

TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

The Town of South Windsor Public Improvement Specifications have been developed as minimum requirements. Situations may arise that have not been addressed within these specifications and shall be addressed on a case by case basis with the approval of the Town Engineer and/or the Director of Public Works.

Effective June 30, 2006

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SECTION I - ROADWAY
DESIGN GUIDELINES

1.1.0 Standards and Specifications for Road Construction

All road construction materials, procedures and testing shall conform to the requirements of the State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004 as amended and these Town of South Windsor Public Improvement Specifications and standard detail sheets.

1.1.1 Construction of Subgrade and Surfacing Courses

When constructing the subgrade, all loam, trees, roots, boulders and ledge shall be removed from the street site. The street site shall be excavated below profile grade to a depth determined by the particular roadway section to be used, but in no case shall this depth be less than fifteen (15) inches below the finished grade of pavement for the full width of the street. All soft spots shall be replaced with gravel subbase and the entire subgrade will be compacted before placing gravel base courses. The subgrade will be surfaced with bankrun and crushed stone base using the compacted depths shown on the approved Roadway Cross Section. Each course will be compacted with a roller weighing at least ten (10) tons or an equivalent means of compaction.

When wet or poor soil conditions for percolation are encountered, subdrainage may be required to be installed at direction of the Town Engineer. (Standard Detail of underdrain in Storm Drainage Section.)

1.1.2 Bituminous Concrete Base Course

All house services, including gas, sanitary sewer, water, electric and telephone shall be constructed before the installation of the bituminous concrete base course, Class 1. (Maximum 2" compacted layer of bituminous concrete each pass.)

1.1.3 Bituminous Concrete Surface Course

The top surface course shall consist of bituminous concrete, Class 2, applied with a paving machine rolled to the compacted depth in compliance with Specifications for "Bituminous Concrete". (Maximum 2" compacted layer of bituminous concrete each pass.)

1.1.4 Sidewalks, Curbs and Driveway Entrances

Sidewalks, curbs, driveway entrances and sidewalk ramps shall be installed in accordance with the Town of South Windsor Standard Detail sheets and ConnDOT Form 816 as amended.

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All portland cement concrete supplied shall be Class F as specified in section M.03.01 of ConnDOT Form 816. All concrete shall have the following minimum properties:

Air entrainment	5-7 percent
Slump	4 inches (max.)
Strength (28 day)	4000 PSI (min.)

The proposed construction or reconstruction of Sidewalks, Curbs, Driveway Entrances and Sidewalk Ramps must be approved by the Town Engineer.

No gate valves, transformers, handholes, manholes, pedestals, poles, etc. shall be allowed within a sidewalk or within one (1) foot of the sidewalk. Sidewalks shall have a paved leak-off leading to the curb to allow water to drain at lowpoints where there is not an adjacent driveway or handicap ramp.

1.1.5 Loaming, Seeding, Fertilizing

The Developer shall place at least four (4) inches of loam on the grass strip and side slopes and spread limestone, fertilizer and grass seed in accordance with Section 9.50, Turf Establishment, Form 816. Grass seed mix shall be submitted to the Town for review and approval. Hay mulch shall be applied uniformly over the area seeded. Grass seed fertilizer, and mulch may be applied by hydroseeding. Straw mats, jute netting or other approved erosion control blankets shall be applied to slopes after seeding when required by the Town.

1.2.0 Monumentation

Concrete monuments or merestones shall be installed by the subdivider, developer or property owner in accordance with the plans and profiles as approved. These monuments shall be set to the finished grade of the streets on the property line, at right angles to and opposite the point of curve and point of tangency of all curves, street intersections and other points designated by the Town Engineer. Concrete monuments, merestones and pins shall conform to Standard Details. The location of all monuments shall be indicated on the final subdivision plan to the satisfaction of the Town Engineer. Bound stones will be furnished by the developer; they must be installed and their A-2 accuracy certified by a Licensed Land Surveyor.

1.3.0 Specification for Street Improvements

All construction details shown on the South Windsor Typical Detail sheets are to be utilized. All construction not otherwise specified shall conform to The State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 816 as amended.

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1.4.0 Time Constraints

No permanent bituminous surface work shall be performed after October 15, or before April 15, except with the written approval of the Director of Public Works.

1.5.0 Pavement Design

The road pavement cross-sections shown on the standard detail sheets are the minimum acceptable to the Town of South Windsor. The Engineer is to provide a pavement design to verify whether or not the minimum standard is applicable.

This design is to be submitted to and approved by the Town Engineer. If the minimum standard is not sufficient, the road shall be built in accordance with the approved pavement design.

The developer is encouraged to do soil testing and analysis during the application phase however, this must be completed prior to the start of construction.

1.6.0 Shimming

Bituminous Concrete shims are to be installed for the protection of facilities (i.e. catch basin tops, manhole frames, and utility gates) during the time the binder course pavement surface is left exposed until the final coat of pavement is applied. (See Temporary Shim Detail)

Shimming can be accomplished one of two ways.

- A. The preferred method is to incorporate shims in binder course when being installed. Pavement to be graded as such to accommodate shim (formula for every $\frac{1}{4}$ inch of rise of facility above pavement equals 1 foot diameter of shim). Binder to be finished graded $\frac{1}{4}$ inch higher than existing facility surface, for their protection from snow removal equipment.
- B. Can be installed separately after binder course is installed. Class III bituminous concrete to be used (shim formula for every $\frac{1}{4}$ inch of rise of facilities above pavement equals 1 foot diameter of shim). The exception when applying formula to catch basin tops specifically, length of shim on front of catch basin top will be six inches for every $\frac{1}{4}$ inch of rise. Shim to be graded $\frac{1}{4}$ inch higher than existing facility surface for their protection from snow removal equipment. Prior to separate shim installment, a tack coat must be used to adhere shim to binder course. Outside edge of shims to be sealed with tack coat to prevent premature deterioration of shim (i.e. chipping, cracking, or flaking).

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1.7 Driveways

1.7.0 Standards & Specifications for Driveway Construction

All driveway construction materials, procedures and testing shall conform to the requirements of the State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, Sect. 9.22, as amended and these Town of South Windsor Public Improvement Specifications and standard detail sheets. See Page VI-16 of these specifications for Construction Details.

1.7.1 Conformance

These standards shall only apply to new or reconstructed driveways. Resurfacing of existing driveways are excluded from these standards.

1.7.2 Permits

No driveway shall be constructed or reconstructed nor shall any access to a driveway be relocated on a Town road, without a permit issued by the Town of South Windsor.

Application for this permit shall be made on forms furnished by the Town Engineer. These forms are to be properly completed, including a scale drawing of the proposed work and the required bond (as indicated on the application) posted with the Town Engineer.

This permit does not preclude any Planning & Zoning, Zoning Board of Appeals or Inland Wetland/Conservation Commission approvals that may be required.

1.7.3 Location

- 1.7.3.1 The minimum distance from a driveway to a road or intersection shall be 75 feet from the centerline of the road to the nearest edge of the driveway unless otherwise approved by Town Engineer and Planning Director. No more than one (1) driveway or access shall be constructed on the same premises unless the distance between them is greater than 50 feet and approval has been granted by the Planning Director and the Town Engineer. All distances shall be measured from nearest edge of pavement to nearest edge of pavement. However, only one (1) driveway or access shall be allowed on the same premises when it is located within a cul-de-sac regardless of separation distance.

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- 1.7.3.2 When a driveway or access is proposed on a collector road, approval will not be given unless access to a lower hierarchy road is not available. If approval is granted, there shall be only one (1) driveway or access onto a collector road from the same premises. A turnaround or "pull off" shall be required within the property to prevent vehicles backing out onto a collector road.
- 1.7.3.3 The standard detail sheets define the design constraints for driveways.
- 1.7.3.4 Sight Distance: The minimum sight distance for all new driveways for single lots shall be 200 feet. Combined driveways sight distance shall conform to that as shown for roadway intersection sight distance (Section I, Table 1). This shall be based upon a 3.5 foot height of eye and 3.5 foot height of object. The Town will review on a case by case basis any driveway that does not meet this requirement.
- 1.7.3.5 Residential driveways on a cul-de-sac shall be limited to three (3) single family driveways see (VI-5). A shared driveway shall be allowed on a cul-de-sac provided that no more than three (3) residential units are served by all driveways off the cul-de-sac.
- 1.7.4 Special Provisions
 - 1.7.4.1 A paved apron with a lip measuring 1" minimum and 1 ½" maximum shall be constructed and maintained by the owner of the premises to prevent road drainage from entering a driveway or access. No brick, gravel, paving stones or any other material shall be acceptable for the apron that is within the Town right of way.
 - 1.7.4.2 The driveway or access shall be so designed so as not to interfere with the location or function of existing culverts or drainage.
 - 1.7.4.3 Wherever possible, water from a driveway or access must be diverted or intercepted before reaching the roadway.
 - 1.7.4.4 The minimum length of a paved driveway apron shall be 20 feet measured from gutter line.
 - 1.7.4.5 When residential driveways are shared, the shared portion of the driveway shall be paved.
- 1.7.5 Rear Lot Driveways
 - 1.7.5.1 These standards apply to driveways over 300 feet, deep lots, and planned building groups in areas that the Fire Marshal determines would be impacted by one or more of the following during a fire:

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- a) Limited water supply
- b) Limited fire department resources
- c) Extended fire department response time
- d) Delayed alarms
- e) Limited access
- f) Hazardous vegetation, unusual terrain, or unusual characteristics

- 1.7.5.2 Every dead-end driveway more than 300 feet in length shall be provided at the closed end with:
- a) a turnaround having not less than a 42 ft. outside radius or
 - b) a hammerhead turnaround
 - c) design specifications for a, and b are located in the TOSW Public Improvement Specifications
- 1.7.5.3 Driveways more than 1000 feet shall be provided with a 50 foot long pull-off (measured parallel with the driveway) at approximately the halfway point of the driveway. The pull-off must be 15 feet wide (measured perpendicular to the driveway) and constructed of the same material as the driveway.
- 1.7.5.4 Trees shall be planted no closer than 15 feet from the edge of the driveway and vertical clearance of 14 feet shall be provided and maintained over the full width of all means of access.
- 1.7.5.5 Driveways serving a single structure shall have a minimum clear width of 12 feet for travel, excluding shoulders and parking. Provisions shall be made for factors that could impinge on the minimum width – for example, drainage, snow removal, parking, and utilities.
- 1.7.5.6 Driveways serving two or more structures shall have a minimum clear width of 18 feet for travel, excluding shoulders and parking. Provisions shall be made for factors that could impinge on the minimum width – for example, drainage, snow removal, parking, and utilities.

Exception: If all structures served by a single driveway are provided with an approved applicable NFPA 13, NFPA 13D, or NFPA 13R automatic sprinkler system, this minimum clear width may be reduced to 15 feet.

1.7.5 State Highways

Any driveways or accesses proposed on a State Highway or road, must receive a State Permit before any construction can begin. When a permit is issued by the State, a copy shall be brought to the Town Engineers Office prior to construction.

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Developer's Checklist for Roadway Construction

Prior to any construction, all sedimentation and erosion control measures will be in place. No construction will commence, nor will the developer be allowed to proceed with the next phase until all erosion and sedimentation control facilities are in place and properly maintained and inspected by the Town.

The Town is to be notified at least 48 hours in advance of each phase of construction. The developer will not proceed to the next phase of construction until the Town has inspected and approved the preceding phase.

The site developer will take particular notice to all conditions of the Planning and Zoning Commission, Inland Wetlands Agency/Conservation Commission and the Water Pollution Control Authority approvals and all terms of the pre-construction meeting.

All permits that are necessary for each phase of construction will be acquired prior to commencing on that particular phase. This shall include all Town, State and Federal permits. Copies of permits shall be submitted to the Engineering Division.

1. **Clearing and grubbing** – set up limits of immediate construction and install erosion and sedimentation control measures.

Method of Construction – ConnDOT Form 816 2.01.03.

2. **Sanitary Sewers** - South Windsor Public Improvement Specifications, ConnDOT Form 816 and Connecticut Public Health Code.

Method of Construction - trenching and backfilling as per Form 816 Section 2.05 - maximum backfill in layers of 6 inches in depth after compaction.

Tests - air tests, vacuum tests and deflection testing shall be performed in accordance with the Town of South Windsor Public Improvement Specifications Section 3.4 and appendix to Section III. Material certification of structures must be provided to Town Engineer prior to installing. Structures must be cured for seven days or reach at least 3000 psi strength prior to shipping. A camera inspection of new sewer mains may be required by the Town.

3. **Storm Sewers** - South Windsor Public Improvement Specifications and ConnDOT Form 816

Method of Construction - trenching and backfilling as per Form 816 Section 2.05 - maximum backfill in layers of 6 inches in depth after compaction.

Tests - material certification of structures and pipes utilized must be given to the Town Engineer prior to installing. Precast structures and pipes must have seven days curing or reach at least 3000 psi strength prior to shipping to jobsite. A standard deflection (mandrel) test may be required for all plastic pipe (CPP, ABS, PVC, etc.) installed. A camera inspection of new storm sewers may be required by the Town.

4. **Utility Coordination** - to be the responsibility of the developer. There shall be no pavement cuts after any pavement has been installed.

All trenching and backfilling as per Section 2.05 of ConnDOT Form 816 maximum backfill in layers of 6 inches in depth after compaction.

5. **Subgrade Preparation** - prior to subgrade establishment, the roadway will be staked to give vertical and horizontal control. Spacing will be a maximum of 50 feet and the developer will insure that all stakes are preserved or replaced throughout the roadway construction. The staking shall be close enough to be of adequate use but at the same time at an adequate offset so as not to interfere with construction.

Method of Construction - as per Section 2.09 of ConnDOT Form 816.

Tests - dry density compaction equal to or greater than 95%. Laboratory compaction test and sieve analysis of native material is required. Frequency of testing to be determined by the Town. A grade check must be performed prior to proceeding further.

6. **After Subgrade & Prior to Paving** – a progress as-built drawing shall be submitted, reviewed and approved. Also all structures, mainlines and laterals shall be field verified as to compliance with proposed location, profile and cross section slope. Progress as-built shall be certified by licensed surveyor.

7. **Subbase**

Method of Construction - as per ConnDOT Form 816 Section 3.04 and Town of South Windsor Public Improvement Specifications.

Materials - a minimum of 6 inches bank run gravel as per Town of South Windsor Public Improvement Specifications and ConnDOT Form 816 Section M02-02 & M02.06 gradation B. As an alternate, a total of 12 inches of processed aggregate base may be installed in lieu of 6 inches gravel / 6 inches processed aggregate (see Base Materials).

Tests - sieve analysis as per ConnDOT Form 816 M.02.06 gradation B. Dry density compaction equal to or greater than 95%. Frequency of testing, maximum 100 foot intervals or as directed by the Town Engineer/Inspector. A grade check must be performed prior to proceeding further.

8. **Base**

Method of Construction - as per ConnDOT Form 816 Section 3.04 and Town of South Windsor Public Improvement Specifications.

Materials - a minimum of 6 inches processed aggregate as per Town of South Windsor Public Improvement Specifications and ConnDOT Form 816 Section M.05.01.

Tests -sieve analysis as per ConnDOT Form 816 M.05.01-1. Dry density compaction equal to or greater than 95%. Frequency of testing, maximum 100 foot intervals or as directed by the Town Engineer/Inspector. A grade check must be performed prior to proceeding further.

9. **Pavement**

Method of Construction - as per ConnDOT Form 816 Section 4.06.03 and Town of South Windsor Public Improvement Specifications. **The laying of pavement between the dates of October 15 and April 15 requires written permission from the Director of Public Works.**

Materials - 2" Class 1, 1 1/2" Class 2 for local roads and 3" Class 1, 2" Class 2 for collector roads with tack coats between layers of pavement and at structures. (See approved pavement detail).

Tests - compaction – ConnDOT Form 816 4.06.03-5; surface test – ConnDOT Form 816 4.06-03-6; materials test - mixture, source of supply, formula for mix, mix tolerances as per Section M.04 of ConnDOT Form 816. A copy of the weight tickets for each load must be retained for the Town.

10. **Bituminous Curbing**

Method of Construction - machine formed, Class 3 mixture as per ConnDOT Form 816 Section 8.15.03 and Town of South Windsor Public Improvement Specifications.

Materials - shall be as per ConnDOT Form 816 Section M.04, Bituminous Class 3.

Tests - all tests required of Sections 8.15.03 and M.04 of ConnDOT Form 816 shall apply.

11. **Portland Cement Concrete Sidewalks** - as per Town of South Windsor Public Improvement Specifications, Section I.

Method of Construction - 5 inches of 4000 psi (Class F) concrete over 8 inches of prepared processed gravel; and at driveways, 8" of concrete with 6" x 6" x 10/10 wire mesh over 8 inches of prepared processed gravel. Expansion joints at 15 feet on center maximum.

Materials – materials shall meet Section M.03 of ConnDOT Form 816 as amended, with the exception of admixtures. Admixtures must be approved by the Town Engineer prior to mix being made.

Materials Certificate and Testing – Certification and testing shall conform to Section 1.06 of ConnDOT Form 816, as amended. The contractor/developer shall furnish certificates signed and dated by a person in responsible charge of the source of materials furnished that the materials meet the specification requirements. Certification of gradation for processed aggregate and mix requirements for portland cement concrete shall be provided prior to or at the time of delivery of the materials. A copy of all concrete trip tickets shall be given to the Town Engineer. The Town Engineer may require testing of portland cement concrete for all new sidewalks. The following is a list of tests to be performed by a certified testing laboratory:

Slump at time of delivery, one (1) test per truckload. (4 inches max)

Air entrainment at time of delivery, one (1) test per truckload. (5-7%)

Strength test, 7-day and 28-day (4000 psi min), one (1) set of cylinders per 500 feet of sidewalk.

Test reports shall be provided to the Town Engineer as soon as they are available. If the concrete fails any of these tests, the load may be rejected and/or the concrete removed and repoured. New tests shall be required of replacement concrete.

Note: All materials, pipes, structure sections, manhole covers and frames, catch basin tops, sumps and all other manufactured articles will be certified by the manufacturer as they pertain to either the Town of South Windsor Public Improvement Specifications or ConnDOT Form 816 as amended. Any precast concrete structures or pipe must have 7 days curing or have attained 3000 psi strength prior to shipping to the job site, as per Town of South Windsor Public Improvement Specifications.

All tests are the responsibility of the developer. The developer shall make all necessary provisions to accommodate the Town regarding testing. The developer will supply all materials and bear the costs for all tests required by the Town.

Form 816 - State of Connecticut, Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction - 2004 as amended.

Town of South Windsor Public Improvement Specifications as of latest revision.

Revised June 2006

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SECTION II - STORM SEWERS
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2.1.0 Specifications for Storm Drainage Improvements

All storm drainage construction materials and procedures shall conform to requirements of the State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004, as amended and the Town of South Windsor Public Improvement Specifications.

2.2.0 Special Drainage Structures

Details of special or unusual structures shall be submitted to the Town Engineer for review and approval before construction.

2.3.0 Design Criteria

Storm drainage systems may be designed using the rational, SCS or other acceptable methods for estimating design discharges. If the rational method is used, the following criteria are appropriate:

- a) Rainfall intensity to be determined from the Hartford Rainfall Intensity Chart. (Chart 2, appendix)
- b) Overland flow less than one thousand (1,000) feet use the Seelye Chart. (Chart 3, appendix)
- c) Overland flow more than one thousand (1,000) feet use the Kirpich Chart. (Chart 4, appendix)
- d) Runoff coefficients based on weighted "c" value, for different types of surfaces.
- e) Hydraulic design for open channel and conduit shall be based on the Manning Formula and in accordance with Connecticut Department of Transportation Drainage manual.
- f) Culverts will be checked to determine whether inlet control or outlet control governs as explained in "Hydraulic Engineering Circular" No. 5 and 10, as published by Bureau of Public Roads.
- g) Storm drains will be designed to maintain a minimum velocity of 2.5 feet per second when the pipe is full, however, at no time will the slope be less than 0.50% (.005 ft/ft).

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- h) Within roadways, a minimum cover of two (2) feet over the bell of the pipe shall be provided for all storm drains. If PVC (SDR35) is used, a minimum cover of (3) feet is required. Pipes with less cover shall be class V RCP or encased in concrete.
- i) Underdrain outlets shall be connected to drainage structures whenever practical. When impractical, they shall be terminated in an approved manner. Underdrain pipes shall be a minimum of 6" inside diameter for roadway system. There shall be no connection to underdrains from footing drains.
- j) Reinforced Concrete Pipe (RCP), and CPP Type S, minimum 15" diameter to be used for all Storm Collection pipes. When the grade is 10% or greater, Class V concrete pipe is to be used. Materials to meet DOT Form 816 Specifications. Pipe joints for RCP shall be of the rubber gasket type.
- k) Values for roughness coefficient "N" to be used in Manning Formula are:

<u>Type</u>	<u>Roughness Coefficient "N"</u>
Reinforced Concrete Pipe	0.015
Polyvinyl Chloride Plastic (PVC) Pipe - SDR35	0.010
Corrugated Polyethylene Pipe-CPP Type S (smooth wall)	0.010
Corrugated Metal or Polyethylene (corrugated wall)	0.024
- l) All storm sewer systems are to be designed to include capacity for all existing upstream flows. The peak flows in the system shall be analyzed and utilized in design of systems.
- m) A capacity analysis of an existing storm sewer system will be required when new storm drainage is proposed to connect to it. When zero increase in runoff is proposed this may not be required.
- n) For any residential, industrial and/or commercial site plan, the number and direction of all roof drains must be addressed.
- o) Lot to lot drainage must be addressed. The grading of all lots in a subdivision or an industrial/commercial site plan must be such that one lot or site does not adversely affect or cause a storm drainage problem on another lot. The grading must be an integral part of the overall storm drainage plan for the subdivision/ site plan. Yard drains shall be included to catch stormwater in back yards or front yards as directed by the Town Engineer.

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2.3.1 Pre and Post Development Analysis

A pre and post development analysis at the design storm is to be prepared. Zero increase in stormwater discharge is to be maintained for 2, 10, 25 and 100 year storms, unless it can be demonstrated that there will be no deleterious downstream affects. Detention basins may be required to maintain pre-development stormwater discharges, see section 2.3.7 for more information. Additional analysis of the upstream and/or the downstream drainage system (including streams, brooks, rivers, ponds, etc.) may be required if the Town Engineer thinks there may be adverse impacts due to changes in flow volume and/or flooding concerns.

2.3.2 Information to be Submitted by Developer:

All storm drainage calculations must be certified by a registered Professional Engineer. The following data shall be submitted for review by the Town Engineer or his/her designated agent:

1. Topographic Contour Map(s) showing drainage area(s). A scale of 1" = 100', shall be used as a minimum.
2. Written description and computations including at least the following:
 - a. Method used to calculate storm runoff.
 - b. Runoff characteristics of the property before and after development.
 - c. Drainage area calculations.
 - d. Maximum velocity and quantity at point or points of discharge from the system.
 - e. Design calculations for all drainage piping and structures.
 - f. Input data used.

2.3.3 Design Storm Criteria

All storm drainage facilities shall be designed based on the following storm frequency criteria:

Storm Drains and Minor Ditches	10-Year Storm
Cross-Culverts and Channels serving less than 200 acres	25-Year Storm
Culverts, Water Courses serving 200 - 1,000 acres	50-Year Storm
Bridges, Culverts & Streams serving over 1,000 acres	100-Year Storm

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2.3.4 Spacing and Location of Storm Inlets:

- a. Catch basin spacing shall be determined in accordance with the Gutter Flow Analysis (see form 2.1) with maximum inundation of shoulder and travel lanes not to exceed one half (1/2) of one lane width in each direction during a ten (10) year storm; in no case shall spacing exceed 300 feet between structures, where structures are piped together.
- b. Catch basins are required at intersections where grades may cause pockets.
- c. There shall be a minimum of two (2) catch basins in a cul-de-sac.
- d. The capacity of a catch basin in a sag location shall be determined by the hydraulic capacity of the grate inlet and shall include all flows associated with up-stream bypassing of catch basins as determined by the Gutter Flow Analysis. (See Appendix Pages II-19 thru II-21 & II-28 thru II-29.)
- e. A drainage area map is to be included delineating the sub-drainage areas and indicating the associated area in acres, showing pre and post development conditions.

2.3.5 Storm Sewer Analysis

- a. Storm sewers are to be sized to flow full with the maximum allowable headwater in structures limited to one (1) foot below the top of grate [at a ten (10) year storm] taking into consideration the possible effect of headwater in the next downstream structure (see form #2.2 & 2.3 - Storm Sewer System Design and Water Surface Analysis).
- b. Where a change in pipe size is required at a structure, the crowns of the pipes are to be aligned on grade.

2.3.6 Rainfall

- a. Rainfall intensities used for storm drainage design shall be taken from the U.S. Weather Bureau "Rainfall Intensity - Duration - Frequency Curves" for the Hartford rain gauge. A reproduction of these curves is included in the Appendix, Chart 2.
- b. Time of concentration shall be derived for all storm drains constructed and its value together with the storm frequency curve will determine the intensity of rainfall used in the rational formula. One acceptable criterion to determine time of concentration is to allow ten (10) minutes for the first inlet plus time in storm drains equals time of concentration. See Charts 3 & 4 to determine time of concentration.

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- c. Runoff coefficient, "C", for different classes of surfaces to be used in the rational formula.

Surface	Flat Less than 2%t	Rolling 2% to 10% -	Hilly <u>over 10%</u>
Pavement & Roofs	0.90	0.90	0.90
Drives & Walks	0.90	0.90	0.90
Gravel Pavement	0.90	0.90	0.90
Cultivated Land			
Clay & Loam	0.50	0.55	0.60
Cultivated Land			
Sand & Gravel	0.25	0.30	0.35
Woodlands & Forests	0.10	0.15	0.20
Meadows & Pasture land	0.25	0.30	0.35
Grass Area (Lawn)	0.30	0.35	0.40

A weighted runoff coefficient should be derived based on the above values for "C".

2.3.7 Detention Basin

Where required under section 2.3.1, the purpose of a detention basin is to store peak storm runoff and release this stored water at a controlled rate. Detention basins will be designed with an emergency spillway to direct overflow safely over the basins when storms exceed the design storage capacity.

Spillway and detention basin will be designed to be consistent with South Windsor Flood Management Plan (1991). Release rate will be equivalent to what existed before development took place and shall be capable of reducing peak flow for storms with return frequencies of 2, 10, 25 and 100 years after development to what the runoff would be before development occurred for a rainfall of 24 hour duration, Type III distribution and antecedent moisture condition II (TR-20).

The procedure for computing the outflow from detention areas shall consist of the development of synthetic hydrographs and routing of these hydrographs through the detention basin. If a significant amount of runoff (as determined by the Town Engineer) is not controlled by the on site detention, a composite hydrograph will be required, correlating the outflow from the detention structure and the uncontrolled runoff.

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Designer will provide the following information:

- a. Input information i.e., time of concentration calculations runoff calculations, etc.
- b. Inflow and outflow hydrographs for detention areas. (Either numeric or graphic)
- c. Maximum storage volume.
- d. Design of spillway or other measures for the release of excess flows beyond that of the design capacity of the structure.
- e. Flood routing of all runoff greater than the design capacity of the detention facility.
- f. Time which is required for the facility to drain to the pre storm discharge elevation.
- g. Materials used in construction of the facility.
- h. Methods employed to avoid clogging the discharge structure.
- i. Safety measures. Top of detention basin will be constructed one (1) foot above level of stormwater consistent with So. Windsor Floodplain Management Plan.
- j. Proposed landscaping and vegetative measures used to stabilize slopes and bottom surfaces.
- k. Maximum water surface elevation for the 2,10,25 and 100 year storms.

Maintenance roads and easements shall be provided for all permanent facilities. The road shall be as a minimum, ten feet wide, having filter fabric under at least eight inches of rolled gravel subbase and four inches of topsoil, seeded and fertilized on top of the gravel. The gradient shall not exceed eight percent. When a raised manhole is located within the "roadway", the roadway shall be widened to provide sufficient room for vehicles to pass on both sides of the structure. This may require additional easement beyond the twenty (20) foot requirement.

2.3.8 Additional Channel Analysis

The Town may require further hydraulic analysis upstream and/or downstream of a proposed development if there may be adverse impacts to the drainage system due to increases in stormwater volume, changes in peak flow rate or timing, and/or changes in flood storage. Such analysis may include upstream and/or downstream routing of flow hydrographs, calculations of water surface elevations, scouring or erosion potential flood stage elevations and flood storage volumes.

2.4.0 Channel Right-of-Way

Where a right-of-way or drainage easement is offered to the Town along a drainage channel or brook for maintenance, the width shall be sufficient to include a fifteen (15) foot access strip in addition to the width of the channel or brook from bank top to bank top for access purposes.

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2.5.0 Drainage Easements

Drainage easements, outside of street lines, shall be twenty (20) feet wide centered on the storm drain. Easements for outlet pipes shall extend to a suitable existing storm drain or an adequate natural watercourse. It is the responsibility of the developer to acquire these easements. For excavations deeper than 8 feet to flow line or when pipe size exceeds 30" diameter, wider easements may be required. If center of pipe is not in center of easement, the easement shall be at least 8 feet from the centerline of pipe.

Maintenance roads and easements shall be provided for all permanent facilities. The road shall be as a minimum, ten feet wide, having filter fabric under at least eight inches of rolled gravel subbase and four inches of topsoil, seeded and fertilized on top of the gravel. The gradient shall not exceed eight percent. When a raised manhole is located within the "roadway", the roadway shall be widened to provide sufficient room for vehicles to pass on both sides of the structure. This may require additional easement beyond the twenty (20) foot requirement.

2.6.0 Intersection Drainage

Where a development street joins an existing Town street, the developer must provide drainage at the intersection as necessary, or as directed by the Town Engineer.

2.7.0 Private Drains

The size and location of all private storm and foundation drains that connect to the Town storm drain system shall be approved by the Town Engineer prior to installation; however, the Town will not be responsible for the private storm and foundation drainage system in the event of any failure. Conduits for underdrain or foundation drain shall not be less than four (4) inches in diameter. Where these drains are combined with each other or with roof drains, the resultant combination drain conduit shall not be less than six (6) inches in diameter. All pipes shall be PVC SDR-35.

Cellar or foundation drains that are connected to the storm drainage system must be shown on the final "as built" plan with ties on both plan and profile sheets.

All private drains that connect to the Town storm drain system shall be connected at a structure (CB or MH) or with a clean out so they are accessible for inspection and maintenance.

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2.7.1 Foundation Drain Outlets

Foundation drain outlet pipes are required for all foundation drains. They may be connected to the storm water drainage system in the road or daylighted in the rear of the property. A foundation drain may be outletted to daylight on a property only if there is no lot to lot drainage impacts.

If a foundation drain outlet is to be connected to the storm drainage system and the invert of the pipe at the building is below the top of frame elevation of the nearest catch basin, a backwater valve will be required. The Developers Engineer should evaluate the existing storm drain system on a case by case basis, to determine if a backwater valve is necessary. All foundation drains should match the crown of the existing pipe in the Town storm drain system.

Backwater valves can be installed either inside or outside the building. In either case, access must be provided to the valve and the access shall meet the current building code that addresses this issue. Backwater valves shall not be placed in catch basins. Details of the backwater valve and access structure must be submitted to the Town Engineer for review and approval. The developer/contractor must notify the Town's Engineering Department for inspection of the backwater valve and access structure installation. At least 24 hour notice is required to schedule inspections.

2.7.2 Roof Leaders

Roof leaders may be allowed to splash on the ground only if there is no impact on lot to lot drainage. The connection of roof leaders to the foundation drain outlet pipe must take place a minimum of five (5) feet away from the building foundation wall.

2.8.0 Stormwater Treatment

Sedimentation structures shall be placed at the last structure prior to discharge into an existing water course or wetland area. Details and specifications of designed sedimentation structures must be submitted to Town staff for review and approval.

Secondary stormwater treatment practices such as sedimentation structures should be designed in conjunction with other primary stormwater treatment practices to achieve the 80 percent total suspended solids (TSS) removal goal as adopted by the State of Connecticut, Department of Environmental Protection in the 2004 Connecticut Stormwater Quality Manual (or latest edition).

2.9.0 Stormwater Wetlands

2.9.1 Sizing of Stormwater Wetlands

Treatment volume is a necessary but not a sufficient condition for achieving reliable levels of urban pollutant removal in a stormwater wetland. For this reason, the designer must design a stormwater wetland to meet seven basic sizing criteria. The precise sizing criteria for each of the four stormwater wetland designs are detailed in Table 2.9-1.

- 2.9.1.1 Minimum Treatment Volume (V_t): The wetland must contain a treatment volume (V_t) that is capable of capturing the runoff generated by 90% of the runoff-producing storms in the region on an annual basis. The pollutant removal capability for any stormwater wetland is limited by how much stormwater runoff is bypassed from the wetland without treatment. This is termed the capture efficiency. An indication of the capture efficiency of a wetland can be based on the regional rainfall frequency spectrum. It is the opinion of the CTDEP that a BMP capable of treating the runoff from a 1.25 inch storm is capable of meeting the design criteria of capturing and treating at least 90% of all storm events within a BMP. The 90% storm event sizing criteria is recommended as target capture efficiency because it can be achieved in the field. A higher design criteria, such as the 99% storm event, would require the treatment of a much higher amount of runoff.

The treatment volume (V_t) can be quickly derived once the maximum rainfall volume has been selected (1.25 inches), using the relationships between site imperviousness and the storm runoff coefficient. The storm runoff coefficient (R_v) has been shown to be equivalent to:

$$(1) \quad R_v = 0.05 + .009 (I)$$

where I = percent site imperviousness

Thus, the required treatment volume for a site will be equal to:

$$(2) \quad V_t = [(1.25) (R_v)(A)/12] (43,560)$$

where V_t = treatment volume in cubic feet

R_v = storm runoff coefficient

A = contributing area (acres)

Using equation (2), it is evident that V_t will be larger for a more impervious site than a lower impervious site. It is strongly suggested that a minimum V_t of 0.25 watershed-inches be established for all sites.

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The value of the RFS approach is threefold. First, it sets an objective criteria for the treatment of runoff volume, based on the probable capture efficiency of the wetland. Second, the treatment volume for a site increases with the percentage of site imperviousness. Third, the RFD approach allows one to calculate the residence times for smaller storms with the wetland system. For example, 50% of all runoff-producing storms are one-third of the treatment volume. As a consequence, these smaller storms only partially displace the treatment volume of the wetland, and therefore have residence times of up to three storm events before they exit the wetland (this can translate to 1 to 3 weeks). This greatly enhances the pollutant removal capability of the stormwater wetland providing, of course, that an adequate flow path exists.

- 2.9.1.2 Surface Area Requirement: The wetland must have minimum surface area in relation to the contributing watershed area. Generally, the pollutant removal capability of a stormwater wetland becomes more consistent when the wetland to watershed area ratio exceeds 2.0% (Nichols, 1983, Strecker et al, 1992). The reality of pollutant removal also tends to increase as the wetland to watershed ratio increases although the relationship is not always consistent.

Thus, it is recommended that a minimum wetland to watershed ratio of 2.0% be used to size the surface area of Shallow Marsh wetlands (Design No. 1). A smaller ratio of 1.0% can be justified in the case of Pond/wetlands and ED/wetlands (Designs Nos. 2 and 3), as the pool and extended detention treatment storage components partially substitute for shallow wetland areas. For pocket wetlands, a 1.0% wetland to watershed area ratio is recommended as a target. However, this criteria may not always be feasible at some sites, and might be waived if the pollutant removal capability of alternative BMPs is expected to be lower.

- 2.9.1.3 Depth/Area Allocation: The allocation of surface area within the wetland must meet targets for certain depth zones. This is important for a number of reasons. Foremost, it is used to achieve the maximum surface area to volume ratio possible within the wetland, by creating a series of depth zones that will produce "microtopography". The target allocations for each of the four stormwater wetland designs as shown in Table 2.9-1. Four basic depth zones are possible: deep water, low (lo) marsh, high (hi) marsh and semi-wet areas. The deep water areas can be further broken down to the three components-forebays, micropools and deepwater channels. In all cases, the deepwater zones are from 1.5 to six feet deep, and support little emergent vegetation (but may support submerged or floating aquatic vegetation),

The lo marsh zone ranges from 18 to 6 inches below the normal pool, and the hi marsh zone ranges from six inches below the pool up to the normal pool. Generally, the hi marsh zone will support greater density and diversity of emergent wetland plants than the lo marsh zone, and should possess a higher surface area to volume ratio, as well. As shown in Table 2.9-1, the recommended target allocation is to create at least as much hi marsh as lo marsh.

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The semi-wet depth zone refers to those areas above the permanent pool that are inundated on an irregular basis, but can still be expected to support wetland plants. The semi-wet zone is usually greatest in area in the ED Wetland System (Design No. 3), where water elevations can increase 2 to 3 feet during storms.

The depth/area allocations shown in Table 2.9-1 are intended only as general targets, and are not meant to be inflexible standards. They are useful in obtaining a range of depths within the wetland to increase the SA/V ratio, create sheetflow conditions, and generally increase the internal structural complexity of the stormwater wetland systems. In so doing, the designer can improve the reliability of pollutant removal and also increase the diversity of the emergent plant community

- 2.9.1.4 Treatment/Volume Allocation: The allocation of the treatment volume within the wetland must meet targets for the depth components of the wetland. General targets for allotting the total treatment volume (V_t) among the three basic treatment methods are shown in Table 2.9-1 and these are used to illustrate the relative dominance of permanent pool, shallow marsh and extend detention storage within the four wetland designs. As with the previous criteria, these allocations represent targets rather than standards, and are used to apportion the three basic treatment methods to maximize removal efficiency.
- 2.9.1.5 Flow Path Length: The wetland must meet a minimum standard for the internal flow path through the wetland. The next sizing criteria is intended to create the longest possible flow path through the wetland system, and thereby increase contact time over the surface area of the marsh. The effective flow path can be maximized in two ways:
- a. By increasing the length to width ratio of the entire wetland design. The length to width ratio is computed by dividing the straight line distance from the inlet to the outlet by the average width of the wetland. As a general rule, the length to width ratio in a stormwater wetland should be greater to or equal to 1, to prevent short circuiting. The ratio can be increased by constructing internal berms within the wetland, so as to increase the effective distance from the inlet to the outlet.
 - b. By increasing the dry weather flow path within the wetland to attain maximum sinuosity. This can be accomplished by placing wedges of hi marsh perpendicular to the flow path, as shown in Figure 2.9-2. The hi marsh wedges act as submerged berms, and add to the length to width ratio of the stormwater wetland during non-storm periods. This can be important as 50% of all storms may reside in the wetland for 2 to 3 storm cycles before they are completely displaced.

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The design criteria for stormwater wetlands is to achieve a dry weather flow path of 2:1 or greater, using both techniques. A shorter flow path may be allowable for pocket wetlands, given the limited ability to manipulate geometry within the smaller surface areas of these sites.

- 2.9.1.6 **Dry Weather Water Balance:** The water supply to the wetland must be greater than the expected loss rate through evaporation, infiltration, and plant transpiration (so that water elevations can be maintained). An adequate dry weather water balance must be confirmed for stormwater wetland Designs 1 to 3. This entails measurement of the incoming baseflow to the wetland, as well as soil borings to determine the elevation of the water table and soil permeability rates. These data can then be converted into common units to determine if the water inputs (inflow and groundwater) are greater than water losses (by infiltration and evaporation). Since this is a dry weather scenario, stormflow inputs to the wetland should be ignored. Infiltration losses depend on the underlying soil type, and may be significant if the wetland is located above karst, fractured bedrock or gravely sands. At these sites, the infiltration losses can be set to zero if a clay or geotextile bottom liner is employed. A pan evaporation rate of 2 inches per day can be used to estimate this loss term.

A general rule of thumb is that a baseflow of 0.002 cfs per acre is needed to maintain water elevations in a stormwater wetland during dry weather, assuming that infiltration losses are minor.

- 2.9.1.7 **Extended Detention Volume:** The design of extended detention (ED) wetlands involves unique sizing rules. In general, the design standards for the ED wetland are as follows:
- a. **Detention Volume:** The volume of extended detention (ED_v) will be no more than 50% of the total treatment volume (V_t).
 - b. **Detention Time:** The target ED detention time for this volume will be 12 to 24 hours.
 - c. **Weir Design:** The use of V-shaped or proportional weirs at the outlet is encouraged to assure a constant detention time for all storm events.
 - d. **Filling Time:** Extended detention is defined here as the retention and gradual release of a fixed volume of runoff (ED_v). For ED wetlands less than 100 acres in size, the ED_v can be assumed to fill instantaneously.
 - e. **Reversed Flow Pipe:** If a reverse-sloped pipe is used for the outlet, the actual diameter of the orifice should be increased to the next greatest diameter on the standard pipe schedule, since the pipe will be equipped with a gate valve.
 - f. **Protection against clogging:** the ED orifice must be well protected from clogging. A reverse-slope submerged orifice or a perforated half-round hood over broad rested weir are the recommended options (see figure 2.9-3).

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- g. Water Elevation: The maximum ED water surface elevation should not be greater than three feet above the normal pool of the wetland. Higher ranges in ED water surface elevations are routinely used in conventional ED ponds, however, these cannot be used in wetland applications. The large and frequent changes in water level are not conducive to the growth of dense or diverse stands of emergent wetland plants.

- 2.9.1.8 Other Design Criteria for Stormwater Wetlands: The sizing criteria presented here exclusively refer to the design of wetlands for stormwater quality control. Most stormwater wetlands must also have the capacity to provide stormwater quantity control i.e., control of the post-development two year peak discharge to pre-development rates. Different (and more complicated) hydrologic and hydraulic models are required to meet these criteria.

Table 2.9-1 Sizing Criteria for Stormwater Wetlands				
Sizing Criteria	Design No.1 Shallow Marsh	Design No. 2 Pond/ Wetland	Design No. 3 ED (Extended Detention Wetland	Design No.4 Pocket Wetland
Runoff Treatment Volume (Vt)	Capture 90% of the Annual runoff volume from site; $V_t = (1.25 \text{ inches}) (\text{Runoff Coefficient}) (\text{Site Area})$. Minimum Vt of 0.25 watershed-inches.			
Wetland to Watershed Area Ratio	0.02	0.01	0.01	0.01
Allocation of of Surface Area (%)	5 - Forebay 5 - Micropool 5 - Deepwater 40 - "Lo Marsh" 40 - "Hi Marsh" 5 - "Semi-Wet"	0 - Forebay 5 - Micropool 40 - Deepwater 25 - "Lo Marsh" 25 - "Hi Marsh" 5 - "Semi-Wet"	5 - Forebay 5 - Micropool 0 - Deepwater 40 - "Lo Marsh" 40 - "Hi Marsh" 10 - "Semi-Wet"	0 - Forebay 0 - Micropool 5 - Deepwater 50 - "Lo Marsh" 40 - "Hi Marsh" 5 - "Semi-Wet"
Allocation of Treatment Volume (%)	10 - Forebay 10 - Micropool 10 - Deepwater 45 - "Lo Marsh" 25 - "Hi Marsh" 0 - "Semi-Wet"	0 - Forebay 10 - Micropool 60 - Deepwater 20 - "Lo Marsh" 10 - "Hi Marsh" 0 - "Semi-Wet"	10 - Forebay 10 - Micropool 0 - Deepwater 20 - "Lo Marsh" 10 - "Hi Marsh" 50 - "Semi-Wet"	0 - Forebay 0 - Micropool 20 - Deepwater 55 - "Lo Marsh" 25 - "Hi Marsh" 0 - "Semi-Wet"
Flow Path a. length to width ratio b. dry weather path	1.0:1.0 2.0:1.0	1.0:1.0 2.0:1.0	1.0:1.0 2.0:1.0	N/A 2.0:1.0
Water Balance	Confirm inflow rate > 0.002 cfs/acre, compute water balance during dry weather			Confirm dry weather water table elevation in field
Extended Detention	Not Employed	Not Employed	EDv=50% of Vt 12 to 24 hrs ED range ≤ 3 ft.	Not Employed

(Source: Modified from Schueler, 1992c)

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2.9.2 Maintenance

Operation and maintenance requirements similar to those for wet ponds should be expected. Studies of mine sites reclaimed as wetlands have shown that monitoring of up to five years can be needed to evaluate the success of vegetation in the wetland. Few, if any, created wetlands systems for stormwater treatment have been in place for more than 5 to 10 years. Therefore, there is little information available to suggest what frequency of maintenance may be required. Some guidance documents suggest that plant biomass should be harvested annually. However, valid documentation to support this recommendation is lacking (Fugro-McClelland, 1992). Where constructed wetlands have been used in reclamation projects, removal of accumulated sediment at intervals of 5-10 years has been found to be necessary. In cases where the created wetland is not preceded by a pre-treatment device to remove sediments, the frequency of routine sediment removal will be increased. Because such sediment removal activities will disrupt the wetlands system and require re-establishment of vegetation, some type of pre-treatment to remove sediments (e.g. sediment forebays, sediment basins, wet ponds) should be utilized.

Maintenance activities are expected to include:

- Clean up of litter and debris from the wetland.
- Periodic inspection of inlets and outlets for clogging and other functional problems.
- Maintenance of embankment vegetation and periodic stabilization of any eroded areas.
- Clean-out and other routine maintenance of pre-treatment measures as needed (at least once a year).
- A stormwater facilities operation and maintenance plan must be submitted for review with each new proposed development. This must include annual inspection, maintenance and reporting of stormwater facilities.

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SECTION II - STORM SEWERS

APPENDIX

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Procedure for Gutter Flow Analysis

1. Inlet Station - Identify inlet by station and location from centerline.
2. Time to Inlet - Time required for surface flow to concentrate at inlet.
3. Area in Acres - Area contributing runoff to inlet.
4. Runoff Coefficient (I) – Runoff Coefficient of area contributing to inlet.
5. AI - the Product of the area and the runoff coefficient.
6. Sum of AI - The sum of the AI bypassing the previous inlet(s).
7. Total of AI - The AI bypassing the previous inlet(s) and the AI for the inlet.
(#5 + #6 = #7)
8. Rainfall Intensity (R) - The intensity determined by the Time to inlet. (from chart 2)
9. Q to inlet - The product of the Total AI, (#7), and the Rainfall Intensity.
(#8) ($Q = AIR$)
10. Grade of Gutter - grade to be expressed in feet per foot.
11. Cross slope of Shoulder - slope to be expressed in feet per foot.
12. Depth of flow - depth of water at gutter. (from chart 1)
13. Width of flow - the width the water will flow in the shoulder or travelway.
14. Q Bypassing Inlet - the portion of flow that is beyond the width of the grate will be used to determine the bypass Q. No consideration will be given to the minimal amount that enters along the longitudinal edge of the grate.
15. AI Bypassing Inlet - determined by dividing the "Q bypassing the inlet," (#14), by Rainfall Intensity (#8)
16. AI entering system - the "Total AI," (#7), minus the "AI bypassing inlet." (#15).

Procedure for Storm Sewer System Design

1. Line Segment - Identification of line usually between inlets by stationing and offset.
2. Time to Inlet - Time for surface flow to concentrate for first inlet. If the area is such that it takes less than the minimum time of 5 minutes then 5 minutes shall be used until the accumulated time exceeds 5 minutes.
3. Time in pipe - time required to pass through line segment.
4. Accumulated Time - Time of concentration effective at location. The longest time is to be used. This can be overland flow to an inlet; accumulation of time in pipe; or a branch line entering a system.
5. AI entering Catch Basin - AI determined by "Gutter Flow Analysis Form".
6. Sum of AI in system - sum of the AI entering inlets effective at location.
7. Rainfall Intensity - The intensity determined by the Accumulated Time (4).
8. "Q" in system - The product of sum of AI in system, (7) and the Rainfall Intensity, (5).
9. Pipe size - self-explanatory.
10. Length of Pipe - self-explanatory.
11. Slope - to be expressed to the nearest thousandths of a foot.
12. Average velocity - that which will be obtained in pipe of size, type and slope specified at design discharge.
13. Full Capacity - discharge which can be carried by pipe of size and type specified flowing full.
14. Headwater - height water will reach above the flowline that will develop at the design discharge in the structure.
15. "n" - roughness Coefficient

Capacity of Grate Inlets in a SAG

A grate inlet in a sag operates first as a weir having a crest length roughly equal to the outside perimeter (P) along which the flow enters. Bars are disregarded and the side against the curb is not included in computing P. Weir operation continues to a depth (d) of about 0.4 foot above the top of grate and the discharge intercepted by the grate is:

$$Q_i = 3.0 P d^{1.5} \quad (1)$$

Where Q_i = rate of discharge into the grate opening in cubic feet per second

P = perimeter of grate opening, in feet, disregarding bars and neglecting the side against the curb.

d = depth of water at grate, in feet

When the depth at the grate exceeds about 1.4 feet, the grate begins to operate as an orifice and the discharge intercepted by the grate is:

$$Q_i = 0.67A (2gd)^{0.5} = 5.37AD^{0.5} \quad (2)$$

Where Q_i = rate of discharge into the grate opening, in cubic feet per second

A = clear opening of the grate in square feet

g = acceleration of gravity, 32.2 feet per second

d = depth of ponded water above top of grate, in feet

Between depths over the grate of about 0.4 and about 1.4 feet the operation of the grate inlet is indefinite due to vortices and other disturbances. The capacity of the grate is somewhere between that given by equations (1) and (2).

Because of the vortices and the tendency of trash to collect on the grate the clear opening or perimeter of a grate inlet should be at least twice that required by equations (1) and (2) in order to remain below the design depth over the grate. Where danger of clogging is slight a factor of safety less than two might be used. If a combination inlet is used, the grate need only be as large as given by equations (1) and (2) because the curb opening provides the safety factor from clogging.

Equations (1) and (2) can be solved graphically with the following charts. (Chart 5)

The dashed lines represent the range where neither weir nor orifice operation is fully effective.

Inlet-Control Nomographs

Instructions for Use

1. To determine headwater (HW), given Q , and size and type of culvert.

a. Connect with a straightedge the given culvert diameter or height (D)

and the discharge Q , or $\frac{Q}{B}$ for box culverts; mark intersection of

straightedge on $\frac{HW}{D}$ scale marked (1).

b. If $\frac{HW}{D}$ scale marked (1) represents entrance type used, read $\frac{HW}{D}$ on

scale (1). If another of the three entrance types listed on the

nomograph is used, extend the point of intersection in (a) horizontally

to scale (2) or (3) and read $\frac{HW}{D}$.

c. Compute HW by multiplying $\frac{HW}{D}$ by D .

2. To determine discharge (Q) per barrel, given HW , and size and type of culvert.

a. Compute $\frac{HW}{D}$ for given conditions

b. Locate $\frac{HW}{D}$ on scale for appropriate entrance type. If scale

(2) or (3) is used, extend $\frac{HW}{D}$ point horizontally to scale (1).

c. Connect point on $\frac{HW}{D}$ scale (1) as found in (b) above and the

size of culvert on the left scale. Read Q or $\frac{Q}{B}$ on the

discharge scale.

d. If $\frac{Q}{B}$ is read in (c) multiply by B (span of box culvert) to find Q .

Inlet Control Nomographs - Instructions for Use (Cont.)

3. To determine culvert size, given Q, allowable HW and type of culvert.
 - a. Using a trial size, compute $\frac{HW}{D}$.
 - b. Locate $\frac{HW}{D}$ on scale for appropriate entrance type. If scale (2) or (3) is used, extend $\frac{HW}{D}$ point horizontally to scale (1)
 - c. Connect point on $\frac{HW}{D}$ scale (1) as found in (b) above to given discharge and read diameter, height or size of culvert required for $\frac{HW}{D}$ value.
 - d. If D is not that originally assumed, repeat process with a new D.

Outlet-Control Nomographs

Instructions for Use

Outlet control nomographs solve the equation $H = [1 + K_e + 29n^2L/r^{1.33}]v^2/2g$ for head H when the culvert barrel flows full for its entire length. They are also used to determine head H for some partfull flow conditions with outlet control. These nomographs do not give a complete solution for finding headwater HW , since they only give H in the equation $HW = H + h - LSo$.

1. To determine head H for a given culvert and discharge Q .

- a. Locate appropriate nomograph for type of culvert selected. Find k_e for entrance type. .
- b. Begin nomograph solution by locating starting point on length scale. To locate the proper starting point on the length scales follow instructions below:
 - (1) If the n value of the nomograph corresponds to that of the culvert being used, select the length curve for the proper k_e and locate the starting point at the given culvert length. If a k_e curve is not shown for the selected k_e , see (2) below. If the n value for the culvert selected differs from that of the nomograph, see (3) below.
 - (2) For the n of the nomograph and a k_e intermediate between the scales given, connect the given length on adjacent scales by a straight line and select a point on this line spaced between the two chart scales in proportion to the k_e values.
 - (3) For a different roughness coefficient n than that of the chart n , use the length scales shown with an adjusted length L_1 , calculated by the formula

$$L_1 = L[n_1/n]^2$$

- c. Using a straightedge, connect point on length scale to size of culvert barrel and mark the point of crossing on the "turning line".
 - d. Pivot the straightedge on this point on the turning line and connect given discharge rate. Read head in feet on the head (H) scale. For values beyond the limit of the chart scales, find H by solving the equation $H = [1 + K_e + 29n^2L/r^{1.33}]v^2/2g$
2. Values of n for commonly used culvert materials.

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SECTION III - SANITARY SEWERS
DESIGN GUIDELINES

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TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

SECTION III - SANITARY SEWERS

DESIGN GUIDELINES

3.1.0 Specification for Sanitary Sewer Improvements

All Sanitary Sewer construction materials and procedures shall conform to the requirements of the State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004 as amended and these Town of South Windsor Public Improvement Specifications and Water Pollution Control Authority Regulations.

3.2.0 Special Sanitary Structures

Details of special or unusual sanitary structures shall be submitted to the Town Engineer for review and approval before construction.

3.3.0 Sanitary Sewer Design Criteria

3.3.01 Flow Determinations: Average daily flow and peak flow for domestic, commercial and industrial generators are to be based on engineering documentation.

The following values of "N" roughness coefficient have been adopted for use with Manning Formula:

Description	Roughness Coefficient "N"	
New Sanitary Sewers	RCP	.015
	Ductile	.013
	PVC	.010
Existing Sewers	PVC	.011
	RCP	.015

3.3.02 Minimum Slopes for Sewers: Minimum slopes shall insure that the velocity is greater than or equal to 2.0 fps with the pipe flowing full and/or 2.5 fps in the upper reaches of sewers. Sewer mains shall generally be laid to not less than 0.5% slope. Building sewer shall be laid to a reasonable straight line and preferably at not less than 2% grade (1/4" per foot) except that where this is impractical or where a hardship would be created by such a grade the pipe may be laid to a grade of not less than 1% (1/8" per foot).

3.3.0 3 Proposed sewers will be designed to provide the required capacity (peak flow, infiltration and other wastewater) to handle all projected flow from upper waste shed based on current zoning.

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- 3.3.04 Sewers will be laid at a minimum depth and no less than a minimum slope to insure that residences will receive basement service without the need for individual wastewater pumps. Sewers located in the right-of-way or low areas shall be constructed at depth with no less than four (4) feet of cover. Building sewers shall be constructed with a minimum of 3'-0" cover using PVC pipe. Special cases will be reviewed on an individual basis.
- 3.3.05 Manholes shall be laid in the center of pavement when the sewer is under roadway.
- 3.3.06 Minimum size of pipe for sanitary sewer is eight (8) inches, inside diameter. Minimum size pipe for building sewers is six (6) inches inside diameter. Pipe shall be as a minimum SDR 35 PVC Pipe.
- 3.3.07 Manholes will be provided at all sewer junctions, changes in direction and changes in grade.
- 3.3.08 Manhole spacing shall not exceed 300 feet.
- 3.3.09 Manholes not in pavement areas shall have locking rims set above grade a minimum of 2", and maximum of 4", to avoid stormwater inflow. Water tight covers shall be used as directed by Town Engineer (See STD Detail).
- All manholes shall be constructed to be watertight so as to prevent infiltration. The Contractor shall plug and grout all lifting holes outside and inside the structure. All joints between sections shall be mortared smooth inside.
- Vented manhole covers shall only be used at high point in sewer line and every 900 feet.
- 3.3.10 Commercial/Industrial Sites
- a. A manhole is required in the building sewer between the building and the main sanitary sewer line located within the Town Right of Way for all buildings located in an Industrial or Commercial Zone.
 - b. If the waste discharge is greater than 5,000 gallons per day, or if discharge involves industrial process wastewater, then a DEP discharge permit will be required.
 - c. Use of public sewers, physical and chemical limitations are defined by the rules and regulations of the Water Pollution Control Authority.
- 3.3.11 Pressure Sewer System
- a. Pipe utilized in pressure sewer systems shall be SDR 21, Schedule 40 or Schedule 80.

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- b. Check valve and isolation ball or gate valve shall be provided on each pressure system prior to the connection to a mainline or common collector line.
 - c. Cleanouts shall be spaced at every 400 to 1000 feet for straight sections and at every change in pipe direction of 45° or greater, or per manufacturer's recommendations.
 - d. Pipe shall be placed below frost line.
 - e. Provisions to connect to an external emergency power supply shall be provided for each pressure/pump installation.
 - f. A pressure sewer system design must be submitted prior to a building permit application, for review and approval by the Town Engineer.
- 3.3.12 Sewer Easements outside of street lines, shall be twenty (20) feet wide centered on the sanitary sewer main. For deep excavations (deeper than 8 feet to flow line), wider easements may be required. It is the responsibility of the developer to acquire these easements. For "Cross Country" sewer lines, a maintenance road ten (10) feet wide shall be provided. This roadway shall consist of filter fabric under at least eight inches of rolled gravel subbase and shall provide sufficient support for typical Town of South Windsor maintenance vehicles. Four inches of topsoil, seeded and fertilized, shall be placed on top of the gravel. When a raised manhole is located within the "roadway", the roadway shall be widened to provide sufficient room for vehicles to pass on both sides of the structure. This may require additional easement area beyond the twenty (20) foot requirement.
- 3.4.0 Testing
- 3.4.01 All sanitary manhole inverts shall be built prior to any testing.
- 3.4.02 Cleaning sewer: upon completion of a sewer line, and prior to performing air and deflection tests, the entire sewer, including manholes, shall be cleaned of all debris. No flushing water or debris shall be discharged to the existing sanitary sewer system.
- 3.4.03 Low pressure air testing of sanitary sewer lines shall be accomplished as described in the appendix to this section. All sanitary sewer mainlines shall be tested. Individual building laterals shall be tested as required by the Public Health Code.
- 3.4.04 In addition to air testing, a deflection test shall be performed on all gravity sewer mains. A mandrel shall be passed thru the pipe to determine the amount of deflection existing. A maximum of 7 1/2% is allowed. If the pipe fails to meet this standard, the pipe shall be repaired or replaced as necessary. The sewer system will not be deemed acceptable until these standards are met. The mandrel used shall be a rigid "Go-No-Go" device.
- 3.4.05 High pressure water testing of sanitary sewer force lines shall be accomplished as described in the appendix to this section.

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- 3.4.06 Vacuum testing of sanitary manholes shall be required in areas with a high water table, or if after construction, infiltration is observed as determined by the Town Engineer or Inspector. Testing shall be accomplished as described in the appendix to this section.

3.5.0 Connection to Existing Mains

Newly installed sanitary sewer systems connected to an existing Sanitary Sewer Main shall not be used and shall be plugged and the plug chained to the stairs or otherwise secured until the following activities are accomplished:

- all air testing and mandrel testing meeting these standards have been completed.
- an occupied facility is connected to the new line.
- the new line is cleaned out (flushed).

3.6.0 Drop Inlets

All drop inlets shall be outside drop inlets. Inside drop inlets will only be allowed by special exception and the approval of the Town Engineer and WPCA/ Superintendent of Pollution Control.

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SECTION III - SANITARY SEWERS
APPENDIX

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APPENDIX - SECTION III

Low Pressure Air Test

General: Sewer lines shall be tested for leakage using low pressure air as specified herein. Tests will be made after the pipe installation is complete, including all laterals, manholes, and backfill in the trench has been placed and compacted or consolidated as required by the Engineer. This test shall be completed before any bituminous pavement is in place and after all utilities under the roadway have been constructed.

The Contractor is required to provide all equipment, test plugs in the required sizes, appurtenances, connecting hose or pipe, labor and materials necessary to conduct and control the low pressure air test.

The tests may be conducted by the Contractor using his own equipment, or a subcontractor approved by the Engineer. All equipment proposed for use in conducting the low pressure air test shall be subject to the approval of the Engineer.

All tests shall be conducted on the completed sewer pipeline between manholes. Testing of shorter sections of pipeline will only be permitted with the approval of the Engineer.

All gages, controls, and appurtenances for equipment used to conduct the test will be located out of manholes.

No one will be permitted in a manhole containing a test plug while air is under pressure in the pipeline being subjected to the test.

Procedure: The Town shall determine the elevation of the ground water table in the area of the pipeline being subjected to the low pressure air test.

When the prevailing groundwater is above the sewer being tested, test pressure shall be increased 0.50 psi for each foot that the water table is above the invert of the sewer.

After cleaning and flushing the line, test plugs will be installed in the pipeline being subjected to the low pressure air test, and braced as necessary to secure the plugs in place.

Utilizing the approved equipment, air at low pressure will be slowly introduced into the pipeline until the pressure within the pipeline being tested increases to 4 PSIG above the back pressure due to the water table, or 4 PSIG if there is no back pressure to compensate for.

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Disconnect the supply air hose from the source of air, and allow the air pressure within the pipe being tested to drop to 3.5 PSIG above the back pressure due to the existing ground water table (or 3.5 PSIG if there is no water table). At this point, start measuring the time for the pressure in the pipeline to drop 1 PSIG, (or to drop to 2.5 PSIG if there is no back pressure due to a water table).

The time necessary to drop 1 PSIG shall not be less than that indicated in Table I for the size and length of pipeline being tested. If the time is less than that indicated in Table I, the line will be considered as having failed the test.

Any section of pipeline which fails to meet this test will be repaired or replaced as necessary by the Contractor, and retested, at no additional expense to the Town.

No sewer line will be considered acceptable until it successfully passes the requirements of this test.

All testing will be conducted by the Contractor or his approved subcontractor in the presence of a representative of the Town Engineer. The Contractor or his subcontractor shall keep a written record which will show the results of the tests conducted. The records should include sufficient data on length of line, pressure levels, time for pressure drop, and related features noted during the testing of each segment of the line. A copy of this record shall be given to the Town engineer.

TABLE I

MINIMUM TIME REQUIRED FOR A PRESSURE DROP OF 1 PSIG AS REQUIRED

IN LOW PRESSURE AIR TEST SPECIFICATION-MINUTES:SECONDS

(Based on 0.0015 CFM/SQ FT of inside surface area of pipe)

Pipe Dia. (in.)	Specification Time for Length (L) Shown (min:sec)				
	100 ft	150 ft	200 ft	250 ft	300 ft
6	5:40	5:40	5:40	5:40	5:40
8	7:34	7:34	7:34	7:34	7:36
10	9:26	9:26	9:26	9:53	11:52
12	11:20	11:20	11:24	14:15	17:05
15	14:10	14:10	17:48	22:15	26:42
18	17:00	19:13	25:38	32:03	38:27
21	19:50	26:10	34:54	43:37	52:21
24	22:47	34:11	45:34	56:58	68:22

Note: If lateral sewers are included in the test, their lengths may generally be ignored in computing required test times. In the event a test section, having a total internal surface area less than 625 square feet, fails to pass the air test when lateral sewers have been ignored, the engineer shall recompute the test time including all lateral sewers.

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High Pressure Water Test

Upon completion of the flushing of the completed force mains, and prior to the installation of the final surface treatment, the Contractor shall pressure test the main under the observance of the Town Engineer or the Town Inspector. Prior to making the test, all rods, clamps, thrust blocks, and other devices necessary to prevent blow outs shall be in place.

The test shall consist of filling the main with water, purging all air and raising the pressure in the main to twice the designed working pressure of the system or as directed by the Town Engineer. Upon reaching that pressure, the pump shall be stopped and the inlet valve closed. **ANY** drop in pressure during the next 2 hours shall be considered a failure of the test. Should the pipe fail to hold the required pressure for 2 hours, the leak shall be located, repaired, re-flushed and re-tested until it does hold the required pressure for the required time. The Contractor shall furnish all necessary equipment to complete the test.

Vacuum Testing of Manhole

Manholes shall be vacuum tested before construction of any manhole inverts and before installation of the frame and cover. The test shall be performed by a qualified technician using testing equipment manufactured specifically for the vacuum testing of manholes.

A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shall be shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches of mercury. The manhole shall pass the vacuum test if the time is greater than 60 seconds for 48 inch diameter manholes, 75 seconds for 60 inch diameter manholes and 90 seconds for 72 inch diameter manholes.

If any manhole fails to pass the vacuum test, then corrective work shall be performed, and the manhole shall be re-tested. Upon completion, all debris shall be removed from manholes and the table broomed. All leaks in manholes shall be caulked and completely repaired to the satisfaction of the Engineer or the entire structure shall be removed and rebuilt.

TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS
SECTION IV - UTILITIES, SIGNAGE
DESIGN GUIDELINES

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TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

4.1 Utilities

4.1.1 General

The utility companies that service the Town of South Windsor are as follows:

Electric:	Northeast Utilities (Connecticut Light & Power)
Gas:	Yankee Gas Service
Cable:	Cox Cable Company
Water:	Connecticut Water Co., MDC, Avery Heights Water Assoc., 8 th Utility District, Burnham Acres Water Assoc. & Hillsdale Water Company
Telephone:	SBC/AT&T

4.1.2 Design Guidelines

Utility poles shall be placed to allow a minimum of three (3) feet clearance between the pole and the face of curb. If this is not possible due to conflicts with other utilities or ROW issues, the Town Engineer shall approve the location of such poles prior to their placement.

Underground utility vault boxes shall not be placed on property corners. Locations shall be subject to approval by the Town Engineer.

The design of street lighting and other electrical requirements are the responsibility of Connecticut Light & Power and are to be coordinated with the Police Service Division. Their standards are described in their "Street and Security Lighting" publication.

Before any design is started, each of the other utility companies are to be contacted to obtain their standard guidelines.

4.1.3 Fire Hydrants

Specifications for fire hydrants are as follows: Model A423 5.25" Super Centurion 250 3-way Fire Hydrant manufactured by the Mueller Co. or approved equal. Hydrants shall be UL/FM approved and shall open left.

4.1.4 Coordination

The developer's Engineer is responsible for the coordination of all utilities and the inclusion of their facilities on any design drawings. The Engineer shall insure that no conflicts exist between the utilities and any other buried structures or pipes such as sanitary and storm sewers.

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4.2 Signage

- 4.2.1 Traffic Control signs for any subdivision, site plan, etc. shall be in accordance with the Town of South Windsor Police Department - Traffic Authority requirements and the Manual on Uniform Traffic Control Devices. It shall be the responsibility of the developer's Engineer to coordinate with the Traffic Authority.

4.2.2 Traffic Signs Specifications

Pole: 12 foot galvanized "rib bak" or flanged equivalent steel u-channel posts with tapered end. Three pounds per foot, 10 gauge.

Fastening Hardware: 5/16 inch 18 x 3 tap bolts, course, all thread zinc plated. 5/16 inch flat washers, zinc plated, 5/16 inch nuts, zinc plated.

Traffic Signs: Diamond grade or Microprismatic sign face on .80 gauge aluminum. Stop signs shall be 30 inches x 30 inches Diamond grade sign face on .80 gauge aluminum. All other traffic sign sizes to be determined by the Traffic Authority.

Placement: Pole installed minimum of two feet from curb with a minimum sign height of 6 and 1/2 feet to bottom of sign. Sign shall be mounted flush with top of pole. Locations per Traffic Authority.

4.2.3 Street Sign Specifications

Pole: 12 feet x 2 3/8 inches O.D. Round Aluminum poles .120 gauge.

Fastening Hardware: Flat blank steel sign post cap and cross separator (where two signs are specified) each flat blank sign bracket to be designed as follows:

Shall have holes drilled and tapped to accept 5/16 inch vandal proof set screws (standard set screws with pin), to lock in flat sign blanks into position. Sign post cap and separator to accept street sign 9 inches in height.

Street Signs: Street signs to be fabricated and installed as follows:

Sign blanks will be .125 inches thick flat aluminum, 9" in height and minimum of 24 inches in length, depending on the street name length with radius corners.

Background material will be white type 9 Diamond Grade, 3M or equivalent, applied to both sides of the sign blank.

Overlay material will be Worbouys green ElectroCut transparent overlay film, 3M series 1170 or equivalent, applied to both sides of sign blank.

Border will be white Diamond Grade, 3M or equivalent, 625 inches wide with .75 inch radius at four (4) corners applied to both sides of the sign blank.

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Fonts (street names) will be white Diamond Grade, 6 inches in height, School Book wide stroke font, all fonts in capitols. Road, street, drive, lane etc. to be two-letter abbreviation, white Diamond Grade, 3 inches in height, all fonts in capitols. Street name and road, drive etc. designation to be on the same line as street name. All fonts will be applied to both sides of the street sign blanks.

Special details such as a reduced 6 inch diameter exact replica of the Town Seal, preceding the street name on each side of each sign.

Placement: Pole to be located on left side of intersection. Pole to be installed a minimum four (4) feet from curb and positioned as close as possible to the intersection. Sign height to be approximately 7 ½ feet to bottom of lowest sign attached to pole. Sign length should be long enough to reasonably accommodate name of street.

TOWN OF SOUTH WINDSOR
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SECTION V - MISCELLANEOUS
DESIGN GUIDELINES

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TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

SECTION V - MISCELLANEOUS

DESIGN GUIDELINES

5.1.0 As-Built Drawings

Reproducible as-built drawings shall be provided to the Town upon completion of the work. These shall be drawn to A-2 & T-2 accuracy and shall have the original seal and signature of a Land Surveyor licensed in the State of Connecticut. The as-built information shall be as indicated on the Towns As-Built Checklists. The as-built drawings shall be a wash-off fixed line or original plot mylar (sepia mylars are not acceptable). In addition, an electronic file (AutoCAD format) of the as-built plan shall be provided to the Town.

5.2.0 Street Trees

5.2.1 Location

Shade trees shall be installed on both sides of all streets in accordance with the approved landscape plan. Trees shall be either massed or spaced evenly along the street or both, and shall be located within a street trees easement per Section 5.2.5, coordinated with utilities companies to ensure no trees are planted above utility lines.

5.2.2 Spacing

When trees are planted at predetermined intervals along streets, spacing shall depend on tree size, as follows:

Tree Size at Maturity (in feet)	Planting Interval (in feet)
Large trees (40+)	50-70
Medium trees (30-40)	40-50
Small trees (to 30)	30-40

When the spacing interval exceeds 40 feet, small ornamental trees can be placed between the larger trees. If a canopy effect is desired, trees may be planted closer together, following the recommendations of a certified landscape architect. The trees shall be planted so as not to interfere with utilities, roadways, sidewalks, sight lines, or street lights. Tree location, landscaping design, and spacing plan shall be approved by the Planning & Zoning Commission as part of the landscape plan.

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5.2.3 Tree Type

Tree type may vary depending on overall effect desired, but as a general rule, all trees on a street shall be the same kind to achieve special effects. Selection of tree type shall be approved by the Commission.

5.2.4 Planting Specifications

All trees shall have a minimum caliper of 2-1/2 inches and be of nursery stock quality, of substantially uniform size and shape, and have straight trunks. Trees shall be properly planted and staked and provision made by the applicant for regular watering and maintenance until they are established. Dead and dying trees shall be replaced by the applicant during the next planting season. See tree planting specifications in the appendix for additional requirements.

5.2.5 Street Trees Easement

All street trees will be located within an easement dedicated to the Town of South Windsor, that is at least ten feet in width, located directly adjacent to the street right-of-way. In the event that a utility company or other easement is located adjacent to the street R.O.W., the street trees easement shall be located adjacent to the utility company easement. Said easement will prohibit removal of street trees without the express written consent of the Public Works Director of the town. Maintenance of street trees will be the responsibility of the lot owner.

5.3.0 Police Services Construction Requirements

5.3.1 Developer is responsible for the purchase and installation of all street and traffic signs. All signs under the control of the town of South Windsor must conform to standards as published by the Town of South Windsor, Department of Public Works. All signs under the control of the State of Connecticut must conform to standards developed by the State of Connecticut, Department of Transportation. All signs will conform to the latest edition of the Manual on Uniform Traffic Control Devices. Street sign material may be purchased through the Town of South Windsor. All other traffic signs shall be purchased from an outside vendor.

5.3.2 Developer will submit three (3) maps of the proposed project for the purpose of identifying and positioning all traffic and/or street signs for review and approval. Any changes in roadway design will require new maps.

5.3.3 When the developer is ready to erect all required signs, contact should be made with the Department of Public Works, Street Services Division, who will arrange for a supervisor to locate each sign position. Each such sign position shall be located by use of a wooden stake. It will be the responsibility of the developer to have the sign(s) erected as required and to ensure that any and all underground utilities are identified so as not to injure any person during installation and maintenance or interfere with sign placement or future maintenance.

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- 5.3.4 Developer is responsible for the purchase of all street lighting through Northeast Utilities (NU). NU will review plans with the developer and suggest placement of all street lighting. Location, fixture and pole type, along with lumen output (watt size) are all subject to approval by the Town Traffic Authority (the Chief of Police or his designee). The developer is responsible for payment of all applicable fees to guarantee the minimum overhead rate to the Town. Once these fees have been paid, the town will assume the normal monthly charge for each light.
- 5.3.5 Any and all work to be conducted within the limits of a public highway or so close thereto, shall require review by the Town Traffic Authority (or his designee), prior to the work taking place, for the purpose of identifying necessary traffic control and safety measures.
- 5.3.6 Developer is required to erect and maintain, throughout the project, a sign identifying the name and/or title of the project. Such sign shall be clearly visible from the public highway. Developer is responsible to erect and maintain temporary street sign(s) throughout the project.
- 5.3.7 Developer must provide emergency 24 hour telephone numbers for the duration of the project on developers letterhead.
- 5.3.8 Developer shall ensure that all buildings located on property which abutt(s) a public highway are numbered. Barns, garages and outbuildings which are located on the same premises as a numbered structure are excluded.

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SECTION V - MISCELLANEOUS
APPENDIX

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PUBLIC IMPROVEMENT SPECIFICATIONS

TOWN OF SOUTH WINDSOR
CHECKLIST OF REQUIRED SUBMISSION DOCUMENTS
SUBDIVISIONS/RESUBDIVISIONS

APPLICANT _____

PROJECT NAME _____

This checklist must be signed by plan preparer (P.E./L.S) declaring that all required information is provided. Place a check mark for each item supplied.

Subdivision
Minor Regular

I. PROJECT-PLOT INFORMATION

A. General Information

- | | | | |
|----------|--|---|---|
| _____ 1. | Appl. & owner name, address | x | x |
| _____ 2. | Engineer & land surveyor name, address, license no. & seal | x | x |
| _____ 3. | Key map at 1" = 100' scale showing location of tract with reference to surrounding properties, streets, municipal boundaries, etc., within 500'. | | |
| | Key map must include: | x | x |
| _____ a. | Outline of buildings. | | |
| _____ b. | Layout of streets | | |
| _____ c. | Surrounding property boundaries-within 500 feet. | | |
| _____ d. | Names of abutting property owners. | | |
| _____ e. | Proposed open spaces and recreation areas. | | |
| _____ f. | Driveway cuts on abutting properties and any properties across from proposed site | | |

TOWN OF SOUTH WINDSOR
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		<u>Subdivision</u>	
		<u>Minor</u>	<u>Regular</u>
_____	g. Distance to and name of nearest intersection street.		
_____	4. A schedule of required and provided zoning district requirements including lot area, lot frontage, lot depth, yard setbacks, open space. variances granted, etc.	x	x
_____	5. North arrow and scale.	x	x
_____	6. Appropriate certification block.	x	x
_____	7. Date of original drawing and all revisions.	x	x
_____	8. Name of development.	x	x
B.	Plot plan at 1" = 40' scale on standard 18" x 24" or 24" x 36" sheets with a 1/2" ruled margin containing the following data. Developments which require more than two 24" x 36" sheets may submit the plot plan at 1" = 100' scale.	x	x
_____	1. Metes and bounds description showing dimensions, bearings, curve data, length of tangents, radii, arcs, chords, and central angles for all centerlines and rights-of-way, and centerline curves on streets. Monuments are required at corners and angles of all new streets and new street lines, at all points of curvature and tangency, and at critical corners and angles of all new Town open space. Coordinates for monuments shall be in tabular form.	x	x
_____	2. CGS datum shall be used on all subdivisions accessible to controls. The Town Engineer shall determine the accessibility of these controls.		
_____	3. Lot layout numbers, square footage of all lots, and all lot dimensions. Iron pins are required at all property angle points. No lots shall be divided on 2 sheets.	x	x
_____	4. Yard setbacks dimensioned.	x	x

TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

			<u>Subdivision</u>	
			<u>Minor</u>	<u>Regular</u>
_____ 5.	Easements, noting grantors, grantees and purpose. Must be shown in table format, e.g. below		x	x
_____ 6.	Development phasing, if proposed.		x	x
_____ 7.	Names of abutting property owners.		x	x
_____ 8.	Proposed street names (use approved list of names).		x	x
_____ 9.	All open space reserved for common or public uses.		x	x
_____ 10.	Appropriate A-2 certification & LS seals.		x	x

II Topographic map at same scale as plot plan containing all data included on the plot plan plus the following:

_____ 1.	All existing structures, streets, wetlands and watercourses, or other environmentally sensitive areas, including enough data beyond property boundaries to allow a reasonable evaluation of the property's ecological relationship to surrounding areas, 100 yr. floodplain.		x	x
_____ 2.	Existing and proposed contours to extend a sufficient amount beyond subject property, to determine the effects on the property as follows (town mapping): up to 3% grade: 1' contour interval 3% grade & over; 2' contour interval		x	x
_____ 3.	Boundary limits, nature, and extent of wooded areas, specimen trees, and other significant physical features.		x	x
_____ 4.	Existing system of drainage of subject site and of any larger tract or basin of which it is a part (can use Town stormwater study).		x	x

TOWN OF SOUTH WINDSOR
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		<u>Subdivision</u>	
		<u>Minor</u>	<u>Regular</u>
_____ 5.	Drainage area map.	*	x
_____ 6.	Drainage calculations	*	x
_____ 7.	Perc test data, preliminary indication of septic system feasibility if individual sanitary sewerage systems provided.	*	x
_____ 8.	Proposed utility infrastructure plans, including sanitary sewer, water, storm water management.	*	x
_____ 9.	Spot and finished elevations at all property corners, corners of all structures or dwellings, or proposed first floor elevations	x	x
_____ 10.	Construction details (per standard specs.)	*	x
_____ 11.	Road and paving cross-sections (per, standard specs).	*	x
_____ 12.	Proposed street names.	x	x
_____ 13.	Landscape plan and details.	x	x
_____ 14.	Site identifications signs, traffic control signs, and directional signs.	*	x
_____ 15.	Sight triangles at new road intersections.	*	x
_____ 16.	Sight triangles at driveway entrance (where there may be a question)..	x	x
_____ 17.	Vehicular and pedestrian circulation patterns (less detail necessary for preapplications, concept plan, and general plan of development.	*	x
III .	Plans and profiles (1" = 40' horizontally and 1" = 4' vertically) showing the following:		x
_____	a. Layout of streets in sections coordinated by stations with the profile.		x
_____	b. Street plan showing roadways, drainage, and partial lot lines		x

TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

Subdivision
Minor Regular

_____	c. Profile of roadway showing existing and finished grades, all tangent grades, and all vertical curve information		x
_____	d. Profile will show all catch basins and all drainage lines between catch basins with all invert and top of frame elevations. Drainage pipe material to be described.		x
_____	e. Typical/critical cross-sections where grading is outside street right-of-way or is at street right-of-way.		x
_____	f. Where any storm drainage line discharges into an existing brook, sufficient profile of this brook will be shown to determine conditions.		x
_____	g. Profiles shall show all sanitary sewer lines and manholes, including pipe material, elevations, sizes, lengths, and slopes of pipes. Top of foundation elevations for habitable buildings shall be shown.	*	x
_____ 15.	Traffic report (by traffic engineer)	*	*
_____ 16.	Open space site improvement plan.	*	x
_____ 17.	Architectural elevations/information per Sect. 4.20 of the zoning regulations		

* - if required by Town Engineer

ALL INFORMATION REQUIRED ABOVE IS INCLUDED IN THIS APPLICATION AT THE TIME OF SUBMISSION.

_____ Date _____
Plan Preparer (PE/LS)

February 2002

TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

TOWN OF SOUTH WINDSOR CHECKLIST
REQUIRED INFORMATION SITE PLANS

APPLICANT _____

PROJECT NAME _____

This checklist must be signed by plan preparer (P.E./L.S.) declaring that all required information is provided. Items 1-7 are required for all applications; items 8-11 required where appropriate.

Check mark for each item supplied.

- _____ 1. On each sheet for plans or maps, title block with the following information:
 - _____ a. Name, address and telephone of applicant.
 - _____ b. Name, address and telephone number of Land Surveyor or Professional Engineer.
 - _____ c. Name of Development.
 - _____ d. Date when drawings were made.
- _____ 2. Key Map: An overall map drawn to a scale of 1 inch equals either 100 feet or 200 feet. This map will show the overall design of the Development and surrounding property within 500 feet.
 - _____ a. Data block which gives needed zoning information such as percentage of lot coverage, acreage of tract, number of apartment units, parking requirements, etc.
 - _____ b. Outline of buildings.
 - _____ c. Layout of streets.
 - _____ d. Surrounding property boundaries-within 500 feet.
 - _____ e. Names of abutting property owners.
 - _____ f. Proposed open spaces and recreation areas.
 - _____ g. Driveway cuts on abutting properties and any properties across from proposed site.
 - _____ h. Distance to and name of nearest intersection street.
- _____ 3. Architectural Elevations: See attached checklist for Architecture and Design Review.

TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

_____ 4. Plot Plan: A layout map of the proposed site drawn to a scale of 1 inch equals 40 feet on either of the following size sheets: (1) 24" x 36" with a 3/4" ruled margin; (2) 18" x 24" with a 1/2" ruled margin, containing the following data:

_____ a. Distance and bearings of all boundary lines and acreage of site. Iron pins required at all property angle points and shown on map.

_____ b. Proposed streets and street lines with center line station, curve data, and parking spaces.

_____ c. Building lines in accordance with zoning regulations.

_____ d. Proposed buildings and other structures, including signs, outside lighting, and dumpsters (on concrete pad and screened).

_____ e. Easements, noting grantors, grantees, and purpose must be shown in table format, e.g. below

Grantor	Grantee	Type of Easement	Date Filed	Vol/Pg

_____ f. Names of abutting property owners.

_____ g. Monuments will be indicated at corners and angles of all streets and at all points of curvature and tangency. The monumented points within proposed site shall be coordinated. These coordinates shall appear in tabular form on the plot plan. The accessibility of these CGS points shall be determined by the Town Engineer.

_____ h. All open space or other common or public land uses shall be indicated.

_____ i. A-2 certification; P.E./L.S. Seal.

_____ 5. Topographic Map: A map drawn to a scale of 1 inch to 40 feet on sheets not exceeding 24 inches by 36 inches, including ruled margins shall in addition to the requirements of the plot plans show the following:

_____ a. All existing and proposed buildings.

_____ b. Curb Lines and pavement width, sidewalks.

_____ c. Existing and proposed sanitary sewers.

_____ d. Existing and proposed water and-all existing utilities.

_____ e. Present wooded area indicated by foliage lines. Any trees to be saved should be shown.

TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

- _____ f. Existing and proposed contours shall be shown in not less than two-foot intervals, but in cases of relatively level land, the contours shall be one-foot intervals and spot elevations.
- _____ g. Regulated wetlands and 100-year floodplain or note that none are present.
- _____ h. Proposed storm drainage system, showing all catch basins, endwalls, manholes, lengths and sizes of pipes and elevations of structures. (Maximum distance between catch basins shall be 300 feet and minimum size of storm drain lines shall be 15 inches, within Town ROW.) If plan/profile sheet is provided all of this does not need to be shown. Only top of frame elevations and inverts of open discharge pipe shall be shown on this plan.
- _____ i. Connections of all springs into proposed storm drainage system as needed.
- _____ j. Location and indications of existing brook channels, and 100-year flood limits.
- _____ k. A-2 & T-2 Certification; P.E & L.S. Seals.
- _____ 6. Landscaping plan
- _____ 7. Drainage calculations: - Zero Runoff Increase per attached guidelines.
- _____ 8. Traffic Report
- _____ 9. Site Lighting Plan
- _____ 10. Plans and Profiles: A plan and profile of the proposed streets drawn on plan/profile paper of scales 1 inch to 40 feet horizontally, and 1 inch to 4 feet vertically on sheets not exceeding 24 inches by 36 inches, including ruled margins and containing the following:
 - _____ a. Layout of streets in sections coordinated by stations with the profile.
 - _____ b. Street plan showing roadways, drainage, sanitary sewer (including house sewer), foundation drains, lot lines, buildings including all utilities with elevations (top frame and inverts), size, type, length, slopes of pipes.
 - _____ c. Sight line at driveway & street intersections.
 - _____ d. Profile of roadway showing existing and finished grades. Roadway profile will show all tangent grade and all vertical curve information.
 - _____ e. Profile will show all catch basins and all drainage lines between catch basins with all invert and top of frame elevations, sizes, lengths and slopes of pipes.

TOWN OF SOUTH WINDSOR
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- _____ f. Where any storm drainage line discharges into an existing brook sufficient profile of this brook will be shown to determine conditions.
- _____ g. CGS datum shall be used on all sites accessible to these controls. The Town Engineer shall, based on standard engineering practices, determine the accessibility of these controls.
- _____ h. Profiles shall show all sanitary sewer lines and manholes, including elevations, (inverts, top of frame) sizes, lengths, and slopes of pipes. Top of foundation elevations for building shall be shown.
- _____ 11. Open Space Site Improvement Plans: For sites which require or include a provision for open spaces, a plan which contains data for site improvement may be required. This map shall be drawn to a scale of 1 inch equals 40 feet.
- _____ 12. Sanitary Report: Where individual sanitary sewage disposal systems are proposed, the final plans shall include a Sanitary Report certified by a Professional Engineer. The report shall demonstrate the feasibility of the proposed individual systems.

PLAN PREPARER (P.E./L.S.)

DATE

February 2002; Rev. 4-04

TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

As-Built Checklist
Required Information

SITE PLANS - Industrial/Commercial and Individual House Lots

The following information is required on all as-built drawings for site plans. Permanent certificate of occupancy cannot be issued until all required information has been provided and approved by town staff. Plans must be same scale as approved site plan.

- a . Distance and bearings of all boundary lines and acreage of site. Iron pins are required at all property angle points, must be set prior to issuance of permanent certificate of occupancy, and must be shown on as-built. (Iron pins on individual lots which are part of a bonded subdivision need not be set prior to issuance of permanent C.O.) Monuments at corners and angles of all new streets and new street lines, at all points of curvature and tangency; and at critical corners and angles of all new Town open space. The coordinates for the monuments shall appear on the as-builts.
- b. Building setback lines.
- c. All structures, including signs, outside lighting, dumpsters (indicate that dumpsters are on concrete pad and screened). Locations of major site structures (buildings, parking lots, etc.) must be certified by L.S.; locations of incidental structures may be approximate.
- d. Easements (with distances and bearings), noting grantees, purpose, volume and page where filed.
- e. A-2 & T-2 certification; live signature and seal of a Connecticut Licensed Land Surveyor (L.S.)
- f. Finished first floor elevation of all buildings (including garages).
- g. Pavement limits and widths, curb lines, type and material of curbs.
- h. Gravel access roadways for storm drainage, sanitary sewers and/or open space.
- i. Sanitary sewer structures, clean-outs and grease traps showing horizontal locations and vertical elevations (tf's and invert). Show adjusted locations and elevations of existing structures. Data on laterals need not be certified by L.S. but must have been inspected by Town and location documented by contractor.
- j. If a septic system was installed, show the septic system including tanks, distribution boxes, grease traps, leachfields, etc with dimensions, invert elevations and ties to major structures.
- k. Contours showing final grading. Spot elevations may be acceptable if they are provided in sufficient detail to determine that final grading is in conformance with the approved site plan.

As-Built Checklist - Required Information
Site Plans

- l. Regulated wetlands and 100-year floodplain; location of existing brook channels.
- m. Site linestriping, pavement markings and traffic signs.
- n. Sidewalks, ramps, crosswalks and permanent pedestrian facilities.
- o. Landscape areas, fences and guardrails.
- p. Culverts and bridges.
- q. Storm drainage system, showing all catch basins, stormwater treatment and sedimentation structures, infiltration structures, drainage swales, detention/retention areas, rain gardens, end walls and outlet structures, manholes, lengths, sizes and types of pipes. Include horizontal locations and vertical elevations (tf's and inverts) certified by an L.S. Show adjusted locations and elevations of existing structures. Also show the locations and elevations of underdrains, foundation drains, roof leader connections, etc. at buildings and the Town system tie-in (data need not be verified by an L.S. but must have been inspected by the Town and location documented by the contractor).
- r. Any and all improvements within Town/State right-of-way including curbing, guardrails, utilities, sidewalks, drainage, etc.
- s. All other underground or above ground utility lines (i.e. gas, water, electric, cable, and phone) as installed, found or relocated during construction. Include valves, poles, transformers, pullboxes, handholes, cabinets, structures, equipment, etc.
- t. All traffic signal equipment including poles, cabinets, structures, equipment, handholes, conduit, wires, traffic detector loops, etc.
- u. Lighting compliance certification verifying that installed site lighting complies with approved site plan and zoning requirements.
- v. The following statement must be on the plans: "The items so noted on this plan have been verified in the field as to location, elevation, and completeness. The following listed items are the only deviations from the original plans approved by the Planning and Zoning Commission and staff approved change orders:

(List)

(Signed and Stamped by licensed L.S.)

Effective 06/2006

TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS

As-Built Checklist
Required Information

SUBDIVISIONS

The following information is required on all as-built drawings for subdivisions with public improvements/town right-of-way improvements. Progress as-builts are required for flow lines of sanitary sewers and storm drainage structures prior to graveling roadbed. Final as-builts are required and must be approved by Town Staff prior to requesting town acceptance of subdivision. Plans must be 1" = 40' scale.

- a . Iron pins are required at all property angle points; setting must be verified by letter from L.S. (Note: subdivision lot pinning requirement supercedes individual site plan pinning requirement.) Monuments at corners and angles of all new streets and new street lines, at all points of curvature and tangency; and at critical corners and angles of all new Town open space. The coordinates for the monuments shall appear on the as-built.
- b . Distance and bearings of street lines, center line (of R.O.W.) stations, horizontal curve data.
- c. Easements (with distances and bearings), noting grantees, purpose, volume and page where filed.
- d. A-2 & T-2 certification; live signature and seal of a Connecticut Licensed Land Surveyor (L.S.)
- e. Curb lines and pavement width; sidewalk locations; gravel access roadways for storm drainage, sanitary sewers and/or open space.
- f. Sanitary sewer structures with horizontal and vertical (tf's and inverts) locations within Town rights-of-way and easements. (Data on laterals need not be certified by L.S. but must have been inspected by Town and location documented by contractor.) Provide swing ties (minimum of 2) for laterals not yet connected to houses.
- g. Show graded areas within Town rights-of-way/easements (e.g. , detention basins), with proposed contours and as-built spot elevations in sufficient detail to show that grading is in conformance with approved plan.
- h . Storm drainage system, showing all catch basins, stormwater treatment and sedimentation structures, infiltration structures, drainage swales, end walls and outlet structures, manholes; lengths, types and sizes of pipes (locations certified by L.S.). Include horizontal and vertical (tf's and inverts), location of underdrains, foundation drains, roof leader connections (if installed), etc., at Town system tie-in locations (data need not be verified by L.S. but must have been inspected by Town and location documented by contractor).
- i. As-built location of existing house on each lot (if constructed). Include locations of all utility lateral connections (water, sewer, gas, electric/telephone/cable).

As-Built Checklist - Required Information
Subdivisions

- j . Modifications to existing brook channels, regulated wetlands, and 100year floodplain.
- k. Improvements within Town/State right-of-way which are not included on individual site plan as-builts including guardrails, traffic signs, etc.
- l. All underground utility mains (i.e. gas, water, electric, cable and telephone).
- m. Plans/profiles (at same scale as approved plan) containing the following:
 - 1. Layout of streets in sections coordinated by stations with the profile.
 - 2. Street plan showing roadways and drainage.
 - 3. Sight line at new street intersections (if required on approved subdivision plan).
 - 4. Centerline profile of pavement indicating grades at (approximately) 50-foot intervals.
 - 5 Profile will show all catch basins and all drainage lines between catch basins with all invert and top of frame elevations. Pipe materials and slopes, as indicated at and calculated from structures, to be included.
 - 6. Where any storm drainage line discharges into an existing brook, cross section of the brook at the point of discharge must be shown.
 - 7 All sanitary sewer main lines and manholes, including elevations, sizes, lengths, and slopes of pipes as indicated at and calculated from structures, must be shown. Finished first floor elevations for existing buildings shall be shown.
 - 8. All underground utility mains.
- n. The following statement must be on the plans: "The items so noted on this plan have been verified in the field as to location, elevation, and completeness. The following listed items are the only deviations from the original plans approved by the Planning and Zoning Commission and staff approved change orders:

(List)

(Signed and Stamped by Licensed L.S.)

Effective 06/2006

**TOWN OF SOUTH WINDSOR
TREE PLANTING SPECIFICATIONS**

1. All trees will be handled by the root ball and not by the trunk of the tree.
2. All rope or twine will be completely removed once the tree has been placed in the planting area, burlap will be rolled down and cut or tucked under the root ball.
3. Any wire baskets will be cut and the upper 2/3 removed after the tree is placed in the planting area.
4. All trees shall be freshly dug within 30 day of delivery to the planting site.
5. All twine, rope or any other objects around the root ball will be removed.
6. A planting area of two times the diameter of the root ball will be excavated. The depth of the excavation shall be two inches less than the overall height of the root ball as measured from the root flair on the trunk to the bottom of the root ball.
7. All excavated material will be deposited at an approved site.
8. When back filling trees, growing medium will be worked in, to avoid any air pockets. Care must be taken not to compact growing medium excessively.
9. The beginning of the root flair will be set two inches above final grade.
10. Water will be applied as soil condition dictate.
11. All tree trunks will be free from any injury or damage.
12. All trees shall have a single central dominant leader.
13. Trees shall not be staked or guyed unless directed by the Tree Warden.
14. The depth of all mulch shall not exceed more than 2".
15. All tags, ribbons or other markings will be removed.
16. No pruning will be performed unless directed to by the Tree Warden.
17. No fertilizers or water polymers will be applied at planting.

TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS
STANDARD DETAILS
SECTION VI

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TOWN OF SOUTH WINDSOR
PUBLIC IMPROVEMENT SPECIFICATIONS
STANDARD DETAILS
SECTION VI

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