DESIGN AND

CONSTRUCTION STANDARDS

2020

Municipality of Dutton Dunwich

Spriet Associates
ENGINEERS & ARCHITECTS

Our Job No. 220087

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The Municipality of Dutton Dunwich is the go-to location if you are looking for a place to open a business, visit or explore historical sites, work on genealogical projects, cycle, hike, bird watch, star gaze, examine heritage trees, find rare prairie grasses, locate farm gate markets, view beautiful horses in meadows, explore Carolinian forests, and enjoy nature at its finest.

The Municipality is located in the western part of Elgin County, on the northern shores of Lake Erie.

The Municipality is the authority for all municipally owned roadways, storm sewers, sanitary sewers, and watermains that are to be installed within all road allowances and registered easements.

It is the Municipality's objective to work collaboratively with developers on site plans and subdivisions towards the end goal of creating great private and public infrastructure and neighborhoods.

Complete Streets	Complete Streets are transportation facilities that are designed for all ages, abilities, and modes of travel. On Complete Streets safe and comfortable access for pedestrians, bicycles, transit users and the mobility-impaired is not an afterthought but an integral planning feature.
H.O.V.	High Occupancy Vehicles.
IESNA RP-8-14	Illumination Engineering Society of North America Recommended Practice for Roadway Lighting (most recent version).
Illuminance	The intensity of light falling on a surface, measured in lux.
Low Maintenance	Means pruning of vegetation for safety, management of non-frangible vegetation, noxious weed control, rubbish removal, fungal and insect attack.
Lumens	Measure of total amount of light emitted by a light source, known as luminous flux.
Luminaire	The lighting luminaire itself.
Luminance	The light that the eye sees, measured in Candelas per square meter (cd/m^2).
Mounting Height	Height of luminaire above the ground level.
Municipal Engineer	Consulting Engineer retained by the Municipality of Dutton Dunwich.
Owner	Means the registered owner of a property and includes a lessee of, a mortgagee in possession of, or a party acting as an authorized agent in lawful control of a property.
PDC	Means a private drain connection.
Pole Height	Height of a light pole above ground level.
Private Hydrant	Means a hydrant connected to a watermain and installed on private property. (Fire Department has full rights of connection.)

Private Watermain	Means a pipe connected to a watermain and installed on private property and from which more than one service and/or hydrant lateral are connected.
ROW	Right-of-way: the width of a road from property line to property line.
Service	Means every water pipe installed from a connection on a watermain, or private watermain, to the meter location or, for a fire service, to the inside of the exterior wall of a structure.
Service Extension	Means the portion of a service from the property line to the meter location, or for a fire service to the inside of the exterior wall of a structure (i.e. an extension of a service stub).
Service Stub	Means the portion of a service from a watermain to the property line which will always include one control valve.
Street Line	Limit of the right-of-way; property line.
Structure	Means a building of any kind, including but not restricted to: apartments, condominiums, single-family homes, town housing, row housing, industrial, commercial, and institutional.
Subdivider	Means the Developer, Owner, or party specifically named in a Subdivision Agreement.
Substantial Completion	When the works within the ROW of a new subdivision development has been completed, which triggers the start of the assumption process.
TAC	Transportation Association of Canada.
Tactile	Describes an object that can be perceived using the sense of touch.
Veiling Illuminance	The veiling, adverse effect, or glare produced by bright sources in the visual field that results in decreased visual performance.
Water Distribution System	Means watermain with connection to feeder mains, feeder mains within subdivision lands, private watermains, services, fire hydrants, and shut-off valves and all other appurtenances thereto.

These Standards provide for the standardization of the design and construction of subdivisions, roads, sanitary sewers, storm sewers, watermains, and lot grading in the Municipality of Dutton Dunwich. These standards shall be used in the design and construction of the above-mentioned services. Deviations from these standards will be acceptable only under unusual circumstances and shall be approved in writing by the Municipality's Engineer. Notwithstanding any provision of the Design and Construction Standards for the Municipality of Dutton Dunwich, these design and Construction Standards may not apply to capital works undertaken by the Municipality on existing municipal infrastructure not designed or constructed to the standards with the same.

These standards shall apply to all design and construction projects as they relate to land use planning approvals and the proposed development shall comply with the applicable Official Plan policies, Zoning By-law regulations, plans of subdivision, consent approvals, and site plan as required for the development. These design and construction submissions may fulfill conditions of approval related to these planning approvals.

This document will be periodically updated to include revisions where required. All submissions will be required to conform to the latest revision.

For developments prepared subject to these guidelines, the Developer shall retain a Professional Engineer, licensed in the Province of Ontario, for design and preparation of Contract Drawings, Specifications and Reports.

3.1 APPROVAL PROCESS

When a Developer commences a project, they shall proceed by requesting a pre-application consultation with the Municipal Planner as per By-law 2020-31. The Planner will assist in determining what information and materials will be required in order to deem the application complete. At this meeting the following shall be discussed:

- Nature of development
- Location
- Size
- Availability of services

- Official Plan, Zoning By-law, subdivision, site plan, consent, or other land use planning approvals
- Requirements for this development, i.e. scope of reports, plans, etc.
- Any other relevant information

Following the meeting, the Developer shall submit preliminary plans and design criteria for submission to the Municipality to ensure sufficient servicing capacity exists, where applicable. This preliminary information shall identify the following:

- Any preliminary investigations completed such as soils report, preliminary servicing report and requirements
- Proposed entrances/exits and connection to existing streets
- Any relevant or required reports, soils, hydrogeological, drainage, traffic studies, environmental assessments, etc.

After the preliminary information has been reviewed and accepted, the Municipality shall provide a written response setting out deficiencies in the submission or provide written acceptance and direction to proceed with final design and formal submission. Once the preliminary information has been reviewed and accepted by the Municipality, the Developer may proceed with final design.

Formal submission of the development shall include, but not be limited to, the following:

- Plans, specifications, and reports
- Cover page with key plan locating project within the Municipality
- Overall area and servicing plans
- Storm drainage plan including developed area and any lands tributary to development area
- Storm water management facilities or low impact development best management practices
- Sanitary drainage plan showing all areas to be developed as well as any exterior areas tributary to the development where applicable
- Lot grading plans indicating grading for each lot as well as an overall grading plan showing existing contours and drainage direction
- Plans and profiles (Scale 1:250 horizontal, 1:50 vertical) for each street to be constructed as well as any easements, servicing extensions, etc.
- Boulevard tree planting plan and landscape plan

- Legal survey, including deed
- Geotechnical report
- Traffic Impact Assessment Report
- Environmental Assessment Report
- Noise Report (if applicable)
- Functional Servicing Report
- Archaeological Study
- Planning Justification Report
- Any other drawings applicable to the construction of the project shall be submitted such as road cross-sections, swale details, outlet details, erosion control and pumping station plans and details, etc. with sufficient detail to allow a Contractor to construct the works
- Any other reports necessary, as set out in the Dutton Dunwich Official Plan

The Municipality shall review the submission package and provide comments and markups to the Developer for revision. The Developer shall then re-submit a revised package to the Municipality for approval. This process shall continue until final approval from the Municipality is obtained. The developer shall enter into a development agreement with the Municipality and shall not commence construction until the agreement is executed and registered on title of the lands, ***and securities have been received by the Municipality. All applications are subject to Peer Review, when required, at the expense of the applicant.***

In addition to the Municipality's approval, the Developer shall obtain approval from, but not be limited to, the following agencies where applicable:

- Ministry of Environment, Conservation and Parks (M.E.C.P.)
- County of Elgin
- Ministry of Natural Resources and Forestry
- Ministry of Municipal Affairs
- Lower Thames Regional Conservation Authority
- Department of Fisheries and Oceans
- Ministry of Tourism, Culture and Health
- Elgin St. Thomas Public Health
- Ministry of Transportation

- Adjacent municipalities where appropriate

The developer shall provide copies of all reports as well as approvals from the agencies to the Municipality.

Prior to construction:

- Copies of all Land Use Approvals
- Copies of all approvals shall be submitted to Municipality including the Ministry of Environment, Conservation and Parks
- Plan of Subdivision (or lots) shall be registered
- Development Agreement shall be executed
- Security deposits shall be submitted to the Municipality
- A signed and executed copy of the Contract Documents between the Contractor and Developer shall be submitted to the Municipality

During the construction process the Developer shall:

- Have the Consulting Engineer provide full-time resident inspection during construction of the works
- Submit "as-built" drawings of the constructed works in digital and hard copy format
- Provide details of material testing, compaction tests, video inspection, pressure and chlorination testing, etc.

Following construction, the Developer's Consulting Engineer shall provide the Municipality with written certification that the constructed work has been completed in conformance with the approved Contract Drawing.

3.2 SITE ALTERATION PERMIT

As per Municipal By-law, property owners must file for a site alteration permit with Municipal staff in the Public Works Department when one of the following works take place:

- Removal of topsoil
- Alteration of the grade of land
- Temporary or permanent placing, dumping, or removal of any fill originating on the site or elsewhere

- The temporary or permanent placement, construction, or alteration of structures on or under the land which will affect established drainage patterns
- The changing of surface cover affecting drainage or erosion risk, including paving or removal of plants, vegetation, or trees

All contract drawings are to be on the Municipality's Standard drawing size (609mm x 914mm). The Municipality's Standard title block is to be used and placed in the lower right-hand corner of the sheet. All drawings are to be signed and sealed by a Professional Engineer at the location provided in the title block. All drawings shall be submitted in an electronic format, AutoCAD 2014, and a pdf version. Base drawings are to be located in UTM17 North, NAD83 with no XRefs.

4.1 Drawing Standards

All drawings must meet the following standards:

a) Existing conditions are to be drawn with a lighter pen than the proposed construction

b) North shall be shown on all drawings to the top or to the right

c) All elevations shall be to Geodetic Survey of Canada Datum

d) The zero chainage shall start at the projection of an intersecting street's center line. Chainages shall be indicated at 25 meters stations. Where possible, the profile must be a vertical projection of the plan. Calculated chainages of the beginning and ending of horizontal or vertical curves must be noted on the plan and profile

e) A legend shall be used to indicate services as shown in MSD-14

f) All revisions to original drawings must be recorded in a revision block and dated

4.2 Drawings to be Submitted

The following drawings are to be submitted when applicable (3 complete sets):

a) Cover Sheet, which shall indicate the following:
   i) A list of drawings included in the Contract Set
   ii) A Key Plan showing the location of the proposed development (scale 1:10,000)
   iii) The project title
   iv) The name and address of the Owner and the Consulting Engineer

b) Master Plan - Services to be Constructed

A drawing showing all services to be constructed using a scale of 1:1000.

c) Lot Grading Plans

The lot grading plan shall meet the following requirements:

i) Indicate north by an arrow on the plan

ii) Basic Plan:

- scale 1:250
- showing all existing and proposed lot numbers
- show all street names
- show all lot frontages and depths
- show all sidewalks to be constructed by the subdivider
- indicate all lots that are semi-detached (SD) or back split (BS)
- show all existing elevations, infrastructure, and features as shown in the field

iii) Elevations that are to be shown on the Grading Plan include:

- all elevations are to be Geodetic
- final ground elevations at lot corners and house corners
- final center line of road elevation every 25 meters
- existing ground elevations are to be shown by means of spot elevations and contours

These contours shall extend a minimum of 25 meters beyond the limit of the plan;

- for single lot applications, the difference between the building sill elevation and the Center road elevation shall be shown. The rear lot difference to sill elevation shall also be shown.

iv) Drainage Information

- show the location and direction of flows of swales by means of arrows. At least one arrow is to be shown at the rear of each lot
- show all proposed rear lot catch basins, leads and easements
- show the location and direction of swales by means of waved arrows
- show the location and direction of overland flow routes by means of bold arrows

See Drawing MSD-14 for typical arrows.

d) General Plan - Sanitary Sewer System

A drawing showing the Sanitary Sewerage System and Areas to a scale of 1:1000, including Sanitary Design Sheet.

e) General Plan - Storm Drainage System

A general plan to a scale of 1:1000 showing the Storm Drainage System and Drainage Areas, including Storm Design Sheet.

f) General Plan - Water Distribution System

A drawing showing the existing and proposed water distribution system to a scale of 1:1000.

g) General Plan - Street Lighting

A general plan to a scale of 1:1000 showing the proposed street lighting layout.

h) Plan and Profile

A plan and profile drawing (Scale 1:250 horizontal, 1:50 vertical) for each street in the subdivision and all rear yard catch basins. These drawings shall include all pertinent information as deemed necessary by the Municipality's Engineer. The location and brief description of soil investigations shall be shown on the plan and profile drawings. (Boreholes)

i) Typical Road Cross-Section

j) Detailed Drawings

The detailed drawings shall include all details necessary for the proper construction of the works. It will be the Developer’s responsibility to ensure that the Contractor is provided with the miscellaneous details included in these Servicing Standards and other various details for the completion of the project.

4.3 "As-Constructed" Drawings

On completion of the project, the drawings must be revised to show the services as they were actually constructed. The completed works shall be provided in a digital and hard copy format and must be of a quality acceptable to the Municipality's Engineer.

Prior to assumption the applicant is required to provide a complete project package to the Municipality. This package includes the following:

- Digital "As Constructed Drawing Set" in an Adobe format (.pdf file), complete with all required signatures
- Digital "As Constructed Drawing Set" in AutoCAD format (.dwg file, which may include LDD or Civil 3D)
- All Paper Space Title Blocks and Plot Style Tables
- All existing survey points are to be contained in the drawing
- All proposed TIN's, grading models, and/or contour lines are to be contained in the drawing
- All line work must be in Model Space at 1:1 scale and unrotated in a World Coordinate System (WCS)
- Drawing units are to be in metric
- Purge all old or extra drawing layers
- Bind all XRef files (no external attachments upon submission)
- Georeferenced plans are preferred, but not mandatory for submission
- All digital "Project" support files which do not reside in AutoCAD such as stormwater calculations, technical reports, etc.
- The digital formats may be from industry standard software including Microsoft Office, Adobe, Synchro Traffic, etc.

The following details shall be shown on the Contract Drawings and shall be amended to indicate the "as-constructed" locations of all services:

- Street names
- Registered plan numbers, lot numbers, and/or Municipal number, lot lines, street lines, frontages, and easements

- Ties to property bars for all water services (0.30m accuracy)
- Chainage of private drain connections measured from the nearest downstream manhole (0.30m accuracy)
- Location and elevation shown on the profile of all services encountered while undertaking the work (0.30m location accuracy, 0.02m elevation accuracy)
- Location on plan of all services (0.50m accuracy)
- Center line road profile (25m minimum intervals)
- Full details for all services i.e. sizes, grades, materials, elevations, etc.
- Digital ‘as-constructed’ drawing should be geo-referenced shape files and include all items such as water, sanitary sewer, storm sewer, and roadwork

All roads shall be designed and constructed in accordance with the current edition of the "Manual of Geometric Design Standards for Canadian Roads" as published by the Roads and Transportation Association of Canada (TAC).

5.1 Reference Standards and Guidelines

Road design shall be in accordance with the following standards and guidelines, as amended or expanded upon within the Municipality of Dutton Dunwich Development Manual:

Municipality of Dutton Dunwich Standard Contract Documents

- Supplemental Specifications - Roads

Transportation Association of Canada (TAC)

- Geometric Design Guide for Canadian Roads (TAC Standards)
- Manual of Uniform Traffic Control Devices for Canada (MUTCD)
- Guide for the Design of Roadway Lighting
- Pedestrian Crossing Control Manual
- Canadian Guide to Neighborhood Traffic Calming

Ministry of Transportation

- Geometric Design Standards for Ontario Highways, 1985 (latest revision)
- Ontario Traffic Manual (OTM) (latest edition)
- OTM Book 12 – Traffic Signal Design
- Ontario Provincial Standards (OPS) (latest edition)

Institute of Transportation Engineers (ITE)

- Trip Generation Manual
- Transportation and Land Development
- Traffic Access and Impact Studies for Site Development - Recommended Practice

5.2 Street Classification

Street Classification for residential roadways (rural or urban) shall be based on the traffic volume and number of houses with access onto the street as follows:

Street Auto-Oriented Classification	No. of Houses	Estimated Daily* Traffic Volume
Minor-Local	up to 25	0 - 250
Local	up to 100	0 - 1000
Collector	100 - up	1000 - 3000
Arterial	--	3000 - up

*Traffic volumes are based on trips per household as follows:

Single Family	8-10 per day
Multi-Family	7-9 per day
Apartment	6-8 per day

5.3 Road Allowance, Pavement Widths, Location, and Layout

a) The minimum width of road allowances and pavement width is shown below:

Street Classification	Minimum Road Allowance	Minimum Pavement Width
Local & Minor-Local	20.10 m	7.5 m
Collector	26.10 m	9.2 m
Arterial	30.48 m	9.2 m
Industrial	26.10 m	9.7 m

b) Intersections of more than two streets shall not be permitted.

c) Streets shall intersect at right angles with each other.

d) Jogged intersections will not be permitted.

e) Street intersections shall not be closer than 60 meters apart.

f) MSD-1A, MSD-2 and MSD-3 show the standard utility locations for residential and industrial roads.

g) The maximum length of a cul-de-sac to the turning circle shall be 215 meters without a secondary or emergency access. MSD-4 and MSD-5 show typical residential cul-de-sacs and industrial cul-de-sacs, respectively.

h) Local street patterns should be planned to minimize through traffic and also minimize dead ends.

i) The street system should clearly indicate the characteristic nature and function of the road.

5.4 Grades

a) The maximum and minimum vertical road grades are 8% and 0.5% respectively, for new developing subdivisions.

b) Vertical curves are required if the algebraic difference in grades is greater than 1%. The minimum length of the vertical curve shall not be less than 45 m.

c) Road grades at intersections shall not exceed 2% across the intersection.

d) All roadways shall be crowned on a 2% slope.

e) Boulevards are to be sloped from the property line to the edge of the roadway at 2% to 6% (10% maximum on approval).

f) Road shoulders shall be sloped from the edge of roadway at a 6% slope.

5.5 Design and Construction

a) Cross-Sections

Typical cross-sections of residential subdivision streets shall conform to the details shown on MSD-6 and MSD-7. Typical cross-sections of industrial subdivision streets shall conform to the details shown on MSD-8.

b) Pavement and Granular Base

i) The gradation requirements, placing and compaction of granular materials are to conform to the current O.P.S. Specifications, O.P.S.S. 314. Hot-mix, hot-laid asphalt shall conform to the current O.P.S. Specifications, O.P.S.S. 310.

ii) An engineered design for residential, industrial, commercial, and arterial roads based on geotechnical data must be submitted to the Municipality for review.

iii) For residential roads the following minimum compacted depths of granular and asphaltic pavement courses shall be provided:

40mm HL3 Asphaltic Concrete
50mm HL8 Asphaltic Concrete
150mm Granular 'A' Base
300mm Granular 'B' Sub-base

and shall be designed in accordance with the recommendations of a Geotechnical Engineer.

iv) Compaction

Compaction for earth fill and native backfill material forming the road subgrade shall be 100% Standard Proctor Density.

Compaction for granular materials in base course construction shall be 100% Standard Proctor Density.

Compaction for all asphalt materials shall be 97% Marshall Density.

v) Road Cuts

The edges of all paved and concrete surfaces to remain must be properly saw cut prior to removal.

c) Subdrains

Two 150mm dia. pipe sub-drains with a minimum 3-meter length shall be installed opposite to each other (parallel to the curb and gutter), for all catch basins installed.

Pipe sub-drain shall be perforated corrugated polyethylene tubing with knit filter sock conforming to the requirements of OPSS 1840/1860 or perforated CSP (OPSS 1801) and installed in accordance with OPSD-216.03. Bedding and backfill material shall be coarse sand or approved granular material conforming to the requirements of OPSS 405. All sub-drains to have an approved geotextile around them together with an approved end cap.

d) Engineered Fill

Following the removal of the topsoil and any fill material, the subgrade should be thoroughly proof-rolled and inspected by a geotechnical engineer. Any loose or soft zones noted in the inspection should be sub-excavated and replaced with approved inorganic fill.

Grades can then be restored with compacted fill material. Any required fill material should be inspected and approved by a geotechnical engineer and should be placed in accordance with the soil engineering recommendations.

e) Curb and Gutter

i) Typical concrete barrier curb with standard gutter will be as per OPSD 600.040.

ii) Typical concrete semi-mountable curb with standard gutter will be as per OPSD 600.060.

iii) Typical concrete curb will be as per OPSS 353 - Construction Specifications for Concrete Curb and Gutter Systems. All local and minor local streets will have concrete semi-mountable curb with standard gutter and all other streets will have concrete barrier curb with standard gutter unless otherwise approved by the Municipality.

iv) Concrete shall be 30 MPa at 28 days with 7% ± 1.5% entrained air.

v) Contraction joints shall be provided every 3.0 m.

vi) Expansion joints shall be provided at both sides of catch basins at the beginning and end of circular curves, at any abutting sidewalk, setbacks, gutter inlets, or any structure.

f) Radii of Curvature

The radii of curvature of the curbs and gutters at the intersections shall be as follows:

i) General

Arterial streets to:	Arterial streets	12.0m R
	Collector streets	12.0m R
	Local streets	12.0m R

Collector streets to:	Arterial streets	10.5m R
	Collector streets	9.0m R
	Local streets	9.0m R

Local streets to:	Arterial streets	7.5m R
	Collector streets	7.5m R
	Local streets	7.5m R

ii) Truck Routes

Collector streets to:	Collector streets	15.0m R

Note: a 3.0m daylighting triangle is required at the intersections itemized in ii) above.

Arterial streets to:	Arterial streets	15.0m R
	Collector streets	15.0m R
	Local streets	15.0m R

Note: a 6.0m daylighting triangle is required at the intersections itemized above.

iii) Cul-de-sac

The minimum required radii of curvature of curb and gutters for a residential and industrial cul-de-sac are as per MSD-4 and MSD-5.

g) Sidewalks

i) Typical sidewalks shall be as per OPSD 310.010, 310.020, and 310.030. See MSD-1A, MSD-2, MSD-6, and MSD-7.

ii) Typical concrete sidewalk will be as per OPSS 351 Construction Specification for Concrete Sidewalk.

iii) Sidewalks shall be provided as follows:

- Sidewalks are required on one side for local roads.
- Sidewalks are required on both sides for collector and arterial roads.
- Sidewalks may be required on:
  a) one side of a minor - local road
  b) both sides of a local street if the street forms a walkway to a park, shopping area or schools
- Sidewalks may be required on one or both sides of cul-de-sacs. This will be reviewed on a case-by-case basis.
- Sidewalks and fencing are required on all walkways as per MSD-9.

iv) Sidewalks shall be minimum of 1.5 meters wide and shall be located as shown in MSD-6 and MSD-7 and shall be increased to 1.8 meters where sidewalk is adjacent to curb.

v) Sidewalks and curbs shall be ramped at street intersections to permit easy passage of wheelchairs, etc. Ramps shall conform to OPSD 310.030.

vi) Concrete shall be 30 MPa at 28 days with 7% ± 1.5% entrained air and not less than 355 Kg/m3 of cement. Maximum slump shall be 70mm.

vii) Sidewalks are to be a minimum thickness of 100mm.

viii) Concrete sidewalks in walkways shall be 125mm thick.

ix) Driveways to industrial, commercial, or multi-family properties shall be 150mm thick.

x) All sidewalks to be constructed on a 100mm minimum thick Granular 'A' bed.

xi) Expansion joints shall be provided every 6.0 meters. Where the sidewalk abuts a rigid object, construction joints shall be provided every 1.5 meters.

xii) Sidewalks shall have a 2% minimum and normal slope towards the road. Gradient in excess of 4% is subject to approval by the Municipality.

xiii) Sidewalks shall have tactile pad plates at all intersections, elevation changes (steps). Pads shall confirm to OPSD 310.033 & 310.039. Pad shall cover the entire width of the sidewalk.

h) Driveways

Driveways shall be as per MSD-10.

5.6 Signing and Markings

a) General

All new subdivision roadways or subdivision boundary roadways may require regulatory or warning signs or pavement markings and will require street name signs at various locations. All plans for signing shall be submitted for approval to the Municipality's Road Superintendent.

b) Design

i) All regulatory signs shall be supplied and installed in accordance with the current edition (March 2001) of the Ontario Traffic Manual - Book 5.

ii) All warning signs shall be supplied and installed in accordance with the current edition (July 2001) of the Ontario Traffic Manual - Book 6.

iii) All pavement markings shall be supplied and placed in accordance with the current edition (March 2000) of the Ontario Traffic Manual - Book 11.

iv) Street name signs are to be placed at every intersection and are to have double name plates. These signs are to be placed off the street lines in a location that will make the sign easily visible, to be approved by the Municipality's Road Superintendent.

c) Materials

i) Regulatory and warning signs will be of the size and materials as outlined in the current editions of the Ontario Traffic Manual - Books 5 and 6.

ii) Pavement markings shall be applied using durable products such as thermoplastics, two-component cold-reacted materials or tapes as outlined in the current edition of the Ontario Traffic Manual - Book 11.

iii) In rural areas, road name signs shall be 14-gauge steel minimum with white enameled 100mm letters on a 200mm high plate on a blue background. In urban areas, street name signs shall be of 14-gauge steel minimum with white enameled 100mm letters on a 150mm high plate on a blue background. These plates are to be secured and mounted on 50mm diameter galvanized steel post, 3.5m long, driven 1.0m into the ground, or alternatively held in position by concrete placed at the bottom of the post.

d) Installation

All signing shall be installed in accordance with the requirements of the most current editions of the Ontario Traffic Manual and as approved by the Municipality's Road Department. All regulatory signs and warning signs shall be installed on 4x4 P.T. posts.

Storm sewers shall be designed in accordance with the design principles as outlined in the most current edition of the Ministry of the Environment, Conservation and Parks (MECP) Guidelines for the Design of Storm Sewers. Design computation sheets shall be submitted to the Municipality's Engineer for approval.

The basic design factors requiring evaluation are land use, design frequency, precipitation, and runoff coefficient. The storm sewers shall be designed for a lifespan of not less than 75 years and shall be designed to convey the 5-year minor storm event (unless otherwise required) to a sufficient outlet or to a storm water management facility which will control post-development peak flows to pre-development flows including the 2, 5, 25, 50 and 100-year storm events.

All storm sewers and/or stormwater management ponds shall outlet to one of the following:

- Watercourse to which the subject development has riparian rights
- Existing municipal drain in which the subject lands have paid benefit as defined under the Drainage Act, and the lands are assessed outlet into it

If the above situations do not exist, the developer of the subdivision will be required to obtain a legal outlet under Section 4 of the Drainage Act.

6.1 Design Storm

The design of storm sewers shall be completed using the data below. The intensities may be calculated using the following formula for the Intensity-Duration-Frequency relationship and corresponding constants:

$$i = \frac{a}{(t+b)^c}$$

	2 year	5 year	10 year	25 year	50 year	100 year
a	604.867	477.211	549.307	564.271	616.620	702.431
b	4.862	2.475	2.819	3.111	2.819	2.936
c	0.728	0.617	0.616	0.578	0.570	0.573

In addition, runoff from major storm events (i.e. 100-year and Regional Storms) shall be accommodated by an overland flow route that has been designed assuming that all of the source controls and storm water conveyance controls have failed.

a) Quantity of Storm Runoff

The Rational Formula is to be used to determine the quantity of storm water runoff. The use of other empirical runoff formulae must be approved by the Municipality's Engineer. The Rational Formula is:

$$Q = 2.78\ C\ i\ A$$

in which Q is the storm water runoff in liters per second (l/s),
C is the runoff coefficient,
i is the average rainfall intensity in mm per hour, and
A is the drainage area tributary to the point under design in hectares.

In order to determine the intensity of rainfall for use in the Rational Formula, the time of concentrations shall be calculated using an approved method such as:

- The Airport Formula
- The Bransby Williams Formula

In the absence of calculations, a Time of Concentration of 15 minutes shall be assumed.

The use of inlet times other than those indicated above, shall be subject to the approval of the Municipality's Engineer.

The following runoff coefficients are to be used with the Rational Formula:

Runoff Coeffiecients	
Sources	Coefficient
	(C)
Asphalt, concrete, roof areas	0.90-1.00
Grassed Areas, parkland	0.15-0.35
Commercial	0.75-0.85
Industrial	0.65-0.75
Residential:	
Single Family	0.40-0.45
Semi-detached	0.45-0.60
Row housing, Townhouses	0.50-0.70
Apartments	0.60-0.75
Institutional	0.40-0.75

In general, infiltration of ground water can be ignored in storm sewer design computations.

b) Location

Storm sewers shall be located in accordance with the Standard Utility Location Drawing MSD-1A, MSD-2, and MSD-3.

c) Minimum Pipe Size

The minimum size of the storm sewer shall be 300mm diameter. The sewer gradient shall be such that a minimum velocity of 0.9 m/s is attained with the maximum velocity being:

4.6 m/s for 300mm to 825mm diameter sewers

6.0 m/s for 900mm diameter and larger storm sewers

d) Cover

Minimum depth of cover on storm sewers shall be 1.5m.

e) Hydraulic Calculations

Hydraulics - Gravity Sewers

The Mannings Formula shall be used to design gravity storm sewers.

The Manning Equation is expressed as:

$$V = \frac{1}{n} \cdot r^{2/3} \cdot S^{1/2}$$

where V is the velocity in metres per second

r is the hydraulic radius in metres

S is the slope of conduit

n is the roughness coefficient

'n' values for pipes flowing full shall be as follows:

0.013 - polyvinyl chloride (PVC) pipe

0.013 - concrete pipe 100mm to 450mm dia.

0.013 - all pipe larger than 450mm dia.

f) Maintenance Hole Losses

Allowances for hydraulic losses in maintenance holes shall be as follows:

Straight through flow	- 0.025 m
22½° change in direction of flow	- 0.035m
45°+ change in direction of flow	- 0.050 m
90° change in direction of flow	- 0.075 m

Although the above invert drops will be adequate for sewers flowing at velocities at the low end of the acceptable range, the required drops should be calculated for high velocity sewers.

If the lateral inflow is a significant portion of the total flow through the manhole, then provision must be made for increased head loss. In such instances, a detailed hydraulic analysis of the head losses shall be submitted to the Municipality's Engineer.

6.2 Open Channels and Culverts

a) The use of open channels shall not be permitted in residential or urbanized areas, however, open channels may be permitted, if approved by the Municipality, in industrial or rural areas.

b) Design of open channels and culverts shall be completed using the chart in Section 6.1.

Alternatively, the intensities may be calculated using the following formula for the Intensity-Duration-Frequency relationship and corresponding constants.

$$i = \frac{a}{(t+b)^c}$$ See Section 6.1 for a, b, and c values.

The appropriate Design Storm shall be approved by the Municipality's Engineer.

c) Thorough soils investigations and interpretations shall be a prerequisite to the detailed design of the open channel.

d) The Manning Formula shall be used in the design of open channels:

i) For grass-lined channels, 'n' values shall be based on the product of the velocity (V) and the hydraulic radius (r):

V x r	n
<0.5	0.150
0.5 to 1.0	0.120
1.0 to 2.0	0.070
2.0 to 5.0	0.050
5.0 to 10.0	0.035
>10.0	0.030

ii) Side slopes for grass-lined channels shall not be steeper than 3H:IV.

iii) Flow velocities shall be in the following ranges:

- sand, sandy loam, or silty loam	-	0.75 m/s to 0.90 m/s
- gravel, or clay material	-	0.75 m/s to 1.50 m/s

e) Full details of open channel design including energy dissipation structures shall be submitted to the Municipality's Engineer.

f) To carry open channel drainage under driveways and across intersections, an appropriately sized culvert shall be used with the minimum size being 375mm in diameter. It may be necessary to increase the culvert size to accommodate higher flows from upstream tributary areas.

g) Culverts shall be 2.8mm thick minimum galvanized corrugated steel pipe or H.D.P.E. 320Kpa Bell and Spigot pipe. This material shall conform to the requirements of CSA Standard CAN 3- G401-M81 - Corrugated Steel Pipe Products.

6.3 Major Overland Flow Routes

Storm drainage shall be provided on a major system and minor system basis, with stormwater management controls, as required by the appropriate agencies, in accordance with the MECP's "Stormwater Management Practices, Planning and Design Manuals."

The maximum depth of ponding for major flow routes shall be 450mm deep. No ponding shall occur in the roadway for the minor storm events.

The major storm drainage system shall permit continuous overland flow along roads and easements without flooding onto lots during a 250-year storm. The route of the flood flows resulting from this storm through to a major watercourse shall be shown on a plan and any potential areas of flooding shall be identified.

6.4 Pipe Materials

Pipe material shall be concrete, polyvinyl chloride (PVC), or high-density polyethylene (HDPE).

Pipe sub-drains to be corrugated steel pipe or polyvinyl chloride (PVC) pipe.

a) Concrete Pipe shall conform to CSA and ASTM Standards manufactured in accordance with the following specifications:
   i) Non-Reinforced to CAN/CSA A257.1 (100mm - 600mm dia.)
   ii) Reinforced to CAN/CSA 257.2 (300mm and larger)

b) Polyvinyl Chloride (PVC) Pipe - smooth wall (100mm - 600mm inclusive) shall be certified to CSA B182.1 and CSA B182.2 and conform to ASTM D3034. Pipe sizes 200mm diameter and larger shall be SDR 35, and less than 200mm diameter shall be SDR 28 for private drain connections (PDC).

c) Ribbed Polyvinyl Chloride (PVC) Pipe (200mm - 600mm inclusive) shall be certified to CSA B182.4 and meet the requirements of ASTM F794.

d) High Density Polyethylene (HDPE) Pipe (200mm-600mm inclusive), for use on storm sewers only, with integral bell and spigot, shall be certified to CSA B182.6.

e) Pipe Joints
   i) Concrete Pipe
      All joints shall be rubber gasket conforming to CSA A257.3 and ASTM C443M-94.
   ii) PVC Pipe
      Sealing gaskets shall meet the requirements of CSA B182.2 and ASTM F477.
      All PVC fabricated and moulded fittings shall be CSA certified.
   iii) HDPE Pipe
      All HDPE fabricated pipe and moulded fittings shall be CSA certified.

6.5 Maintenance Holes

a) Maintenance Holes shall be located at the junctions of sewers and at changes in grade, alignment, or diameter. Maintenance Holes shall be precast concrete conforming to OPSD - 701.010 to 701.080.

b) Manhole frames and grates to be in accordance with OPSD 401.010 (Type A).

c) The precast concrete adjustment units used to extend maintenance holes and catch basins shall be in accordance with OPSD 704.010 and OPSS 408. A minimum of three courses of approved adjustment units are required on precast maintenance holes. The outside and interior faces of all concrete rings should be plastered and trowelled smooth with mortar 6mm thick, consisting of one-part masonry cement and 3-parts sand.

d) Maintenance hole steps shall be circular or rectangular aluminum and shall be in accordance with OPSD 405.010 or OPSD 405.020. Steps to be at 300mm centers vertically with 450mm maximum distance from top of maintenance hole to the first step.

e) Aluminum safety landings shall be provided in maintenance holes deeper than 5.0 meters from the top of maintenance hole cover to the lowest invert. Details shall be in accordance with OPSD 404.020.

f) All precast maintenance hole section joints shall contain an approved rubber gasket or approved equal. Joints, lifting holes and pipe connections are to be filled with a non-shrink mortar mix.

g) Drop structures are required at maintenance holes where the difference in invert elevations is greater than 900mm for storm sewers and shall be in accordance with OPSD 1003.010 or OPSD 1003.020. Internal drop structures are an acceptable alternative, when connecting to existing manholes and shall be according to OPSD 1003.030 and 1003.031.

h) Benching of manholes is to be performed in accordance with OPSD 701.021.

i) A flexible joint shall be provided on all pipes, within 0.3m of the outside wall of the maintenance hole. Concrete bedding 20 MPa to solid ground and extending to the first pipe joint may be used as an alternate approach.

j) All maintenance holes installed must be a “boot type” KOR-N-SEAL style, or an approved equal.

k) Maintenance hole spacing shall be as follows:

Pipe Size	Maximum Maintenance Hole Spacing
Up to 450mm	120 m
525mm to 750mm	150 m
over 750mm	180 m

l) Precast Maintenance hole tees may be used in storm sewers 1200mm in diameter and over. The precast riser sections shall be at least 1200mm in diameter. Maintenance hole tees shall be bedded on 28 MPa concrete. Full details shall be submitted to the Municipality's Engineer for approval.

6.6 Catch Basins

a) Catch basins shall conform to OPSD 705.010, 705.020, 705.030 and 705.040.

b) Catch basin leads shall not be less than 250mm in diameter and shall connect to the storm sewer as shown in OPSD 708.01 or OPSD 708.03.

c) Catch basin frames and grates shall conform to the details in OPSD 400.020 and must meet ASTM Designation A-48. Catch basin frames with curb inlet overflow, OPSD 400.090, shall be used for arterial roads and at all low points in the road. Ditch inlet catch basin grate shall conform to OPSD 403.010. Curb inlet catch basin to be in accordance with MSD-17.

d) Curb inlet catch basins shall be provided at all low points in the road with single inlet catch basins at intersections. Additional catch basins shall also be provided as follows:

Road Gradient (%)	Maximum Spacing
0.5 to 3.0	90 m
3.1 to 4.5	75 m
greater than 4.6	60 m

e) The precast concrete adjustments units used to extend maintenance hole and catch basins shall meet the OPSD 704.010 and OPSS 407. A minimum of three courses of approved adjustment units are required on precast maintenance holes. The outside and interior faces of all concrete rings shall be plastered and troweled smooth with mortar 6mm thick, consisting of 1-part masonry cement and 3-parts sand.

f) All joints, lifting holes, and pipe connections are to be filled with a non-shrink mortar mix.

6.7 Installation

a) Sewer pipe bedding shall conform to the Municipality's bedding standards for gravity and pressure pipe and shall be in accordance with MSD 11 and MSD 12.

b) Approved excavated material may be used for backfill under roads, sidewalks, and driveways where an independent soils investigation, carried out by a Geotechnical Engineer, indicates that this is practical. Compacting of the material shall be carried out in accordance with the recommendations of the Geotechnical Engineer.

If the excavated material is unsuitable, the trench shall be backfilled with Granular 'B' material conforming to OPSS 1010 and compacted to 95 percent Standard Proctor Density.

c) Sewer service connections for rigid main pipe sewer shall be in accordance with OPSD 1006.010 and for flexible main pipe sewer shall be in accordance with OPSD 1006.020.

A 50mm x 100mm timber marker stake shall be installed at the end of the private service connection from the invert to 300mm above finished ground. The stake shall be painted brown.

d) All installations shall be subject to the inspection, approval, and acceptance of the Municipality.

e) If any utilities or services are encountered during construction, they are to be supported in accordance with the requirements of the various utility companies as applicable.

f) Road surfaces shall be restored to its original condition where existing roads are disturbed, all to the satisfaction of the Municipality.

g) All new sewers shall be inspected by means of a closed-circuit television inspection in accordance with OPSS 409 and one copy of the video given to the Municipality for its records. This work shall be performed by an independent inspection company under the supervision of the Municipality and paid for by the Contractor.

h) Ring deflection testing shall be performed on all new pipe sewers constructed using plastic pipe in accordance with OPSS 410.07.15.05. Testing is to take place no sooner than 30 days after the completion of backfilling and installation of service connections and again just prior to the end of warranty.

6.8 Private Drain Connections

Refer to Section 10 – ‘Lot Servicing and Grading’.

Storm sewer systems shall include Stormwater Management Facilities and/or measures for both water quality and quantity in accordance with accepted practices as outlined in the most current edition of the publication entitled "Stormwater Management Planning and Design Manual" prepared for the Ontario Ministry of the Environment, Conservation and Parks (MECP). Stormwater storage requirements for quality control shall be in accordance with Table 3.1 of the above noted Manual with the "Level of Protection" being determined in consultation with the applicable Conservation Authority, the Department of Fisheries (DFO), and the Municipality's Engineer.

The design of individual Stormwater Management Facilities (SWM) shall apply a 3-hour Chicago Rainfall Distribution using the Atmospheric Environmental Services (AES) Intensity Chart, see chart in Section 6 – Storm Sewers, 6.1 Design Storm. All storms provided (i.e. 2, 5, 10, 25, 50, and 100 year) shall be evaluated for quantity and quality control purposes.

7.1 Quantity and Quality of Stormwater

a) Land Use

The Municipality's Official Plan shall be used to forecast the ultimate probable land use in any particular area. Consideration should be given to the effect of increased urbanization. Planning and development on a watershed or a sub-watershed basis is essential.

b) General

- Provide all SWM calculations to show the existing (pre-construction) stormwater flows and the proposed (post-construction) flows. These flows shall be calculated based on the latest MECP guidelines and the Municipality’s Development Manual
- Provide calculations for SWM facility sizing, orifice sizing, and any other relevant calculations completed for the design of the facility
- Identify the major overland flow routes and provide volume calculations for the routes at various cross sections to confirm that the major overland flow route will carry the major flow
- Identify the levels of stormwater in the storage facility for the various rainfall events

- All designs of SWM ponds must follow the most current edition of the MECP SWM Planning and Design Manual and must also reference the Best Management Practices
- Identify the proposed landscaping in the vicinity of the SWM facility
- Design storm sewer pipe system to 5-year storm return period for pipe flow condition
- Keep development maximum outlet flows to pre-development values for the 2 to 100-year return period
- Detain the first 13mm or 24mm, as applicable, of rainfall generated runoff from all new development for a period of 24 to 48 hours for quality control
- Use of shallow grassy lined swales for stormwater conveyance is recommended
- Utilizing inlets for temporary ponding and buried perforated pipe covered with porous material (granular or topsoil material) for infiltration may also be considered
- Typically, site plan developments require the installation of a stormwater quality control device (i.e. oil grit separator). The stormwater quality control devices will be approved on an individual basis. Most areas within the Municipality of Dutton Dunwich fall under the 'Type 2 Habitat' designation
- Include all design detail, sizing calculations, sediment removal rate, and floatable storage capacity for the unit, ensuring its design and installation will more than adequately suit the site plan development

In the absence of watershed/sub-watershed planning, the following principles must be considered in determining water quantity and quality criteria:

- Post Development flows must be kept to Pre-Development flows for 2-year through 100-year storm return period.
- Water Quality control is to be done to the requirements of the MECP Stormwater Management Manual and the classification of the downstream receiving body.
- Overland flows from storm events greater than a 5-year event must be addressed and conveyed to a sufficient outlet.

The use of computer software programs to determine and evaluate the SWM, runoff generated, etc. is acceptable provided the program is approved by the Municipality's Engineer. All design parameters and output are to be provided to the Municipality's Engineer by hard copy and digitally in a format acceptable to the Municipality's Engineer. In addition, a Certificate of Approval is required from the M.E.C.P. prior to construction being undertaken.

7.2 Stormwater Management Facility Landscaping

All landscaping of the SWM shall be supplied and installed by the developer, in accordance with the approved Landscaping Plan, during the first planting season after the registration of the development agreement.

Native and non-invasive trees, shrubs, ground covers, and aquatic plants are required in a low maintenance landscape design which has regard for the ecology of the site and the eco-region.

All lands conveyed to the Municipality are to be seeded. Seeding of exposed soil surfaces should be done as soon as possible after fine grading is completed.

All landscape treatments, as specified in the approved landscape design, shall be installed after the seed has established, but within 2 years of registration of the subdivision or development agreement.

All slopes greater than 4:1 from a horizontal distance of 3.0 meters from the bottom of the basin to the property line (not including walkways and trails) shall be planted.

Low maintenance vegetated buffers will be required around the pond perimeter. This buffer shall be comprised of tall grasses and wildflowers, followed by trees and densely planted shrubs. A densely vegetated margin on the aquatic safety bench would serve as an aesthetic amenity and an additional barrier. Where trees are to be planted, they must be planted at a minimum rate of 1 tree (50mm cal.) per 50 square meters.

All subdivisions shall be serviced with sanitary sewers connected to the municipal sanitary sewer system. Consideration will be given on an individual case by case basis for small residential developments where no municipal sanitary sewer system exists (less than 5 lots by severance). All plans of such works shall be approved by the Municipality's Engineer.

8.1 Design

a) Sanitary sewers shall be located in accordance with the Standard Utility Location Drawing MSD-1A, MSD-2 and MSD-3.

b) Sanitary sewers shall be designed in accordance with the design principles recommended in the most current edition of the Ministry of the Environment, Conservation and Parks (MECP) Guidelines for the Design of Sanitary Sewers. Design computation sheets are to be submitted to the Ministry for approval and shall be in accordance with the design criteria as outlined in Section 8.2 – 'Sanitary Sewage Flows'.

c) The minimum size of sanitary sewer shall be 200mm in diameter.

d) Sewer Gradients shall be such that the minimum velocity is 0.6 m/s and the maximum velocity is 3.0 m/s. At the upstream sections of a 200mm diameter sanitary sewer the slope shall be governed by the number of dwelling units connected:

1 to 5 units	S = 0.70%
6 to 8 units	S = 0.60%
9 to 12 units	S = 0.50%
13 or more units	S = 0.40%

The minimum slope for a 200mm diameter sanitary sewer shall be 0.40%, except at the top end where it shall be 0.60%.

The minimum slope for a 250mm diameter sanitary sewer shall be 0.28%.

e) The minimum depth of cover over the crown of the pipe in residential areas shall be:

Basement Drainage required 2.75 m

f) The Mannings formula shall be used to design gravity sanitary sewers, as shown in Section 6.1 (e) 'Hydraulic Calculations'.

g) Allowances for hydraulic losses in manholes shall be as shown in Section 6.1 (f) 'Maintenance Hole Losses'.

h) Hydraulics – Force Mains

i) The Hazen-Williams Formula shall be used to design force mains for peak sanitary sewage flows and is expressed as:

$$V = 0.849\ C\ r.63s.54$$

where V is the velocity in metres per second
C is the roughness coefficient = 120
r is the hydraulic radius in metres
s is the slope of the conduit

ii) Head losses in force mains shall be computed and submitted to the Municipality for approval. Allowances shall be included for hydraulic losses due to valves, bends, and other miscellaneous fittings.

8.2 Sanitary Sewage Flows

Sanitary sewage flows shall be based on the following:

a) Tributary population densities in accordance with the recommendations of the Official Plan and Zoning Bylaw.

b) Daily per capita sewage flows of 365 liters (excluding infiltration allowance) shall be used to compute sewage flows for residential.

c) Sewage flow allowances for industrial and commercial development shall not be less than 22,500 liters per gross hectare per day. Industry shall be required to provide the Municipality with their estimated average and peak daily flow rates.

d) i) Peak residential sewage flows shall be based on the “Harmon Formula”.

$$\text{Harmon formula } M = 1 + \frac{14}{4 + P^{1/2}}$$

where M = ratio of peak flow to average flow

P = tributary population in thousands

ii) Peak industrial/commercial sewage flows shall be "Harmon" x 0.8

iii) A maximum peaking factor of 4 will overrule where applicable.

e) Infiltration allowance for all types of development shall be as follows:
8640 litres per hectare per day or 0.100 litres per hectare per second

The infiltration allowance shall be approved by the Municipality's Engineer prior to design of the sanitary sewer system.

8.3 Pipe Materials

Pipe material shall be concrete or polyvinyl chloride (PVC).

a) Concrete Pipe shall conform to CSA and ASTM Standards manufactured in accordance with the following specifications:

i) Non-Reinforced to CAN/CSA A257.1 (100mm - 600mm dia.)

ii) Reinforced to CAN/CSA 257.2

b) Polyvinyl Chloride (PVC) Pipe - smooth wall (100mm - 600mm inclusive) shall be certified to CSA B182.1 and CSA B182.2 and conform to ASTM D3034. Pipe sizes 200mm diameter and larger shall be SDR 35, and less than 200mm diameter shall be SDR 28 for private drain connections (PDC).

c) Ribbed Polyvinyl Chloride (PVC) Pipe (200mm - 600mm inclusive) shall be certified to CSA B182.4 and meet the requirements of ASTM F794.

d) Pipe Joints

i) Concrete Pipe

All joints shall be rubber gasket conforming to CSA A257.3 and ASTM C443M-94.

ii) PVC Pipe

Sealing gaskets shall meet the requirements of CSA B182.2 and ASTM F477. All PVC fabricated and moulded fittings shall be CSA certified.

8.4 Maintenance Holes

a) Refer to Section 6.6 'Catch Basins' regarding maintenance hole specifications.

b) The maximum spacing between sanitary manholes is 120m.

c) Drop structures are required at sanitary maintenance holes where the difference in invert elevations is greater than 600mm. Refer to Section 6.6 'Catch Basins' regarding OPSD references.

8.5 Private Drain Connections

Refer to Section 10.1 'Lot Servicing'.

8.6 Installation

a) The installation of sanitary sewers shall be carried out in accordance with the requirements of Section 10.1 'Lot Servicing'.

b) The test pressure for force mains shall be 700 kPa and may be measured at any point on the force mains by applying an appropriate connection. The test pressure shall be maintained for at least one hour. The maximum permissible leakage shall not exceed 4.45 liters per mm diameter of pipe per kilometer length of pipe per day.

This section presents requirements for the design and construction of water distribution systems. All water distribution systems including watermains, services, private watermains and appurtenances shall be designed and installed to the following:

a) Municipality of Dutton Dunwich Standards
b) Reg. 435/93, 170/03 and any other regulations under the Safe Drinking Water Act and the Ontario Water Resources Act.

These specifications shall apply to all services and private watermains and to all watermains up to 450mm diameter including appurtenances. For watermains larger than 450mm diameter and for any other water system installation, special specifications must be prepared for and approved by the Municipality.

9.1 APPROVAL OF PLANS

9.1.1 WATERMAINS

a) Preliminary Approval

Approval of plans by the Municipality will be required prior to installation of watermains. All plans shall be prepared in metric. Submission for preliminary approval shall consist of:

i) One (1) digital copy of the proposed layout plan. Preferred scale is 1:1000. The layout plan shall show the location of the proposed watermains and the existing watermains to be connected, dimensioned to street lines, the location of valves and hydrants and the size and type of pipe.

ii) One (1) digital copy of the detail plan and profile drawings. Preferred scale is 1:250 horizontal and 1:50 vertical.

The detail drawings for new subdivisions shall show in plan the proposed watermain, sewers, other existing and proposed utilities, and all surface detail within the street allowance. In profile they shall show the existing and proposed ground surface, proposed watermain and details of other existing and proposed utilities where they pass over or under the watermains.

Both plan and profile shall show all details of watermain installation including valves, hydrants, fittings, offsets, deflection angles, joint thrust restraints, concrete thrust blocks and other pertinent details. Watermain profiles shall be shown as straight-line grades with centerline of pipe elevation shown at each grade change and percent grade of each section shown. Hydrants to have flange elevation shown. Detail drawings for watermains or watermain extensions on existing streets shall show, in addition to the above requirements, all other existing utilities in plan and profile relative to proposed watermains.

iii) One (1) digital copy of the design data and calculations for the watermain or watermain system. This information shall include domestic and fire design flows used, location of fire demand flows and resulting head loss in each section of watermain.

iv) In addition to submission of copies of drawings, a digital version of the drawings on USB in AutoCAD release 14 (or latest version) must be submitted.

A computer analysis shall be carried out on the proposed system, the results of which should be noted on a general plan of the system together with an indication of the conditions imposed in the program.

b) Final Approval

A final digital submission shall then be made consisting of the layout plan and detailed drawings, revised as requested, as well as the completed and signed Ministry of Environment, Conservation and Parks (MECP) or the applicable environmental agency, (FORM 1) application for the approval of Waterworks forms.

The Ministry application documents will be signed by the Municipality as the operating authority of the Dutton Dunwich Water System.

For installation of watermains, the Developer must have final approval from the Municipality and all required agreements executed with the Municipality prior to construction.

c) Revisions

Any changes required by the Developer to plans which have final approval must be resubmitted to the Municipality for approval before such changes be made in installation.

d) As Recorded Drawings

Prior to and as a condition of assumption, the Developer shall ensure that one complete digital set of “as recorded” drawings is supplied to the Municipality. Drawings shall be layout plan and detail drawings, as specified in Section 4.2 – ‘Drawings to be Submitted’, revised to show all changes made during installation. The Developer or their agent shall provide the drawings in digital form on a USB in AutoCAD and PDF format, including a list of layer’s and pen settings used. Refer to Section 4.3 – ‘As-Constructed’ for additional details regarding As-Constructed drawing requirements.

9.1.2 Services and Private Watermains

However, when services are larger than 50mm (2”) diameter, when fire protection may be required, when more than one building is serviced off one private watermain or when any other problem may exist, the Developer must submit plans to the Municipality for approval. When a final submission drawing has been approved and returned to the Developer and the Developer has paid all applicable charges, the Municipality will authorize installation or inspection of the service.

For installation of private watermains, the Developer must have written approval and must comply with the Municipality General Conditions, Specifications, and Standard Drawings for the Water Distribution System (latest revision) and the Ontario Plumbing Code (latest revision).

e) Preliminary Approval

A digital copy of the site plan(s) must be submitted. Preferred scales are 1:250 or 1:500. Drawings shall show: location and size of watermain to be connected to; location of service and private watermain dimensioned from property line or structure; offsets from

sanitary sewer and storm sewer; type and size of pipe, fittings, valves, and hydrants; size and location of meters; type of fire protection system with maximum volume of water required in L/min. and location of siamese connections; all site structures, poles, hydrants, roads, driveways, parking areas, sidewalks and sewers; municipal number, assessed frontage, lot dimensions, acreage, floor area, number of storeys and number of dwelling units. One preliminary drawing will be marked with required revisions and returned to the Developer or his agent.

f) Final Approval

A digital copy of the site plan(s) showing all requested revisions must be submitted for final approval.

g) Revisions

Any changes required by the Developer to plans which have final approval must be resubmitted to the Municipality for approval before such changes be made in installation.

9.2 DESIGN AND LAYOUT OF WATERMAINS

a) Watermain Location

Water Distribution Systems shall be laid out in the gridiron system or so that they can be later incorporated in a gridiron system. Dead end watermains will not be allowed, unless unavoidable. Watermains located on a cul-de-sac shall be looped with a 50mm watermain.

Watermains shall be located in accordance with Drawing MSD-1A, MSD-1B, MSD-2, and MSD-3. Deviation from the standard location must be approved by the Municipality.

The standard location must be used on straight streets. On bends, the Watermain may deviate from the standard up to 1.0 m closer to the street line but not closer to the curb and gutter. Maximum use shall be made of pipe joint deflections so that a minimum

number of bends are used on any curved laying line. Refer to AWWA C600 and suppliers' specification for allowable joint deflection and pipe bending.

Watermains shall be terminated opposite street lines or property lines.

Watermains shall have no less than 1.7 m (5'6") nor more than 1.9 m (6'3") of cover from final surface grade. Variations from this cover may be made only if approved on plans or in writing by the Municipality.

b) Watermain Design

i) Pressure and Flow Requirements

Watermains shall be sized to maintain the greater of:

a. Maximum day demand plus fire flow at a pressure not less than 140 kPa (20 psi) at any hydrant lateral or potential fire service connection.
b. Maximum hourly demand at a pressure not less than 275 kPa (40 psi) in residential areas and not less than 310 kPa (45 psi) in industrial areas.
c. Maximum residual pressure should not exceed 690 kPa (100 psi) and a minimum residual pressure (peak hour) shall not be below 275 kPa (40 psi).
d. The pipes shall be designed so that the velocity for normal rates will be between 0.9 and 1.5 m/s (3 to 5 ft/sec.). The maximum velocity for fire demand shall not exceed 3.0 m/s (10 ft/sec.). Fire flows shall be calculated on the standards of the Fire Underwriters Survey, Insurers' Advisory Organization.

ii) Domestic Water Demands

Average day domestic demand for design shall be 250 L/D (55 IGPD) per capita. Maximum peaking factors of 3.5 for maximum day and 7.8 for maximum hour shall be used for design.

Use	Population per unit
Low Density Residential	3 people per unit
Medium Density Residential	2.4 people per unit
High Density Residential	1.6 people per unit

iii) Commercial, Institutional and Industrial Water Demands

These demands vary greatly with the type of water using facilities or process present in the development. If the Developer (designer) does not know the required demand he should refer to Ontario Ministry of the Environment, Conservation and Parks (or the applicable environmental agency) "Guidelines for the Design of Water Distribution Systems". For industrial demands the Developer (designer) should discuss water requirements with the Municipality.

iv) Fire Demands

To estimate the fire flow requirements for a particular structure or area of a Municipality, the designer should refer to the guide "Water Supply for Public Fire Protection - A Guide to Recommended Practice", (latest revision) prepared by Fire Underwriters Survey, Insurers' Advisory Organization. For further fire related requirements refer to the Ontario Building Code and the Ontario Fire Code.

v) Friction Factors

The following Hazen-Williams "C" values shall be used for design, regardless of material:

Diameter	"C" Factor
100mm and 150mm	100
200mm and 250mm	110
300mm to 600mm	120
Over 600mm	130

vi) Minimum Pipe Sizes

The minimum size for watermains shall be 150mm (6") diameter, except beyond the last hydrant on cul-de-sacs where smaller diameter pipe shall be used and designed for domestic and maximum hour demands only. Smaller diameter watermain may be used in a looped system at the discretion of the Municipality. However, consideration for future expansion and growth must be made in determining appropriate watermain sizes, as directed by the Municipality.

c) Watermain Valves

In developments of single family and semi-detached units, valves shall be distributed so that any section of watermain serving up to sixty (60) units can be isolated by operating not more than four (4) valves.

In these residential areas, valves shall be spaced no more than 250 m (820') apart and in high density residential, industrial, and commercial areas, no more than 150 m (500') apart. Feeder watermains should have valves spaced no more than 400 m (1300') intervals.

At intersections where smaller watermains connect to larger feeder watermains, each smaller watermain shall be valved whereas the larger watermain shall be valved as required above.

Watermains crossing rivers, railways and controlled access highways shall be valved on each side of the crossing.

Valves shall be located on the extension of street lines. Valves shall be located on all hydrant laterals. All valves shall be provided with valve boxes. All valves shall be located to avoid installation in driveways.

Air release valves shall be placed at all significant high points of the system. These valves shall be located in approved chambers. Prior to design, the designer should discuss site specific requirements with Municipality staff.

d) Blow-offs and Dead Ends

All watermain layout shall be looped to avoid dead ends. If a dead end is unavoidable a hydrant and valve shall be installed on the end. The Municipality may require the Developer to submit cash for the future extension of the system so that it can be looped. For a street to be extended in the future a hydrant and valve shall be installed on the end. In certain cases a blow-off may be allowed on the end of a short section of watermain upon approval by the Municipality.

All dead ends, both temporary and permanent shall be equipped with an automatic flushing device.

e) Watermain and Other Utilities Separation

Designers should refer to Ontario Ministry of Environment Conservation and Parks (or the applicable environmental agency) Guidelines regarding the location of watermains relative to sewers and to the Public Utilities Act of Ontario regarding the location of watermains relative to other utilities.

i) Parallel Installations

Sewers and watermains located parallel to each other should be constructed in separate trenches maintaining the maximum practical horizontal and vertical separation as noted in the Ontario Ministry of the Environment Conservation and Parks Guidelines.

Under normal conditions, watermains shall be laid with at least 2.5 m (8') horizontal separation from any sewer or sewer manhole. The horizontal distance shall be measured from the nearest edges.

In cases where it is not practical to maintain separate trenches, deviation from the above may be permitted provided that there is no less than 1.5 m (5') clear horizontal separation and the crown of the sewer at least 0.50 m (1'8") below the invert of the watermain. Where this vertical separation cannot be achieved, the sewer shall be constructed of materials and joints that are equivalent to watermain standards of construction and shall be pressure tested at a pressure of 350 kPa (50 psi) with no leakage. Any deviation is subject to approval by the Municipality in conjunction with other remedial measures.

ii) Crossings

a. Under normal conditions, watermains shall cross above sewers and (Private Drain Connection) PDC's with a vertical separation of 0.20 m (8") to allow for proper bedding and structural support of the watermain and sewer or PDC. Where crossing above sewers requires the pipe to be laid with less than 1.5m (5') of cover, insulation shall be placed to prevent freezing. Type and configuration (box, channel, flat top, etc.) of insulation shall be reviewed and accepted on a case by case basis.

b. Where it is not possible for the watermain to cross above the sewer or PDC, the watermain passing under a sewer or PDC shall be protected by providing a vertical separation of at least 0.20 m (8") between the invert of the sewer or PDC and the crown of the watermain.

9.3 DESIGN AND LAYOUT OF SERVICES AND PRIVATE WATERMAINS

a) Domestic Service

i) Size Required

The Developer will be responsible for private watermain and service sizing. The Municipality should be consulted for available pressures and flows at the watermain under design conditions. If the results of hydrant flow tests are to be used, the Municipality should be consulted for necessary adjustments since flow tests are not usually performed at design conditions. Minimum size for services is 19mm (¾") diameter within Dutton, and 25mm (1") diameter within the rural areas.

ii) General Requirements

a. All structures, including duplexes, apartments, commercial, industrial, and institutional properties shall have one meter and one service connected to a watermain or private watermain. For private developments, a meter pit shall be installed at Property Line.

b. Each structure in a commercial or industrial mall may have one meter and one service connected to a watermain or private watermain.

c. Swimming pool facilities and lawn sprinkler systems must be serviced by connecting to the metered side of a service that is in use yearlong and that is in a heated structure.

d. When there are two (2) watermains on a road allowance, the water service shall be laid from the structure to the watermain that, in the opinion of the Municipality, provides adequate flow and/or pressure.

e. Services to semi-detached housing must front the unit they serve.

f. All new development shall include grounding of electrical system other than to the water system. **Refer to Ontario Hydro Electrical Safety Code (Section 10)** for grounding requirements.

iii) Looped Private Watermain

A looped private watermain connected to a watermain or watermains must be installed when one watermain will not supply the required flow for domestic use and fire protection.

Looping private watermains to municipal watermains is not permitted.

iv) Location

The service pipe must be installed at right angles to the watermain and in a straight line from the watermain to the meter. The standard single unit residential or subdivision service stub will be normally located to pass through the midpoint of the lot frontage.

A private watermain to a complex of structures shall be located to serve all structures in the complex with the least amount of bends possible. Services off a private watermain are subject to the same requirements as services off a watermain.

Any private watermain ending in a dead end must have a hydrant and valve installed at the end.

b) Fire Service

i) Fire Service Design

The determination of fire service requirements and the sizing of supply piping shall be the responsibility of the Developer. If a domestic service is combined with a fire supply service, the Developer is responsible to ensure that the supply pipe is large enough to carry the combined demand. Design and installation of sprinkler and standpipe systems and their supply services shall conform to the requirements of the Ontario Building Code, Division B, Part 3.2, and the Fire Code and must be approved by the Chief Official (Fire Prevention Office) of the Municipality of Dutton Dunwich. The designer should obtain information from the Municipality regarding flows and pressures available for fire systems. If the flows and pressures required are in excess of the minimum design standards given in Part 3.2 and in excess of the actual capacity of the system, the Developer shall install booster pumps and/or storage to satisfy the required demand.

ii) Fire Service Layout

Layout and installation of fire services to the structure including required valves and hydrants must be approved by the Municipality and the Fire Department. This requires a submission of plans as specified in Division B, Part 3.2.

Sprinkler and standpipe services may be combined or a domestic service may be combined with either or both but the Developer is advised to obtain the approval of his Insurance Underwriter before combining them.

All fire protection systems must have a reduced pressure backflow preventer device conforming to CSA Standard B64.4 - 1976 as required by the Ontario Plumbing Code.

c) Services to Blocks in Subdivisions

Where service stub size and/or location for any block cannot be determined prior to street construction, the Municipality will not approve installation of the service stub. The following policy administered by the Municipality will apply and the cost will be paid by the Developer of the block serviced. “Where any water service connection is required to be made following the construction of curb, gutter, concrete sidewalk and/or wearing surface coat of asphalt on any street in a new subdivision, such water service connection shall not be made using "open cut" methods but shall be made using drilling or boring techniques and in such a manner as to eliminate the possibility of settlement of such curb, gutter, concrete sidewalk or wearing surface coat of asphalt. This policy shall apply except where, in the opinion of the Municipality, ground conditions are such that the use of drilling and boring methods become unreasonable or uneconomical.”

d) Services and Backflow Prevention

A building or group of buildings that is supplied by one service and that has plumbing interconnected within the building(s) shall have check valves or other approved devices, which will prevent backflow into the watermains, where in the opinion of the Municipality, potentially hazardous conditions exist.

Backflow preventers shall be per AWWA Standard C506 and shall conform to the requirements of the Ontario Water Resources Act, Plumbing Code, O.R. 401/91 or latest revision.

e) Services and Private Watermain Valves

On services of 50mm (2”) diameter and smaller, a main or corporation stop shall be installed at the watermain and a curb stop shall be installed on the property line. Services are to be located such that curb stops are not located in driveways.

On services of 100mm (4”) diameter and larger where the watermain cannot be closed off for the service connection, a tapping sleeve and valve will be required at the watermain. Where the watermain can be closed off and a tee cut into it, or where a new watermain is being installed, a valve shall be installed on the property line.

Services to structures in a complex that are to be connected to a private watermain shall have the curb stop or valve placed at the service main. A main stop is not required if replaced by a Ford main stop replacement piece.

Valves shall be installed on looped private watermains to isolate buildings or groups of building so that no more than sixty (60) individual services are on any one valved section. The Developer shall install a valve on the street watermain between connections to a looped private watermain if there is no existing valve.

All service valves and curb stops shall be installed with valve boxes and operating rods.

The Developer shall ensure that service control valves on his property are not covered by "mound" or "berm" type landscaping.

9.4 LAYOUT OF HYDRANTS AND FIRE DEPARTMENT CONNECTIONS

a) Hydrants on Public Streets

Hydrant spacing shall be no greater than 140 m (450') in residential areas, and 105 m (350') in commercial and industrial areas, measured along the centerline of the watermain. Hydrants shall be placed at every second intersection. Hydrants shall be placed 0.60m (2') from the property line at lot lines whenever possible.

If a non-standard location is required, details must be submitted to the Municipality. Hydrant valves shall not be located in sidewalks. All hydrants shall be valved with counterclockwise opening valves.

For a more detailed discussion of hydrant spacing requirements, refer to "Water Supply for Public Fire Protection" - A Guide to Recommended Practice.

b) Hydrants on Private Property

Hydrants will be located on private property where required by the Fire Department. Fire hydrants must be installed at grades such that they are readily accessible to the fire department and a minimum of 3.0 m (10') from a building foundation. The Developer must supply, install and maintain these hydrants.

i) Hydrants for Fire Department Connections

Refer to requirements within Section 3.2 of the Ontario Building Code.

ii) Protection of Hydrants

Bollards are to be installed in sufficient number to protect a hydrant from damage where placement of the hydrant increases the possibility of damage from vehicular traffic. The minimum distance from any bollard to a hydrant is 0.65m, measured centre to centre.

Bollards shall be 1.0m in height above ground. Bollard material is steel with concrete fill, painted hydrant yellow.

9.5 MATERIAL

The Municipality has sole discretion in choosing the type of pipe material to be used in any given situation. In general, the most current version of OPSS 701.05 Construction Specification for watermain installation in open cut, materials are to be followed with the following amendments.

Transition from one pipe material to another must be made at a valve or joint (tee or cross).

The Municipality may approve the use of jack and bore, and directional boring as alternative construction techniques. The Municipality has sole discretion in their use on a per project basis. Design calculations submitted shall conform to the current standards accepted by the industry. Design and construction methods including materials shall be submitted to the Municipality for review and approval.

Protective shipping and storage end caps are required for all watermain pipe material.

a) Pipe Material

Replace OPSS 701.05.02 – 701.05.09 for pipe material and fittings with:

i) Concrete Pressure Pipe

The use of concrete pressure pipe may be accepted in special circumstances (i.e. trunk lines) at the discretion of the Municipality. Concrete pressure pipe to be designed in accordance with current standards and to the Municipality's satisfaction.

ii) Ductile Iron Pipe

The use of ductile iron pipe is not acceptable to the Municipality.

iii) Polyvinyl Chloride Pipe (PVC) – Flexible Pipe

The Polyvinyl Chloride (PVC) plastic pipe shall be constructed of rigid polyvinyl chloride compound and shall conform to the current AWWA C-900 (CSA B-137.3). Polyvinyl chloride plastic pipe shall be DR18 – C900 "blue brute" for sizes up to and including 300mm diameter.

All watermain pipe delivered to site shall be “Factory Capped”. For watermains larger than 300mm diameter the type of watermain shall be determined in consultation with the Municipality's Engineer.

Pipes shall be supplied in standard lengths of not less than 6 meters nor more than 11.6 meters except that short lengths and special adaptors shall be provided as required for completing connections or where ground conditions are such that shorter lengths are necessary. Pipes shall be joined by means of a "Tyton" type rubber ring bell joint which shall be an integral and homogeneous part of the pipe barrel. Rubber rings shall conform to ASTM Specifications D1869. The class and type of pipe shall be stenciled on each length of pipe.

Joints shall be bell and spigot with rubber gaskets. The spigot shall be lubricated. A solid 12-gauge TWN copper wire must be supplied along the full length of the pipe to provide electrical continuity for location purposes.

Fittings:

Fittings shall be cast iron with mechanical joint or push-on ends adapted for use in making connection with PVC pipe and in accordance with AWWA C110 and C111. All fittings shall be cement lined in accordance with AWAA C104.

PVC Injection Molded Fittings with push-on joints (for use with PVC and PVCO Pressure Pipe conforming to AWWA C900, CSA 137.3, and AWWA [C909], CSA B137.3.1 having cast iron OD) shall conform to AWWA C907, shall be UL listed and FM approved and shall be certified by the Canadian Standards Association to CSA Standard B137.2.

Joint Thrust Restraints:

a. All fittings shall be installed with mechanical restraints. Restraint devices to meet or exceed the minimum requirements of ASTM F 1674-96, be UL listed and FM approved.

Restraining glands (100 to 300mm) to be manufactured of high strength ductile iron conforming to the requirements of ASTM A536, Grade 65 45 12 m (min) (400 to 600mm) shall be manufactured of structural steel conforming to the requirements of ASTM A36. Pipe joint restraints shall be designed for the same design, test, and surge pressure ratings as the pipeline in accordance with AWWA-M23 PVC pipe design and installation. All restraints are to be installed as per the manufacturer's specifications and torqued using a calibrated torque wrench. If the contractor uses power equipment during installation, it shall be set so as not to over torque the bolts. Final torqueing of bolt shall be done using a torque wrench set to the proper torque.

b. All fittings and joints must be restrained as determined by the manufacturer and approved by the Municipality and noted on the drawings. At minimum, no less than three (3) joints (minimum 18.0 m length) in each direction from each fitting, valve and dead end must be restrained.

iv) Pipe – Directional Drilling

When directional drilling is accepted by the Municipality, the following materials shall be used:

For watermains installed by directional drilling, pipe material shall be fusible polyvinyl chloride (PVC) DR18. Use of fusible PVC will require the pipe supplier to provide written confirmation of a suitable wall thickness, but in no case shall the wall thickness be thinner than DR18.

Thermal Insulation:

Material used to thermally insulate watermains shall have a minimum compressive strength of 690 Kpa (100 psi). Approved material is STYROFOAM HI 100 BRAND by Dow Chemical or Approved equal.

c. Cathodic Protection

All Cast Iron (CI) fittings shall be protected with 14.5kg (32 lb) high purity magnesium anode. The anode shall be attached to the fitting used a Cadwell and coated with mastic (Handy Cap IP). Fire hydrants shall be protected using 14.5kg magnesium anode attached using Cadwell.

Epoxy coated gate valves do not require cathodic protection unless, in the opinion of the Municipality, the epoxy coating is compromised.

d. Tracer Wire

For purposes of locating plastic pipe, a solid 12-gauge TWN copper wire with white coating must be installed along the top of the pipe, strapped to it at 6.0 m (20') intervals. The wire must be installed between each valve and/or the end of the watermain.

Joints in the wire between valves will not be allowed. At each valve, a loop of wire must be brought up outside the valve box.

The tracer wire must not be wrapped around the valve-operating nut. The inspector must test the tracing wire for conductivity. If it is not continuous from valve to valve, the Developer shall, at their expense, replace the wire.

At all hydrants a continuous loop of wire must be brought up the backside of the barrel. A 40mm (1 ½") PVC pipe with push off cap shall cover the wire for the top 1.0 m (3') section.
In cases of installing plastic watermain pipe by directional drilling, double (2) tracer wires must be installed with the pipe.

e. Valves

All watermain valves shall be gate valves. All valves must be epoxy coated inside and out (minimum of 3mm thickness) and conform to AWWA C550. All valves up to 200mm

diameter may be M.J. or push-on joint. Valves 250mm to 400mm diameter must be mechanical joint to allow adequate mechanical thrust restraints.

Gate valves shall be iron body, bronze-mounted, non-rising stem. Gates may be double disc parallel seal or solid wedge. Valves shall be manufactured in accordance with AWWA Standard C500/C509 or other approved specification. Minimum design working water pressure shall be 1.21 MPa (175 psi). "O" rings shall be used for valve stem stuffing box packing.

Valves to open to the LEFT i.e., counterclockwise and stems fitted with 50mm square operating nut with arrow showing opening direction and have S.S. nuts and bolts.

A 10.9kg zinc anode shall be connected to all watermain valves. Epoxy coated gate valves do not require anodes unless coating is damaged in the opinion of the Municipality. All valves to have rod extension to 300mm below finished grade.

Valve Chambers:

A cast iron valve chamber or valve box shall be supplied and installed on every watermain valve and hydrant shut-off valve. Box shall have a minimum internal diameter of 125mm and be adjustable for total length. Box to have attachable base of sufficient size to prevent box bearing on the valve. Cover to be marked WATER. Valve boxes may be the No. 5 Slide Type Valve Box or the No. 5 Screw Type W\No. 6 base as manufactured by EMCO or approved equal.

Air Valves:

Design requirements and specifications for air release valves shall be submitted to the Municipality for approval on a case-by-case basis.

f. Hydrants

OPSS 701.05.10 has been amended with the following:

Hydrants shall conform to AWWA C502 for dry barrel hydrants. All hydrants shall open left (counterclockwise) and shall be Canada Valve Century with break flange, with two 63mm (2 ½") hose connections, and one 100mm (4") Storz (black) pumper connection.

Hose connections threads and operating nut to be to Ontario Provincial Standard Specifications and comply to all ULC Standards.

All hydrants shall have anchor tees with tie rod assemblies. All tie rods and bolts shall be wrapped with Denso tape, all to the satisfaction of the Municipality.

Fire hydrants shall have a chrome yellow high gloss exterior paint over quick dry red oxide primer. Damage to the fire hydrant paint coating shall be repaired prior to installation, as per manufacturer's recommendations. Prior to the end of the one-year maintenance period, all hydrants shall be given one coat of new paint to the manufactures' specifications with approved paint and shall be serviced by the Contractor.

The Dutton Dunwich Fire Department reserves the right to select the required hydrant(s), appurtenances, and location of hydrant(s) depending on the fire risk of the area.

Valves for buried installation shall have mechanical or push on ends as required.

g. Service Connections

i) Connection Pipes

For new service connections under and including 25mm (1") diameter, the approved connection pipe material is:

Municipex: Cross-linked polyethylene service pipe shall conform to CSA-B137.5, ASTM F876 & F877, NSF 14 & 61; AWWA C904

For service connections with 38mm (1 ½") and 50mm (2") services, the approved

For service connections with 38mm (1 ½") and 50mm (2") services, the approved pipe material is:

Polyethylene Pipe: Polyethylene service connection pipe shall conform to CSA B137 and AWWA C901 and shall be certified series 200 for potable water applications.

ii) Service Fitting Appurtenances

OPSS 701.05.12 has been amended with the following:

a. Service Saddles:

20mm (3/4") and 25mm (1") services may be direct tapped into all sizes of DI and CI watermains except a service saddle must be used for a 25mm (1") service into a 100mm (4") watermain. Service saddles must be used for all sizes of service into PVC pipe and for 38mm (1 ½") and 50mm (2") services into CI and DI pipe.

All saddles shall have AWWA thread outlet. Saddles for DI and CI pipe shall have ductile iron epoxy body with electro galvanized steel double straps and bolts.

Approved service saddles are:

- For PVC 100mm (4") to 400mm (16"):
  20mm to 25mm (3/4 to 1") outlets - Romac Style 304
  38mm to 50mm (1½ to 2") outlets - Romac Style 306
  20mm to 50mm (3/4 to 2") outlets – Rockwell Style 372
  20mm to 50mm (3/4 to 2") outlets – Cambridge Brass "Teck" Series 403 double bolt
  20mm to 50mm (3/4 to 2") outlets – Robar Series 2616 double bolt
- For DI and CI:
  20 to 50mm (3/4 to 2") outlets – Romac Style 202S and 202NS

Saddles for PVC pipe shall be full circumference wide band with stainless steel band, nuts, bolts, and outlet. Band shall be Type 304 Stainless Steel of minimum 18-gauge thickness.

b. Tapped Service Tees:

For 150mm (6") and 200mm (8") watermains a tapped service tee may substitute a service saddle for 20mm (3/4"), 25mm (1") and 50mm (2") services. All tees shall have an AWWA thread outlet.

Approved PVC injection molded tap tee for 150mm (6") and 200mm (8") PVC C900 CL150 DR18 pipe:

- Ipex C907 for 20mm to 50mm (3/4 to 2") outlets
- Royal C907 for 20mm to 50mm (3/4 to 2") outlets

c. Watermain Stops:

Watermain stops shall be brass ball with inlet AWWA thread and outlet compression.

Approved watermain stops for copper and Municipex pipe are:

Cambridge Brass, Series 301	Mueller
20mm (3/4") – 301-A3H3	All sizes – B-25008
25mm (1") – 301-A3H4	
38mm (1½") -301-A3H6	
50mm (2") – 301-A3H7	

For services connected to private watermains, main stops may be replaced by Ford F60 main stop with AWWA thread inlet and outlet compression.

d. Curb Stops:

Curb stops shall be brass ball with both inlet and outlet compression.

Approved curb stops for copper and Municipex pipe are:

Cambridge Brass, Series 202	Mueller
20mm (3/4") – 202-H3H3	All sizes – B-25209
25mm (1") – 202-H3H4	
38mm (1½") – 202-H3H6	
50mm (2") – 202-H3H7	

e. Couplings:

Couplings shall be brass with both inlet and outlet compression.

Cambridge Brass, Series 119	Mueller
20mm (3/4") – 119-H3H3	All sizes - H15403
25mm (1") – 119-H4H4 25mm	
38mm (1½") – 119-H6H6	
50mm (2") – 119-H7H7	

f. Services Boxes and Rods:

Shall be CI type to suit curb stop and shall have 20mm (3/4") 5-sided brass lid plug.

Length shall be adjustable to suit depth of service.

Approved boxes for 20mm and 25mm (3/4 and 1") curb stops are:

Mueller	Domestic
H10385 & H10386	Style No. DF900

Service rods including cotter pin shall be stainless steel of minimum 13mm (1/2") diameter.

Approved boxes for 38mm (1½") and 50mm (2") curb stops are:

Mueller	Cambridge Brass
H10385 & H10386 - Operating rod to have modified top to enable use of same key as used on the H10385 & H10386 box	Series 161-1

h. Concrete

Concrete for thrust blocks shall conform to OPSS 1350 with a nominal minimum 28-day compressive strength of 20 MPa.

Concrete thrust blocks to be used for vertical bends only and must be used in conjunction with mechanical joint restraints for stability. All restraint shop drawings from the Manufacturer must be stamped by a Professional Engineer. Unstamped restraint shop drawings will not be accepted.

Granular materials greater than 20mm (3/4”) in size shall not be used for pipe bedding.

Concrete for bedding shall conform to OPSS 1350 with minimum 28-day strength of 15 MPa.

i. Pipe Bedding Materials

Granular materials greater than 20mm (3/4”) in size shall not be used for pipe bedding.

Concrete for bedding shall conform to OPSS with minimum 28-day strength of 15 Mpa.

9.6 CONSTRUCTION

In general, the current version of OPSS 701.07 Construction Specification for Watermain Construction by open cut method, construction to be followed with the following amendments.

All installations shall be subject to the inspection, approval, and acceptance of the Municipality. Any portion of the work that is backfilled before inspection by the Municipality will not be approved unless the trench is reopened, and the pipe inspected.

The provision of inspection by the Municipality is not to be considered a substitute for supervision by the Developer.

The Developer must engage the services of a Consultant who shall provide a qualified inspector for full time inspection during construction. An inspector must have completed the MEA/MOE Inspectors Course for the Construction of sewers and watermains or a consultant may obtain approval from the Municipality upon written request for use of Inspectors with a minimum of ten (10) years related construction experience in lieu of the MEA/MOE Inspectors Course.

a) Site Preparation

Site preparation shall conform to OPSS 503.

b) Protection Against Floatation

Damage to the watermain and/or service connections due to hydrostatic pressure shall be prevented during construction.

c) Cold Weather Work

All work related to temporary above-ground or permanent below ground watermains shall be protected from freezing. Pipes and bedding materials shall not be laid on frozen ground.

d) Transporting, Unloading and Storing Pipe

Delivery and unloading of pipes and fitting at the job site shall cause the least possible delay to traffic. All pipes, specials, fitting and gaskets that are unsound or damaged shall be removed from the site and replaced.
Protective shipping and storage end caps are required for watermain pipe material.

Manufacturer's handling and storage recommendations shall be followed.

e) Dewatering

Dewatering shall conform to OPSS 517 and be certified by Professionals experienced in dewatering.

f) Shoring and Bracing

Shoring and bracing shall conform to OPSS 538.

g) Connection to Existing Watermains

All work is to be supervised by Municipality personnel.

The Municipality will witness all connections to existing watermains where a tapping sleeve and valve is to be used. The Contractor will be required to supply and install tapping sleeves and valves and the Municipality will tap the watermain at the Developer's expense, billed at the Municipality's rates. Where the connection to the existing watermain is by cutting out and installing a joint (tee, cross), the Contractor will be allowed to complete the work, but only under the direct supervision of the Municipality.

Dewatering and removal of any plugs, caps, blow offs and for thrust blocks from an existing watermain or fitting and reconstruction of the joint will be considered part of the work of constructing the new watermain.

Where connections are to be made to DI pipe using steel tapping sleeves the installation must be mastic coated. Clean sand bedding shall be used at least 300mm (1') above and 150mm (6") beneath the installation. Tapping of PVC pipe must be done as recommended by the pipe manufacturer. The sleeve must be supported and blocked during tapping and supports for the sleeve and valve must be left in place. Thrust blocks must be used.
Connecting to PVC watermains: Refer to UNI-B-3 - **Section 5.3.6.** Direct tapping is not permitted.

h) Shutting Down or "Charging Watermains"

The Contractor shall not shut down or fill any watermain that is in service or operate any gate valve or other control for any purpose. Operation of all valves, hydrants, blow-offs and curb stops shall be performed solely by the Municipality.

At least 48-hours notice must be provided to the Municipality when valves which will shut off services to consumers are required to be operated.

The Contractor shall give notice of interruption of service to consumers at least forty-eight (48) hours before the interruption occurs. The Contractor shall prepare notice cards and submit to the Municipality for review at no charge and upon approval, shall distribute them at no expense to the Municipality.

i) Trenching, Backfilling, and Compacting

Trenching, Backfilling, and Compacting shall conform to OPSS 514.

Approved excavated materials may be used for backfill under roads, sidewalks, and driveways where an independent soils investigation carried out by a Soils Consultant indicates that it is practical to do so. Compaction of the material shall be carried out in accordance with the recommendations of the Soils Consultant.

If excavated material is unsuitable, the trench shall be backfilled with granular material conforming to MTO Granular 'B' and compacted to 95% of its maximum Standard Proctor Density.

j) Pipe Bedding

Pipe bedding shall be shaped true to the line and grade, free from sags and high points. Bedding shall be shaped to a cylindrical surface with the radius conforming to the pipe in accordance with pipe manufacturer's recommendations. Bedding materials shall be placed simultaneously on each side of the centre line of the pipe.

Bedding shall extend to a minimum depth of 100mm below the pipe barrel and shall be brought up around the pipe to a minimum depth of 300mm above the top of pipe and shall be compacted to 98% modified Proctor Density. The width of bedding shall be the width of the trench.

Granular bedding shall be dimensioned as shown on MSD-11 for rigid pipe or flexible pipe. Granular bedding shall be uniformly compacted in layers not exceeding 150mm (6") in thickness. Compaction shall conform to OPSS 501 with a density of not less than 95 percent of the maximum dry density.

k) Installation of Pipes

All watermain installation shall be performed in accordance with manufacturer's instructions and the latest requirements of the Occupational Health and Safety Act.

l) Jointing

Joint surfaces shall be clean. Pipe ends shall be lubricated with material recommended by the pipe manufacturer. Manufacturer's instructions for jointing pipes shall be followed. Joints and all connections shall be made watertight.

Pipe shall be pulled or pushed only by hand power operated winch. A backhoe shall not be used for pushing pipe.

Joints shall be prevented from opening after the pipe has been laid.

i) Jointing Polyvinyl Chloride (PVC) Pressure Pipe

a. Bell and Spigot Joints:

Jointing of PVC pipe shall be in accordance with UNI-B-3-92 and manufacturer's specifications.

b. Restrained Joints and Thrust Blocking:

Thrust block and joint restraining as per UNI-B-3-92, UNI-B-l 3-92 and manufacturer's

specifications.

Tie-rods and collars to be Denso wrapped.

ii) Cutting of Pipe

Whenever cutting of pipe is required, the pipe shall be cut in conformance with the recommendations of the pipe manufacturer.

m) Change in Line and Grade

PVC Pipe

PVC pipe may be deflected in order to follow the curvature of the trench. Such deflections may be accomplished by a combination of joint deflection and axial flexure of the pipe to the extent recommended by the pipe manufacturer.

Where it is not possible by using allowable joint deflection or pipe bending to lay pipe to the required radius or relocate pipe past an obstruction bends must be used including mechanical joint restraint.

n) Installation of Valves

Valves shall be installed at the locations shown on the approved design drawings. Valves and connecting pipes shall be aligned accurately and supported as specified.

Damage to Epoxy coating shall be repaired prior to installation, as per manufacturer's recommendations.

o) Installation of Hydrants

Fire hydrants are to be installed at a grade, whereby the fire hydrant boot has a minimum bury of 1.7 m (5'7") to a maximum bury of 1.9 m (6'3"), measured from the base of the fire hydrant boot to finished grade.
In cases where the depth of the watermain is greater than 1.9m, bends may be used to offset the hydrant lateral (past the gate valve) to achieve the standard fire hydrant boot depth.

A fire hydrant barrel extension may also be used. Extensions over 300mm (1') to be added at the bottom of the hydrant.

The hydrant shall be plumb with the nozzles parallel to the edge of pavement or curb line and the pumper connection facing the roadway.
Fire hydrants shall have a chrome yellow high gloss exterior paint over quick dry red oxide primer. Damage to the fire hydrant paint coating shall be repaired prior to installation, as per manufacturer's recommendations. Prior to assumption and as needed based on condition, all hydrants shall be given one coat of new paint to the manufacturer's specifications with approved paint and shall be serviced by the contractor.

Hydrants shall be set at a grade whereby the final grading of the street or area shall be 75mm (3") from the break flange of the hydrant. Grading which results in a depression or ponding at the hydrant will not be accepted.

Hydrant leads shall be constructed of the same material as the watermain line.

p) Installation of Services

For new installations a blow off tail shall be installed from the curbstop to a minimum distance of 0.6 m (2') above final grade. The tail shall be fastened to the marker stake securely.

All connections must be approved and inspected by the Contract Administrator (Developer's Consulting Engineer).

No service extensions to any users or use of the water from a watermain will be permitted until the watermain has been cleaned and pressure, leakage and disinfection tests have all passed. No pressure losses within the watermain shall be permitted.
For services of 100mm (4") in diameter and larger, the method of connection shall be prescribed by the Contract Administrator. The method shall either cut out and install a tee, or the use of a tapping sleeve and valve.

For services 25mm (1") and smaller the Contractor can complete a wet tap to the watermain, but only under the supervision of the Municipality.

For services greater than 25mm (1") the Contractor shall supply and install the tapping sleeve and valve for Municipality forces to complete the wet tap to the watermain.
Water service connections shall be installed from the watermain to the property line at locations as shown in the Contract or as directed by the Contract Administrator.
For services to new dwelling's where PEX water services are installed, this material must be used continuously from the watermain to curb stop, and curb stop to meter.

Curb stop valve boxes shall be installed vertically and flush with the final grade elevation.

All service boxes that fall within a concrete sidewalk or driveway, shall have a 100mm (4") piece of l0M (#3 bar-0.375dia.) reinforcing rod welded horizontally to the underside of the service box cover, approximately 40mm below the surface, to prevent frost heave.

A surface stake painted blue, 40mm X 90mm X 450mm long (standard 2”x 4”), shall be placed after trench restoration to mark the termination of a water service.

9.7 WATERMAIN TESTING

At minimum, watermain testing is to be performed in accordance with all current provincial regulations, AWWA/AWSI and OPSS standards.

a) Disposal of Wastewater

Dispose of all chlorinated water used for testing, flushing, or disinfecting watermain in accordance with Section 8 of the MOE Bulletin 65-W-4 or latest revision. No water shall be discharged to storm sewers or watercourses.

Method of disposal of chlorinated water is subject to approval of the Municipality and permission shall be obtained in writing.

Adequate mixing and dosage of the chemicals with chlorinated water must be ensured so that the residual chlorine concentration is not more than 25ppm.

b) Flushing and Disinfecting Watermains

At minimum, all flushing and disinfection testing is to comply with all current provincial regulations, AWWA/AWSI, and OPSS standards. Notify the Municipality at least four (4) days in advance of the proposed date when disinfection operations are to commence. The Municipality must be present to witness all disinfection operations. The Developer is responsible for all costs related to disinfection.

Following completion of the flushing operation, the Contractor shall swab based upon their proposed methodology which requires Municipality approval prior to commencement.

c) Bacteriological Testing

Bacteriological testing must confirm to AWWA and Ontario Watermain Disinfection Procedures.

d) **Connecting Pipe**

After testing has been completed and accepted, the Developer is required to complete construction connections in a timely fashion. If the work is not completed in a timely fashion, the Municipality shall have the right to request additional sampling.

All pipe used for connecting the new watermain to the existing system shall be thoroughly cleaned, swabbed and disinfected prior to the connection being completed to the existing system. All work is to be supervised and approved by Municipality personnel for the connection to the existing water system.

9.8 FINAL INSPECTION, ACCEPTANCE, MAINTENANCE, AND REPAIRS

This section applies only to waterworks constructed privately to be conveyed to the Municipality after completion.

a) Final Acceptance Inspection

Requests for "Final Acceptance Inspection" for water distribution systems shall be made directly to the Municipality.

Watermains, services, hydrants, valves and all other waterworks distribution installations will not be accepted by the Municipality until an inspection has been made by the Municipality or representative who shall be assisted during the inspection by a competent person supplied by the Developer at their expense. The inspection shall not be made until all the finished roads, grades and lines are established.

Any deficiencies found during acceptance inspection will be listed and submitted to the Developer for correction. If the Developer has not made these adjustments within one month of receiving written notice from the Municipality or his representative, the Municipality reserves the right to make these adjustments and charge all costs to the Developer. Work undertaken by the Municipality's forces shall not relieve the Developer or their Contractor of any obligations contained in any Performance Bond, maintenance Bond, or Specification applying to the project.

b) Acceptance

After the area has been inspected and corrections made to the satisfaction of the Municipality, or his representative, and the security deposit (against possible damage and/or adjustment to grade of curb boxes, valve chambers and hydrants fronting lots or blocks of land not built upon and/or the installation of additional hydrants that might be required on Municipal property) is received and "as-built" drawings are received, the Developer will be issued with a "Certificate of Acceptance" in the form of a letter stating the area is accepted subject to a one year guarantee period and listing those lots or blocks of land that are unfinished.
At the end of this guarantee period, providing all requirements herein have been met to the satisfaction of the Municipality or his representative, the Developer will be issued a Final Assumption Letter indicating the installations that, except for those covered by the security deposit, are the responsibility of the Municipality.

Regardless of the one-year guarantee period and the security deposit, lots not built upon will remain the responsibility of the Developer for the protection of the water installation.

Any required repairs to these installations, up to and including the time of the setting of the water meter, shall be the responsibility of the Developer and any work considered necessary and undertaken by the Municipality to correct deficiencies shall be charged to the Developer and withheld from the security deposit.

As the lots are built upon to the extent of no less than 30% of the lots listed as unfinished in the assumption letter and on request of the Developer, the Municipality will inspect the completed lots and on acceptance of those lots will then authorize release of security relative to the completed lots. This procedure will continue until the area is completely developed.

When a water service is provided to premises previously served by a private well, the new service will not be accepted nor turned on until the original supply is mechanically separated from the Municipality supply in accordance with the Public Health Act, latest revision.

c) General maintenance by Developer

When repairs are undertaken by the Developer during the guarantee period, such repairs shall be made while a Municipality Inspector is present.

10.1 Lot Servicing

a) General

The servicing of all lots is to be in accordance with the standards set out in this section. Before any work is to commence in the Municipality's right-of-way, approval must be given by the Municipality's Engineer.

b) Sanitary Private Drain Connections

i) Pipe materials shall conform to Section 8 – 'Sanitary Sewers'.

ii) Each property will be provided with a private drain connection of a minimum diameter of 125mm having a minimum slope of 2%, as per MSD-16.

iii) Private drain connections to industrial, commercial, or high-density residential properties shall not be less than 150mm diameter with an inspection manhole placed at the property line just onto private property.

iv) MSD 15 shows the orientation of the private drain connections.

v) Roof water leaders shall not be connected to the sanitary PDC. Connection of foundation weeping tiles to the sanitary sewer is prohibited.

vi) The installation of private drain connections shall meet the standards set out in Section 6.7 – 'Installation'.

c) Storm Private Drain Connections

i) Pipe materials shall conform to Section 6.4 - 'Pipe Materials'.

ii) Each property will be provided with a private drain connection of a minimum diameter of 100mm having a minimum slope of 2%, as per MSD-16.

iii) Private drain connections to industrial, commercial, or high-density residential properties shall not be less than 150mm diameter with an inspection manhole placed at the property line just onto private property.

iv) MSD 15 shows the orientation of the private drain connections.

v) Roof water leaders shall not be directly connected to the storm sewers. Direct connection of foundation weeping tiles, as well as perimeter foundation tiles and the storm sewer, is prohibited. Weeping tiles may be connected to the Storm Sewer in accordance with the Storm Sewer use by-law or pumped above the foundation elevation prior to connection into the storm PDC.

vi) The installation of the private drain connections shall meet the standards set out in Section 6.7 – 'Installation'.

d) Water Services

Refer to Section 9 – 'Watermains', OPSD-1104.010, and OPSD-1104.020.

e) Utilities

i) All other utilities are to be installed in accordance with the standards of the utility company.

ii) Refer to MSD 15 for the location of required services and utilities.

f) Driveways

i) All driveways shall meet the requirements shown in MSD 10.

ii) Driveways are to be designed and installed perpendicular to the roadway.

iii) No part of the driveway shall encroach upon the property boundaries when extended from the edge of the right-of-way to the roadway.

iv) If a concrete driveway is installed, expansion joints are to be installed at the property line, at both sides of the sidewalk, and at the curb.

10.2 Lot Grading

a) General

All subdivisions shall be graded in accordance with these specifications and the details shown on MSD 13. Lot grading plans shall be prepared by the developer and approved by the Municipality along with the subdivision servicing drawings.

Existing elevations and grading details to be shown shall include sufficient area of adjacent lands to define total drainage patterns.

b) Lot Grading Specifications

i) Yard surfaces shall have a minimum slope of 2% (in special cases 1% to be approved by the Municipality's Engineer).

ii) Drainage flows shall be directed away from foundations.

iii) Drainage flows which are carried around houses are to be confined in defined swales located as far from the houses as possible.

iv) The desirable side yard swale depth is to be 225mm. The minimum allowable depth shall be 150mm. The maximum swale depth is to be variable, but dependent on location and safety considerations.

v) The minimum major/rear yard swale depth is to be 300mm, located a minimum 1.5m from rear property line with minimum 4H:IV slope.

vi) Grades:

a. Minor swales - provides drainage for up to four lots

- the minimum grade shall be 2% (special cases 1% to be approved by the Municipality).

b. Major/rear yard swales - provide drainage for more than four lots

- the minimum grade shall be 1%.

c. Driveways

- Optimum grade: 2% to 4%
- Maximum grade: 8%
- Walks: Optimum cross slope: 2%

vii) The maximum flow allowable in a side yard swale shall be that from four back yards.

viii) The maximum flow in a rear yard swale shall be that from 14 back yards, depending on lot size and grade. The maximum length of a rear yard swale to a catch basin shall be 80 meters. The maximum area contributing to the rear yard swale shall be 1.0 hectare. The maximum flow in a rear yard swale which is discharged directly onto the road allowance, is that from six backyards.

ix) Where possible, it is preferred to have lots drain to the front of the property, rather than to a rear yard catch basin.

x) Ground elevations at buildings shall be 300mm above any adjacent downstream overland flow routes.

10.3 Boulevard Grading

All boulevards between the curb and street line shall be fine graded. The slopes on boulevards shall be not less than 2%, preferably 3%, and not greater than 8%. All debris, rubbish, and junk shall be removed from the street right-of-way before final acceptance of the subdivision.

When parkland dedication is required pursuant to the Planning Act or the Development Agreement, the areas so designated shall be identified on the development plans with sufficient details, notes, and typical sections as may be required to identify lot grading, drainage, landscaping, access, and other details as may be required. The developer shall complete the necessary works as identified by the Municipality's Parks and Recreation Department within the Subdivision Agreement. Access for maintenance must be incorporated into the layout.

Within new developments, the Municipality desires to help facilitate the integration of the Stormwater Management (SWM) facilities into open space and passive recreation opportunities, where possible. Trails, sidewalks, and other pedestrian connections should be created to promote and accent adjacent natural areas within the new developments.

11.1 Passive and Active Recreational Uses

The design and site preparation of the parkland and open space shall take into account the intended and future passive and/or active recreational uses in accordance with the Municipality's Cycling Master Plan, Trails Master Plan and other relevant plans.

11.2 Site Clearing

No topsoil shall be removed from the site. The parkland and open space areas shall be fenced or otherwise made secure during land development and house construction activities to prohibit the removal of topsoil and the dumping of debris and unauthorized fill.

11.3 Site Grading / Drainage

Park drainage and grading plans shall be submitted to the Municipality at the same time as the servicing drawings and shall meet the following minimum standards.

a) Drainage

i) Drainage of parkland dedications shall be self contained such that areas drain to channels or swales which then outlet to catch basins and storm sewers or other suitable outlet, so that park drainage does not adversely affect other properties.

ii) Swales should have gently sloping sides and should be used wherever possible rather than steep sided ditches. The minimum slope of channel and swale inverts shall be 1.5%. Maximum side slope permitted is 4:1.

iii) Maximum depth to bottom of channel shall be 1 metre. Minimum depth of swale shall be 150mm.

iv) In general, except for natural watercourses, catch basins shall be provided in open channels and swales at maximum intervals of 100 metres.

v) Swales or open ditching shall not cross the entrance way into the park area.

vi) Natural wetland areas may require special attention and preservation.

b) Grading

i) In general, the minimum grade for grassed areas shall be as in Section 10 - Lot Servicing and Grading. Subsurface drainage may be required.

ii) Grassed slopes shall not have gradients steeper than 4:1 so as to allow safe use of moving equipment.

iii) All lands must be satisfactorily graded before the lands will be accepted by the Municipality for park purposes.

iv) Grading or natural contours which result in undrained areas are not acceptable. If overland drainage cannot be modified, catch basins and pipe will be required.

v) The Developer shall do all rough grading and filling where required, under all landscaped areas, to establish the sub-grade parallel to the finished grades indicated on the grading plans, to allow sufficient topsoil depth. All soft and unstable areas below sub-grade shall be excavated and filled with compacted select fill material.

vi) All areas shall have uniform slopes between points for which finished grades are indicated on the plans or between such points and existing grades. Grades shall be smoothly rounded at top and bottom of slopes.

vii) Sub-grade shall be scarified to minimum depth of 75mm to produce an even, loose textured surface free of all stones, roots, branches, etc. larger than 50mm in diameter.

viii) Topsoil shall be loose textured and free of all stones, roots, branches, etc. larger than 50mm in diameter.

11.4 Walkways

Where walkways are required through parklands, they shall be constructed as per the applicable grades and slopes for roadways. The minimum width shall be 3.0 meters.

11.5 Fencing

Where permanent fencing is required within or along parkland boundaries, it shall be 1.5 meters high and shall meet material specifications as approved by the Municipality on a project by project basis.

11.6 Tree Planting

All tree plantings associated with Planning applications and Capital projects shall follow the County of Elgin Tree Planting Standards. If any discrepancies exist between this manual and the Tree Planting Standards, the Tree Planting Standards shall take precedence.

11.7 Topsoil Requirements

Topsoil shall be a fertile, natural loam, capable of sustaining healthy growth, containing organic matter for clay loams and organic matter for sandy loam.

Topsoil shall be loose and friable, free of subsoil, clay lumps, stones, roots, or any other deleterious material greater than 25mm diameter. Topsoil shall be free of all litter and toxic materials that may be harmful to plant growth. Topsoil containing sod clumps, crabgrass, couch grass or other noxious weeds is not acceptable. Topsoil shall not be delivered or placed in a frozen or excessively wet condition.

Where necessary, and at the discretion of the Municipality of Dutton Dunwich, the Owner shall be required to provide topsoil test recommendations to the Municipality confirming topsoil type (i.e. percentage of sand, clay, and organic content), macro and micronutrient content, and pH levels. The Owner shall ensure fertilizers and soil amendments are incorporated into the topsoil in accordance with topsoil test recommendations.

11.8 Landscaping Plan

Landscaping plans are typically required for site plan control applications. All plans shall be reviewed by the Parks and Recreation Department.

For subdivision developments, tree boulevard planting plans are required and shall be reviewed and approved by Parks and Recreation Department, in conjunction with the Public Works Department.

12.1 Bicycle Lanes and Multi-Use Trails

The Developer shall provide for the construction of bicycle lanes or multi-use trails in a location agreed to with the Municipality during the consultation process.

12.2 Design

Multi-use trails shall be a minimum width of 3.0 meters, located as determined by the Municipality, and constructed as per the Municipality's standard drawings. Alternative materials must be submitted to the Municipality for approval.

Bicycle lanes shall have the same structural standard as the remainder of the roadway. Bicycle lanes shall be designated through pavement marking and shall be 1.5 metres wide. Where bicycle lanes are adjacent to the curb and gutter they shall be measured from the edge of pavement.

Bike lanes shall be delineated and signed in accordance with the Transportation Association of Canada Standards and Ontario Traffic Manuals.

The width of paved shoulders shall be designed as per the following table:

Operating Speed	AADT<3000	AADT>3000
Shared Lanes	Permitted	Not Permitted
<50km/h	1.5m	1.5m
51km/h – 70km/h	2.0m	2.0m
>71km/h	2.5m	2.5m

Notes:

1. The construction of new Sidewalks within Municipal limits shall comply with the design standards and requirements as set under Accessibility for Ontarians with Disability Act (AODA) Act 2012.

2. In addition to complying with the accessibility design standards set out in the Accessibility for Ontarians with Disabilities Act, the developer must also meet the accessibility design requirements and standards set out by the Municipality of Dutton Dunwich.

12.3 Connectivity

Pedestrian access shall be provided where appropriate and connectivity and looped walkway concept designs will be encouraged.

In the event that a community trail has been identified and/or required by the Municipality in the vicinity or adjacent to a Stormwater Management facility, they shall be implemented no less than 0.5 meters above the 100-year stormwater level.

Asphalt or concrete trails shall follow the cross section provided in Section 5.5 Design and Construction and be designed with 1% to 6% cross-sectional slope with a maximum 8% profile slope.

To enhance public comfort and safety, a 3.0-meter buffer area on each side of the community trail shall be designed and maintained in such a way that sightlines are preserved. If barriers are required, they must not interfere with visibility or create entrapment areas. In situations where a community trail is designed within the active storage area, the 3.0-meter buffer area above the trail shall have a 5:1 maximum slope. The buffer area shall be planted with low ground cover.

Deciduous trees should be planted at a minimum distance of 1.5 meters from the edge of the trail. Maintenance is required to ensure that tree canopies are raised to a minimum of 2.2 meters and shrubs must be regularly prevented from naturalizing this area. The planting of coniferous trees within this zone is not permitted.

All subdivisions shall be provided with streetlights in accordance with the standards in this section.

Proposed lighting layout, specifications, and details are subject to approval of the Municipality and the local hydro utility provider. For Subdivisions abutting collector or arterial roads, special lighting requirements and/or a photometric report may be required to evaluate the intensity of light. The Subdivider's Engineer shall review lighting requirements with the Municipality prior to final design.

Underground wiring shall be used for the electrical distribution system.

13.1 Design

a) Streetlights shall be located in accordance with the Utility Location Drawing MSD-1A, MSD-2, and MSD-3.

b) All lighting systems shall meet the requirements of the current edition of the "Guide for the Design of Roadway Lighting" as published by the Roads and Transportation Association of Canada.

c) On streets with sidewalks on one side, light poles are to be located on the same side of the street as the sidewalk.

13.2 Installation

The installation of the electrical wiring, poles, lights, and connections will be carried out by a Municipality-approved Contractor and the cost of the materials and installation shall be borne by the Developer.

Requirements

The Minimum Distance Separation formula will be applied to any proposal in a non-urban designation where agriculture and the keeping of livestock is permitted.

Minimum Distance Separation Implementation, as amended from time to time, shall be applied.

Dutton Dunwich

Standard Drawing	Description
MSD-1A	Utility Locations for Residential Roads - 20.1m Road Allowance
MSD-1B	Standard R.O.W. - Residential Asphalt - Ditches
MSD-2	Utility Locations for Residential Roads - 26.1m Road Allowance
MSD-3	Utility Locations for Industrial Roads - 26.1m Road Allowance
MSD-4	Residential Cul-De-Sac
MSD-5	Industrial Cul--De-Sac
MSD-6	Local and Minor - Local Roadway Residential - 20.1m Road Allowance
MSD-7	Collector/Arterial Roadway Residential - 26.1m Road Allowance
MSD-8	Industrial Roadway - 26.1m Road Allowance
MSD-9	Walkway Details
MSD-10	Residential Driveway Entrance
MSD-11	Pipe Bedding Details Class B and Class C
MSD-12	Pipe Bedding Details Class A-1 and Class A-2
MSD-13	Lot Drainage Plan
MSD-14	Plan and Profile Legend
MSD-15	Lot Servicing
MSD-16	Private Drain Connections at Street Line
MSD-17	600 x 840 Precast Concrete Curb Inlet Catchbasin
MSD-18	Water Sampling Station

OPSD

Standard No.	Description
216.010	Boulevard Treatments, Urban Section
310.010	Concrete Sidewalk
310.030	Concrete Sidewalk Ramps at Signalized Intersections
400.020	Cast Iron, Square Frame with Square Flat Grate for Catchbasins, Herring Bone Openings
400.090	Cast Iron, Curb Inlet Overflow for Catchbasins
401.010	Cast Iron, Square Frame with Circular Closed or Open Cover for Maintenance Holes
403.010	Galvanized Steel Honeycomb Grating for Ditch Inlets
404.020	Aluminum Safety Platform for Circular Maintenance Holes
405.010	Maintenance Hole Steps (Hollow)
405.020	Maintenance Hole Steps (Solid)
600.040	Concrete Barrier Curb with Standard Gutter
600.060	Concrete Semi-Mountable Curb with Standard Gutter
701.010	Precast Concrete Maintenance Hole - 1200mm dia.
701.011	Precast Concrete Maintenance Hole - 1500mm dia.
701.012	Precast Concrete Maintenance Hole - 1800mm dia.
701.013	Precast Concrete Maintenance Hole - 2400mm dia.
701.014	Precast Concrete Maintenance Hole - 3000mm dia.
701.015	Precast Concrete Maintenance Hole - 3600mm dia.
701.021	Maintenance Hole Benching and Pipe Opening Alternatives
701.030	Precast Concrete Maintenance Hole Components - 1200mm dia.
701.040	Precast Concrete Maintenance Hole Components - 1500mm dia.
701.050	Precast Concrete Maintenance Hole Components - 1800mm dia.
701.060	Precast Concrete Maintenance Hole Components - 2400mm dia.
701.070	Precast Concrete Maintenance Hole Components - 3000mm dia.
701.080	Precast Concrete Maintenance Hole Components - 3600mm dia.
704.010	Precast Concrete Adjustment Units for Maintenance Holes, Catch Basins, And Valve Chambers
705.010	Precast Concrete Catch Basin 600mm x 600mm
705.020	Precast Concrete Twin Inlet Catch Basin 600mm x 1450mm
705.030	Precast Concrete Ditch Inlet 600mm x 600mm

OPSD Standard No.	Description
707.010	Precast Concrete Maintenance Hole Manufactured Tee
708.010	Catch Basin Connection for Rigid Main Pipe Sewer
708.030	Catch Basin Connection for Flexible Main Pipe Sewer
1003.010	Cast-in-Place Maintenance Hole Drop Structure Tee
1003.020	Cast-in-Place Maintenance Hope Drop Structure Wye
1003.030	Internal Drop Structure for Existing Maintenance Holes
1003.031	Internal Drop Structure for New Maintenance Holes
1006.010	Sewer Service Connections for Main Pipe Sewer
1102.01	Trench Bedding for Pressurized Conduits up to 900mm Diameter (Rigid Pipe)
1102.02	Bedding for Pressurized Conduits (Flexible Pipe)
1104.010	Water Service Connection - 19 and 25mm Diameter Sizes
1104.020	Water Service Connection - 32, 38 and 50mm Diameter Sizes
1104.030	Blow Off Installation
1105.010	Hydrant Installation
1109.011	Cathodic Protection for PVC Watermain Systems

Plan of Subdivision – Not exempt from approvals

Official Plan Amendment (OPA) – Not exempt from approvals

Zoning By-Law Amendment

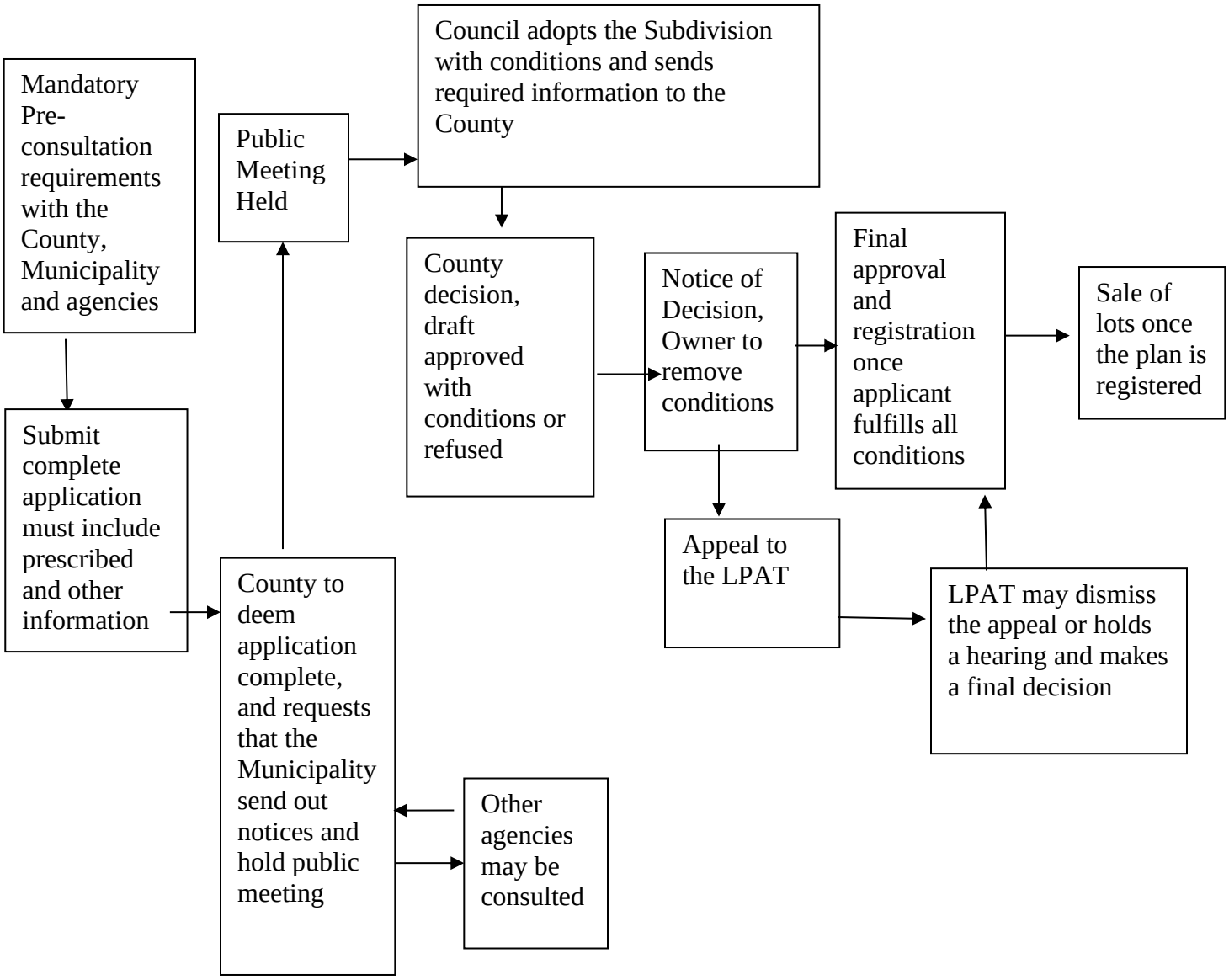
Minor Variance

A.5 Consent

Site Plan Control

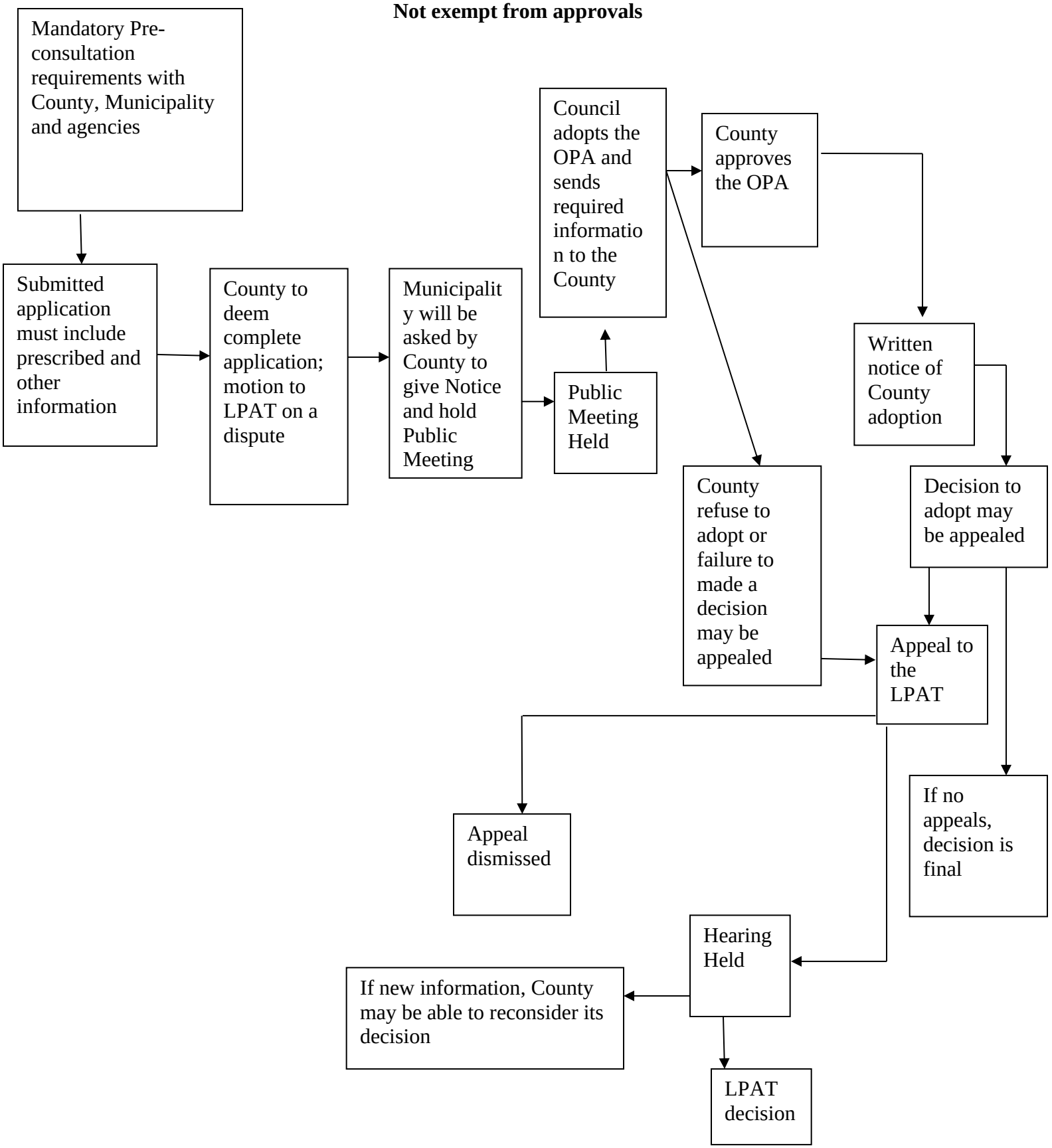
Plan of Subdivision

Not exempt from approvals

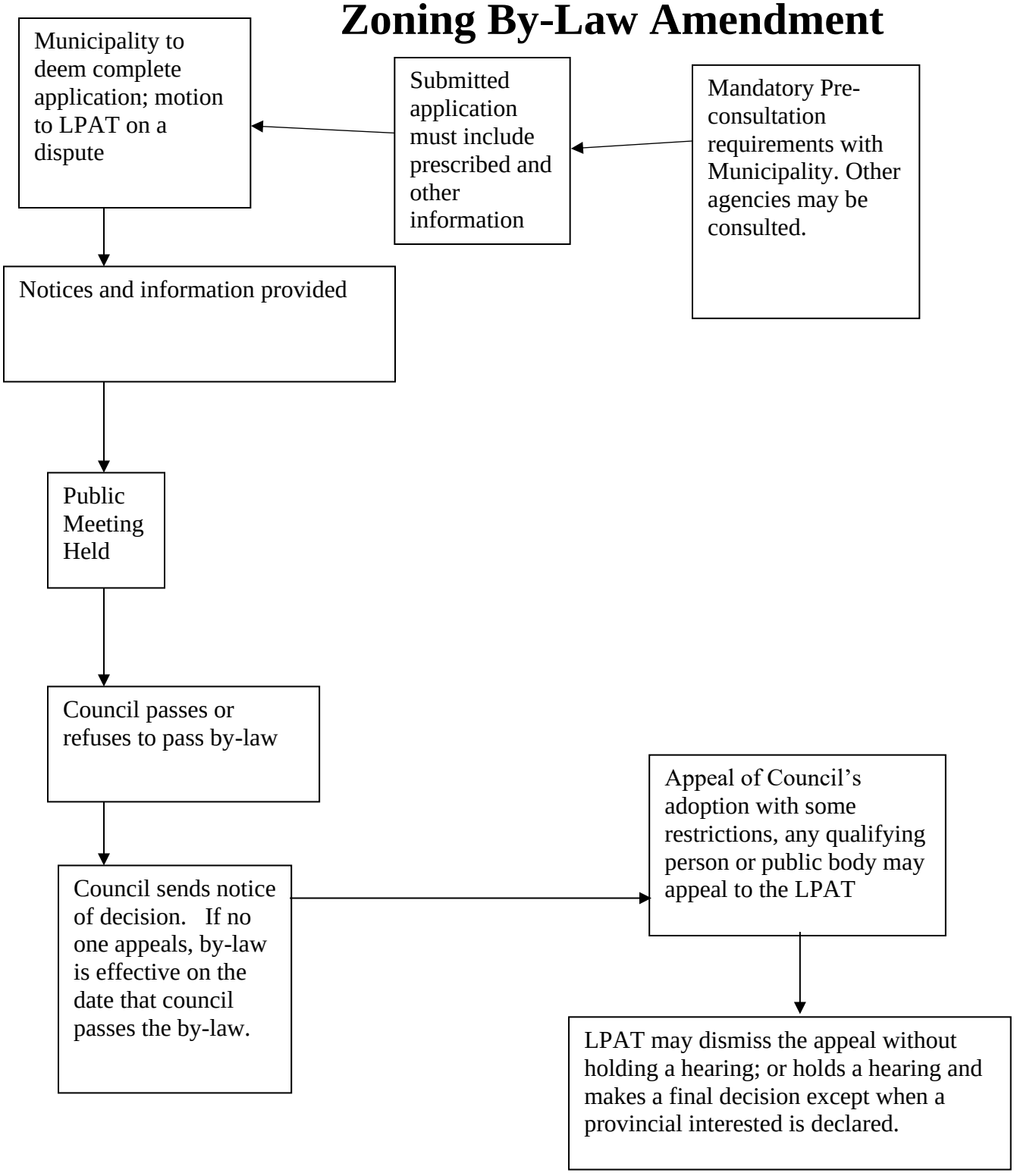


Official Plan Amendment (OPA)

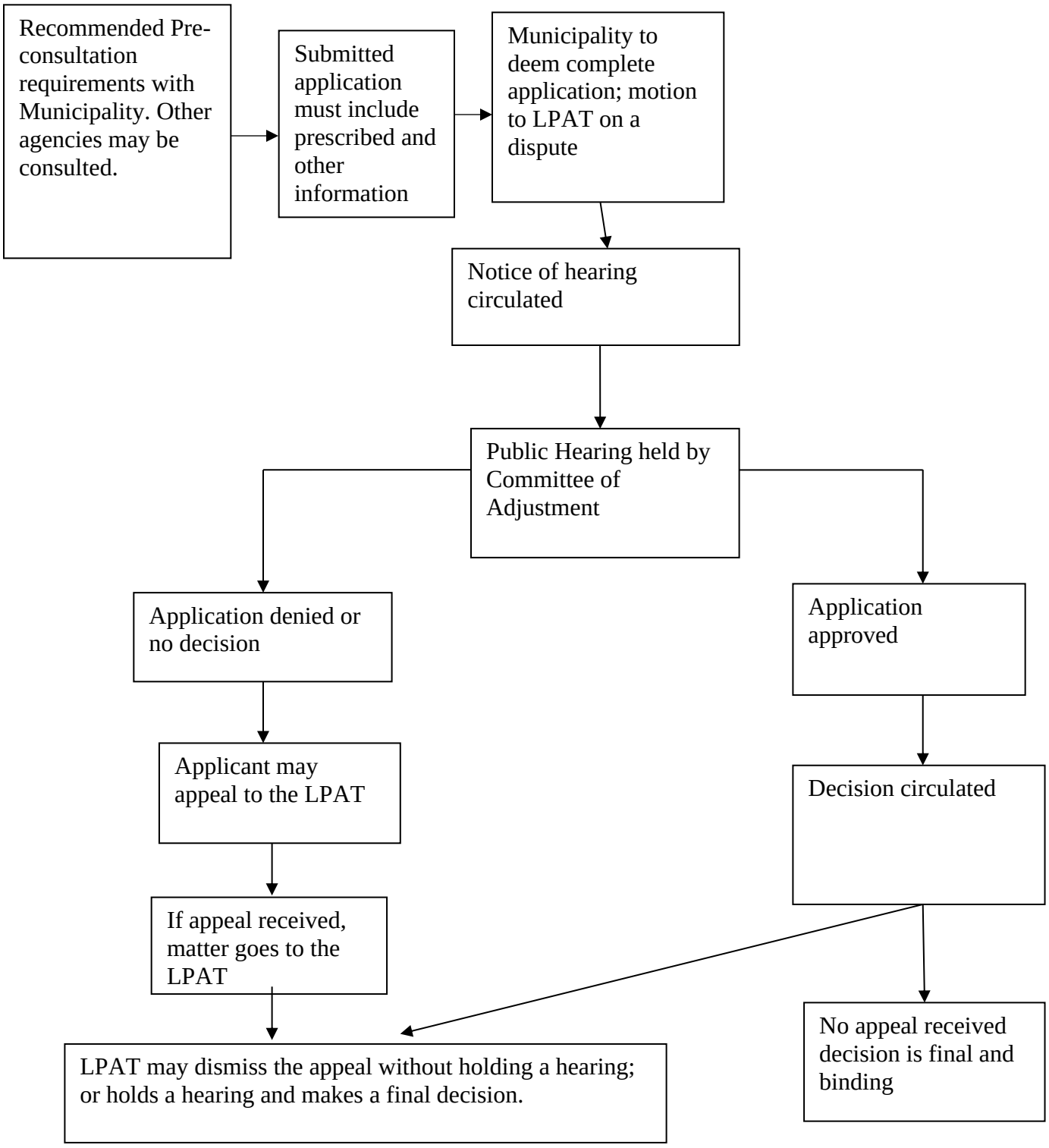
Not exempt from approvals



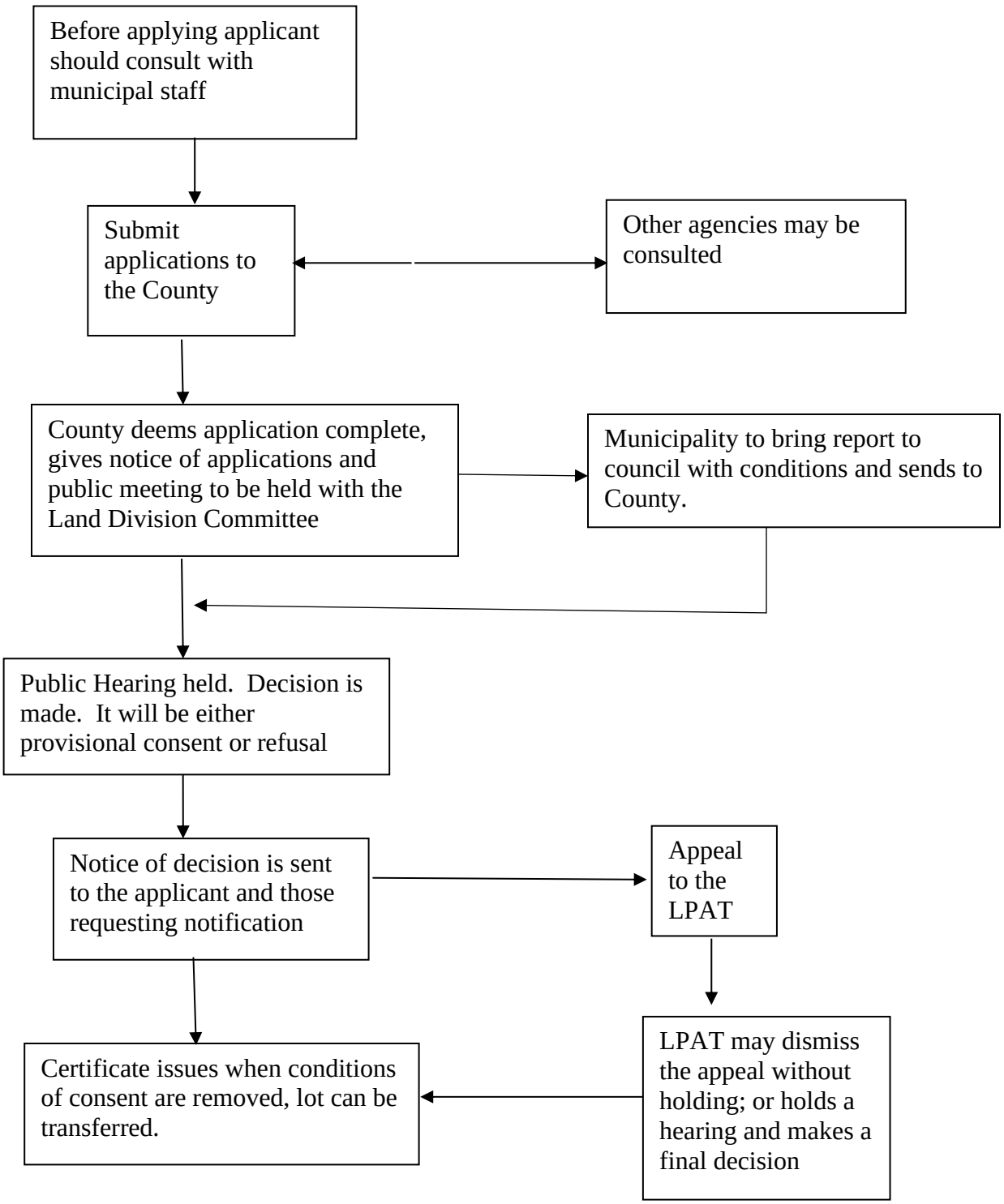
Zoning By-Law Amendment



Minor Variance



A.5 Consent


Before applying applicant should consult with municipal staff
Submit applications to the County
Other agencies may be consulted
County deems application complete, gives notice of applications and public meeting to be held with the Land Division Committee
Municipality to bring report to council with conditions and sends to County.
Public Hearing held. Decision is made. It will be either provisional consent or refusal
Notice of decision is sent to the applicant and those requesting notification
Appeal to the LPAT
LPAT may dismiss the appeal without holding; or holds a hearing and makes a final decision
Certificate issues when conditions of consent are removed, lot can be transferred.

Site Plan Control