth and that an Owner should consult during the planning of a development. The UCPR have a more comprehensive list that can be found at the following website;

http://www.en.prescott-russell.on.ca/UserFiles/Servers/Server_2375121/File/2018/government/repertoire_directory-2018

3.3.1 Enbridge Gas Distribution Inc.

Enbridge Gas Distribution provides natural gas infrastructure within Hawkesbury. Their Customer Connections Department should be contacted to discuss installation and clearance requirements for service and metering facilities.

3.3.2 Bell Canada

Bell Canada provides communications infrastructure in new developments including telephone and buried fibre-optic cable. Subdivision applications are circulated by the United Counties to Bell Canada's Development and Municipal Services Control Centre. Developers are required to contact the Control Centre to arrange for service.

3.3.3 Ontario Power Generation

Ontario Power Generation (OPG) is a producer of electricity to almost one-half of Ontario, including the Town of Hawkesbury. The Town and the United Counties circulate development applications to OPG in order to assist them with their facility planning to meet the future demand for electricity.

3.3.4 Hydro One Networks Inc.

Hydro One is an electricity transmission and distribution utility service for the province of Ontario. Hydro One is circulated planning applications by the Town for comment.

3.3.5 Hydro Hawkesbury

Hydro Hawkesbury is circulated planning applications by the Town for comment. The local utility is the provider of electrical service to new dwellings and buildings.

3.3.6 Conseil des écoles publiques de l'Est de l'Ontario; Conseil des écoles séparées catholiques de langue française de Prescott-Russell; Conseil scolaire de district catholique de l'Est ontarien; Upper Canada District School Board

The Town and the United Counties circulate for comment planning applications to all school boards that serve the Town to assist the Boards in making enrolment projections and determining the need for school facilities.

3.3.7 Aboriginal Communities

The Town and the United Counties (UCPR) circulate planning applications to the Algonquins of Ontario and the Metis Nation of Ontario to determine whether the aboriginal communities have any interest in the land to which the application applies.

3.3.8 CN Rail – Community Planning and Development

CN Rail has an operational rail line that serves the Town's business park and much of the vacant land intended for development abuts the line. The Town and the United Counties circulates planning applications to CN Rail to assist them with providing rail services to potential clients in the business park as well as affording them the opportunity to comment on other development that abuts their infrastructure.

3.3.9 Cogeco Inc.

Cogeco Inc. is a provider of internet and cable television services to the Town. The United Counties circulate subdivision applications to Cogeco so that they may coordinate the provision of their infrastructure as part of the servicing of the subdivision.

3.3.10 Champlain Township.

When a new development in the Town has potential to impact the land in the adjacent municipality (Champlain Township), such as a new subdivision development along a boundary, the Town would solicit input from the adjacent municipality as part of its consultation on the proposed development.

4.0 WATER DISTRIBUTION SYSTEM

The Town's waterworks serves a population of 10,854 in Hawkesbury and a population of approximately 3,400 in the surrounding Township of Champlain. In accordance with its Official Plan, all development in the Town is provided with municipal water supplied by the Water treatment Plant (located at 670 Main Street West) and a 5,454 m3 elevated water storage reservoir located on Spence Avenue – both owned and operated by the municipality.

The following fundamental factors are to be considered when designing potable water distribution facilities:

- Provision of high quality drinking water at all times;
- Minimized interruption in service delivery; and
- Provision of adequate fire protection.

In all cases the water supply for new developments will be from the existing Hawkesbury system.

The water distribution system is to be designed as a network system to meet the water demand for each area or subdivision to their maximum future development in accordance with the Town of Hawkesbury's Official Plan and IMP. Allowance shall be made for connection to appropriate mains in adjacent subdivisions or areas to provide looping - exact location for connecting to mains in adjacent subdivisions or areas shall be as approved by the Town and in accordance with sizing established by the IMP (JLR 2018).

A summary of the most recent annual performance of the waterworks (and previous years) is provided in the Annual Reports prepared under the Municipal Drinking Water License, and can be found at the following website;
https://www.hawkesbury.ca/en/town-hall/public-works/drinking-water

4.1 WATER QUALITY REQUIREMENTS

Water distribution design should prevent water quality degradation from improper material selection, poor construction phasing and practices, stagnation due to poor configuration or oversizing of watermains and dead-ends. If watermain dead-ends are unavoidable, calculations must be provided to verify a maximum residence time of 48 hours based on average domestic water demands per Section 4.2.1 below.

Where requested by the Town, a hydraulic analysis may be requested to confirm flow characteristics under various demands. The Town recently (2018) completed a model for this type of hydraulic analysis which the Owner could access through the Town (Owner may be responsible for some external costs depending on complexity of project).

4.2 DISTRIBUTION SYSTEM DESIGN CONSIDERATIONS

In 2014, the Town completed a hydraulic analysis of their water distribution system to evaluate flow characteristics under various demands. This analysis was undertaken by Groupe Tanguay and results reported in a report "ANALYSE HYDRAULIQUE DU RESEAU DE DISTRIBUTION D'EAU DE LA VILLE DE HAWKESBURY" dated May 2016.

The analysis considered short term and mid-term water demand based on existing consumption (2012-2013) and projections for future growth (3271 units) including allowance for the Industrial/Commercial/Institutional - ICI sector (19.6 m^3/hr), the Hospital (19.8m^3/hr) and servicing Township of Champlain communities of Vankleek Hill and L'Orignal. The analysis was based on an average demand of 257.2 m^3/hr to service a population of 14,740 people. Maximum day and peak hour were calculated by applying a peaking factor of 1.29 and 2.5 to average day demand. Storage requirements were calculated to represents 8,600 m^3, for which fire protection accounted for 2925 m^3, and was being supplied (10,455 m^3) from an underground reservoir at the WTP (5000 m^3) and an elevated storage tank (5455 m^3). Generally, the distribution system can supply demand for future growth under all demand loads – Figure 5-1 identifies the hydraulic model created for the distribution system

4.2.1 Design Flow

Domestic water demand calculations shall be based on an average daily consumption rate of 350 L/cap/day and an average dwelling population density per that listed below. The UCPR Official Plan provides the following guidance on population density for planning purposes'

4. In order to meet the varied housing requirements of Prescott and Russell residents and to provide for orderly residential development, it is the policy of this Plan that, subject to the availability of water and waste water services, zoning regulations be designed to provide for a mix of 70% low density residential development, 20% medium density residential development and 10% high density residential development in the Urban Policy Area.

5. For the purposes of this section, low density development is defined as up 35 units per net hectare. Medium density development on full municipal services should not exceed 55 units per net hectare for townhouses or row houses, and 75 units per net hectare for apartments. A net hectare is defined as the net area of the site developed for residential purposes. This term excludes roads, road right-of-way and areas that have been dedicated to the local municipality or another public agency.

Where dwelling numbers are not available, use 2.5 density to estimate the average population for a suburban type development. Consumption rates presented in **Table 4-1** shall be used for commercial, industrial, and institutional flows. Where more detailed building information is available, a more accurate demand may be calculated using Table 3-2 of the MOECC's Design Guidelines for Drinking Water Systems. Typical peaking factors presented in Table 3-1 of the MOECC's Design Guidelines for Drinking Water Systems shall be used.

Table 4-1: Typical Consumption Rates for Non-Residential Demands

Demand Type	Consumption Rate
Commercial and Institutional	28 m^3/ha/day
Industrial, light	35m^3/ha/day
Industrial, heavy	55m^3/ha/day

4.2.2 Pressure Objectives

Based on the Ministry of Environment (MOECC) Water Design Guidelines, it is generally accepted best practice to design new water supply and distribution systems to operate between 345 kPa to 552 kPa (50 psi to 80 psi).

During peak hour demands, the minimum pressure in the distribution system shall not be less than 276 kPa (40 psi) at ground elevation. During average day demands, the maximum pressure shall not exceed 552 kPa (80 psi) as per the Ontario Building Code (OBC); pressure reducing measures are required to service areas where pressures greater than 552kPa (80 psi) are anticipated.

The distribution system shall be designed to provide the required fire flow during periods of maximum day demands at a residual pressure of 140 kPa (20 psi).

4.2.3 Fire Flow Requirements

Fire flows requirements should be in accordance with the methods developed by the Fire Underwriters Survey (FUS), more particularly the report "Water Supply for Public Fire Protection, 1999". In 2014, the Consulting firm WSP had calculated the fire flow requirements for several buildings in Hawkesbury and had identified a fire flow of 118.75 L/s for the hospital. Table 4 of the 2016 Groupe Tanguay report identifies the FUS fire flow for several locations within Hawkesbury.

If the distribution is not capable of providing the FUS calculated fire flow, the level of fire protection can be increased as per the Ontario Building Code (Section 11.4.3.1 Compensating Construction - fire walls, sprinklers, etc.) or the watermain can be upsized where necessary to a maximum size of 250mm in diameter, if it can be demonstrated that it will not degrade water quality.

4.2.4 Watermains

4.2.4.1 Sizing and Materials

Residential watermains should be a minimum of 150 mm in diameter. Watermains, fittings and connections shall be manufactured in accordance with the latest specifications of the American Water Works Association and the Canadian Standards Association for 1000 kPa rated working pressure as follows:

- Cement mortar lined ductile iron pipe – Class 52 - conforming to CSA B131.10, may be used with plastic wrap, or other approved form of electrochemical corrosion protection where corrosive soils are present;

- Polyvinyl chloride pipe (CL235 C900) – conforming to CSA B137.3, AWWA C900 may be used for distribution watermains on private property, diameter 150 mm to 300 mm (DR 18 minimum), including approved fittings compatible with Ductile iron pipe and including tracer wire between hydrants or other conducting appurtenances. Pipe to be UL Listed, NSF-61 Certified and FM approved;

All watermain joints to be approved push-on, mechanical or flange type joints as required for a 1000 kPa rated working pressure.

Permitted pipe deflections are as per pipe manufacturer documentation.

Cathodic protection shall be provided as per OPSD 1109.011 for non-metallic watermain systems and OPSD 1109.010 for ductile iron watermain systems.

Mechanical restrainers will be required at all horizontal or vertical bends, fitting and caps. Length of restraint shown on City of Ottawa standard drawings W25.5 and W25.6

4.2.4.2 Friction Factors

The following Hazen-Williams coefficients ("C-Factors") shown in **Table 4-2** shall be applied to the new watermains regardless of pipe material in accordance with the Design Guidelines for Drinking Water Systems (MOECC, 2008).

Table 4-2: C-Factors Based on Pipe Diameter

Pipe Diameter (mm)	C-Factor
150	100
200 to 300	110
350 to 600	120
> 600	130

When evaluating existing systems for expansion, C-Factor testing can be carried out in the field to determine actual pipe hydraulics.

4.2.4.3 Minimum Horizontal and Vertical Separation of Watermain to Sewers

As per MOECC Procedure F-6-1, watermains shall be laid with at least 2.5 m of clear horizontal separation from any storm or sanitary sewer, forcemain or maintenance hole. While this is achievable within new development areas, infill or redevelopment within the existing developed core may require an exception to this practice, and should be discussed with the Town during the pre-submission consultation.

When crossing sewers, it is preferred that watermains cross above sewers with sufficient vertical separation to allow for proper bedding and structural support of both utilities. Where the watermain cannot cross above the sewer, a minimum clear vertical separation of 0.5 m will be required between the invert of the sewer and crown of the watermain.

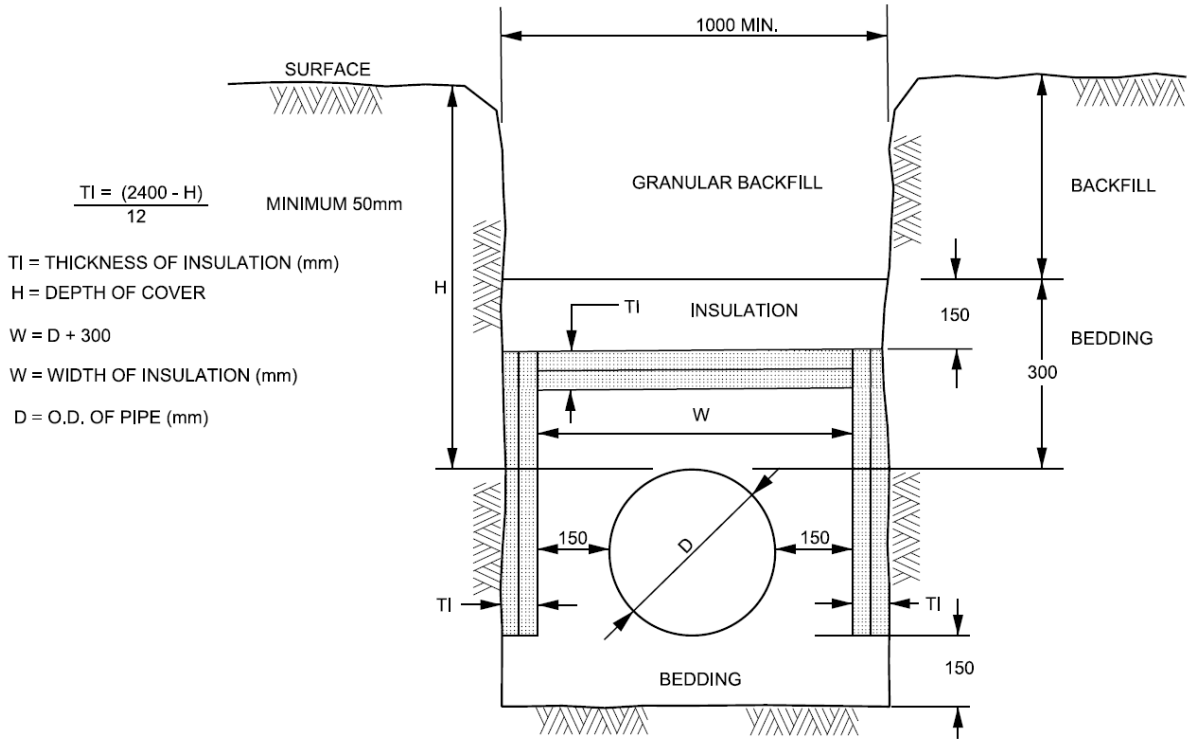
4.2.4.4 Dead Ends

Dead-end mains and single supply systems are to be avoided. Where unavoidable, a fire hydrant or approved automated blow-off shall be required near the dead end or additional piping supplied for recirculation. Dead end pipe size should not exceed 200mm to avoid water stagnation. These measures could also be required at temporary dead-ends caused by phased construction. When evaluating water supply options, preference should be given to options that loop watermains.

4.2.4.5 Depth of Cover

To prevent freezing, the minimum depth of cover over watermains and servicing lines must be greater than frost penetration, which varies depending on location, soil conditions and rock conditions.

A minimum acceptable cover of 2.4 m over proposed watermains shall be permitted. Minimum clearances between other types of services shall be provided in accordance with MOECC Guidelines. Where depth of cover cannot be achieved due to obstructions, rigid insulation can be considered on a case by case basis, provided that the depth of cover is greater than 1.5 m. Thickness of insulation and its placement to be accordance with OPSD 1109.03 - rigid high-density insulation with minimum compressive strength of 275 kPa (40 psi) to ASTM C578 Type VI. The calculation of insulation thickness is shown below – additional details can be found in the City of Ottawa standard drawing W22.



4.2.5 Valves

Valves shall be located generally aligned with the intersecting road ROW limit on approach to intersections, and as required for spacing. Generally, three (3) valves shall be placed at cross-

intersections and two (2) valves at "T" intersections, such that broken sections can be isolated without jeopardizing flow to other sections.

Valves shall be spaced so that no more than 60 dwelling units are isolated along a watermain and at a maximum spacing of 300m.

Air release valves shall be considered at high points of all distribution watermains over 400mm in diameter, and where possible, installed together with valves in valve chambers. Drains shall be considered at low points of all watermains, and where possible, installed together with valves in a valve chamber. Valves to have cathodic protection as per OPSD 1109.010.

Valves size should match the pipe size. Valves to be resilient-seated gate valves to AWWA C509 for nominal pipe diameters up to and including 300mm, opening counter clockwise and 51x 51 operating nut. For valve sizes less than 300mm in diameter, valve boxes to be 130mm ductile iron adjustable by Mueller or approved equivalent with cap. All valves of 300mm diameter or greater shall be installed in valve chambers and valve type for pipe diameters 400 mm and larger shall be butterfly style.

4.2.6 Hydrants

Hydrants shall be on the same side as the watermain to reduce lateral length and located generally on lot lines where practical, and 1.5 m minimum away from edge of driveways, walkway ramps and house service connections. Isolation valves shall be installed on all hydrants as per OPSD 1105.010.

At intersections where smaller diameter lines connect to larger mains, hydrant placement off the larger main is preferred for improved fire flows. Hydrants shall also be located at the end of all 150 mm or larger dead end watermains.

The maximum spacing for hydrants shall be 90m or as approved by the Town's Fire Department.

Hydrant flange elevation shall be set at a grade so that it can provide a final flange elevation of 50 mm to 100 mm above final grade.

Standard hydrant colour coding per the Fire Code and NFPA 291 "Fire Flow Testing and Marking of Hydrants" is presented in **Table 4-3**. Painting of hydrants shall be completed by the Town of Hawkesbury however, it is the Developer's responsibility to colour code hydrants for private servicing.

Hydrants shall be Brigadier M-67B manufactured by Clow Canada in compliance with ANSI/NSF 61 and AWWA C502. Pumper nozzle shall be of the type STORZ.

Table 4-3: Standard Hydrant Colour Coding

Class	Flow Rate (USGPM)	Bonnet Colour
C	< 500	Red
B	500 – 999	Orange
A	1,000 – 1,499	Green
AA	≥ 1,500	Blue

The Developer is to provide hydrant marker flags as part of the hydrant installation. Hydrants not commissioned shall be bagged by the developer until the watermain and hydrants have been commissioned to the satisfaction of the Director of Water Works.

The Developer's Contractor shall commission each hydrant in the presence of the Municipal representative prior to preliminary approval. Each hydrant is to be opened and closed under operation pressure to demonstrate that the hydrant functions as required.

4.2.7 Service Connections

Service pipes should be sized based on peak demand flow. Single service connections shall be provided to each lot and connected to the watermain that fronts the property. The service connection is to be laid perpendicular to the fronting watermain and laid straight to the building connection point. On crescents or cul-de-sacs, the service lateral may be laid at other than right angles to the watermain, but in a straight line from the watermain to the meter. Service connections shall be located at a minimum depth of 2.4m and where less than this due to physical constraints, shall be insulated to achieve this level of frost protection.

If the residual pressure is greater than 310 kPa (45 psi), the minimum size for a residential service shall be 19 mm, whereas if the residual pressure is less than or equal to 310 kPa (45 psi), minimum size for a residential service shall be 25 mm. Water services shall be type "K" (W.H.) soft copper, properly grounded at the home, and laid to a minimum of 1 metre inside the property. Services must have cathodic protection as per OPSD 1109.011. Commercial, institutional, industrial, parklands, or multiple use block service lateral diameters will be considered on a case-by-case basis.

The water service shall generally be located 2.5 m to the north or west of the sanitary lateral that is located at the centre of the lot. Connection locations for commercial, institutional, industrial, parklands or multiple use blocks will be considered on a case-by-case basis.

All main stops, curb stops, meter stops, and shut off valves up to and including 50 mm are to be ball valves. Any water service 50mm in diameter or less shall have a curb stop and box on the property line.

The Developer shall complete and arrange all tappings off any existing charged watermain to be supervised by Town Water Works staff. The Developer shall provide all materials, excavation, necessary safety devices, backfill, restoration and scheduling of installation so that all connections to the supply can be supervised by the Town Water Works staff.

4.2.8 Tappings

When connecting to an existing charged watermain of equal or greater diameter than the proposed tap, it is preferred that a wet tap connection be done. The work shall be completed and paid for by the Developer but shall be coordinated with the Town. The Developer/Contractor performing the wet tap connection must be approved by the Town prior to commencing work.

On PVC watermain, tapping for 19mm to 25mm services shall be at the 10 o'clock or 2 o'clock position. Tapping of 38mm to 50mm services shall be at the 3 o'clock or 9 o'clock position. Each tap shall have a minimum separation of 600mm and must not be closer than 600mm from watermain dead ends, tees, or valves. Avoid tapping into discoloured areas of the pipe and do not tap a curved pipe. All tappings on PVC watermain require saddles.

Tapping of ductile iron watermain requires a tapping saddle and sleeve, and shall be located at the 3 o'clock and 9 o'clock positions.

Prior to any tapping, the Developer is to review procedures with the Town Water Works staff and be knowledgeable of location of nearest valves to completely shut off water supply should the connection fail. The Developer/Contractor shall be responsible for all Town costs associated with tapping watermains.

4.2.9 Watermain Bedding

Watermain for flexible pipes shall be constructed with bedding, surround and cover as per OPSD 802.010 (for Type 1,2,3 and 4 Soils) with granular 'A' material.

4.2.10 Watermain Commissioning and Testing

A watermain commissioning and testing plan shall be developed in consultation with the Town and for approval by the Town. The plan shall include but not be limited to:

- Process and duration for swabbing, chlorination, pressure testing, flushing, sampling.
- The Developer shall not operate any existing valves, existing blow-offs, existing hydrants or remove any anti-tampering devices for any reason.

Each section of water main shall be cleaned with a minimum of two swabs. Additional swabbing is required at the Developer/Contractor's expense if the water is not clear after the second swab has passed through the water main. Swabbing details to be as per Town's Water Works practice – typically length of swab shall be 1.5 x swab diameter and swab diameter shall be 50 mm greater than the inside diameter of the water main.

Water mains and services shall be disinfected in accordance with AWWA C651-05 or as amended. All chlorine shall be NSF -60 certified. Water from the flushing shall be discharged to the sanitary sewer. Sampling for water quality shall be done on two occasions, with 24 hours between sampling events. Analysis of water to be done at an accredited laboratory.

5.0 SANITARY SEWERS, STORM SEWERS & CULVERTS

The sanitary sewer collection system is to be designed to carry domestic, commercial, and industrial sewage for each area or development under consideration. The storm sewers are essential for collection of stormwater, snowmelt and to prevent flooding.

The system shall be designed to service all areas within the subdivision to their maximum future development in accordance with the Town's Official Plan. Allowance shall be made for inflows from the appropriate adjacent subdivisions or areas. Discharges of the system are to be into sewers that can carry the flows without surcharging. The location for connecting a new development into the sewers of an adjacent subdivision or area shall be as approved by the Town.

In general, a network wide hydraulic analysis is required for any new development that has not been analyzed previously, or for any development that significantly alters the servicing scheme such that an existing hydraulic network analysis is no longer applicable. An analysis is required, in particular where sewage generation rates have been altered in a way that will affect existing customers.

In new greenfield development, the sanitary sewer shall be installed 9.0 m from the south or west right-of-way property line in an urban cross-section or in the center of the road in a rural cross-section. Typical road section and utility location for new development is shown in City of Ottawa standard drawing ROW-20A.

5.1 SANITARY DESIGN FLOW

Where dwelling numbers are not available, the JLR IMP provides the following guidance for summarizing the equivalent population per type of development for flow assessment.

Population projections for future industrial and commercial development areas will be estimated based water demands recommended in the Ministry of the Environment and Climate Change (MOECC) Water Design Guidelines, 2008. For this Master Plan 35,000 l/ha/day and 28,000 l/ha/day will be applied to industrial and commercial development lands, respectively. From the resulting water demands an equivalent residential population is estimated assuming a daily water consumption of 500 L/unit and a household occupancy of 2.5 people/unit, which remains consistent with the May 2016 Water Network Master Plan. The short-term development is summarized in the following table.

Table 2: Short Term Development (1 to 5 years)

Development Label	Description	Estimated Number of Units or Area	Equivalent Population (Rounded)
Residential (S2)	Greenfield development west side of Town	172	430
Residential Infill and Intensification (S1, S3 to S8)	Development throughout Town	178	445
Industrial (S9)	Development along Tessier Street	1.9 ha	333
Commercial (S10)	South-east Quadrant of Town	5.8 ha	812
	Total Short-Term	**350**	**2,020**

Where dwelling numbers are available, demand calculations are recommended to use the following breakdown of population density per dwelling type;

Unit Type	Persons per unit
Residential, single family	3.0
Residential, semi-detached	2.7
Residential, duplex	2.3
Residential, townhouse (row)	2.7
Apartment, bachelor	1.4
Apartment, 1 bedroom	1.4
Apartment, 2 bedroom	2.1
Apartment, 3 bedroom	3.1
Apartment, average	1.8

The average daily sanitary sewage flow rates represented in the table below shall be used for commercial, industrial, and institutional land uses in the absence of detailed fixture demand calculations or monitored rates. These are common allowances to be used for conceptual planning purposes – more accurate flows can be calculated if type of development is known.

Development Type	Average Flow
Commercial, Institutional	28,000 L/gross ha per day
Industrial, light	35,000 L/ gross ha per day
Industrial, heavy	55,000 L/ gross ha per day

Source: City of Ottawa Design Guidelines - Water Distribution

An allowance for extraneous flow sources should be included in the total peak flow rate when the design of sewer system design. A general allowance of 0.28 L/s/effective gross hectare shall be applied for extraneous flow for new areas.

Peak sanitary design flows are to be determined using average daily flows and the peaking factor determined using the Harmon Equation:

$$Peaking\ Factor = 1 + \left(\frac{14}{4 + \left(\frac{P}{1000}\right)^{1/2}} \right)$$

Where: P = Population in thousands

Residential peaking factor to be a minimum of 2 and a maximum of 4. Peaking factors for non-residential land uses are as follows;

- Commercial peaking factor of 1.5
- Institutional peaking factor of 1.5
- Industrial peaking factor shall be determined from Appendix B of the 1984 MOE Sewage Design Guidelines

Pipe selection is described in Section 5.3.1.

Pipe sizing and flow velocity are described in Sections 5.3.3 and 5.3.4 respectively.

5.2 STORM DESIGN FLOW

5.2.1 Rational Method

Storm sewers for greenfield developments within urban and suburban areas are to be sized via the Rational Method;

$$Q = 10000/3600 \times CIA$$

Where:

Q = Run-off flow from a given area (L/s)

A = Drainage area (ha)

C = Runoff Coefficient (ratio of run-off to rainfall)

I = Intensity of rainfall for the selected time of concentration (mm/hr)

5.2.1.1 Intensity of Rainfall

The intensity of rainfall can be determined using an Intensity Duration Frequency (IDF) curve, which is a statistical description of the expected rainfall intensity for a given duration and storm frequency.

The IDF curve below was originally derived from rainfall data taken from the Meteorological Services of Canada (MSC) rainfall data taken from the Ottawa Macdonald-Cartier International Airport, and shall be used for the Town of Hawkesbury. The equations for these curves are shown in Table 5-1.

Table 5-1: IDF Curve Equations

Storm	IDF Curve Equation
2-Year	$I = 732.951 / (Tc + 6.199)^{0.810}$
5-Year	$I = 998.071 / (Tc + 6.053)^{0.814}$
10-Year	$I = 1174.184 / (Tc + 6.014)^{0.816}$
25-Year	$I = 1402.884 / (Tc + 6.018)^{0.819}$
50-Year	$I = 1569.580 / (Tc + 6.014)^{0.820}$
100-Year	$I = 1735.688 / (Tc + 6.014)^{0.820}$

Where:

I = Rainfall intensity (mm/hr)

Tc = Time of concentration (min)

Further details on hydrological modeling is presented in **Section 6.7**

5.2.1.2 Time of Concentration

The time of concentration (Tc) consists of the inlet time plus the time of concentration of flow in the open channel or in the conduit from the most remote inlet to the point under consideration. A minimum initial time of concentration of 10 minutes may be used for proposed development areas, whereas time of concentration for existing areas must be calculated, and subject to the minimum initial time of concentration of 10 minutes.

5.2.1.3 Runoff Coefficient

Unless otherwise specified or demonstrated otherwise (via assessment of impervious areas for each subject subcatchment), minimum runoff coefficients shall be as per the table below;

Table 5-2: Typical Runoff Coefficient by Land Use

Land Usage	Runoff Coefficient
Grassed Areas, Wooded Areas	0.20
Parkland	0.25
Single Family Residential Lots	0.55
Mixed Residential Lots	0.65
Gravel, Unpaved Parking	0.70
Townhouse Residential Lots	0.70
Schools, Institutional	0.70
Commercial, Industrial	0.75
Asphalt, Concrete, Rooftops	0.90

5.3 SEWERS AND CULVERTS

5.3.1 Storm and Sanitary Pipe Material

Sewer Material	Material	Note
Sanitary Mains, <= 450 mm dia.	PVC DR 35 to CSA B182.2	Service laterals for sanitary to be PVC DR 28.
Sanitary Mains > 450 mm dia.	Reinforced Concrete to CSA A257.2, minimum Class 65-D or greater, depending on height of fill	
Storm Mains, <= 450 mm dia.	PVC DR 35 to CSA B182.2	
Storm Mains, > 450 mm dia.	PVC to CSA B182.4	320 kPa (Ultra Rib, etc.)
Storm Mains, > 450 mm dia	Reinforced Concrete to CSA A257.2, minimum Class 65-D or greater, depending on height of fill	See O.P.S.D. 807.010 & O.P.S.D. 807.030

In urban cross-sections, 150 mm diameter HDPE perforated subdrains shall be provided on both sides of the road to drain the granular base and sub-base. Perforated subdrains shall outlet to catch basins. Perforated subdrains shall meet the requirements of OPSS 1840 and shall be covered with a geotextile sock as per OPSS 1860.

5.3.2 Roof Leaders, Foundation Drains, and Storm Connections

Roof leaders shall not be connected to municipal sanitary sewer systems. Leaders shall discharge to concrete splash pads in landscaped areas and directed to side yard swales or an approved alternate discharge point (storm sewer with on-site stormwater management).

Foundation drains shall not be connected to municipal sanitary sewer systems. Foundation drains shall discharge to the municipal storm sewer system or directed to side yard swales (if feasible) or an approved alternate discharge point at the discretion of the Town. Sump pump discharge to a concrete splash pad at ground surface may be permitted if the Developer can demonstrate continued operation of the system during power outages (over 24 hours). The geotechnical report (where required) shall consider the ground water table elevation and recommend minimum basement elevations.

5.3.3 Sizing

Sewer pipe and culvert sizing shall be performed using the Chézy-Manning Formula:

$$Q = \frac{1}{n} A R^{2/3} S^{1/2}$$

Where:

- Q = Discharge (m^3/s).
- A = Cross-sectional area of flow at right angle to direction of flow (m^2)
- R = Hydraulic radius (m)
- S = Slope or grade (gradient) (m/m)
- n = Coefficient of roughness

The roughness coefficient, n, for smooth bore pipes shall be 0.013 and 0.024 for corrugated metal pipe.

The minimum size of sanitary sewers (mains) shall be a diameter of 200mm, whereas the minimum size of storm sewers shall be 250mm. Minimum sizing of cross culverts shall be a diameter of 600 mm and minimum sizing of driveway and access culverts shall be a diameter of 400 mm.

5.3.4 Pipe Velocity

5.3.4.1 Sanitary Sewers

Sanitary sewers shall have a minimum velocity of 0.6 m/s. The maximum velocity shall be 3.0 m/s at full flow. No sewer shall have a slope less than 0.1%. Using a minimum velocity of 0.6m/s and pipe roughness of 0.013, minimum slopes for sanitary sewers shall be as follows:

Table 5-3: Minimum Slopes for Sanitary Sewer Mains

Nominal Sewer Size	Minimum Slope (%)
200 mm	0.32
250 mm	0.24
300 mm	0.19
375 mm	0.14
450 mm	0.12
525 mm and larger	0.10

5.3.4.2 Storm Sewers

Storm sewers shall have a minimum velocity of 0.8 m/s. Where velocities exceed 3 m/s, sewer design must protect against displacement of sewers. The maximum velocity shall be 6.0 m/s at full flow. No sewer shall have a slope less than 0.1%.

Using a minimum velocity of 0.8m/s and pipe roughness of 0.013, minimum slopes for storm sewers shall be as follows:

Table 5-4: Minimum Slopes for Storm Sewer Mains

Nominal Sewer Size	Minimum Slope (%)
250 mm	0.432
300 mm	0.34
375 mm	0.25
450 mm	0.195
525 mm	0.16
600 mm	0.132
675 mm	0.113
	0.1%

5.3.5 System Layout

Except for special cases, the downstream pipe diameter shall always be greater than or equal to the upstream pipe diameter. The most upstream run of a sewer shall have a minimum grade of 0.65% for maintenance considerations.

A minimum clearance of 500 mm shall be provided between the obvert of the sanitary sewer and the invert of the storm sewer.

5.3.6 Easements

The use of easements for municipal storm and sanitary sewers, temporary or permanent, shall be avoided where possible. Easements shall be restricted to special circumstances at the discretion of the Town. Sewers that cannot be installed in the right-of-way will require a minimum 6.0 m wide easement for access and maintenance purposes.

Easements located between two (2) new lots shall be centred between the lot, whereas easements between one (1) existing and one (1) new lot shall be installed on the new lot entirely. Easements shall be recorded on title to property by the Developer.

5.3.7 Depth of Cover

A minimum cover of 2.4 m below the centre line road elevation and sufficient depth for gravity flow from basement floor drains shall be provided. Where this is not feasible, rigid high-density insulation to OPSS 1605 shall be installed on sewer mains and laterals at all locations with insufficient frost cover. Rigid high-density insulation shall have a minimum compressive strength of 275 kPa (40 psi), and shall be installed in thicknesses (City of Ottawa standard drawing W22) and widths as required to achieve sufficient frost protection, as shown in OPSD 1109.030.

A general note or comment shall be added to the Grading Plan, specifying lot numbers where gravity drainage of basements may not be possible, should the preferred cover on the storm and/or sanitary sewer not be achievable for all or some lots, or if the Engineer cannot demonstrate that basement drainage is achievable.

5.3.8 Stormwater Catch Basins & Inlets

Catch basins are to be located at all low points, upstream of pedestrian crossings and not within 1.0 m of curb depressions. Preferably, catch basins where required will be adjacent to lot lines. Rear lot catch basins shall be located 1.5 m from the back lot line and 1.0m from the side lot line and the catch basin and lead shall be located in a minimum 3.0m wide easement centered on the catch basin lead.

Catch basins within the right-of-way must be precast concrete and shall be designed and constructed in accordance with the most recent OPSD 705.010 for single (600mm by 600mm) and OPSD 705.020 for twin inlet. When placed within rear yard, precast concrete catch basins can be replaced with HDPE (such as DrainTech Drain Basins).

5.3.8.1 Location and Spacing

Catch basins shall be selected, located, and spaced in accordance with the conditions of design. The design of the catch basin location and type shall take into consideration the lot areas, the lot grades, pavement widths, road grades and intersection locations.

Maximum spacing for catch basins including cul-de-sac gutters shall be as presented in **Table 5-5**.

Table 5-5: Maximum Spacing Based on Road Grade

Road Grade (%)	Maximum Spacing (m)
0.5 – 0.75	90
0.76 – 3.0	75
3.1 – 4.5	60
> 4.6	45

5.3.8.2 Catch Basin Leads

Catch basin leads shall be minimum 200 mm diameter and installed at a minimum grade of 0.7% for single catch basins and 250 mm diameter at a minimum grade of 0.7% for double catch basins. Catch basin leads shall have a maximum length of 30m. Where catch basins are designed for flow control, the inlet control device shall be installed on the interior face of the catch basin's outgoing lead.

Interconnected catch basins are not permitted. In general, catch basins shall have their leads connected to the storm sewer rather than a maintenance hole, and maintaining a minimum of 1m separation from the maintenance hole wall exterior.

5.3.8.3 Frame and Grate

The frame and cover for catch basins in roadway or walkway areas shall be as detailed in OPSD 400.02. Catch basins located within the traveled portion of a roadway shall have the frame elevation set flush with the surface of the base course asphalt and adjusted to final grade. The adjustment and setting of the frame and cover shall be completed in accordance with the details provided in OPSD 704.010.

Catch basins located in grassed areas shall be per OPSD 400.100.

5.3.9 Maintenance Holes

Maintenance holes shall be placed at the end of each line, at changes in size or material, and at abrupt changes in grade and alignment. Curved or properly deflected sewer lines are allowed with approval of the Town.

Maintenance hole types and sizes shall be in accordance with MOECC guidelines and most recent provincial standards. All sanitary maintenance holes are to be benched to the satisfaction of the Town. No sanitary sewer maintenance hole may be constructed closer than 1.5 m to the curb. The maximum spacing between maintenance holes shall be 110 m.

Maintenance hole tops are to be set to base course asphalt grade and then adjusted to final grade, when top lift of asphalt is placed. Where maintenance holes are located within areas subject to ponding per stormwater management requirements, maintenance hole covers shall be watertight per OPSD 401.030, and suitably vented.

A sufficient drop between connecting inverts shall be provided across each maintenance hole to offset any hydraulic losses per the table below;

Table 5-6: Minimum Drops at Maintenance Holes

Angle between Inlet & Outlet	Minimum Invert Drop - metre
0 degrees – straight thru	0.02
1 to 45 degrees	0.03
46 to 90 degrees	0.06
Greater than 90 degrees	Not recommended

In no case shall downstream inverts be above upstream inverts. Drop structures shall be used where invert drops of more than 0.9m within a sanitary sewer are necessary. Drop structures are to be designed in accordance with OPSD 1003.010.

Commercial, institutional, and industrial properties require inspection maintenance holes at the property line prior to connection to existing infrastructure.

5.3.10 Connection to Existing Infrastructure

New storm and sanitary sewers servicing multiple buildings are to be connected to existing sewer infrastructure by core drilling an existing maintenance hole structure and making a watertight connection. Watertight gaskets shall be used to make a watertight connection for sanitary sewers, while non-shrink grout may be used for storm sewer connections. Single building service connections may be made to sewer mains via factory made tees where the diameter of the main is less than 450mm in diameter and is less than twice the diameter of the service connection, or via cored tee connection to concrete sewers where the service diameter is 375mm or less.

Where it is not feasible or practical to connect to an existing storm or sanitary maintenance hole, a connection to existing infrastructure may be done by removing a section of existing sewer and installing a new maintenance hole with flexible couplers on either side. In all cases, flows in existing storm and/or sanitary sewers must be maintained through either temporary rerouting of the sewer or mechanically pumping around the restricted area.

Storm sewers discharging to an existing open ditch or drain may require a headwall as per OPSD 804.030 (pipe diameter less than 900 mm) or OPSD 804.040 (pipe diameter greater than 900 mm), complete with grating as per OPSD 804.050 depending on the physical constraints of the outlet surroundings, flow characteristics and Town requirements. Additionally, rip-rap with geotextile shall be installed at storm sewer outlets as per OPSD 810.010 (Type B) in order to protect against erosion.

Headwalls are not permitted on driveway culverts.

5.4 SERVICE CONNECTIONS

Single sanitary laterals for residential and industrial use, shall generally be located at the centre line of the lot with the water service located 2.5 m to the north or west of the sanitary lateral. Connections for commercial, institutional, or multiple use will be considered on an individual basis if similar locations cannot be used. Non-standard locations must be detailed on plan and profile and lot grading plans.

Residential sanitary sewer laterals shall be a minimum of 135mm in diameter, and storm laterals a minimum of 150mm in diameter to avoid accidental cross-contamination. Both services are to be laid at a slope of 2% and should not be less than a minimum of 1%. Pipes for sewer laterals of any diameter shall be PVC SDR 28 with rubber gasket joints conforming to CSA B182.2.

Connections for commercial, industrial, and institutional properties are to be complete with an inspection maintenance hole located at the property line with only one sewer entering the structure for monitoring purposes.

Sanitary service connections to maintenance holes (MH) shall be permitted under exception basis, provided that the invert elevation of the service connection to the MH is no higher than the obvert elevation of the MH outlet pipe and that the MH is properly benched.

If a defective connection is being replaced at the same location, the Owner can over core the existing connection and attach a new stub (1m of oversize pipe) using a saddle and reconnect stub to the existing pipe using a reducer.

All floor drains, as well as catchbasins in fully covered areas (e.g. underground parking lots with provisions for odour traps) are to be connected to the sanitary sewer. Foundation drains, sump pumps, and roof water leaders are not to be connected to the sanitary sewer. Backwater valves to be provided to conform to Part 7 of the building code.

5.5 CULVERTS

If development proceeds in areas where drainage is provided through roadside ditches, sizing of culverts for commercial and industrial entrances to be done to accommodate the 1:25 year return storm event. Minimum culvert size to be 450mm for commercial/industrial entrances and 400mm for residential entrances. No headwall permitted on residential entrances. Culvert types to be corrugated steel pipe or HDPE (smooth wall interior).

6.0 STORMWATER MANAGEMENT

The purpose of this section of the Design Guidelines is to provide guidance with respect to current design practices within the Town, and to ensure proposed developments give adequate consideration of current operational and maintenance issues faced by Town personnel. This section has been developed specifically in consideration of small subdivision and site plan level development for which local receiving sewers or pre-existing drainage outlets have already been identified in previous studies and within the current model for Town stormwater distribution systems (J.L. Richards 2018). Developments requiring expansion of Town infrastructure where no previous expansion area has been considered within downstream infrastructure, or the requirement for new drainage outlet(s) will require additional consideration, and may require the resources of an external Consultant to complete any required hydraulic assessment, with such cost to be borne by the Owner. Should such a situation arise, consultation should be made with Town personnel prior to implementation of the guidelines below.

The guidelines below seek to apply modern dual drainage methodology to limit inflows to the minor (piped) system preventing surcharge to serviced properties, as well as maintenance of an engineered major overland flow route (road network, ditches, watercourses) to safely convey excess flows to downstream infrastructure. Stormwater management will be required for all development applications regardless of existing infrastructure – should the recommendations below not be achievable, the engineering rationale for their omission must be demonstrated within the necessary reports for approval by Town personnel.

6.1 STORMWATER QUALITY/QUANTITY CONTROLS

Stormwater management consists of both water conveyance control (quantity control) and water quality control. In greenfield developments, quality control is most often achieved with the use of end of pipe facilities (treatment ponds) as well as other best management practices (source and conveyance control measures). In older parts of the Town, however, quality control is more complex due to land availability and the configuration of pre-existing storm systems. In some cases water quality enhancements can be achieved with the use of various best management practices (oil and grit separators for example). If water quality controls are required, the designer is encouraged to apply criteria for Enhanced protection (80% removal of suspended solids) per the MOECC SWM Planning & Design Manual in the absence of formal consultation with the Ministry of Natural Resources or Fisheries and Oceans Canada.

The preferred hierarchy of stormwater management practices is outlined in the MOECC Storm Water Management Planning and Design Manual (March 2003) and consists of: 1) Stormwater Lot Level Controls, 2) Stormwater Conveyance Controls and 3) End-of-pipe Stormwater Controls.

1. Stormwater lot level controls involve treating storm water before it reaches the development conveyance systems. The following are different types of lot level controls available:
    - Reduced lot grading
    - Rear lot ponding
    - Soak away pits

- Rooftop and parking lot storage (commercial buildings)

2. Stormwater conveyance controls are implemented as part of the conveyance system. Storm water conveyance controls can be categorized into several types of systems:
    - Pervious pipe systems
    - Pervious catch basins
    - Grassed swales
    - Open ditches
    - Parks, recreational fields, public open spaces
3. End-of-pipe storm water controls receive storm water from a conveyance system and discharge the treated water to receiving waters. The various types of end-of-pipe systems are as follows:
    - Wet ponds (multi-use)
    - Dry ponds (multi-use)
    - Constructed/artificial wetlands
    - Infiltration trench
    - Infiltration basin
    - Filter strip
    - Sand filter
    - Oil/grit separator

6.2 STORMWATER QUALITY DURING CONSTRUCTION

Temporary erosion and sediment control measures will be required and shall meet the general requirements of MOECC Guideline B-6 – Guidelines for Evaluating Construction Activities Impacting on Water Resources (January 1995).

Generally, erosion and sediment control measures shall consist of light-duty or heavy- duty silt fencing as per OPSD 219.110 or 219.130, and straw bale flow check dams as per OPSD 219.180. Additional measures of erosion and sediment control are encouraged. The designer is encouraged to apply additional measures noted within the Erosion and Sediment Control Guideline for Urban Construction (December 2006) produced by the TRCA (Toronto and Region Conservation Authority).

Temporary erosion and sediment control measures shall be maintained throughout construction, monitored on a weekly basis, and after significant rainfall events throughout construction. Repairs shall be undertaken as necessary to maintain functionality.

Temporary erosion and sediment control measures shall be removed only once seeding or sodding is completed and grass has reached a height of 150 mm or has been mowed twice.

6.3 MINOR SYSTEM

Stormwater conveyance control consist of limiting the flow that enters the minor system so as not to surcharge the sewers. The flow that remains on the surface must then be conveyed safely to an outlet. Minor system controls consist mostly of inlet restrictions but in some cases on-line storage may be required.

Storm sewers shall be designed for at least a 2-year return frequency storm without surcharge, and are to be sized using the Rational Method or an approved computer model. Post-development storm catchment areas shall be noted on engineering drawings to correspond and permit review of the provided storm sewer design sheets.

Minor system design must ensure that the hydraulic grade line (HGL) will be below the underside of footing of proposed buildings and will not negatively impact any existing downstream HGLs. Where building foundation elevations are not available the following shall apply:

- HGL to remain at least 2.0m below ground surface in 100-year event.
- HGL to remain within the pipe where the pipe invert is within 2.3m of ground surface.

Backwater valves shall be installed where storm sewer HGLs cannot be maintained below foundation drain elevations. Sump pumps shall not be accepted except in extreme cases to be reviewed and approved on a case by case basis.

6.4 MAJOR SYSTEM

Major systems are designed to ensure that the roadway network can safely accommodate the overland flow, that storage ponds are used at strategic locations if runoff cannot be safely conveyed to an outlet and that the proposed strategy does not negatively impact water courses (i.e. erosion, sedimentation, etc.). The combination of overland flow system and minor system shall be designed for the 100-year return frequency storm subject to the following criteria;

- Rear yard swales and roadways shall be designed to permit a maximum water depth (both static water depth and cascading flow depths from upstream areas) of 300mm during the 100-year storm event.
- Static water depths (ponding areas) shall be demonstrated on the provided engineering drawings.
- Building openings must maintain a minimum 150mm freeboard from the high water elevation of nearby ponding areas.
- Engineering drawings must clearly indicate major overland flow routes in consideration of static water elevations, and must be continuous throughout the development.
- A major overland flow route shall be demonstrated from the development lands to an existing watercourse, Town-owned right-of-way, or rear yard swale to which the site must drain under existing conditions. No increase in major system flows to downstream infrastructure beyond existing conditions shall be permitted without supporting engineering rationale.

6.5 STORMWATER QUALITY STANDARDS

The Town will be requesting that the Owner provide an enhanced level of water quality treatment (total suspended solids (TSS) removal of 80%) for new developments.

A total suspended solids (TSS) removal of 70%, may be considered on a case by case basis where development involves intensification and land availability is constrained – this level is equivalent to the normal protection defined in the MOECC Stormwater Management Planning and Design Manual (2003).

Stormwater quality treatment can be achieved with on-site measures (inlet control, stormcepter or equivalent devices), wet ponds, wetlands or infiltration basins in accordance with criteria established by the MOECC Stormwater Management Planning and Design Manual (2003) or via the Low Impact Development Stormwater Management Guidance Manual (final version not yet available – September 2018).

6.6 STORMWATER QUANTITY STANDARDS

New storm water systems must be designed without exceeding peak flow capacities of the older downstream systems to which they connect; this applies to both overland flow routes and well as underground components of the system.

In greenfield areas, or areas where connection to a downstream drainage system maintained by the Town exists and does not have a history of surcharge, the peak post-development flow rates from the development are not to exceed pre-development flow rates for storms with return periods ranging from 2-100 years per the MOECC SWM Planning & Design Manual section 3.5.1. The Town maintains the option of requiring over control below pre-development flow rates to satisfy a decreased level of service in up/downstream areas, to be determined on a site-to-site basis.

6.7 HYDROLOGICAL AND HYDRAULIC MODELING

For areas 5 hectares and larger, and/or complex drainage systems (including developments requiring expansion of Town infrastructure where no previous expansion area has been considered using downstream infrastructure, developments upstream of existing infrastructure with a history of surcharge, or the requirement for new drainage outlet(s), hydrological/hydraulic modeling is to be carried out as necessary to the satisfaction of the Town using a computer software approved by the Town such as SWMM, PCSWMM, SWMHYMO, OTTSWMM, OTTHYMO, etc. The Town has developed a stormwater model that can be used to quantify the capacity of downstream infrastructure to ensure that design proposals do not impact existing development. The Town may require the resources of an external Consultant to complete this hydraulic assessment with such cost to be borne by the Owner.

For smaller developments, application of the modified rational method is acceptable to determine volume requirements for storage of runoff beyond the minor system design event, as well as peak release rates from orifice controls or uncontrolled subcatchments to the minor system. Runoff coefficients for the 25-year design event, 50-year event and 100-year event shall be increased by 10%, 20% and 25% respectively to a maximum of 0.95 per MTO Drainage Management Manual recommendations.

In all cases, the major overland conveyance system must be demonstrated to be adequately sized to convey peak capture rates per the above analyses.

6.7.1 Design Storms

In cases where a discrete hydrologic model of the development is required, the model is expected to apply either the Chicago storm distribution or SCS Type II storm distribution as required for design storm events to suit the type of analysis.

The Chicago storm distribution shall be selected for hydraulic analysis of the minor system where the development is predominantly urban/suburban (Runoff C>0.4), and where the time to peak for the entire development is less than half the duration of the storm event (i.e. < 1.5 hours). Designs requiring stormwater management facilities with longer length detention times require additional application of the SCS distribution for verification of volume requirements for the SWM facility.

The time step for discretization of the designed storm can vary according to the size of the sub-watershed, but must not exceed the estimated time of concentration. The maximum rainfall intensity should be compatible with that of real storms on record and the design storms noted in the section below.

6.7.1.1 SCS Type II Design Storms

The Soil Conservation Service of America Developed the SCS Type II distribution in 1973 for applications in agricultural and rural areas. The SCS distributions are commonly applied as design storms in Ontario.

Distributions for SCS Type II design events shall be as per Part 4 of the MTO Drainage Management Manual (Design Chart 1.05). Total rainfall depths for each design event shall be as follows;

Design Storm Event	Total Rainfall Depth (mm)
2-Year	43.2
5-Year	57.6
10-Year	67.2
25-Year	79.2
50-Year	87.6
100-Year	96.0

The designer is to verify the results for a range of storm durations to ensure that a conservative design is proposed.

6.7.1.2 Chicago Design Storms

The Chicago storm distribution was developed by C.J. Keifer and H. Chu and is based on 25 years of rainfall record in the city of Chicago. This storm distribution, which is derived with IDF curves, is generally applied to urban basins where peak runoff rates are largely influenced by peak rainfall intensities.

The time step for the storm should be chosen very carefully, as it is related to the computational time step and may therefore impact the accuracy of the generated hydrograph. Small time steps may produce peak flows that are unrealistically high. In general, the time step for this type of design storm should not be less than 10 minutes for most urban applications. The duration of the storm should also be chosen carefully as it will have an impact on the peak flows. For example, a small duration storm in a large watershed may produce unrealistically low flows. Generally, the storm’s duration should be greater than twice the basin’s time of concentration.

Table 6-1 provides both a 5-Year and 100-Year 3-hour Chicago storm with a 10-minute storm time step.

Table 6-1: 5-Year and 100-Year - 3 Hour Chicago Storm

Time	Chicago Storm (mm/hr)		Time	Chicago Storm (mm/hr)	
(min)	5-Year	100-Year	(min)	5-Year	100-Year
10	3.68	6.05	130	4.87	8.02
20	4.58	7.54	140	4.30	7.08
30	6.15	10.17	150	3.86	6.34
40	9.61	15.98	160	3.51	5.76
50	24.17	40.76	170	3.22	5.28
60	104.19	178.56	180	2.98	4.88
70	32.04	54.04	190	-	-
80	16.34	27.31	200	-	-
90	10.96	18.23	210	-	-
100	8.29	13.73	220	-	-
110	6.69	11.05	230	-	-
120	5.53	9.28	240	-	-

6.7.2 Additional Modeling Parameters

Typical depression storage values are 1.57mm for impervious areas, and 4.67mm for pervious areas. Infiltration for hydrologic models shall be determined via either Horton infiltration method for urban/suburban (runoff coefficient >0.4) catchment areas, or via the SCS method for large rural catchments. CN values and application of the SCS method shall be as per Chapter 8 and Design Chart 1.09 of the MTO Drainage Management Manual, where the AMC is type II, and an initial abstraction of 0.2S. The hydrologic soil group used is to correspond directly with findings of a geotechnical report for the region. Default values for the Horton infiltration method are as follows:

- Maximum infiltration rate = 76.2mm/hr
- Minimum infiltration rate = 13.2mm/hr
- Decay coefficient = 0.00115 s^{-1}

6.8 OPEN CHANNELS & DITCHES

The proposed criteria for an open channel design shall be submitted to the Town for approval prior to the actual design being undertaken. Open channels shall be defined as major system overland flow channels, minor system outfall channels or natural channels. Major system overland flow channel designs may be required to accommodate the Regional storm or the 100-year storm for new development.

“Natural” channel design criteria will be determined on a site-by-site basis. The following guidelines must be considered:

Open Channels	Maximum Velocity
Grass lined – Natural	1.5 m/s
Grass lined – Maintained	1.5 m/s
Gabion lined	2.5 m/s
Concrete lined	4.0 m/s

Manning's 'n' roughness values as per MTO Drainage Management Manual (1995-1997).

Open channels are to be designed for the Regional Storm where the upstream watershed area exceeds 1 km2 and using a minimum 25-year return frequency storm. Outfall structures to existing channels or watercourses shall be designed to minimize potential erosion or damage in the vicinity of the outfall from maximum design flows.

While open ditches are discouraged within an urban setting, it would be considered on a case by case basis for industrial developments. Where allowed, ditches shall be constructed below the sub-grade of the roadway – typically a maximum of 1.0 m below top of road grade. Open channel ditches within easements off the road allowance shall be at a maximum depth of 1.5 m below existing grades. Depths greater than 1.5 m shall be designed as a piped system.

The minimum ditch grade shall be 0.5% and the maximum 6%. In exceptional cases and where ditches are on easements off the Road Allowance, ditches with grades greater than 6% may be allowed by the Town and shall be suitably protected against erosion to the satisfaction of the Town.

The urban minimum ditch protection on all ditches shall be 150 m of topsoil and staked sod on the side slopes and bottom of the ditch, regardless of the ditch gradient. In rural areas, hydroseeding can be used to replace sod.

Culverts beneath driveways should be HDPE (as per CSA B182.8) with a minimum size of 400mm, a minimum cover of 300mm and Granular A bedding as per OPSD 802.010. No headwalls should be installed at culvert ends. The Town will also permit standard galvanized or aluminized corrugated steel pipe (CSP – 2.0 mm thickness). If the culvert is buried deep or is shallow and subject to heavy loads , the Town may accept reinforced concrete pipe (RCP) culverts as per CSA A257.

6.9 FUTURE CHANGES AND EXTERNAL GUIDANCE DOCUMENTS

The Ontario Ministry of Environment and Climate Change has issued *Draft No. 2 Low Impact Development (LID) Stormwater Management Guidance Manual*, November 2017. These draft guidelines outline procedures and requirements for runoff volume reduction. While currently only issued in draft these guidelines may become policy in the near future. The documents listed below may be referenced to guide stormwater management designs in meeting the runoff volume reduction requirements.

- *Stormwater Management Planning and Design Manual*, Ministry of Environment and Climate Change, 2003
- *Low Impact Development Stormwater Management Planning and Design Guide*, Credit Valley Conservation, 2010

7.0 LOT GRADING & DRAINAGE CONTROL

Lot grading and drainage control within the Town of Hawkesbury has a general intent of reducing the amount of storm water inflow entering the sanitary sewers via foundation drains and to ensure functional surface drainage to protect private property from flooding caused by storm water runoff.

Lot grading design shall be based upon the overall major (overland) drainage system grading plan prepared for a development area in conjunction with the Storm Water Management Plan for the area.

7.1 LOT DEVELOPMENT PLAN DETAILS

The following details shall be required for each lot development plan:

1. Indicate house type (normal, side split, back split, etc.);
2. Elevation for Finished first floor, garage floor, existing and proposed lot corners, top of foundation, underside of footing, finished grade adjacent to building at all corners and at centre of building and at all breaks in slope.
3. Driveway location, elevation on sidewalk and grade, walkways and proposed grade;
4. Proposed elevations on the swales where the grade changes and elevations adjacent to the building corners, also showing direction of surface flow;
5. Locations of swales, terraces, retaining walls;
6. Locations of patios, decks, or porches;
7. Centre-line elevations of roadway, adjacent to the lot(s);
8. Locations for catch basins, hydrants, streetlights, transformers, telephone pedestals, and sidewalks;
9. Label street(s) adjacent to lot(s);
10. All proposed rear lot catch basins, and top of grate elevations;
11. Scale to be 1:250 for a single lot;
12. Municipal address for each lot;
13. Percent (%) grades on driveways (2% min., 7% max.) and swales;

7.2 DESIGN CRITERIA

Lot grading and drainage control shall be designed to meet the following criteria:

1. Grass surfaces shall have a minimum slope of 2%;
2. Grading around houses and buildings shall direct the water away from the structure;
3. Drainage flows that are adjacent to houses are to be in defined swales located as far from the house as possible;
4. Swale grades shall be at least 2% for side lot swales and 2.0% for rear lot swales;
5. The proposed driveway location should not be in conflict with existing or proposed utility services;
6. The minimum “flat” area immediately adjacent to a building shall be 0.6m at the side and 5.0m at the back, with the slope directing drainage away from the building. This flat area must have grades between 2% and 5%;
7. Lots with more than 1.2 m fill to the specified house grade may require extended footings;
8. Grassed swales shall have a maximum side slope of 3:1, and a minimum depth of 0.15m;
9. Maximum flow allowable in a side yard swale shall be that from 3 backyards. Individual lot drainage is preferred;
10. The maximum length of a rear yard swale without an outlet shall be 30m;
11. The maximum flow in rear yard swale may be discharged onto the road allowance is from 3 backyards (and less than 675 m2);
12. Upstream lots shall be sodded first;
13. Grading shall be performed in such a way as to preserve existing trees wherever possible;
14. The maximum slope between houses in any direction shall be 3:1. If these objectives cannot be met, steps and/or retaining walls shall be provided. Retaining walls with a grade difference of 1.0m or more shall be designed and stamped by an Engineer. Where the grade difference poses a safety concern to the public, a fence shall be installed along the top of the retaining wall;
15. An undistributed flat area having a width of 0.5m shall be provided at the boundary limits adjacent to other properties, in order that the existing boundary elevations shall be maintained. No filling up to or upon private lands shall be tolerated unless written permission is obtained from the adjacent owner;
16. All semi-detached lots and lots having 1.0 m or less side yard setbacks shall have rear lot drainage unless otherwise approved by the Town;
17. All catch basin leads shall be located a minimum of 1.0 m from the lot line; catch basin leads to be constructed on one lot. All catch basin leads to be on a minimum of 3.0m wide easements.

8.0 ROADWAYS

The current practice is to use a system of arterial roadways, collector roadways, local roadways, sidewalks, and pathways to move people and goods. Roads shall be classified as arterial, collector, or local in accordance with the Town's Official Plan. The Town currently maintains 55.3 centerline kilometers or 109 lane-kms of roadway. Figure 1 identifies the existing street layout.

The objective of the roadway system is to allow movement of people and goods into, out of and within the Town while maintaining an acceptable quality of life. In considering the layout of streets; safety and convenience are overarching principles. Design of local roadways shall focus on providing safe access to adjacent properties while minimizing speed and potential for transient traffic use.

The road design shall account for the type of traffic and pedestrian travel anticipated in the development. Granular base thicknesses, asphalt type and thickness, shoulder width, cul-de-sac radii shall be designed specifically for the development utilizing these standards as minimum requirements.

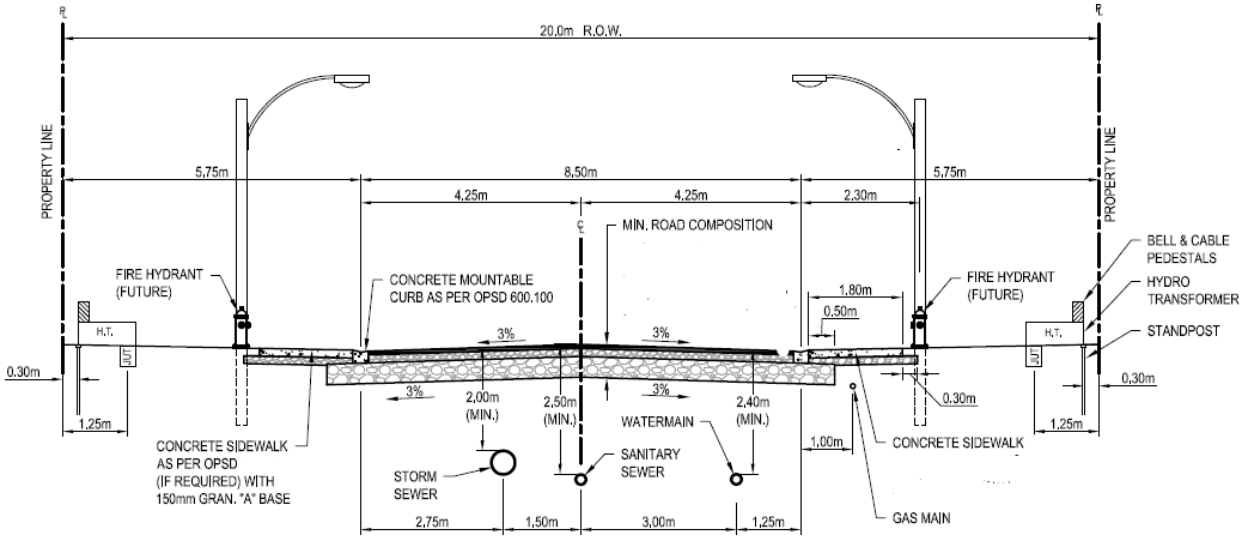
8.1 LAYOUT

All roads to be constructed in the Town of Hawkesbury shall be designed to urban standards unless specific approval from the Town is received prior to the development plan receiving draft plan approval. Roads designed to rural standards will only be considered for industrial developments.

Where the development adjoins or incorporates an existing Highway, County Road or Town's arterial road as shown on the Town's Official Plan, the Developer shall deed to the Ministry of Transportation of Ontario, County or Town any required widenings or lands for daylighting purposes.

The Town will require 0.3 m reserves at dead-ends and open side(s) of a right-of-way to maintain control. Blocks will be required for parkland, road widenings, stormwater management facilities, walkways, accesses or other property to be transferred to the Town.

Typical layout for utilities within an urban section of a local road within a 20m ROW is shown below;

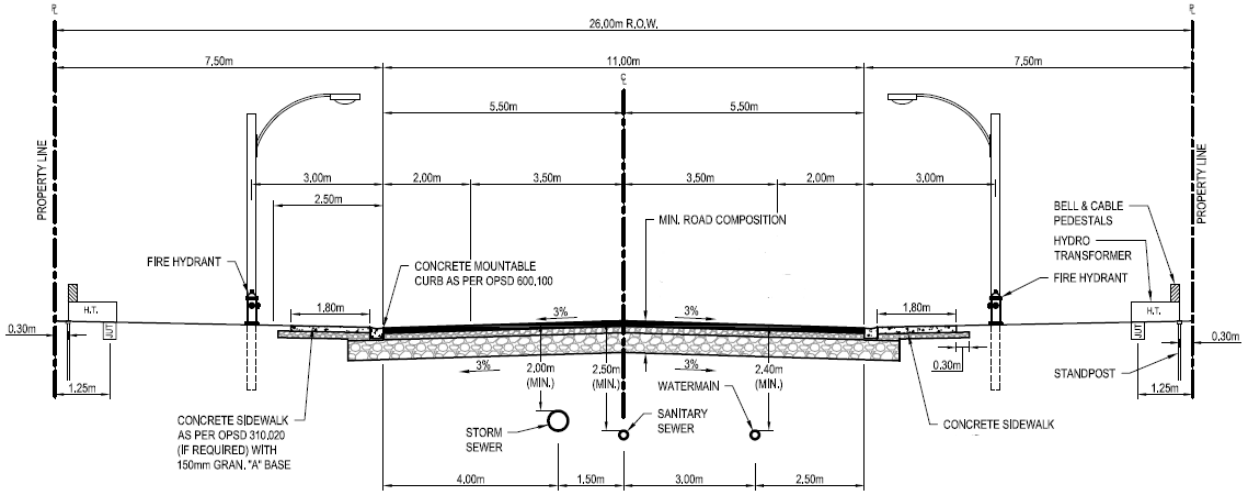


The typical section shown for road construction is defined as follows;

Minimum road construction;
- 50mm thick Superpave 12.5 PG 58-34
- 60mm thick Superpave 19.5 PG 58-34
- 150mm Granular A
- 450mm Granular B

Mountable curb can be replaced with Barrier curb

f asphalt road top is increased from 8.5m to 11.0m, as shown below;



8.2 DESIGN & MATERIALS

All asphalt materials and work shall conform in all respects to OPSS and testing shall be carried out as required by the Town. The road base structure for all roads shall be specified in a geotechnical report prepared by the Owner. Industrial subdivisions, due to their potentially heavier traffic loading will require a specific pavement design.

As soon as the granular base has been completed, it shall be thoroughly compacted and shaped before the base course asphalt is placed.

Depending on the strength of the subgrade and the volume and type of traffic, the Town would anticipate that all roads have a minimum road structure consisting of;

- 450mm thickness of Granular B Type II over a competent subgrade
- 150mm thickness of Granular A overlying the Granular B, Type II
- 60 mm minimum thickness of Superpave 19.5mm PG 58-34 (or equivalent HL8 Base Course) with a minimum in-situ A.C. content of 4.5%.
- 50 mm minimum thickness of Superpave 12.5mm PG 58-34 (or equivalent HL3 Surface Course Asphalt).

The above depths of asphalt and granulars are minimums for most local roads. The geotechnical report may specify thicker granular and asphalt layers once traffic loading, subgrade and material strength/compaction, and other factors that are specific to a development are known.

For new developments, the surface course asphalt shall not be placed for at least one (1) year from the date of placement of the base course asphalt and until 75% of the houses/development have been constructed, whichever is greater. For an existing road reconstruction, a minimum of 24 hours shall be provided between placement of base and final courses.

Developments must provide for Fire route(s) to the requirements of the OBC. Developments with over 20 dwelling should have a second egress route in the event of a fire or other mishap that blocks one of the entries.

8.3 RIGHT-OF-WAY WIDTHS & SLOPES

The minimum right-of-way and pavement width (up to face of barrier curb or end of gutter for mountable curb) shall be as follows:

Residential	ROW	Pavement Width
Local Urban	20.0 m	8.5 m
Local Rural	20.0 m	7.0 m
Major Collector	26.0 m	11.0 m
Industrial		
Local	20.0 m	8.5 m
Collector	26.0 m	8.5 m
Arterial		
Arterial	30.0 m	14.0 m

The minimum grade for all roadways shall be 0.5%. The maximum road grade shall be 7.0% for local residential roadways and 6.0% for all other roadways. The maximum grades change shall be 1.0% in 6.0 m with a minimum road cross fall of 2.0% and maximum road cross fall of 3.0% in cul-de-sacs.

A minimum pavement width plus curb and gutter each side shall be of 8.5 m except for industrial roads on 26.0 m wide right-of-way, which may be 8.5m minimum pavement width on 12.0 m wide granular base including 2.0 m granular shoulders and sodded ditches.

For rural cross sections, the edge of pavement shall be 7.0 m.

8.4 ALIGNMENT & VISIBILITY

On all streets, horizontal and vertical sight distances conforming to TAC geometric design standards shall be provided. Center line radius horizontal curves shall be in accordance to TAC Geometric Design Standards. Minimum horizontal curve centerline radius shall be 15m for all cul-de-sacs on rural, commercial or industrial roads (OPSD 500.010 and 500.030 respectively). Minimum horizontal curve centerline radius can be decreased to 13.0m for all other urban residential roadways as per OPSD 500.020.

Minimum K-Values for all roadways shall be in accordance with TAC Geometric Design Standards. In all cases, the K-Values for crests and sags shall be no less than 8 and 4,respectively. Vertical curves are required for a change in grade greater than 2%.

The edge of the roadway's paved surface shall have a minimum radius at intersections of 12.0 m for residential roads and 18m for industrial roads.

Finished roadways on cul de sac shall have a cross fall of 3% from the centerline to each outside curb line.

To maintain visibility, fencing greater than 0.75 m in height is not permitted within 6 m visibility triangle at intersections. Similarly fencing greater than 0.75 m in height is not permitted within 2 m visibility triangle at driveways, walkways or bicycle pathway. Trees and shrubs that provide visual screening or can grow to a height to block sight are also prohibited from planting in the vicinity of the visibility triangle.

8.5 SIDEWALKS, PATHWAYS & DRIVEWAYS

A 1.5 m wide concrete sidewalk shall be placed in locations approved by the Town at minimum on one side of each roadway on new developments. If a sidewalk is deemed not required by the Town, a paved shoulder could be installed instead.

All sidewalks shall be constructed on a properly constructed foundation of 150 mm minimum depth of Granular "A" in accordance with OPSD 310.010. Sidewalks shall be continuous through all driveways and entrances.

Concrete thickness shall be 125 mm in general and increased to 150mm over driveways and 200 mm across commercial and industrial entrances. Sidewalks shall be 1.5 m in width as per OPSD 310.010 and sidewalk ramps shall conform to OPSD 310.030. A grade of 0.5% minimum to 7% maximum and a minimum cross fall of 2% is to be used - no steps allowed.

Driveways with urban cross sections are to conform to OSPD 350.010 or 351.010 and driveways with rural cross sections are to conform to OPSD 301.010 or 301.020.

Sidewalks & pathways need to consider pedestrian traffic connectivity when selecting on which side to place the sidewalk.

8.6 CURBS & GUTTERS

Concrete mountable curb with narrow gutter as per OPSD 600.100, or concrete barrier curbs as per OPSD 600.110 depending on the cross-section. Provide a minimum 0.5% slope along curbs.

8.7 CONNECTION TO EXISTING ROADS

Where new roads are to connect to existing roads the design shall extend along the existing road for a sufficient length to verify a satisfactory transition.

All roads are to be extended to the limit of the subdivision boundary and shall terminate at a cul-de-sac when not connecting to an existing road unless otherwise approved by the Town.

Connections to existing roads shall be done as a tee. The approach to a connection should be done at 90 degrees. Where unavoidable, a skew up to 70 degrees could be considered on a case by case basis. At the connection, design to consider a minimum corner radius = 9.0 m at internal intersection and 12.0 m if intersection is with a County Road and/or a collector road.

8.8 STREET NAME SIGNS

Street names to be proposed by the Owner and shown on plans to be reviewed/approved by the Town. Street names shall be in accordance with Prescott & Russell 9-1-1 Protocol – please refer to UCPR website (hyperlink included in Appendix B) for guidance.

Double unit street name signs of an approved design shall be erected on approved metal posts (U-Flange galvanized 3.6 m long) with an imbedded length of 1.2 m in the ground. Lettering shall be reflective white with a green background.

Street name signs shall be placed at every intersection and shall be double sided. Street name and traffic signs shall be supplied and erected by the Town at the Developers expense and temporary regulatory signs must be reflective.

8.9 TRAFFIC SIGNS

The signs shall be located as required by the Town after a By-law is passed providing for their installation. Signs of the standard type approved by the Ministry of Transportation shall be mounted on approved metal posts 3.6 m long and buried 1.2 m into the ground.

Traffic control signs shall conform to the most recent versions of the Uniform Traffic Control Devices for Ontario or the Highway Traffic Act Regulations for Ontario.

Signs are to be aluminum, anodized both sides, according to the following requirements:

Sizes	Material
600 mm – 1.6 mm	Utility Series
600 mm – 900 mm	2.0 mm No. 655T6
Over 900 mm	3.2 mm No. 655T6

All traffic control signs are to be made with high intensity type reflective sheeting approved by the Ministry of Transportation Ontario, the current standards of the Manual of Uniform Traffic Control Devices for Ontario, the Highway Traffic Act Regulation for Ontario and the Town, including colours.

8.10 PAVEMENT MARKINGS

Upon completion of the final asphalt paving and upon notification by the Town, the surface of the roadway shall be painted in conformity with the standards of the Ministry of Transportation and Communications of Ontario at all intersections, school crossings, walkways and railway crossings to clearly indicate the proper traffic zones and stop lines. A pavement marking plan shall be submitted for approval along with the plans submitted for subdivision or Site Plan approvals.

9.0 UTILITIES

9.1 STREET ILLUMINATION

Streetlights on 5.5m (18.0 ft) concrete or aluminum poles shall be installed throughout the subdivision and on arterial or county roadways bordering the development if deemed necessary by the Town.

The type and layout of the street lighting must be to the satisfaction of the Town. At a minimum, streetlights shall be located at all intersections and at horizontal bends in the road alignment. Street lights should be located on property lines where possible or coordinated with the proposed driveway locations. Spacing of street light are to be equidistant and shall not exceed 75 m.

In urban areas with sidewalks continuous lighting is required in accordance with ANSI/IESA RP- 8-00 standard. Street lighting shall be one of the standardized LED luminaires approved by the Town, being Roadview, UrbanScape or L40U as supplied by Cree. Poles must be installed on projections of lot lines. The wattage of lights shall be sufficient to provide the following illumination:

The illumination level and uniformity ratio shall be as follows:

Road Classification	ROW/ Pavement	Illumination Level/ Uniformity Ratio
Arterial & Collectors	26.0 m/ 8.5 m	2 Lux/ 6:1
Local	20.0 m/ 14.5 m	6 Lux/ 3:1
Industrial/Commercial	30.0 m/ 16.0 m	9 Lux/ 3:1
Walkways	-	2 Lux/ 6:1

9.2 CANADA POST

The Developer must communicate directly with Canada Post for locating their proposed facilities. All proposed locations must be shown on the Composite Utility Plan. Any temporary placement of post boxes must be placed in accordance with approved final location.

9.3 UTILITY SERVICES

The Engineer must contact utilities companies directly for natural gas, underground hydro, cable, and communication services. Utility easements, where necessary, shall be provided to the satisfaction of the utility companies.

9.4 WASTE MANAGEMENT & OTHER SERVICES

The Town will require certain types of development (such as multi residential, commercial and industrial) to provide a location for the placement of waste containers. Waste containers to be located as per requirements of the Zoning By-Law and be readily accessible to compactors/garbage trucks. In new multi residential developments, the province of Ontario will be requiring that recycling facilities be provided within the next few years. The Town will require that Owners provide adequate space near the waste containers so that recycling depots can be added.

10.0 CONSTRUCTION

10.1 INSPECTION DURING CONSTRUCTION

The Developer shall retain the services of a qualified Engineer to provide inspection services during construction of municipal infrastructure, to supervise/monitor the construction and confirm that procedures for quality control were adhered to.. A site inspector must be present at all times during any underground construction. Periodic inspections will be required during the construction of surface works. Additionally, the Town will complete periodic inspections at its discretion.

The Town Chief Building Official will conduct inspections of structures to ensure compliance with Building Code, the building permit and the approved plans. .

10.2 GEOTECHNICAL ENGINEERING REQUIREMENTS

At the preconstruction meeting, the Owner shall provide the Town with a schedule of the works, together with the names of all inspectors to be on site during the construction of the various phases of the works.

During construction, the owner is to retain a geotechnical consultant to supervise the installation of bedding and the backfilling of all trenches within road allowances and easements. The geotechnical Consultant shall ensure that OPSS 514.07.08 regarding backfilling and compaction within road allowances and lots where fill exceeds 1.0 m in thickness is strictly adhered to. Where grading operations require the placement of “engineered fill” the Geotechnical Consultant must certify that the fill below finished grade and deeper has been sufficiently compacted according to geotechnical recommendations.

The Owner must have their own representative on site during any grading and/or construction works.

A final subgrade certification is required to confirm that the final subgrade conditions are equal to or better than those anticipated by the design. If these conditions are less than what was anticipated, the Owner shall advise the Town and propose remedial measures to rectify the problem.

The material testing of any major structure, as determined by the Town, is to be carried out by an independent testing firm. Such testing is to be carried out in accordance with the latest revision of the OPSS and CSA requirements. All test results are to be forwarded to the Owner, the engineering consultant, and the Town, with the appropriate comments and recommendations.

10.3 WARRANTY PERIOD

A one year warranty period for all constructed works will begin once Substantial Completion Acceptance is achieved. Financial Security will be required for the duration of the warranty period and is typically valued at 50% of total construction costs.

10.4 MAINTENANCE & EMERGENCY REPAIRS

The Developer is responsible to satisfactorily maintain the Work until Final Acceptance has been issued by the Town. With respect to roads in particular, the Owner shall keep all roads clean, dust free, graveled

and graded to the satisfaction of the Town and shall maintain reasonable access at all times for the public and for Town services such as garbage collection, emergency services, etc.

Should the Developer fail to satisfactorily maintain the Work, the Township reserves the right to provide such maintenance as it deems necessary at the Developer's expense following a 24 hour notice.

Similarly, in the case of emergencies and as determined by the Town, the Town may complete emergency repairs to the Works at the Developer's expense and without prior notice.

The provision of such maintenance or emergency repairs on the part of the Town shall not be deemed an acceptance of any of said Works by the Town nor an assumption by the Town of any liability nor a release of the Owner from any of its obligations.

Furthermore, the Owner shall repair any damages caused to any road allowance and related infrastructure as a result of the development.

At the written request of the Developer, the Town may accept to carry snow and ice removal on un-assumed roads, at the expense of the Owner. Cost related to this work will be borne by the Owner until the roads are assumed by the Town.

11.0 RECREATIONAL

As per the requirements of Section 42 and 51.1 of the Planning Act, a minimum of 5% of park space is required for a residential subdivision, while a minimum of 2% of park space is required for commercial and/or industrial uses. At the Town's discretion, cash-in-lieu of parkland may be acceptable.

It should further be noted that a parcel (or portion thereof) located within the flood plain and/or used for stormwater management will not be counted towards the minimum parkland area required. Parcels located partly within the flood plain and/or used for stormwater management may be accepted as parkland provided they are well located, and provided that the portion of the parcel suitable for park use meets the minimum parkland area requirement mentioned above.

Areas designated as parkland shall be finished with a minimum of 100 mm of topsoil and hydroseeded. At the Town's discretion, parkland left in a natural state may be acceptable.

The Developer shall install a water service to sufficient size to service the park and an electrical service from the street right-of-way to the park property line connections for new park installations. A minimum 50 mm water service is required for all parks unless a larger service is identified as being required based on the functions and size of the proposed park.

12.0 LANDSCAPING

A landscaping plan shall be provided with each proposed development showing the proposed finished surfaces to be used and their incorporation into the existing environment. New plantings shall include species that are native to the area and are purchased from a local nursery to ensure that the trees are acclimatized to the Hawkesbury area. The Town will require details to be provided on the landscape plan showing the number of trees to be provided and the approximate location for planting.

On each individual lot, the Owner shall plant at least one shade tree in the front yard and two trees on a corner lot (1 in front yard and 1 in side yard) of a type required by the Town. Trees shall be planted within private property and not within the sight triangle of intersections. Fast growing trees with short lifespans are not allowed (such as willow, alder, poplar, aspen). The Owner to provide the necessary care for a period of one year at their expense to ensure tree survival.

The Town completed a Community Improvement Plan in 2018 to identify streetscapes that could be implemented to improve aesthetic. The Owner is advised to consult with the 2018 CIP for guidance on potential layout options.

13.0 CLOSURE

As noted previously, this document is considered a living document and should be reviewed by Town staff every 5 years to ensure conformance with the Town's Official Plan, the UCPR Official Plan, and Provincial Policy Statement. As this document contains hyperlinks within the body of its report, and these are subject to change by their Owners without notification to the Town, the Town will update the hyperlinks in Appendix B once notified of a change. The reader is advised to try the link in Appendix B if the hyperlink in the report no longer is functional.

The administrator of this document is the Director of Engineering for the Town.

APPENDICES

Appendix A FIGURES

Stantec

Legend

Street Classification

- County Road
- Provincial Road
- Urban Road
- Entry/Exit Ramp

0 500 1,000 metres

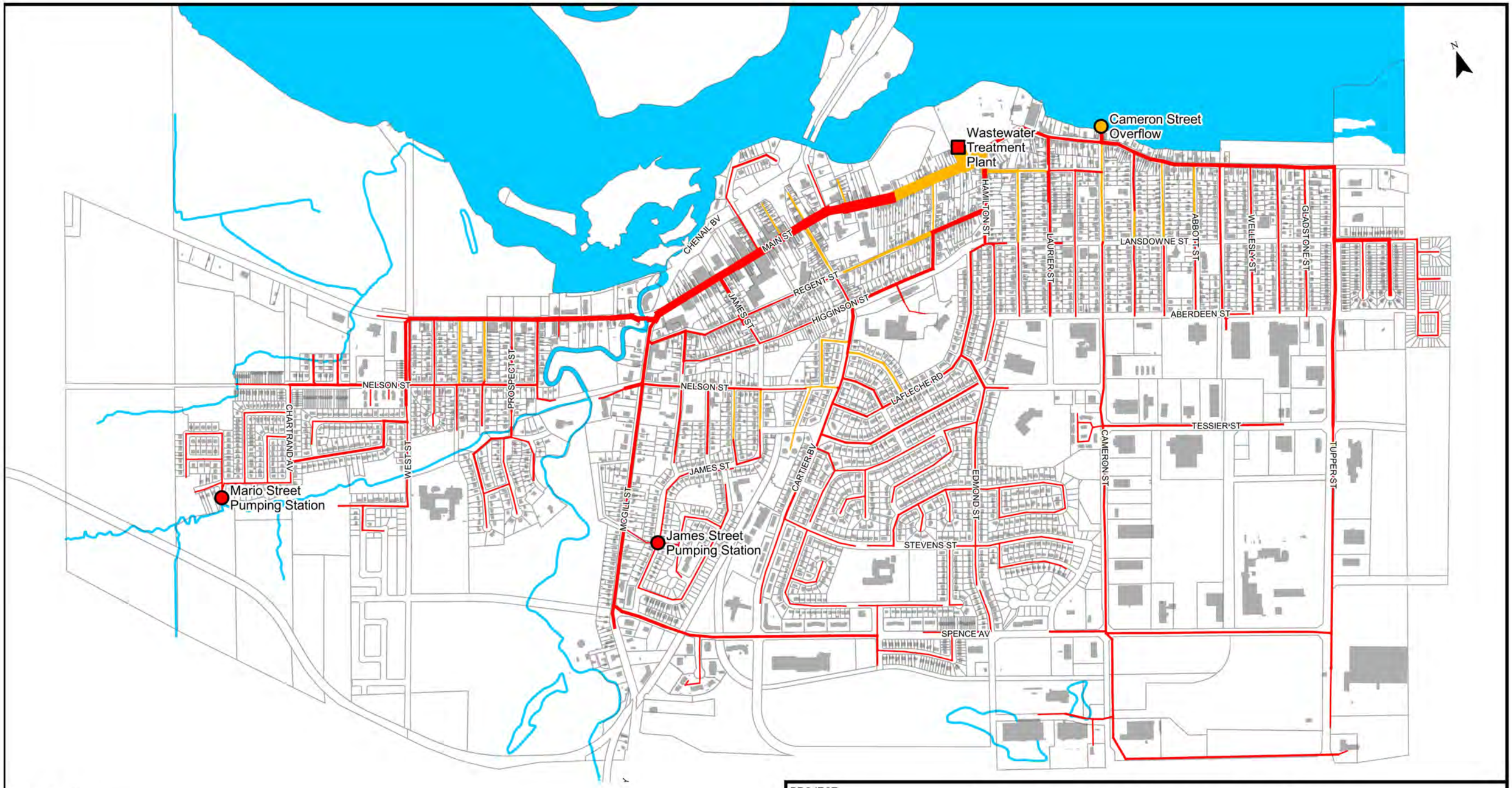
1:30,000 (At Original document size of 8.5x11)

Project Location
Hawkesbury

Client/Project
Town of Hawkesbury

Figure No.
1

Title
Transportation Network



Legend

- Sanitary Sewer
- Combined Sewer
- Cameron Street Combined Sewer Overflow (CSO)
- Pump Station
- WWTP

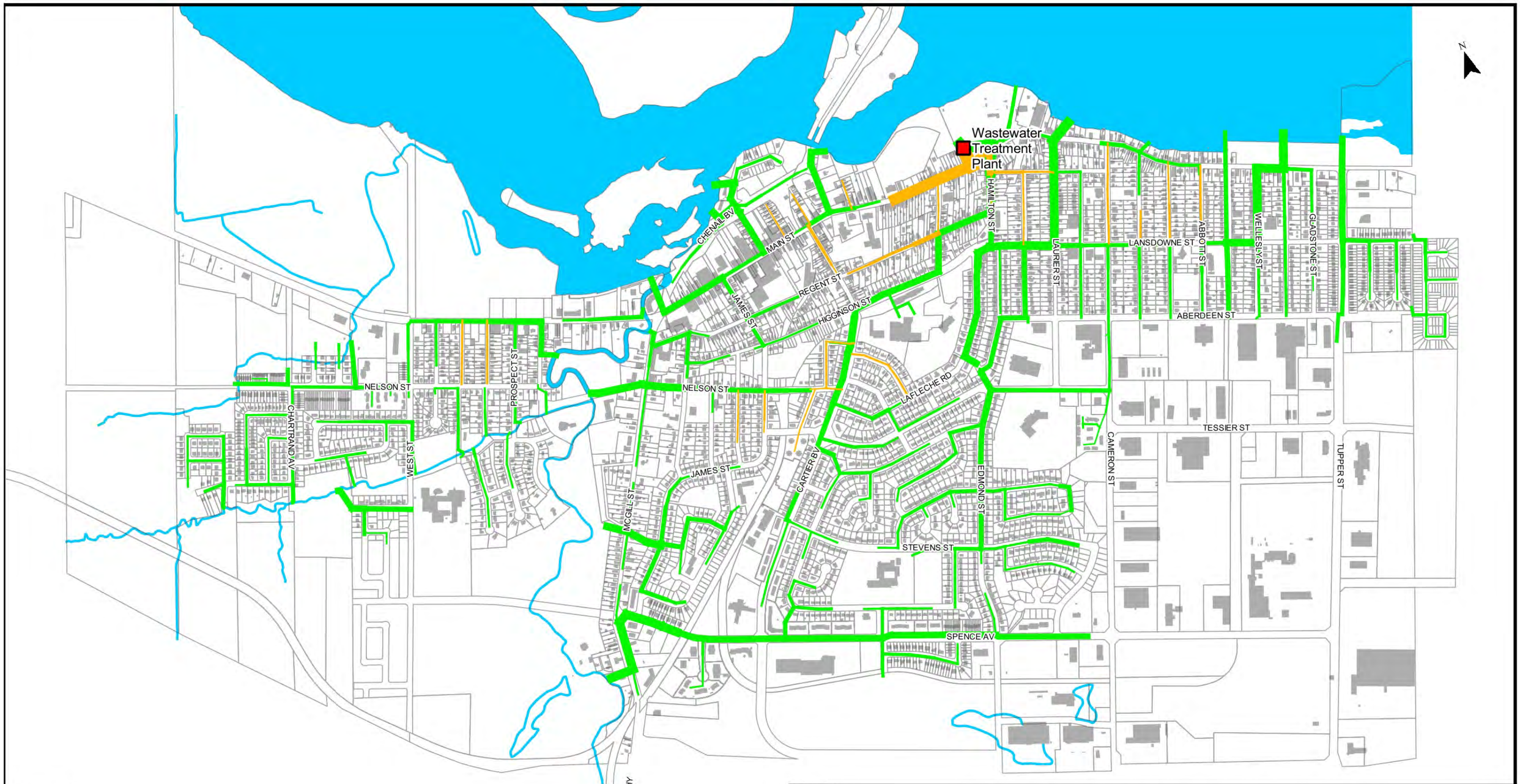
150 0 150 300 450 600 m

PROJECT: **Sanitary, Storm, Water Infrastructure Master Plan**
HAWKESBURY, ONTARIO

DRAWING: **Existing Wastewater System**

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

DESIGN: ID
DRAWN: BP
CHECKED:
JLR NO: 27423
DRAWING NO: **Figure 2-1**



Legend

- Storm Sewer
- Combined Sewer
- WWTP

150 0 150 300 450 600 m

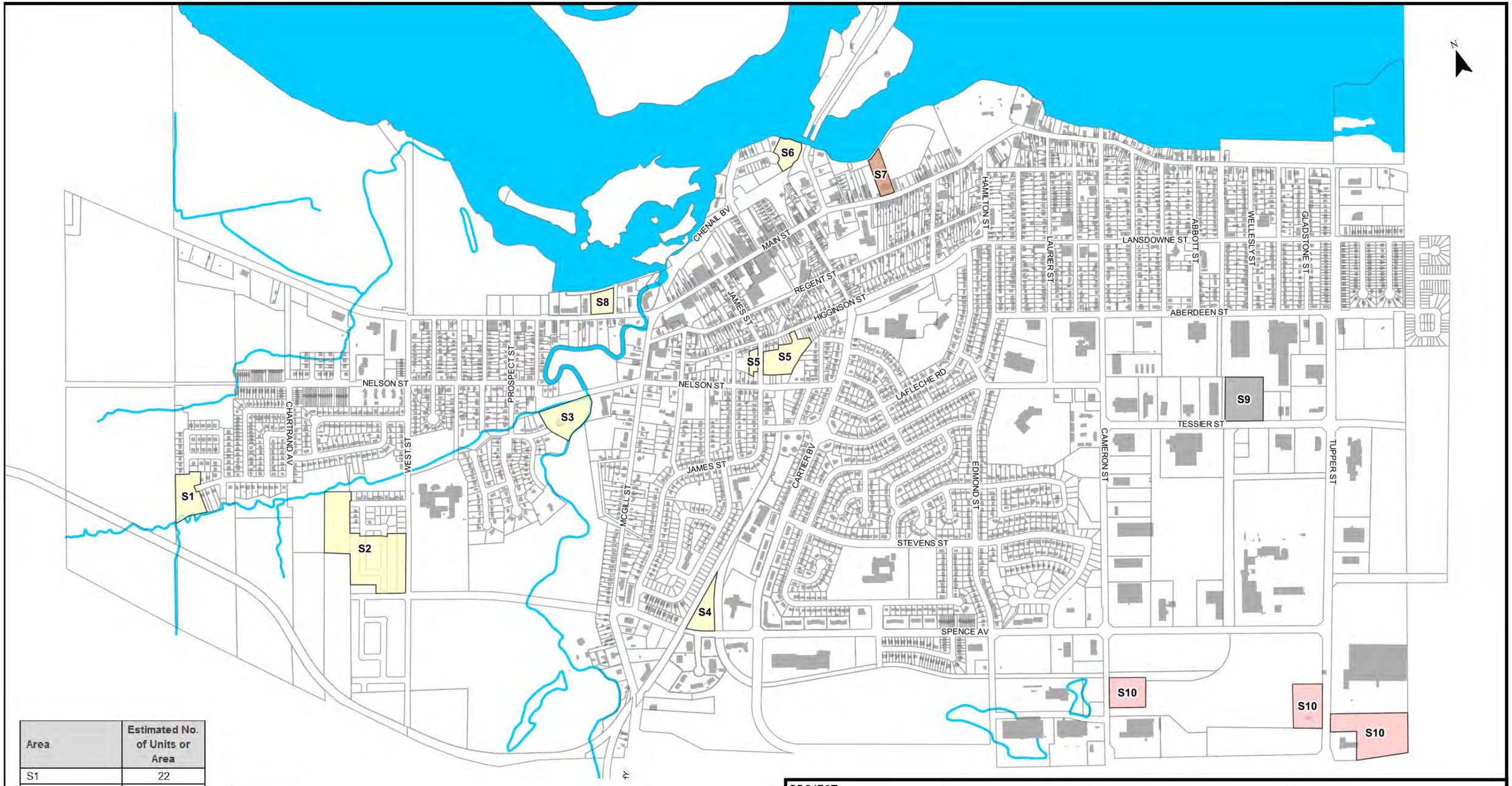
PROJECT: **Sanitary, Storm, Water Infrastructure Master Plan**
HAWKESBURY, ONTARIO

DRAWING: **Existing Stormwater Network**

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

DESIGN: ID
DRAWN: BP
CHECKED:

JLR NO: 27423
DRAWING NO: **Figure 2-4**



Area	Estimated No. of Units or Area
S1	22
S2	172
S3	41
S4	24
S5	27
S6	24
S7	24
S8	16
S9	1.9 ha
S10	5.8 ha
Short Term Units	**350**

Legend

Future Development Type

- Residential
- Commercial
- Mixed Use
- Industrial

150 0 150 300 450 600 m

PROJECT:

Sanitary, Storm, Water Infrastructure Master Plan

HAWKESBURY, ONTARIO

DRAWING:

Short Term Future Development

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

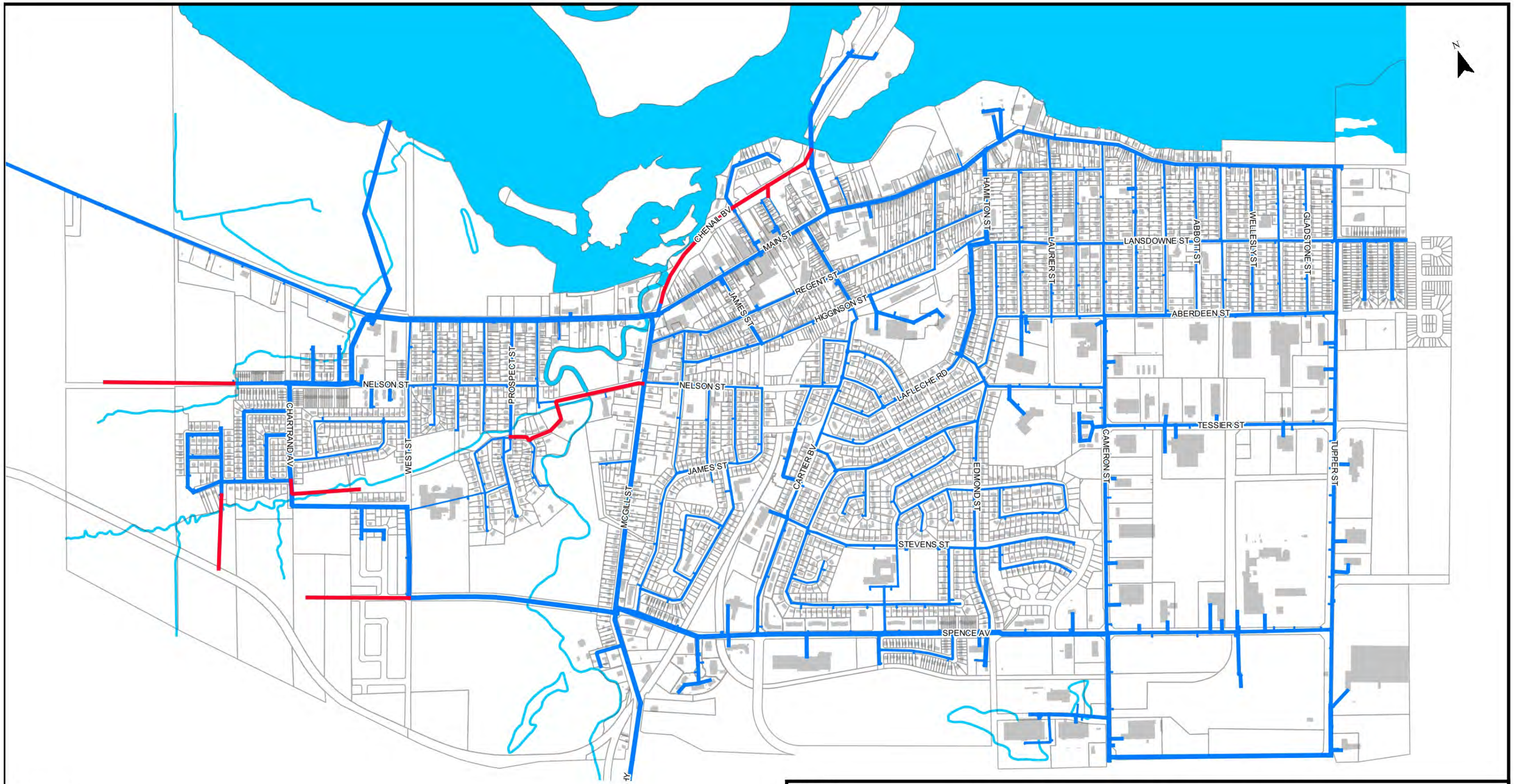
DESIGN: ID

DRAWN: BP

CHECKED:

JLR NO: 27423

DRAWING NO: **Figure 4-1**



Legend

- Existing Watermain Network
- Proposed Watermain Network

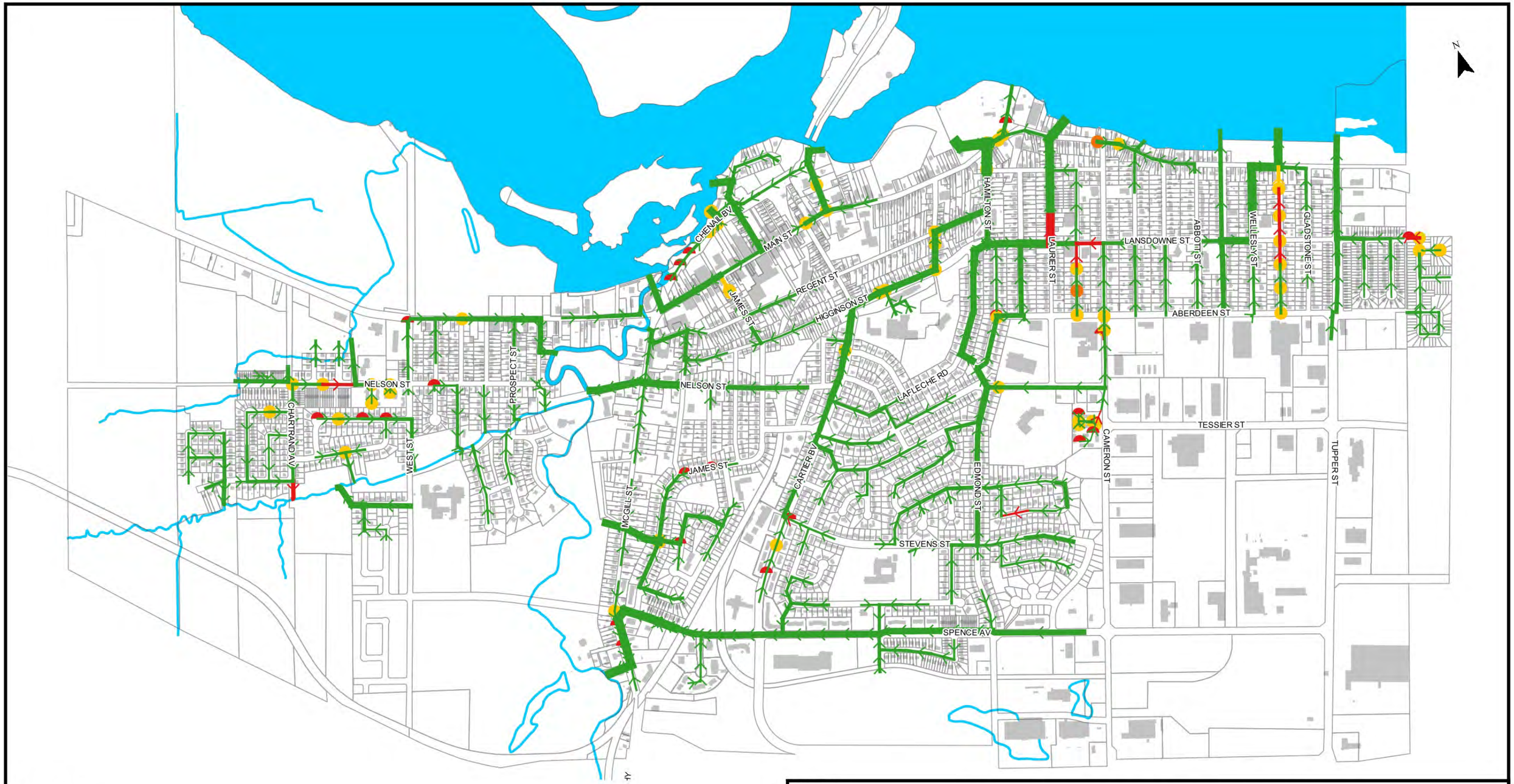
150 0 150 300 450 600 m

PROJECT: **Sanitary, Storm, Water Infrastructure Master Plan**
HAWKESBURY, ONTARIO

DRAWING: **Proposed Watermain Network (Groupe Tangauy & Associes Ltd)**

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

DESIGN: GTA Ltd
DRAWN: BP
CHECKED:
JLR NO: 27423
DRAWING NO: **Figure 5-1**



Legend

Level of Service Flow Criteria
- Within 90% of capacity
- 90% to 100% of capacity
- Above capacity

Level of Service HGL Criteria
- HGL within 2m of Surface
- HGL within 300mm of Surface
- HGL Above Surface
- HGL Above Sewer Obvert in Shallow Pipe

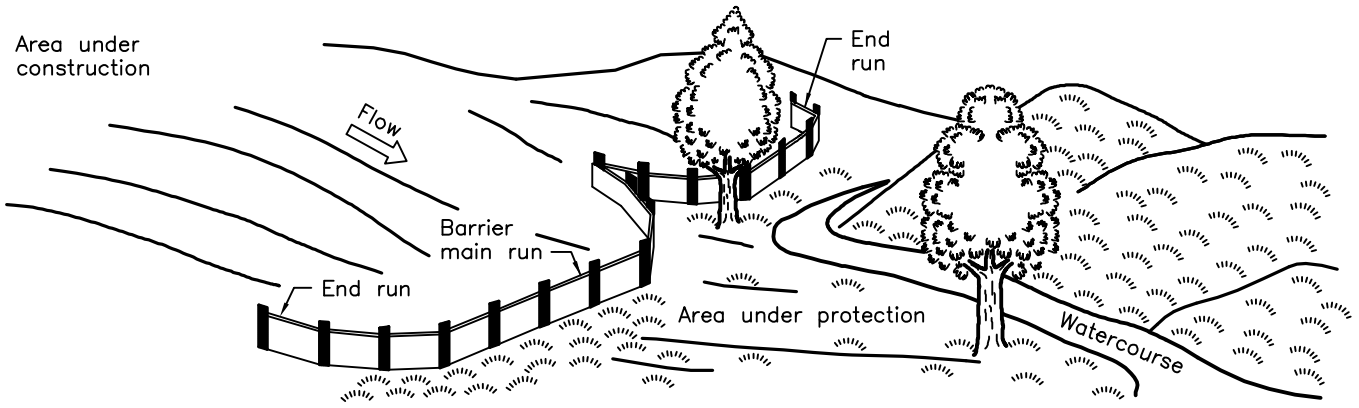
PROJECT:
Sanitary, Storm, Water Infrastructure Master Plan
HAWKESBURY, ONTARIO

DRAWING:
Existing Stormwater System Level of Service

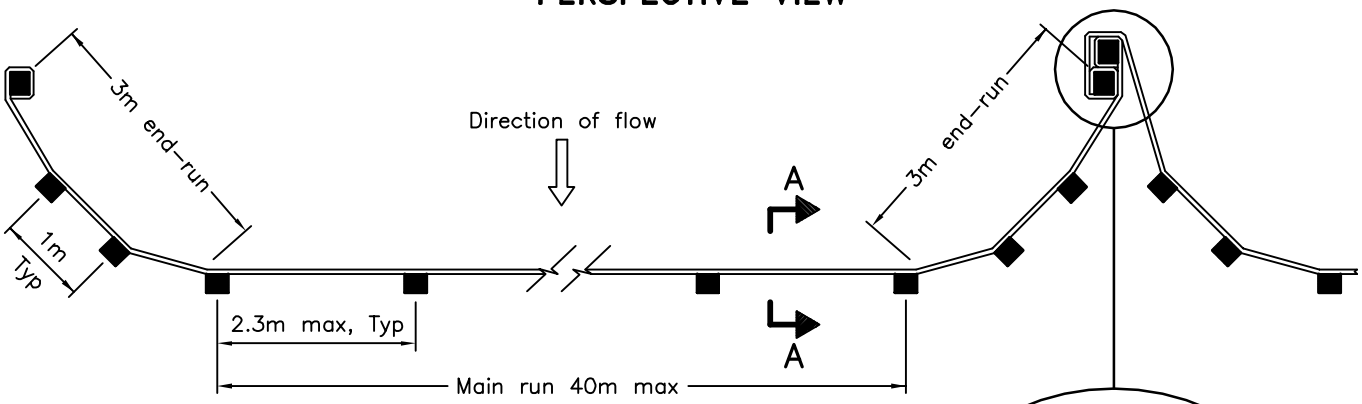
J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

DESIGN: ID
DRAWN: BP
CHECKED:

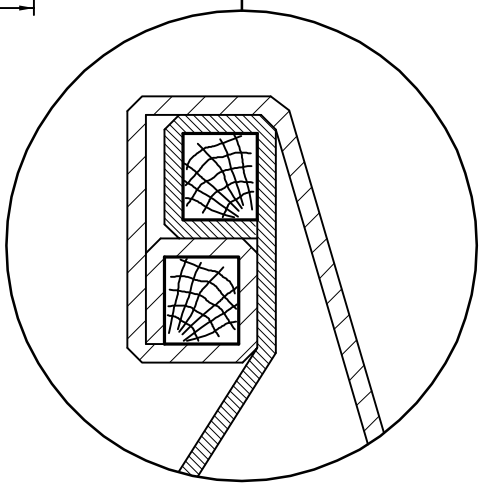
JLR NO: 27423
DRAWING NO: **Figure 7-1**



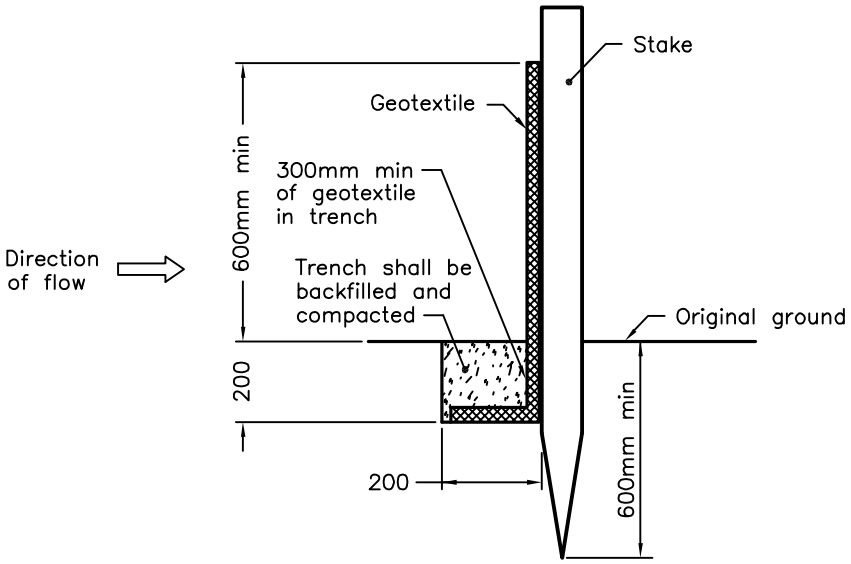
PERSPECTIVE VIEW



PLAN



JOINT DETAIL

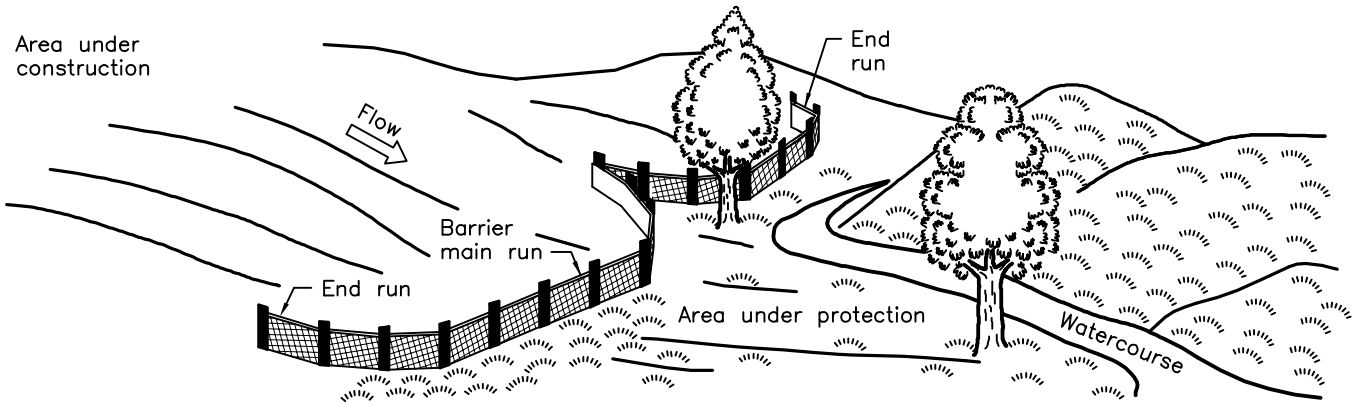


SECTION A–A

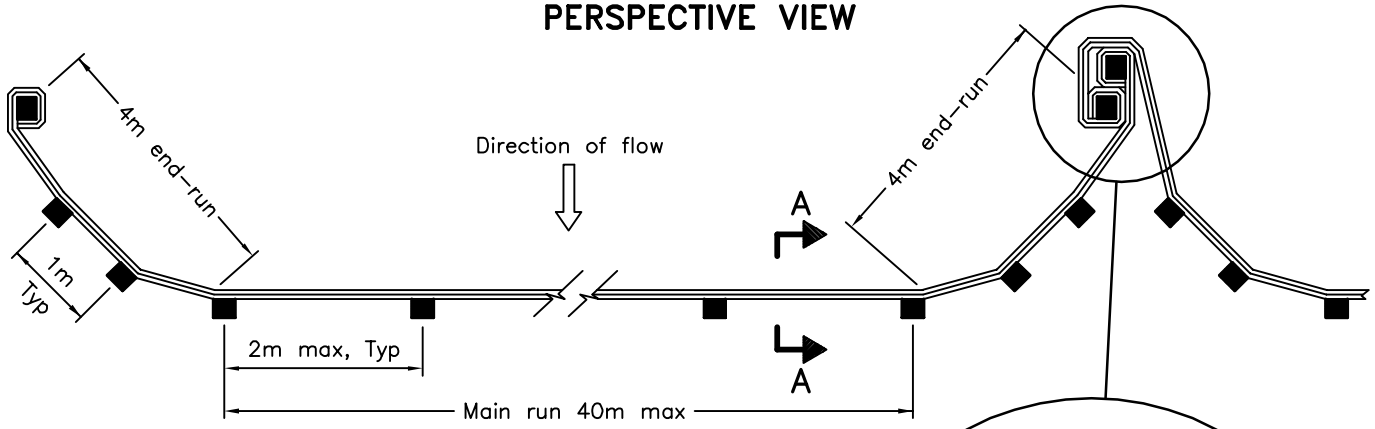
NOTE:

A All dimensions are in millimetres unless otherwise shown.

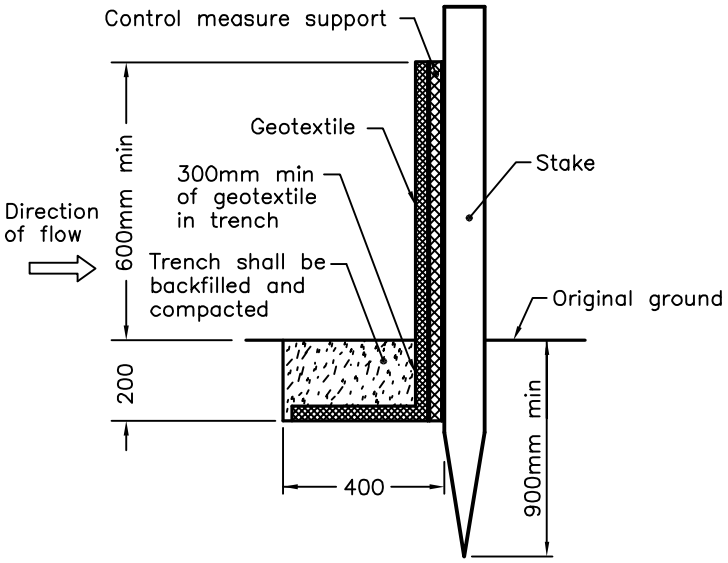
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
LIGHT–DUTY SILT FENCE BARRIER			
	OPSD 219.110		



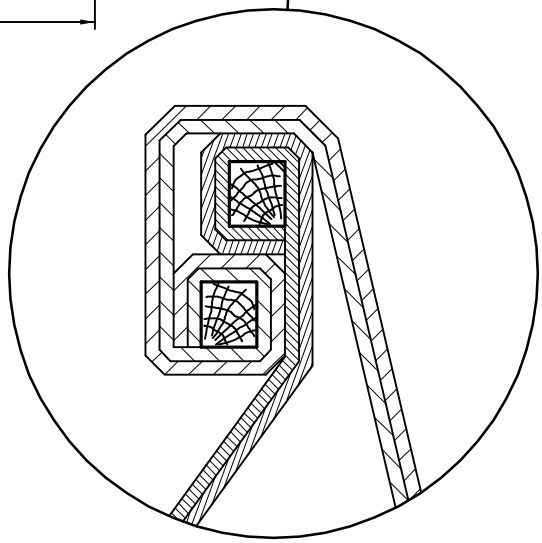
PERSPECTIVE VIEW



PLAN



SECTION A–A

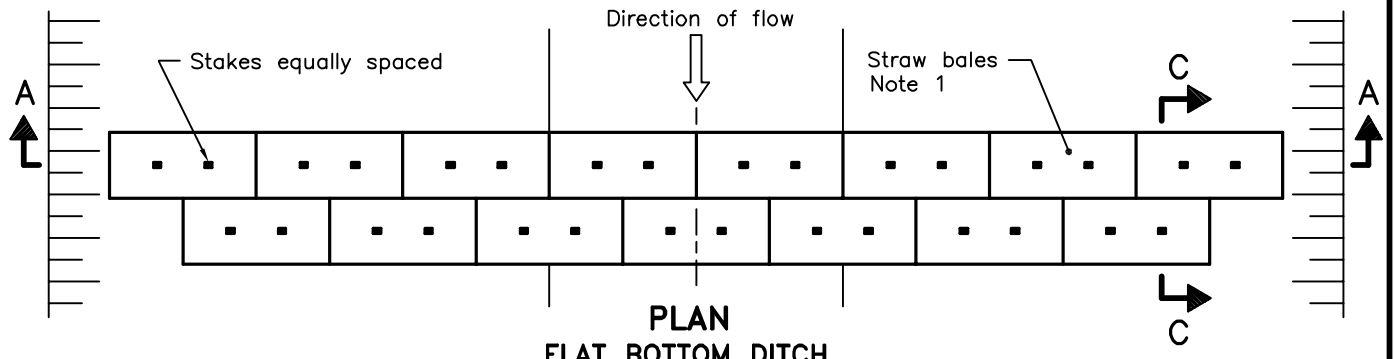


JOINT DETAIL

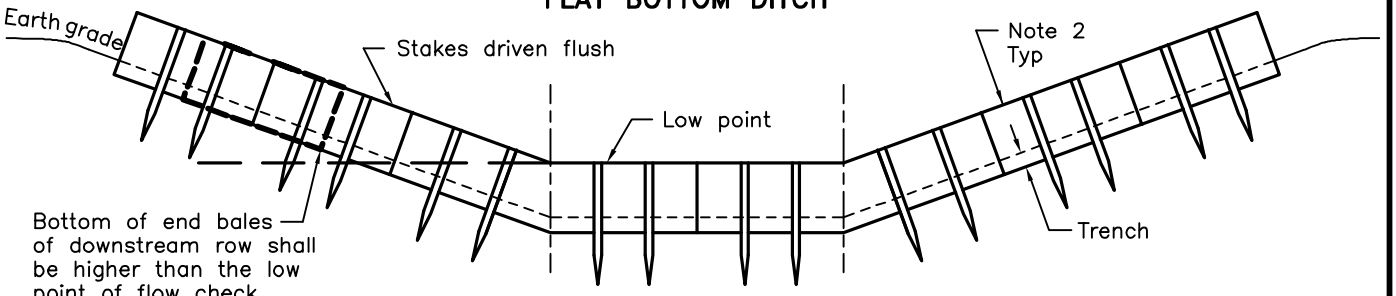
NOTE:

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
HEAVY–DUTY SILT FENCE BARRIER			
	OPSD 219.130		

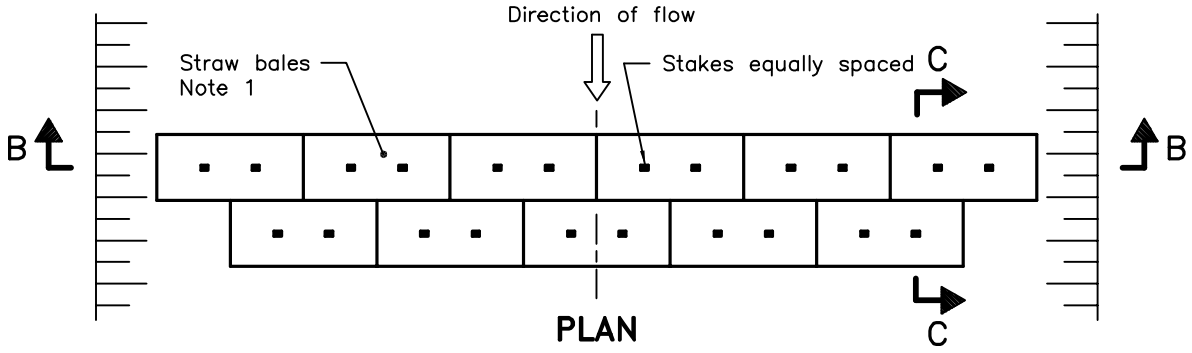


PLAN
FLAT BOTTOM DITCH

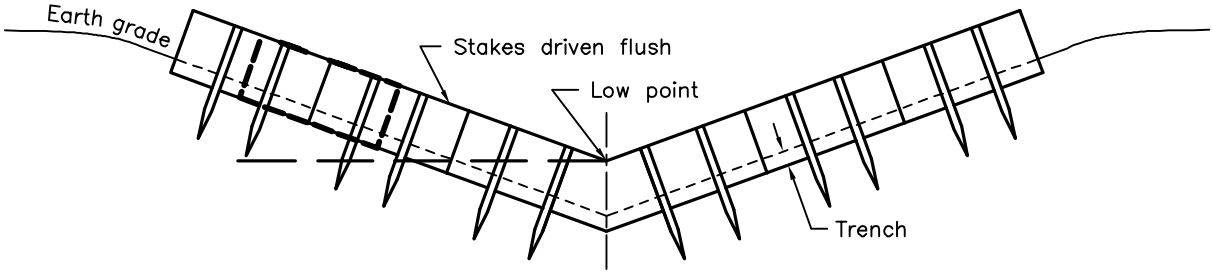


Bottom of end bales of downstream row shall be higher than the low point of flow check. Downstream bale position outlined. Typ

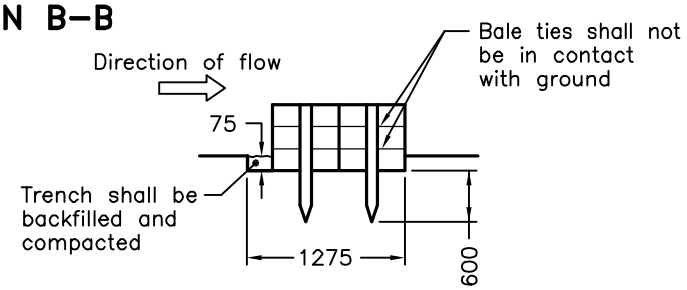
SECTION A–A



PLAN
V–DITCH



SECTION B–B



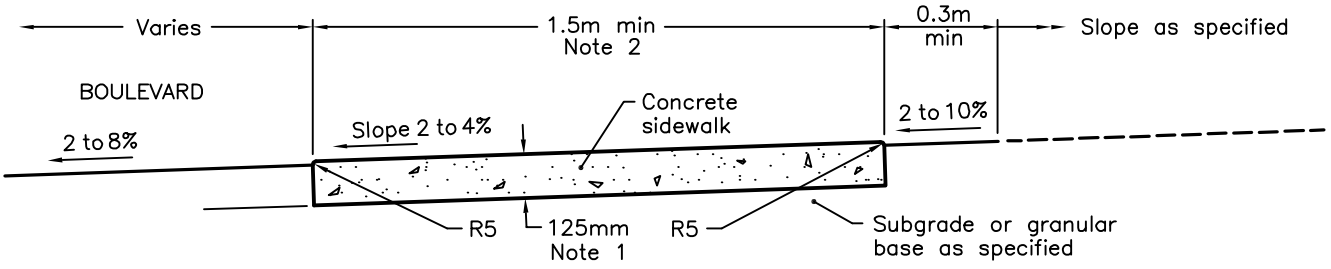
SECTION C–C

NOTES:

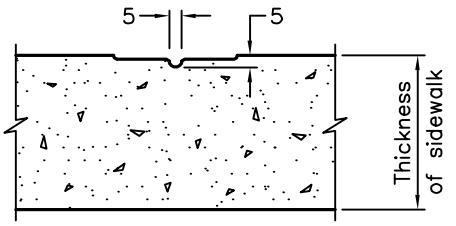
1 Number of bales varies and shall suit ditch.
2 Straw bales shall be butted tightly against adjoining bales and shaped to conform to the sides of the ditch to prevent water flow through barrier.

A All dimensions are in millimetres unless otherwise shown.

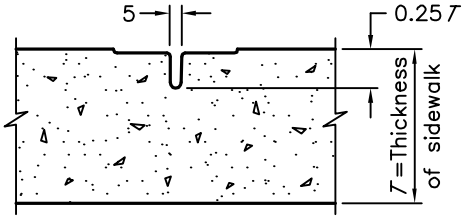
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
STRAW BALE FLOW CHECK DAM			
	OPSD 219.180		



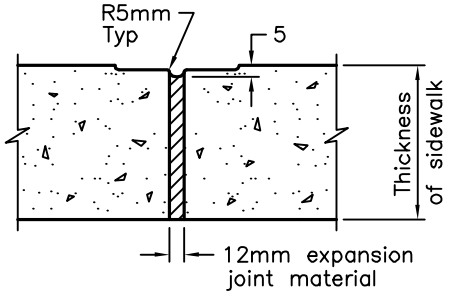
TYPICAL SECTION



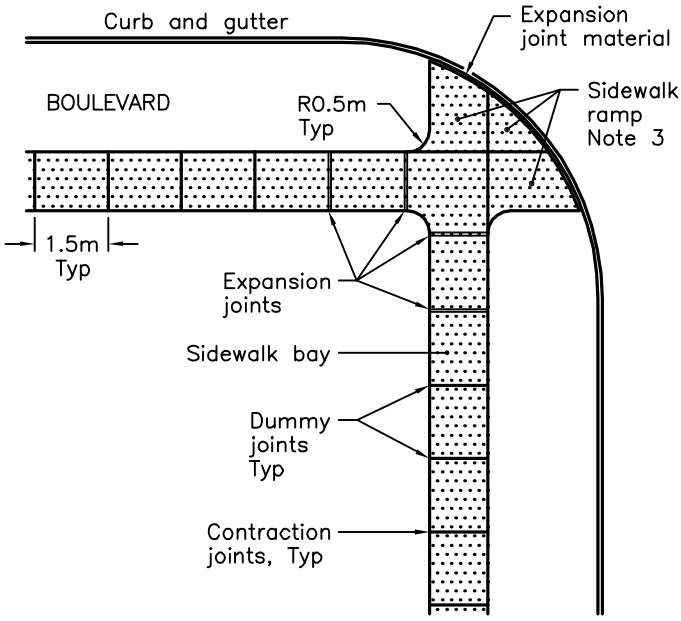
DUMMY JOINT (OPTIONAL)



CONTRACTION JOINT



EXPANSION JOINT



JOINT LAYOUT

NOTES:

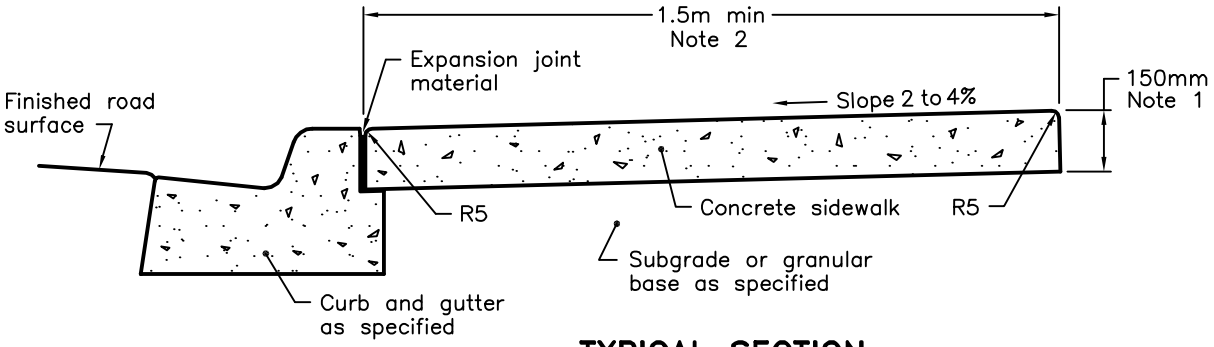
1 Sidewalk thickness at residential driveways and adjacent to curb shall be 150mm. At commercial and industrial driveways, the thickness shall be 200mm.

2 Sidewalk width shall be wider when specified.

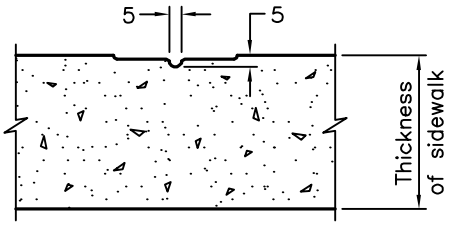
3 This OPSD shall be read in conjunction with OPSD 310.030, 310.031, 310.032, 310.033 and 310.039.

A All dimensions are in millimetres unless otherwise shown.

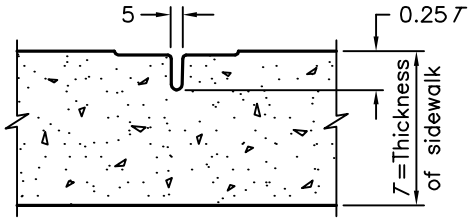
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
CONCRETE SIDEWALK			
	OPSD 310.010		



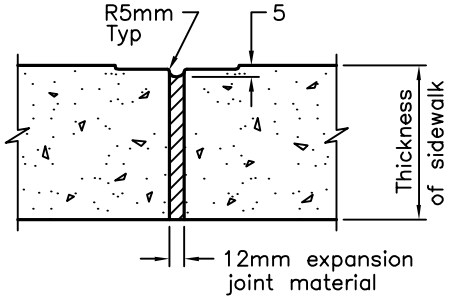
TYPICAL SECTION



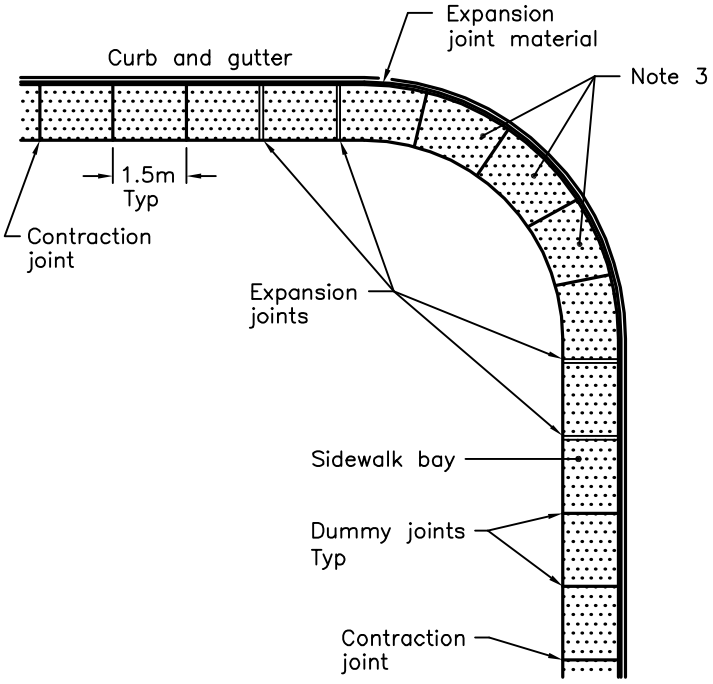
DUMMY JOINT



CONTRACTION JOINT



EXPANSION JOINT



JOINT LAYOUT

NOTES:

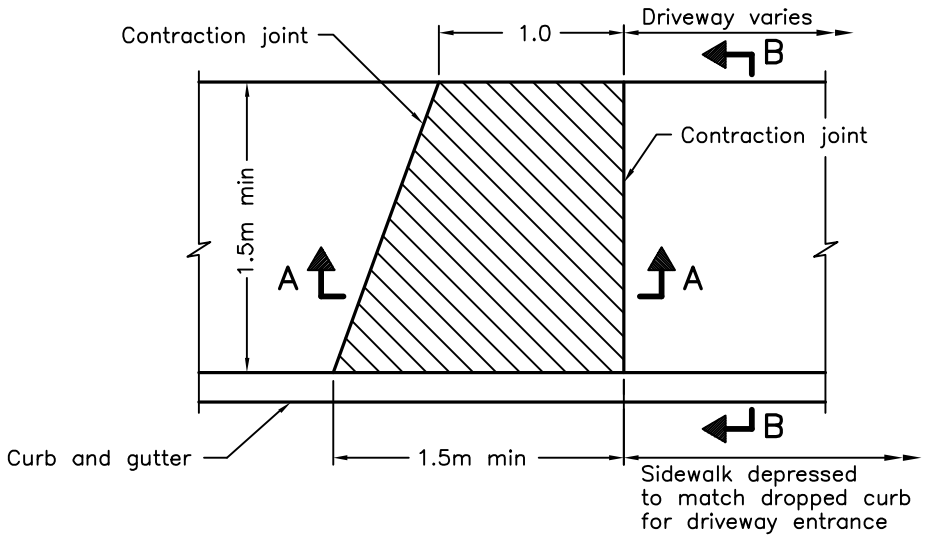
1 At commercial and industrial driveways, the thickness shall be 200mm.

2 Sidewalk width shall be wider when specified.

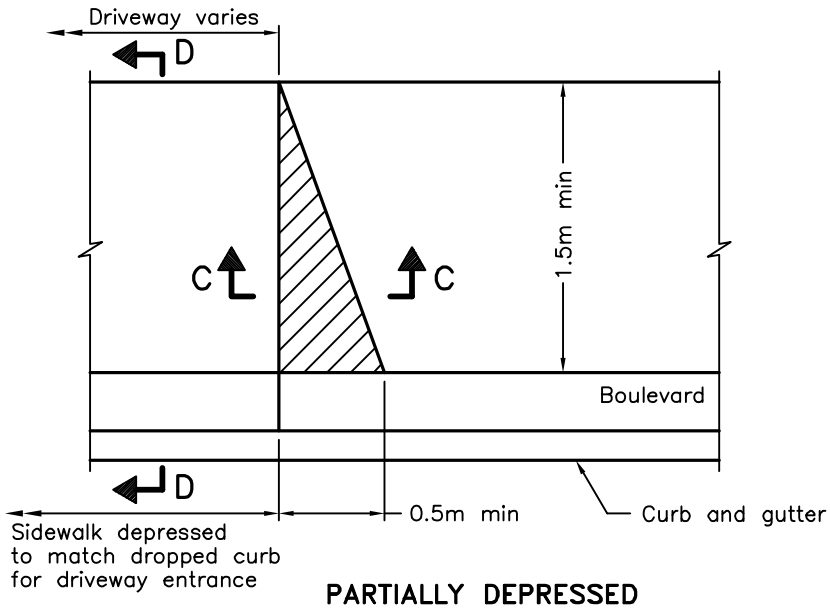
3 This OPSD shall be read in conjunction with OPSD 310.030, 310.031, 310.032, 310.033 and 310.039.

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
CONCRETE SIDEWALK ADJACENT TO CURB AND GUTTER			
		OPSD 310.020	

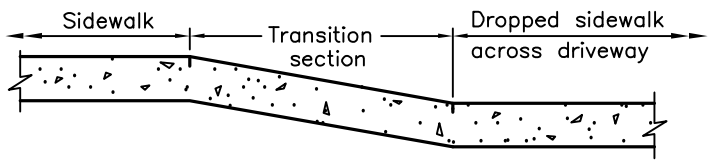


FULLY DEPRESSED

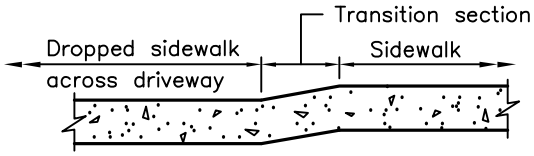


PARTIALLY DEPRESSED

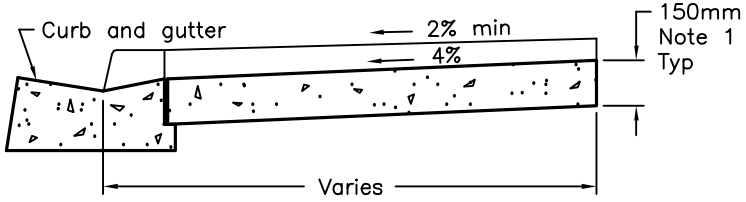
PLAN



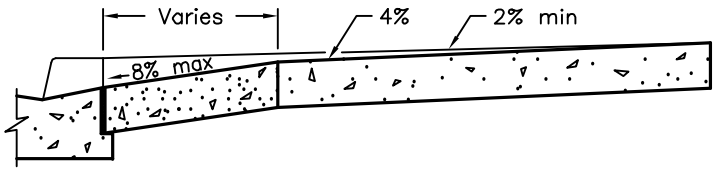
SIDEWALK WITHOUT BOULEVARD
SECTION A–A



SIDEWALK WITH BOULEVARD
SECTION C–C



SECTION B–B



SECTION D–D

NOTES:

1 At commercial and industrial driveways, the thickness shall be 200mm.

A For contraction joint detail, see OPSD 310.010.

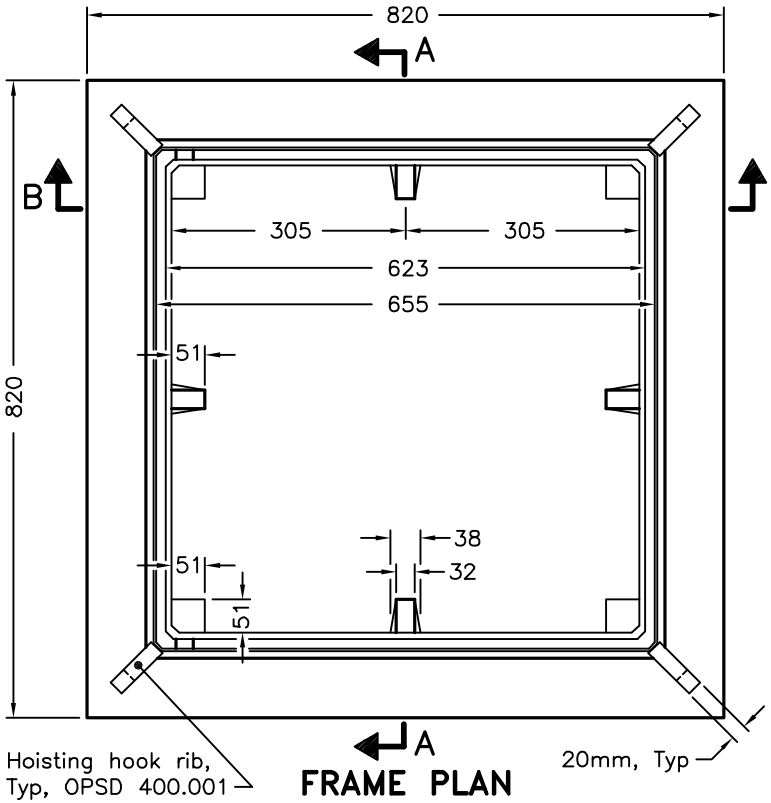
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

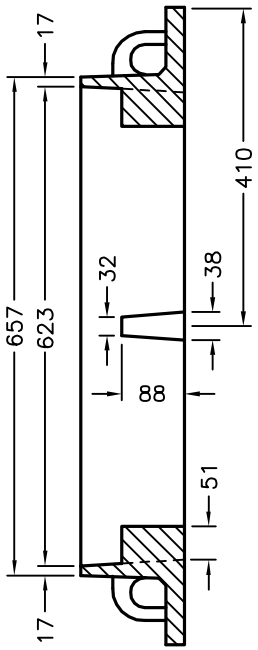
CONCRETE SIDEWALK DRIVEWAY ENTRANCE DETAILS

Nov 2015 | Rev 2

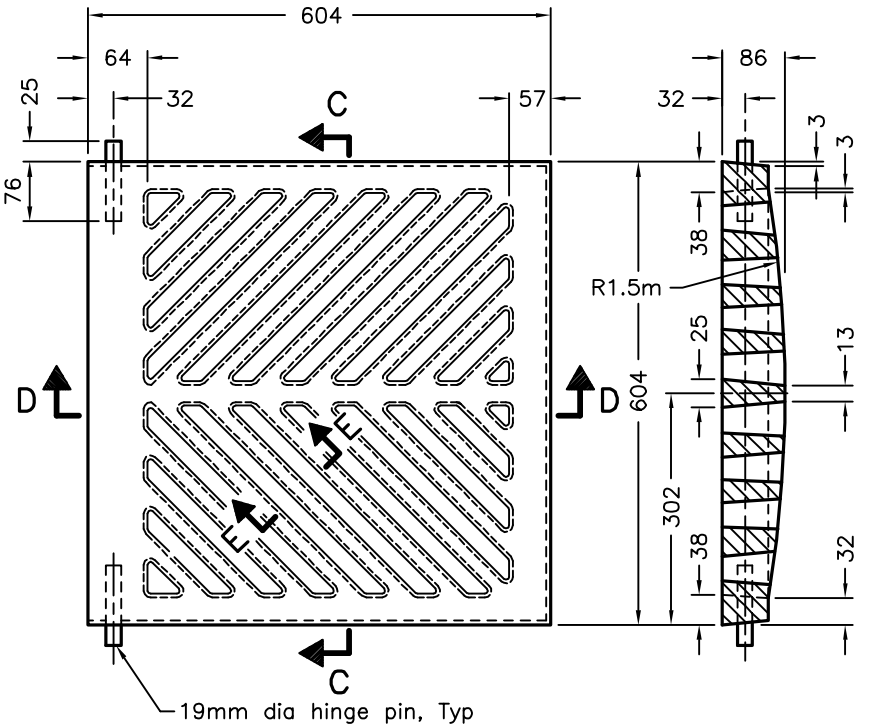
OPSD 310.050



FRAME PLAN

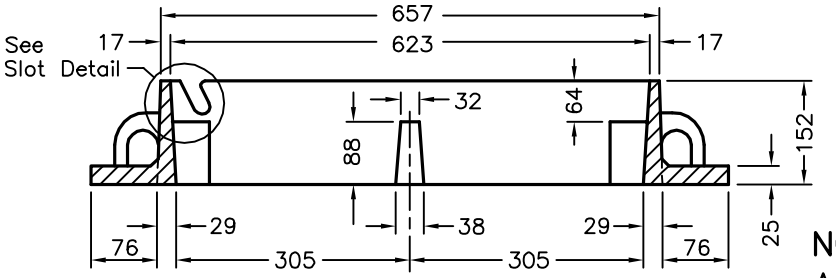


SECTION A–A

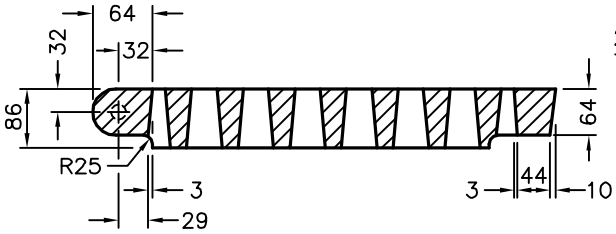


GRATE PLAN

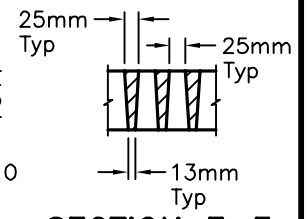
SECTION C–C



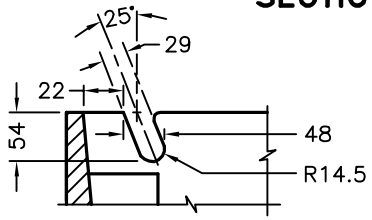
SECTION B–B



SECTION D–D



SECTION E–E



SLOT DETAIL

NOTES:

A This OPSD shall be read in conjunction with OPSD 610.010 and 610.020.

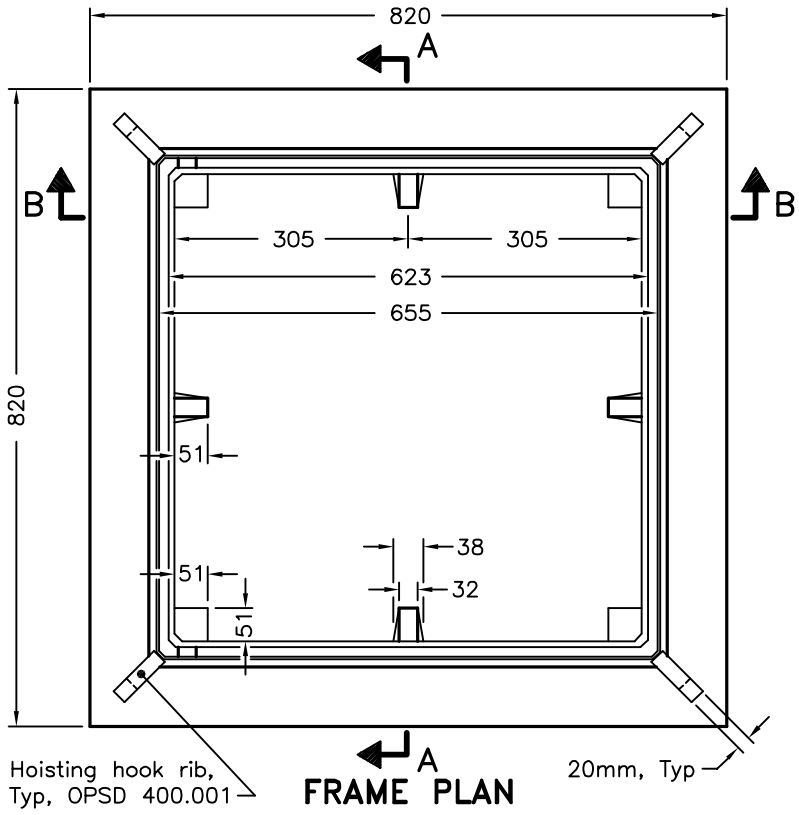
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

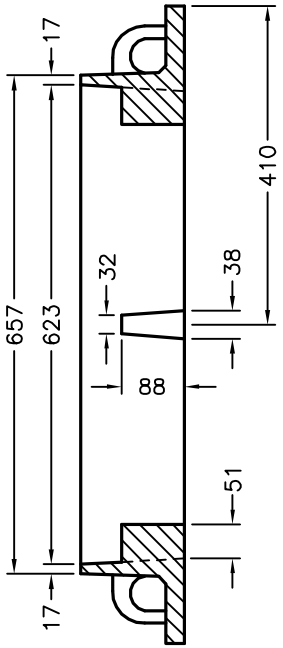
CAST IRON, SQUARE FRAME WITH SQUARE FLAT GRATE FOR CATCH BASINS, HERRING BONE OPENINGS

Nov 2013 | Rev 2

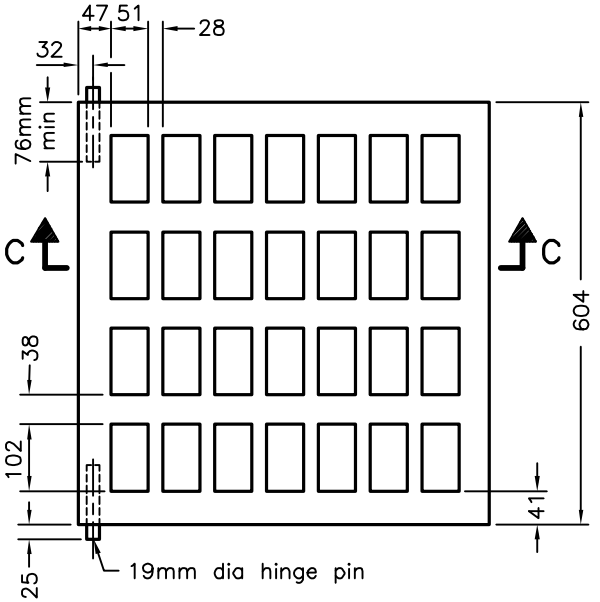
OPSD 400.020



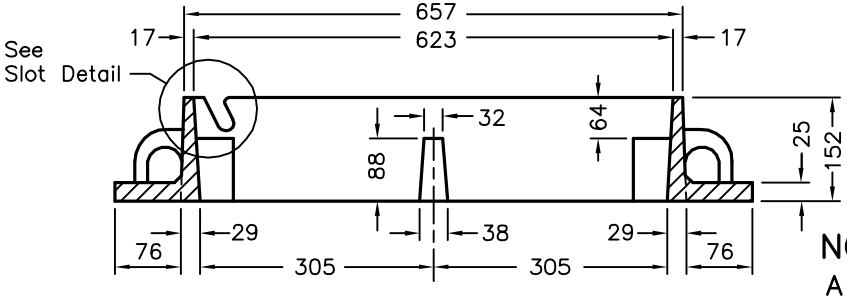
FRAME PLAN



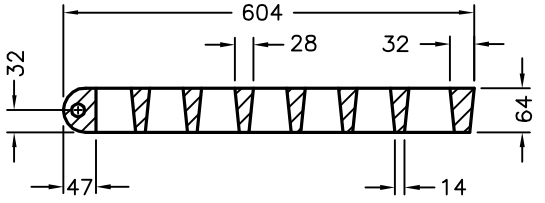
SECTION A–A



GRATE PLAN



SECTION B–B

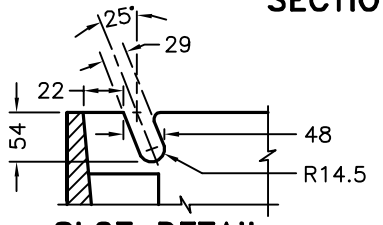


SECTION C–C

NOTE:

A This OPSD shall be read in conjunction with OPSD 610.010 and 610.020.

B All dimensions are in millimetres unless otherwise shown.



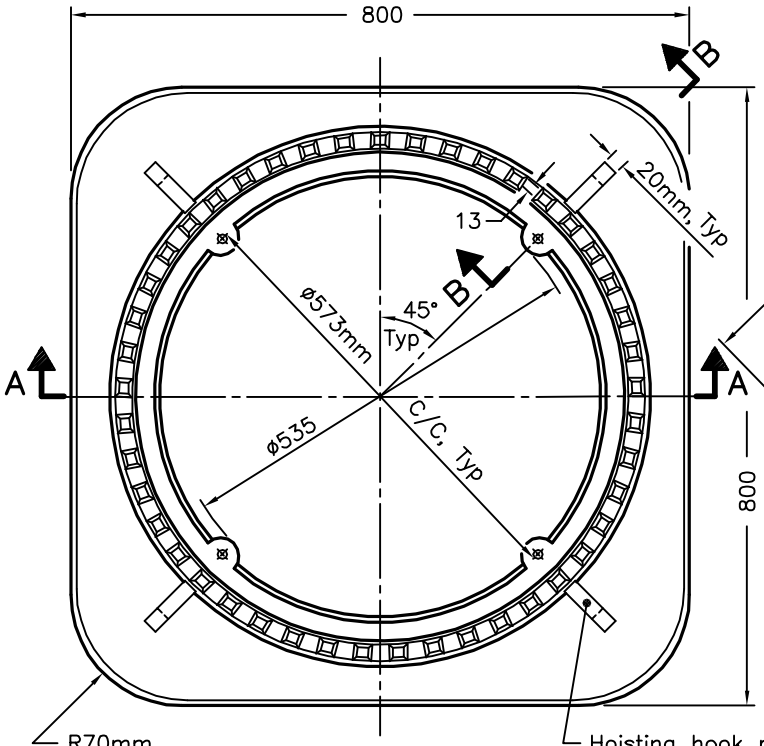
SLOT DETAIL

ONTARIO PROVINCIAL STANDARD DRAWING

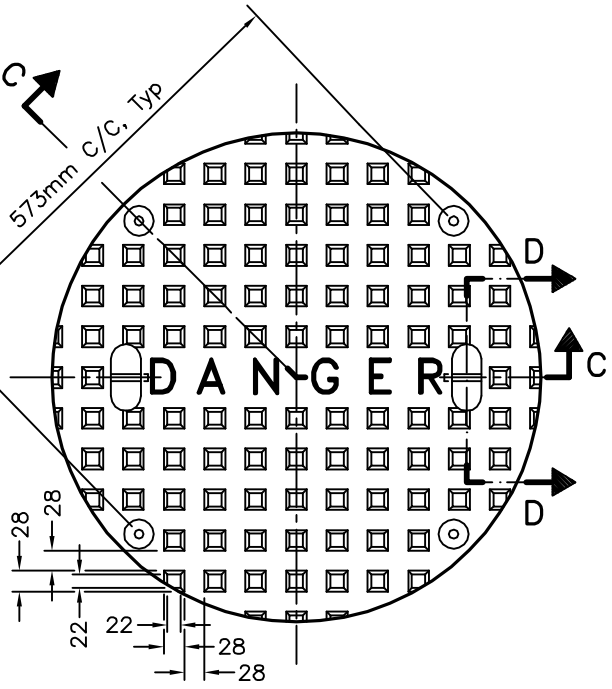
Nov 2013 | Rev 2

CAST IRON, SQUARE FRAME WITH SQUARE FLAT GRATE FOR CATCH BASINS, PERFORATED OPENINGS

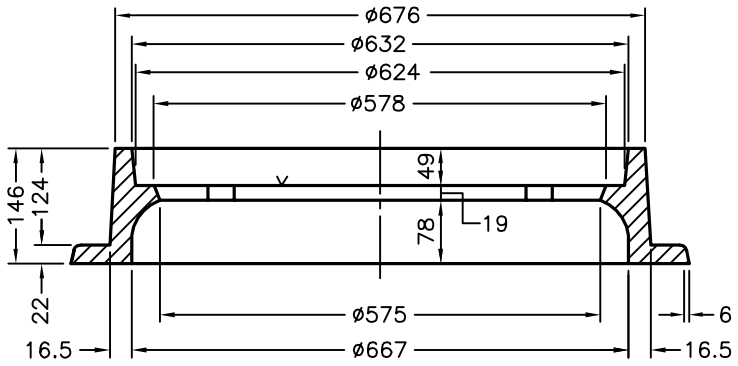
OPSD 400.100



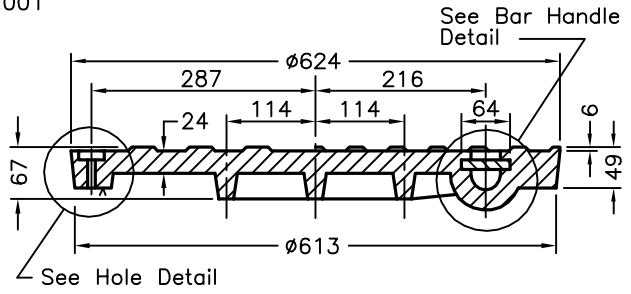
FRAME PLAN



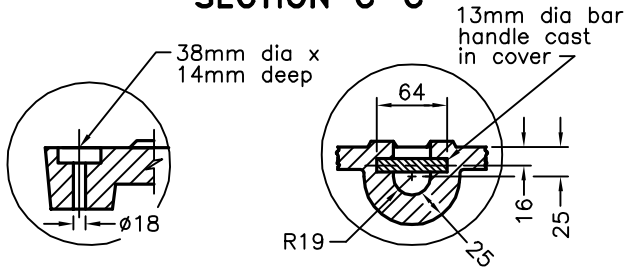
COVER PLAN



SECTION A–A

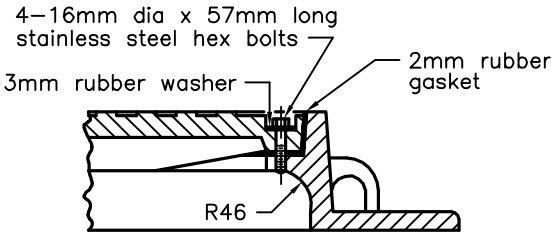


SECTION C–C

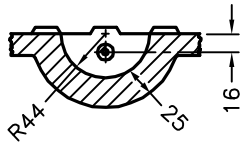


HOLE DETAIL

BAR HANDLE DETAIL



SECTION B–B



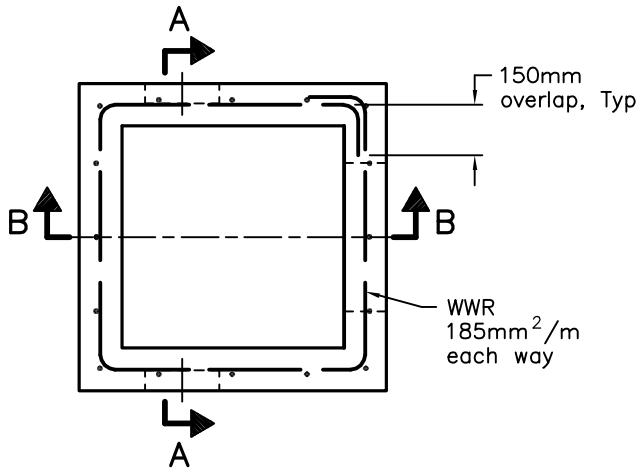
SECTION D–D

NOTE:

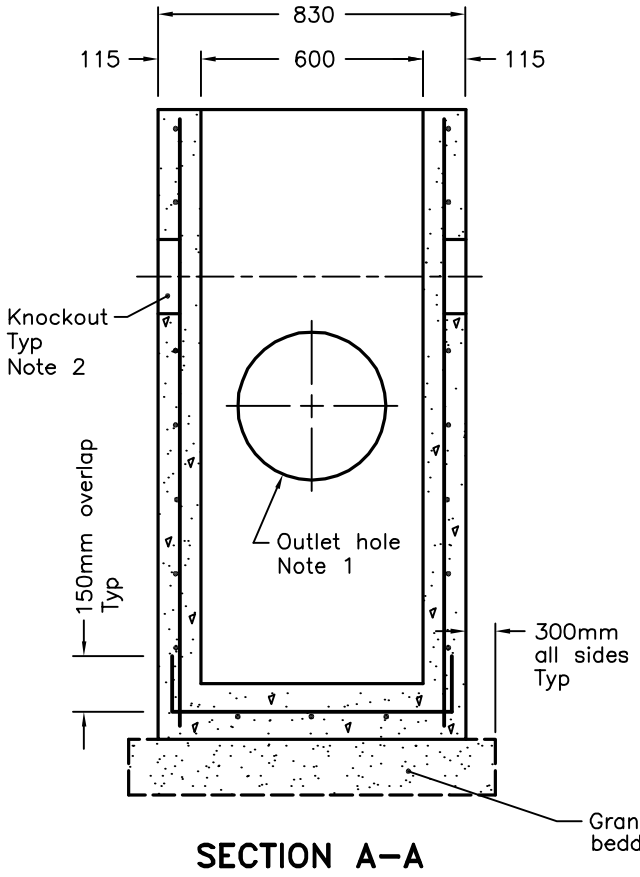
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev	3
CAST IRON, SQUARE FRAME WITH CIRCULAR WATERTIGHT COVER FOR MAINTENANCE HOLES			
	OPSD 401.030		

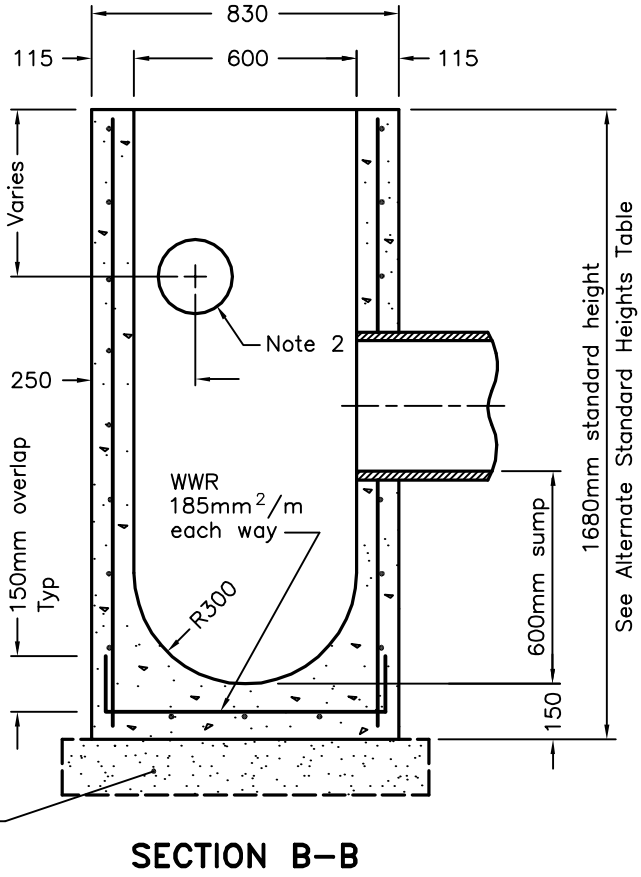
ALTERNATE STANDARD HEIGHTS	
ALTERNATIVE	DIMENSION
A	1980
B	1830
C	1520
D	1380



PLAN



SECTION A–A



SECTION B–B

NOTES:

1 Outlet hole size 525mm diameter maximum, location as required.

2 200mm diameter knockout to accommodate subdrain. Knockout shall be 60mm deep.

A Centre reinforcing in base slab and walls ±20mm.

B Granular backfill shall be placed to a minimum thickness of 300mm all around the catch basin.

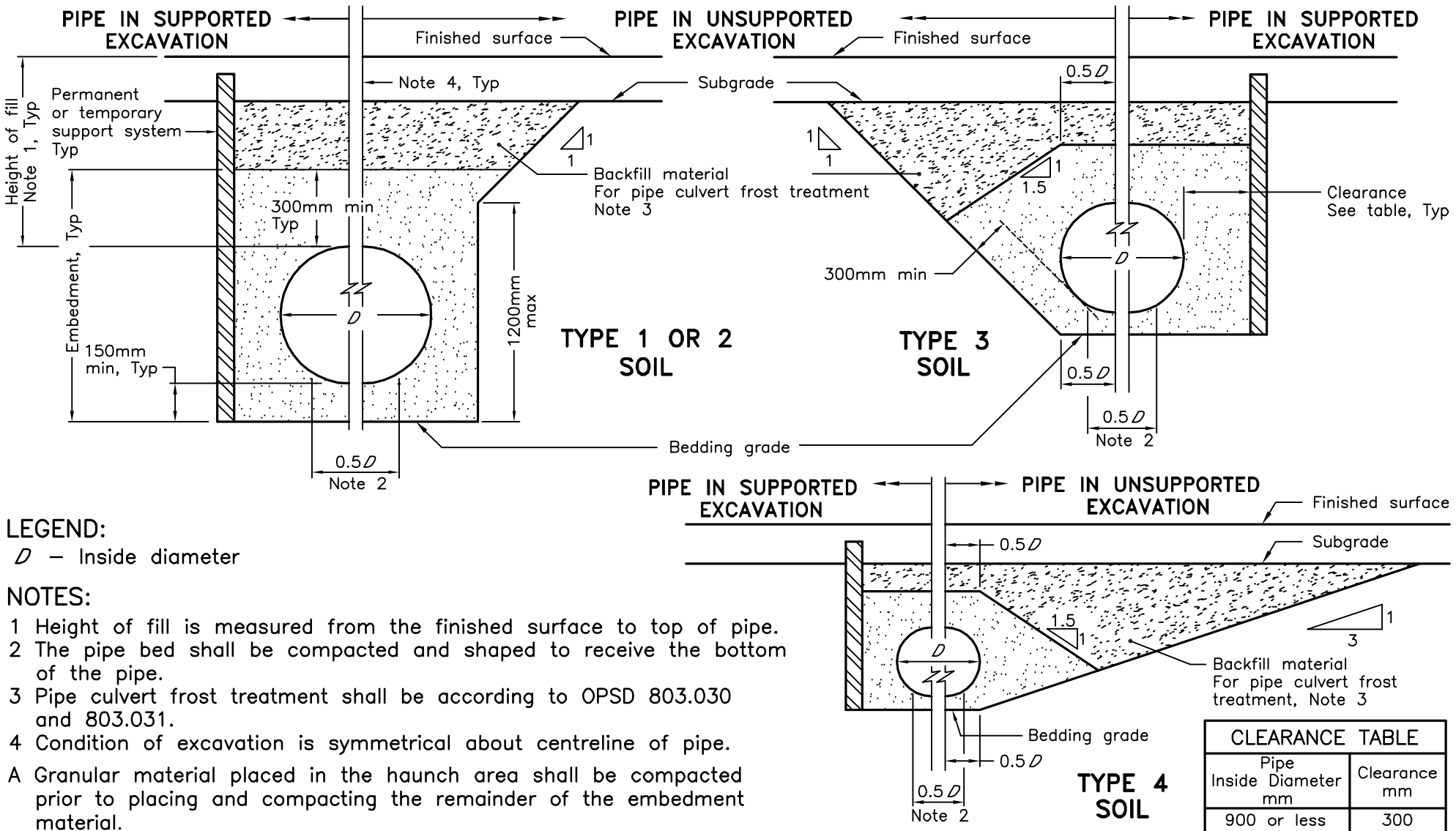
C Frame, grate, and adjustment units shall be installed according to OPSD 704.010.

D Pipe support shall be according to OPSD 708.020.

E All dimensions are nominal.

F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev	3
PRECAST CONCRETE CATCH BASIN 600x600mm			
	OPSD 705.010		



LEGEND:

D – Inside diameter

NOTES:

1 Height of fill is measured from the finished surface to top of pipe.
2 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
3 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
4 Condition of excavation is symmetrical about centreline of pipe.

A Granular material placed in the haunch area shall be compacted prior to placing and compacting the remainder of the embedment material.

B Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.

C All dimensions are in metres unless otherwise shown.

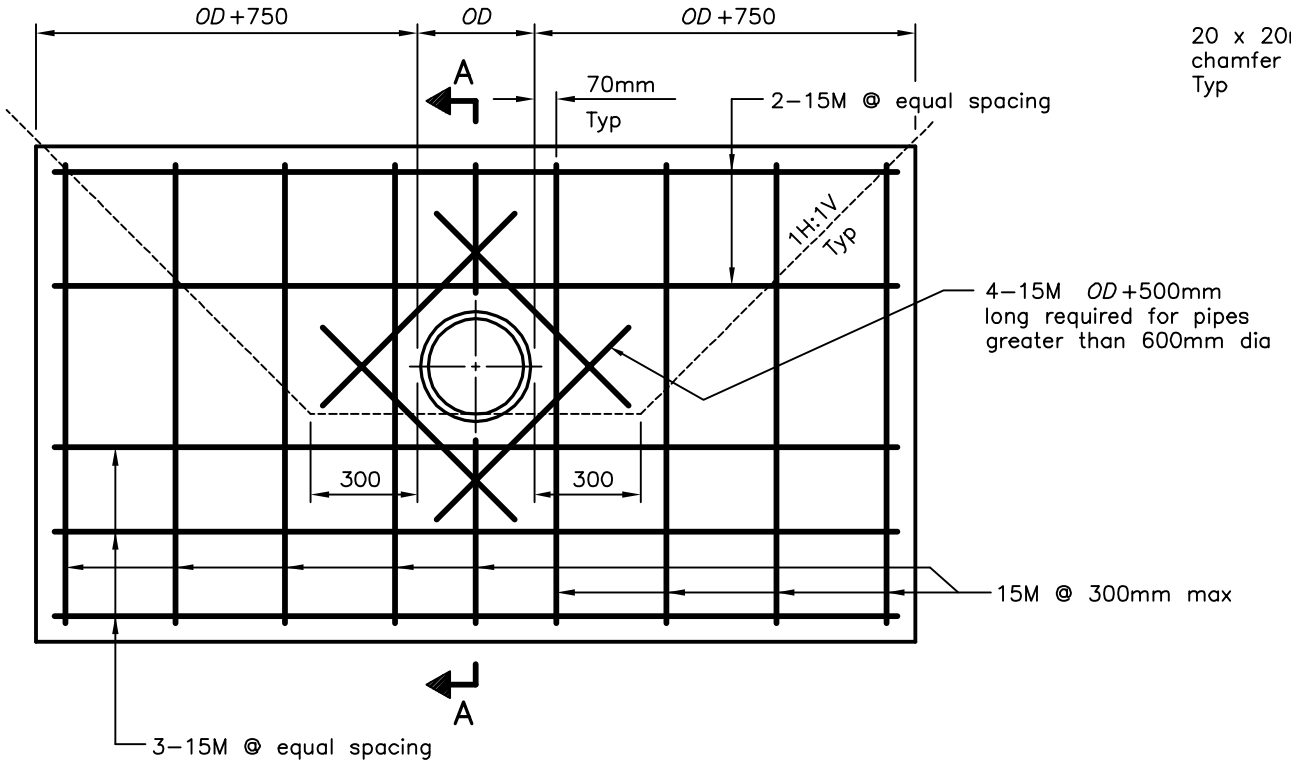
CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

ONTARIO PROVINCIAL STANDARD DRAWING

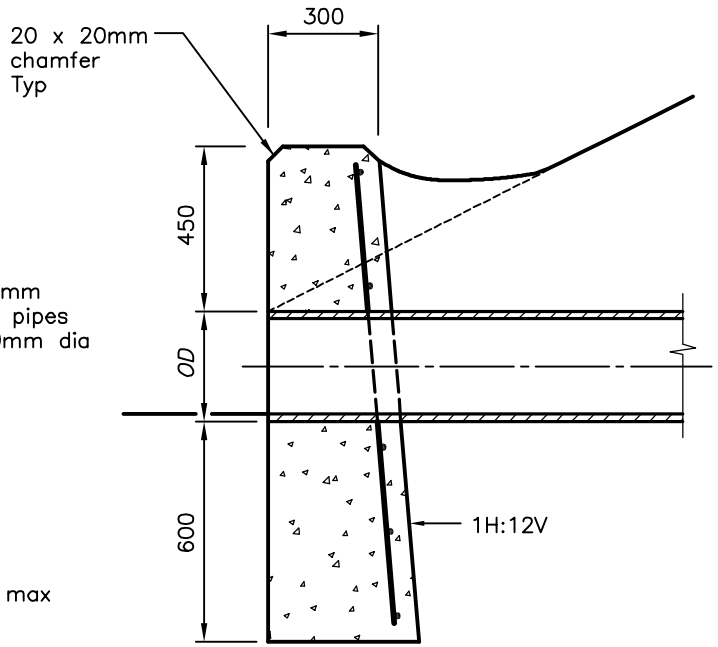
Nov 2014 | Rev 3

FLEXIBLE PIPE EMBEDMENT AND BACKFILL EARTH EXCAVATION

OPSD 802.010



FRONT ELEVATION



SECTION A–A

LEGEND:

OD – Outside diameter of pipe

NOTES:

A This OPSD to be read in conjunction with OPSD 3940.150.

B If a steel grate is required, refer to OPSD 804.05.

C Class of concrete: 30MPa.

D Cover to reinforcing bars 70mm ± 20mm.

E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

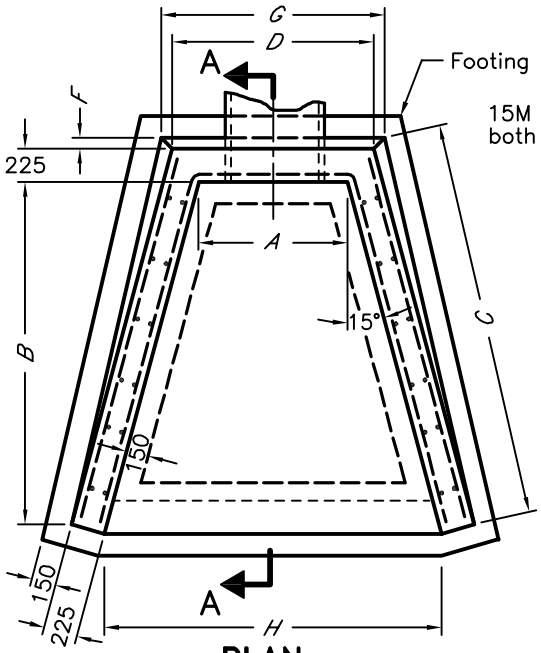
CONCRETE HEADWALL

FOR PIPE LESS THAN 900mm DIAMETER

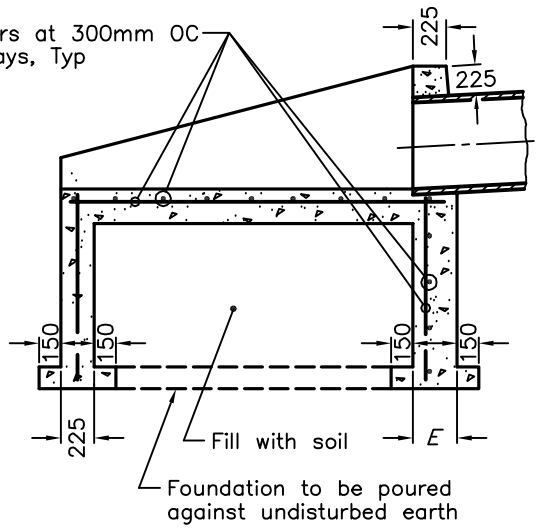
Nov 2017 | Rev 2

ONTARIO STANDARDS – MUNICIPAL – PROVINCIAL

OPSD 804.030

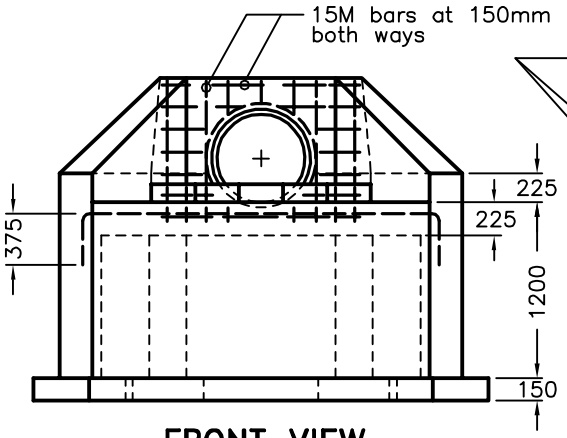


PLAN

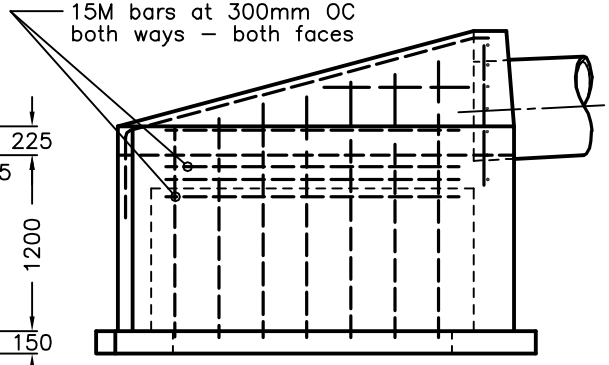


SECTION A–A

PIPE DIA	ENDWALL DIMENSIONS							
	A	B	C	D	E	F	G	H
600	1050	2400	2725	1400	300	75	1525	2350
675	1125	2400	2725	1475	300	75	1600	2425
750	1200	2400	2725	1550	300	75	1675	2500
825	1275	2400	2725	1625	300	75	1755	2575
900	1350	2400	2725	1700	300	75	1825	2650
975	1425	2400	2725	1775	375	150	1975	2725
1050	1500	3000	3400	1850	375	150	2050	3100
1200	1650	3000	3400	2000	375	150	2200	3250
1350	1800	3000	3400	2150	375	150	2350	3400
1500	1950	3000	3400	2300	375	150	2500	3550
1650	2100	3000	3400	2450	375	150	2650	3700
1800	2250	3000	3400	2600	375	150	2800	3850
2400	3000	3000	3400	3350	375	150	3550	4600



FRONT VIEW



SIDE VIEW

NOTES:

A This OPSD to be read in conjunction with OPSD 3940.150.

B Class of concrete: 30MPa.

C Cover to reinforcing bars: 75mm ±20mm.

D Granular backfill to be placed to 300mm min thickness on all sides.

E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

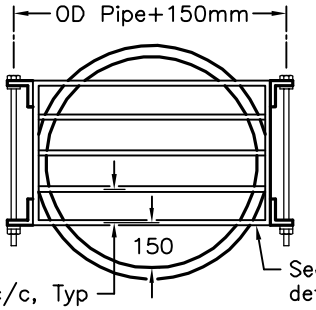
Nov 2017 | Rev 1

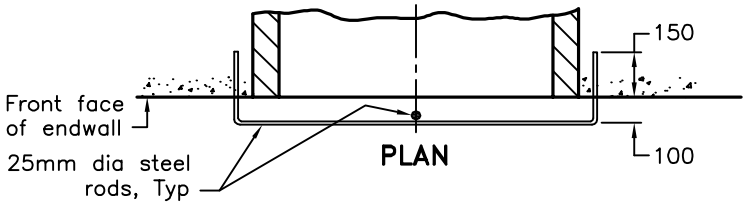
CONCRETE HEADWALL

FOR SEWER OR CULVERT PIPE OUTLET

ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · O P S

OPSD 804.040





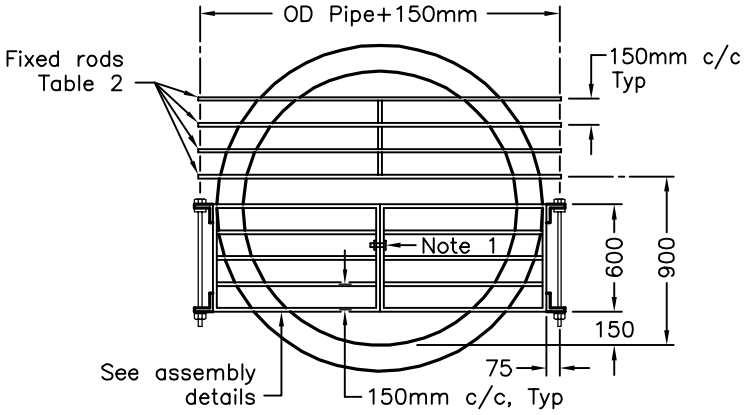
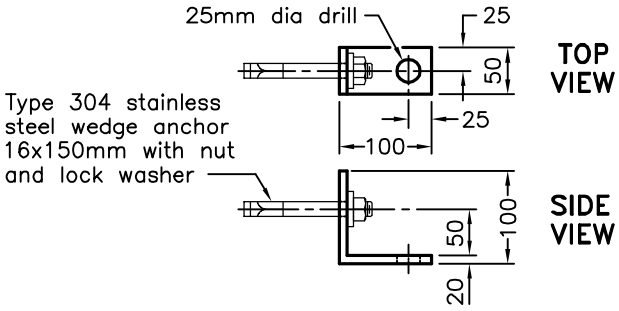


TABLE 1 – NUMBER OF RODS IN FRAME	
PIPE DIA	No of RODS
450	1
525	1
600	2
675	3
750	3
825	4
900	4
975	5
1050	6
1200	7

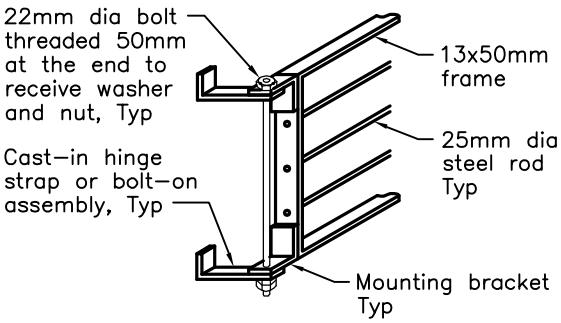
PIPE DIA up to 1200mm

TABLE 2 – NUMBER OF RODS IN FIXED UPPER FRAME	
PIPE DIA	No of RODS
1350	1
1500	2
1650	3
1800	4
1950	5
2100	6
2250	7
2400	8

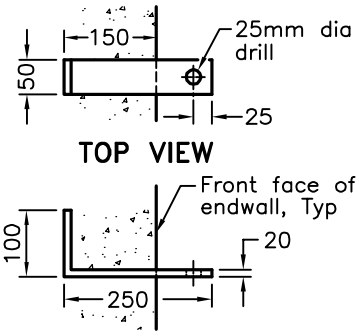
PIPE DIA 1350 to 2400mm

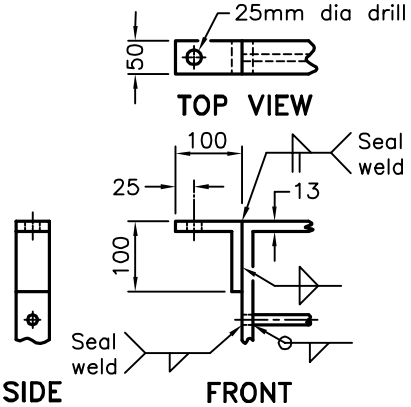


BOLT–ON ASSEMBLY DETAIL



ASSEMBLY





CAST–IN HINGE STRAP ASSEMBLY DETAILS

NOTES:

1 Grates shall be secured by either a bolt and nut or a locking device as specified.

A Metal surfaces shall be either painted with 2 coats of self priming abrasion resistant immersion grade epoxy or hot dip galvanized, as specified.

B Frame, hinge strap, mounting bracket, and steel rods shall be medium grade steel.

C All welding shall be according to CSA W59 and W47.1.

D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev	1
GRATING FOR CONCRETE ENDWALL			
	OPSD 804.050		

PIPE DIA mm	BEDDING CLASS	CONFINED TRENCH			
		50–D	65–D	100–D	140–D
		MAXIMUM HEIGHT OF FILL			
300	A	5.1	11.8	NL	NL
	B	2.9	3.9	7.4	NL
	C	2.2	3.1	5.1	10.2
375	A	6.5	NL	NL	NL
	B	3.0	4.1	8.8	NL
	C	2.4	3.2	5.7	12.8
450	A	7.6	NL	NL	NL
	B	3.1	4.4	10.0	NL
	C	2.5	3.4	6.2	13.2
525	A	8.5	NL	NL	NL
	B	3.3	4.7	10.9	NL
	C	2.6	3.5	6.6	17.6
600	A	9.2	NL	NL	NL
	B	3.4	4.9	11.5	NL
	C	2.6	3.7	7.0	18.6
675	A	9.7	NL	NL	NL
	B	3.5	5.1	11.8	NL
	C	2.7	3.8	7.2	18.6
750	A	10.0	NL	NL	NL
	B	3.6	5.2	12.0	NL
	C	2.8	3.8	7.2	18.0
825	A	10.2	NL	NL	NL
	B	3.6	5.2	12.0	NL
	C	2.8	3.8	7.4	17.4
900	A	9.8	NL	NL	NL
	B	3.8	5.4	11.6	NL
	C	2.8	4.0	7.4	16.0
975	A	6.2	9.6	NL	NL
	B	3.4	4.6	8.0	14.4
	C	2.8	3.8	6.0	9.6
1050	A	6.4	9.8	NL	NL
	B	3.6	4.6	8.2	14.6
	C	2.8	3.8	6.2	9.8
1200	A	6.8	10.4	NL	NL
	B	3.6	4.8	8.4	15.0
	C	3.0	3.8	6.4	10.2
1350	A	7.0	10.8	NL	NL
	B	3.8	5.0	8.6	15.2
	C	3.2	4.0	6.4	10.4
1500	A	7.2	11.0	NL	NL
	B	3.8	5.0	8.8	15.2
	C	3.2	4.0	6.6	10.4
1650	A	7.4	11.2	NL	NL
	B	4.0	5.2	9.0	15.2
	C	3.4	4.2	6.8	10.6
1800	A	7.6	11.4	NL	NL
	B	4.0	5.2	9.0	15.2
	C	3.4	4.2	6.8	10.6

LEGEND:

NL = No Limit

NOTES:

A Height of fill is measured from the finished surface to top of pipe.

B The load factor used for the calculation of the variable bedding factor is: Class A bedding=2.8, Class B bedding=1.9, and Class C bedding=1.5.

C The excavation width is based on OPSD 802.030 and is the width of the excavation measured at the top of the pipe.

D Minimum height of fill over top of pipe shall be 600mm.

E Strength designations are 50–D, 65–D, 100–D, and 140–D according to CSA A257.2.

F The table is based on backfill density of 1900 kg/m^3.

G For confined trench $K\mu$=0.130.

H Conditions other than those indicated shall be calculated from first principles.

I All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev 3

HEIGHT OF FILL TABLE

REINFORCED CONCRETE PIPE – CONFINED TRENCH
CLASS 50–D, 65–D, 100–D, and 140–D

ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · OPS

OPSD 807.010

PIPE DIA mm	BEDDING CLASS	POSITIVE PROJECTING EMBANKMENT			
		50–D	65–D	100–D	140–D
		MAXIMUM HEIGHT OF FILL			
300	A	4.5	6.0	9.0	12.9
	B	2.4	3.6	5.7	7.8
	C	1.8	2.7	4.5	6.3
375	A	4.8	6.0	9.6	13.5
	B	2.7	3.6	5.7	8.1
	C	2.1	3.0	4.8	6.6
450	A	4.8	6.3	9.9	13.8
	B	2.7	3.9	6.0	8.4
	C	2.1	3.0	4.8	6.9
525	A	4.8	6.6	9.9	14.1
	B	3.0	3.9	6.0	8.7
	C	2.4	3.0	5.1	7.2
600	A	5.1	6.6	10.2	14.4
	B	3.0	3.9	6.3	8.7
	C	2.4	3.3	5.1	7.2
675	A	5.1	6.6	10.2	14.4
	B	3.0	3.9	6.3	9.0
	C	2.4	3.3	5.1	7.2
750	A	5.1	6.6	10.5	14.7
	B	3.0	4.2	6.3	9.0
	C	2.4	3.3	5.1	7.5
825	A	5.1	6.9	10.5	14.7
	B	3.0	4.2	6.6	9.0
	C	2.4	3.3	5.4	7.5
900	A	5.1	6.9	10.5	15.0
	B	3.3	4.2	6.6	9.3
	C	2.4	3.3	5.4	7.5
975	A	5.4	6.9	10.8	15.0
	B	3.3	4.2	6.6	9.3
	C	2.4	3.3	5.4	7.5
1050	A	5.4	6.9	10.8	15.0
	B	3.3	4.2	6.6	9.3
	C	2.7	3.3	5.4	7.5
1200	A	5.4	7.2	11.1	15.6
	B	3.3	4.5	6.9	9.6
	C	2.7	3.6	5.7	7.8
1350	A	5.4	7.2	11.1	15.6
	B	3.3	4.5	6.9	9.6
	C	2.7	3.6	5.7	8.1
1500	A	5.7	7.2	11.1	15.6
	B	3.3	4.5	6.9	9.9
	C	3.0	3.6	5.7	8.1
1650	A	5.7	7.2	11.4	15.9
	B	3.6	4.5	6.9	9.9
	C	3.0	3.6	5.7	8.1
1800	A	5.7	7.2	11.4	15.9
	B	3.6	4.5	7.2	9.9
	C	3.0	3.9	5.7	8.1

NOTES:

A Height of fill is measured from the finished surface to top of pipe.

B For the positive projecting embankment, the load factor used for the calculation of the variable bedding factor is: Class A bedding=2.8, Class B bedding=1.9, and Class C bedding=1.5.

C Minimum height of fill over top of pipe shall be 600mm.

D Strength designations are 50–D, 65–D, 100–D, and 140–D according to CSA A257.2.

E The table is based on backfill density of 1900 kg/m^3.

F For positive projecting embankment $K\mu$=0.190, p=0.7, and r_{sd}=0.7.

G Conditions other than those indicated shall be calculated from first principles.

H All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev 3

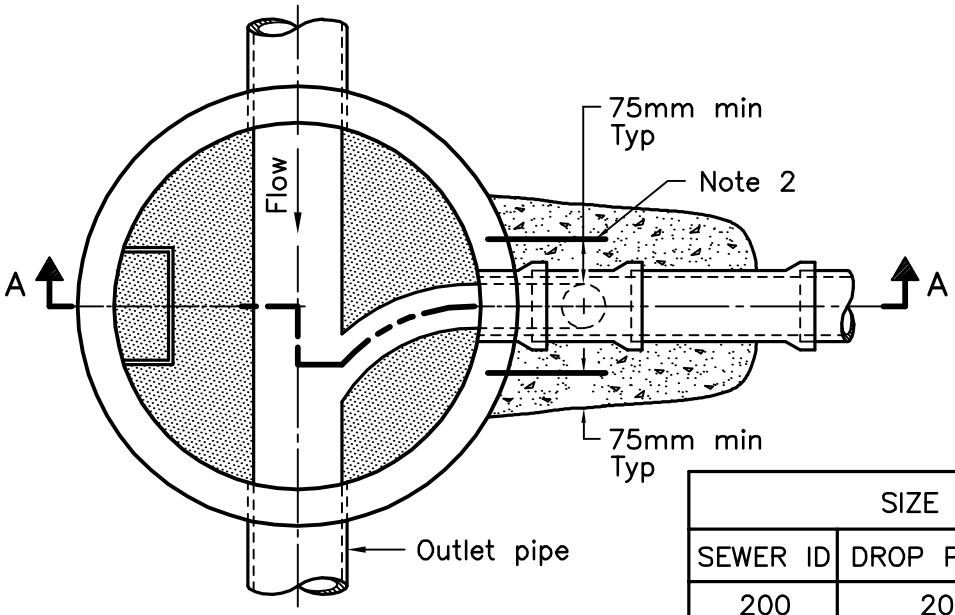
HEIGHT OF FILL TABLE

REINFORCED CONCRETE PIPE – EMBANKMENT

CLASS 50–D, 65–D, 100–D, and 140–D

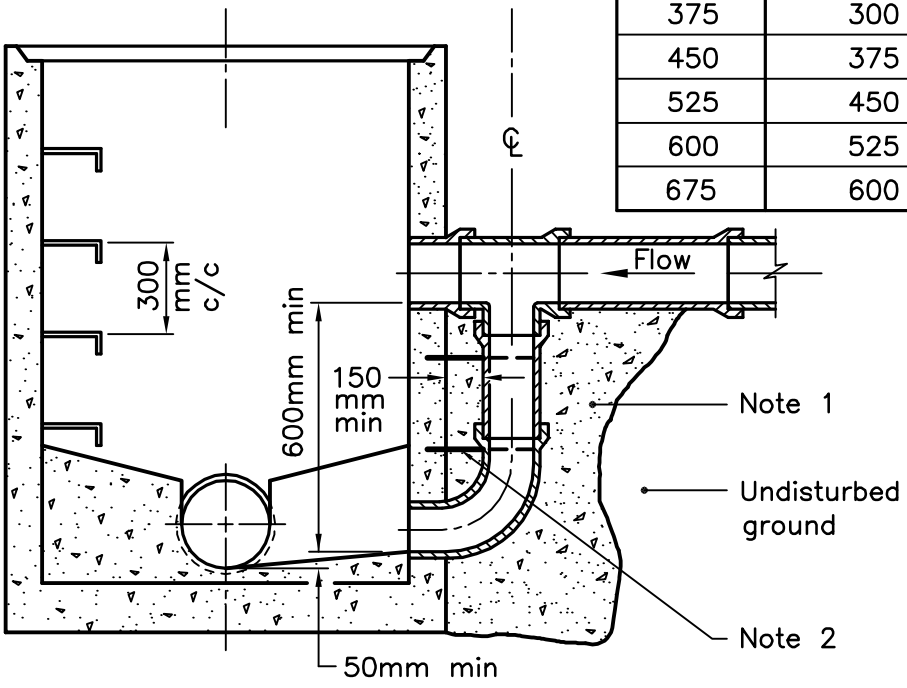
ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · OPSS

OPSD 807.030



PLAN

SIZE OF DROP PIPE		
SEWER ID	DROP PIPE ID	APPLICATION
200	200	Storm and Sanitary
250	200	Storm and Sanitary
300	250	Storm and Sanitary
375	300	Storm and Sanitary
450	375	Storm
525	450	Storm
600	525	Storm
675	600	Storm



SECTION A–A

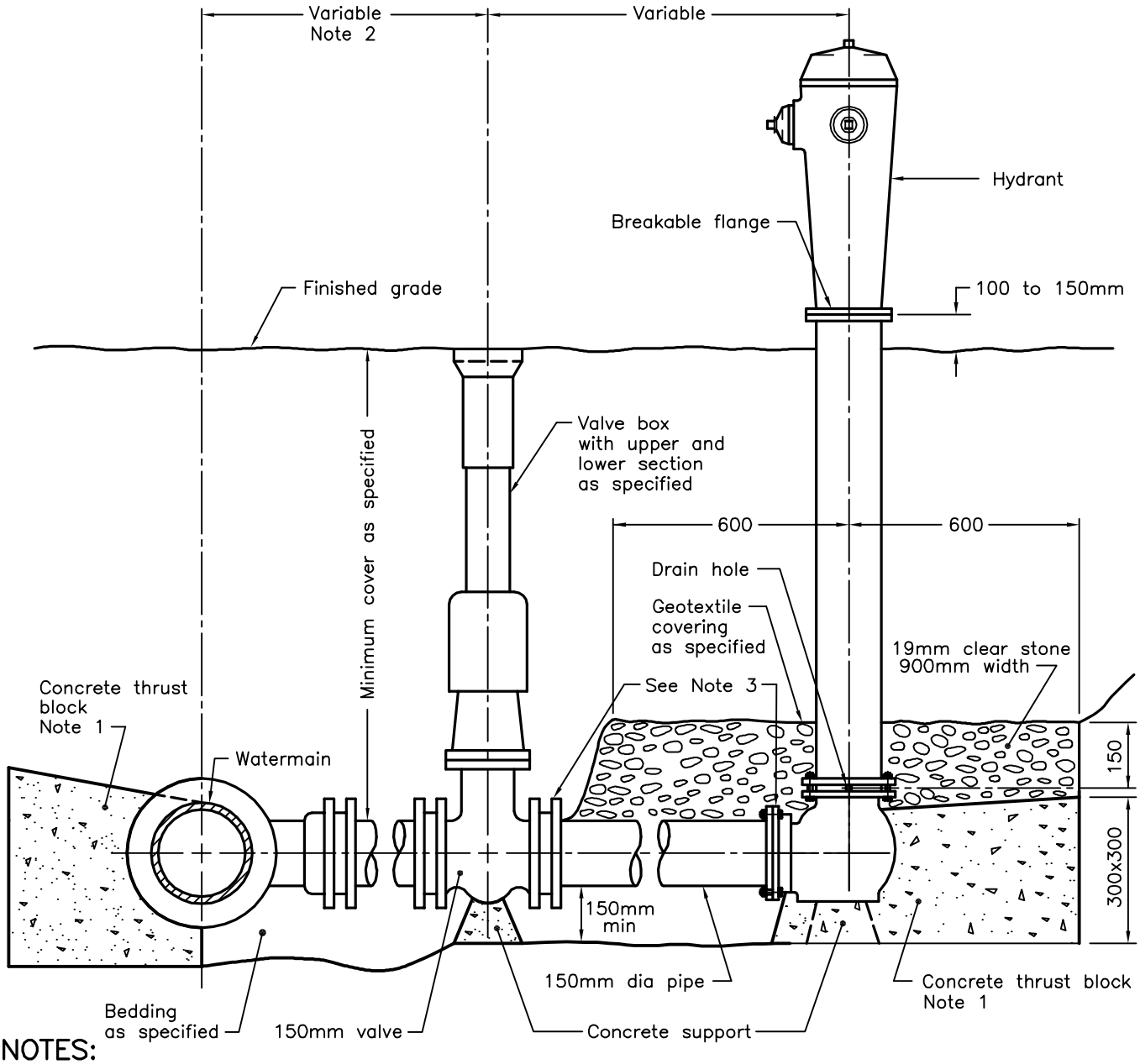
NOTES:

1 Concrete shall be placed to undisturbed ground and the outside face of the maintenance hole, but there shall be a minimum of 150mm of 15MPa concrete around the drop pipe.

2 Concrete shall be secured to the maintenance hole with 450mm long, 13mm diameter threaded rods and drilled expansion anchors down either side of the drop pipe at 300mm centres.

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2016	Rev	3
CAST–IN–PLACE MAINTENANCE HOLE DROP STRUCTURE TEE			
		OPSD 1003.010	



NOTES:

1 All concrete thrust blocks shall be poured against undisturbed ground.

2 When specified, for watermains 400mm and less, locate valve within 1.0m of centreline of watermain. Retaining and restraining devices shall be utilized. For watermains 600mm and over, bolt valve with flanged end directly to flanged tee.

3 When specified, retaining and restraining devices shall be utilized, in addition to thrust blocks.

A Bond breaker shall be used between the concrete and the fittings and appurtenances.

B Bolts and nuts for buried flange to flange connections shall be stainless steel.

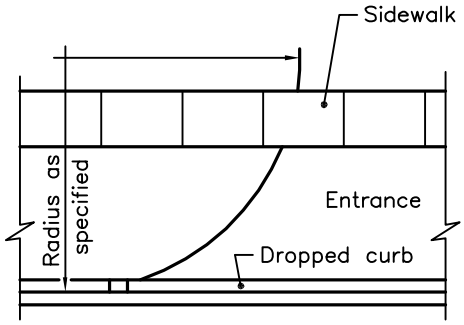
C When required, flange of standpipe extensions shall not be in frost zone.

D This OPSD shall be read in conjunction with OPSD 1103.010 and 1103.020.

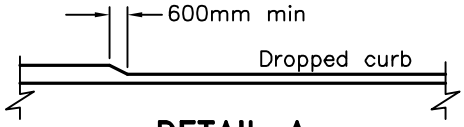
E Backfill material within 500mm of service box shall be native or imported, as specified.

F All dimensions are in millimetres unless otherwise shown.

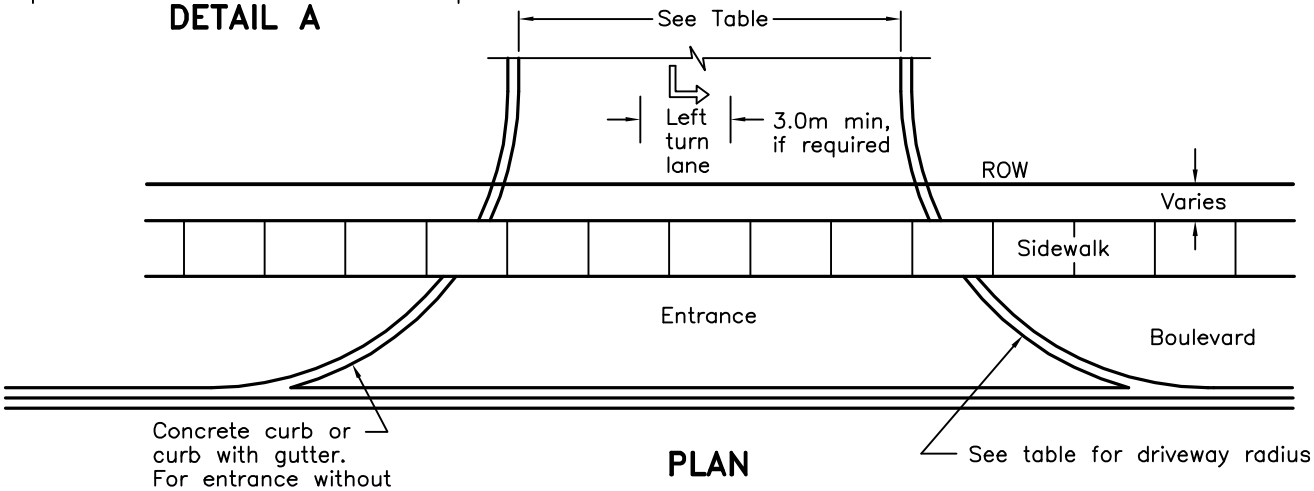
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev	2
HYDRANT INSTALLATION			
	OPSD 1105.010		



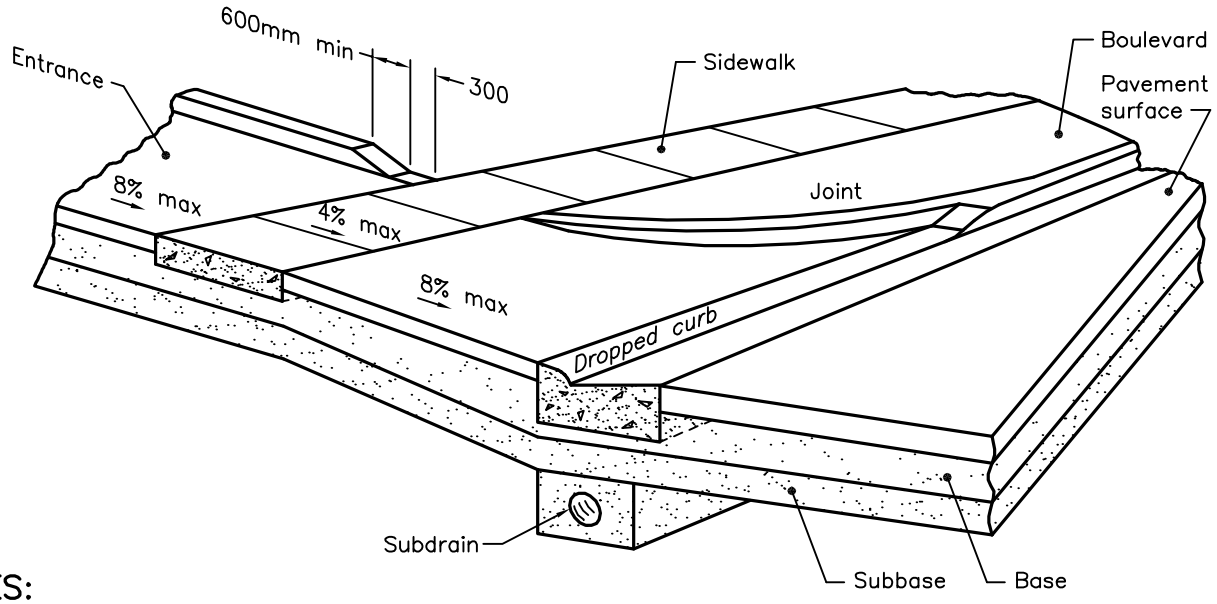
DRIVEWAY DIMENSIONS						
LAND USE	WIDTH m				RADIUS m	
	One–Way		Two–Way			
	min	max	min	max	min	max
Light Industrial, Commercial, and Apartment	4.5	7.5	7.2	12.0	4.5	12.0
Heavy Industrial	5.0	9.0	9.0	15.0	9.0	15.0



DETAIL A



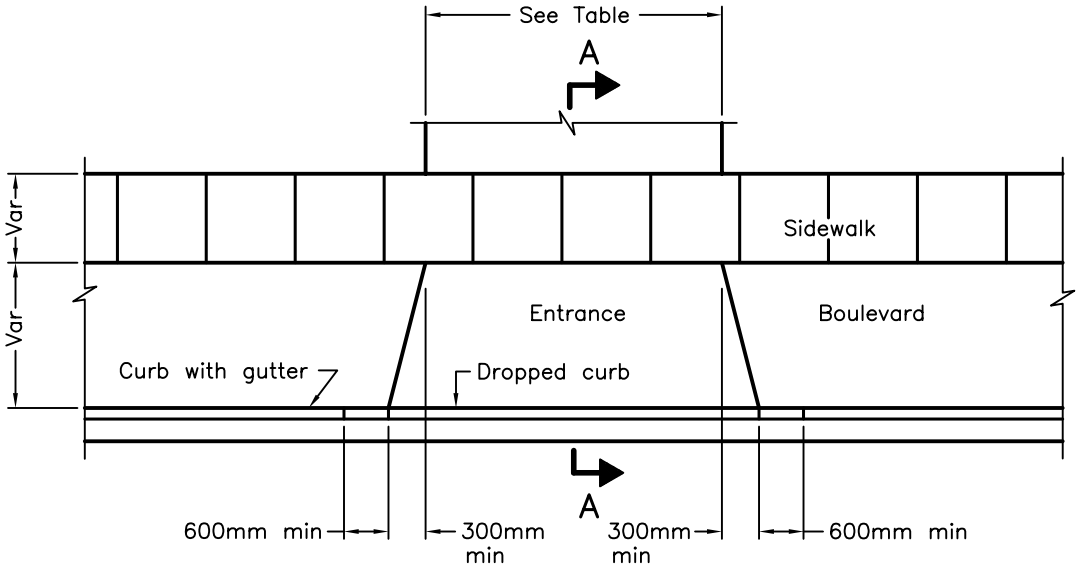
PLAN



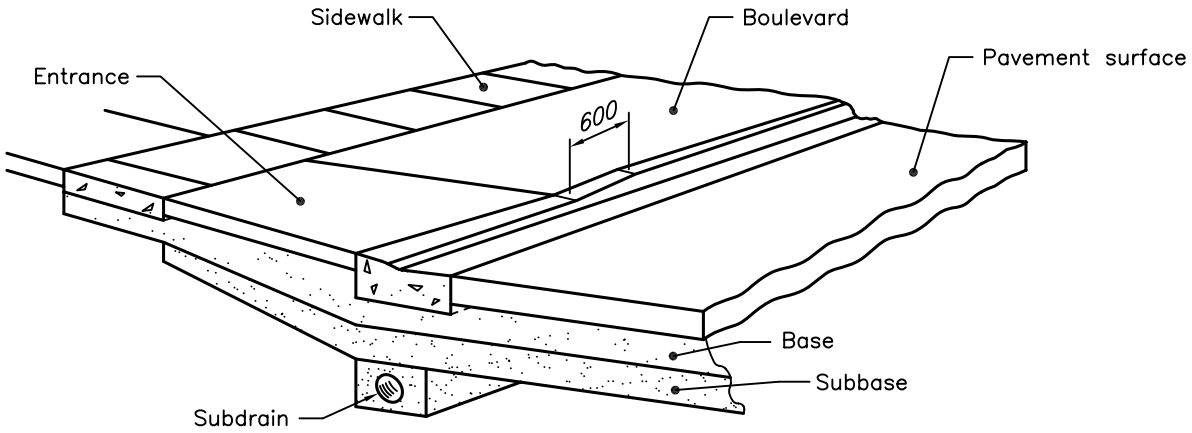
NOTES:

A All dimensions are in millimetres unless otherwise shown.

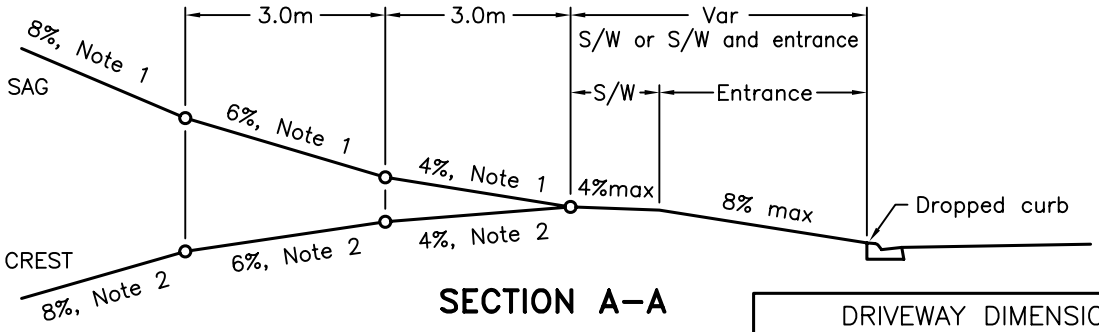
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2009	Rev	1
URBAN INDUSTRIAL, COMMERCIAL, AND APARTMENT ENTRANCES			
	OPSD 350.010		



PLAN



ISOMETRIC VIEW



SECTION A–A

DRIVEWAY DIMENSIONS				
LAND USE	WIDTH m			
	Single		Double	
	min	max	min	max
Residential	3.0	4.3	6.0	7.3

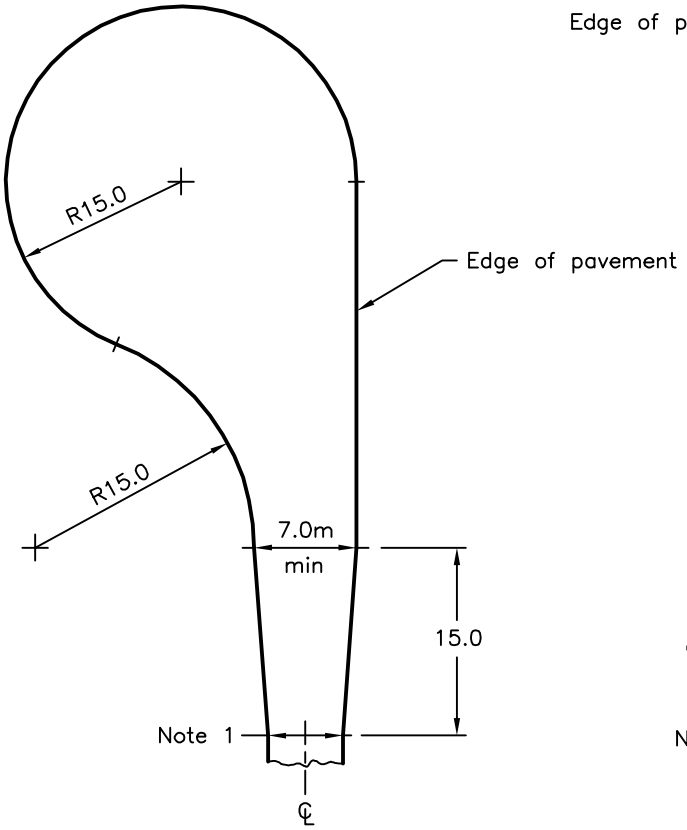
NOTES:

1 Maximum upgrade shall be 10%.

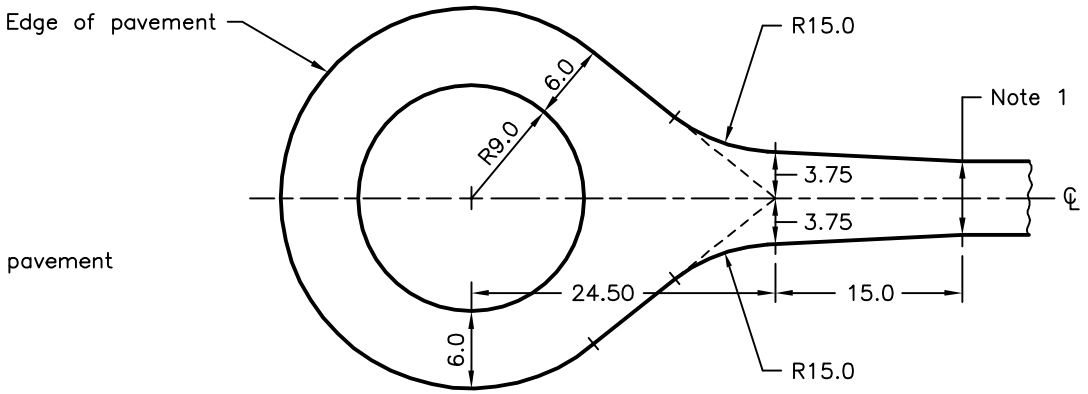
2 Maximum downgrade shall be 8%.

A All dimensions are in millimetres unless otherwise shown.

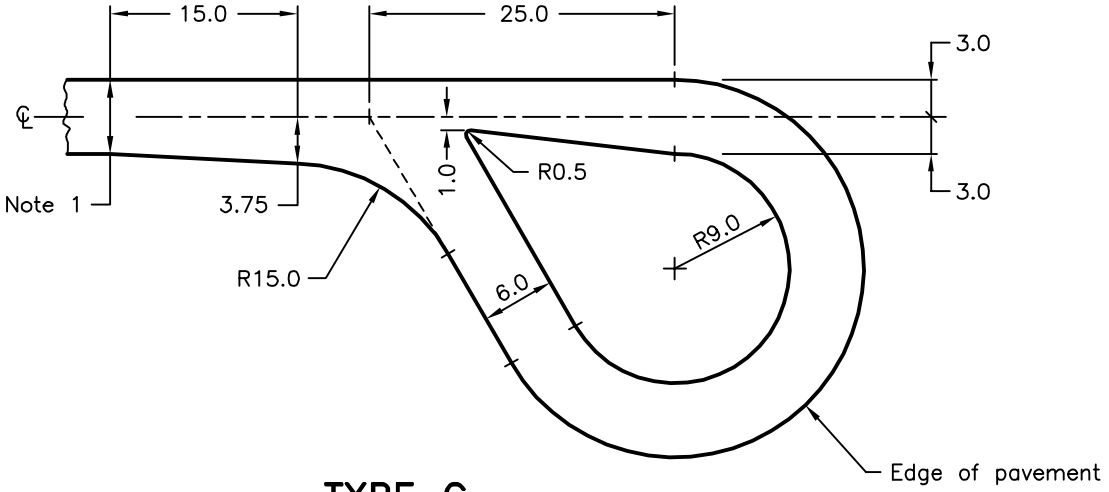
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2009	Rev	1
URBAN RESIDENTIAL ENTRANCE			
	OPSD 351.010		



TYPE A



TYPE B



TYPE C

NOTES:

1 Width of pavement, shoulder, and rounding to match terminated roadway.

A Drainage and grading as specified.

B All dimensions are in metres unless otherwise shown.

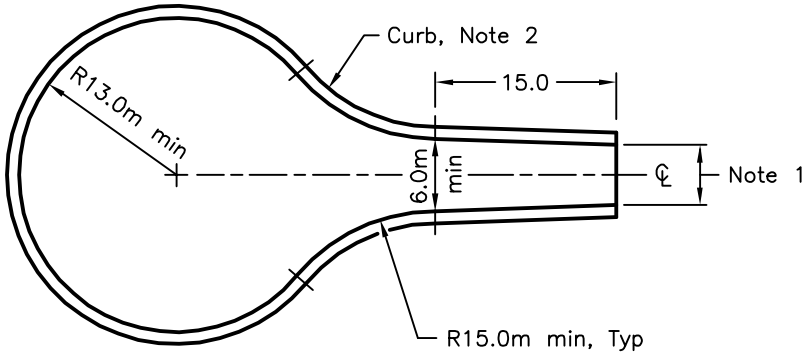
ONTARIO PROVINCIAL STANDARD DRAWING

TURNING BASINS FOR TERMINATED RURAL ROADWAYS

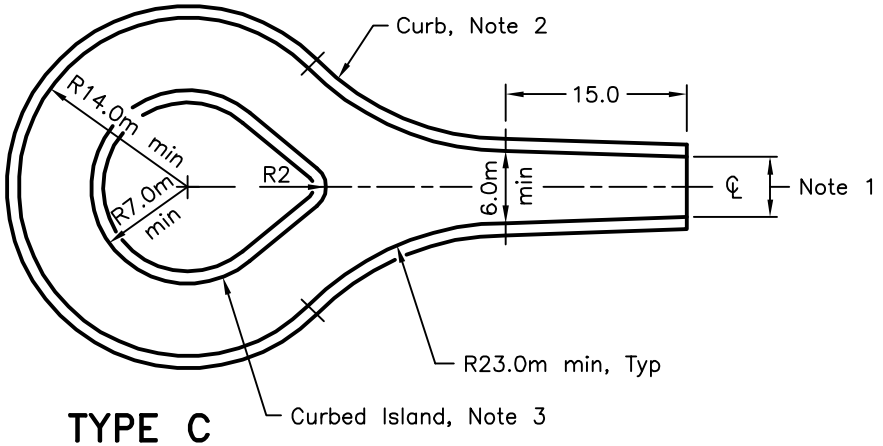
Nov 2009 | Rev 0

ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · O P S

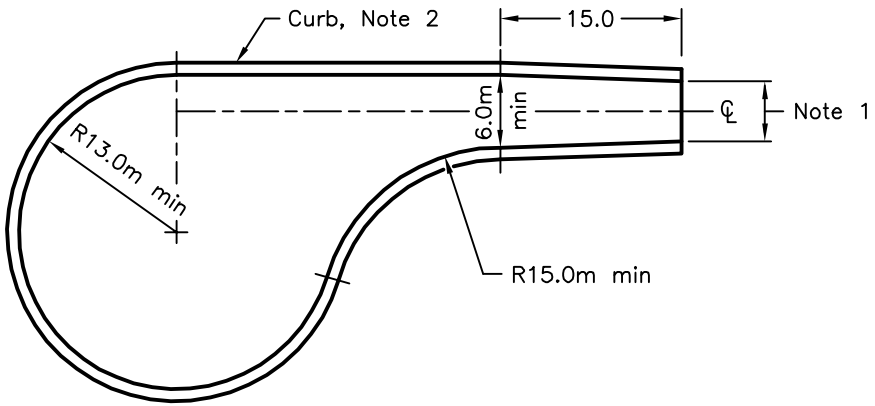
OPSD 500.010



TYPE A



TYPE C



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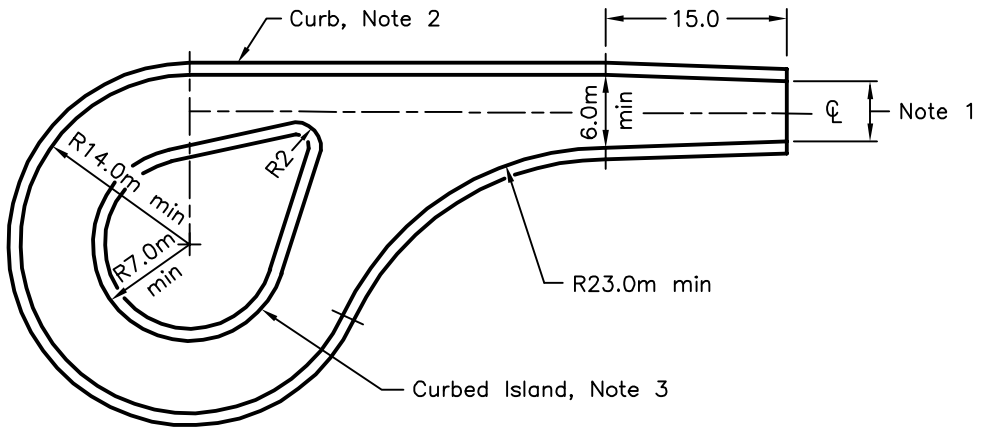


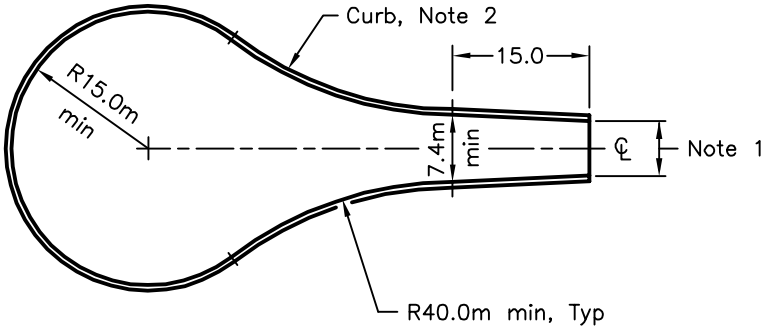
TYPE D

NOTES:

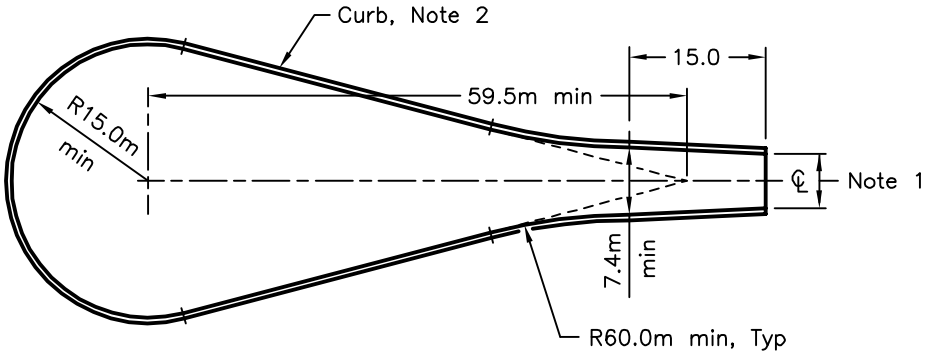
1 Width of pavement to match terminated roadway.
2 Type of curb to match terminated roadway.
3 Island curb shall be according to OPSD 600.090.

A Drainage and grading as specified.
B All dimensions are in metres unless otherwise shown.

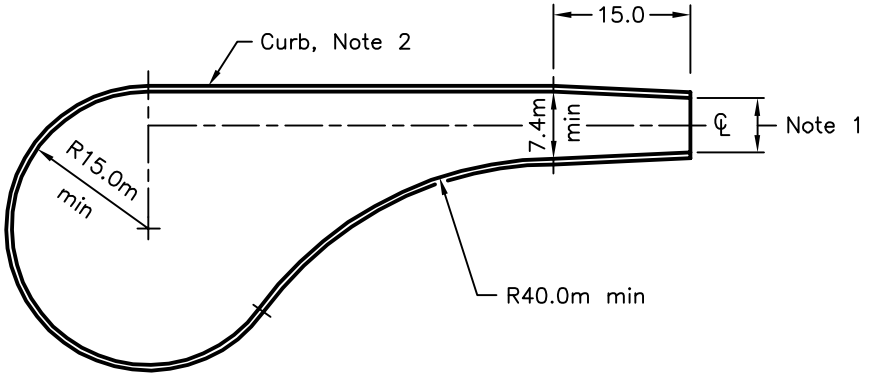
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2009	Rev	0
TURNING BASINS FOR TERMINATED URBAN ROADWAYS RESIDENTIAL			
	OPSD 500.020		



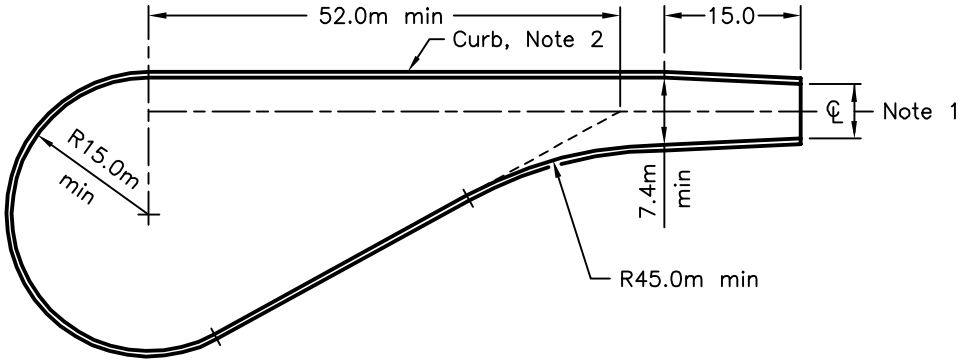
TYPE A



TYPE C



TYPE B



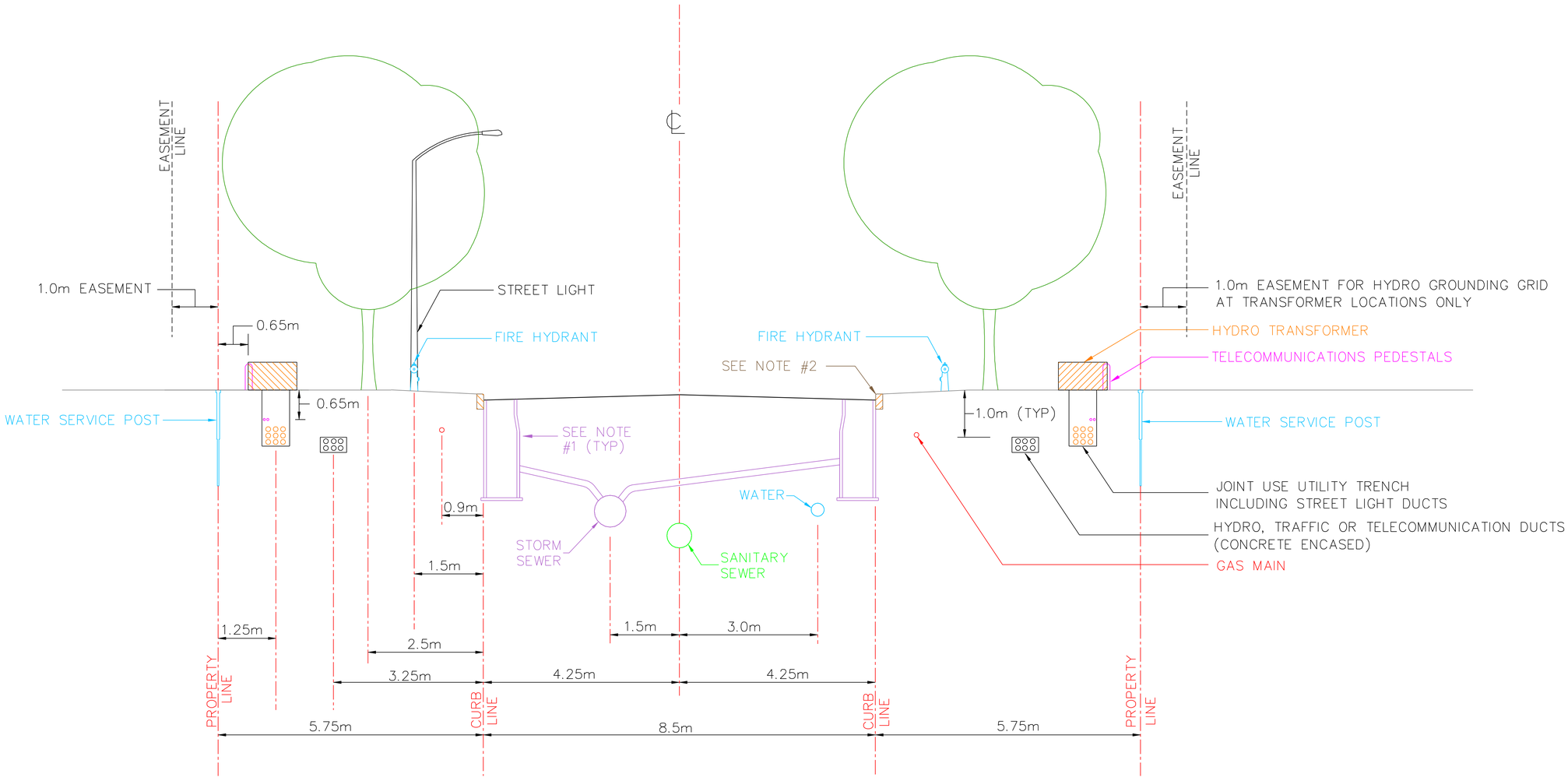
TYPE D

NOTES:

1 Width of pavement to match terminated roadway.
2 Type of curb to match terminated roadway.

A Drainage and grading as specified.
B All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2009	Rev	0
TURNING BASINS FOR TERMINATED URBAN ROADWAYS INDUSTRIAL AND COMMERCIAL			
	OPSD 500.030		



NOTES:

1. REFERENCE STANDARD NOTES ROAD ALLOWANCE (DGN:ROW-NOTES)
2. CONCRETE CURBS MAY BE BARRIER TYPE OR MOUNTABLE TYPE, CATCH BASIN TYPE WILL SUIT CURB DESIGN.
3. AT CATCH BASIN AND HYDRANT LOCATIONS THE GAS MAIN SHALL HAVE 0.6m CLEARANCE FROM STRUCTURES.
4. PRIMARY HYDRO DUCTS & COMMUNICATION DUCTS (ENCASED) TYPICALLY REQUIRED ON ONE SIDE OF ROW ONLY. PROVIDE 1.0m COVER ON ALL CONCRETE ENCASED DUCTS.
5. STREET LIGHTS CAN BE LOCATED ON EITHER SIDE OF ROW.

Ottawa

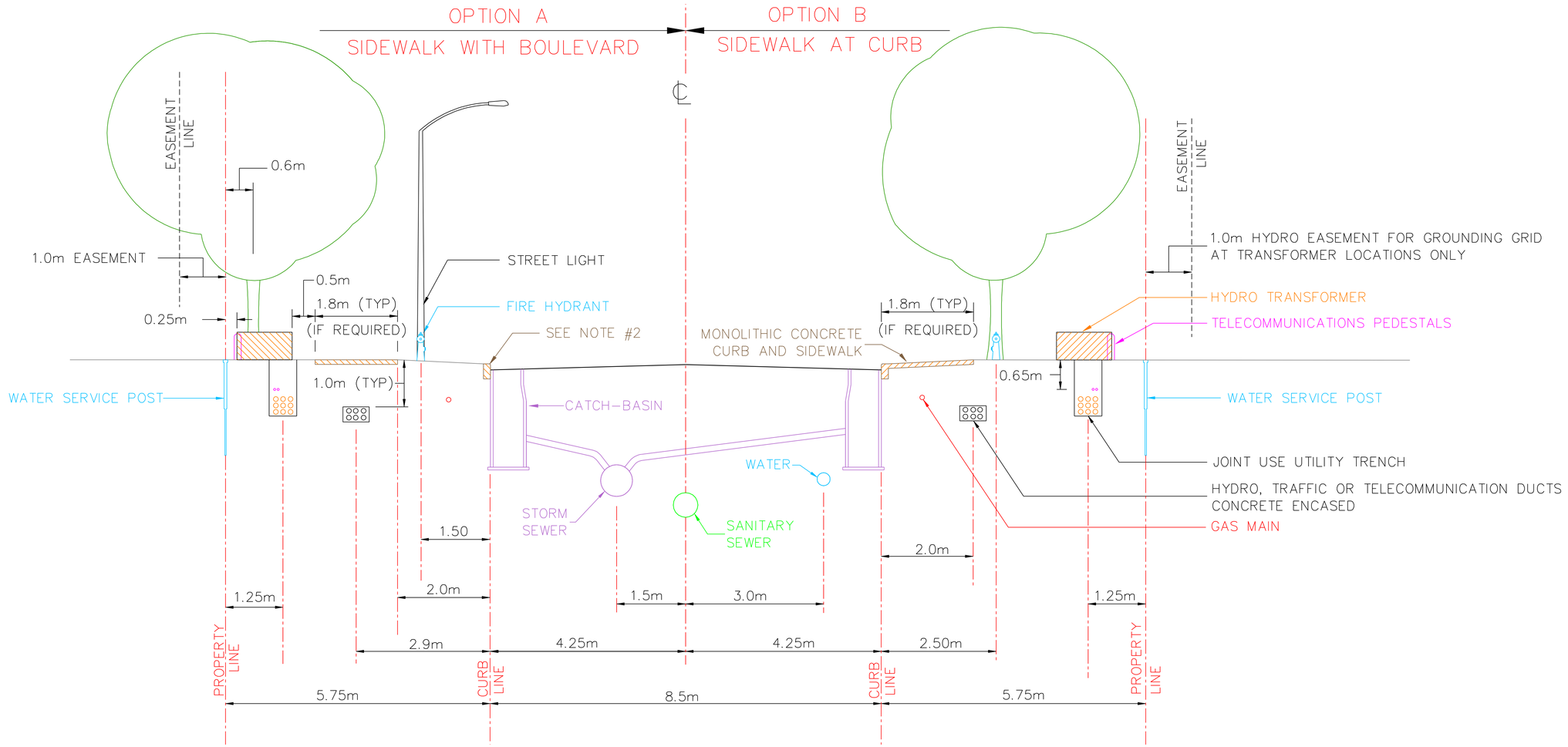
RESIDENTIAL ROAD

20.0m ROAD ALLOWANCE

W. R. Newell, P Eng.
Director, Infrastructure Services Branch

Scale: 1:100	Revision: 5
Date: March 20, 2007	
Dwg/Dgn: ROW-20	Sheet: 7 of 13

ROW-20-xs.dgn 2007-Mar-21 07:58:13 AM



NOTES:

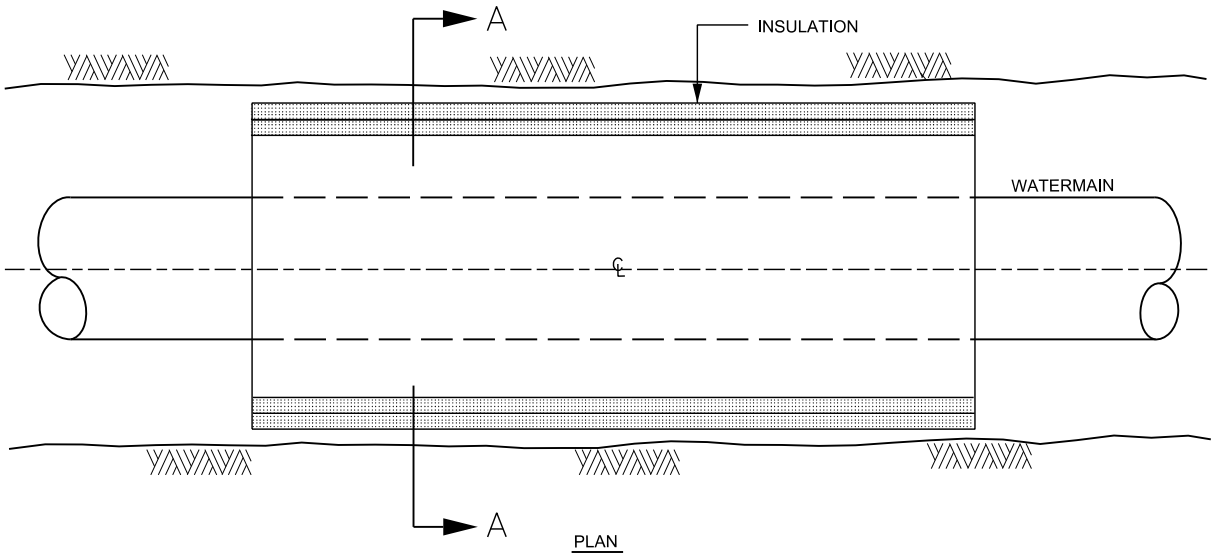
1. REFERENCE STANDARD NOTES ROAD ALLOWANCE (DGN:ROW-NOTES).
2. CONCRETE CURBS MAY BE BARRIER TYPE OR MOUNTABLE TYPE, CATCH BASIN TYPE WILL SUIT CURB DESIGN.
3. AT CATCH BASIN AND HYDRANT LOCATIONS THE GAS MAIN SHALL HAVE 0.6m CLEARANCE FROM STRUCTURES.
4. HYDRO TRANSFORMERS AND SIDEWALKS ARE TO BE LOCATED ON OPPOSITE SIDE OF THE ROW WHENEVER POSSIBLE.
5. PRIMARY HYDRO DUCTS & COMMUNICATION DUCTS (ENCASED) TYPICALLY REQUIRED ON ONE SIDE OF ROW ONLY. PROVIDE 1.0m COVER ON ALL CONCRETE ENCASED DUCTS.
6. STREET LIGHTS AND SIDEWALKS ARE TO BE LOCATED ON OPPOSITE SIDES OF THE ROW FOR THE OPTION WITH SIDEWALK AT CURB.

Ottawa

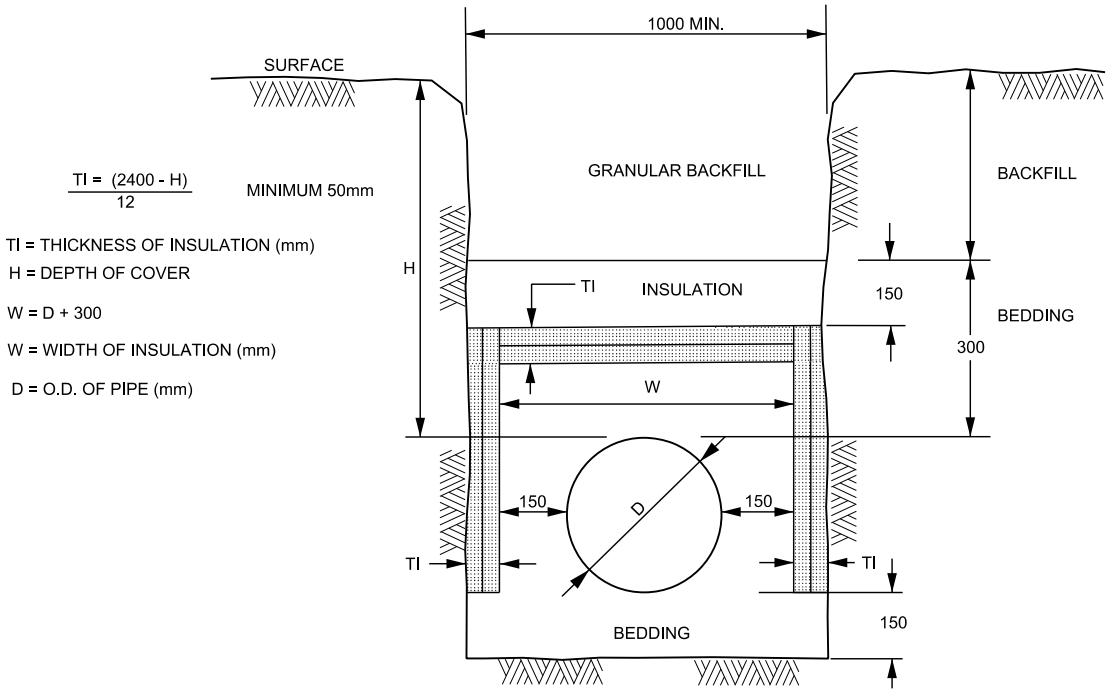
RESIDENTIAL ROAD 20.0m ROAD ALLOWANCE SIDEWALK OPTIONS

W. R. Newell, P Eng.
Director, Infrastructure Services Branch

Scale: 1:100	Revision: 5
Date: March 20, 2007	
Dwg/Dgn: ROW-20A	Sheet: 8 of 13



PLAN



SECTION A - A

NOTES

FOR 150 - 400mm (NOMINAL DIAMETER) WATERMAINS, WHERE THE DEPTH OF COVER IS LESS THAN 2400mm

1. INCREMENTS OF THICKNESS SHALL BE ADJUSTABLE TO 25mm.
2. IN PROXIMITY OF MAINTENANCE HOLES, CULVERTS, CATCHBASINS, ETC., INSULATION SHALL BE PLACED PER DETAIL W23
3. DEPTH OF COVER LESS THAN 1200mm REQUIRES SPECIAL DESIGN
4. STAGGER JOINTS OF MULTIPLE SHEETS.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.

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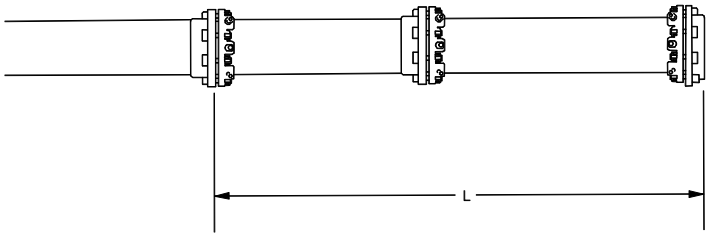
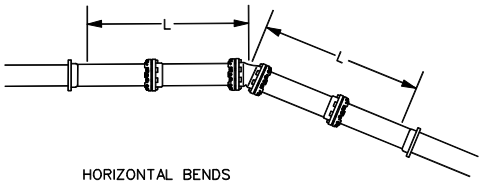
THERMAL INSULATION FOR WATERMAINS IN SHALLOW TRENCHES

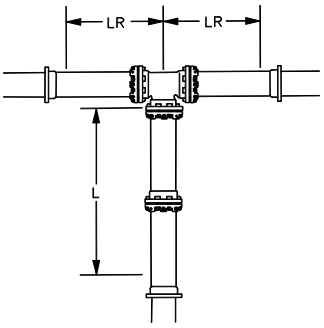
DATE:	MAY 2001
REV. DATE:	MARCH 2013
DWG. No.:	W22



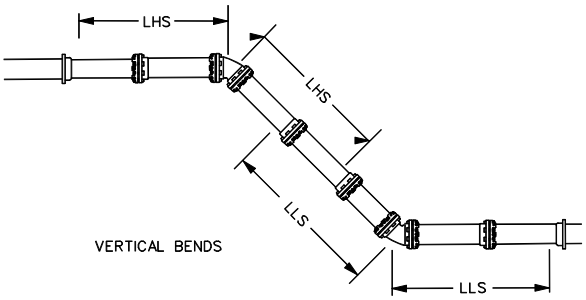
DEAD ENDS, CAPS PLUGS AND ISOLATION VALVES



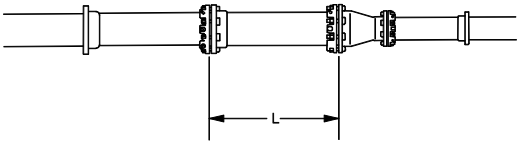
HORIZONTAL BENDS



TEES



VERTICAL BENDS



REDUCERS

NOTES:

1. ANY JOINT THAT FALLS WITHIN THE RECOMMENDED LENGTH (L) SHALL BE RESTRAINED. SEE DRAWING W25.6
2. TO REDUCE THE NUMBER OF RESTRAINERS REQUIRED THE USE OF FULL PIPE LENGTHS IS RECOMMENDED IN THESE AREAS.

Ottawa	RESTRAINING AND RETAINING RINGS FOR PVC AND DI PIPE 400mm AND UNDER	DATE: MAY 2001 REV. DATE: NONE DWG. No.: W25.5

TABLE OF RESTRAINED LENGTHS FOR DI AND PVC WATERMAIN PIPE IN STANDARD GRANULAR 'A' EMBEDMENT IN SOILS OF BEARING CAPACITY OF 100 KPa AND OVER

REDUCERS	LARGER DIAMETER SIDE (TO BE RESTRAINED)					
SMALLER DIAMETER (UNRESTRAINED)	100mm	150mm	200mm	250mm	300mm	400mm
100mm	N/A	3	6	8	10	14
150mm	N/A	N/A	4	6	9	13
200mm	N/A	N/A	N/A	3	6	11
250mm	N/A	N/A	N/A	N/A	4	9
300mm	N/A	N/A	N/A	N/A	N/A	7
400mm	N/A	N/A	N/A	N/A	N/A	N/A

	PIPE DIAMETER					
	100mm	150mm	200mm	250mm	300mm	400mm
DEAD ENDS, CAPS, PLUGS, VALVES						
BEFORE CAPS AND EITHER SIDE OF VALVES - L	5	6	9	10	12	16
VERTICAL BENDS						
LENGTH HIGH SIDE - LHS	3	4	5	6	7	9
LENGTH LOW SIDE - LLS	1.5	2	2.5	3	3.5	4.5
TEES						
LENGTH ALONG THE BRANCH - L	1	1	1	1	1	1
LENGTH ALONG THE RUN - Lr	3	3	3	3	3	3
HORIZONTAL BENDS						
11.25, 22.5, AND 45 DEGREE BENDS	1	1.5	1.5	2	2	2.5

NOTES:

1. THE ABOVE RESTRAINED LENGTHS MEET OR EXCEED THE WATERMAIN DESIGN CRITERIA FOR FUTURE ALTERATIONS AUTHORIZED UNDER A DRINKING WATER WORKS PERMIT.
2. THE ASSUMPTIONS MADE FOR THE ABOVE CALCULATIONS ARE AS FOLLOWS:
   a) MAXIMUM OPERATING PRESSURE OF 100 psi.
   b) MAXIMUM SURGE PRESSURE WITH A FLOW VELOCITY CHANGE OF 0.6 m/s OF 115 psi (115 psi FOR CLASS 52 DI AND FOR PVC MAX. SURGE IS 35 psi)
3. FOR SOFTWARE CALCULATIONS A TEST PRESSURE OF 150 psi AND A SAFETY FACTOR OF 1.5 WAS USED WHICH RESULTS IN 225 psi MAXIMUM PRESSURE.
4. TYPE 5 TRENCH BEDDING.
5. DEPTH TO BURY 2.4 METRES EXCEPT FOR VERTICAL BENDS WHERE THE HIGH SIDE IS AT 1.8 METRES.
6. EMBEDMENT MATERIAL GRANULAR 'A' WITH CHARACTERISTICS OF ASTM D2487 GP.
7. GP SOILS ARE DESCRIBED AS POORLY GRADED GRAVEL AND SAND-GRAVEL MIXES WITH LITTLE OR NO FINES.
8. (Lr) MUST BE OF SOLID PIPE WITHOUT JOINTS, FITTINGS, ETC.
9. THE TABLES APPLY TO BOTH DUCTILE IRON AND PVC. WHERE ONE LENGTH EXCEEDED THE OTHER THE LONGER LENGTH WAS USED.
10. RESTRAINED LENGTHS ARE IN METRES.

Ottawa

TABLES OF RESTRAINED LENGTHS FOR PVC AND DI PIPE 400mm AND UNDER

DATE:	MAY 2001
REV. DATE:	MARCH 2011
DWG. No.:	W25.6

Appendix B HYPERLINKS

Ontario Provincial Standard Drawings:
http://www.raqsa.mto.gov.on.ca/techpubs/OPS.nsf/OPSHomepage

Ontario Provincial Standard Specifications:
http://www.raqsa.mto.gov.on.ca/techpubs/OPS.nsf/OPSHomepage

Ontario Traffic Manual:
http://www.mto.gov.on.ca/english/publications/mto-research- library-online-catalogue.shtml

The Town's Official Plan:
https://www.hawkesbury.ca/images/hotel_de_ville/reglements/by-laws-en/pdf/offical_plan_eng.pdf

The Counties Official Plan:
http://www.en.prescott-russell.on.ca/services/planning_and_forestry/official_plan

Strategic Plan Hawkesbury/Horizon 2030:
https://www.hawkesbury.ca/en/town-hall/publications/vision-2030-strategic-plan

Community Improvement Plan:
https://www.hawkesbury.ca/en/town-hall/urban-planning/community-improvement-plan

Zoning By-Law:
https://www.hawkesbury.ca/images/hotel_de_ville/urbanisme/zoning_bylaw_no_20_2018.pdf

Zoning By-law Map:
https://www.hawkesbury.ca/images/hotel_de_ville/urbanisme/zoning_bylaw_map.pdf

Transport Canada's Navigation Protection Program: https://www.tc.gc.ca/eng/programs-621.html under Marine Transportation Programs, Navigation Protection Program.

Department of Fisheries and Oceans (DFO) - Fisheries Act: http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html under "on the water" projects near water –authorizations.

Raisin-South Nation Source Protection Plan:
https://www.gisapplication.lrc.gov.on.ca/SourceWaterProtection/Index.html?viewer=SourceWaterProtection.SWPViewer&locale=en-US

Transportation Association of Canada: Geometric Design Guide for Canadian Roads
http://www.tac-atc.ca/sites/tac-atc.ca/files/site/2011-gdg-revisions.pdf

Ministry of Transportation – Chapter 4 Drainage Management Manual

https://www.library.mto.gov.on.ca/SydneyPLUS/Sydney/Portal/default.aspx?lang=en-US

Annual Reports prepared under the Municipal Drinking Water License:
https://www.hawkesbury.ca/en/town-hall/public-works/drinking-water