



TOWN OF TYGNSBOROUGH

CONSTRUCTION AND DESIGN STANDARDS AND DETAILS

Adopted by the Board of Selectmen on, 05/11/2020

Town Hall
25 bryants Lane
Tyngsborough, ma 01879

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GLOSSARY

AAB	Architectural Access Board
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials <u>Note:</u> ASTM International is originally known as the American Society for Testing and Materials, is an international standards organization that develops and publishes voluntary technical standards for a wide range of materials, products, systems, and services
BMP	Best Management Practice
CDF	Controlled Density Fill
CLOMR	Conditional Letter of Map Revisions
DEP	Massachusetts Department of Environmental Protection
DI	Ductile Iron
Engineer	A Professional Engineer licensed within the Commonwealth of Massachusetts
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
HDPE	High Density Polyethylene
HMA	Hot Mix Asphalt
ID	Inner Diameter
LOMR	Letter of Map Revisions
M.G.L. c. 30, §39M	Massachusetts General Law “General Provisions Relative to State Departments, Commissions, Officers and Employees: Contracts for Construction and Materials; Manner of Awarding”
M.G.L. c. 83, §10	Massachusetts General Law – Sewers, Drains and Sidewalks - Rules and regulations regarding use and connections”
mg/l	milligrams per liter
MassDOT	Massachusetts Department of Transportation (formerly Massachusetts Highway Department)
MUTCD	Manual on Uniform Traffic Control Devices

NPDES	National Pollutant Discharge Elimination System
OD	Outer Diameter
OSHA	Occupational Safety and Health Administration
PE	Polyethylene
PVC	Polyvinyl Chlorides
ppm	Parts per million
PROWAG	Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way
psi, psig	Pounds per square inch, pounds per square inch (gauge)
RCP	Reinforced Concrete Pipe
Regulations	Design and Construction Regulations, Standards and Details for Drainage and Roadways for the Town of Tyngsborough
ROW	Right of way
SDR	Standard Diameter Ratio
Standards	Town of Tyngsborough Design & Construction Standards &Details
Town	Town of Tyngsborough
Town Engineer	Town Engineer for the Town of Tyngsborough or their designee
TED	Tyngsborough Engineering Department
TPD	Tyngsborough Police Department

1 - GENERAL PROVISIONS

1.1 Preamble

- A. The Design and Construction Standards and Details are hereby adopted by the Tyngsborough Engineering Department. Their purpose is to provide consistent policy under which construction of the physical aspects of infrastructure system improvements within the Town limits will be implemented. The infrastructure system includes, but is not limited to: roadways, stormwater management systems and erosion control measures
- B. These Design and Construction Standards and Details are herein after referred to as the Standards. They are provided as specifications in the materials and methods for performing work within the Town of Tyngsborough. The Standard Details provided graphically depict and illustrate key elements outlined within the written portion of these Standards.
- C. These Standards also establish the Tyngsborough Engineering Department's minimum criteria for plan submittal and design requirements relative to technical peer reviews. It is the responsibility of the property owner/applicant/contractor to verify and obtain all applicable permits and meet all applicable submittal requirements.
- D. The requirements of these Standards are in addition to the requirements of any other policy, rule, regulation or other provision of law. Where any provision of these Standards imposes restrictions different from those imposed by any other policy, rule, regulation or other provision of law, whichever provision is more restrictive or imposes higher protective standards for human health or the environment shall control. If uncertain, the applicant may request in writing to the Town to provide clarification as to which provision is more restrictive.
- E. These Standards govern projects conducted by or for the Town and any activity that is required by Town Bylaw or regulation to be conducted in compliance with these Standards. For private work that does not fall within the regulatory jurisdiction of Town Bylaws or regulations, TED strongly recommends that these Standards be used as a basis for construction and design. These Standards address the more typical infrastructure components. Accordingly, these Standards are intended to assist but not to substitute for competent work by design professionals by providing basic information. It is expected that the design professionals (e.g. engineers, architects, landscape architects, etc.) will bring to each project the best of skills from their respective disciplines, and shall contact the TED for clarification and direction regarding design aspects not covered by these Standards.
- F. The Standards are also not intended to unreasonably limit any innovative or creative effort which could result in a project of better quality, greater cost savings or meeting Town objectives. However, any proposed departure from the Standards will be evaluated on the basis that such exception will produce a long-term compensating or comparable result, in every way adequate for the user and Town resident. Any exception from these Standards must be approved in writing by the Town Engineer or their designee. Further, these Standards are not intended to restrict the TED in its efforts to obtain the maximum benefits for the Town in any construction project.
- H. The invalidity of any section or provision of these Standards shall not invalidate any other section or provision thereof nor shall it invalidate any approval or determination that has been previously issued. If any provision is held unenforceable, then such provision will be modified to reflect the intention of the standard or construction

specification. All remaining provisions of these Standards shall remain in full force and effect.

1.2 General Requirements

1.2.1 Plan Review/Content

- A. Proposed work requiring technical review by the TED under a Town Regulation or as part of a Right of Way Permit Application, Building Permit Application or Town Board/Commission permit application shall be submitted as an engineering plan stamped by a Professional Engineer registered in the Commonwealth of Massachusetts.
- B. The Town Engineer or their designee will provide the Applicant or appropriate Town Board/Commission written correspondence indicating acceptability of the plan, deficiencies within the plan/design and/or required additional information.
- C. Plan content and design/report submittal requirements are included within the applicable sections of these Standards. At a minimum all plans submitted to the TED shall be prepared in monochrome format utilizing gray scale and line types to differentiate features (gray scale for existing features and bold for proposed features) and shall include:
 1. *General Data:*
 - a. Name of record owner(s) of land shown on plan
 - b. Identification of parcel by Assessor's Map Number and Parcel Number
 - c. Property lines, easements, and/or legal rights within the property lines
 2. *Roadway Data (including elevations):*
 - a. Roadway limits including edge of pavement and centerline at a maximum 50' cross section interval.
 - b. Location and material of drives, sidewalks and walkways. Walkway and drive survey information shall extend at least 10' beyond the back of right-of-way.
 - c. Curb location and type, with top and bottom elevations at appropriate intervals.
 - d. Location of right-of-way and control points.
 3. *Utility Data:*
 - a. Sewer and drainage structures (including rims and inverts) and mains (including size and material type).
 - b. Drainage culverts with inverts, material type and size.
 - c. Stormwater management systems and structural best management practices.
 - d. Utility poles with pole numbers, associated guy wires.
 - e. Electric, telephone, cable television conduits, transformers, vaults, handholes, and associated structures.
 - f. Water main (including material and size), valves, curbstops and hydrants
 - g. Gas main including shut offs and vaults.
 4. *Topographic Features:*
 - a. Trees (greater than 8" caliper within ROW)
 - b. Fence lines (within 10' of ROW)
 - c. Guardrails
 - d. Walls
 - e. Stairways
 - f. Mailboxes
 - g. Signs
 5. *Natural Features:*

- a. Vegetative cover (wooded areas/tree line, grass areas, etc.)
 - b. Wetland areas (including wetland flags)
 - c. Rivers/streams (including bank flags)
 - d. Ponds
 - e. Buffer Zones
- 6. All coordinate data shall be provided in the Mass State Plane Coordinate System
 - 7. All elevation data shall reference NAVD88.
 - 8. Any additional information required by the TED.
- D. To ensure timely review it is the responsibility of the property owner/applicant/contractor to verify that all plan content and submittal requirements are met. Incomplete submittals will delay the review process.
 - E. TED generally requires a minimum of a two-week turnaround for technical review. Larger projects may require additional review time.
 - F. In addition to obtaining plan approval, it is the responsibility of the property owner/applicant/contractor to verify and obtain all written permits from appropriate Town departments and state and federal agencies and pay all permit fees prior to commencing construction.

1.2.2 Construction

- A. All construction materials and methods shall conform to the requirements contained in the latest version of the Massachusetts Department of Transportation – Highway Division (MassDOT), formerly Massachusetts Highway Department, *Standard Specifications for Highways and Bridges and Construction and Traffic Standard Details* as amended. These two documents are collectively referred to as the MassDOT Standards within these Standards.
- B. These Standards also draw on and refer to the *Massachusetts Stormwater Management Standards* and the *Massachusetts Stormwater Handbook* (Massachusetts Department of Environmental Protection, January 2008 et seq.).
- C. All work shall be completed in accordance with the lines and grades shown on the approved plans.
- D. TED and Highway field inspectors may approve field changes that differ from approved plans or standards referenced herein when determined to promote a public interest. Any such field changes shall require written approval from the TED or Highway field inspector.

1.2.3 As-Built/Record Documents

- A. When required, the Contractor/Applicant shall be responsible for the preparation and submittal of record drawings to the TED when construction is complete. The as-built plan of project improvements (roadway, site work, and utilities), shall be submitted in hardcopy and electronic formats, for review and approval. A stamped paper hardcopy of the as-built plan shall be submitted for review. Once approved, a stamped **mylar** hard copy and electronic copies of the as-built plan shall be submitted for archival. All drawing sheets shall not exceed ARCH Size D (24" x 36") and shall be prepared at readable plan scale, preferably consistent with the design plan scale. Plans shall be prepared in monochrome format utilizing gray scale and line types to differentiate

features (color as-built plans will not be accepted). The record as-built submittal shall also include any reports required to be submitted upon the completion of the project.

Electronic as-built information shall be in both AutoCAD Civil 3D 2020 and Acrobat PDF formats. The electronic CD/DVD media shall be properly labeled with the Project Name, date, and all file names.

Record drawings shall at a minimum include the following:

1. *General Data:*
 - a. Name of record owner(s) of land shown on plan
 - b. Identification of parcel by Assessor's Map Number and Parcel Number
 - c. Property lines, easements, and/or legal rights within the property lines
 2. *Roadway Data (including elevations):*
 - e. Roadway limits including edge of pavement and centerline at a maximum 50' cross section interval.
 - f. Location and material of drives, sidewalks and walkways. Walkway and drive information shall extend 10' beyond the back of right-of-way.
 - g. Curb location and type, with top and bottom elevations at appropriate intervals.
 - h. Location of right-of-way and control points.
 3. *Utility Data:*
 - h. Sewer, water and drainage structures (including rims and inverts) and mains (including size and material type).
 - i. Drainage culverts with inverts, material type and size.
 - j. Stormwater management systems and structural best management practices.
 - k. Utility poles with pole numbers, associated guy wires.
 - l. Electric, telephone, cable television conduits, transformers, vaults, handholes, and associated structures.
 - m. Water main (including material and size), valves, curbstops and hydrants
 - n. Gas main including shut offs and vaults.
 4. *Topographic Features:*
 - h. Trees (greater than 8" caliper within ROW)
 - i. Fence lines (within 10' of ROW)
 - j. Guardrails
 - k. Walls
 - l. Stairways
 - m. Mailboxes
 - n. Signs
 5. *Natural Features:*
 - a. Vegetative cover (wooded areas/tree line, grass areas, etc.)
 - b. Wetland areas (including wetland flags)
 - c. Rivers/streams (including bank flags)
 - d. Ponds
 - e. Buffer Zones
 6. All coordinate data shall be provided in the Mass State Plane Coordinate System
 7. All elevation data shall reference NAVD88.
 8. Any additional information required by the TED.
- B. Unless specifically provided elsewhere recommendations for Certificates of Occupancy will not be signed until a final site inspection is concluded to validate completeness and accuracy of the submitted as-built plan documents. TED requires a minimum of two weeks following the delivery of as-built documents package to provide sign-off. Turnaround time is subject to document package completeness.

1.3 General Construction Requirements

1.3.1 Brand Name or Equal

- A. If an item in these Standards is identified as “brand name or an approved equal,” the product will reflect the characteristics and level of quality that will satisfy the Town’s needs. The Town will evaluate “equal” products on the basis of information furnished by the Applicant or Contractor. All “or Equal” submissions must be approved during the Plan review process and will be judged consistent with MGL 30 §39M. All technical information submitted must be as provided by the manufacturer. The Town is not responsible for locating or obtaining any information not identified.

1.3.2 Protection of Existing Trees

- A. In accordance to M.G.L Chapter 87 and these Standards, public shade trees near the proposed construction that have not been approved to be cut, removed, destroyed or trimmed shall be saved from harm and injury. Measures to prevent any harm and injury caused during construction operations shall be provided as required by the Town Engineer.

1.3.3 Protection of the Public

- A. No work shall be performed within the Town right-of-way unless a street opening permit is first approved by the Highway Supervisor, Town Engineer or their designee. If the work requires a trench more than 3 feet in depth, will require a Trench Permit regulated under 520 CMR 14.00.

Trenches shall not be excavated in traveled ways until all materials and equipment required for such work are at the site and available for immediate use. When work is not in progress, trenches in areas subject to public travel shall be covered with steel plates capable of safely sustaining a 36.5-ton truckload with impact. The work in each trench shall be practically continuous, with the placing of pipe, backfilling, and paving of the roadway surfaces closely following each preceding operation.

At the end of each working day where trenches in areas of public travel are covered with steel plates, each edge of such plates shall be either beveled or protected by a slope of 2-feet horizontally to 1-inch vertically. Temporary bituminous concrete patching material shall be used to construct the ramps.

- B. The Contractor shall take every measure necessary for the protection of personnel and property. The Contractor shall at all times, until written acceptance of the physical work by the Town, be responsible for the protection of the work and shall take all precautions for preventing injuries to persons or damage to property on or about the project.
- C. All construction equipment, material and debris shall be removed from the traveled way at the end of each working day and shall be stored in such manner as not to interfere with the flow of driveway traffic or pedestrians.
- D. All personnel who are working in areas open to traffic shall wear MHD approved safety vests.
- E. To the extent feasible, the Contractor shall maintain access for all abutters so that they may use the driveways and approaches adjacent to their properties. Pedestrian

access to abutting property and access for emergency vehicles shall be provided at all times.

1.3.4 Traffic Management Plan

- A. The Contractor shall prepare and submit a traffic management plan to the TED and the Tyngsborough Police Department (TPD) for review and approval by the Town Engineer or their designee and Chief of Police or their designee respectively. The Traffic Management Plan shall be prepared for all streets affected by construction operations, unless specifically directed otherwise by the TPD or TED. The Traffic Management Plan shall contain information on lane closures and proposed detour routes if requested, location and type of detour and warning signs, barricades and other safety and traffic control means and devices to ensure a safe, orderly flow of vehicular and pedestrian traffic.
- B. All temporary and permanent signs, traffic control devices, and pavement markings shall conform to the latest relevant sections of the Manual on Uniform Traffic Control Devices (MUTCD), and the Massachusetts Standard Specifications for Highways and Bridges.
- C. The Traffic Management plan shall be submitted for review at least fourteen (14) days prior to any work being performed on the public roadways. No work would be allowed until the Traffic Management Plan is approved by the Town and implemented by the Contractor.
- D. Temporary pavement markings and other traffic control devices shall be provided in accordance with the Traffic Management Plan and as directed by the Town Engineer.
- E. Traffic Police Details shall be provided as outlined within the Traffic Management Plan or as may be required by the TPD.
- F. The Traffic Management Plan shall demonstrate that detoured pedestrian routes are in full compliance with the latest version of the MUTCD, the PROWAG, the ADA, and the standards herein.

1.3.5 Work Schedule

- A. Work on public ways is restricted to a normal eight (8) hour day between the hours of 7:30am and 3:30pm, five (5) day week Monday through Friday, with the prime contractor and all subcontractors working on the same shift. No work shall be done during nights, on Saturday's, Sunday's, or holidays without the prior written approval by the Highway Superintendent, Town Engineer or their designee. Lane closures on public ways may be further restricted if deemed appropriate by the Town Engineer, Chief of Police or Highway Superintendent due to traffic volumes.

1.3.6 Sampling and Testing Materials

- A. All materials used in the construction of the project shall be subject to inspection, examination, or testing, by a certified material testing laboratory as determined necessary by the Town Engineer. All sampling and testing shall be done by an approved commercial testing laboratory at the Contractor's expense. Before tests are made, a certificate shall be furnished to the Town Engineer from the laboratory stating that it is fully equipped and qualified to make the required tests, is fully acquainted with specification requirements and the intended use of materials represented by the tests and is an independent establishment in no way connected

with the organization of the Contractor, Developer, or Manufacturer of the materials to be tested. Upon approval of the certificates, the laboratory will make the required tests and submit, through the Contractor to the Town Engineer for approval, detailed results of tests. No materials shall be used in the work until laboratory test reports have been submitted and approved, and laboratory certificates fully identifying materials have been furnished. All sampling and materials for all tests shall be taken by the testing laboratory, under the direction of the Town Engineer.

- B. Unless otherwise approved in writing by the Town Engineer, only new materials and equipment shall be incorporated in the work.
- C. As soon as possible after the formal execution of the Contract Agreement, permit approval, or approval of final definitive plans the project Contractor shall submit to the Town Engineer the names and addresses of the manufacturers and suppliers of all materials and equipment he proposes to incorporate into the work.

1.3.7 Defective Work

- A. The inspection of the work shall not relieve the Contractor of any of their obligations to fulfill their contract or permit obligations as herein prescribed and defective work shall be made good and unsuitable materials shall be rejected, notwithstanding that such work and materials have been previously overlooked by the Town Engineer. If the work or any part thereof shall be found defective at any time before the final acceptance of the whole work, the Contractor shall make good such defect in a manner satisfactory to the Town Engineer. If any material brought on site for use in the work, or selected for the same, is deemed by the Town Engineer as unsuitable or not in conformity with the specifications, the Contractor shall remove such materials from the vicinity of the work. If any material furnished by the Town of Tyngsborough shall be damaged or rendered defective by the handling or improper installation by the Contractor, his agents, or employees, it shall be made good or replaced at the Contractor's own expense.

1.3.8 Field Location of Existing Utilities

- A. The contractor shall be responsible for properly locating all utilities on site prior to the beginning of construction. The contractor shall verify the location of the existing utilities shown on any plan submitted to the TED or provided by the TED.
- B. The contractor shall be responsible for locating any additional utilities not shown on plans submitted to the TED or provided by the TED. If necessary, the contractor shall hire a private marking company to locate additional utilities.
- C. The contractor is required to contact "DIG-SAFE" at (888-344-7233) 72 hours prior to beginning construction. A valid DIG SAFE number shall be provided to the TED prior to construction commencement.
- D. The contractor shall excavate test pits to verify utility line locations as necessary and as required by the Town Engineer or their designee.
- E. Utility markings shall be properly maintained throughout the construction process. The contractor shall refresh all utility markings when required by the Town Engineer or their designee.

1.3.9 Cold Weather Construction

- A. Any work being done outside the normal permitted construction time period of April 1st through November 15th is considered cold weather construction with respect to these Standards.
- B. Projects within the public way or to be accepted by the Town shall not be constructed during cold weather conditions unless a hardship, emergency or compelling need is demonstrated and the work is approved in writing by the Highway Superintendent, Town Engineer or their designee. An approved street opening permit containing cold weather conditions will satisfy these requirements.
- C. Planned cold weather construction shall commence only when there is no indication of subsurface frost conditions within work area. Should subsurface frost conditions exist, it is the responsibility of the contractor/owner to remove subsurface materials and replace it with compacted well drained gravel materials. These activities must be witnessed by a member of the Highway Department or Engineering Department. The TED reserves the right to require Control Density Fill (CDF) if acceptable compaction of trench can not be obtained.
- D. Cold weather construction shall commence only when a favorable extended 5-day weather forecast, based on local weather forecasting services, indicating no less than freezing evening conditions (i.e. 32 degrees Fahrenheit) and 40 degrees Fahrenheit and rising conditions during daylight hours (i.e. 7 a.m. to 5 p.m.). In addition, there is no indication of precipitation during the time period.
- E. When construction is permitted to commence within cold weather conditions the sub grade beneath the work area shall be protected from frost penetration when freezing temperatures are expected.
- F. In emergency conditions, no fill shall be placed over frozen soils. The frozen soils shall be removed to the satisfaction of the Town Engineer or their designee prior to fill placement.
- G. The Highway Superintendent, Town Engineer, or their designee reserves the right to cease construction activities for the winter at any point.
- H. All work installed after November 15th shall be considered temporary and shall be inspected in the Spring following the work by the Town prior to acceptance. If required by the Highway Superintendent, Town Engineer, or their designee, the temporary work shall be removed and reinstalled.

1.4 Easements

- A. Easements for utilities across lots or centered on rear or side lot lines shall be provided where necessary and shall be at least twelve (12) feet wide for electric and telephone and twenty-five (25) feet wide for drainage, sewerage, water and access. Signed copies of easements and/or agreements affecting land not within a subdivision's right of way or public way, but necessary for provision of utilities shall be submitted to the TED before a plan can be approved. Where a parcel is traversed by a water course, drainage way, channel, or stream, the Planning Board or TED may require a storm water easement or drainage right of way be provided of adequate width to conform substantially to the lines of such water course, drainage way, channel, or stream.

1.5 Street Acceptance Process:

When a road or street within a subdivision has been completed in a manner fulfilling the requirements of the Board and there are no outstanding performance guarantees the applicant may request to the Board of Selectmen to accept the street or road. The Street Acceptance process shall be in accordance with sections 6.13.4 and 6.13.5 of the Tyngsborough Subdivision Rules and Regulations.

2 – DRAINAGE STANDARDS

2.1 General

- A. Any activity subject to the Town of Tyngsborough Storm Water Regulations and/or Storm Water Permit that will measurably change the ability of a ground surface area to absorb and/or infiltrate stormwater, will change existing surface drainage patterns or will change the rate or volume of stormwater discharging from a site will require the development of a *stormwater management plan*.
- B. All stormwater management plans and calculations shall be completed by a Professional Engineer licensed within the Commonwealth of Massachusetts.

2.2 Design

2.2.1 Criteria

- A. All projects requiring stormwater management review shall provide adequate stormwater management measures to ensure the rate and volume of stormwater discharge from a project do not exceed pre-development conditions.
- B. Post development conditions shall maintain natural drainage flow patterns to the maximum extent feasible.
- C. Storm drains, culverts, catch basins, manholes, retention/detention structures, water quality structures, permeable surfaces, Low Impact Development (LID) techniques and related best management practices (BMPs), shall be installed where necessary to provide adequate treatment and onsite infiltration or offsite disposal of surface water from all streets and adjacent land as shown on the proposed plans that require approval by the Town prior to construction.
- D. All stormwater designs and calculations shall be completed for the 2-year, 10-year, 25 year and 100-year frequency, Type III, NRCS 24-hour rainfall distribution.
- E. Hydraulic calculations shall utilize appropriate engineering methodologies to properly model project hydraulic conditions including: Soil Conservation Service (SCS) unit hydrograph method (TR-20), Storage-Indication method, or other approved method. The preferred method of delivery is a printout utilizing HydroCAD software.
- F. Storm drain capacity calculations shall be performed for all conveyance BMPs (i.e. drain pipe, grass swale, etc.). Capacity calculations shall be provided utilizing the rational method for a 50-year frequency storm event and Manning's equation for open channel flow.
- G. Proper operation and maintenance of the stormwater management system shall be considered when selecting, sizing and siting stormwater best management practices (BMPs) in the proposed design.

2.2.2 Stormwater Management in New Development and Redevelopment

- A. All projects that require stormwater review must meet the requirements set forth in the MADEP Stormwater Management Standards regardless of proximity to wetland resource areas.
- B. Redevelopment projects must meet the MADEP Stormwater Standards to the maximum extent practicable.

- C. New development projects shall also meet the following requirements:
1. All stormwater management systems shall be designed to retain the volume of runoff equivalent to, or greater than, one (1.0) inch multiplied by the total post-construction impervious area on the site, AND/OR
 2. Remove 90% of the average annual load of Total Suspended Solids (TSS) generated from the total post-construction impervious area on the site and 60 % of the average annual load of Total Phosphorus (TP) generated from the post-construction impervious area on the site. Pollutant removal shall be calculated consistent with EPA Region 1's BMP Performance Extrapolation Tool or other BMP performance evaluation tool provided by EPA Region 1, where available. If EPA Region 1 tools do not address the planned or installed BMP performance any federally or state approved BMP design guidance or performance standards may be used to calculate BMP performance. All BMP performance reports shall be included in the Stormwater Management Plan for review and approval.
- D. Redevelopment projects shall also meet the following requirements:
1. All stormwater management systems shall be designed to retain the volume of runoff equivalent to, or greater than, 0.80 inch multiplied by the total post-construction impervious area on the site, AND/OR
 2. Remove 80% of the average annual load of Total Suspended Solids (TSS) generated from the total post-construction impervious area on the site and 60 % of the average annual load of Total Phosphorus (TP) generated from the post-construction impervious area on the site. Pollutant removal shall be calculated consistent with EPA Region 1's BMP Performance Extrapolation Tool or other BMP performance evaluation tool provided by EPA Region 1, where available. If EPA Region 1 tools do not address the planned or installed BMP performance any federally or state approved BMP design guidance or performance standards may be used to calculate BMP performance. All BMP performance reports shall be included in the Stormwater Management Plan for review and approval.

2.2.3 Stormwater Management Plan Contents:

- A. Existing Conditions Plan:
1. Size and location of existing storm drainage facilities and conveyances.
 2. Existing utility locations (i.e. gas, water, sewer, electric, CATV, etc.)
 3. Existing utility easements
 4. Existing topography – Contours provided at 2' intervals with spot grades provided at critical divide locations. Slopes less than 1% shall have spot elevations every 25'.
 5. Delineation of resource areas and buffer areas, as defined by the Wetlands Protection Act and the Town of Tyngsborough Wetland Bylaw.
 6. Locations of soil test holes including depth to groundwater.
 7. Delineation of ground cover type (i.e. woods, grass, impervious areas)
- B. Proposed Conditions Plan:
1. Size and location of proposed storm drainage facilities, BMPs and conveyance.
 2. Proposed topography – Contours provided at 2' intervals with spot grades provided at critical divide locations. Slopes less than 1% shall have spot elevations every 25'.
 3. Delineation of resource areas, as defined by the Wetlands Protection Act and the Town of Tyngsborough Wetland Bylaw.
 4. Locations of soil test holes in areas of proposed recharge areas
 5. Delineation of proposed ground cover type (i.e. woods, grass, impervious areas)

- C. Drainage Divide Plans: Plans depicting Pre-Development and Post Development Sub-Watershed divides shall be provided at an appropriate scale. Plan data shall be overlaid on screened versions of the Existing Condition and Proposed Condition plans respectively and shall include:
1. Sub-Watershed Areas with reference number/letter, quantified in square feet or acres and with individual ground cover types.
 2. Times of concentration path for each Sub Watershed Area.
 3. Drainage analysis points with reference number/letter
- D. Rational Method Divide Plan: Plan depicting catch basin Subcatchment divides shall be provided at an appropriate scale. Plan data shall be overlaid on screened version of the Proposed Condition plan and shall include:
1. Subcatchment Areas with reference number/letter, quantified in square feet or acres and with individual cover types.
 2. Times of concentration path for each Subcatchment Area.
 3. Respective conveyance BMP clearly shown.
- E. Stormwater Calculations and Report: Supporting calculations developed and stamped by a Professional Engineer licensed within the Commonwealth of Massachusetts certifying that the *Stormwater Management Plan* has been prepared in accordance with the criteria established within the Massachusetts Stormwater Standards, Town regulations and requirements as well as these Standards. The report shall include:
1. *Drainage Design Narrative*: Brief written description of Sub-Watersheds depicted on the Drainage Divide Plans. Description shall explain how and where stormwater will be controlled on-site including all assumptions utilized within the hydraulic model. The Narrative shall also clearly describe the location of drainage analysis points utilized in the design. The Narrative shall also include a summary table which clearly compares pre-development and post-development runoff rates and volumes at each analysis point.
 2. *Hydrologic and hydraulic design*: Calculations for pre-development and post-development conditions shall be modeled as for the design storms as specified in these Standards. The calculations shall be a HydroCAD printout, hand calculations or other approved delivery method. The calculations shall clearly illustrate:
 - a. Description of the design storm frequency, intensity and duration used in the calculations as required by these regulations.
 - b. Time of concentration utilized for each Sub-Watershed Area.
 - c. Soil Runoff Curve Number (CN) based on land use and soil hydrologic group for each Sub-Watershed Area.
 - d. Peak runoff rates and total runoff volumes for each Sub-Watershed area and analysis point.
 - e. Infiltrative BMP design information including: infiltration capacity of soils based on test hole results and Rawls Tables.
 - f. Any additional documentation of sources for computation methods and field test results.
 - g. When appropriate, downstream tail water conditions, shall be evaluated within the hydraulic model.
 3. *MA Stormwater Standards Calculations*: Supporting narratives and calculations to demonstrate how the drainage system will meet the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards. The plans shall include details and descriptions of erosion control and stormwater management during construction. Section 4 - Erosion Control of these Standards provides additional guidance on the Erosion and Sedimentation Control Plan contents.

4. *Conveyance Design*: Calculations shall be provided to determine the required capacity for all proposed stormwater conveyances utilizing the rational method for the design storm outlined within these standards. All stormwater conveyances shall be sized utilizing Manning's equation. Calculations shall clearly show in a tabulated form:
 - Required Capacity (Rational Method)*:
 - a. Area (A) of each subcatchment
 - b. Curve number (C) for each subcatchment
 - c. Time of concentration for each subcatchment
 - d. Design storm intensity (I) for each subcatchment
 - e. Required design flow rate (Qr) for each subcatchment
 - Conveyance Sizing (Manning's Equation)*:
 - f. Stormwater conveyance type, size, etc.
 - g. Stormwater conveyance Manning's equation roughness coefficient (use C=0.013 for concrete pipe)
 - h. Design capacity (Qd) for each stormwater conveyance
 - i. Pipe velocity (V) utilizing the Rational Method required design flow (Qr) and stormwater conveyance design.

5. *Infiltrative BMP Design*: Calculations and supporting documentation shall be provided to clearly demonstrate:
 - a. Soils information from test pits performed within the footprint of the proposed stormwater management facilities, including but not limited to soil descriptions, depth to seasonal high groundwater, depth to bedrock, and percolation rates. Soils information will be based on deep holes and percolation tests logged by a Massachusetts Registered Soil Evaluator and witnessed by the Town.
 - b. All infiltrative BMPs shall include drawdown calculations demonstrating that stormwater for all design storms will be completely infiltrated within 72 hours.
 - c. All infiltrative BMPs shall have proper pretreatment. Pretreatment BMPs must be sized for prescribed water quality volume. (i.e. include forebay sizing calculations).
 - d. BMP Performance analysis report.

6. *Long-term Operation and Maintenance Plan (LTO&M)*: All Stormwater Management Plans shall include for review a document/manual which shall clearly outline the long-term maintenance responsibilities for all BMPs included within the plan. BMP maintenance responsibilities should be consistent with guidance provided within the MADEP Stormwater Manual and outlined in the Tyngsborough Stormwater Regulations. The LTO&M Plan shall include at a minimum:
 - a. The owner on record for continuing LTO&M.
 - b. Annual maintenance cost for the plan and assignment of financial responsibilities.
 - c. The person(s)/entity responsible for financing maintenance and emergency repairs.
 - d. A plan outlining location of and access points to all BMPs proposed. The plan shall also depict/describe the woody and herbaceous vegetative stabilization utilized within the stormwater design.
 - e. A chart outlining the type of and frequency of maintenance work required for all stormwater BMPs proposed on site, including any landscaping required.

2.2.4 Structural Best Management Practices

A. General:

1. All structural Best Management Practices shall be designed in accordance with these standards as well as applicable sections from the *Massachusetts Stormwater Management Standards* and the *Massachusetts Stormwater Handbook* (Massachusetts Department of Environmental Protection, January 2008 et seq.).
2. Where appropriate, the Town of Tyngsborough encourages the use of Low Impact Development techniques.

B. Bioretention Areas/Rain Gardens:

1. Bioretention areas/rain gardens shall be used as treatment BMPs and/or water recharge BMPS in accordance with the "MA Stormwater Handbook".
2. Bioretention areas/rain gardens shall not be used to attenuate peak flows.
3. Bioretention areas shall be designed to have a maximum ponding depth of 18".
4. Bioretention areas shall be designed without filter fabric unless an *engineered soil mixture* is not used.
5. If a bioretention area/rain garden system is designed to exfiltrate, the system shall be designed to incorporate an 8" overflow standpipe with grated cap connected to an offline leaching pipe beneath the system if the maximum ponding depth cannot be achieved.
6. If a bioretention area/rain garden system is not designed to exfiltrate, the system shall be designed to with an underdrain system that is connected to an outlet for discharge or conveyance to an additional BMP.
7. Safe overflow of these devices shall be provided in the event of severe storm events or clogging of the soils surrounding the device. Discharge of the overflow shall be incorporated into the drainage design.

C. Detention/Infiltration Basins:

1. Basins shall be designed to provide a minimum of 1' of freeboard above the proposed 100-year flood elevation.
2. Basins shall be designed to provide an emergency spillway with an invert elevation at the 100-year flood elevation. The design shall be consistent with Standard Detail DRN-15 and be a rip rap trapezoidal channel.
3. Infiltration basins shall only utilize bottom of pond areas when calculating the time to drain and basin infiltration rates.
4. Infiltration basins will be designed to utilize a sand bottom consistent with Standard Details DRN-12 & DRN-12A.
5. Dry detention basins can be designed utilizing a sand, pea stone, or water tolerant grass bottoms pursuant the "MA Stormwater Handbook"
6. The top of berm in all basins shall be a minimum of 5' wide.

7. Basins proposed to be maintained by the Town, shall be designed to incorporate a 10' wide access road on the embankment to all critical basin components. This includes but is not limited to: forebay embankment, emergency spillway, outlet control structure, emergency drawdown. etc.
8. Basins shall be designed to have a maximum drawdown within 72-hours.
9. Basins shall be designed with an outlet control structure consistent with Standard Details DRN-16 and DR 16A.
10. Basin outlet control structures shall be furnished with an emergency drawdown device.

D. *Forebay/Sediment Trap:*

1. Forebay berms shall be a minimum of 4' wide and contain a low-flow-through stone outlet consistent with Standard Detail DRN-14.
2. Forebay shall be sized for the contributing water quality volume.
3. Forebay bottoms shall be designed to be a stable surface to promote sediment removal.
4. Forebay volume shall not be included within detention basin design volume.
5. Forebay area shall not be utilized for stormwater infiltration within the design.

E. *Leaching Basins/Drywells/Underground Infiltration Systems:*

1. Leaching basins, drywells, and underground infiltration systems shall only be used in areas with highly permeable soils (i.e. Hydrologic Soils Group A & B). Testholes shall be required within the proposed footprint of all infiltrative BMPs to verify the HSG. All testholes shall be witnessed by the TED.
2. Unless designed to infiltrate rooftop runoff, leaching basins drywells, and underground infiltration systems shall be designed as offline systems.
3. Safe overflow of these devices shall be provided in the event of severe storm events or clogging of the soils surrounding the device.
4. Discharge of the overflow shall be incorporated into the drainage design.
5. Systems shall be sited a minimum of 10 feet away from buildings and property lines and meet applicable Title V setbacks.

F. *Swales*

1. The maximum depth of a swale shall be 24 inches. Side slopes shall be no steeper than 2:1 (horizontal: vertical) with a minimum grade of 1%.
2. The minimum bottom width for a swale, whether earthen, gravel, or paved is 2 feet.
3. The maximum velocity for earthen/grass swales is 3 cfs.
4. The use of swales draining across a sidewalk into the gutter or discharging to the Town right-of-way is generally unacceptable.

2.2.5 Culverts

- A. All new culverts shall be designed to convey the 100-year frequency, Type III, 24 hour storm events, using the Soil Conservation Service (SCS) unit hydrograph method or other approved method.
- B. All new culverts designed to convey a perennial stream as depicted on the current USGS maps shall be designed to meet Massachusetts River and Stream Crossing Standards developed by the River and Stream Continuity Partnership, dated March 1, 2006 and as amended.
- C. All new culverts shall be a manufactured concrete box oversized to be embedded and provide an 8" thick minimum natural stream bottom.
- D. The proposed line and grade of the culvert shall match the existing stream/wetland slope.
- E. The concrete box shall meet HS-25 loading criteria.
- F. All culverts shall be designed to provide 24" cover from finish grade.
- G. Utility sleeves for water, sewer, etc., may be required beneath the culvert to allow for future maintenance of utility.

2.2.6 Prohibited Activities

- A. The Town of Tyngsborough prohibits activities that have an adverse impact to storm water, water bodies, property, etc. and are written in the Storm Water bylaw.

2.3 Construction

2.3.1 Methods

- A. All construction methods shall conform to the requirements contained in the latest version of the Massachusetts Department of Transportation – Highway Division (MassDOT), formerly Massachusetts Highway Department, *Standard Specifications for Highways and Bridges and Construction and Traffic Standard Details* as amended. These two documents are referred to collectively as the MassDOT Standards within these Standards.
- B. Construction methods shall also conform to the *Massachusetts Stormwater Management Standards* and the *Massachusetts Stormwater Handbook* (Massachusetts Department of Environmental Protection, January 2008 et seq.).
- C. All work shall be completed to the lines and grades shown on the approved plans.
- D. The Highway Department, Engineering Department, or consulting field inspectors may approve field changes that differ from approved plans or Town standards when determined to provide a public interest. No field changes are allowed without prior written approval from the Highway Superintendent or Town Engineer.
- E. Each step within the construction process shall be inspected and approved by the Highway Department or Engineering Department before the next step in the process shall begin.

2.3.1.1 Separation of Storm Drains and Water or Sewer Mains

- A. The horizontal separation of drainage mains from water and sewer mains shall be reviewed and approved by the Tyngsborough Water District and Sewer Commission.
- B. Vertical Separation: Drainage mains shall be laid to provide a separation of at least 18 inches from either water or sewer lines. The minimum vertical separation is measured from outside of water or sewer main to outside of the storm drain main. In instances when vertical separation cannot be achieved with existing water/sewer mains utility support shall be provided consistent with standard detail DRN-9.
- C. Unusual Conditions: Storm drain crossings that cannot meet standard separations due to existing and unusual conditions must be approved on a case by case basis by the TED.

2.3.1.2 Pipe Laying

A. Minimum Cover over Drainage Pipes

- 1. The minimum flow line depth for drainage pipes shall be 4 feet. The minimum cover over RCP drainage pipes shall be 3 feet below the pavement slab or as specified by the type of pipe per manufacturer's specifications, whichever is greater. Where the clearance is less than 1 foot below the pavement, provide a design method to maintain the integrity of the pipe and right of way. For drainage pipe outside of the pavement, the minimum cover shall be 18 inches or as specified by the type of pipe, whichever is greater.
- 2. No backfilling of the pipe in the trench shall take place unless approved by the Town Engineer, Highway Superintendent or their designee.

B. Minimum Drain Pipe Grades

- 1. Main lines and cross runs – grades 1% minimum
- 2. Building storm drainage stubs – 1% minimum
- 3. Subdrains – 0.5% minimum
- 4. All other – 0.5% minimum.
- 5. Any slope greater than 8% requires Town approval.

C. Reinforced Concrete Pipe (RCP):

- 1. Pipe shall be carefully laid to the lines and grades as shown on the approved plans. The Contractor, when possible, shall use laser beam aligning equipment.
- 2. See Section 2.3.2.1 for bedding material. The bottom of the trench shall be excavated to a flat grade 6 inches below the pipe invert for trenches in suitable earth and 12 inches below pipe invert for trenches in rock. When rock or ledge is encountered it shall be removed to such widths as will give a clearance of at least 12 inches on each side of the pipe or other structure and a sand cushion used. The width of trenches shall be sufficient to allow thorough compacting of the refill adjacent to the lower quarters of the pipe.
- 3. Trenches at pipe joints shall be excavated as necessary to give ample room for properly making and inspecting the pipe joints. RCP pipe joints shall be cement mortared (as specified in MassDOT Section M4.02) carefully placed in the joints

around its entire perimeter and mixed relatively dry, in the ratio of one part cement to two parts sand.

4. Pipe bedding material shall be carefully and lightly tamped under pipe to provide uniform support. Fill to a minimum depth of 12 inches above the top of the pipe. Material for backfilling the rest of the trench, except for sub base (top 15 inches) shall be suitable material, approved by the Town. The compaction process shall be material placed in 12-inch lifts and thoroughly compacted by mechanical rammers, vibrators, or other methods to be approved by The TED (e.g., hydraulic plate compactors) to 90 percent Modified Proctor density in off-road or nonstructural areas and 95% in roadway or structural areas. **Bucket compaction will not be accepted.**
 5. When laying pipe in groundwater, pipe material and method of installation shall be approved by the TED or Highway Superintendent. Water must not be permitted to rise in the trench until all pipes have been securely bedded, jointed and observed by the town and until backfilling has progressed to an elevation at least one foot above the top of the pipe. Temporary plugs shall be installed in open ends of pipe to prevent silt from washing into pipe during construction; and open ends of the pipe shall be closed with suitable plugs upon suspension of the work for any reason.
- D. *High Density Polyethylene (HDPE) Pipe:* The requirements for laying of RCP pipe also apply to HDPE pipe. The following additional requirements apply to HDPE pipe:
1. Installation of HDPE pipe shall be in accordance with either AASHTO Section 30 and M330, ASTM D2321 and ASTM F2881, and as recommended by the manufacturer.
 2. Because HDPE pipe will float in standing water, a dry trench shall be provided prior to laying the pipe. A qualified engineer shall be consulted to determine dewatering methods.
 3. Haunching large-diameter pipes (greater than 30 inches) shall be performed using maximum 8-inch lifts and compacted to 95 percent standard proctor density.
 4. Water tight joints shall be used. Pipe shall be watertight according to the ASTM D3212. Joint design shall be bell-and-spigot with an elastomeric rubber gasket meeting ASTM F477 or equal approved by the Engineering Department.
 5. HDPE pipe beneath a roadway, parking lot, or areas subjected to vehicular traffic shall have a minimum cover of twenty-four (24) inches.

E. *Ductile Iron (DI) Pipe*

1. Where minimum cover requirements are not able to be met, ductile iron pipe may be substituted for RCP pipe if approved by the TED.
2. Requirements of Section 2.3.1.2 C – Items 1,2,4,5 shall apply for installing ductile iron pipe.

F. *Pipe Testing:*

1. At the discretion of the Town, a mandrel test shall be conducted following completion of pipe laying. Placement of curb, gutter, sidewalk, or asphalt concrete pavement shall not occur until the Town's Inspector has approved the mandrel test. The Town's Inspector shall be present through the duration of the mandrel testing. Alternatively, a television survey may be performed on the line after installation, with the results being provided to the TED in electronic format as directed by the TED.

2. The allowable deflection (reduction in vertical inside diameter) for all non-rigid pipe shall be 7.5 percent maximum. The deflection shall be tested by pulling a mandrel which is 92.5 percent of the inside pipe diameter through all installed pipe. The mandrel shall be the "go/no-go" type and shall be pulled without mechanical assistance. At each location in which the mandrel cannot pass, the cause shall be ascertained. Obstacles in the pipe shall be removed. If it is determined that the deflection exceeds 7.5 percent, that a gasket has been improperly installed or that the pipe has been damaged due to trenching for another utility, the respective section of pipe shall be re-bedded or removed, replaced and re-bedded using water tight repair couplings. A passing mandrel retest is required. At the contractor's discretion, any sections of non-rigid pipe not passing the mandrel test may be televised to ascertain the problem.

2.3.1.3 Structures

A. General:

1. Contractor shall excavate to a depth of 12 inches below the bottom of and all around the proposed manhole or catch basin base, compact and fine grade and install washed screened gravel as a sub-base material. Pipes shall extend no more than 3 inches inside the interior wall and all openings around pipe entrances and lift holes shall be thoroughly grouted with non-shrink grout prior to back filling. Compaction process shall be the same manner as compaction around pipe.
2. The tops of frames and grate shall be set 1/8 inch below finish grade pavement in the street. Final grade locations for installations outside of the paved roadway shall be as approved by the Town.
3. All joints between the frame, grade rings, dome, barrels and base shall be set in place with non-shrink mortar. Inside the manhole, all joints where the sealing material is not flush with the inside wall shall be grouted with nonshrink mortar and finished by hand / wet-brushed.
4. Grade adjustments shall be made using clay bricks.
5. No backfilling of the structure in the excavation shall take place unless approved by a Town's inspector.
6. As circular concrete block walls are laid, the horizontal joints and key ways shall be flush full with mortar. As rectangular blocks are laid, all horizontal and vertical joints shall be flushed full with mortar. Vertical joints shall be staggered.

B. Manholes:

1. Manholes spacing shall exceed 300 feet, unless otherwise approved by the Town.
2. Manholes shall be required at all changes of drainage pipe material, changes in horizontal pipe alignment and changes in vertical elevation (i.e. elevation drop), unless otherwise approved by the Town

C. Catch Basins:

1. Maximum spacing for catch basins installed on new roadways shall be 300 feet. In some cases, the TED may require grate inlet capacities provided for review to verify proper basin spacing.

2. Catch basins shall not be connected in series unless permitted by the TED or Highway Department.
3. TED requires the installation of all catch basins within public ways to be in line with the edge of pavement. In instances where an existing utility conflicts with the proper installation of a catch basin, TED requires the use of a gutter inlet and deep sump manhole configuration as shown in standard detail DRN-2.
4. Double catch basin grates shall be installed perpendicular to the curb line.

D. Leaching Basins/Drywells:

1. Leaching basins shall be set in an excavation lined with a geotextile. The basin shall be placed on a pad of free draining double washed crushed stone, with the excavation around the basin back-filled with similar material.
2. Excavated material shall be placed away from the excavated sides to prevent wall instability during excavation and backfilling.
3. Large tree roots shall be trimmed flush with the sides to prevent puncturing or tearing of filter fabric during installation.
4. The side walls shall be roughened where sheared and sealed by heavy equipment.
5. No construction sedimentation control measure shall be sited within the footprint of leaching basins.

2.3.1.4 Best Management Practices

A. Bioretention Areas/Rain Gardens

1. All vegetation, top and subsoils shall be removed within the footprint of bioretention areas.
2. Care shall be taken not to compact underlying parent "C" Horizon soils during construction.
3. No construction sedimentation control measure shall be sited within the footprint of a bioretention area/rain garden.
4. No construction equipment shall park over or drive over the footprint of proposed bioretention areas/rain gardens.

B. Detention/Infiltration Basins

1. All vegetation, top and subsoils shall be removed within the footprint of the detention/infiltration basins.
2. Contractor shall excavate to a depth of 12 inches below the bottom of the basin's outlet control structure compact, fine grade and install washed screened gravel as a sub-base material prior to placing the structure.
3. Basins constructed in a fill condition will require the basin berm/dyke to be constructed with a low permeability glacial till core. The low perm berm/dyke core will be constructed in 6" lifts. The low perm fill will be compacted to 95% of its maximum proctor density and placed within $\pm 2\%$ of the optimum moisture content.

4. The basin's emergency spillway shall be lined with rip rap placed on a 6" gravel base consistent with Standard Detail DRN-15

C. Forebay/Sediment Trap

1. Construction sedimentation control measures may be sited within the footprint forebays and sediment traps. All sediment collected during site preparations must be removed prior to beginning construction.

D. Underground Infiltration Systems

1. Systems shall be set in an excavation lined with a geotextile. The system shall be placed on a pad of free draining double washed crushed stone, with the excavation around the basin back-filled with similar material.
2. Excavated material shall be placed away from the excavated sides to prevent wall instability during excavation and backfilling.
3. Large tree roots shall be trimmed flush with the sides to prevent puncturing or tearing of filter fabric during installation.
4. The side walls shall be roughened where sheared and sealed by heavy equipment.
5. Drainage aggregate (double washed) shall be placed in lifts of no more than 12 inches and compacted using plate compactors. Voids between the fabric and excavation sides due to boulders or other obstacles shall be filled with natural soils to ensure fabric conformity to excavation sides.
6. No construction sedimentation control measure shall be sited within the footprint of the underground infiltration systems.
7. No construction equipment shall park over or driven over the footprint of the underground infiltration systems.

2.3.1.5 Rip Rap/Pipe Ends

- A. Pipe ends shall be accurately aligned on compacted gravel fill unless otherwise approved by the Town. Rip Rap stone shall be placed to line and grade as shown on the plans on a prepared bed of gravel material. Layout shall create a sediment trap as depicted on Standard Details DRN-10 and DRN-10A.
- B. Each stone shall be placed by hand, normal to the slope and firmly embedded. Larger stones shall be placed directly at the drainage end to prevent erosion and displacement. Stone size shall be determined by the design storm flow discharging from the pipe. When appropriate, smaller diameter stones shall be provided to lock in rip rap stone.

Headwalls

- A. Field stone headwalls shall be constructed at open ends of any drainage pipes where the same serve as outlets or inlets to the drainage system. All pipe ends/outfalls shall have a field stone headwall installed and shall conform to Standard Detail DRN-11.

2.3.2 Materials

- A. All construction materials shall conform to the requirements contained in the latest version of the Massachusetts Department of Transportation (MassDOT), formerly Massachusetts Highway Department, Standard Specifications for Highways and Bridges as amended, unless otherwise specified herein or approved by the Town.
- B. All materials shall conform to the highest quality and applicable standards. If there is a conflict within these Standards, or between other standards referenced herein and these Standards, then the most stringent criteria shall be used.

2.3.2.1 Bedding Material

- CA. Pipe, manholes, catch basins, and leaching basins shall be laid in any of the following materials, as specified hereafter or as approved by the Town's inspector.
 1. Pea stone (3/8 inch in size)
 2. Angular crushed stone or rock, dense or open graded with little or no fines (¼ inch to 1 ½ inches in size).
 3. AASHTO classifications A1 and A3: Clean, coarse grained materials, such as gravel, coarse sands and gravel/sand mixtures (1 ½ inches maximum in size).
 4. AASHTO classifications A-2-4 and A-2-5: Coarse grained materials with fines including silty or clayey gravels or sands. Gravel or sand must comprise more than 50 percent of Class III materials (1 ½ inches maximum size).
 5. Approved material shall be sifted to remove rocks larger than 3 inches.

2.3.2.2 Pipe

- A. *Reinforced Concrete Pipe (RCP)*: Pipe shall conform to the AASHTO M170 for Standard Strength Reinforced Concrete Culvert Pipe for class III Pipe, Wall B. All pipe 24 inches in diameter or smaller shall be of the bell and spigot type. Pipes larger than 24 inches in diameter shall be tongue and groove or bell and spigot. A preformed flexible plastic sealing compound of Butyl Mastic Rope Sealer" 1" size, "EZ Stick" as manufactured by Concrete Products supply or an approved equal shall be used for sealing water-tight joints.
- B. *High Density Polyethylene (HDPE) Pipe* –For uses within and outside of the ROW, the pipe shall conform to MassDOT Section M5.03.10. Pipe shall be smooth interior wall and corrugated exterior wall, and be water-tight. Pipe shall be minimum 12-inch diameter. Ends shall be bell-and-spigot unless approved by the Town for the specific application. Pipe shall comply with the requirements for test methods, dimensions and markings found in AASHTO Designations M252 and M294. Pipe shall support an HS-20 live load with a maximum deflection of 5% of the minimum pipe diameter. Pipe and fittings shall be made from virgin polyethylene compounds which conform to the applicable current edition of the AASHTO Material Specifications for cell classification as defined and described in ASTM D3350. Nominal sizes of 12- to 60-inch shall be either AASHTO Type 'S' or Type 'D' dual wall.
- C. *Ductile Iron Pipe*: Ductile iron pipe shall conform to the requirements of AWWA C150, C151, C111 and shall be double cement lined and asphalt seal coated in accordance with AWWA C104. The wall thickness shall be Class 52.
- D. *Perforated Drain Pipe Trenches (Subdrain)* :

1. Drain Pipe Trenches shall meet MassDOT Standard Specifications Section 260 and MassDOT Construction and Traffic Standard Details Drawing 209.1.0. Perforated pipe shall be either of the following.
 - a. Polyvinyl chloride (PVC) pipe up to and including 15 inches in diameter, conforming to ASTM D3034, SDR 35.
 - b. Perforated, polyethylene (PE) (flexible) pipe and fittings per AASHTO M252. Joints shall be coupling type.
2. Filter fabric shall meet MassDOT Standard Specifications Section M9.50.0; complying with AASHTO M 288 for use with subdrains.
3. Subdrain bedding and fill material shall be crushed stone, 3/8 inch to 1 inch.

2.3.2.3 Drainage Structures

A. Manholes

1. *General:*
 - a. Manholes over 8 feet in depth shall have minimum of 5 feet inside diameter. When drop manholes are used the drop shall not be more than 3 ½ feet without the installation of a granite stone bottom. Risers shall be brick, not concrete blocks. Risers shall be clay or shale brick, and shall conform to the requirements of AASHTO M 91, Grade MM or as specified in MassDOT M4.05.
2. *Precast Manholes:*
 - a. Precast Manholes shall be constructed of reinforced precast concrete monolithic base section, barrel section and dome section meeting the latest applicable requirements of ASTM C478 I and AASHTO M 199, or latest revision thereto. Special manholes shall also meet the requirements of MassDOT Standard Specifications, section M4.02.14, Precast Units. After curing a minimum of 14 days, the outside surface of the tapered or cone section of precast cement concrete drainage structures shall be dried and cleaned.
 - b. Manhole steps are required if manhole is over 4 feet in height, and shall line up from section to section. They shall be aluminum alloy 6061 T6, 12 inch on center cast in place at point of manufacturer plus 2 inches shall be coated with aluminum oxide. Tongue and groove sections between barrel sections shall be mortared or use butyl rubber sealants. Live load design shall be HS-25 loading. A 26-inch opening will be cast in the top section to accept a cast iron frame and cover. Inside diameter shall be a minimum of 4 feet.
 - c. All precast drainage manholes shall conform to Standard Detail DRN-5.
3. *Constructed-in-Place Manholes:*
 - a. TED prefers the use of precast catch basin structures but recognizes the need to use constructed in place structures (block) under certain circumstances. Use of block structures requires approval from the Town.
 - b. All manholes constructed in place shall conform to the Block Drainage Structure Standard Detail DRN-6 and shall support HS-25 live loading.
 - c. Cement concrete blocks used in the construction of drainage structures shall meet the requirements of MassDOT standard specification M4.05.1.
4. *Manhole Covers:*
 - a. Cast iron frames and covers shall conform to MassDOT Standard Specification M8.03.0 and Standard Detail DRN-5A. Manhole frame shall have a clear opening of 24 inches and be a minimum of 8 inches in height. The frame and cover shall have a combined weight of 475 pounds.

- b. Manhole covers shall have a diamond pattern; pick holes and the word "DRAIN" cast in 3-inch letters.
- c. Frames and covers shall be as manufactured by East Jordan Iron Works model number (frame) OMA1240000238 and (cover) OMA124000026, or approved equivalent.

B. Catch Basins

1. General:

- a. All basins shall have a sump of at least 48 inches (4 feet) below the invert of the outlet pipe, or otherwise approved by the Town, and an inside diameter of 4 feet minimum.
- b. In locations where, existing utilities preclude the installation of a full deep sump catch basin, a gutter inlet/sump drain manhole configuration shall be substituted as shown on Standard Detail DRN-2.

2. Precast Catch Basins:

- a. All precast catch basins shall conform to Standard Detail DRN-1.
- b. Live load design shall meet HS-25 loading. Catch basins which are limited by height shall be installed with a flat top slab, cast in place, designed for HS-25 loading.

3. Constructed in Place Catch Basins:

- a. The Town prefers the use of precast catch basin structures but recognizes the need to use constructed in place structures (block) under certain circumstances. Use of block structures requires Town approval.
- b. When permitted by the Town, constructed in place structures shall conform to Block Drainage Structure Standard Detail DRN-6 shall meet HS-25 live loading.
- c. Cement concrete blocks used in the construction of drainage structures shall meet the requirements of MassDOT standard specification M4.05.1.

4. Catch Basin Grates:

- a. Cast iron frames and grates shall conform to MassDOT Standard Specification M8.03.0 and Standard Detail DRN-1A
- b. Frames shall have an 8" height. Shorter heights may be used if necessary to meet grades
- c. The frame and grate shall have a combined weight of 453 pounds.
- d. Inlet grates shall have be 24" x 24" with a pattern of 36 square holes.
- e. Frames and grates shall be as manufactured by East Jordan Iron Works model number (frame) OMA552000029 and (cover) OMA552000075, or approved equivalent.

5. Catch Basin Hoods

- a. Catch basin hoods shall be used in off-roadway operations such as parking lots and service areas to minimize the entry of oil, gasoline, and debris into drainage pipes. Catch basin hoods shall also be used in urbanized roadways where drainage is contained by vertical curbs and sidewalks are adjacent to the roadway (increasing the likelihood of litter). Catch basin hoods shall protrude no more than 12 inches beyond the end of pipe into the structure. Acceptable hoods are Ground Water Rescue Inc. Eliminator, Best Management Practices Inc. Snout® or equal approved by the Town.

6. Granite Curb Inlets (Throat Stones)

- a. Granite curb inlets are required for all new catch basins installed.
- b. Granite shall conform to MassDOT Standard Specifications Sections M9.04.0 and M9.04.5.

- c. Where drainage inlets are installed adjacent to a vertical curb or edging, granite inlet stones conforming to the requirements of MassDOT Standard Specification Section M9.04.5.
- d. Curb inlets set on a radius of 160 feet or less shall be cut to that radius. The gutter mouth at least 3 inches in depth and at least 2 feet in length shall be cut in the front face of the stone.
- e. If there is no other curbing, or as applicable, transitional curbing shall be required on both sides of the inlet. The transitional curbing shall be 6 feet in length, with a height equal to the inlet and tapering to grade at the end.

2.3.2.4 Structural Best Management Practices

A. Bioretention Area

- 1. *Engineered Soil Mix:* The soil mix for bio-retention areas should be a mix of sand, compost, and soil meeting the percentages identified below and should conform to the specifications in the Massachusetts Stormwater Handbook (2008), Volume 2, Chapter 2, Page 26.
 - 40% Sand
 - 20-30% Topsoil
 - 30-40% Compost
- 2. *Perforated Pipe:*
 - a. PVC pipe and standpipe shall meet the requirements specified under section 2.2.2.3 of these Standards.
 - b. Standpipe shall have a grated cap in a beehive style.
- 3. *Plantings:* The number, type, and location of plantings shall be subject to approval by the Town. All planting shall be water tolerant.

B. Detention/Infiltration Basins

- 1. *Berm Material:* Low permeability fill utilized for the detention basin berm constructed within fill shall be a well graded glacial till material, free of rubbish, ice, snow, tree stumps, roots, organic material, or other deleterious materials. There shall be no stones greater than three inches in diameter.

Gradation of low permeability core fill shall conform to the following schedule:

<u>U.S. Standard</u>	<u>Minimum Passing by</u>	<u>Maximum Passing</u>
<u>Sieve</u>	<u>Weight</u>	<u>by Weight</u>
3-inch	100%	-
#4	70%	95%
#40	40%	65%
#200	15%	35%

Soil characteristics shall conform to the following requirements:

<u>Soil Characteristic</u>	<u>Minimum</u>	<u>Maximum</u>
	<u>Value</u>	<u>Value</u>
Plasticity Index (PI)	5	20
Uniformity Coefficient (C _u)	12	---
Coefficient of Curvature (C _c)	1	3

- 2. *Outlet Control Structures (OCS):*
 - a. Basin outlet control structures shall be constructed of reinforced precast concrete monolithic base section, riser section and slab top meeting the latest applicable

requirements of ASTM C478 I and AASHTO M 199, or latest revision thereto. Special manholes shall also meet the requirements of MassDOT Standard Specifications, section M4.02.14, Precast Units. After curing a minimum of 14 days, the outside surface of the tapered or cone section of precast cement concrete drainage structures shall be dried and cleaned.

- b. The OCS shall be fabricated with orifice and weir sizes and invert elevations as outlined within the drainage report and *Stormwater Management Plan*.
 - c. Consistent with Standard Details DRN-16 and DRN-16A the OCS shall be designed to manufactured to incorporate the basin's emergency drawdown.
 - d. The OCS shall have the top of concrete elevation set at the 100-year flood elevation.
 - e. An aluminum grate shall be set into the top of OCS. The grate shall have a hinge and locking mechanism. The grate shall meet the requirements set forth in ASTM B 306, Alloy 6061-T6 or an equivalent performing alloy registered and recognized in the Aluminum Standards and Data book produced by the Aluminum Association.
3. *Emergency Drawdown System:*
- a. Emergency drawdown system shall utilize extruded aluminum stop logs/or sluice gate, lifting lugs, and frame.
 - b. The Emergency drawdown system shall meet the requirements set forth in ASTM B 306, Alloy 6061-T6 or an equivalent performing alloy registered and recognized in the Aluminum Standards and Data book produced by the Aluminum Association.
 - c. The emergency drawdown activation device shall be set below the grate so as not to be utilized unnecessarily.
 - d. The manufacturer shall design the connection system between the emergency drawdown system and outlet control structure.
 - e. Connection accessories shall be of stainless steel. The connection system shall include a resilient watertight gasket. Submit connection detail to the Town Engineer.
 - f. The emergency drawdown system shall be sealed against the outlet control structure. The seals shall be made of neoprene rubber. Seals shall be mounted in a manner that allows for easy replacement in the event of damage.
 - g. All welding shall be done in accordance with AWS D1.2 for aluminum and AWS D1.6 for stainless steel.
 - h. The emergency drawdown system shall have a locking system.
4. *Loam and Seed:*
- a. All basins shall be loamed with 6" of clean loam containing no stones over 3" in diameter and seeded with New England Erosion Control/ Restoration Mix for Detention Basins and Moist Sites from New England Wetland Plants, or approved equal.
5. *Infiltration Basin Bottom:*
- a. Infiltration basins shall have sand bottoms meeting Title V gradation requirements or double washed crushed stone with a diameter 2" and smaller.

C. Forebay/Sediment Trap

1. Forebay embankments shall be loamed with 6" of clean loam containing no stones over 3" in diameter and seeded with New England Erosion Control/ Restoration Mix for Detention Basins and Moist Sites from New England Wetland Plants, or approved equal.

2. Bottom material shall promote ease of maintenance.
3. Flow-through stone outlet shall be constructed of gabion baskets, or double washed 1" to 1-1/2" crushed stone.

2.3.2.5 Culverts:

- A. Culvert, headwall, wingwall, and end wall materials and specifications shall meet MassDOT Standard Specifications Sections 230 and M4, and as shown on MassDOT Construction and Traffic Standard Details, Drawings 206.40 through 206.70, and 207.1.0 through 207.3.0.

2.3.2.5 Rip Rap/Pipe Ends:

- A. Stone shall conform to MassDOT Standard Specifications Section 258 and Standard Detail DRN-10A. Stone size shall be determined by the design storm flow discharging from the pipe. Stone for drainage swales shall be no smaller than 3 inches, unless otherwise approved by the Town.

2.3.2.6 Headwalls:

- A. Headwall materials and specifications shall meet MassDOT Standard Specifications Sections 230 and M4, and as shown on Standard Detail DRN-11.

DRAINAGE DETAIL INDEX

DESCRIPTION

DETAIL NUMBER

STANDARD CATCH BASIN	DRN-1
CATCH BASIN FRAME AND GRATE	DRN-1A
CATCH BASIN WITH GUTTER INLET	DRN-2
BIO-RETENTION AREA	DRN-3
DRAINAGE LEACHING BASIN	DRN-4
STANDARD DRAINAGE MANHOLE	DRN-5
DRAINAGE MANHOLE FRAME AND COVER	DRN-5A
BLOCK DRAINAGE STRUCTURE	DRN-6
TYPICAL TRENCH FOR DRAIN PIPE	DRN-7
UNDER-DRAIN TRENCH	DRN-8
UTILITY SUPPORT	DRN-9
OUTLET EROSION PROTECTION	DRN-10
OUTLET EROSION PROTECTION CROSS SECTION	DRN-10A
FIELD STONE HEADWALL	DRN-11
INFILTRATION BASIN	DRN-12
INFILTRATION BASIN CROSS SECTION	DRN-12A
BASIN BERM CROSS SECTION	DRN-13
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OUTLET CONTROL STRUCTURE GRATE	DRN-16A

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
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DRAINAGE INDEX

SCALE: N.T.S

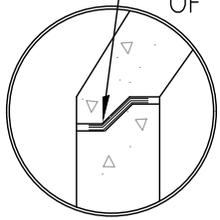
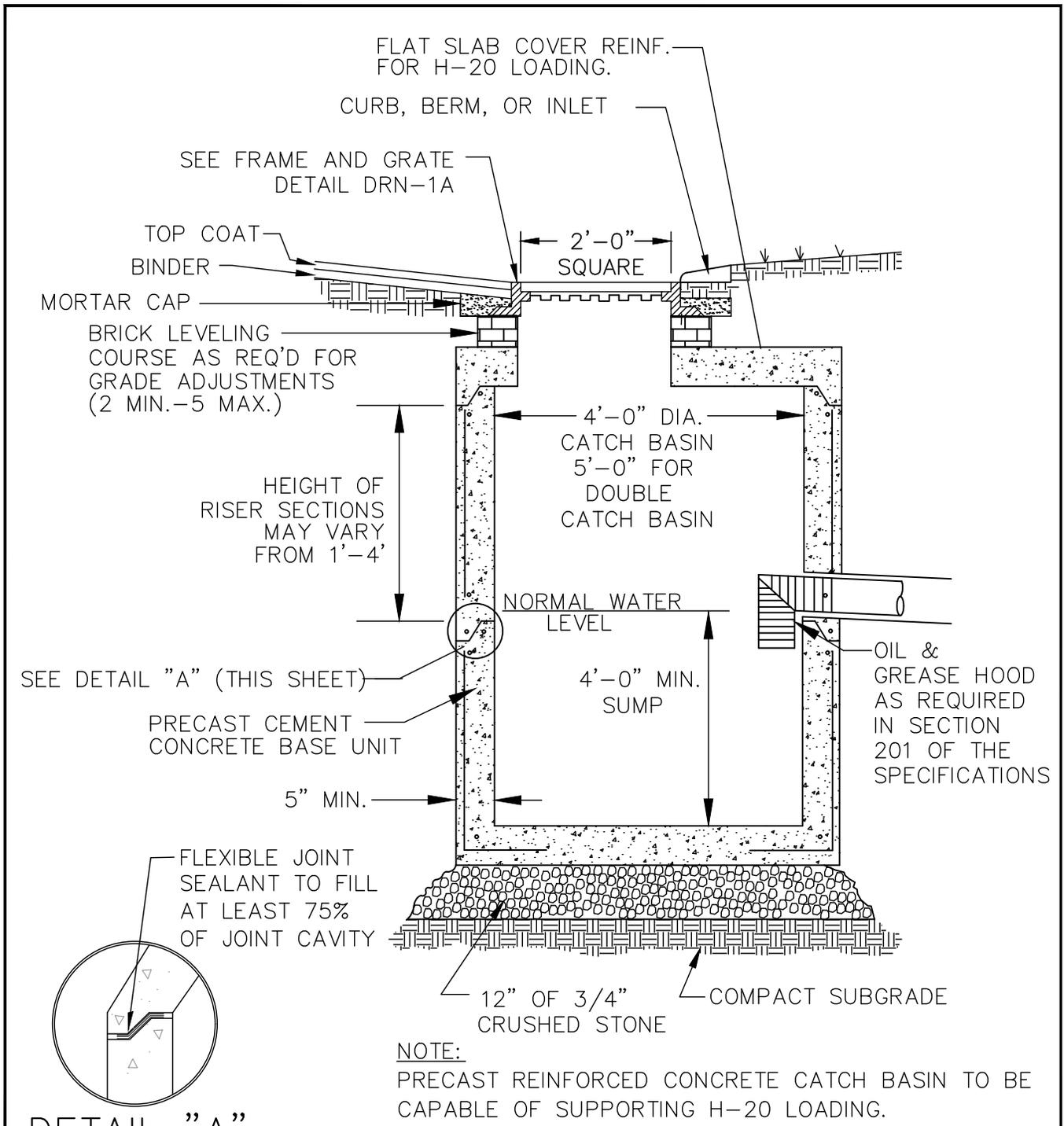
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JOB NO. \FILE NAME:
STANDARD_DETAILS

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PLAN NO.
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DETAIL "A"
NOT TO SCALE

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

STANDARD CATCH BASIN DETAIL

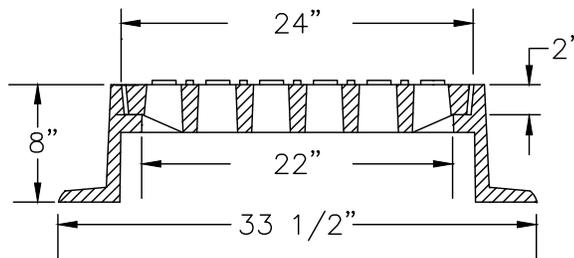
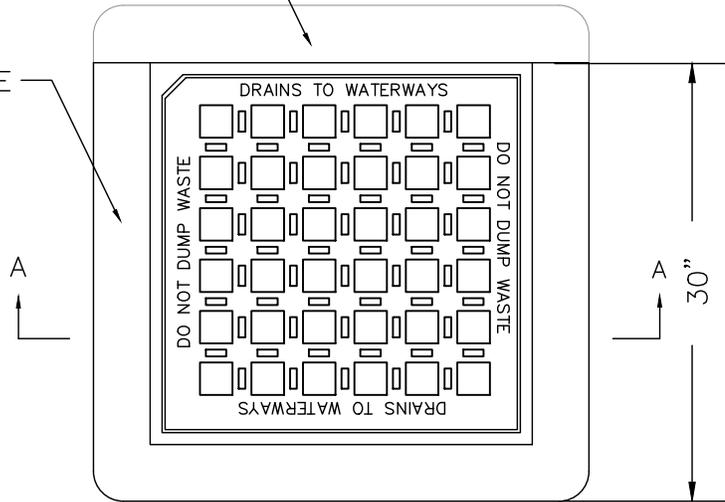
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4 FLANGE AVAILABLE
(SEE NOTE BELOW)

3 FLANGE FRAME



SECTION A-A

NOTE:

FRAME EJ CATALOG NO. OMA552000029
 GRATE EJ CATALOG NO. OMA552000075
 OR APPROVED EQUAL.

3 FLANGE FRAMES TO BE USED WHERE INLET IS ADJACENT TO CURB STONES, 4 FLANGE FRAME TO BE USED ELSEWHERE.

"DO NOT DUMP WASTE, DRAINS TO WATERWAYS" SHALL BE FORGED INTO THE GRATE.

TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
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CATCH BASIN COVER DETAIL

SCALE: N.T.S

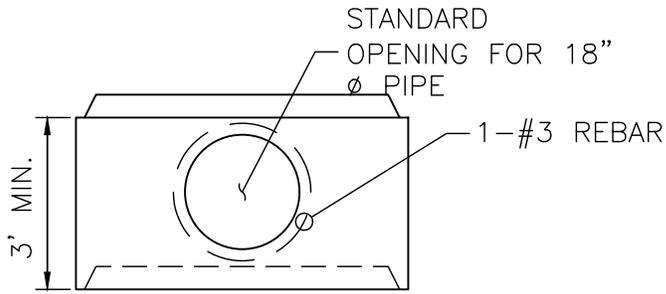
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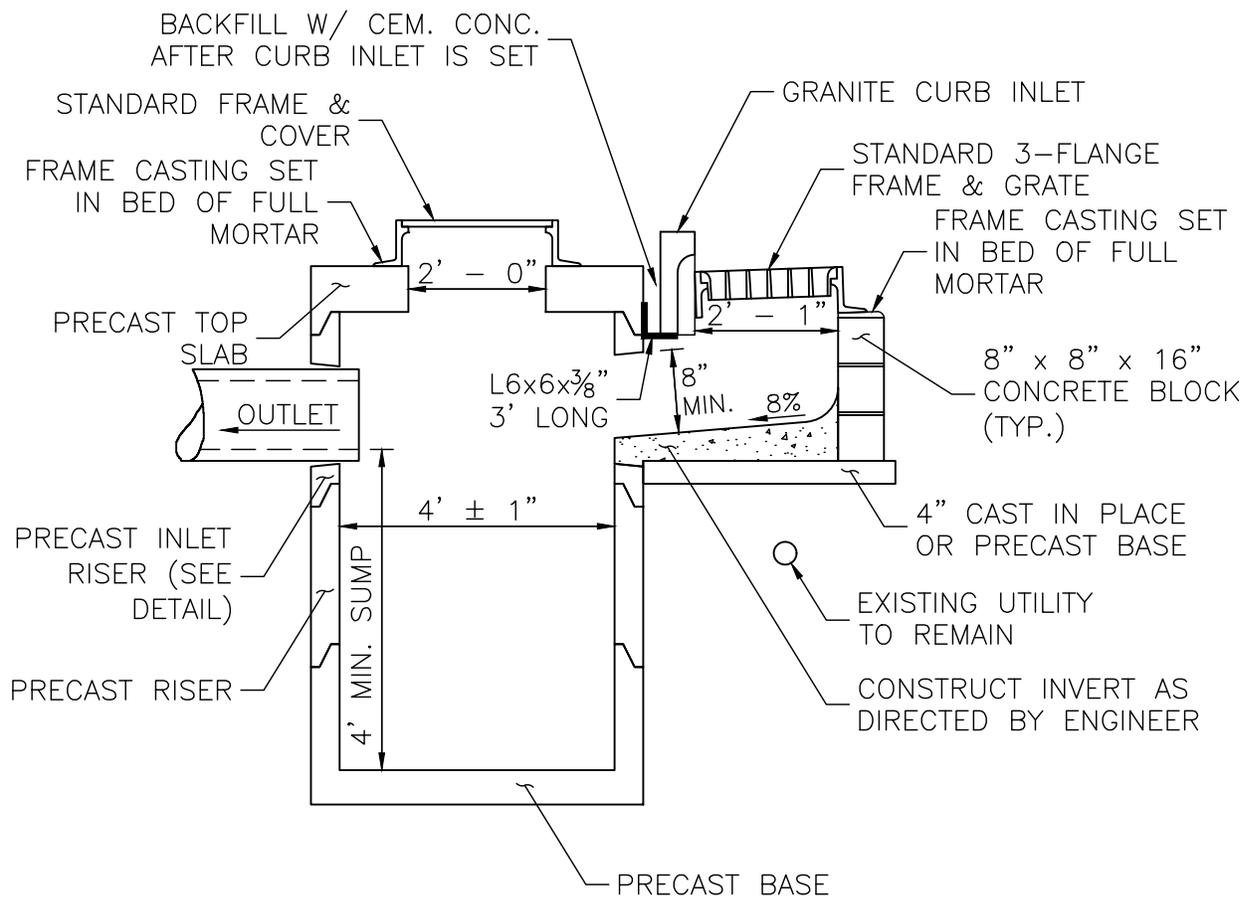
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PLAN NO.
 DRN-1A





INLET RISER



SECTION

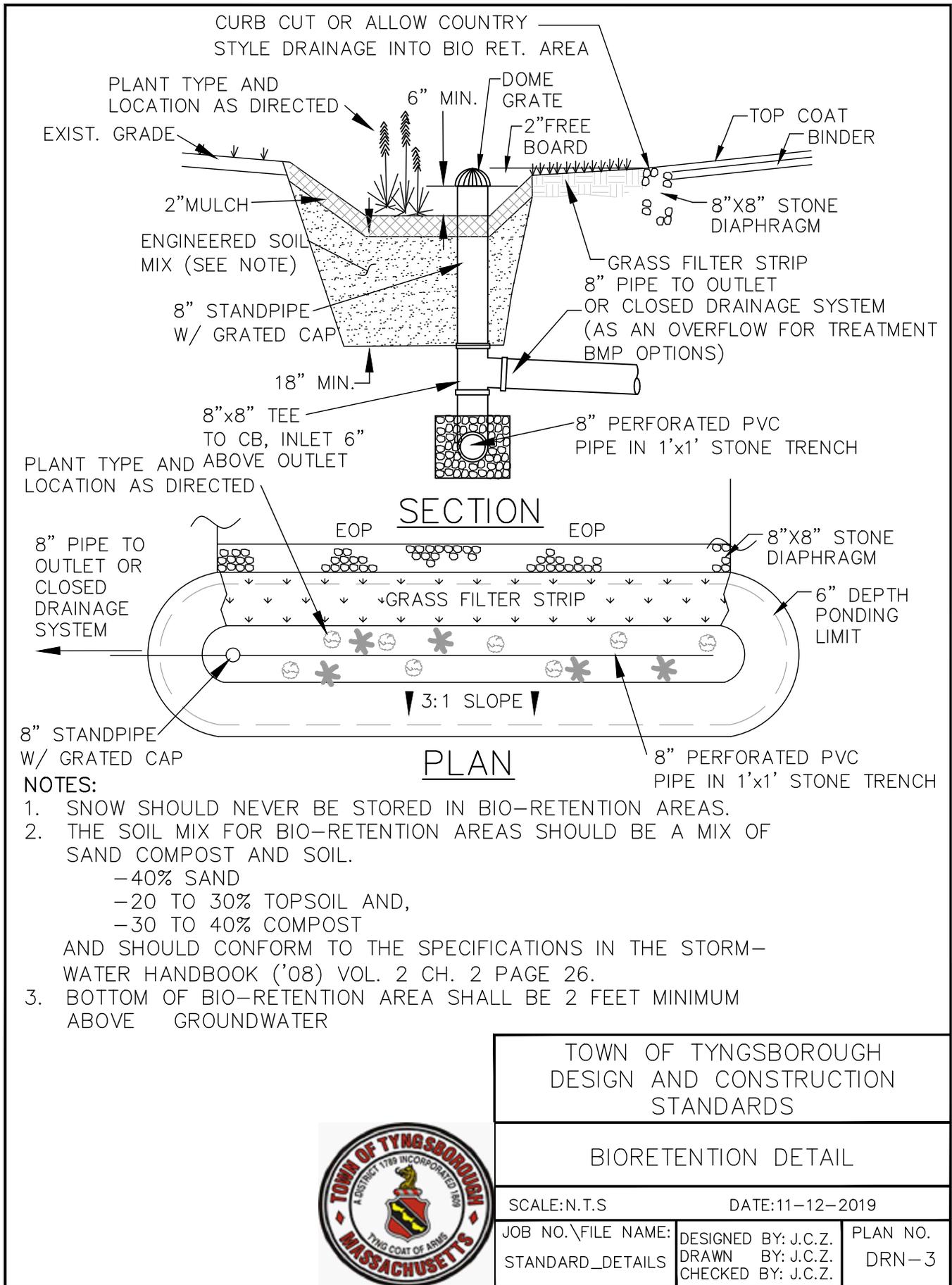
TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

CATCH BASIN WITH GUTTER INLET
DETAIL

SCALE: N.T.S. DATE: 11-12-2019

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STANDARD_DETAILS	DRAWN BY: J.C.Z.	DRN-2
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NOTES:

1. SNOW SHOULD NEVER BE STORED IN BIO-RETENTION AREAS.
2. THE SOIL MIX FOR BIO-RETENTION AREAS SHOULD BE A MIX OF SAND COMPOST AND SOIL.
 - 40% SAND
 - 20 TO 30% TOPSOIL AND,
 - 30 TO 40% COMPOST
 AND SHOULD CONFORM TO THE SPECIFICATIONS IN THE STORM-WATER HANDBOOK ('08) VOL. 2 CH. 2 PAGE 26.
3. BOTTOM OF BIO-RETENTION AREA SHALL BE 2 FEET MINIMUM ABOVE GROUNDWATER

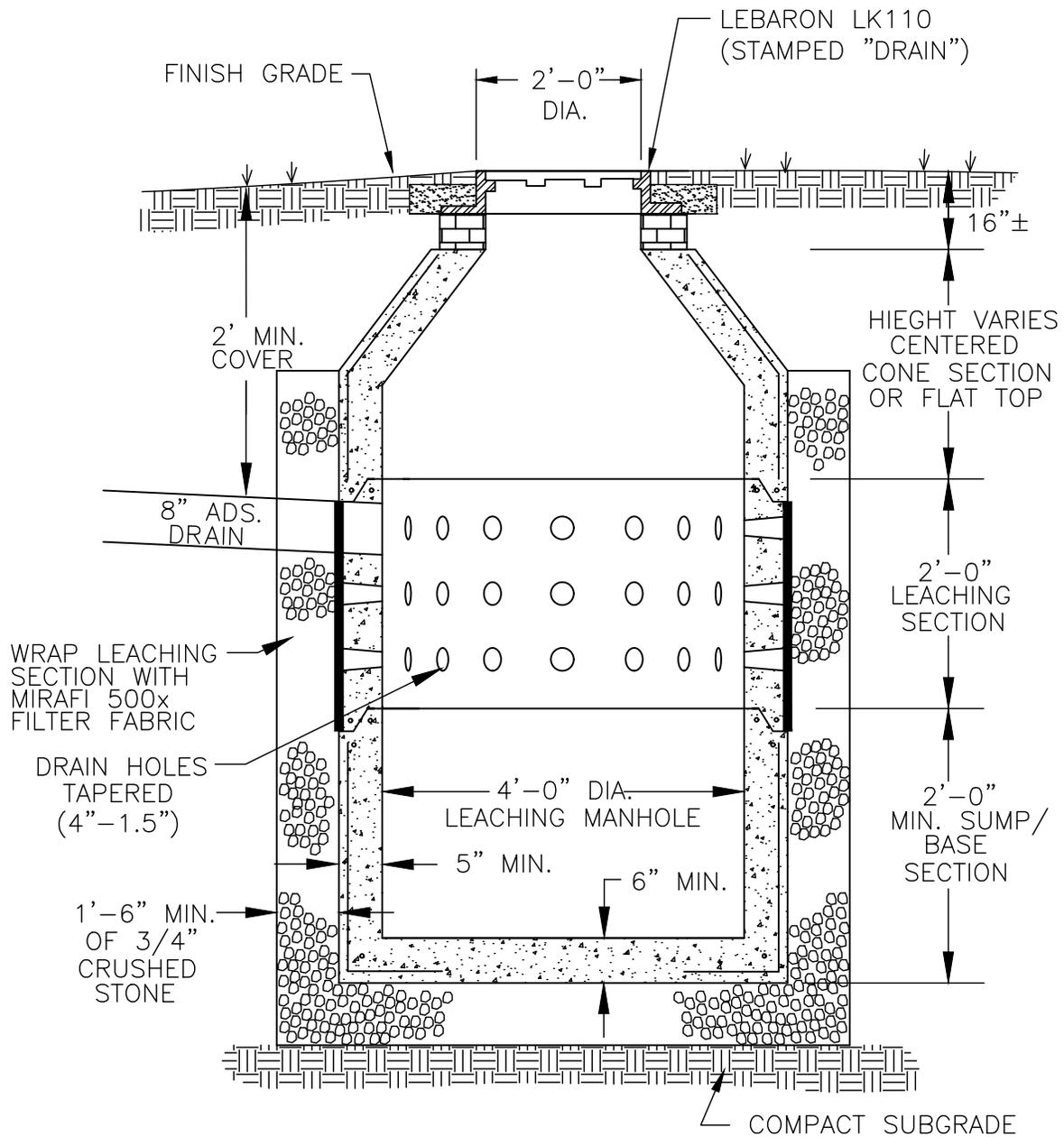
TOWN OF TYNGSBOROUGH
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BIORETENTION DETAIL

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STANDARD_DETAILS	DRAWN BY: J.C.Z.	DRN-3
	CHECKED BY: J.C.Z.	





NOTE:

LEACHING MANHOLE TO BE 4' DIAMETER MANHOLE WITH LEACHING SECTION AS MANUFACTURED BY WILLIAM N. LAMARRE CONCRETE PRODUCTS, INC. OR APPROVED EQUAL. MANHOLE SHALL MEET H-20 LOADING REQUIREMENTS.

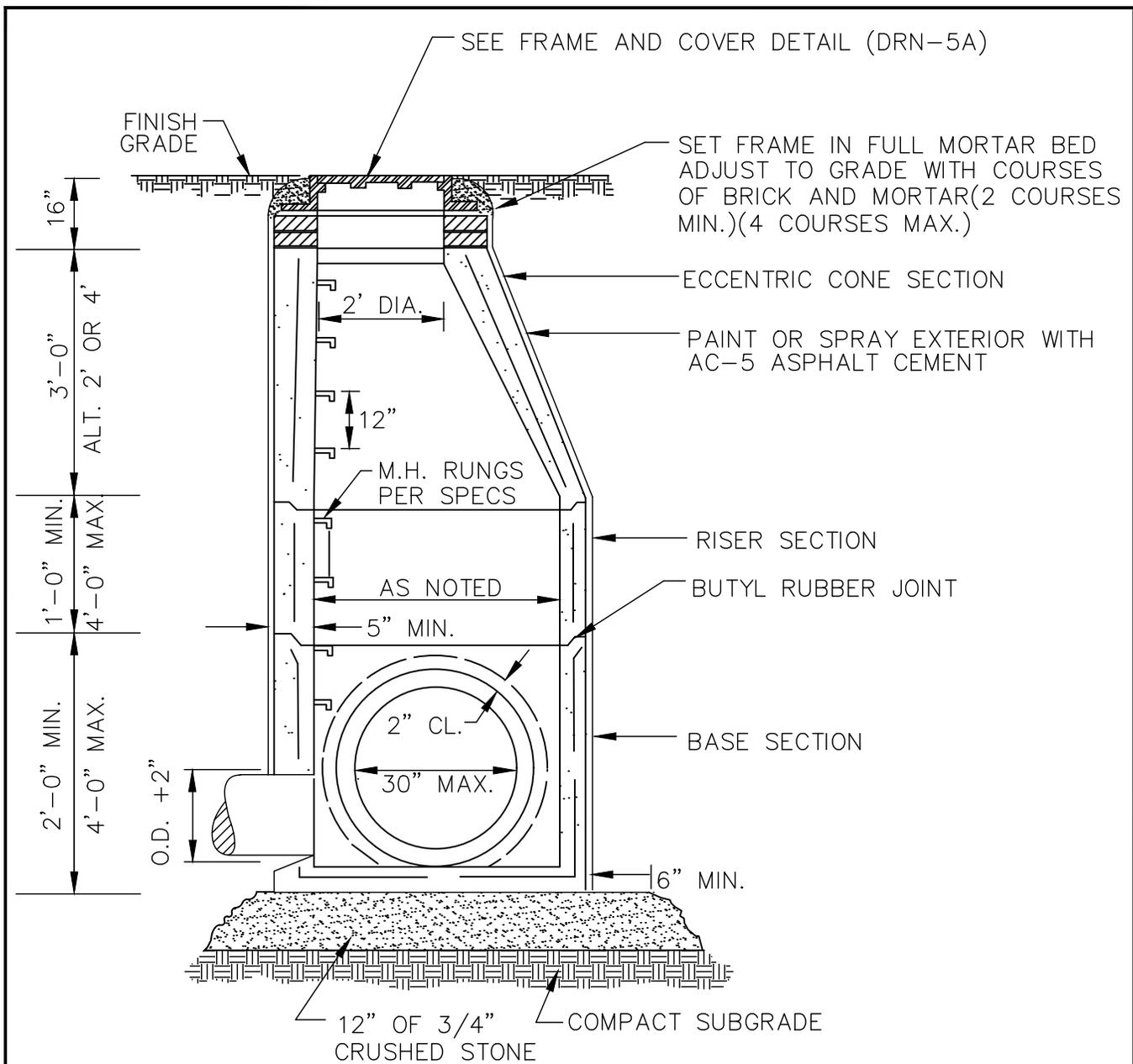
TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

DRAINAGE LEACHING BASIN DETAIL

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STANDARD_DETAILS	DRAWN BY: J.C.Z.	DRN-4
	CHECKED BY: J.C.Z.	





NOTE:

PRECAST REINFORCED CONCRETE MANHOLE TO BE CAPABLE OF SUPPORTING H-20 LOADING

TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
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STANDARD PRECAST DRAINAGE
 MANHOLE DETAIL

SCALE: N.T.S

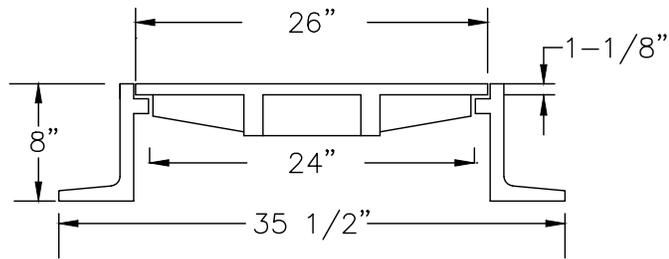
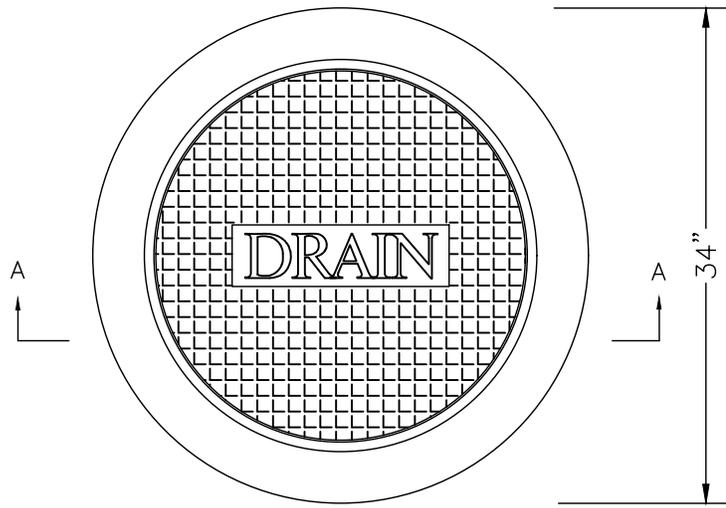
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PLAN NO.
 DRN-5





SECTION A-A

NOTE:

FRAME EJ CATALOG NO. OMA1240000238
 COVER EJ CATALOG NO. OMA124000026
 OR APPROVED EQUAL.

TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

DRAINAGE MANHOLE FRAME AND
 COVER

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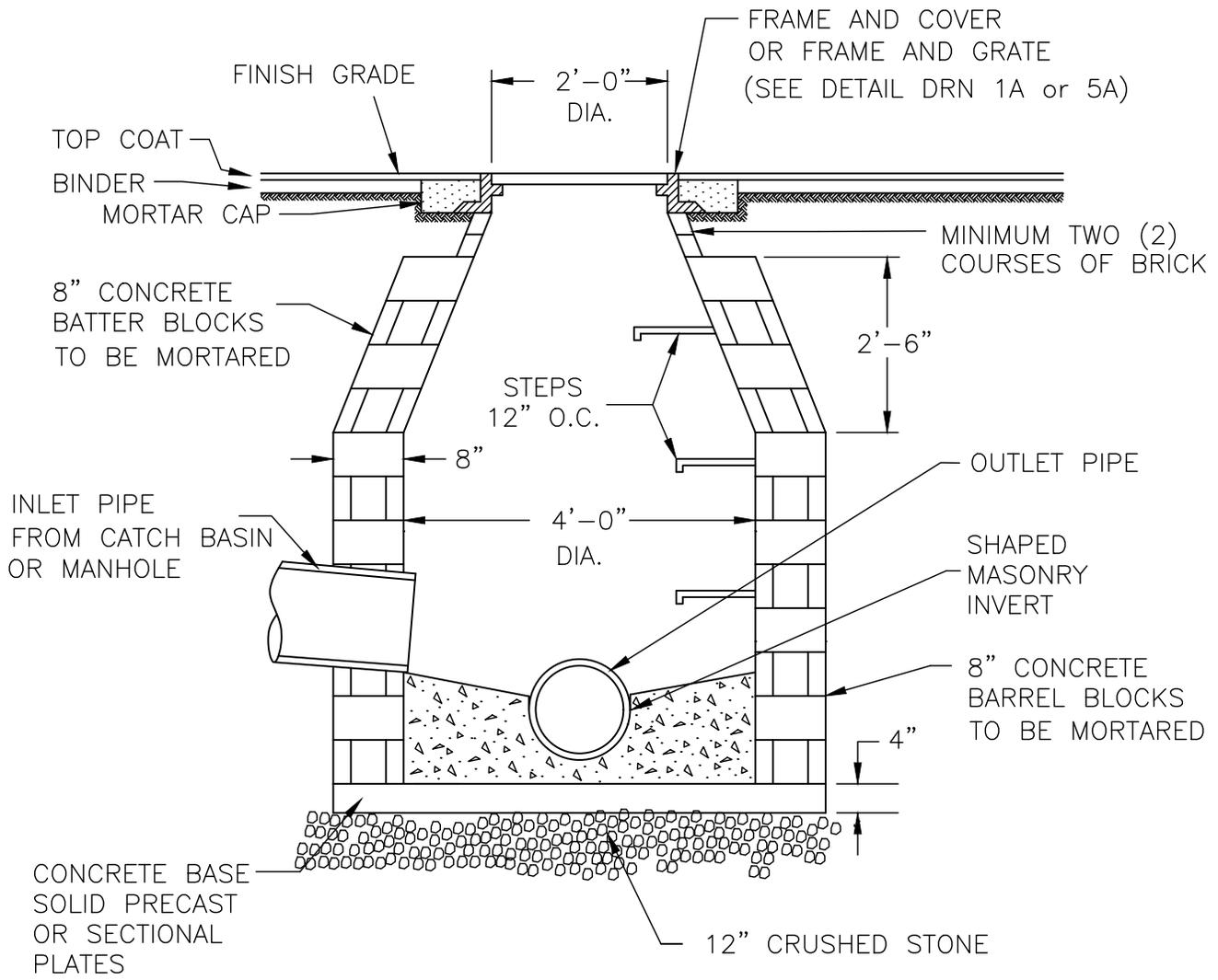
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PLAN NO.
 DRN-5A





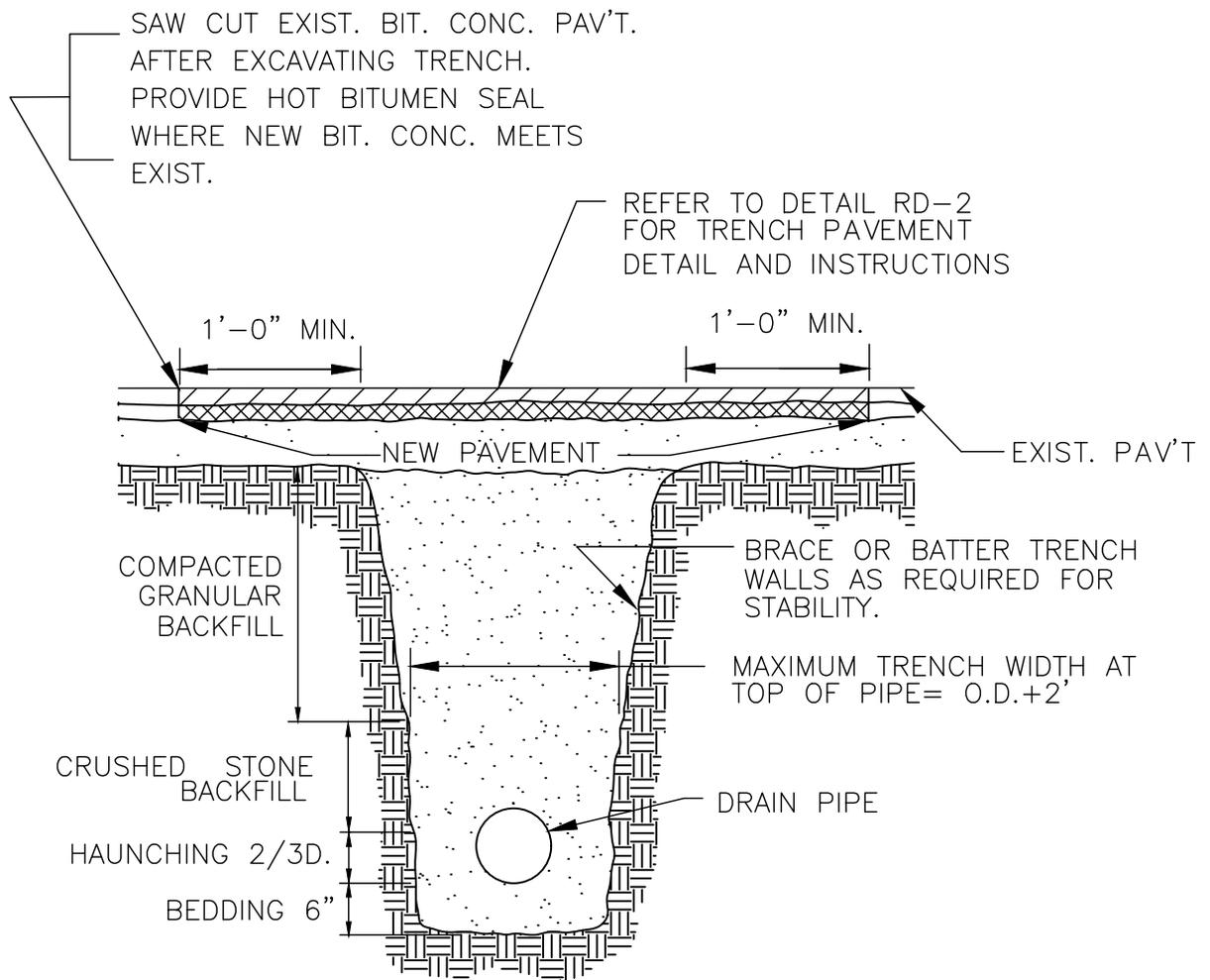
TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
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BLOCK DRAINAGE STRUCTURE
 DETAIL

SCALE: N.T.S. DATE: 11-12-2019

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STANDARD_DETAILS	DRAWN BY: J.C.Z.	DRN-6
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NOTE:
BEDDING AND HAUNCHING
SHALL BE 3/4" STONE

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

TRENCH FOR DRAIN PIPE
DETAIL

SCALE: N.T.S

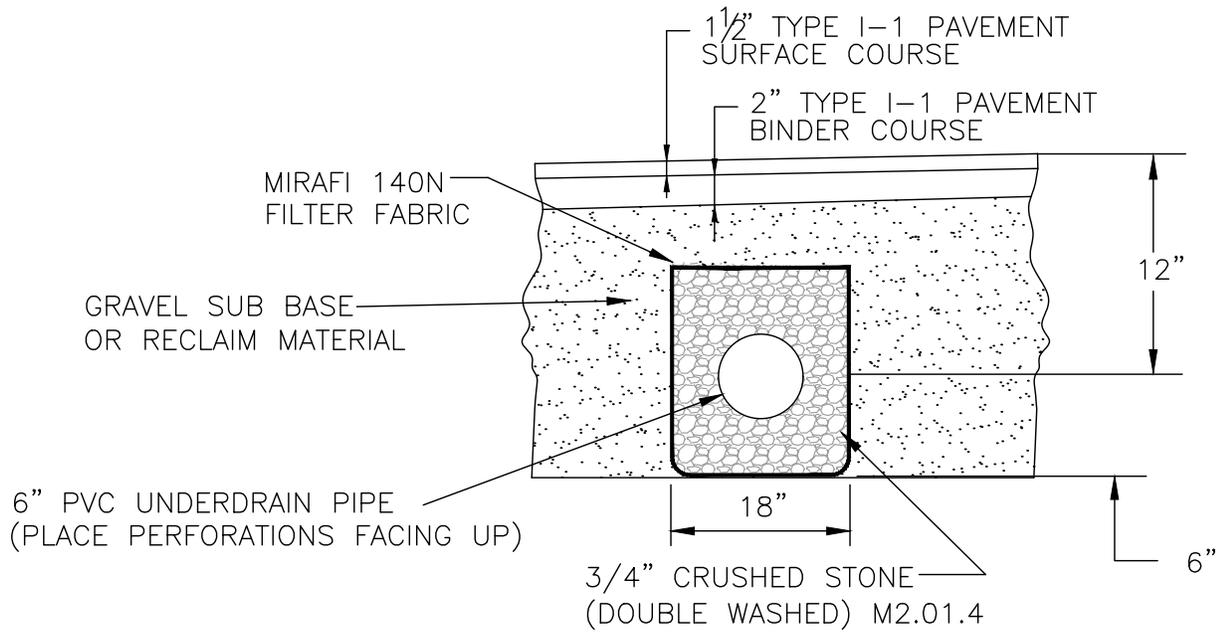
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PLAN NO.
DRN-7





TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
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ROADWAY UNDER-DRAIN
 DETAIL

SCALE: N.T.S

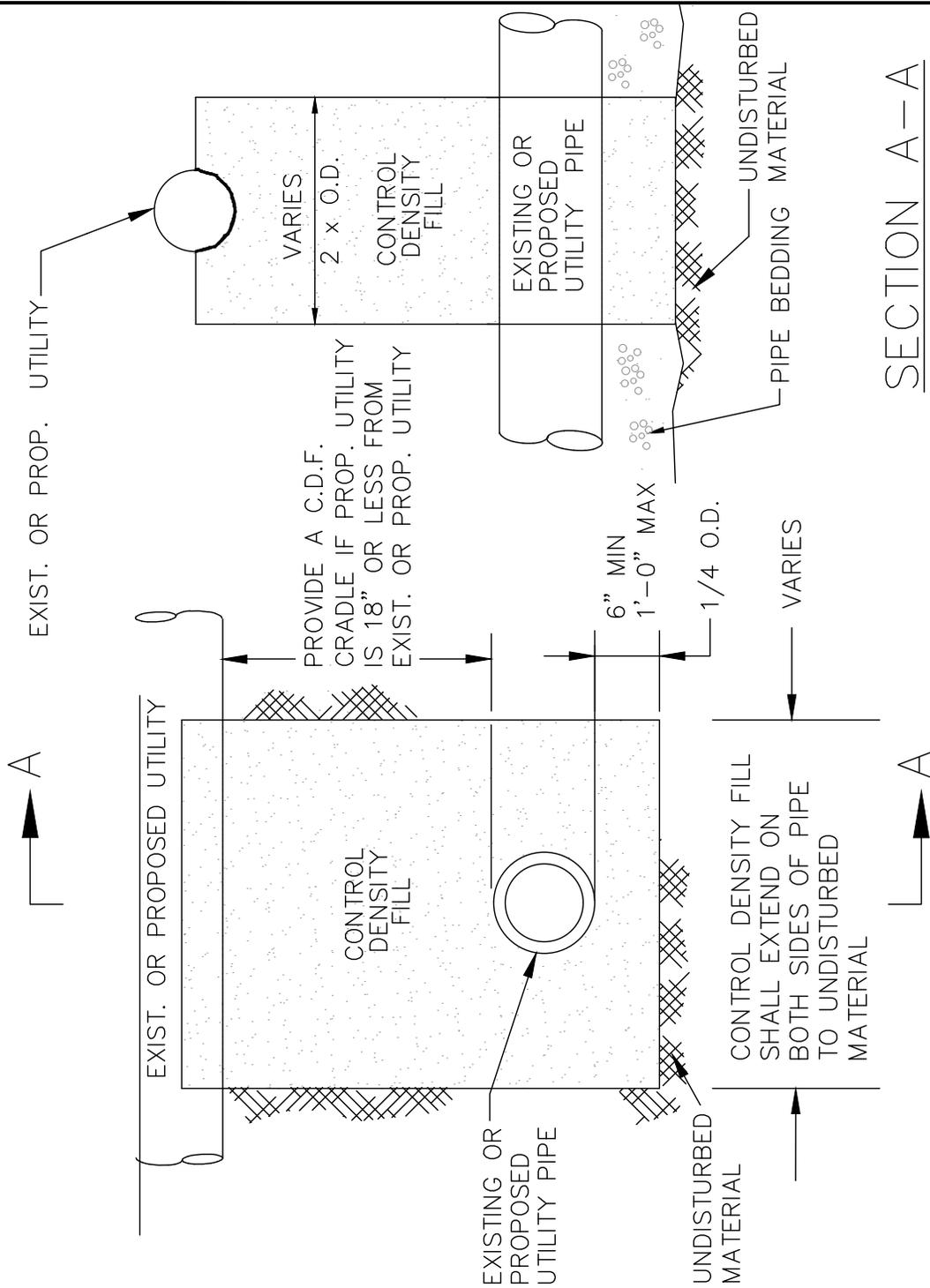
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PLAN NO.
 DRN-8





SECTION A-A

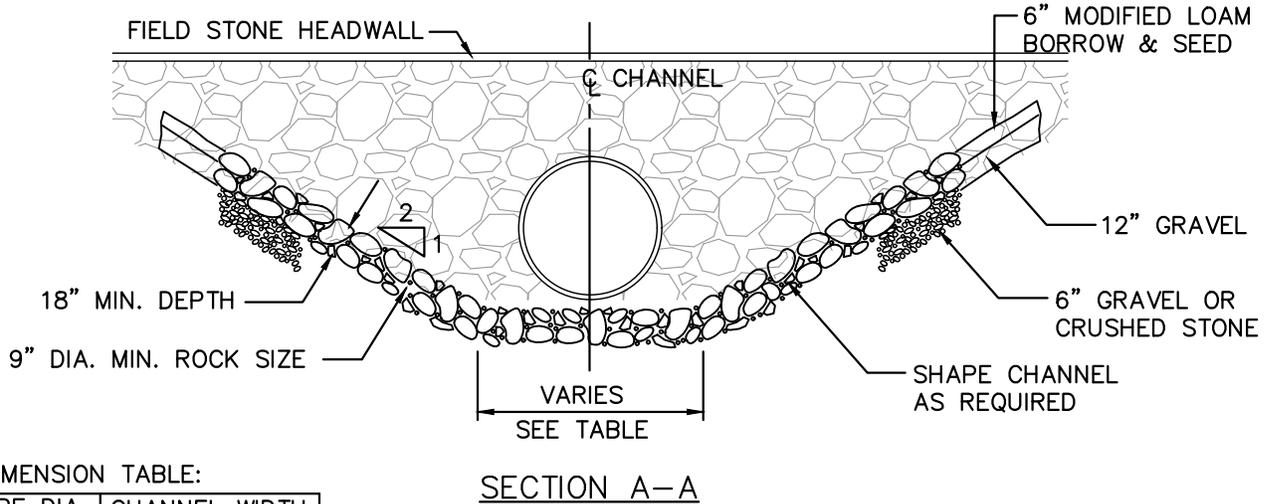
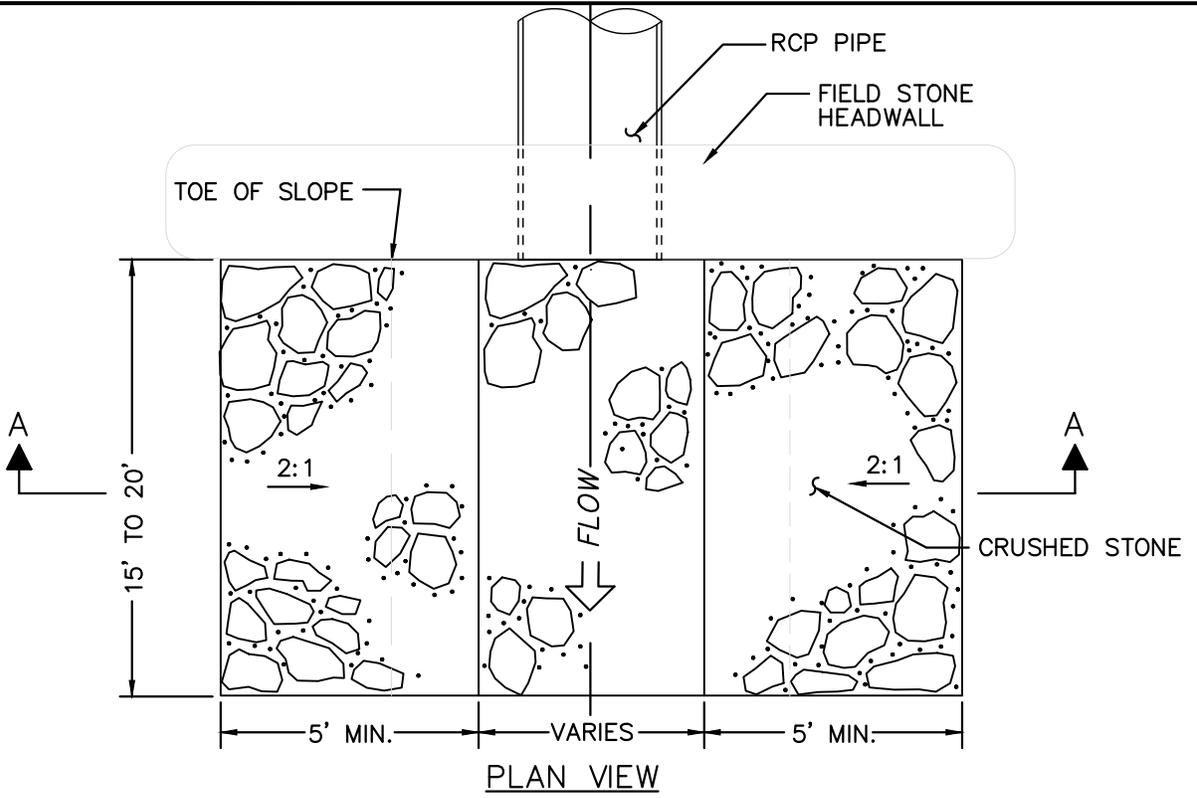


TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

UTILITY SUPPORT
 DETAIL

SCALE: N.T.S. DATE: 11-13-2019

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STANDARD_DETAILS	DRAWN BY: J.C.Z.	DRN-9
	CHECKED BY: J.C.Z.	



DIMENSION TABLE:

PIPE DIA.	CHANNEL WIDTH
12"	2'-6"
15"	3'-0"
18"	3'-7"
24"	4'-8"

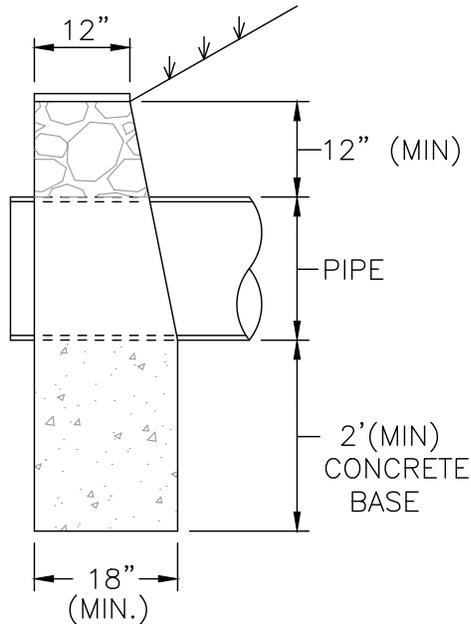
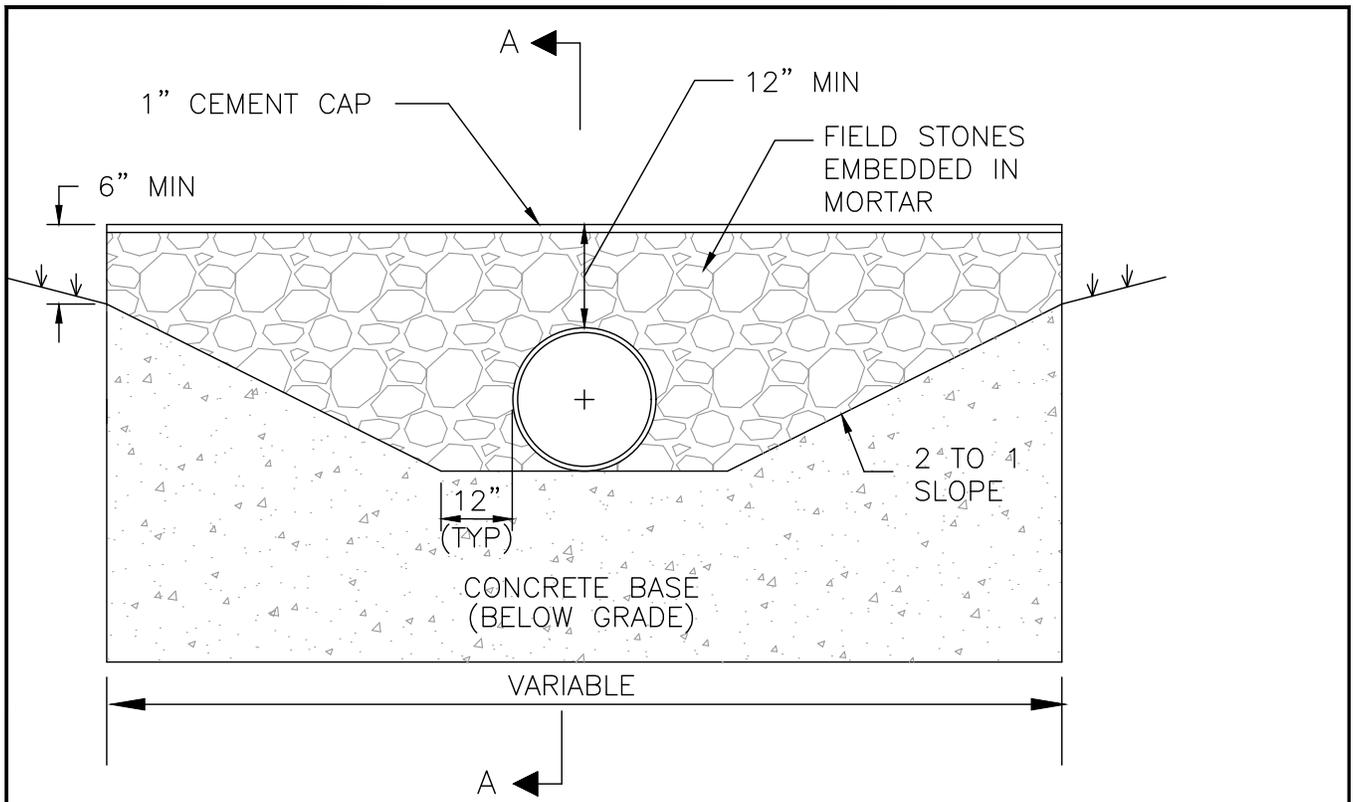
TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
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OUTLET EROSION PROTECTION
 DETAIL

SCALE: N.T.S. DATE: 11-13-2019

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STANDARD_DETAILS	DRAWN BY: J.C.Z.	DRN-10
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SECTION A-A

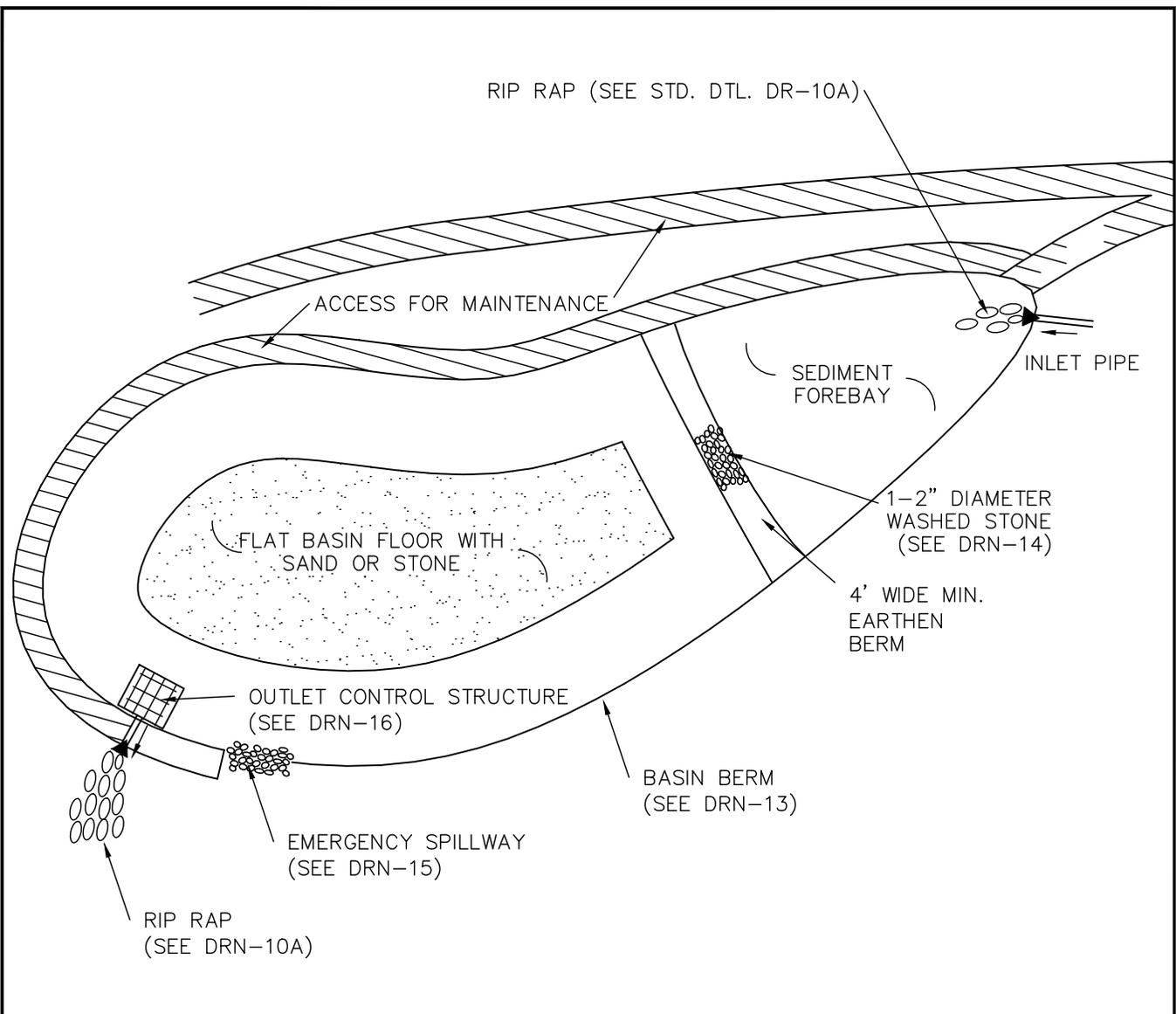
TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

FIELD STONE HEADWALL
 DETAIL

SCALE: N.T.S. DATE: 11-13-2019

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STANDARD_DETAILS	DRAWN BY: J.C.Z.	DRN-11
	CHECKED BY: J.C.Z.	





NOTE:

1. THE INFILTRATION BASIN SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER, AND SHALL COMPLY WITH ALL ASPECTS OF THE MA-DEP STORMWATER HANDBOOK.
2. DRY BASINS MAY BE DESIGNED WITH GRAVEL, PEA STONE, SAND, AND WATER TOLERANT GRASSES.

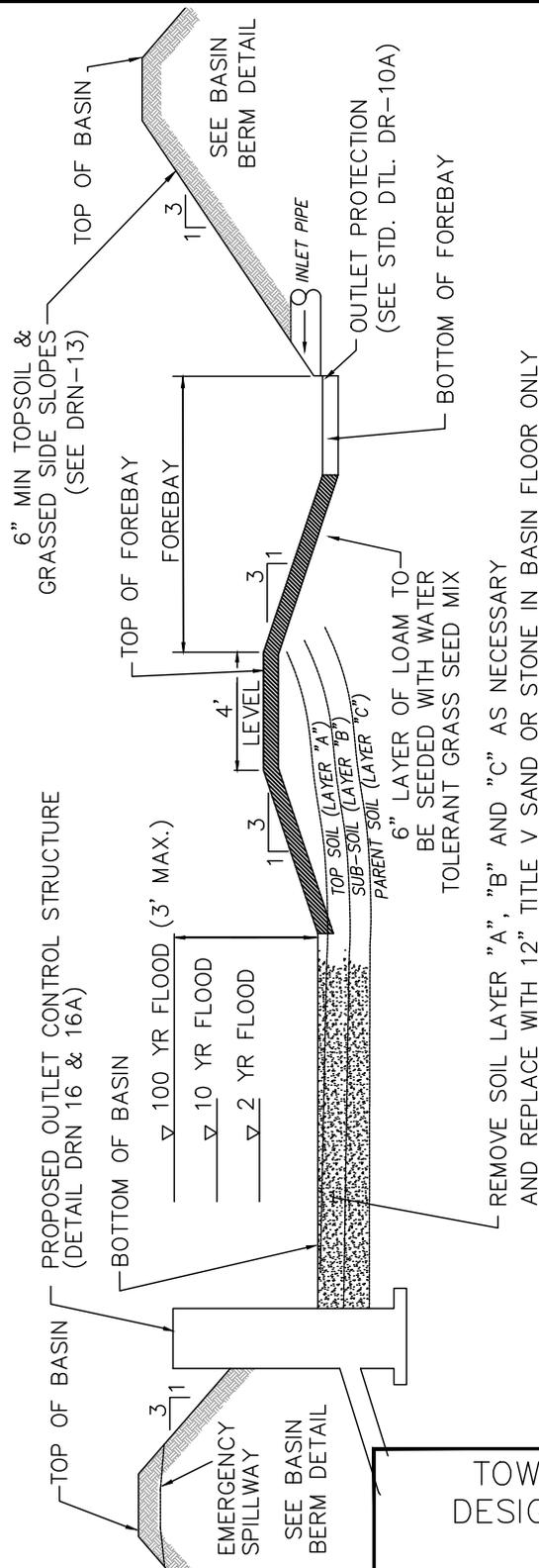
TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

INFILTRATION BASIN
 DETAIL

SCALE: N.T.S DATE: 11-13-2019

JOB NO. \ FILE NAME:	DESIGNED BY: J.C.Z.	PLAN NO.
STANDARD_DETAILS	DRAWN BY: J.C.Z.	DRN-12
	CHECKED BY: J.C.Z.	





NOTES:

- 1.) THE INFILTRATION PORTION OF EACH BASIN SHALL BE SET A MINIMUM OF 2' ABOVE THE SEASONALLY HIGH GROUNDWATER TABLE. ALL OTHER PORTIONS OF THE BASIN SHALL BE SET A MINIMUM OF 2' ABOVE THE SEASONALLY HIGH GROUNDWATER TABLE.
- 2.) THE LOWEST PORTION OF THE BASIN FLOOR SHALL CONSIST OF A MINIMUM OF 12" OF TITLE V SAND OR STONE PLACED DIRECTLY OVER NATIVE "C" LAYER SOILS.
- 3.) THE INFILTRATION CAPACITY SHALL BE DETERMINED UTILIZING THE RAWLS TABLE AS WELL AS ALL OTHER ASPECTS IN THE STORMWATER HANDBOOK.

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

INFILTRATION BASIN CROSS SECTION
DETAIL

SCALE: N.T.S

DATE: 11-13-2019

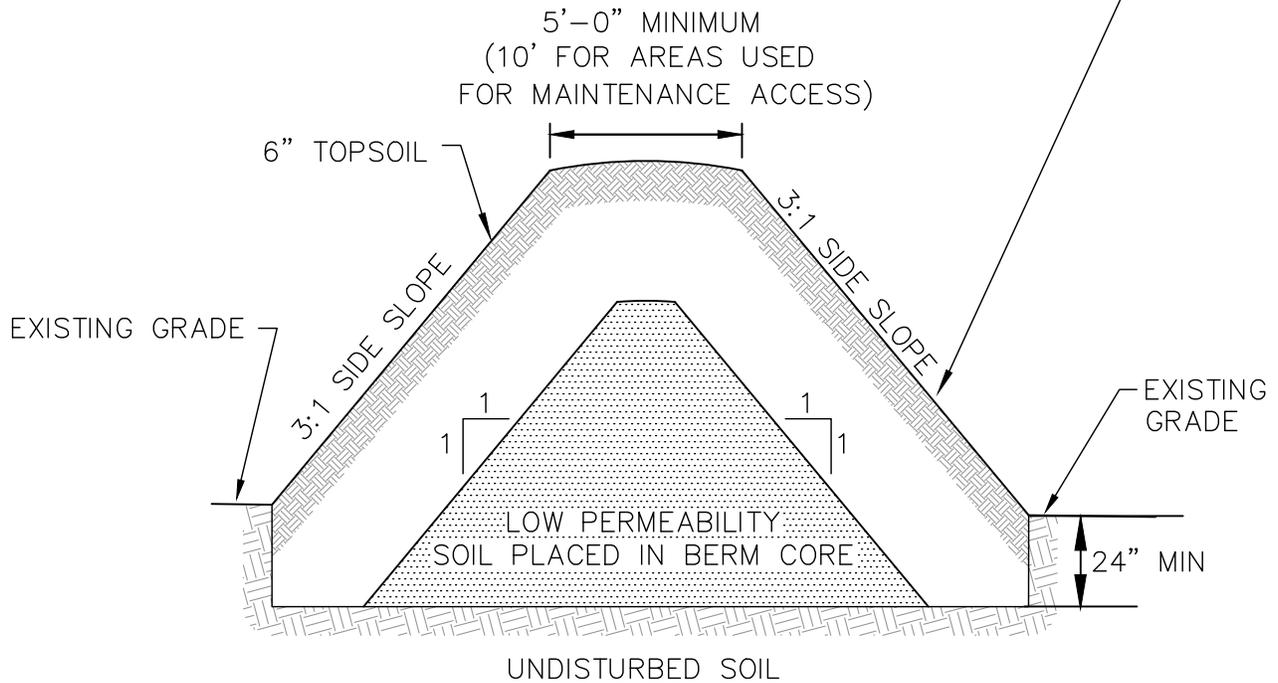
JOB NO. \ FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
DRN-12A



NEW ENGLAND EROSION CONTROL/
RESTORATION MIX FOR DETENTION
BASINS AND MOIST SITES.
MIX BY NEW ENGLAND WETLAND
PLANTS, INC.



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

BASIN BERM
DETAIL

SCALE: N.T.S

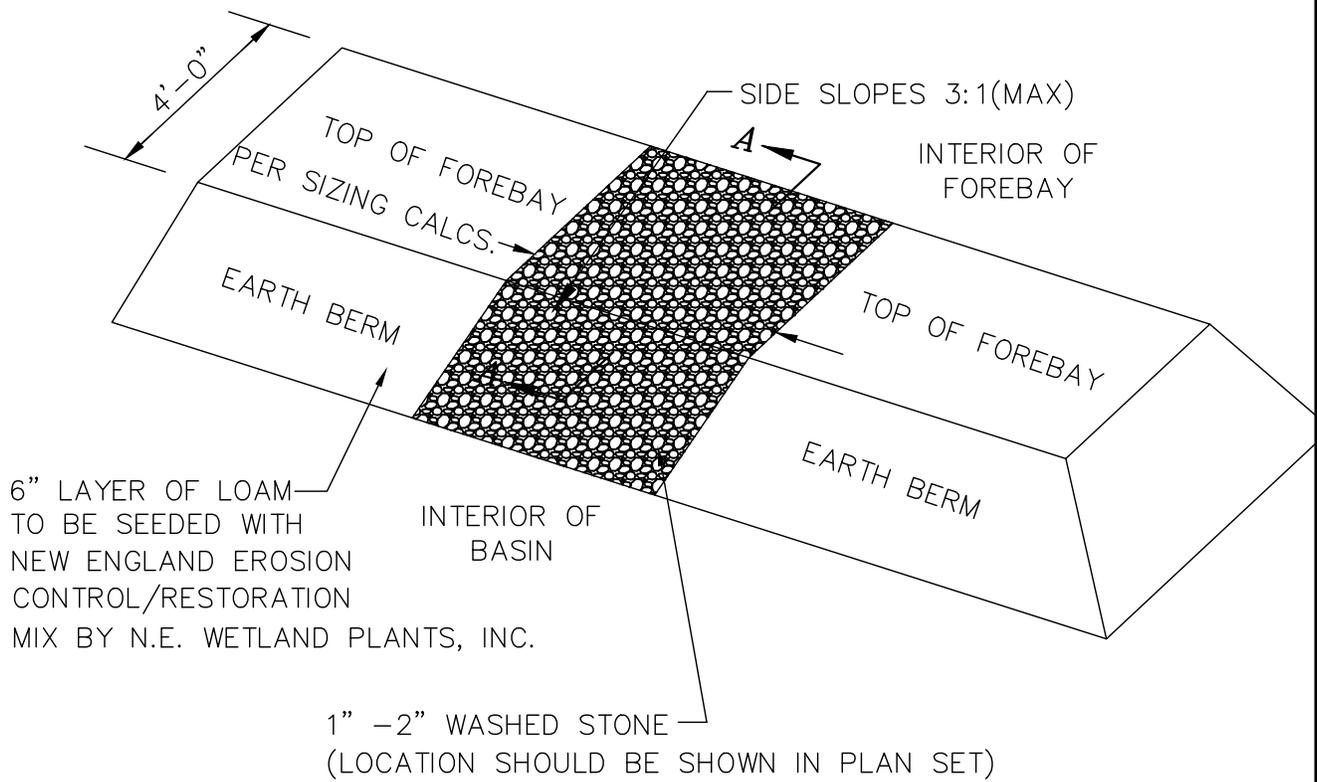
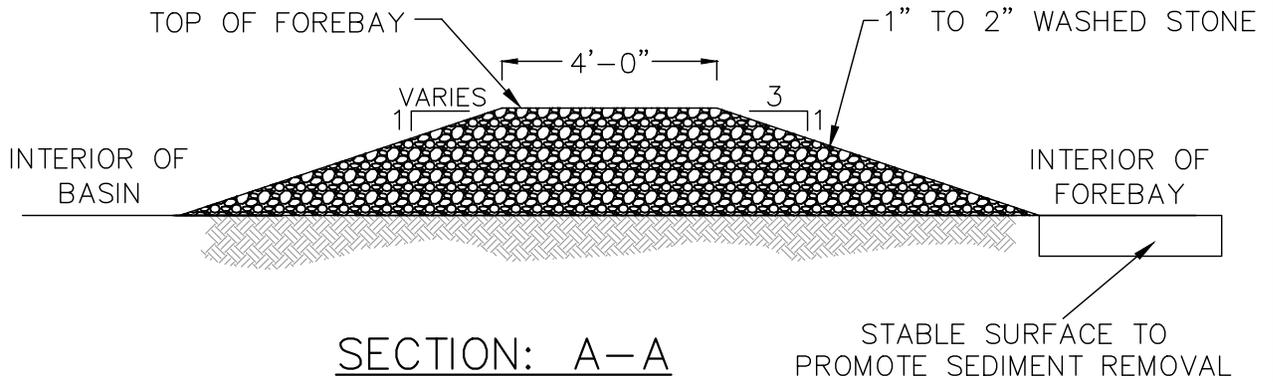
DATE: 11-13-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
DRN-13





TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

FOREBAY BERM
DETAIL

SCALE: N.T.S

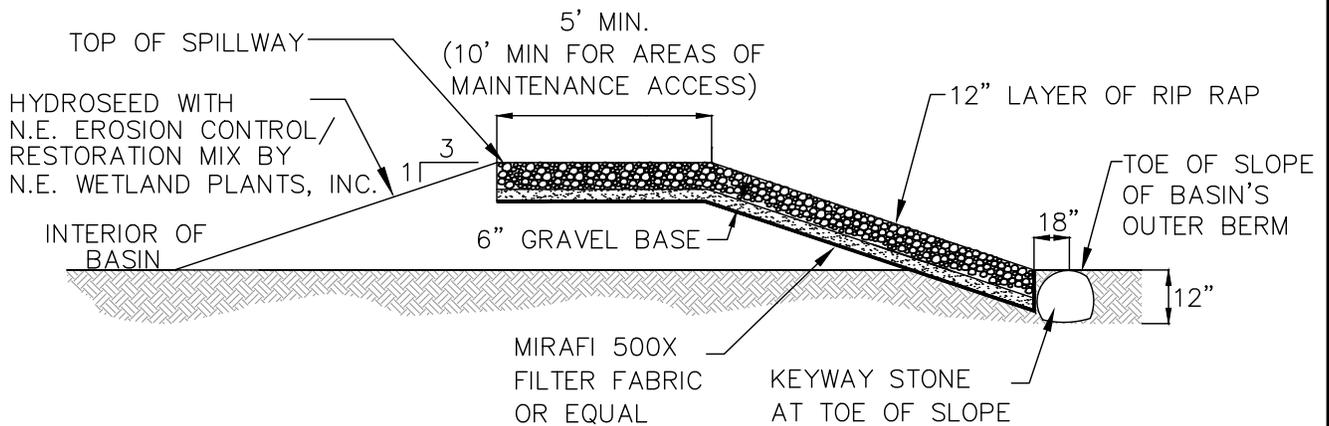
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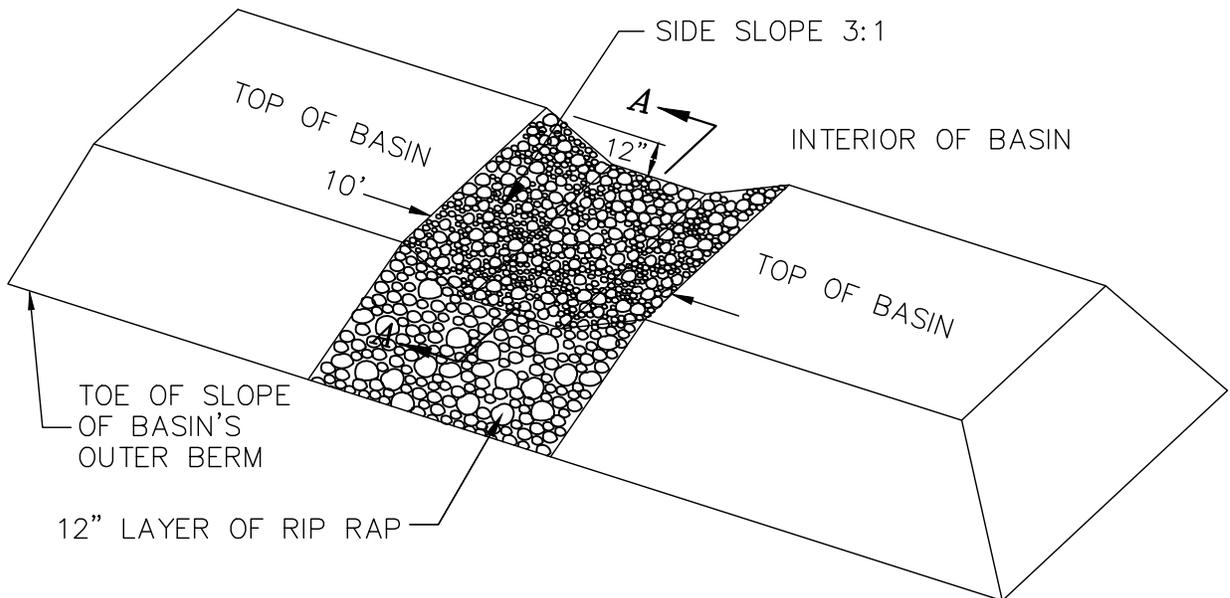
PLAN NO.
DRN-14





NOTE: 60% OF THE RIP RAP SHALL BE 6" OR MORE AND IN ACCORDANCE WITH M.D.P.W. STD. SPEC. 258.20.

SECTION: A-A



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

EMERGENCY SPILLWAY
DETAIL

SCALE: N.T.S

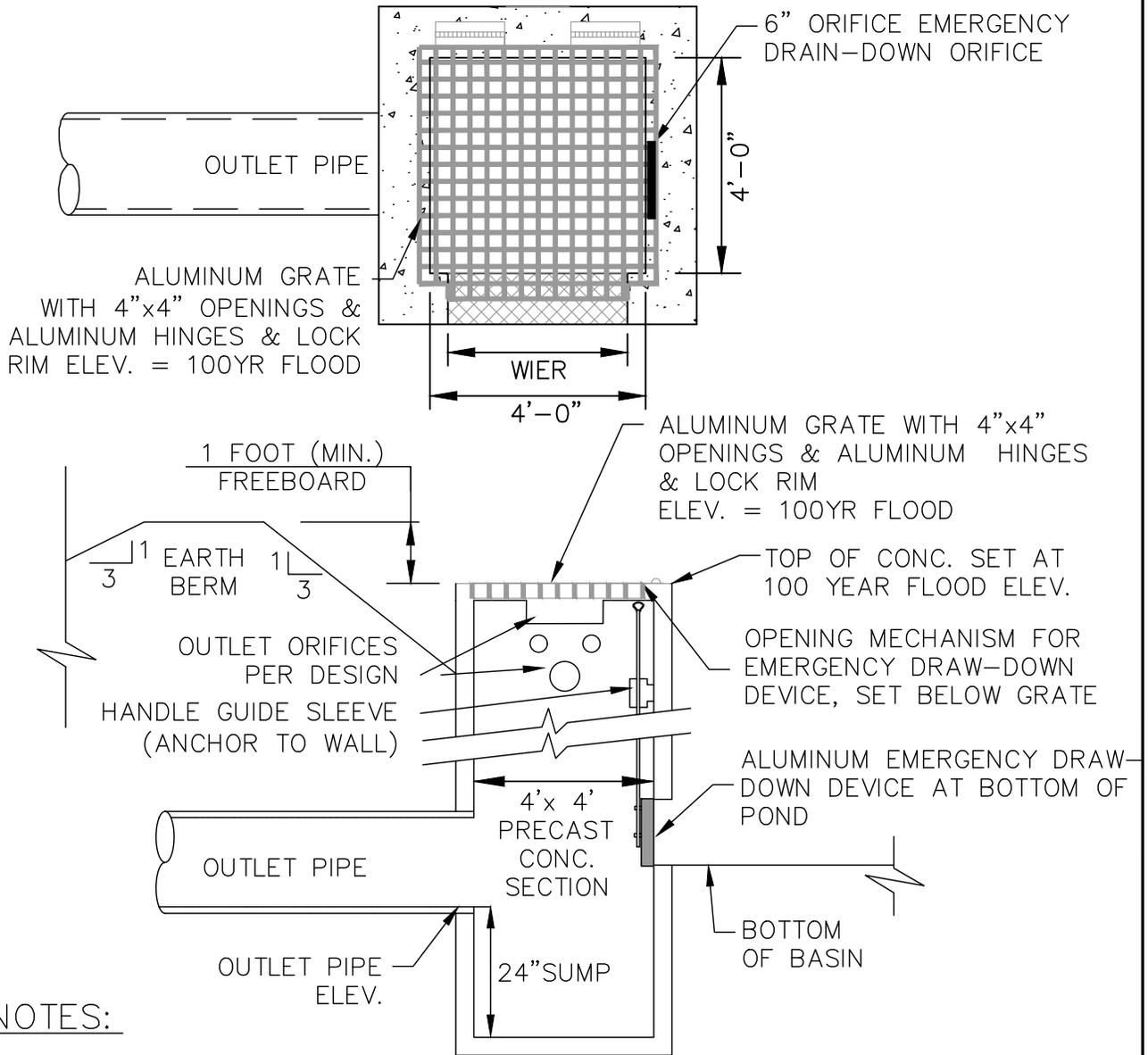
DATE: 11-13-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
DRN-15





NOTES:

- 1.) ORIFICE ELEVATIONS SHALL BE SHOWN ON DESIGN PLANS.
- 2.) CONTRACTOR SHALL CONFIRM INVERT GRADES IN FIELD PRIOR TO STRUCTURE INSTALLATION.
- 3.) THE EMERGENCY DRAW-DOWN DEVICE IS PROVIDED TO ALLOW THE BASIN TO BE MANUALLY DRAINED IF NECESSARY. THE MECHANISM SHALL REMAIN CLOSED DURING NORMAL CONDITIONS.

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

OUTLET CONTROL STRUCTURE
DETAIL

SCALE: N.T.S

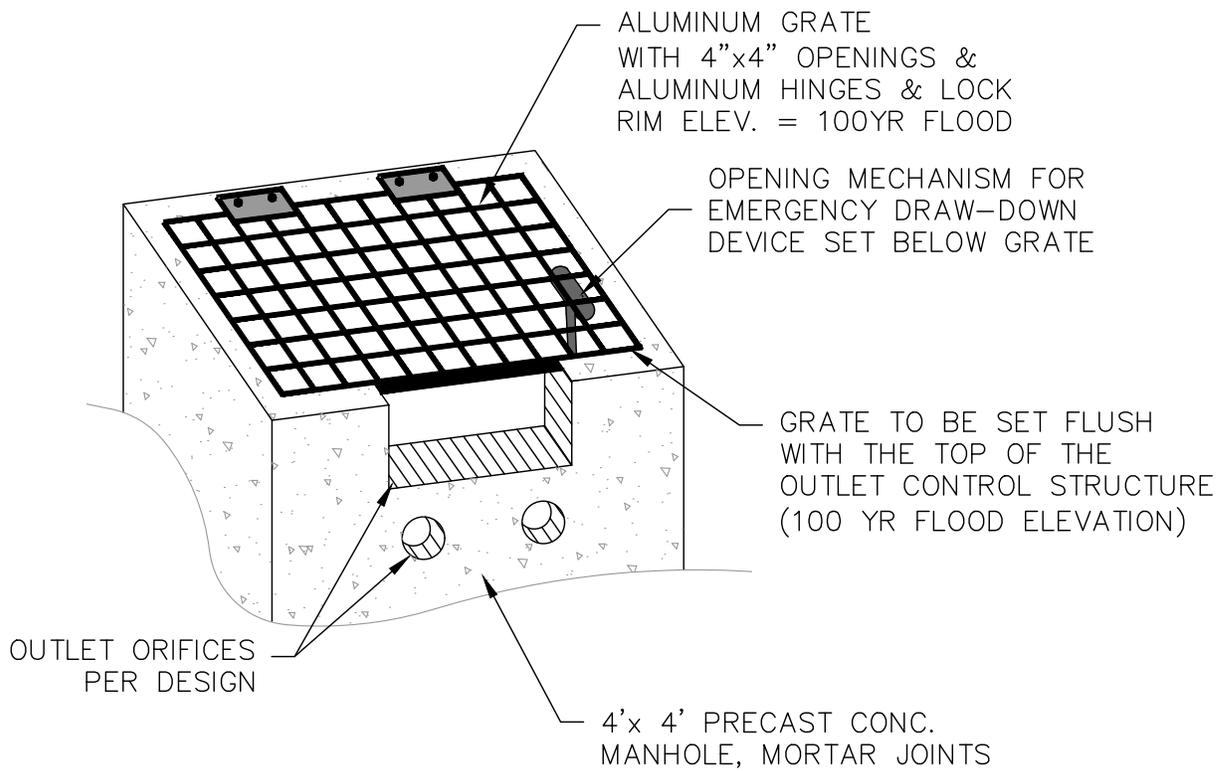
DATE: 11-13-2019

JOB NO. \ FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
DRN-16





NOTES:

- 1.) ORIFICE ELEVATIONS SHALL BE SHOWN ON DESIGN PLANS.
- 2.) CONTRACTOR SHALL CONFIRM INVERT GRADES IN FIELD PRIOR TO STRUCTURE INSTALLATION.
- 3.) THE EMERGENCY DRAW-DOWN DEVICE IS PROVIDED TO ALLOW THE BASIN TO BE MANUALLY DRAINED IF NECESSARY. THE MECHANISM SHALL BE REMAIN CLOSED DURING NORMAL CONDITIONS.

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

OUTLET CONTROL
STRUCTURE-GRATE DETAIL

SCALE:N.T.S

DATE:11-13-2019

JOB NO.\FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
DRN-16A



3 – ROADWAY STANDARDS

3.1 General

- A. For the purposes of these Standards, streets shall be classified as Local, Collector and Arterial.
- B. Any contractor, corporation, public utility or person desiring to open a public way must comply with the Highway's Street Opening Permit and the associated standard operating procedures. For further information, please refer to the Town of Tyngsborough Web site.
- C. All trenches within the town's right-of-way, and trenches on private property that are excavated for the purpose of test pits coordinated through the Engineering Department, that are at least 3 feet in depth and less than 15 feet in width, regardless of the length, shall apply for a trench permit through the Building Department.
- D. All work in a public way shall be done in compliance with the minimum standards of the Town of Tyngsborough as set forth herein.

3.2 Design

- A. Street design minimum standards for Primary Streets shall conform to the best accepted design practice as recommended the MassDOT Project Development and Design Guide, in consultation with the Tyngsborough Engineering Department.
- B. Location and alignment shall conform to the requirements contained in these Standards.
- C. Boring or test pits shall be taken as determined by the Town. These shall show soil strata and high ground water elevations. Drought conditions shall be noted.
- D. The existing water table shall be located and particular attention given to changes in the present and in the possible future water table caused by the movement of earth and other construction work.
- E. The pavement cross section shall be designed to provide a 20-year life based on soil and traffic conditions. The minimum pavement cross section for residential streets shall be: 2 inches of Top Course material placed on 3 inches of Binder Course material founded on 4 inches of Dense Graded Crushed Stone on 8 inches of Processed Gravel or Dense Graded Crushed Stone.

Pavement designs for all other roadways, or where high truck traffic is expected, shall be in accordance with MassDOT guidelines and the pavement cross section shall be approved by the Town Engineer.
- F. Electric, telephone, cable television cables and ducts shall be placed in the grass strip outside of the traveled way, on the opposite side of the centerline of the street as the water main.

- G. Street light standard locations shall be determined by the local electrical utility supplier.
- H. A note shall be placed on all plans stating "The Town of Tyngsborough Engineering Department shall be notified seventy-two (72) hours in advance of any roadway or municipal service construction. No portion of any utility shall be backfilled until approval for such backfilling is obtained from the TED. Such approval does not constitute acceptance of such utilities by the Town of Tyngsborough."

3.3 Construction

3.3.1 Methods

- A. All trench repair work must be guaranteed and bonded as required by the Town's Street Opening Permit.
- B. All work shall be conducted in strict accordance with the latest OSHA regulations.
- C. Workmanship:
 1. The Permittee shall furnish all materials and conduct the job in an orderly, timely, quality-controlled manner.
 2. The Permittee shall keep a competent foreman and sufficient competent employees to carry on the work with proper speed and in accordance with the requirements of law and other public authorities and to the reasonable satisfaction of the Town.
 3. The Permittee shall conduct the work in a manner that will not unreasonably interfere with other work being done by the Town, by contract or otherwise. If deemed necessary by the Town, the work done under these standards shall conform to the progress of said other work. The Permittee shall cooperate with the contractors or employees who may be doing work for the Town, and with public service corporations affected by the work in arranging for storage places, temporary support for structures, repairs, etc.
 4. All temporary repairs shall be properly maintained by the Permittee to assure good rideability conditions until permanent restoration has been made.
 5. Permanent pavement restoration shall be properly maintained to assure good rideability conditions until acceptance by the Town.
- D. The Permittee shall perform the necessary restoration beyond the limits of the street pavement, including lawns, shrubs, gardens, curbing, sidewalks, underdrains, separation fabrics, fences, walls, etc. Upon completion of the permanent repairs outside the limits of the street pavement, the Permittee shall notify the Highway Department or Town Engineer in writing that the permanent repairs and/or replacements have been completed, setting forth the date of completion. The Permittee shall maintain the repaired area outside of the pavement for a period of three (3) years after completion, with the exception that once proper horticultural growth has been established, no further horticultural maintenance will be required.
- E. All traffic control signs (i.e. STOP, YIELD, DO NOT ENTER, ONE WAY, NO PARKING, SPEED LIMIT, CURVE WARNINGS, etc.) approved by the Town for removal, relocation, replacement, etc. shall be immediately replaced by the

Permittee, unless otherwise directed by the Town Engineer. No such traffic control sign shall be removed, relocated or replaced without the express approval of the Town.

- F. All traffic devices, signs, pavement markings or traffic loops disturbed, damaged, altered or removed by the Permittee shall be promptly replaced by the Permittee, unless otherwise directed by the Town, in accordance with Town and State of Massachusetts rules and regulations at the expense of the Permittee. The Permittee shall promptly repair all other damage caused by the work or activities. Street markings (centerlines, crosswalks, stop bars, lane markings, etc.) and traffic loops shall be replaced no later than thirty (30) days after completion of work or as may be directed by the Town Engineer. If work disturbs centerlines or lane markings on primary streets, the Permittee shall place temporary reflective markers immediately after the pavement is placed.

3.3.1.1 Excavation

- A. No excavation shall remain open during non-working hours (5:00 p.m. to 7:00 a.m., or as identified in specific permit requirements). All excavations shall be backfilled and paved, or covered with steel plates as approved by the Town at the end of each work day. Steel plate use requires approval by the Town Engineer or Highway Superintendent. Steel plates are generally not accepted.
- B. Length of Trench Opening:
 - 1. The maximum length of open trench permissible at any time shall be two hundred (200 feet) feet, and no greater length shall be opened for pavement removal excavation, construction, backfilling, repairing, or any other operation without the express written permission of the Town.
- C. Removal of asphalt pavement:
 - 1. All initial excavations into paved street surfaces shall be pre-cut in a neat line with pavement breakers or saws. The initial cutting of the pavement shall be restricted to the area directly over the sidewalls of the proposed trench to be excavated, or as directed by the Highway Superintendent or Town Engineer.
 - 2. Heavy duty pavement breakers may be prohibited by the Town when the use endangers existing substructures or other property.
 - 3. No irregular shapes will be allowed. No shape will be allowed that would prevent compaction equipment from adequately compacting all of the area. The shape of pavement cutouts shall be rectangular, or a combination of rectangular and square shapes unless otherwise agreed to by the Town and Permittee.
 - 4. Pavement edges shall be trimmed to a neat vertical face free of loose materials and neatly aligned with the centerline of the trench.
 - 5. Unstable pavement shall be removed over cave outs and over breaks and the subgrade shall be treated as the main trench.
 - 6. The Permittee shall make every effort to avoid damage to existing pavement to remain. Any damage shall be promptly repaired by the Permittee.

- D. All material excavated from trenches and piled adjacent to the trench or in any street shall be piled and maintained in a manner that will not endanger those working in the trench, pedestrians or users of the streets, and so that as little inconvenience and obstruction as possible is caused to those using streets and adjoining property. The excavated material shall be hauled away from the site by the end of each working day.
- E. The Permittee shall secure the necessary permission and make all necessary arrangements for all required storage and disposal sites.
- F. When excavated material is laid along the side of the trench, it shall be kept trimmed. Whenever necessary in order to expedite the flow of traffic or to abate the dirt or dust nuisance, toe boards or bins may be required by the Town to prevent the spreading of dirt into traffic lanes. If any portion of the excavated material is allowed to be used as backfill, it shall be stockpiled separately from all other materials.
- G. Sections of sidewalks and curbs shall be removed to the nearest real joint or scoreline.
- H. Tunneling, boring or other methods may be required by the Town to avoid or minimize pavement removal.

3.3.1.2 Backfill

- A. Before backfilling, the Permittee shall notify the Highway Department or Town Engineer for inspection. Backfilling shall not occur without approval.
- B. In unpaved areas, excavations shall be backfilled as directed by the Town with approved material thoroughly compacted in layers not to exceed twelve inches (12 inches) in thickness until flush with the surrounding ground surface. If the backfilled material settles, additional approved materials shall be installed by the Permittee, as required, to keep the surface even. After settlement is completed, the excavated area shall be left by the Permittee in as good a condition as before the work was started.
- C. Temporary sheeting and bracing used to support the side walls shall be removed, unless otherwise directed by the Town, as backfilling progresses. When backfilling has reached the bottom of a brace, the latter and its horizontal ranger shall be removed, and this procedure shall be repeated throughout the backfilling operation. The sheeting shall be pulled in short increments, care being taken to avoid significant lateral movements of the sides of the trench. During and after pulling the sheeting, the backfill in the space formerly occupied by the sheeting shall be compacted.
- D. Whenever water is found standing in the excavation area, the water shall be removed by pump or other means before backfilling operations may commence.
- E. Backfilling shall be performed as soon as practicable so that the least possible subsequent settling will occur. In most cases backfilling shall occur on the same day as the excavation was begun. If this is not feasible due to the complex nature of work, emergency, or unpreventable conditions, the Permittee shall notify the Town that same day, if not sooner, and take appropriate measures to protect public safety and infrastructure until work commences again the following day.

- F. Backfill in paved areas shall be granular gravel borrow, processed gravel, sand or crushed stone material placed to a depth of 1 foot over the utility. The backfill shall be spread in layers not exceeding eight inches (8 inches) in loose depth and thoroughly compacted, up to the pavement subgrade surface.
- G. Broken pavement, large stones, roots and other debris shall not be used in backfill. Unused excavated material shall be removed from the jobsite and disposed of in a manner that will minimize interference and obstruction with pedestrian and vehicular traffic. No material shall be left within the right-of-way once the repair and/or installation is complete.
- H. The Town will allow, and may in some cases require under certain conditions, as an alternate, Controlled Density Fill (CDF) under the following conditions:
 - 1. Only Type IE or 2E, Excavatable, Fill will be allowed.
 - 2. This material shall not be used for bedding material or in situations that will cause floating of the utility lines, or in the presence of cast iron or steel pipes.
 - 3. CDF placement in trenches shall be fully barricaded or police protected for a minimum of three (3) hours after the pour or until a set is reached that will prevent a hazard to animals or humans.
 - 4. CDF shall be placed up to the pavement subgrade surface.
 - 5. CDF shall be separated from gas lines with a minimum of six (6) inches of sand cover over the lines.

3.3.1.3 Pavement Patching

- A. Upon the completion of proper backfilling, the Permittee shall install pavement. The Permittee shall take all reasonable measures to complete pavement on the same day excavation work was begun especially for primary roads. If same day paving is not achievable due to complexity of work, emergency, or unpreventable conditions, or otherwise agreed to by the Town, the Permittee must make the roadway surface safe and passable by bringing the excavation up to match the adjacent grade with dense graded crushed stone or other approved method. Unpaved excavations must be inspected and maintained as necessary on a daily basis. No excavation will be allowed to go unpaved for a period longer than one week.
- B. The Permittee shall notify the Town Engineer or Highway Department 24 hours prior to beginning paving operations for inspection. All hot mixed asphalt paving must first be approved by the Town Engineer or Highway Superintendent as to depth and materials.
 - 1. Notification of the anticipated timing of all paving activity must be acknowledged by the Town. Any notification delivered by facsimile machine must be preceded or followed up by a telephone conversation to assure its proper and timely receipt.
 - 2. Permittees shall endeavor to make a follow-up notification by 9:00 a.m. of each workday that paving is still anticipated. In the event of schedule changes or emergencies, the Permittee shall provide a minimum of one-hour notification to assure inspection availability.
 - 3. If a Town inspector is not able to be on site within 24 hours of the acknowledged anticipated start time of paving activity, the Permittee may be allowed to commence paving. Inspector may sample in-place material for specification compliance.

4. Permittees who do not provide proper notification of paving activities may be subject to required removal and replacement of pavement for the purpose of inspection.
- C. The existing pavement shall be sawcut a minimum of twelve (12) inches beyond the initial excavation limits to expose a twelve (12) inch width of undisturbed soil.
- D. The temporary pavement, backfill and undisturbed soil shall be removed to the depth of the proposed pavement and disposed of off the site.
- E. The permanent pavement patch shall be a minimum of 5 inches (2 inches of Top Course material placed on 3 inches of Binder Course material). If the existing pavement has a thicker section, the depth of the pavement patch shall at a minimum match the existing pavement.
- F. Trench backfill shall be checked for compliance with 95 percent compaction requirement. If compaction is found to be less than 95 percent, trench shall be re-compacted before paving will be allowed.
- G. The Permittee will not be required to repair or replace damaged pavement existing prior to commencement of the work unless excavation operations result in small, unstable sections. These shall be removed and replaced as part of the work.
- H. Each course of hot-mixed asphalt shall be compacted separately, meeting the requirement of 95 percent minimum compaction of standard laboratory maximum theoretical density for the specific material.
- I. Mechanical compactors will be permitted for repairs less than 10 square yards. Repairs exceeding 10 square yards shall be rolled with an appropriately sized, power-driven, steel-wheeled roller to obtain specification density.
- J. All sawcut vertical faces of existing pavement shall be neat, free of loose materials, and tack coated with an approved asphalt emulsion by applying the emulsion material in conformance with MassDOT Standard Specifications Section 460.62, to fully cover the surfaces prior to pavement installation.
- K. A tack coat shall be applied to the previous course surface if the subsequent course is not immediately placed.
- L. For trenches in excess of 100 feet in length, shall have the joint between the old and new pavement sealed with an asphalt fiber crack sealer in conformance with MassDOT Standard Specifications Section M3.05.1.
- M. Hot mixed asphalt paving of trenches deemed by the Town to be major excavation shall be installed using an asphalt paver, unless otherwise authorized by the Town.
- N. If two or more excavations are made for the same utility or client in the same construction season and are within six (6) feet of each other, edge to edge, they shall be permanently restored as one trench, including the pavement between excavations.
- O. The Permittee shall keep the pavement in acceptable condition until the end of the guarantee period.

- P. If cobblestones, granite, or brick pavers, or other material also exists within in the pavement section to be disturbed, the Permittee shall be required to replace those materials using the construction methods originally used to install those features.

3.3.2 Materials

All construction materials and methods shall conform to the requirements contained in the latest version of the Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges as amended, unless otherwise specified herein or approved by the Town.

Specific standard materials to be used shall be as described below and as shown on the Construction Details.

3.3.2.1 Gravel Borrow

- A. Gravel shall conform to MassDOT Standard Specification Section M1.03.0, Type b.

3.3.2.2 Dense Graded Crushed Stone for Subbase

- A. Dense graded crushed stone shall conform to MassDOT Standard Spec. M2.01.7.

3.3.2.3 Curbing

- A. Granite curbing shall be type VA4.
- B. Where transitions from vertical granite curb to either sloped granite edging or hot mix asphalt berm are being made, granite transition stones as shown in Construction Detail RD-5 shall be utilized.
- C. Where drainage inlets are installed adjacent to a vertical curb or edging, granite inlet stones conforming to the requirements of MassDOT Standard Specification Section M9.04.5.

3.3.2.4 Curb Ramps

- A. Refer to Section 4.

3.3.2.5 HMA Berm and Curb

- A. HMA Berm shall conform to MassDOT Standard Specification Section M3.11.0 and Construction Detail RD-6.
- B. HMA Curb shall conform to MassDOT Standard Specification Section M3.12.0 and Construction Detail RD-6.

3.3.2.6 Retaining Walls

- A. Walls to be constructed within the Town Right-of Way shall be constructed in accordance with MassDOT Standard Specification Section 685 and the MassDOT Construction Standard Detail 302.2.0.

3.3.2.7. Loam Borrow

- A. Loam Borrow shall conform to MassDOT Standard Specification Section M1.05. Loam shall have a finished depth of six (6) inches (minimum).

3.3.2.8 Seeding

- A. Seeding shall conform to MassDOT Standard Specification Section M6.03. Permittees shall be required to continually seed and water areas of loam until a satisfactory growth of grass is established.

3.3.2.9 Guard Rail

- A. Guard Rail galvanized steel with galvanized posts in conformance with MassDOT Standard Specification Section M8.07.0.

3.3.2.10 Street Signs

- A. Street signs shall conform to latest version of MUTCD.
- B. Signs shall be reflectorized aluminum in conformance with MassDOT Standard Specification Section 828 and M9.30.0.

3.3.2.11 Dust Control

- A. The Town may require dust control which shall consist of the application of calcium chloride. The contractor may also be required to furnish sprinkler trucks or hoses to wet down surfaces in lieu of applying calcium chloride.

3.3.2.12 Hot Mix Asphalt for Roadways

- A. Binder Course- Binder course shall meet MassDOT Standard Specifications section M3.11.1 Superpave Intermediate Course- 19.0
- B. Top course – Top course shall meet MassDOT Standard Specification section M3.11.1 Superpave Top Course- 9.5.

ROADS AND SIDEWALKS

<u>DESCRIPTION</u>	<u>DETAIL NUMBER</u>
TYPICAL PAVEMENT SECTION	RD-1
TRENCH PAVEMENT DETAIL	RD-2
VERTICAL GRANITE CURB	RD-3
SLOPED GRANITE EDGING	RD-4
EDGING TO CURB TRANSITION	RD-5
HOT MIX ASPHALT BERM & CURB	RD-6
HOT MIX ASPHALT SIDEWALK	RD-7A
HOT MIX ASPHALT SIDEWALK WITH GRASS STRIP	RD-7B
CEMENT CONCRETE SIDEWALK	RD-8
STONE DUST WALK	RD-9
CURB RAMP TYPE A (COMBINATION RAMP)	RD-10
CURB RAMP TYPE B (SINGLE DIRECTION RAMP)	RD-11
CURB RAMP TYPE C (PARALLEL RAMP)	RD-12
CURB RAMP TYPE D (PERPENDICULAR RAMP)	RD-13
CURB RAMP TYPE D.1 (PERPENDICULAR RAMP)	RD-13A
CURB RAMP TYPE D (APEX RAMP)	RD-14
CURB RAMPS – NOTES AND TABLE OF TRANSITION LENGTHS	RD-15
DETECTABLE WARNING PANEL	RD-16
TYPICAL DRIVEWAY DETAIL	RD-17
LOOPED DRIVEWAY DETAIL	RD-18
DETAILS FOR RAISING CASTINGS – DRAINAGE STRUCTURES	RD-19
DETAILS FOR RAISING CASTINGS – WATER SERVICE BOXES	RD-20
GUARD RAIL	RD-21
W BEAM COR-TEN VT LOW SPEED END TREATMENT DETAIL	RD-22



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

ROADWAYS AND SIDEWALK DETAILS
INDEX

SCALE: N.T.S

DATE: 11-14-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
INDEX

W BEAM COR-TEN VT LOW SPEED END TREATMENT DETAIL	RD-22A
W BEAM COR-TEN VT LOW SPEED END TREATMENT DETAIL	RD-22B
STEEL PLATE INSTALLATION	RD-23
TYPICAL ROADWAY CROSS SECTION	RD-24
STREET NAME SIGNS	RD-25
CURB RAMP SUBMITTAL DETAIL	RD-26
PEDESTRIAN CHANNELING DEVICE	RD-27



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

ROADWAYS AND SIDEWALK DETAILS
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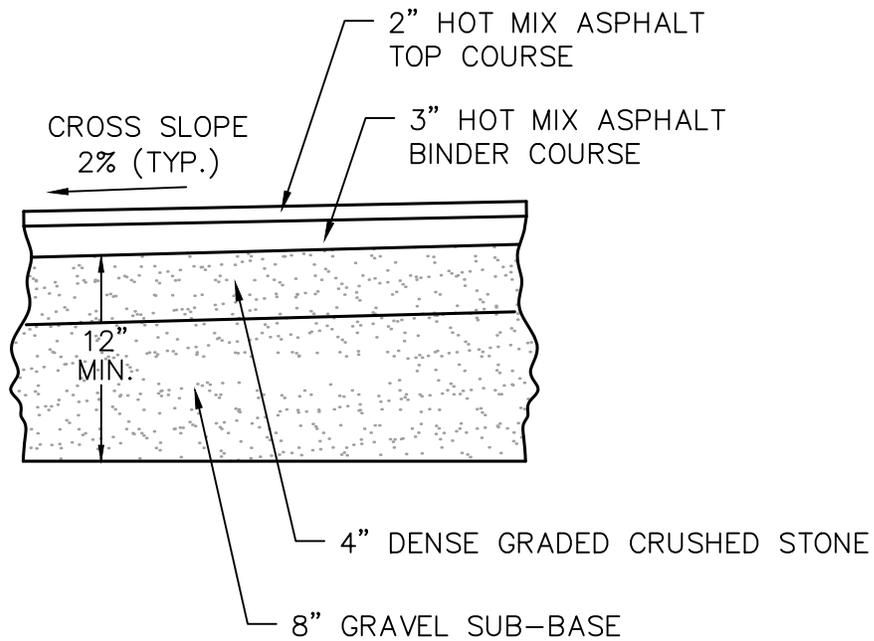
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DESIGNED BY: J.C.Z.
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PLAN NO.
INDEX



NOTES:

1. MINIMUM PAVEMENT THICKNESS SHOWN IS FOR RESIDENTIAL STREETS, PROPOSED PAVEMENT DESIGNS FOR OTHER ROADWAYS TO BE APPROVED BY TOWN ENGINEER.
2. RECLAIMED ASPHALT PAVEMENT MATERIAL MAY BE SUBSTITUTED FOR DENSE GRADED CRUSHED STONE AND GRAVEL SUB-BASE IF APPROVED BY TOWN ENGINEER. GRADATION SHALL MEET AASHTO A-1-A @ A MIN.

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

TYPICAL PAVEMENT
SECTION

SCALE: N.T.S

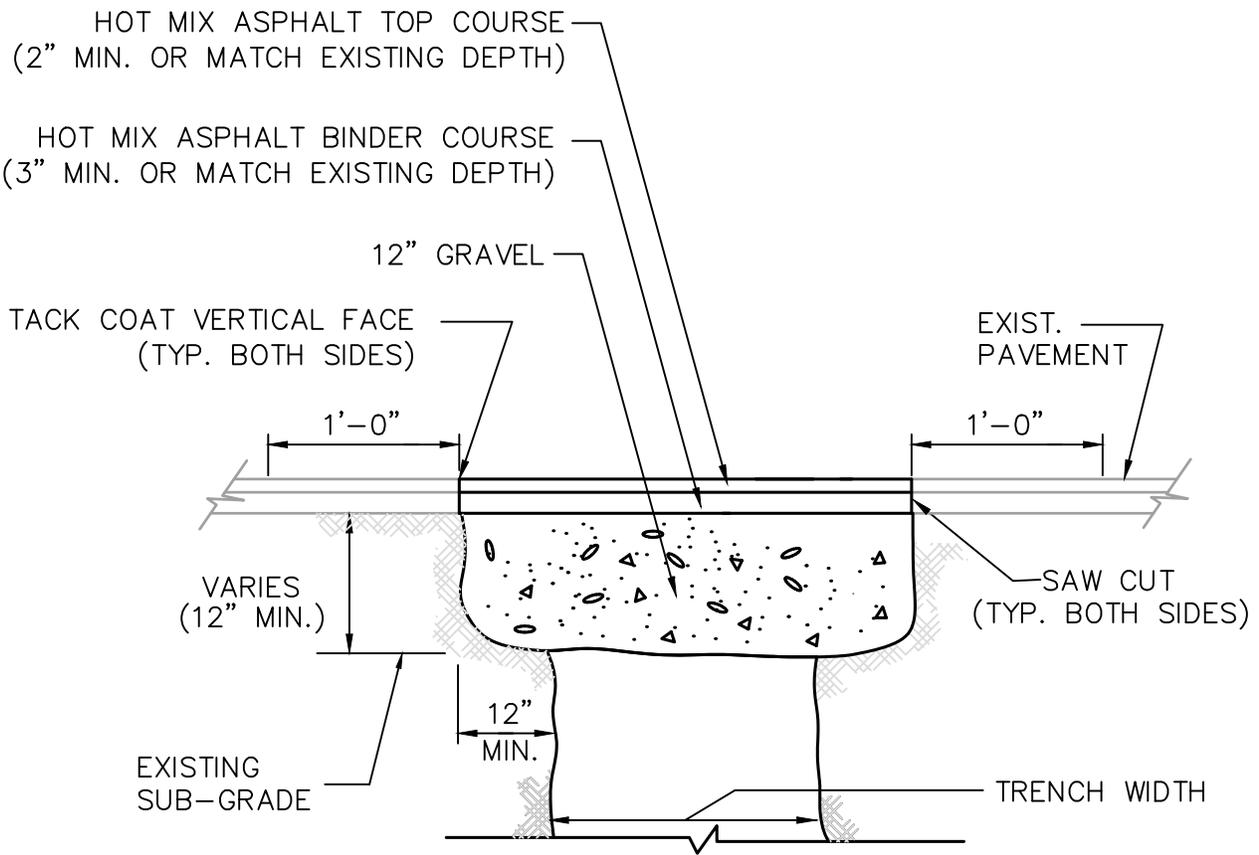
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JOB NO. \ FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
RD-1





NOTES:

1. 12" OF GRAVEL BASE COURSE SHALL BE COMPACTED TO 95% OF MAXIMUM DRY DENSITY.
2. HOT MIX ASPHALT TRENCH PATCH SHALL BE A MINIMUM OF 5" TOTAL THICKNESS, OR SHALL MATCH THE EXISTING PAVEMENT THICKNESS, WHICHEVER IS GREATER.
3. TRENCHES IN EXCESS OF 100 FEET IN LENGTH SHALL HAVE THE JOINT BETWEEN NEW AND OLD PAVEMENT SEALED WITH AN ASPHALT FIBER CRACK SEALER (M3.05.1)

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

TRENCH PAVEMENT
DETAIL

SCALE: N.T.S

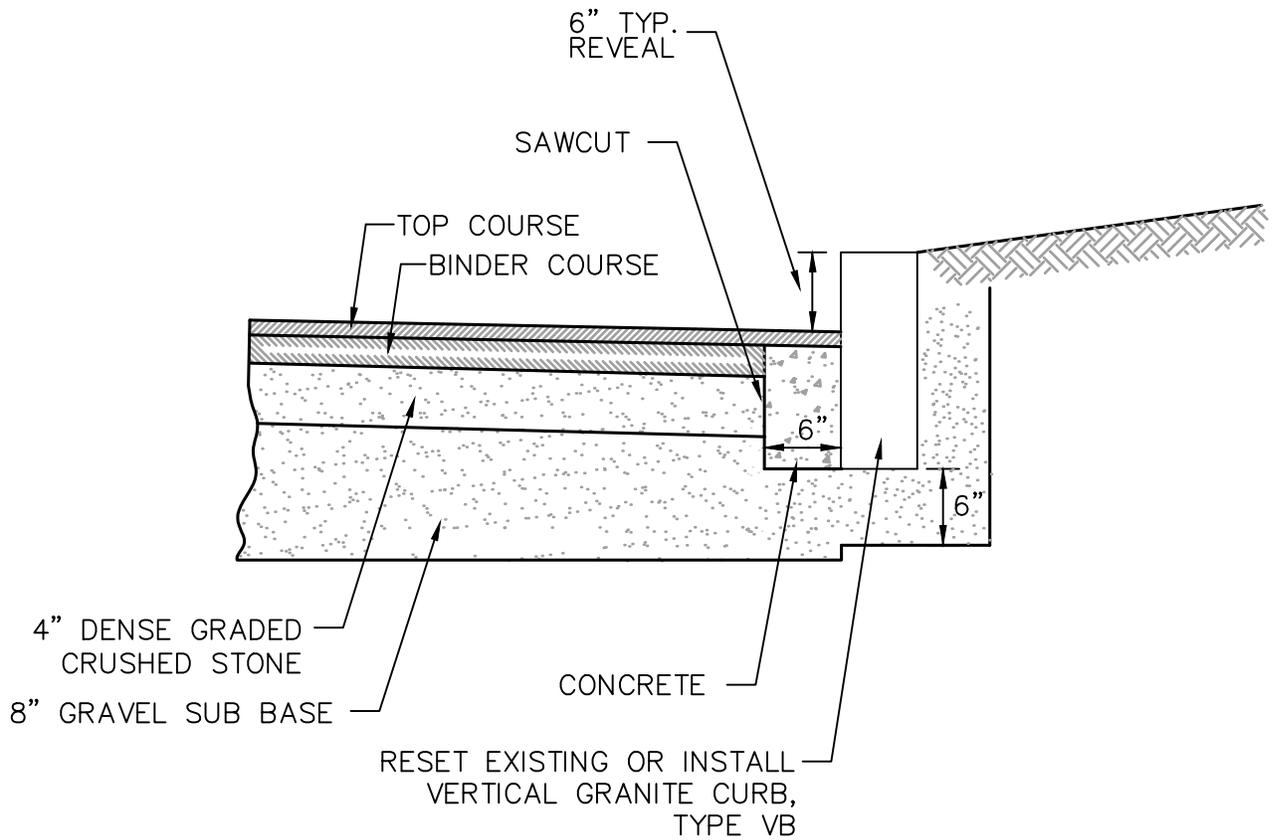
DATE: 11-14-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
RD-2





NOTE:

1. RECLAIMED ASPHALT PAVEMENT MATERIAL MAY BE SUBSTITUTED FOR DENSE GRADED CRUSHED STONE AND GRAVEL SUB-BASE IF APPROVED BY TOWN ENGINEER.

TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

VERTICAL GRANITE CURB
 DETAIL

SCALE: N.T.S

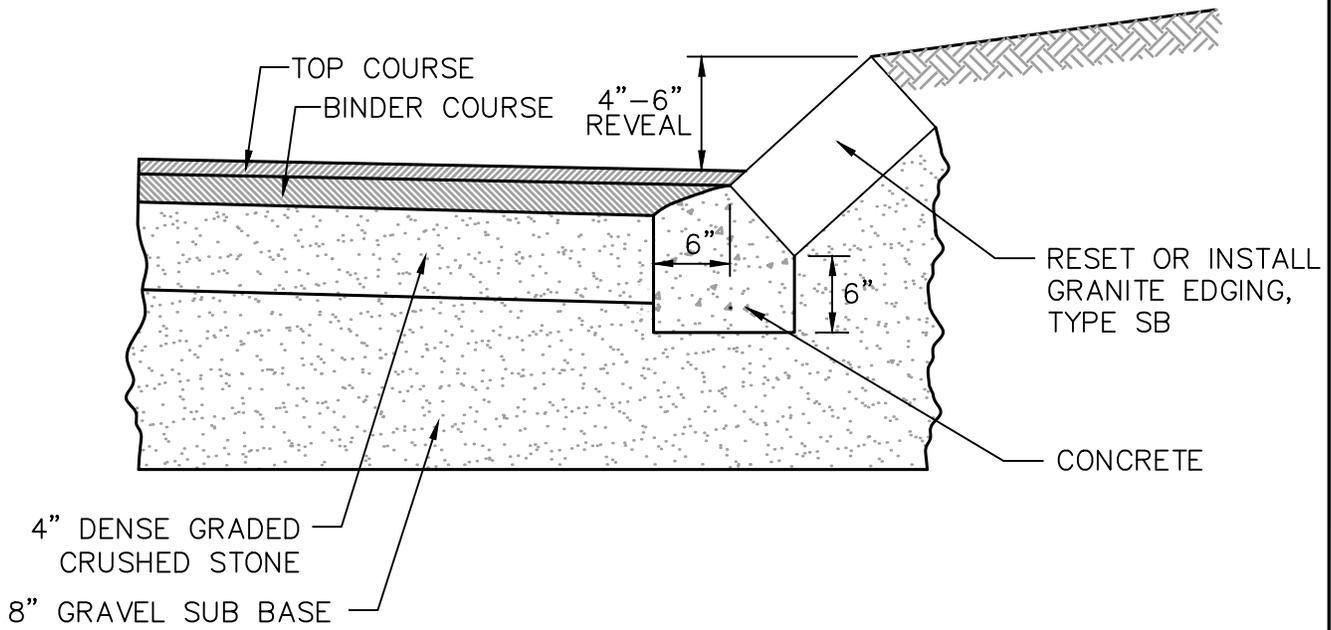
DATE: 11-14-2019

JOB NO. \ FILE NAME:
 STANDARD_DETAILS

DESIGNED BY: J.C.Z.
 DRAWN BY: J.C.Z.
 CHECKED BY: J.C.Z.

PLAN NO.
 RD-3





NOTE:

1. RECLAIMED ASPHALT PAVEMENT MATERIAL MAY BE SUBSTITUTED FOR DENSE GRADED CRUSHED STONE AND GRAVEL SUB-BASE IF APPROVED BY TOWN ENGINEER.

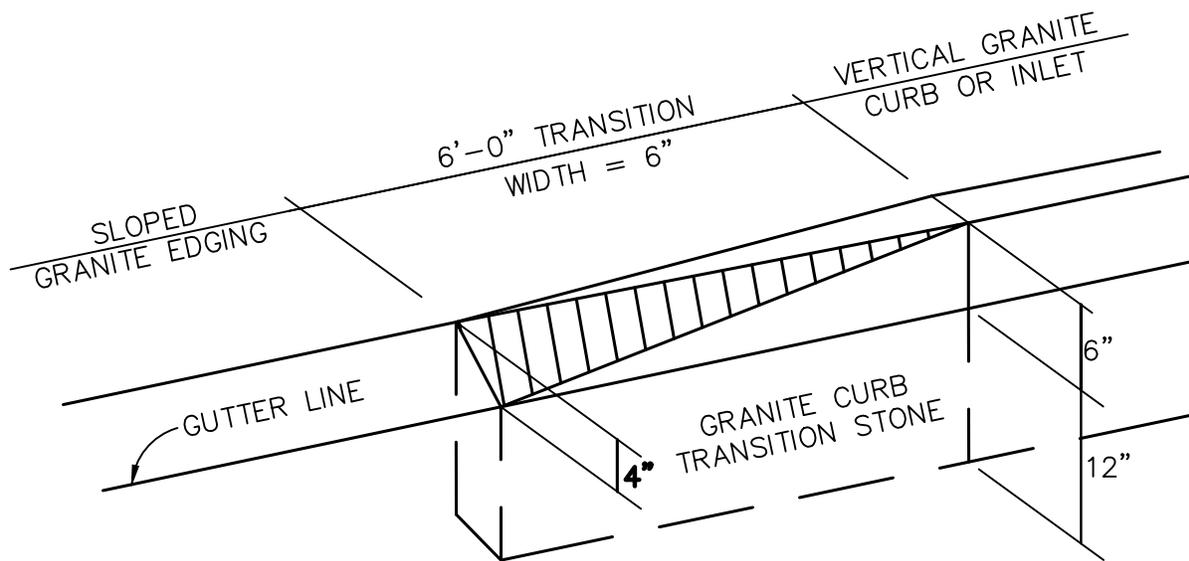
TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

CLOPED GRANITE EDGING
DETAIL

SCALE: N.T.S DATE: 11-14-2019

JOB NO. \ FILE NAME:	DESIGNED BY: J.C.Z.	PLAN NO.
STANDARD_DETAILS	DRAWN BY: J.C.Z.	RD-4
	CHECKED BY: J.C.Z.	





TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

EDGING TO CURB TRANSITION
 DETAIL

SCALE: N.T.S

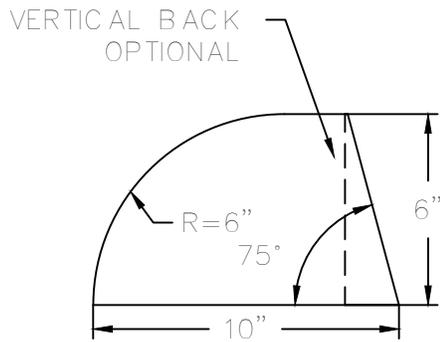
DATE: 11-14-2019

JOB NO. \ FILE NAME:
 STANDARD_DETAILS

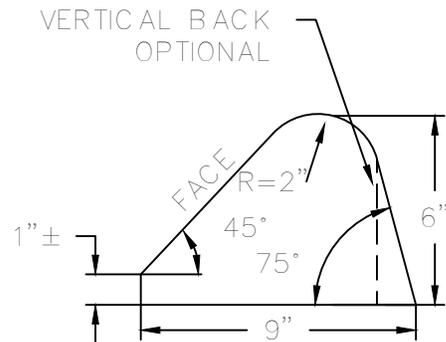
DESIGNED BY: J.C.Z.
 DRAWN BY: J.C.Z.
 CHECKED BY: J.C.Z.

PLAN NO.
 RD-5

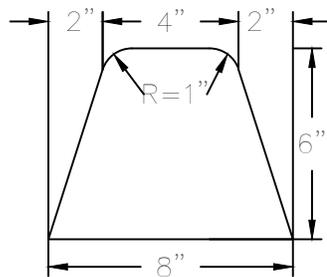




TYPE-1

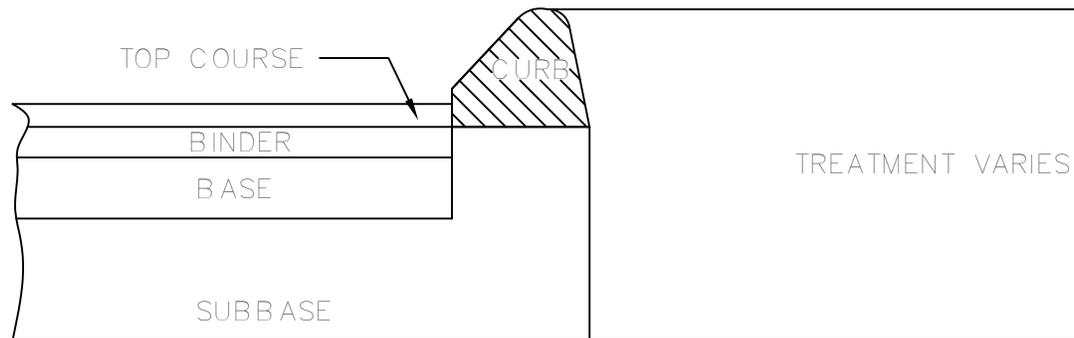


TYPE-2



TYPE-3

LEVEL



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

HOT MIX ASPHALT BERM & CURB
DETAIL

SCALE: N.T.S

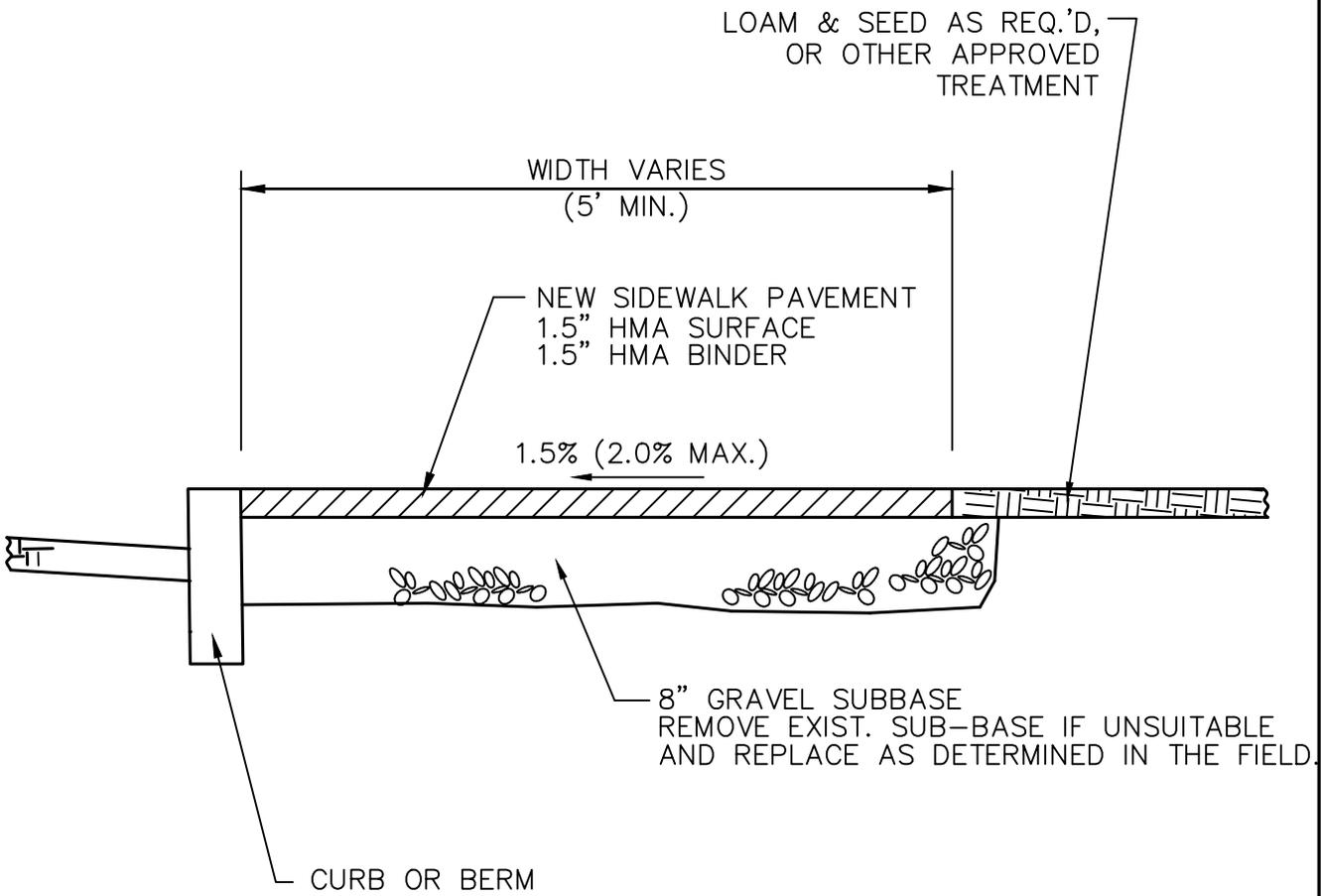
DATE: 11-14-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
RD-6





TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

HOT MIX ASPHALT SIDEWALK
DETAIL

SCALE: N.T.S

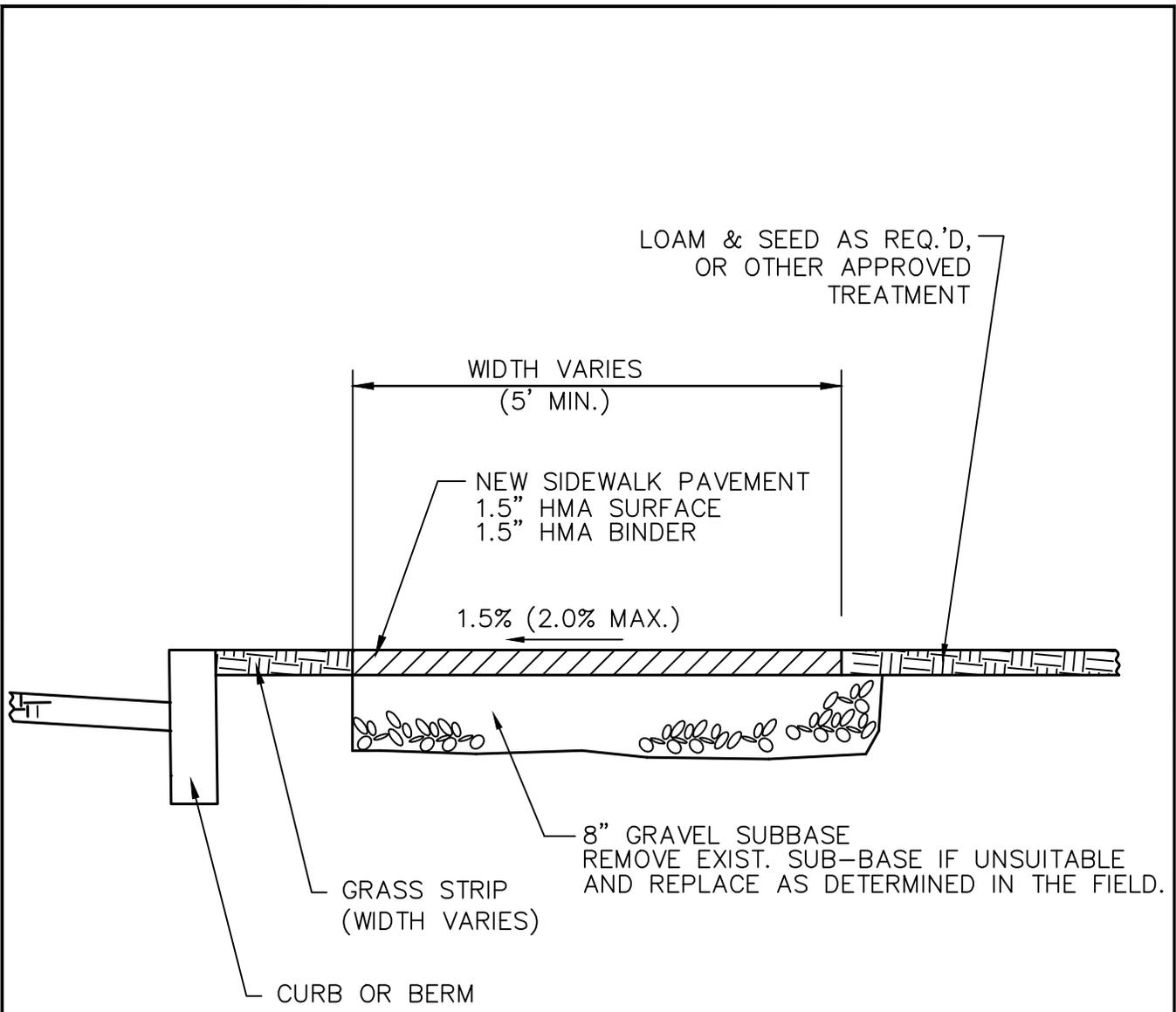
DATE: 11-14-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
RD-7A





TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

HOT MIX ASPHALT SIDEWALK WITH
GRASS STRIP DETAIL

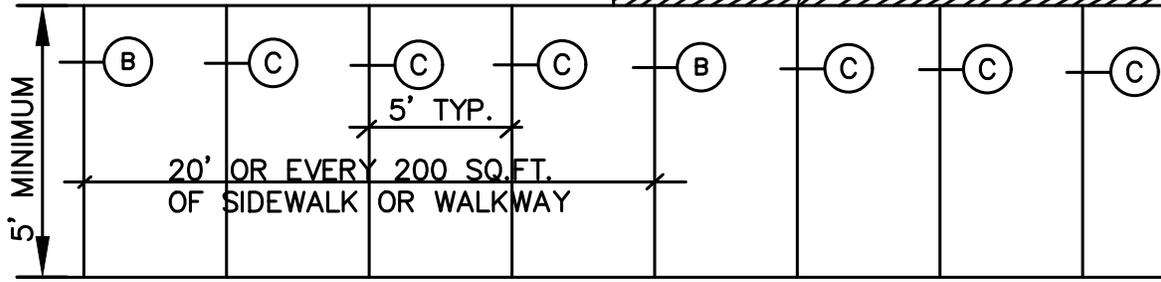
SCALE: N.T.S. DATE: 11-14-2019



JOB NO. \ FILE NAME:	DESIGNED BY: J.C.Z.	PLAN NO.
STANDARD_DETAILS	DRAWN BY: J.C.Z.	RD-7B
	CHECKED BY: J.C.Z.	

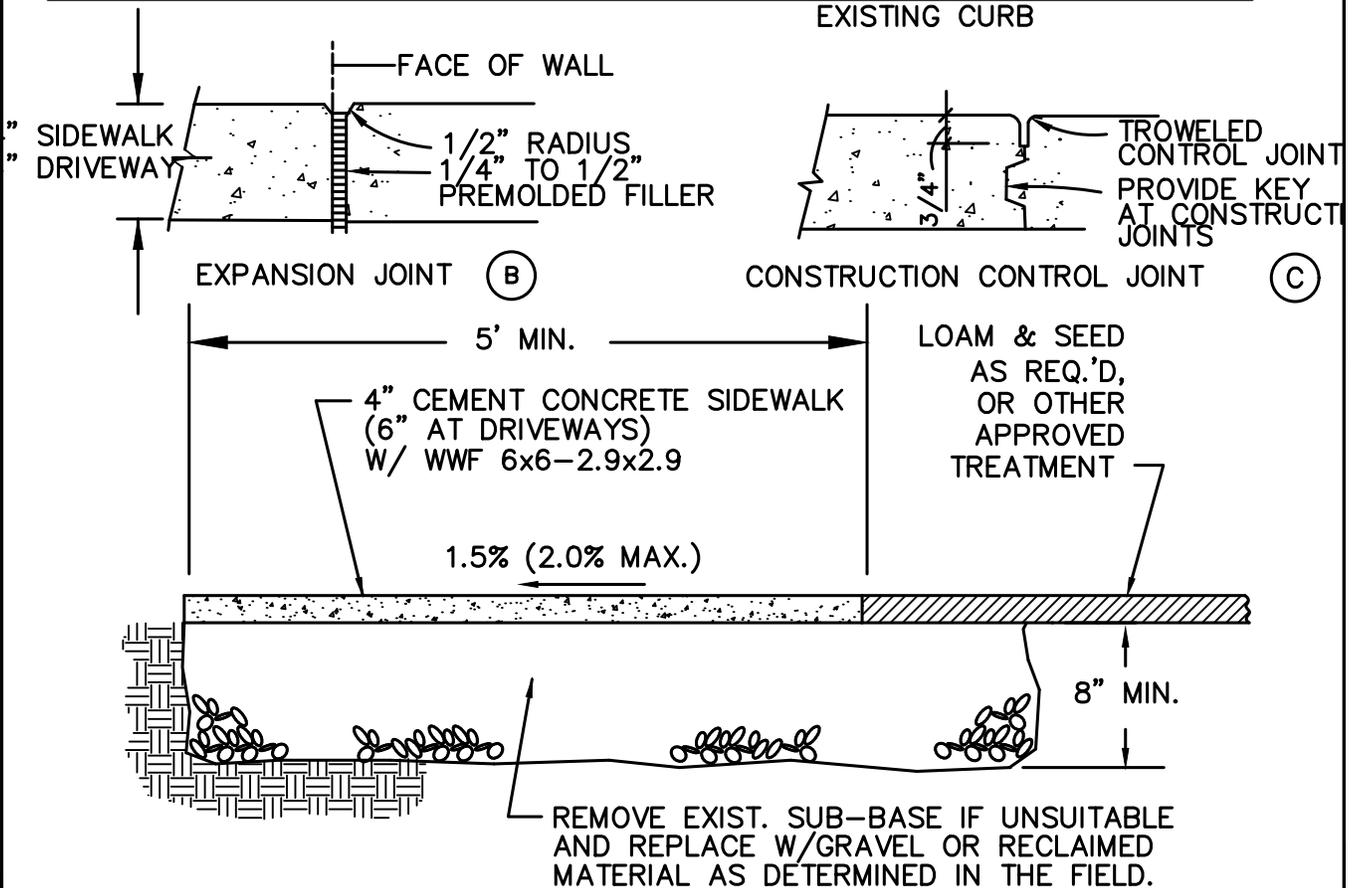
ROUND CURB SHOWN IN PLAN SECTION TYPICAL FOR ANY CURB

AT FACE OF RETAINING WALL OR BUILDING USE EXPANSION JOINT (B)



GRASS STRIP

EXISTING CURB



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

CEMENT CONCRETE SIDEWALK
DETAIL

SCALE: N.T.S

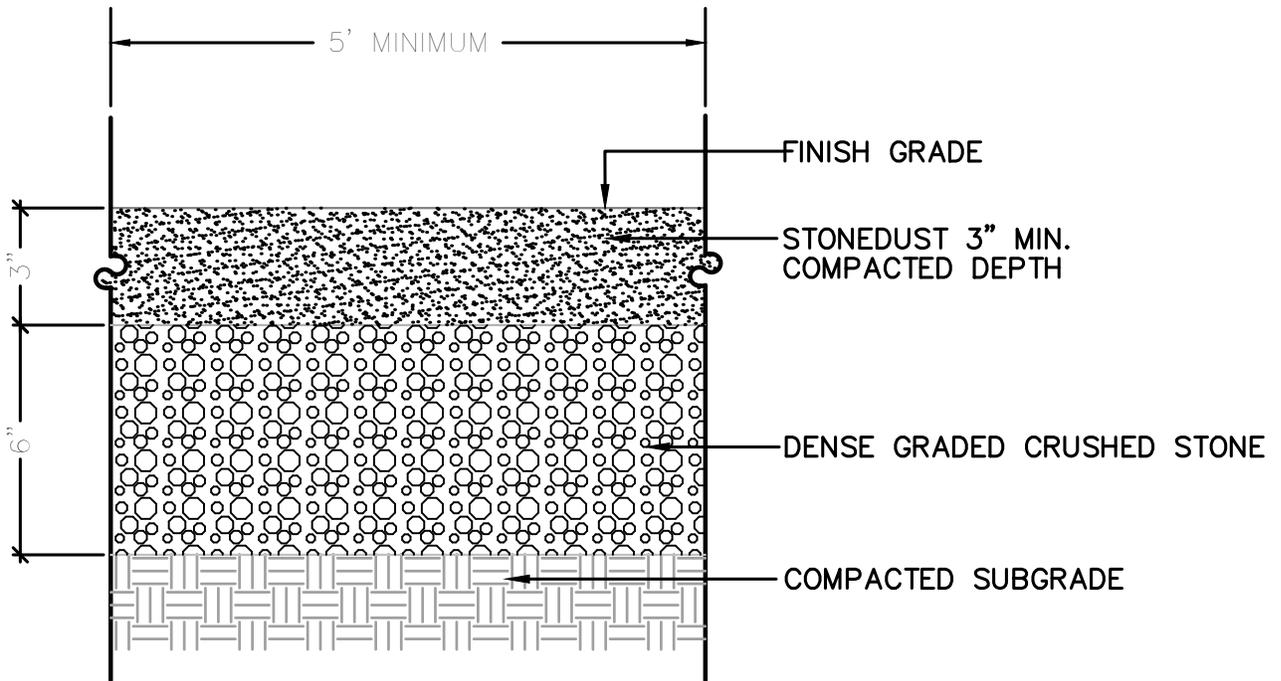
DATE: 11-14-2019

JOB NO. \ FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
RD-8





TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

STONE DUST SIDEWALK
 DETAIL

SCALE: N.T.S

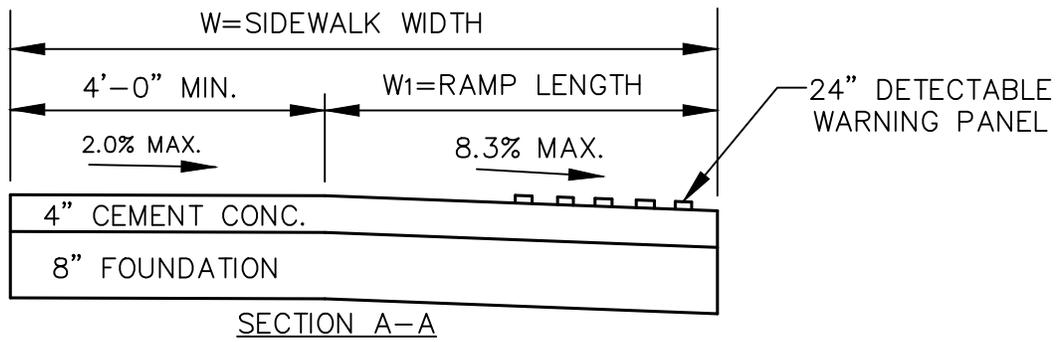
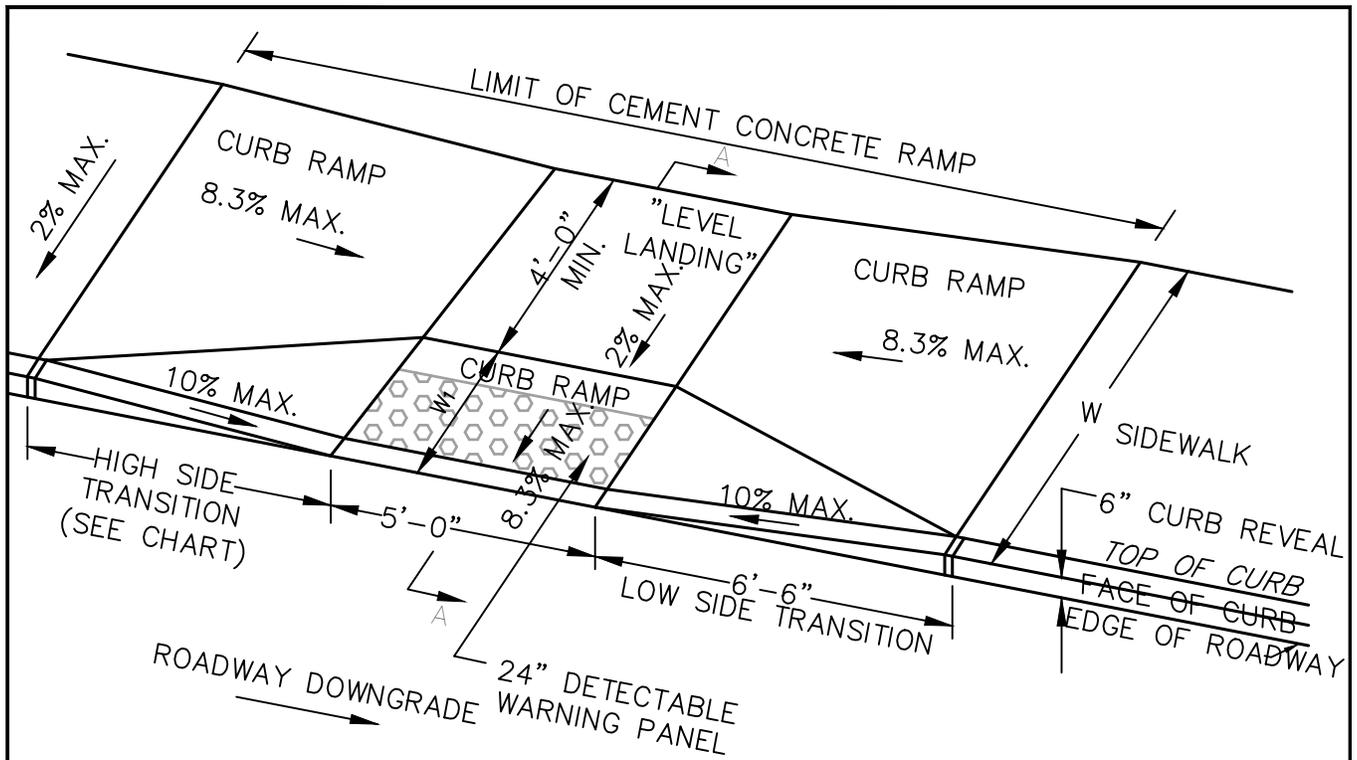
DATE: 11-14-2019

JOB NO. \FILE NAME:
 STANDARD_DETAILS

DESIGNED BY: J.C.Z.
 DRAWN BY: J.C.Z.
 CHECKED BY: J.C.Z.

PLAN NO.
 RD-9





LEGEND

W = SIDEWALK WIDTH
 (MIN. 5' EXCLUDING CURB)
 W₁ = PERPENDICULAR RAMP LENGTH

NOTE

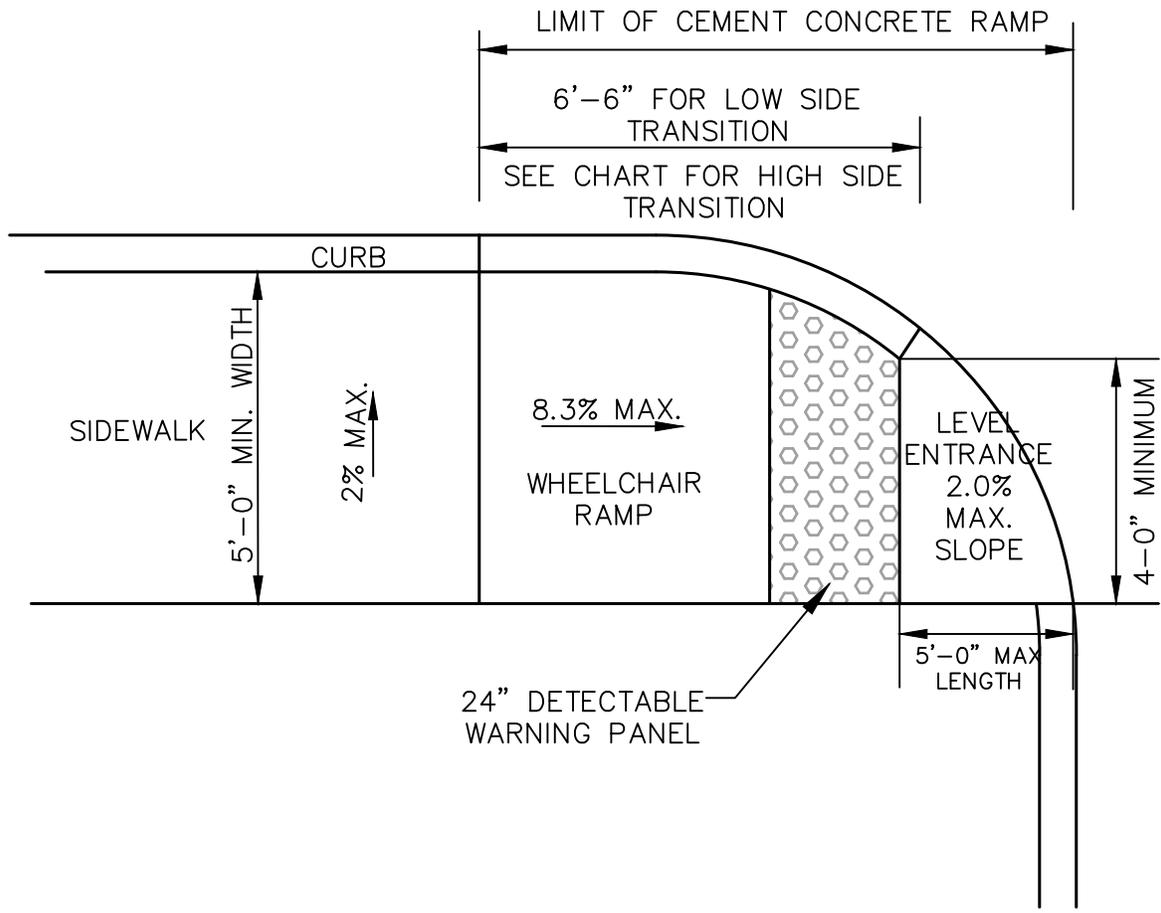
- LEVEL LANDING SHALL BE 60" MIN IN DIRECTION OF PEDESTRIAN CROSSING WHEN CONSTRAINED. RECOMMENDED 60" x 60"

TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

CURB RAMP TYPE A
 DETAIL

SCALE: N.T.S		DATE: 11-14-2019	
JOB NO. \ FILE NAME:	DESIGNED BY: J.C.Z.	PLAN NO.	
STANDARD_DETAILS	DRAWN BY: J.C.Z.	RD-10	
	CHECKED BY: J.C.Z.		





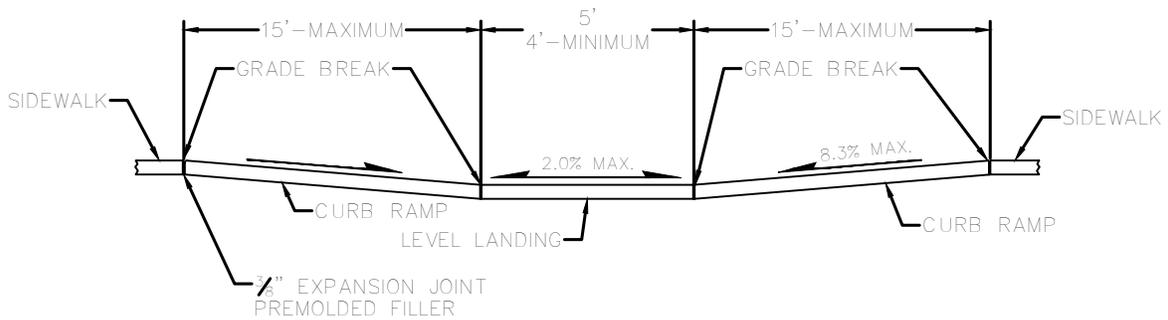
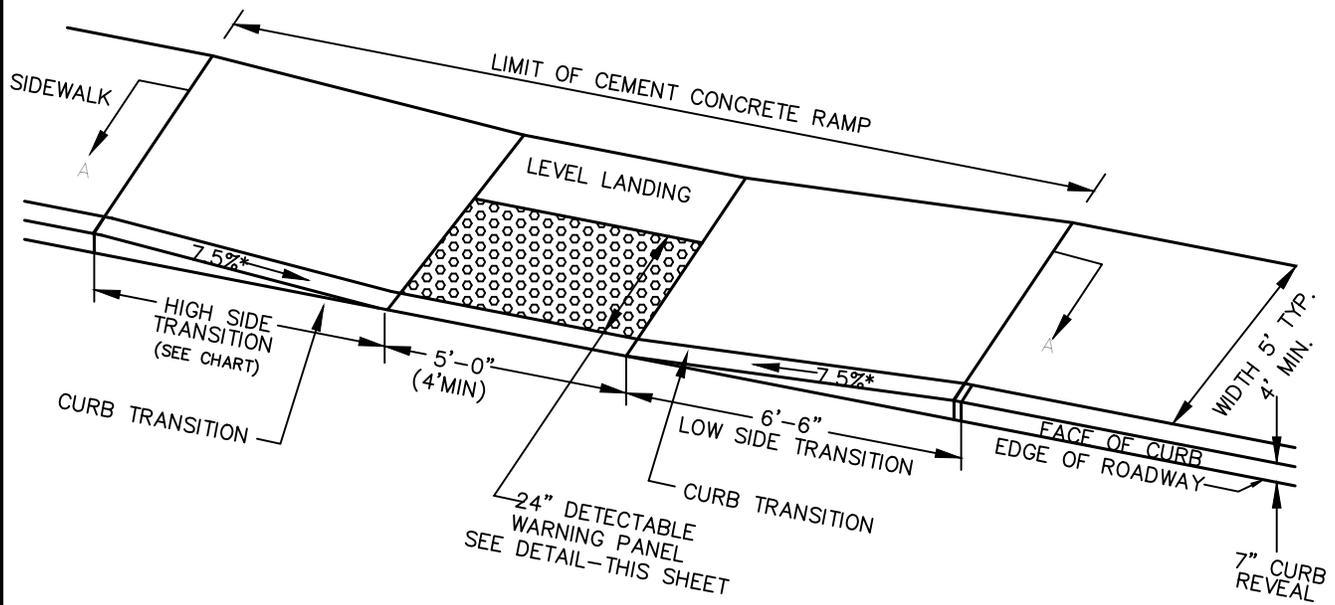
TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

CURB RAMP TYPE B
 DETAIL

SCALE: N.T.S. DATE: 11-14-2019

JOB NO. \ FILE NAME:	DESIGNED BY: J.C.Z.	PLAN NO.
STANDARD_DETAILS	DRAWN BY: J.C.Z.	RD-11
	CHECKED BY: J.C.Z.	





SECTION A-A

TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

CURB RAMP TYPE C
 DETAIL

SCALE: N.T.S

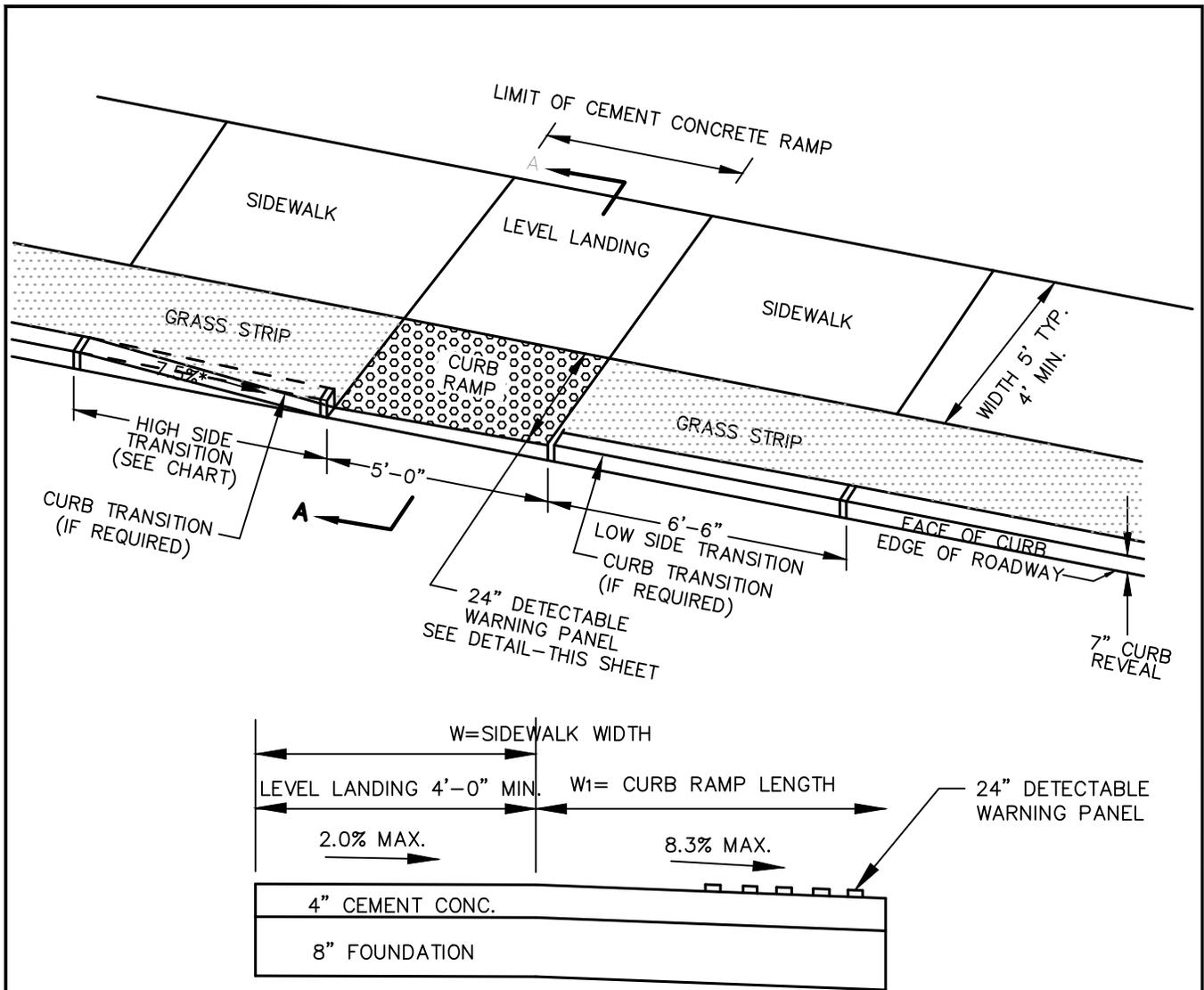
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JOB NO. \FILE NAME:
 STANDARD_DETAILS

DESIGNED BY: J.C.Z.
 DRAWN BY: J.C.Z.
 CHECKED BY: J.C.Z.

PLAN NO.
 RD-12





SECTION A-A

LEGEND

W = SIDEWALK WIDTH (MIN. 5' EXCLUDING CURB)
 W1 = PERPENDICULAR RAMP LENGTH

NOTE

- LEVEL LANDING SHALL BE 60" MIN IN DIRECTION OF PEDESTRIAN CROSSING WHEN CONSTRAINED. RECOMMENDED 60"x 60"

TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

CURB RAMP TYPE D
 DETAIL

SCALE: N.T.S

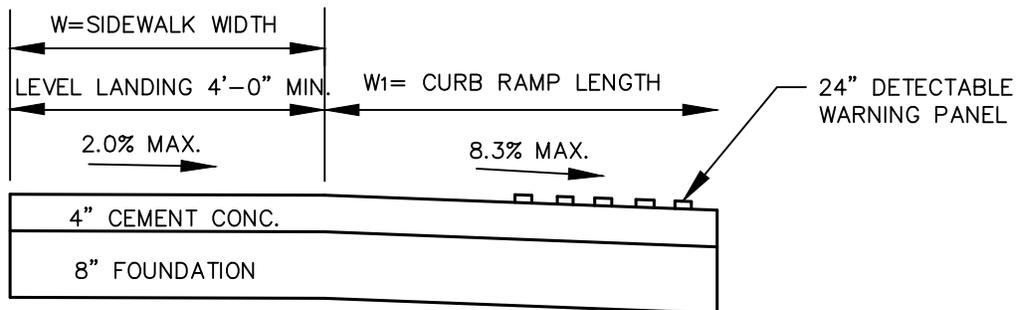
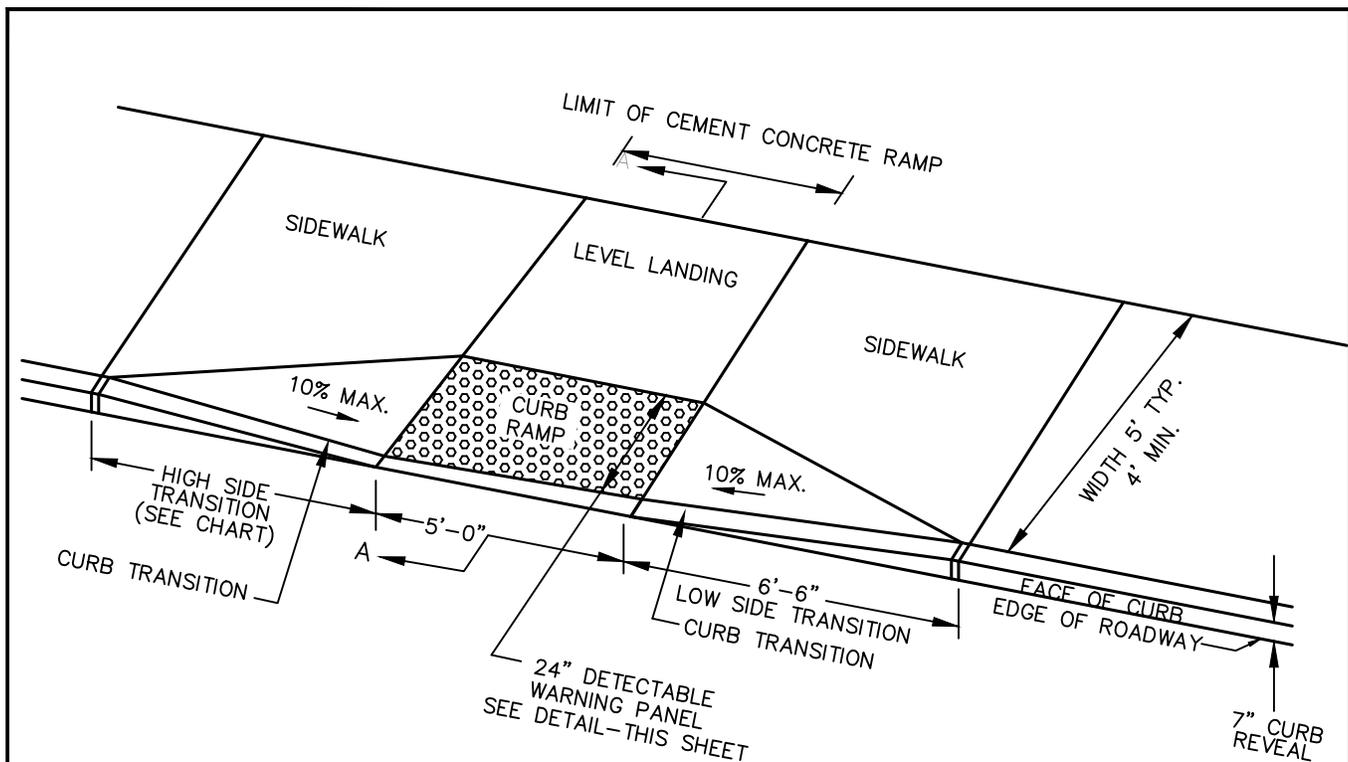
DATE: 11-14-2019

JOB NO. \ FILE NAME:
 STANDARD_DETAILS

DESIGNED BY: J.C.Z.
 DRAWN BY: J.C.Z.
 CHECKED BY: J.C.Z.

PLAN NO.
 RD-13





SECTION A-A

LEGEND

W = SIDEWALK WIDTH (MIN. 5' EXCLUDING CURB)
 W1 = PERPENDICULAR RAMP LENGTH

NOTE

- LEVEL LANDING SHALL BE 60" MIN IN DIRECTION OF PEDESTRIAN CROSSING WHEN CONSTRAINED. RECOMMENDED 60"x 60"

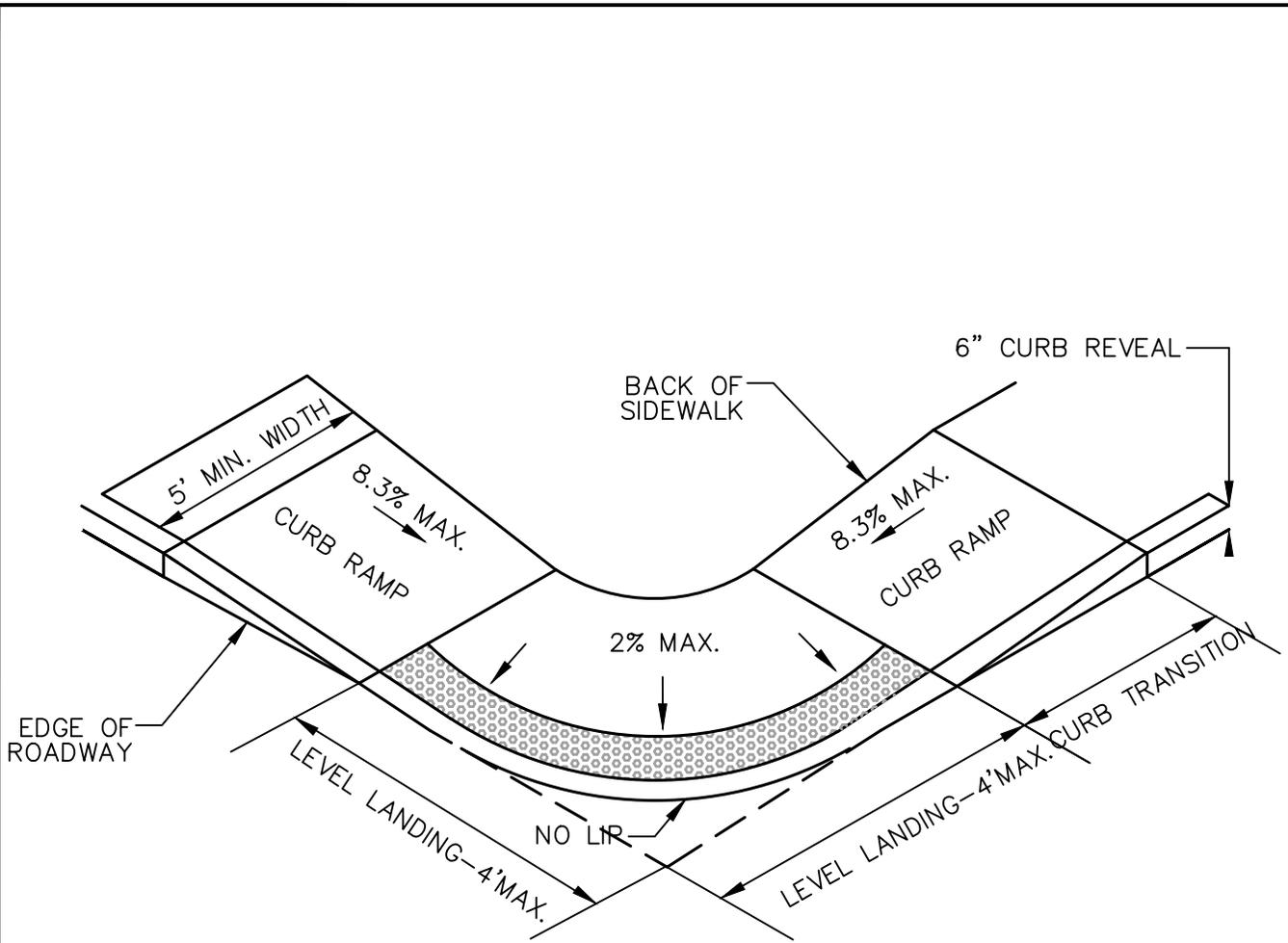
TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

CURB RAMP TYPE D.1
 DETAIL

SCALE: N.T.S. DATE: 11-14-2019

JOB NO. \ FILE NAME:	DESIGNED BY: J.C.Z.	PLAN NO.
STANDARD_DETAILS	DRAWN BY: J.C.Z.	RD-13A
	CHECKED BY: J.C.Z.	





TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

CURB RAMP TYPE E
 DETAIL

SCALE: N.T.S

DATE: 11-14-2019

JOB NO. \FILE NAME:
 STANDARD_DETAILS

DESIGNED BY: J.C.Z.
 DRAWN BY: J.C.Z.
 CHECKED BY: J.C.Z.

PLAN NO.
 RD-14



NOTES:

1. ALL RAMPS TO BE CONSTRUCTED OF CEMENT CONCRETE.
2. ALL RAMPS TO HAVE DETECTABLE WARNING PANELS CONFORMING TO RS-13.
3. FIELD LOCATION OF CURB RAMPS TO BE APPROVED BY TOWN ENGINEER PRIOR TO CONSTRUCTION.

TABLE OF TRANSITION LENGTHS

ROADWAY PROFILE GRADE (%)	HIGH SIDE TRANSITION LENGTH
0	6'-6"
>0-1	7'-8"
>1-2	9'-0"
>2-3	11'-0"
>3-4	14'-0"
>4	15'-0" (MAX.)

* BASED ON A DESIGN SLOPE OF 7.5% AND
6" OF CURB REVEAL

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

CURB RAMP NOTES AND TABLE OF
TRANSITION LENGTHS

SCALE: N.T.S

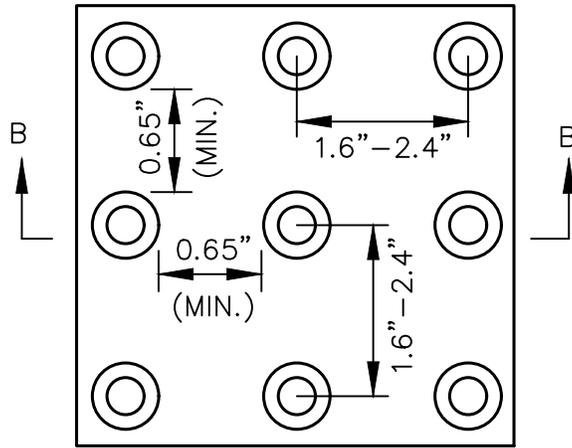
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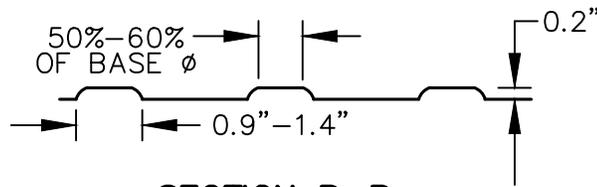
DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
RD-15





PLAN



SECTION B-B

NOTE:

1. WARNING SURFACE SHALL CONTRAST VISUALLY WITH ADJACENT WALKING SURFACES.
2. DETECTABLE WARNING PANEL TO BE SMC COMPOSITE.
3. ADA SOLUTIONS CATALOG NO. 2460NV11REP OR APPROVED EQUAL

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

DETECTABLE WARNING STRIP
DETAIL

SCALE: N.T.S

DATE: 11-14-2019

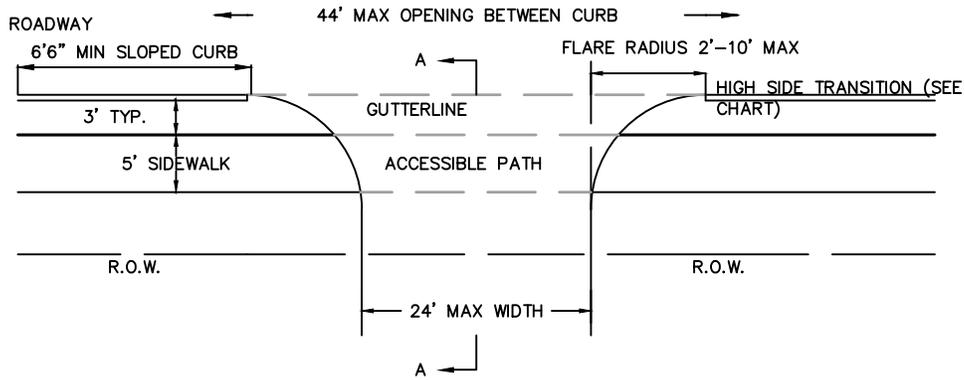
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STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

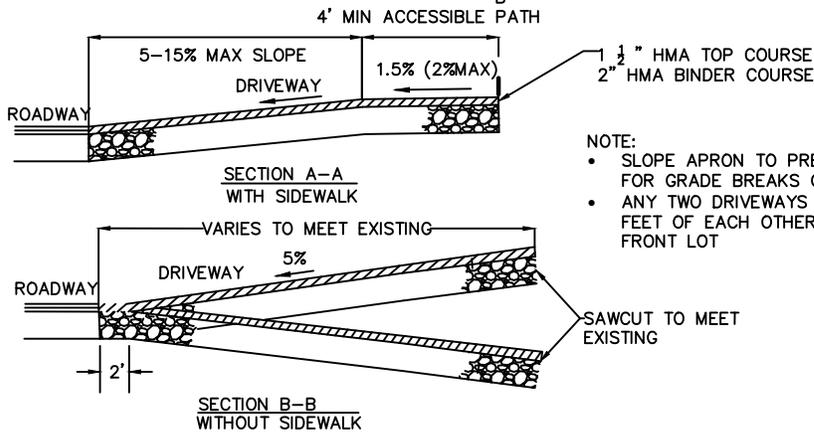
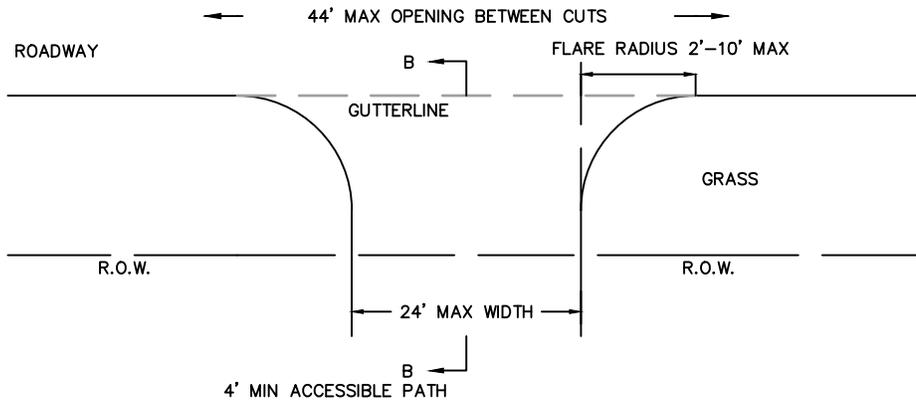
PLAN NO.
RD-16



RESIDENTIAL DRIVEWAYS WITH CURB/BERM



RESIDENTIAL DRIVEWAYS WITH NO CURB/BERM



NOTE:

- SLOPE APRON TO PREVENT RUNOFF FROM LEAVING ROADWAY. FOR GRADE BREAKS OVER 5% USE 10' VERTICAL CURVE.
- ANY TWO DRIVEWAYS SHALL NOT BE WITHIN THIRTY (30) FEET OF EACH OTHER AT THEIR INTERSECTIONS WITH THE FRONT LOT

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

TYPICAL DRIVEWAY
DETAILS

SCALE: N.T.S

DATE: 11-14-2019

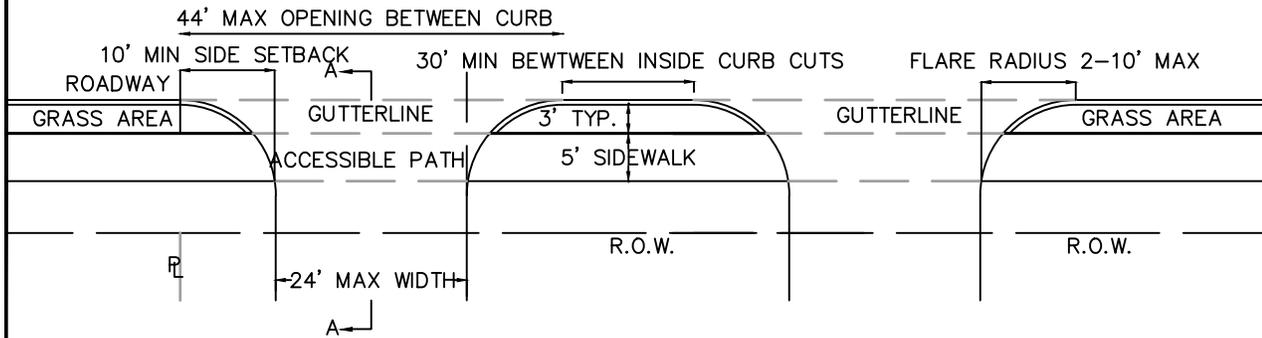
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STANDARD_DETAILS

DESIGNED BY: J.C.Z.
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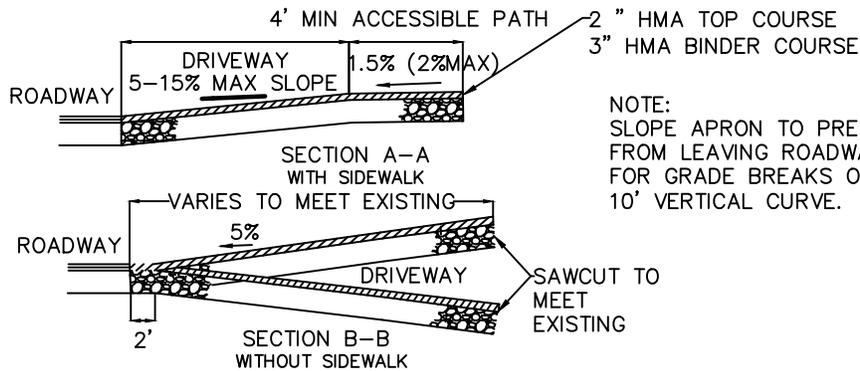
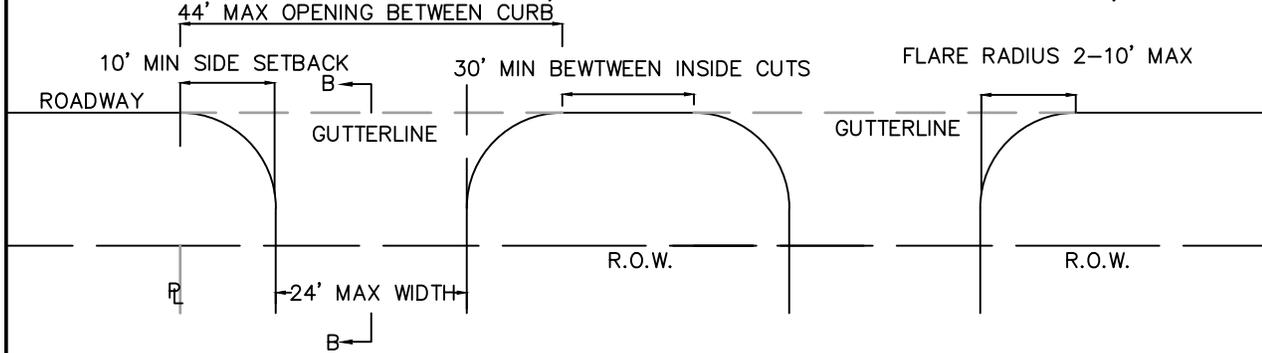
PLAN NO.
RD-17



RESIDENTIAL LOOPED/MULTIPLE DRIVEWAYS WITH CURB/BERM



RESIDENTIAL LOOPED/MULTIPLE DRIVEWAYS WITH NO CURB/BERM



NOTE:
SLOPE APRON TO PREVENT RUNOFF
FROM LEAVING ROADWAY.
FOR GRADE BREAKS OVER 5% USE
10' VERTICAL CURVE.

TOWN OF TYNGSBOROUGH DESIGN AND CONSTRUCTION STANDARDS

LOOPED DRIVEWAY DETAIL

SCALE: N.T.S

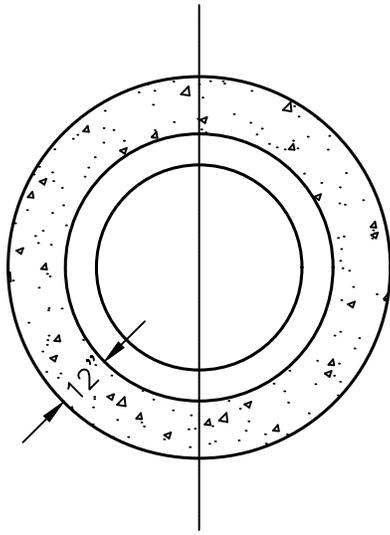
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STANDARD_DETAILS

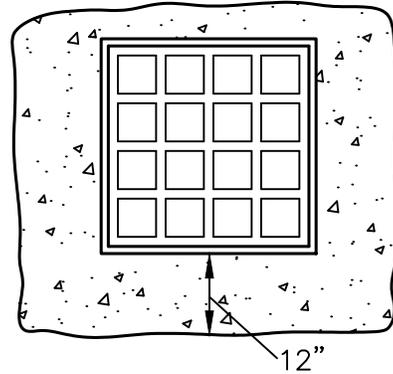
DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
RD-18

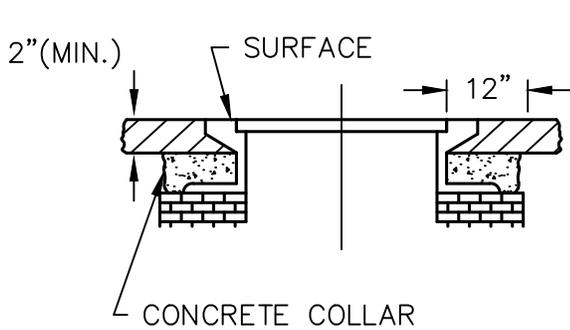




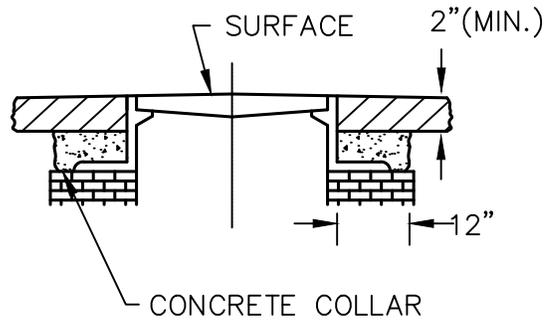
PLAN



PLAN



SECTION
MANHOLES



SECTION
CATCH BASINS

USE BRICK COURSES AS
NEEDED TO BRING RIM TO
REQUIRED ELEVATION



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

DETAILS FOR RAISING CASTINGS
DRAINAGE STRUCTURES

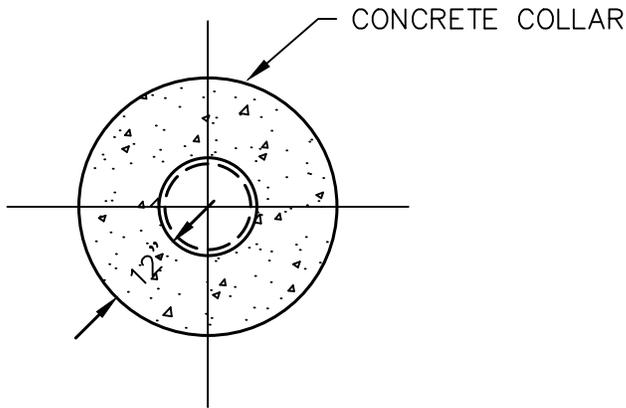
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DATE: 11-14-2019

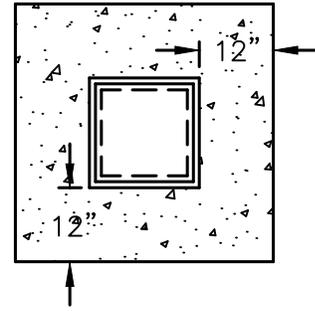
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STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

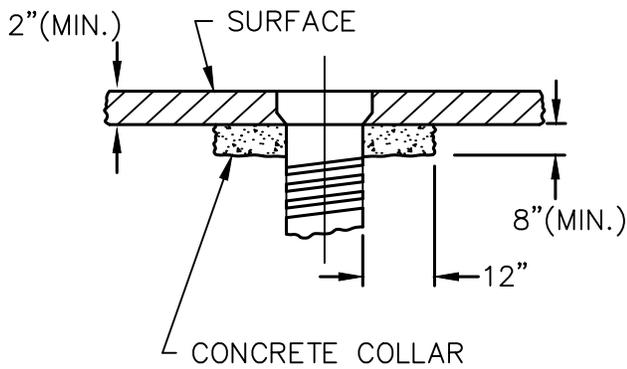
PLAN NO.
RD-19



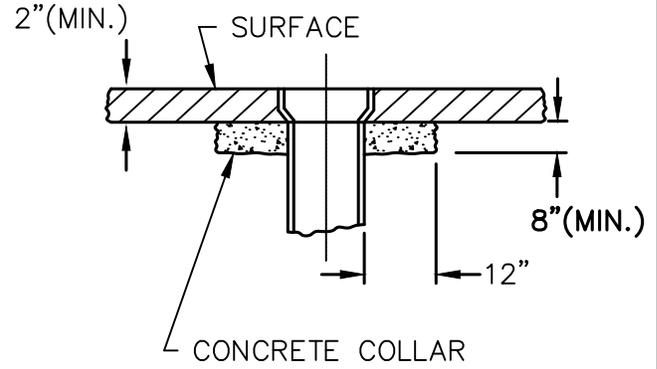
PLAN



PLAN



SECTION



SECTION

TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

DETAILS FOR RAISING CASTINGS
 WATER SERVICES BOXES

SCALE: N.T.S

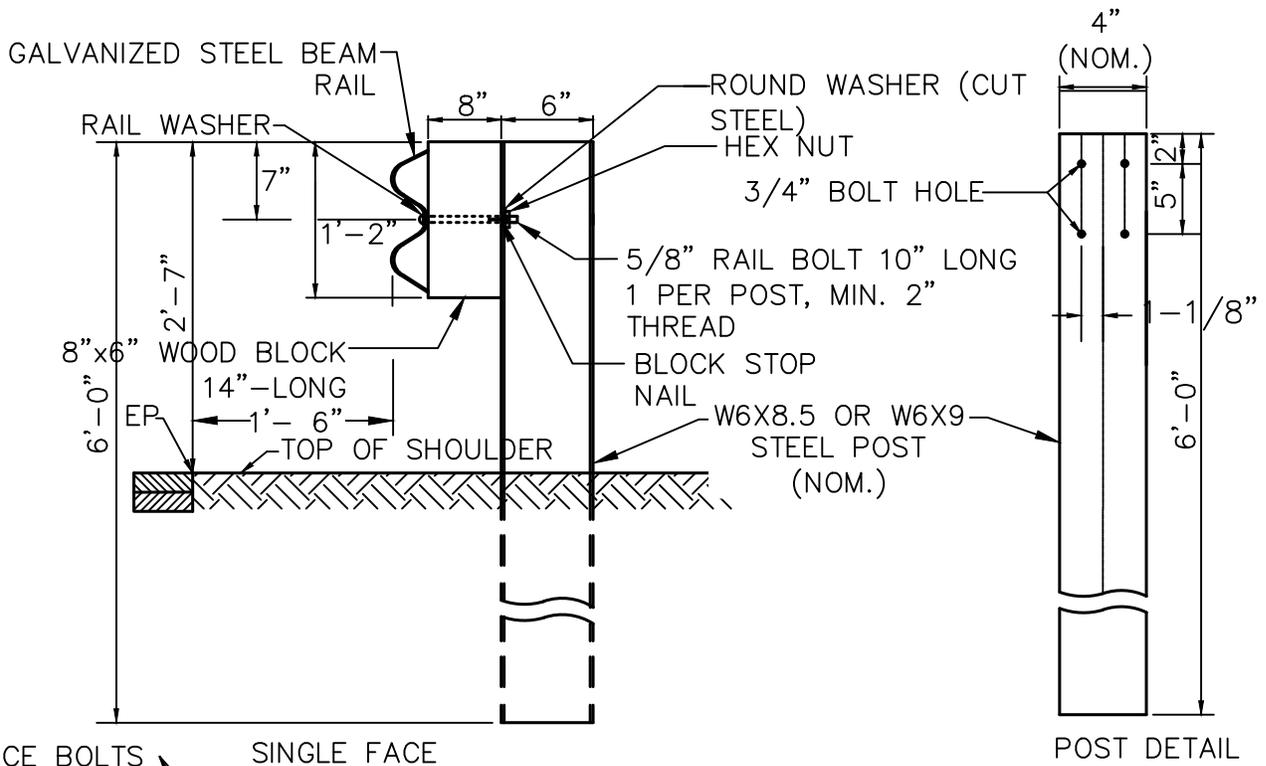
DATE: 11-14-2019

JOB NO. \FILE NAME:
 STANDARD_DETAILS

DESIGNED BY: J.C.Z.
 DRAWN BY: J.C.Z.
 CHECKED BY: J.C.Z.

PLAN NO.
 RD-20

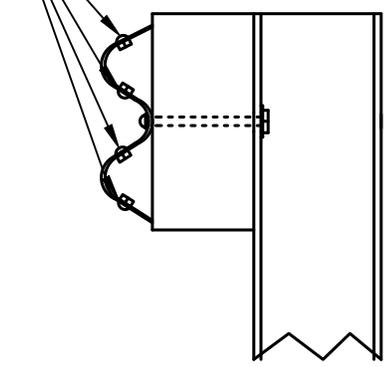




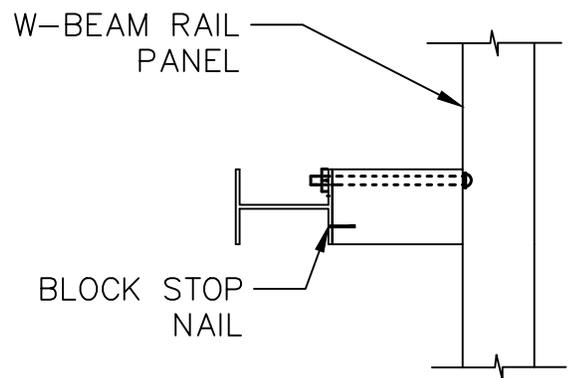
SPLICE BOLTS
8 PER JOINT

SINGLE FACE

POST DETAIL



SINGLE FACE
RAIL SPLICE



BLOCK STOP
NAIL

NOTE:

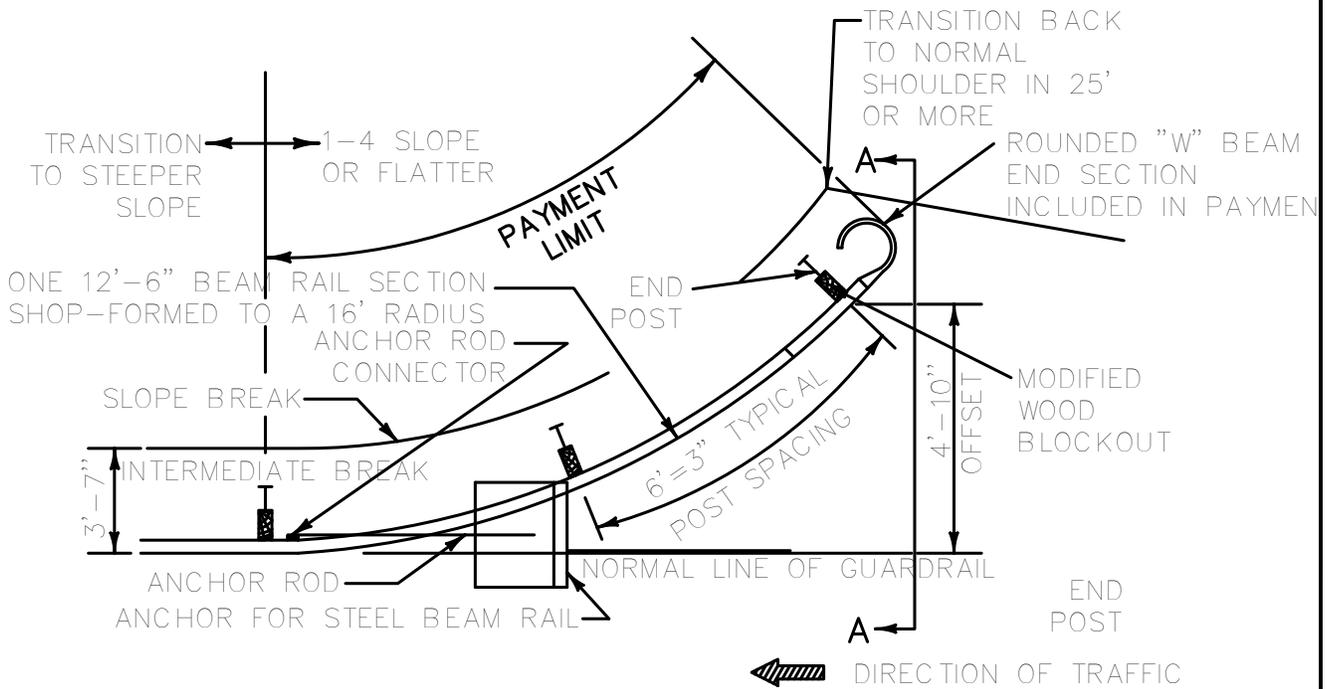
ALL HARDWARE TO BE GALVANIZED
STEEL. DELINEATOR EVERY OTHER P

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

GUARDRAIL
DETAIL

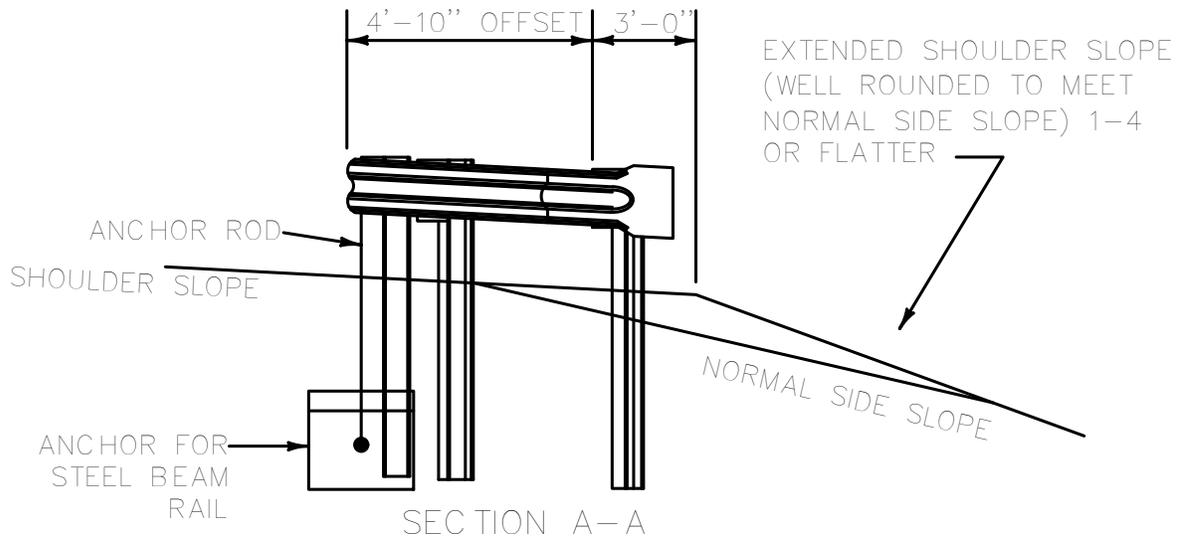
SCALE: N.T.S		DATE: 11-14-2019	
JOB NO. \ FILE NAME:	DESIGNED BY: J.C.Z.	PLAN NO.	
STANDARD_DETAILS	DRAWN BY: J.C.Z.	RD-21	
	CHECKED BY: J.C.Z.		





APPROACH END DETAIL

NHS APPROVED FOR USE WHERE DESIGN SPEED IS 40 OR LESS MPH
 NON-NHS APPROVED FOR USE WHERE DESIGN SPEED IS 50 OR LESS MPH



TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

W BEAM STEEL LOW SPEED END
 TREATMENT DETAIL

SCALE: N.T.S

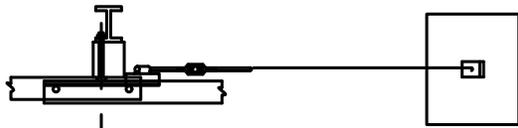
DATE: 11-14-2019

JOB NO. \FILE NAME:
 STANDARD_DETAILS

DESIGNED BY: J.C.Z.
 DRAWN BY: J.C.Z.
 CHECKED BY: J.C.Z.

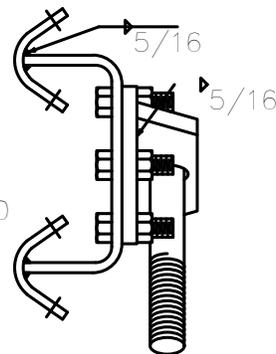
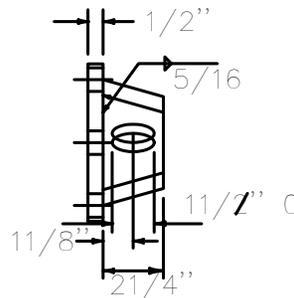
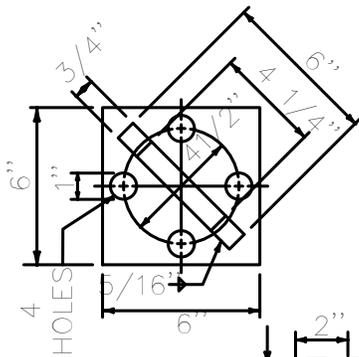
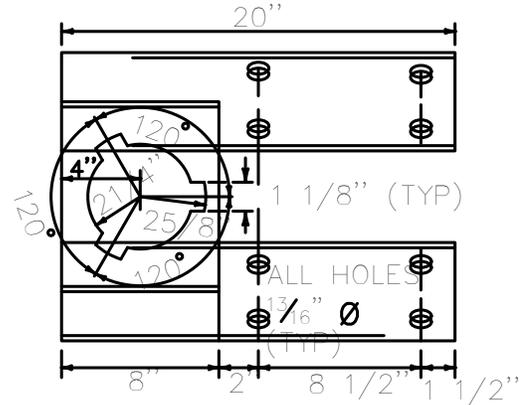
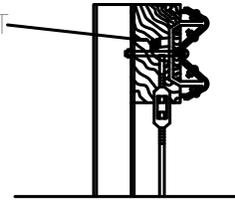
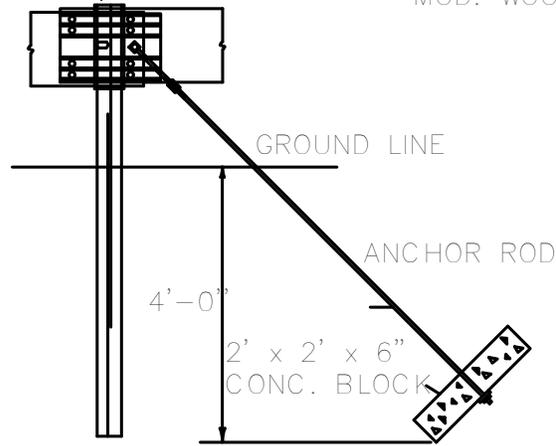
PLAN NO.
 RD-22





ANCHOR ROD CONNECTOR

MOD. WOOD BLOCKOUT



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

W BEAM STEEL VT LOW SPEED END
TREATMENT DETAIL

SCALE: N.T.S

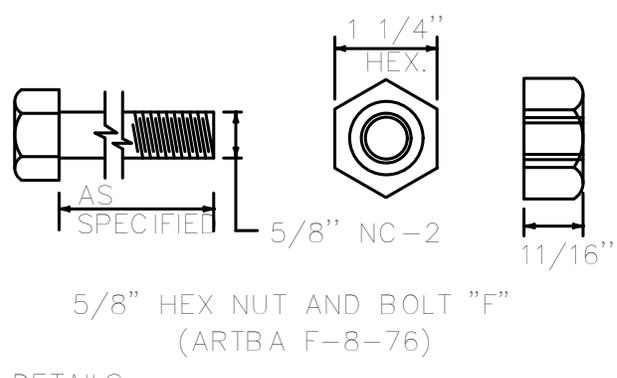
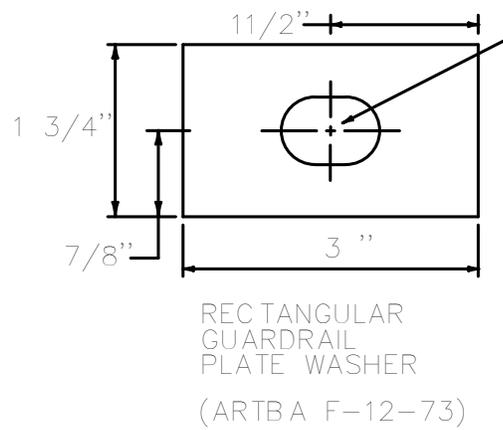
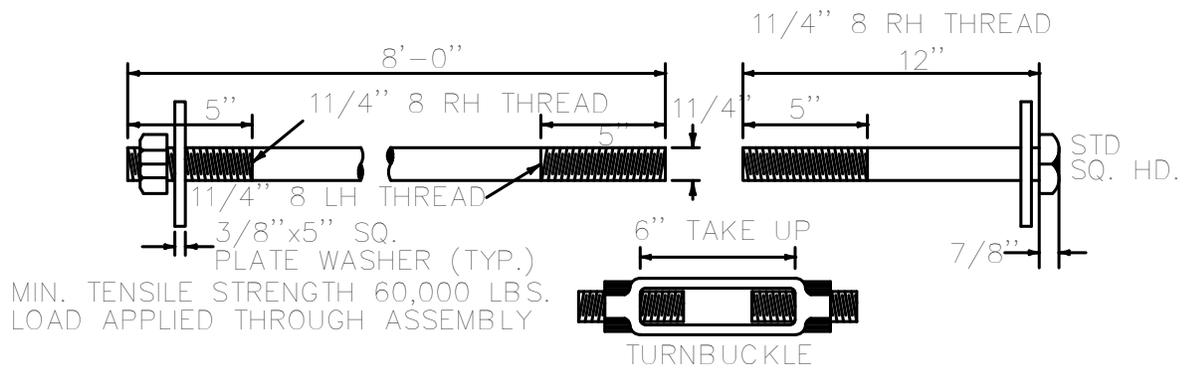
DATE: 11-14-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
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CHECKED BY: J.C.Z.

PLAN NO.
RD-22A





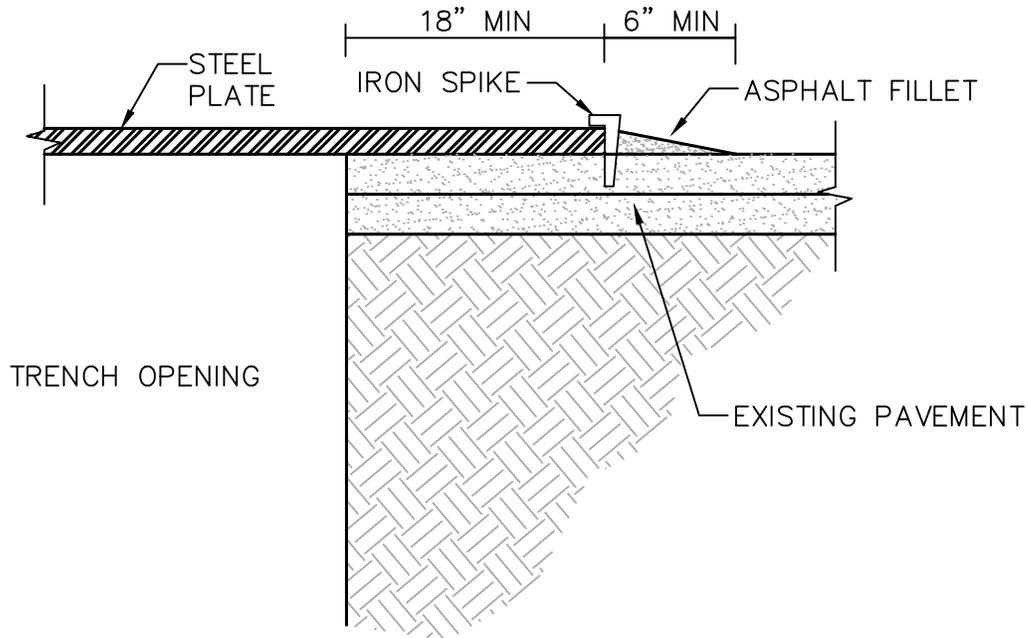
FASTENER DETAILS

GENERAL NOTES

1. ALL METAL PARTS SHALL BE GALVANIZED STEEL
2. ALL WOOD POSTS SHALL BE GIVEN A PRESERVATIVE TREATMENT



TOWN OF TYNGSBOROUGH DESIGN AND CONSTRUCTION STANDARDS		
W BEAM STEEL VT LOW SPEED END TREATMENT DETAIL		
SCALE: N.T.S		DATE: 11-14-2019
JOB NO. \ FILE NAME: STANDARD_DETAILS	DESIGNED BY: J.C.Z. DRAWN BY: J.C.Z. CHECKED BY: J.C.Z.	PLAN NO. RD-22B



NOTES:

1. USE OF STEEL PLATES ALLOWED ON A CASE BY CASE BASIS, PENDING WRITTEN APPROVAL BY TOWN.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES OR CLAIMS RESULTING FROM THE USE OF STEEL PLATES.
3. MUTCD COMPLIANT RETROREFLECTIVE ORANGE CONSTRUCTION WARNING SIGNS (48"X48") WITH WORDING "STEEL PLATE AHEAD" SHALL BE INSTALLED IN ADVANCE OF STEEL PLATE INSTALLATION.
4. THE CONTRACTOR SHALL DESIGN AND UTILIZE STEEL PLATES OF ADEQUATE DIMMENSIONS AND THICKNESS FOR INTENDED USE AND VEHICLE LOADING. MAXIMUM ALLOWABLE DEFLECTION SHALL BE 0.025". IRON SPIKE FASTENERS SHALL BE INSTALLED AROUND THE PERIMETER OF THE STEEL PLATE.

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

STEEL PLATE
DETAIL

SCALE: N.T.S

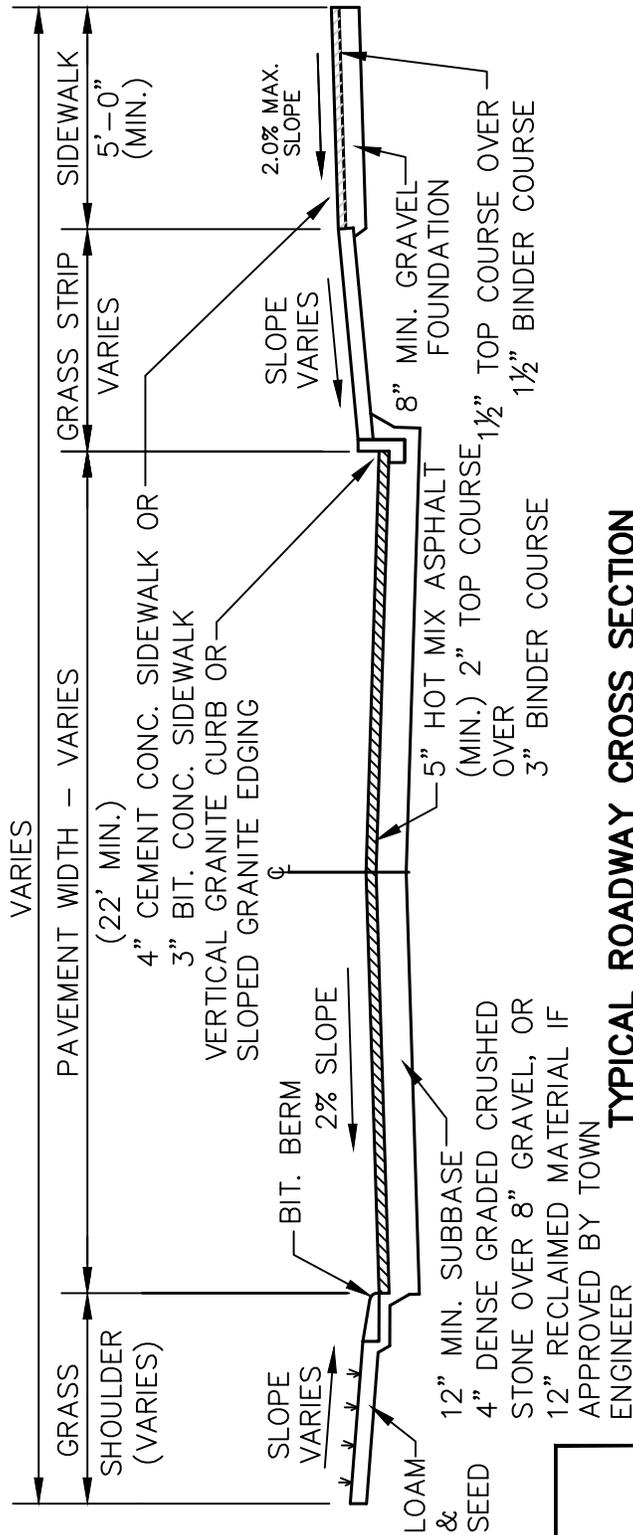
DATE: 11-14-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
RD-23





TYPICAL ROADWAY CROSS SECTION

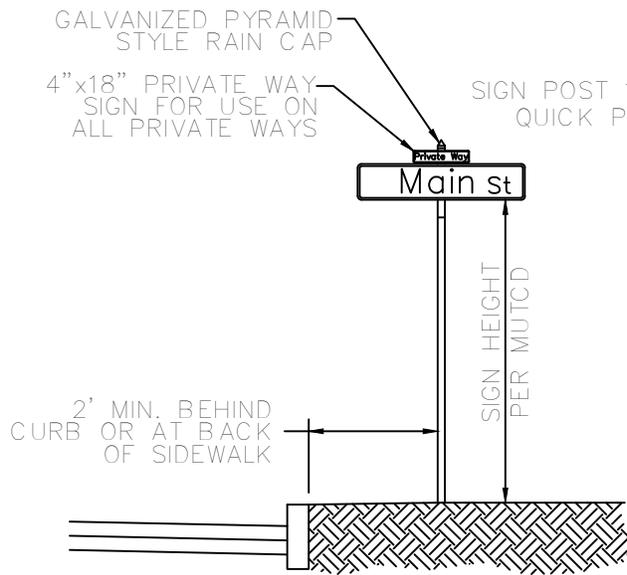
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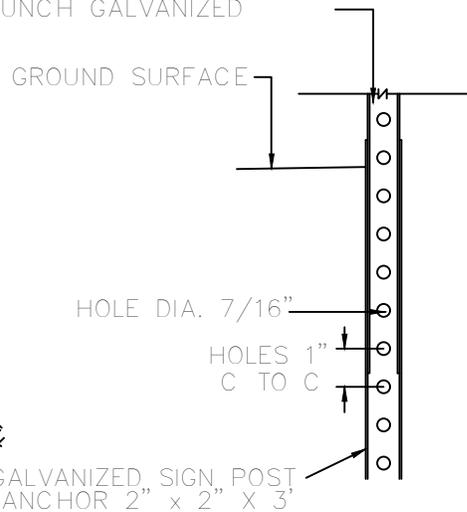
TOWN OF TYNGSBOROUGH DESIGN AND CONSTRUCTION STANDARDS		
TYPICAL ROADWAY CROSS SECTION DETAIL		
SCALE: N.T.S	DATE: 11-14-2019	
JOB NO. \ FILE NAME: STANDARD_DETAILS	DESIGNED BY: J.C.Z. DRAWN BY: J.C.Z. CHECKED BY: J.C.Z.	PLAN NO. RD-24

ABBREVIATIONS:

STREET = ST
 AVENUE = AVE
 PLACE = PL
 WAY = WAY
 BOULEVARD = BLVD
 PARKWAY = PKWY
 LANE = LN
 COURT = CT
 DRIVE = DR
 ROAD = RD
 CIRCLE = CIR
 RIDGE = RDG
 OTHER ABBREVIATIONS USE
 MUTCD TABLE 1A-1



SIGN INSTALLATION



P-5 TELESCOPIC POST

NOTES

1. ALL STREET NAME SIGNS SHALL CONSIST OF 2 SINGLE SIDED SIGNS MOUNTED BACK TO BACK 9" x VARIES FLAT ALUMINUM, 0.080 GAUGE
2. BACKGROUND AND COPY: 6" WHITE LETTERS ON GREEN BACKGROUND WITH WHITE BORDER. HIGH INTENSITY PRISMATIC SHEETING. TYPEFACE AND SPACING TO MEET MUTCD STANDARDS

TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

STREET NAME SIGNS
 DETAIL

SCALE: N.T.S

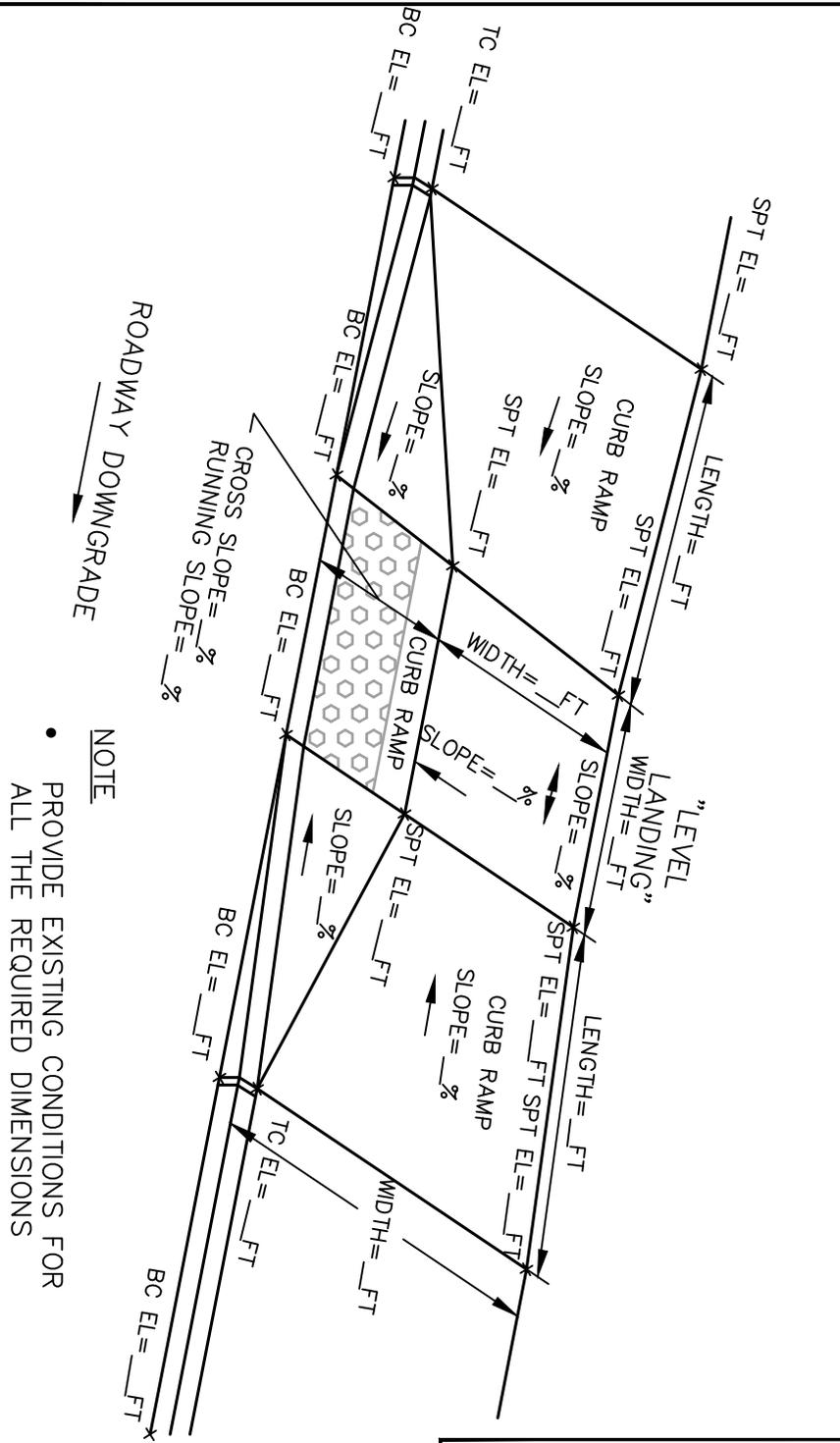
DATE: 11-14-2019

JOB NO. \ FILE NAME:
 STANDARD_DETAILS

DESIGNED BY: J.C.Z.
 DRAWN BY: J.C.Z.
 CHECKED BY: J.C.Z.

PLAN NO.
 RD-25





NOTE

- PROVIDE EXISTING CONDITIONS FOR ALL THE REQUIRED DIMENSIONS

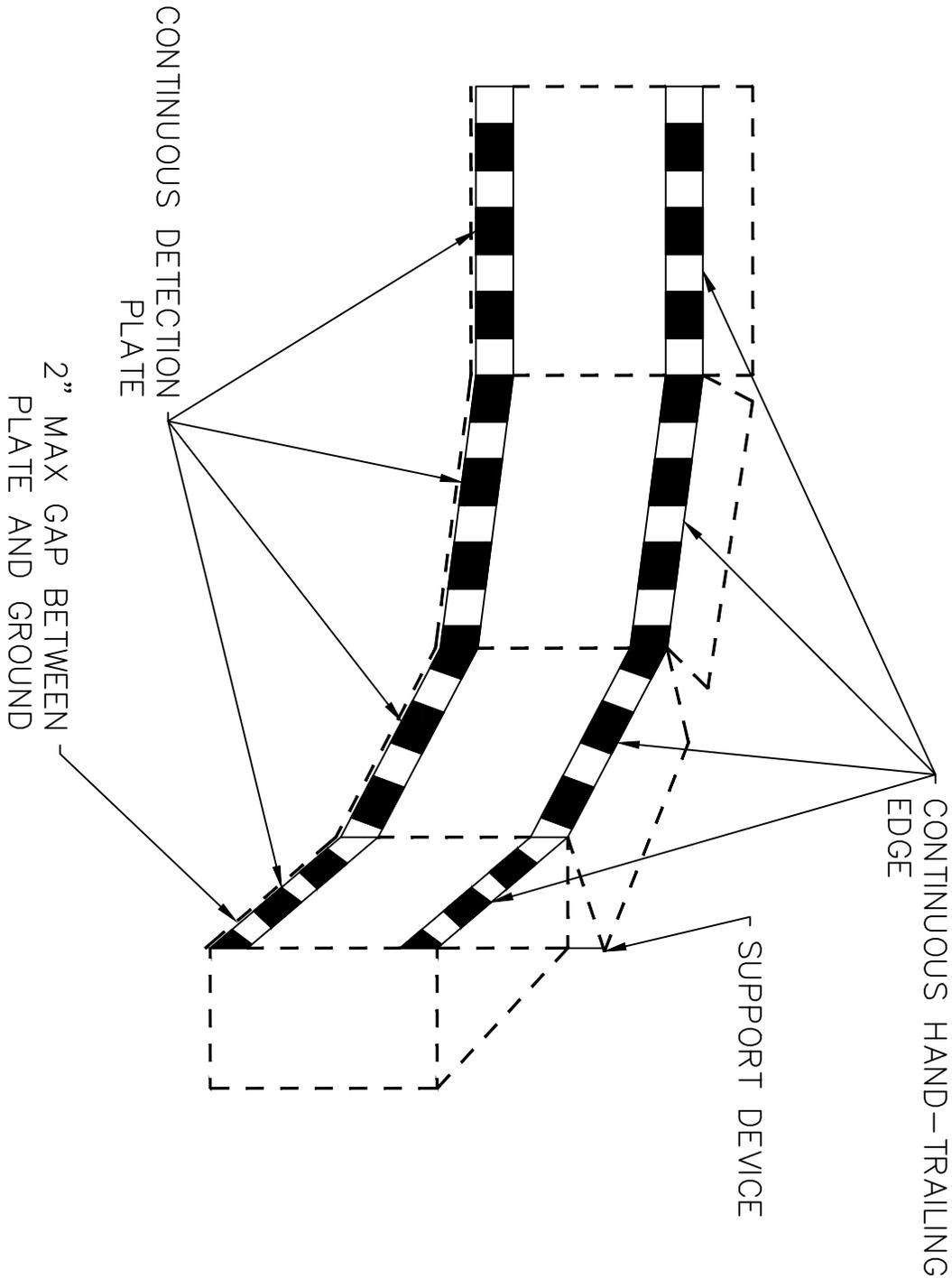
TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

CURB RAMP SUBMITTAL
 DETAIL

SCALE: N.T.S DATE: 11-14-2019

JOB NO. \ FILE NAME:	DESIGNED BY: J.C.Z.	PLAN NO.
STANDARD_DETAILS	DRAWN BY: J.C.Z.	RD-26
	CHECKED BY: J.C.Z.	





TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

PEDESTRIAN CHANNELING
 DEVICE

SCALE: N.T.S

DATE: 11-14-2019

JOB NO. \FILE NAME:
 STANDARD_DETAILS

DESIGNED BY: J.C.Z.
 DRAWN BY: J.C.Z.
 CHECKED BY: J.C.Z.

PLAN NO.
 RD-27



4 – PEDESTRIAN ACCESSIBILITY STANDARDS

4.1 General

- A. Pedestrian Access Routes (PARs) are continuous unobstructed paths designated for pedestrian use that connects accessible elements, spaces, and other Pedestrian Access Facilities (PAFs) within the town's right-of-way.
- B. In accordance with federal American with Disabilities Act (ADA), state (28 CFR 35.151 & 2004 ADAAG), Public Right of Way Accessibility Guidelines (PROWAG), Massachusetts Architectural Access Board (MAAB), and these Standards, all PAFs or a portion thereof within the town's right of way that is constructed or altered shall be designed and constructed in such manner that the PAFs or portion thereof is readily accessible to and usable by individuals with disabilities.

4.2 Design

4.2.1 Criteria

- A. The design and construction of **new** pedestrian facilities within the public right-of-way shall conform to the ADA, ADAAG, MAAB, PROWAG and these Standards.
- B. The re-design and reconstruction of **existing** pedestrian facilities with in the public right-of-way shall conform to the ADA, ADAAG, MAAB, PROWAG and these Standards.
- C. It is recognized that there are times when full compliance with federal and state laws and these Standards cannot be achieved due to structural impracticality, technical infeasibility, or would result in excessive and unreasonable costs without any substantial benefit to individuals with disabilities. See the "**Technical Infeasibility Determination Process and Policy**" in Appendix 1 for maintaining compliance in such scenarios.

4.2.2 Plan Review/Content

- A. Any project requiring approval by a Town Board or Commission which proposes new PAFs or the reconstruction of PAFs, design plans or details shall be submitted to said Board or Commission for distribution to the Engineering Department and approval by the Town Engineer or his/her designee.
- B. Any project **not** requiring approval by a Town Board or Commission which proposes new PAFs or the reconstruction of PAFs, design plan(s) or details shall be submitted to Engineering Department directly with a street opening permit application. The plan(s) shall be reviewed and conditionally approved by the Town Engineer or his/her designee through the issuance of street opening permit.
- C. The plan, or portion thereof, shall require a technical review and comply, at a minimum, with the sections of 1.2.1 (A-F) of the Standards. The applicant is responsible to submit the plan with satisfactory detail which provides sufficient documentation that a determination of compliance can be adequately established by the town. Often, this will include greater detail than the minimum thresholds outlined in the aforementioned section.

- D. All design plans shall provide the following information in addition to the requirements of section 1.2.1 of these Standards:
1. The design plans shall provide all proposed dimensions including cross slopes(perpendicular to path of travel), running slopes (parallel to path of travel), lengths, widths, transitions, top and bottom of curb elevations, existing and proposed spot grades within the PAF at critical grade changes, etc. necessary to verify that the design is compliant. Please refer to RD-26 for a typical plan detail of a curb ramp.
 2. It is recognized that there are times when PAFs must transition into pre-existing non-compliant features. These transition areas shall be clearly labeled as such and shall be designed in accordance with all federal, state, and local laws, regulations and standards.
 3. All design material for PAFs or other public access facilities proposed to be constructed and/or altered shall be clearly labeled.
- E. A note shall be placed on all plans stating: *“The Town of Tyngsborough Engineering Department shall be notified a minimum of 48 hours prior to the installation of materials to inspect and verify that the lines and grades of any form work needed to construct the pedestrian facilities (i.e. curb ramps, concrete sidewalks, etc.) are in reasonable conformance with the design plans. This inspection does not constitute acceptance of such infrastructure by the Town of Tyngsborough.”*

4.3 Pedestrian Access Facilities

4.3.1 Sidewalks

- A. Shall comply with R302 of the PROWAG and the Standards herein.
- B. Sidewalks shall be constructed of either cement concrete, bituminous concrete, and in some instances stone dust.
- C. The continuous width of a sidewalk shall be five (5) foot minimum, exclusive of the width of curb.
- D. Cross slopes of sidewalks shall be 1.5 percent and may not exceed 2 percent.
- E. A sidewalk's running grade shall be consistent and match as closely as possible to the street grade.

4.3.2 Pedestrian Street Crossing

- A. Pedestrian street crossing shall comply with R306 of the PROWAG and the standards herein.
- B. Pedestrian street crossings **without** yield or stop control shall have a cross slope not to exceed 5 percent perpendicular to the PAR.
- C. Pedestrian street crossings **with** yield or stop control shall have a cross slope not to exceed 2 percent perpendicular to the PAR.

4.3.3 Alternate Pedestrian Access Routes

- A. No closures, disruptions, or relocations of PARs are permitted without providing the most convenient and compliant alternative possible.

- B. Advanced notification of temporary closures, disruptions, or relocations of PARs shall be provided to the Engineering Department or Highway Department as part of the traffic management plan required as part of a street opening permit application.
- C. Alternate PARs shall be provided when existing PARs are temporarily closed, disrupted, or relocated due to construction, alterations, maintenance operations, and other conditions for the protection of safety and welfare of the public. Alternate PARs shall comply with sections 6D.01, 6D.02, and 6G.01 of the MUTCD 2009 edition.
 - 1. The alternate PAR shall be constructed to provide convenience and accessibility that replicates the existing PAR that is being blocked, obstructed, or relocated to the maximum extent practicable.
 - 2. A smooth, continuous suitable surface shall be provided throughout the temporary PAR, free of obstructions, uneven surfaces, curbing, and sudden grade changes.
- D. If pedestrian barricades and channelizing devices are used, such devices shall comply with sections 6F.63, 6F.68, and 6F.71 of the MUTCD 2009 edition.
 - 1. Devices used to channelize pedestrians shall be detectable to users of long canes and visible to persons having low vision to the maximum extent practicable.
 - 2. Pedestrian channelizing devices shall be constructed with baseboard with a maximum gap of 2 inches from the ground and a railing no lower than 32 inches. Please refer to RD-27 for a typical plan detail of a pedestrian channeling device.

4.3.4 Curb Ramps

- A. Provides a transition between PARs across streets, driveways, islands, etc.
 - 1. Shall comply with R304 of the PROWAG and the Standards herein.
 - 2. The turning space and ramp portion of the curb ramps shall be constructed of Portland Cement Concrete.
 - 3. Refer to details RD-10, RD-11, RD-12, RD-13, RD-13A, and RD-14 for “typical” curb ramp design. For non-typical curb ramps, refer to section 4.2.B of these standards.
 - 4. A 4ft minimum by 4ft minimum turning space shall be provided at the top of curb ramps and shall be permitted to overlap other turning spaces. Turning spaces with constraints on one or more sides, the turning space shall be 5ft minimum in the direction of the constraint.
 - 5. The running slope of a curb ramp shall be a maximum of 8.3 percent. The running slope shall not exceed a ramp length of 15ft. When installing a parallel ramp in the direction of the roadway travel, the running slope shall not exceed 15ft when attempting to match existing grade. The slope shall be a consistent and unvarying in grade.
 - 6. There shall be a 4ft by 4ft (4' X 4') clear space beyond the bottom of the grade break and shall be provided within the pedestrian street crossing. The clear space shall be outside of the parallel vehicle travel lane and within a crosswalk.

4.3.5 Blended Transitions

- A. Similar to curb ramps, blended transitions provide an accessible route between PARs across street, driveways, islands, etc.
 - 1. Shall comply with R304.4 and 304.5 of the PROWAG and the standards herein.
 - 2. The running slopes of blended transitions shall be 5 percent maximum.
 - 3. The cross slope of blended transitions shall be 2 percent maximum.

4.4 Detectable Warning Surfaces

4.4.1 Purpose

- A. A standardized surface feature built in or applied to walking surfaces and/or ramps to warn visually impaired people of hazards on a PAR. (ADAAG)

4.4.2 Fabrication

- A. The detectable warning panels shall be constructed of SMC composite or approved equal.
- B. Shall be a “wet set” replaceable type panel.
- C. Shall consist of truncated domes aligned in square or radial grid pattern. (Refer to detail RD-13 of the construction detail section herein)

4.4 .3 Installation

- A. Detectable warning panels shall contrast visually with the ramp, street, or adjacent PAR.
- B. Detectable warning surfaces shall extend 2ft in depth in the direction of travel and span across the width of the ramp runs, blended transition, or turning spaces.
- C. The placement of detectable warning surfaces shall comply with R305.2

4.5 On-Street Parking Spaces

- A. To ensure that there is a minimum number of accessible parking spaces which are strategically located and properly designed in order to accommodate those with disabilities.
 - 1. Shall comply with R214 and R309 of the PROWAG and Standards herein.
 - 2. Where on-street parking is provided on the block perimeter and the parking is marked **or** metered, accessible parking spaces shall be provided in accordance with the following table:

Total Number of Marked or Metered Parking Spaces on the Block Perimeter	Minimum Required Number of Accessible Parking Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 and over	4 percent of total

3. Where parking on part of the block perimeter is revised or altered, the minimum number of accessible parking spaces required shall be provided. The minimum number is based on the total number of marked or metered parking spaces on the block perimeter regardless of the amount of accessible spaces are present at the time of construction. This may require a project proponent to make improvements within the block outside of the original project limit of work.
4. Shall adhere to the provisions for pavement marking in section 3B.19 of the MUTCD.
5. Accessible parking spaces must be identified by signs displaying the International Symbol of Accessibility (R211.3 and R411).
6. Accessible parking spaces should be “centrally” located, to allow for easily accessing key destinations within the block (i.e. schools, public buildings, etc.).
7. The sidewalk adjacent to accessible parallel parking spaces should be free of signs, street furniture, and other obstructions to permit the deployment of a side-lift or ramp. Accessible parallel parking spaces located at the end of the block face should be usable by vans that have rear lifts and cars that have scooter platforms.
8. The town has Narrow Sidewalk widths (less than 14.0 ft.) in public street parking areas. Accessible parking spaces shall adhere to section R309.2.2 of the PROWAG.

5 - EROSION & SEDIMENTATION CONTROL DURING CONSTRUCTION

5.1 - General

- A. Any activity subject to the Town of Tyngsborough Storm Water Regulations or requires a Storm Water Permit shall be required by the Town to prepare and implement an *Erosion and Sedimentation Control Plan*.
- B. The purpose of the *Erosion and Sedimentation Control Plan* is to minimize the introduction of sediments into the Town's drainage system, public right of ways, waterways, wetland areas and abutting properties resulting from the land disturbance activities.
- C. The submission to the Town of the Stormwater Pollution Prevention Plan (SWPPP) required to be developed under the EPA Construction General Permit will meet the *Erosion and Sediment Control Plan* requirement.
- D. The *Erosion and Sedimentation Control Plan* shall be developed to include Best Management Practices (BMPs) that are appropriate for the site, including efforts to minimize the area of the land disturbance. The plan shall contain sufficient information for the Town Engineer or the Conservation Director to evaluate the environmental impact, effectiveness and acceptability of the measures proposed by the applicant for reducing adverse impacts from stormwater runoff during the land-disturbing activities.
- E. For phased construction, the *Erosion and Sedimentation Control Plan* shall identify the different construction phases and clearly delineate the BMPs to be utilized within each construction phase.

5.2 Design Criteria

5.2.1 General

- A. Minimize total area of disturbance and minimize unnecessary clearing and grading from all construction sites. Clearing and grading shall only be performed within areas needed to build the project, including structures, utilities, roads, recreational amenities, post-construction stormwater management facilities, and related infrastructure.
- B. Whenever practicable and feasible, construction shall be phased to limit disturbance to only one area of active construction at a time. Future phases shall not be disturbed until construction of prior phases is complete and the land area is stabilized. Mass clearings and grading of the entire site shall be avoided.
- C. Interim and permanent stabilization measures shall be instituted on a disturbed area as soon as practicable but no more than 14 days after construction activity has temporarily or permanently ceased on that portion of the site.
- D. Steep slopes shall be protected from erosion by limiting clearing of these areas in the first place or, where grading is unavoidable, by providing special techniques to prevent upland runoff from flowing down a steep slope and performing immediate stabilization to prevent gullyng. Runoff from the site shall be diverted from highly erodible soils and steep slopes to stable areas.
- E. Perimeter sediment controls shall be applied to retain or filter concentrated runoff from disturbed areas to trap or retain sediment before it leaves the activity site.
- F. Uncontaminated stormwater shall be diverted around disturbed areas.

- G. Sediment trapping and settling devices shall be employed to trap and/or retain suspended sediments and allow time for them to settle out in cases where perimeter sediment controls (e.g., silt fence and hay bales) are deemed to be ineffective in trapping suspended sediments on-site.
- H. Off-site transport of sediment, including off-site vehicle tracking, shall be prevented.
- I. Dust and debris shall be controlled at the site.
- J. The following discharges are prohibited on the construction site:
 - 1. Wastewater from washout of concrete, unless managed by an appropriate control;
 - 2. Wastewater from washout and cleanout of stucco, paint, from release oils, curing compounds and other construction materials;
 - 3. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance; and,
 - 4. Soaps or solvents used in vehicle and equipment washing.
- K. On and off-site material storage areas, including construction and waste materials, shall be properly protected and managed.
- L. No erosion control measures shall be designed to be installed within the footprint of BMPs designed to provide permanent infiltration within the Stormwater Management Plan and design. Infiltration technologies are not designed to handle the high concentrations of sediments typically found in construction runoff, and thus must be protected from construction related sediment loadings.

5.2.2 Erosion and Sedimentation Control Plan Contents:

- A. A plan prepared by a Professional Engineer (PE) licensed in the Commonwealth of Massachusetts, stamped certifying that the *Erosion and Sedimentation Control Plan* is in accordance with the criteria established in these Standards.
- B. Description of the following in narrative and drawings, as appropriate:
 - 1. Estimates of the total area expected to be disturbed by excavation, grading, or other construction activities, including dedicated off-site borrow and fill areas
 - 2. All pollution control measures (structural and non-structural BMPs) that will be implemented as part of the construction activity to control pollutants in storm water discharges. Appropriate control measures must be identified for each major construction activity and the operator responsible for the implementation of each control measure must also be identified
 - 3. The intended sequence and timing of activities that disturb soils at the site and the general sequence during the construction process in which the erosion and sediment control measures will be implemented
 - 4. Structural practices to divert flows from exposed soils, retain/detain flows or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Placement of structural practices in floodplains must be avoided to the degree practicable
 - 5. Interim and permanent stabilization practices for the site, including a schedule of when the practices will be implemented. Site plans should ensure that existing vegetation is preserved where possible and that disturbed portions of the site are stabilized. Use of impervious surfaces for stabilization should be avoided
 - 6. Construction and waste materials expected to be stored on-site with updates as appropriate, including a description of controls, including storage practices, to

minimize exposure of the materials to storm water, and spill prevention and response practices

7. Measures to minimize, to the maximum extent practicable, off-site vehicle tracking of sediments onto paved surfaces and the generation of dust
 8. Design of appropriate controls to properly manage discharges from dewatering activities, including discharges from dewatering of trenches and excavations,
 9. Measures to minimize the discharge of pollutants. At a minimum, such measures must be designed, installed, implemented and maintained to:
 - a. Minimize the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other wash waters. Wash waters must be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;
 - b. Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste and other materials present on the site to precipitation and to stormwater; and
 - c. Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures.
- C. An Operation and Maintenance Schedule for structural and non-structural measures, interim grading, and material stockpiling areas. The O&M schedule shall clearly outline the inspection and cleaning frequencies required.
- D. Written authorization from the property owner for representatives of the Town to enter the site to inspect erosion and sedimentation control measures during the period of land disturbance.

5.3 Construction Criteria

5.3.1 General

- A. Prior to any land disturbance activities commencing on the site, the applicant or its agent shall physically mark limits of no land disturbance on the site with tape, signs, or orange construction fence, so that workers can see the areas to be protected. The physical markers shall be inspected daily.
- B. Appropriate erosion and sediment control measures shall be installed prior to soil disturbance. Measures shall be taken to control erosion within the project area. Sediment in runoff water shall be trapped and retained within the project area. Wetland areas and surface waters shall be protected from sediment.
- C. Erosion and Sediment Control measures shall be installed and maintained in accordance with the manufacturer's specifications and good engineering practices.
- D. Soil stockpiles must be stabilized or covered at the end of each workday. Stockpile side slopes shall not be greater than 2:1. All stockpiles shall be surrounded by sediment controls.
- E. Disturbed areas remaining idle for more than 14 days shall be stabilized with seeding, wood chips bark mulch, tarpaulins, or any other approved methods.
- F. For active construction areas such as borrow or stockpile areas, roadway improvements and areas within 50 feet of a building under construction, a perimeter sediment control system shall be installed and maintained to contain soil.

- G. A temporary construction entrance shall be constructed consistent with detail EC-7A at all site entrance/exit points to reduce the amount of soil carried onto roadways and off the site.
- H. On the cut side of roads, ditches shall be stabilized immediately with rock riprap or other non-erodible liners, or where appropriate, vegetative measures.
- I. Permanent seeding shall be undertaken in the spring from March through May, and in late summer and early fall from August to October 15. During the peak summer months and in the fall after October 15, when seeding is found to be impractical, an appropriate temporary mulch shall be applied. Permanent seeding may be undertaken during the summer if plans provide for adequate mulching and watering.
- J. All slopes steeper than 3:1 (h:v, 33.3%), as well as perimeter dikes, sediment basins or traps, and embankments must, upon completion, be immediately stabilized with sod, seed and erosion control matting, or other approved stabilization measures. Areas outside of the perimeter sediment control system must not be disturbed.
- K. Temporary sediment trapping devices must not be removed until permanent stabilization is established in all contributory drainage areas.
- L. All temporary erosion and sediment control measures shall be removed after final site stabilization. Disturbed soil areas resulting from the removal of temporary measures shall be permanently stabilized within 30 days of removal.

5.3.2 Materials

5.3.2.1 Silt Fence

- A. Silt Fence shall be constructed consistent with Standard Detail EC-3.
- B. Silt fence shall be erected in a continuous fashion from a single roll of fabric. The bottom of the fabric fence shall be buried sufficiently below the ground surface to prevent gaps from forming, usually 4 to 6 inches below ground surface.
- C. The fabric shall be installed on the upstream side of the stakes.
- D. Stakes shall be strong enough and tall enough to securely anchor the fabric to the ground. Stake spacing shall be no more than 10 feet apart for extra-strength fabric and 6 feet apart for standard strength fabric.
- E. Maintenance of the fence is required during construction when the fence shows signs of wear.
- F. Material shall be based on the synthetic fabric requirements as follows:
 1. Filtering efficiency: 75% (minimum)
 2. Tensile strength: Standard strength: 30 lb/linear inch (minimum),
Extra strength: 50 lb/linear inch (minimum)
 3. Elongation: 20% (maximum)
 4. Ultraviolet radiation: 90% (minimum)
 5. Slurry flow rate: 0.3 gal/ft²/min (minimum)

5.3.2.2 Fiber Roll

- A. The Town of Tyngsborough has a preference for fiber rolls (a.k.a. straw wattles) over hay bales for erosion control. Construction of fiber rolls shall be consistent with Standard Detail EC-10
- B. Fiber rolls shall be staked securely into the ground and oriented perpendicular to the slope using wood stakes. A minimum of 3 inches of the stake should stick out above the roll. Stakes should be spaced 3 to 4 feet apart.
- C. Locations where grades exceed slopes of 3:1, two rows of fiber rolls shall be installed as directed by the Engineer.

5.3.2.3 Temporary Construction Entrance

- A. Temporary construction entrance shall be constructed consistent with detail EC-7.
- B. Temporary construction entrance shall be installed to prevent sediment from the construction site entering the roadway. Aprons shall be a minimum of 20 feet in length, and 10' wide of the entrance.
- C. The temporary construction entrance shall be constructed with 3" crushed stone.
- D. All temporary construction entrance shall be constructed with a 5' deep paved apron to support the edge of pavement. The apron shall be constructed with 4" of hot mix asphalt and 8" type "B" gravel borrow and meet the applicable standards outlined within Section 3 – Roadway Standards and MassDOT standard Specifications

5.3.2.4 Silt Sacks

- A. Construction of silt sacs shall be consistent with Standard Detail EC-11.
- B. Silt sacks (or equivalent) shall be placed in catchbasins downgradient of the project/work area to prevent sediment from entering the drainage system.
- C. Silt sacks shall be periodically cleaned while in use and must be cleaned prior to and after precipitation events.

5.3.3 Maintenance

- A. Sediment shall be removed once the volume reaches $\frac{1}{4}$ to $\frac{1}{2}$ the height of a hay bale or fiber roll, or the silt fence shows signs of failure.
- B. Require the removal of accumulated sediment from sediment controls when sediment storage capacity has been reduced by at least 50 percent; and
- C. Applicants are advised they may be required to respond immediately for repair and maintenance at the request of the Town within two hours of notification.

5.3.4 Inspection

- A. The Town will require applicants/contractors to hire at their expense an Environmental Monitor to perform inspections of the erosion control measures implemented for a project. The Environmental Monitor will be required to submit monthly reports to the approving Town authority with a copy submitted to the Tyngsborough Engineering Department. The initial report shall demonstrate that the erosion control measures have been installed, in

conformance with the approved Erosion and Sedimentation Control Plan. Subsequent reports shall evaluate the operation of erosion control measures and any required maintenance activities. Should an erosion control measure be found to be inadequate for properly controlling sedimentation, an adequate measure shall be designed and implemented.

- B. Contractor shall conduct inspections as outlined within the Operation & Maintenance section of the *Erosion and Sediment Control Plan*. Inspections shall occur at least on a 14 day interval. Additionally, the contractor shall conduct inspections after any rainfall event of 0.5" or more.
- C. During construction, the installation, maintenance and operation of erosion control measures will be subject to inspection and enforcement by the Town of Tyngsborough.

EROSION AND SEDIMENTATION CONTROL

DESCRIPTION

DETAIL NUMBER

EROSION AND SEDIMENTATION CONTROL NOTES 1	EC-1
EROSION AND SEDIMENTATION CONTROL NOTES 2	EC-2
SILTATION FENCE	EC-3
HAYBALES AND SILT FENCE	EC-4
ONSITE DEWATERING BASIN	EC-5
DRAIN INLET PROTECTION	EC-6
TEMPORARY CONSTRUCTION ENTRANCE	EC-7
EROSION CONTROL MATTING	EC-8
EROSION CONTROL MATTING INSTRUCTIONS	EC-9
EROSION CONTROL FIBER ROLL	EC-10
SILT SACK	EC-11
DEWATERING SUMP DETAIL	EC-12
LOAM AND SEED DETAIL	EC-13



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

EROSION AND SEDIMENTATION
CONTROL INDEX

SCALE: N.T.S

DATE: 11-14-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
INDEX

GENERAL

THIS PLAN PROPOSES EROSION CONTROL MEASURES TO ADEQUATELY CONTROL ACCELERATED SEDIMENTATION AND REDUCE THE DANGER FROM STORM WATER RUNOFF AT THE SITE. THE RUNOFF SHALL BE CONTROLLED BY THE INTERCEPTION, DIVERSION, AND SAFE DISPOSAL OF PRECIPITATION. RUNOFF SHALL ALSO BE CONTROLLED BY STAGING CONSTRUCTION ACTIVITY AND PRESERVING NATURAL VEGETATION WHEREVER POSSIBLE.

EXISTING VEGETATION SHALL BE PROTECTED AND ONLY THAT CLEARING AND GRUBBING ABSOLUTELY NECESSARY TO THE PROPOSED CONSTRUCTION SHALL BE PERFORMED. ALL DISTURBED AREAS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION AND CONTOUR, UNLESS OTHERWISE INDICATED ON THE PLANS. THE CONTRACTOR SHALL TAKE SPECIAL CARE WITH HIS CONSTRUCTION METHODS AND SHALL COMPLY WITH THE FOLLOWING GUIDELINES.

SEDIMENTATION CONTROL

ALL AREAS SHALL BE PROTECTED FROM SEDIMENTATION DURING AND AFTER CONSTRUCTION, PARTICULARLY THE STORAGE OF EXCAVATED OR STOCKPILED MATERIAL. THE CONTRACTOR SHALL CAREFULLY STRIP ALL TOPSOIL, LOAM, OR ORGANIC MATTER PRIOR TO THE TRENCHING OR OTHER OPERATIONS AND SHALL STORE THEM SEPARATELY FROM ALL OTHER MATERIALS DURING EXCAVATION. EACH STOCKPILE MUST BE ADEQUATELY RINGED WITH SEDIMENT CONTROL MATERIAL (i.e. HAY BALES AND/OR FILTER FIBER ROLL).

DEBRIS AND OTHER WASTE RESULTING FROM EQUIPMENT MAINTENANCE AND CONSTRUCTION WILL NOT BE DISCARDED ON SITE.

EROSION AND SEDIMENTATION CONTROL PLAN

SEDIMENTATION CONTROL SYSTEM – THE SEDIMENTATION CONTROL SYSTEM SHALL CONSIST OF FILTER FABRIC BARRIER FENCE & HAYBALES OR FIBER ROLLS. THE SEDIMENTATION CONTROL SYSTEM SHALL BE INSTALLED IMMEDIATELY AFTER A CUT SLOPE HAS BEEN GRADED, BEFORE A FILL SLOPE HAS BEEN CREATED AND AS INDICATED ON THE PLANS. THE SYSTEM DESIGNED TO INTERCEPT SILT AND SEDIMENT BEFORE IT REACHES THE WETLANDS OR WATERCOURSES. SLOPES OF GREATER THAN 3:1 SHALL REQUIRE DOUBLE ROWS OF FIBER ROLLS AS DIRECTED BY THE ENGINEER. DEPOSITS OF SEDIMENT AND SILT ARE TO BE PERIODICALLY REMOVED FOR THE UPSTREAM SIDE OF THE FENCE. THIS MATERIAL IS TO BE SPREAD AND STABILIZED IN AREAS NOT SUBJECT TO EROSION, OR IN AREAS WHICH ARE NOT TO BE PAVED OR BUILT ON. THE SEDIMENTATION CONTROL SYSTEM IS TO BE REPLACED AS NECESSARY TO PROVIDE PROPER FILTERING ACTION. THE SYSTEM IS TO REMAIN IN PLACE AND BE MAINTAINED TO INSURE EFFICIENT SILTATION CONTROL UNTIL ALL AREAS ABOVE THE SYSTEM ARE STABILIZED AND VEGETATION HAS BEEN ESTABLISHED.

STACKED HAY BALES – HAY OR STRAW BALES USED FOR EROSION CONTROL SHALL BE STACKED AT CATCH BASINS WHERE SEDIMENT MAY ENTER THE CATCH BASIN OR AS DIRECTED BY THE RESIDENT ENGINEER. DEPOSITS OF SEDIMENT AND SILT ARE TO BE PERIODICALLY REMOVED FROM THE UPSTREAM SIDE OF THE EROSION CHECKS. THIS MATERIAL IS TO BE SPREAD AND STABILIZED IN AREAS NOT SUBJECT TO EROSION, OR IN AREAS WHICH ARE NOT TO BE PAVED OR BUILT ON. HAY OR STRAW BALES ARE TO BE REPLACED AS NECESSARY TO PROVIDE PROPER FILTERING ACTION. THE SYSTEM IS TO REMAIN IN PLACE AND BE MAINTAINED TO INSURE EFFICIENT SILTATION CONTROL UNTIL ALL AREAS ABOVE THE EROSION CHECKS ARE STABILIZED AND VEGETATION HAS BEEN ESTABLISHED.

EROSION CONTROL MATTING – MATTING SHALL BE USED FOR EROSION CONTROL ON SLOPES GREATER THAN 3:1. SOIL ON SLOPES SHALL BE PREPARED BEFORE INSTALLING MATTING, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER AND SEED. THE SYSTEM IS TO REMAIN IN PLACE AND BE MAINTAINED TO INSURE EFFICIENT EROSION CONTROL UNTIL VEGETATION HAS ESTABLISHED.

IN ALL AREAS, REMOVAL OF TREES, BUSHES, AND OTHER VEGETATION, AND DISTURBANCE TO THE SOIL, IS TO BE KEPT TO AN ABSOLUTE MINIMUM WHILE ALLOWING PROPER DEVELOPMENT OF THE SITE.



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

EROSION AND SEDIMENTATION
CONTROL NOTES 1

SCALE: N.T.S

DATE: 11-14-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

DESIGNED BY: J.C.Z.
DRAWN BY: J.C.Z.
CHECKED BY: J.C.Z.

PLAN NO.
EC-1

EROSION AND SEDIMENT CONTROL MAINTENANCE PROCEDURES

DURING CONSTRUCTION, AS SMALL AN AREA OF SOIL AS POSSIBLE SHOULD BE EXPOSED OR AS SHORT A TIME AS POSSIBLE. AFTER CONSTRUCTION, GRADE, RESPREAD TOPSOIL, AND STABILIZE SOIL BY SEEDING AND MULCHING AS TO PREVENT EROSION.

ALL SEDIMENTATION AND EROSION CONTROL DEVICES SHALL BE INSPECTED DURING CONSTRUCTION ON A DAILY BASIS AND FOLLOWING ALL STORMS BY THE RESIDENT ENGINEER. THE CONTRACTOR SHALL MAINTAIN AND MAKE REPAIRS AND REMOVE SEDIMENT AS REQUESTED BY THE RESIDENT ENGINEER. THIS WORK SHALL BE PERFORMED WITHIN 24 HOURS OF REQUEST.

THE CONTRACTOR SHALL CLEAN SEDIMENT AND DEBRIS FROM ALL DRAINAGE STRUCTURES, AND PIPES AT THE COMPLETION ON CONSTRUCTION, THE CONTRACTOR SHALL REPAIR ALL ERODED AREAS AND ENSURE A GOOD STAND OF TURF IS ESTABLISHED THROUGHOUT. THE CONTRACTOR SHALL REPAIR ALL ERODED OR DISPLACED RIPRAP, AND CLEAN SEDIMENT COVERED STONES.

CONSTRUCTION PROCEDURES:

1. HAY BALES SHALL BE PLACED AROUND EXISTING CATCH BASINS AND DROP INLETS TO PREVENT SEDIMENTATION AND OTHER DEBRIS FROM ACCUMULATING ON THE GRATE OR IN THE SUMP. HAY BALES SHOULD BE KEPT CLEAN AND FREE OF DEBRIS TO FACILITATE FLOW.
2. EACH BALE SHALL BE EMBEDDED IN THE SOIL A MINIMUM OF 4 INCHES, AND PLACED SO THE BINDINGS ARE HORIZONTAL.
3. BALES SHALL BE SECURELY ANCHORED IN PLACE BY EITHER TWO STAKES OR OR REBARS DRIVEN THROUGH THE BALE. THE FIRST STAKE SHALL BE DRIVEN TOWARD THE PREVIOUSLY LAID BALE AT AN ANGLE TO FORCE THE BALES TOGETHER. STAKES SHALL BE DRIVEN FLUSH WITH THE BALE.
4. INSPECTION SHALL BE FREQUENT AND REPAIR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
5. BALES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFULNESS SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

EROSION AND SEDIMENTATION
CONTROL NOTES 2

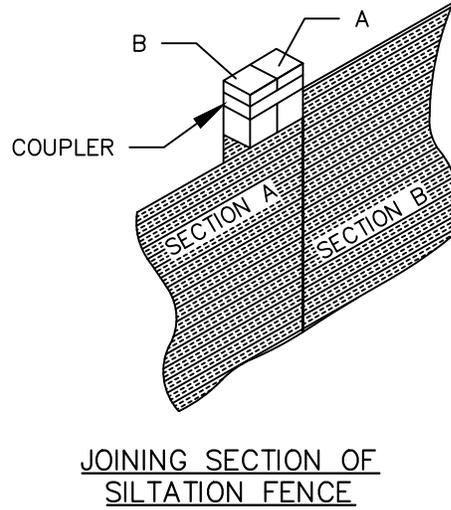
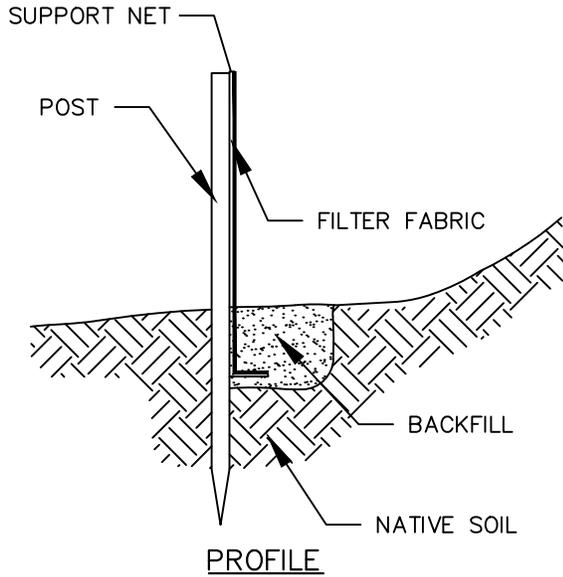
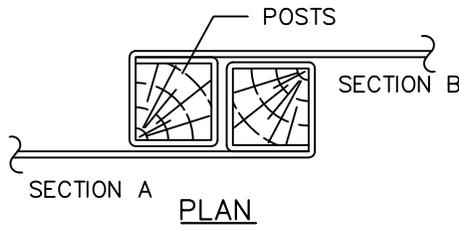
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PLAN NO.
EC-2



CONSTRUCTION NOTES

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POST WITH WIRE TIES OR STAPLES.
2. FILTER FABRIC TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION.
3. WHEN TWO SECTIONS OF FILTER FABRIC ADJOIN EACH OTHER, THEY SHALL BE OVERLAPPED BY 6 INCHES AND FOLDED.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.
5. INSPECTION SHALL BE FREQUENT AND REPAIR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
6. FENCES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFULNESS SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

SILT FENCE
DETAIL

SCALE: N.T.S

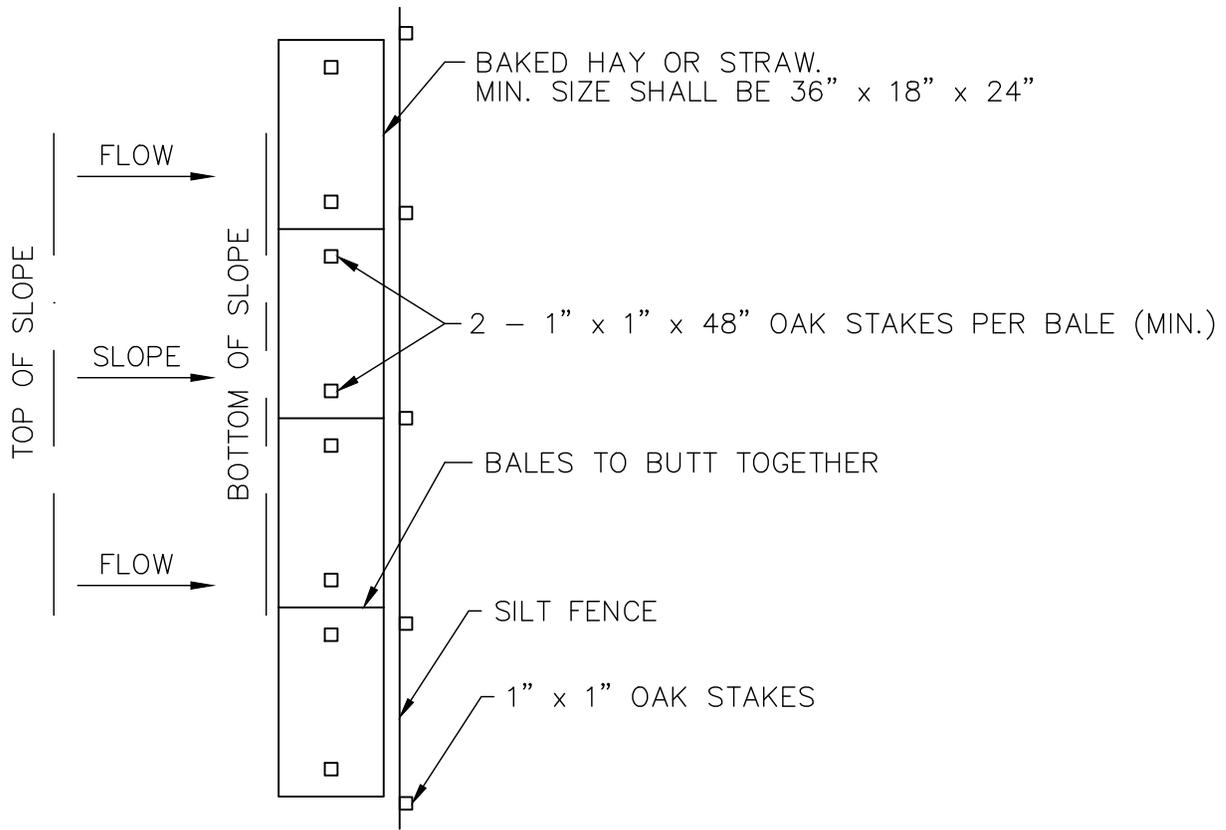
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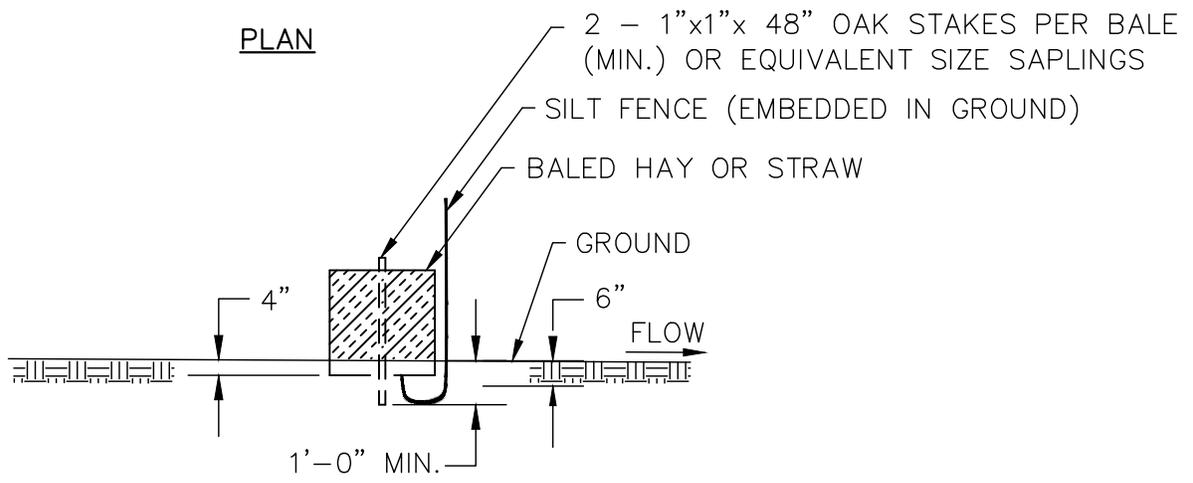
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PLAN NO.
EC-3





PLAN



SECTION

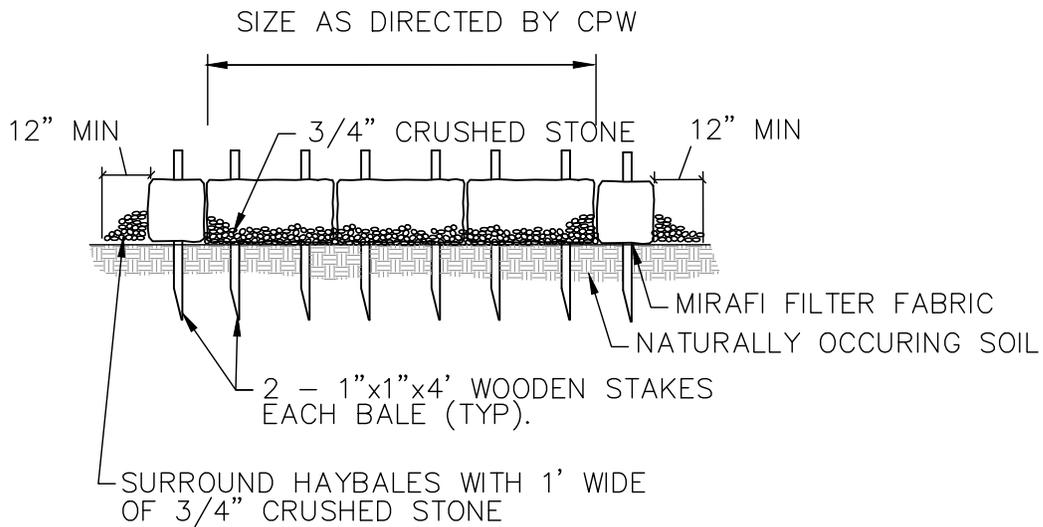
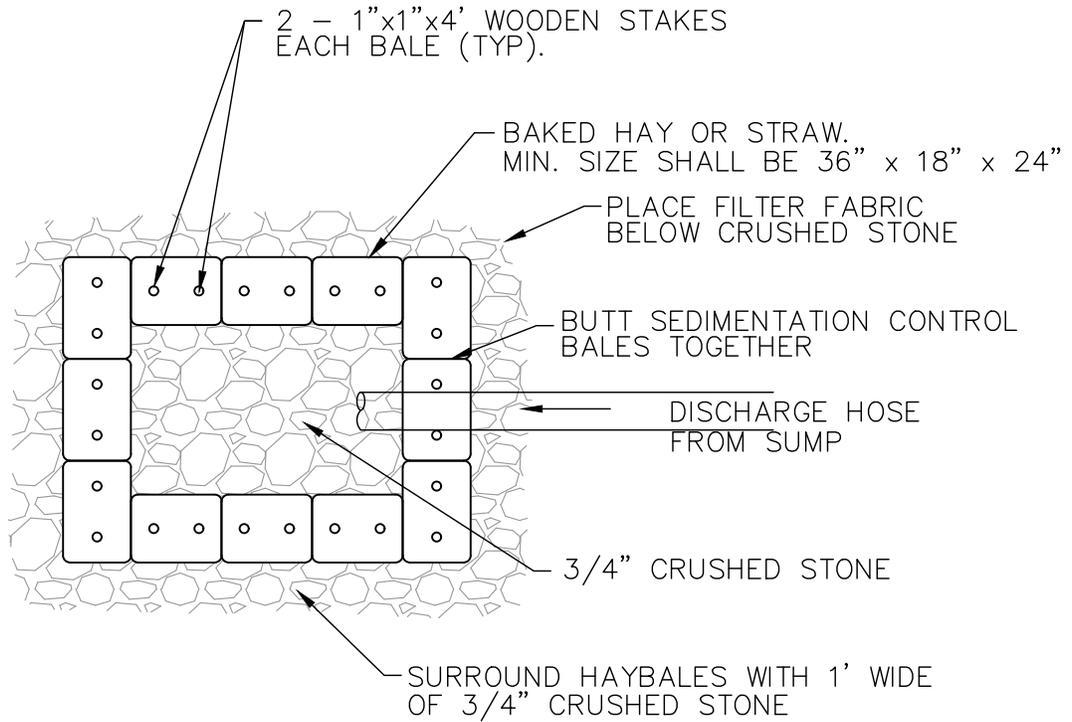
TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

HAYBALES AND SILT FENCE
 DETAIL

SCALE: N.T.S. DATE: 11-14-2019

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STANDARD_DETAILS	DRAWN BY: J.C.Z.	EC-4
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TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

ONSITE DEWATERING
BASIN DETAIL

SCALE: N.T.S

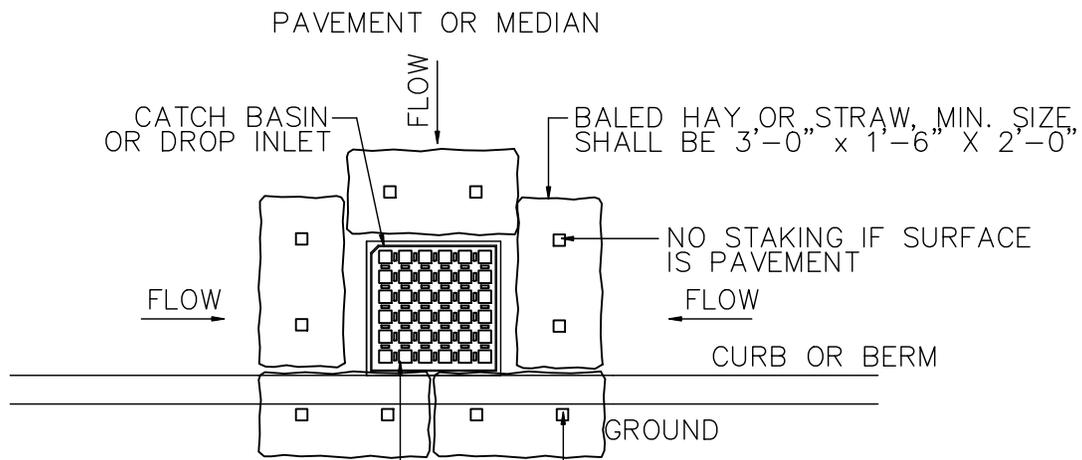
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PLAN NO.
EC-5

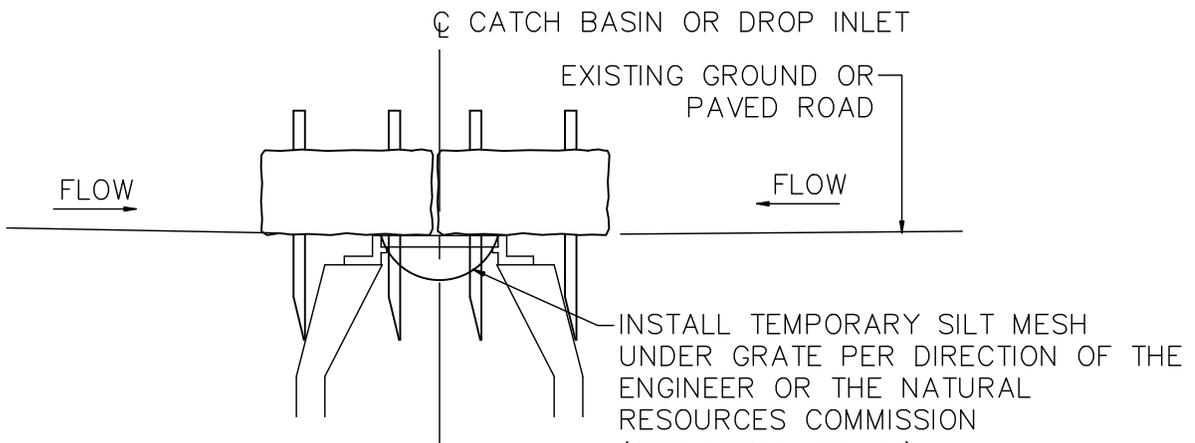




INSTALL TEMPORARY SILT MESH UNDER GRATE PER DIRECTION OF THE ENGINEER OR THE DEPARTMENT OF NATURAL RESOURCES

2" x 2" x 4'-0" OAK STAKE (2 PER BALE) OR EQUIVALENT SIZE SAPLINGS (TYP.)

PLAN



SECTION

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

DRAINAGE INLET PROTECTION
DETAIL

SCALE: N.T.S

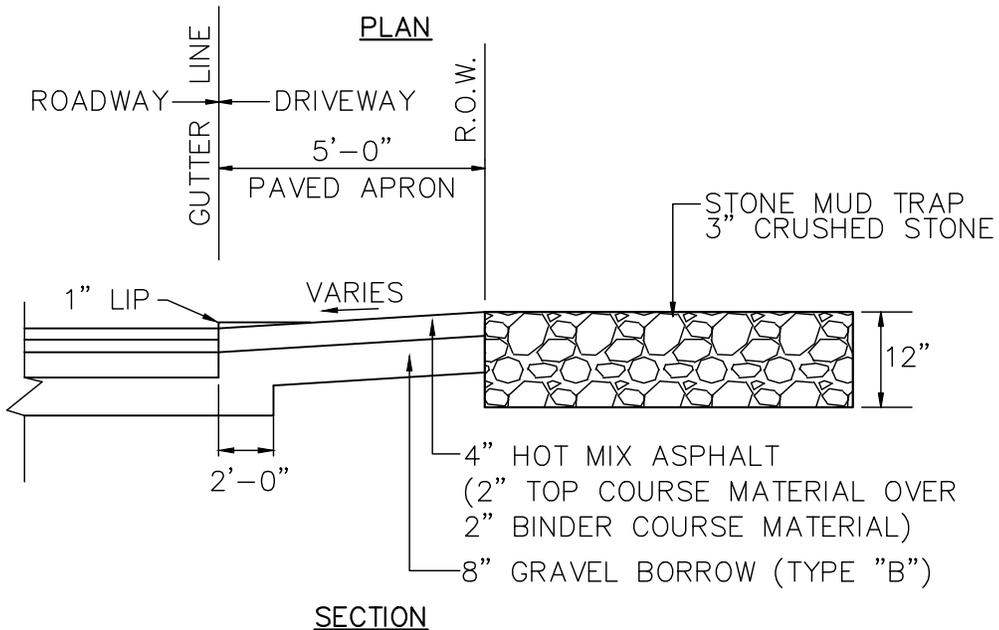
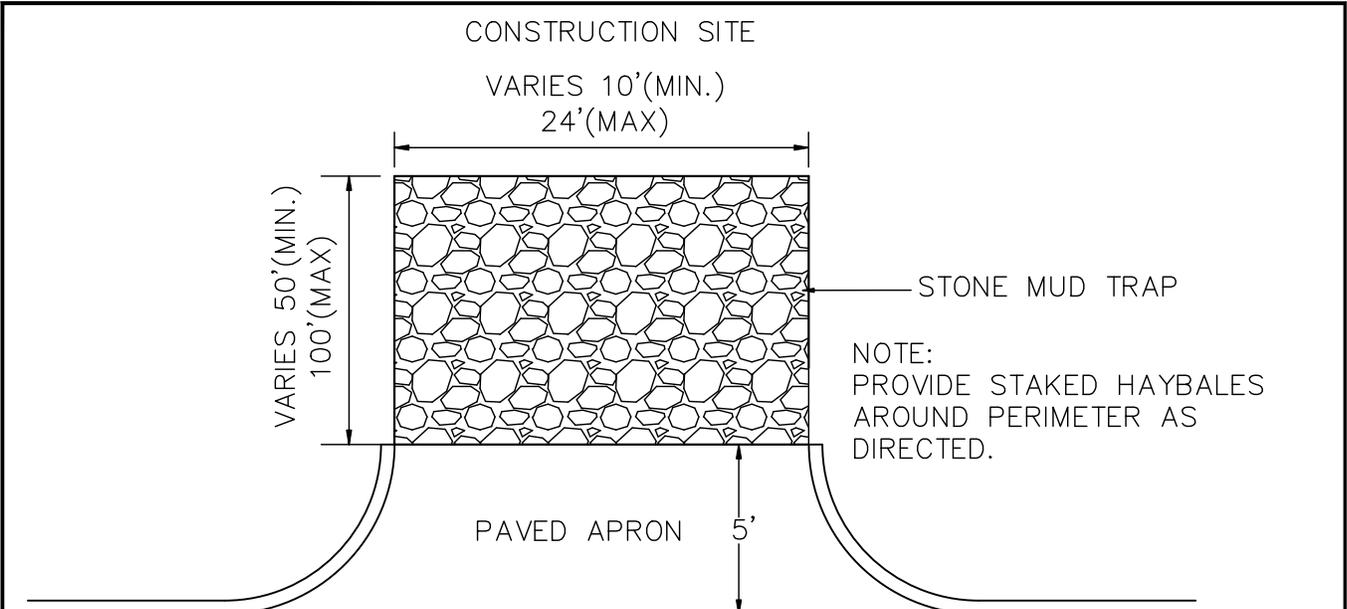
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PLAN NO.
EC-6





NOTE:
STONE MUD TRAP SHALL BE REMOVED AND
REPLACED WHEN FILLED WITH SEDIMENT OR
AS REQUIRED BY THE TOWN ENGINEER OR
HIS DESIGNEE.

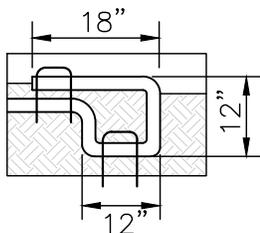
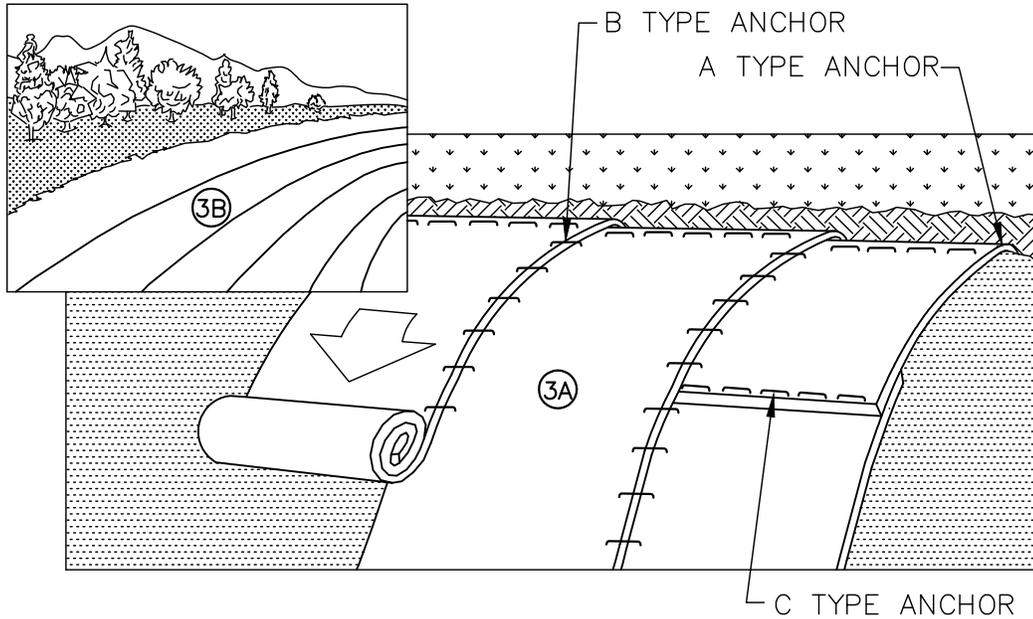
TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

TEMPORARY CONSTRUCTION
ENTRANCE DETAIL

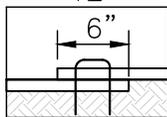
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STANDARD_DETAILS	DRAWN BY: J.C.Z.	EC-7
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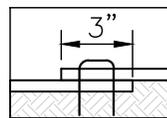




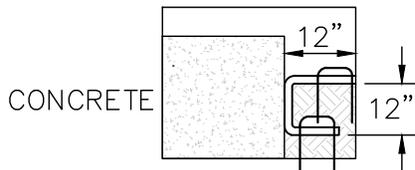
A TYPE ANCHOR
(TOP OF SLOPE/CREST, TERMINATION OF TRM)



B TYPE ANCHOR
(LENGTH OF OVERLAP)



C TYPE ANCHOR
(WIDTH OF OVERLAP)



D TYPE ANCHOR
(CONCRETE/MASONRY INTERFACE)

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

EROSION CONTROL MATTING
DETAIL

SCALE: N.T.S

DATE: 11-14-2019

JOB NO. \FILE NAME:
STANDARD_DETAILS

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PLAN NO.
EC-8



EROSION CONTROL MATTING INSTALLATION NOTES

1. INSTALL TURF REINFORCEMENT MAT (TRM) IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS. MANUFACTURERS REPRESENTATIVE SHALL INSPECT THE SITE PREPARATION PRIOR TO INSTALLATION OF THE TURF REINFORCEMENT MAT AND PROVIDE ON SITE SUPERVISION FOR THE INSTALLATION. UPON COMPLETION, THE REPRESENTATIVE SHALL PROVIDE WRITTEN CERTIFICATION AS TO THE ACCEPTABILITY OF THE INSTALLATION.
 2. PREPARE SOIL BEFORE INSTALLING TRM, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER AND SEED. NOTE: WHEN USING CELL DO NOT SEED PREPARED AREA. CELL-0-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
 3. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE TRM IN A 6"dx6"w TRENCH WITH APPROXIMATELY 12" OF TRM EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE TRM WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF TRM BACK OVER SEED AND COMPACTED SOIL. SECURE TRM OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE TRM
 4. ROLL THE TRM (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. TRM WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL TRM MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
 5. THE EDGES OF PARALLEL TRM MUST BE STAPLED WITH APPROXIMATELY 2"-5" OVERLAP DEPENDING ON TRM TYPE.
 6. CONSECUTIVE TRM SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 6" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART ACROSS ENTIRE TRM WIDTH.
- NOTE: IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY SECURE THE TRM.
7. WHERE THE BLANKETS RUN PARALLEL TO CONCRETE OR STONE MASONRY WALL, PLACE AND SECURE BLANKET WITH D-TYPE ANCHOR.



TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

EROSION CONTROL MATTING
INSTALLATION NOTES

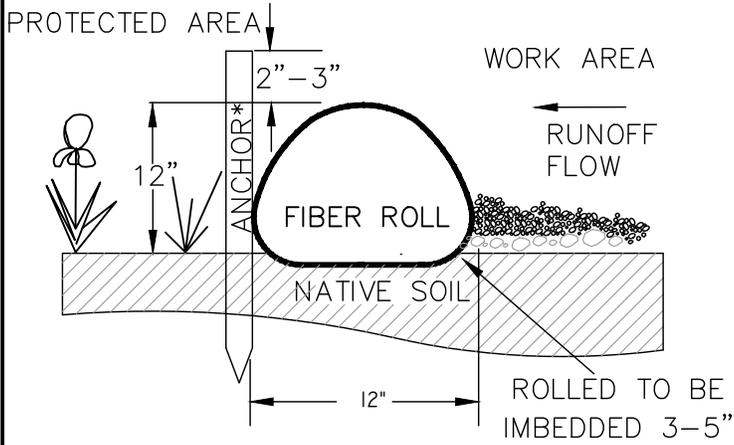
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STANDARD_DETAILS

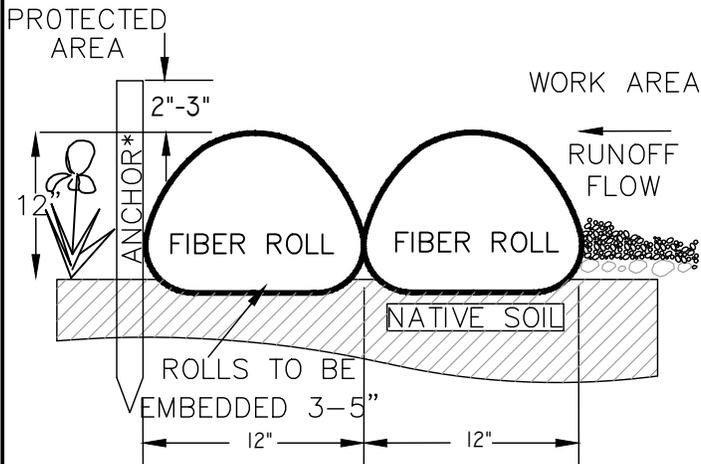
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PLAN NO.
EC-9



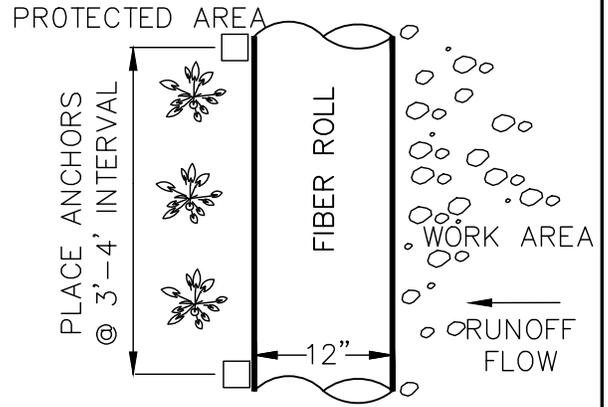
FIBER ROLL
SECTION VIEW

* ANCHOR STAKES TO BE 1"x1"x24"
WOOD, AND DRIVEN TO 2"-3"
THE TOP OF THE FIBER ROLL

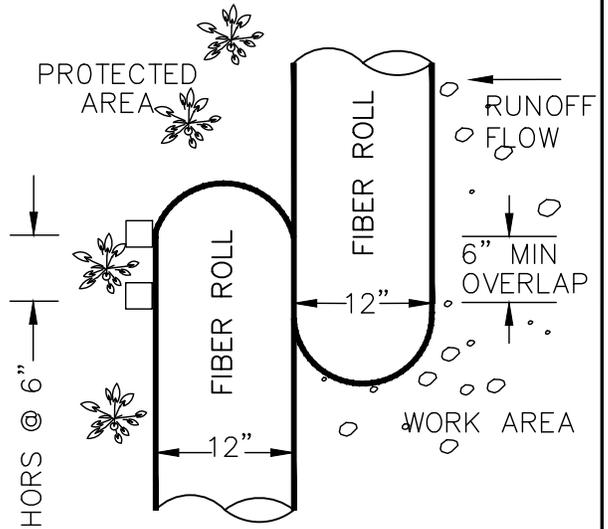


FIBER ROLL
OVERLAP END VIEW

* ANCHOR STAKES TO BE 1"x1"x24"
WOOD, AND DRIVEN TO 2"-3"
THE TOP OF THE FIBER ROLL



FIBER ROLL
TOP VIEW



FIBER ROLL
OVERLAP TOP VIEW

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

EROSION CONTROL FIBER ROLL
DETAIL

SCALE: N.T.S

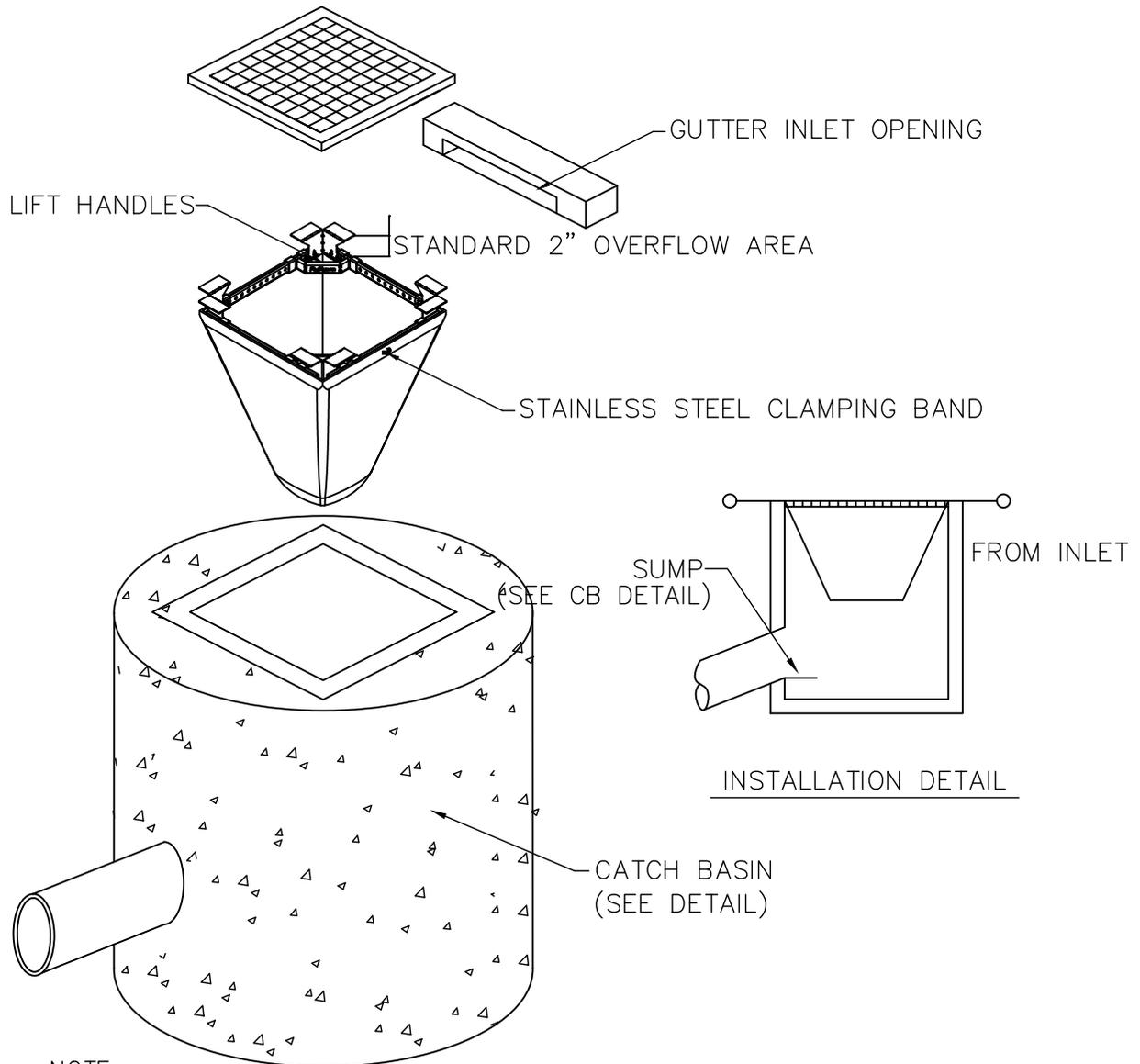
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STANDARD_DETAILS

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PLAN NO.
EC-10





NOTE:

1. SILTSACKS SHALL BE FLEXSTORM CATCH-IT OR APPROVED EQUAL
2. SILTSACKS SHALL BE INSTALLED IN ALL CATCH BASIN UNTIL DRAINAGE AREA HAS BEEN FULLY STABILIZED.

EROSION CONTROL SILT SACK

N.T.S.

TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

EROSION CONTROL SILT SACK
DETAIL

SCALE: N.T.S

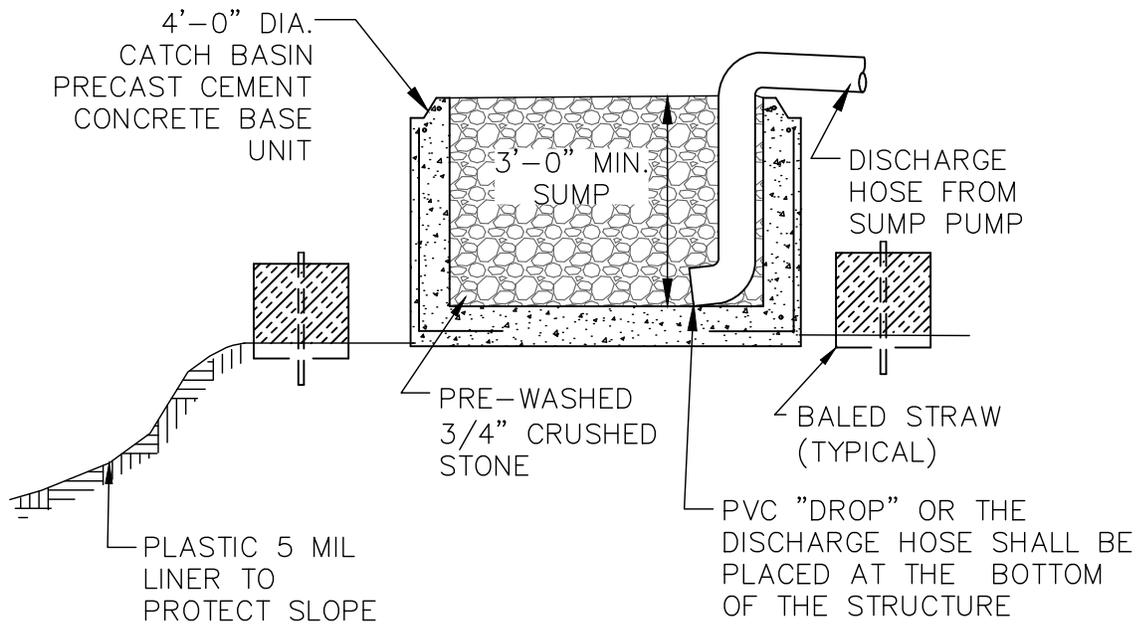
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PLAN NO.
EC-11





TOWN OF TYNGSBOROUGH
DESIGN AND CONSTRUCTION
STANDARDS

DEWATERING SUMP
DETAIL

SCALE: N.T.S

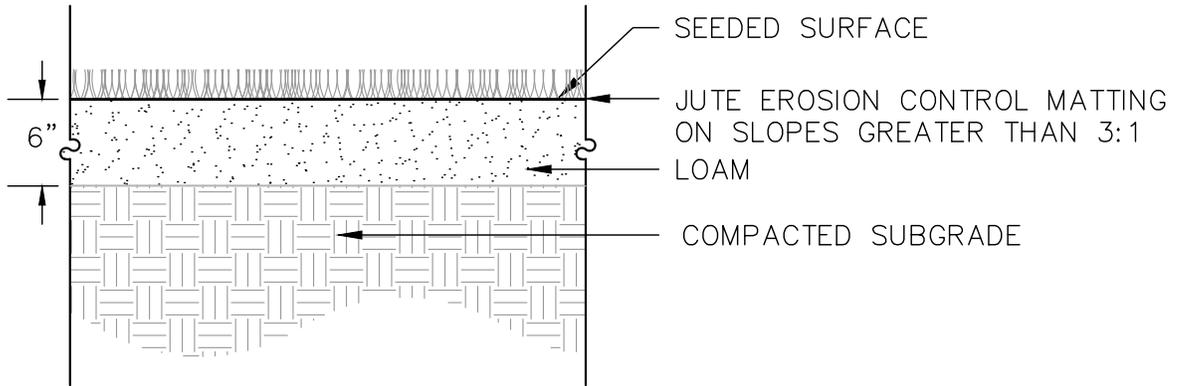
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PLAN NO.
EC-12





TOWN OF TYNGSBOROUGH
 DESIGN AND CONSTRUCTION
 STANDARDS

LOAM AND SEED
 DETAIL

SCALE: N.T.S

DATE: 11-14-2019

JOB NO. \ FILE NAME:
 STANDARD_DETAILS

DESIGNED BY: J.C.Z.
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 CHECKED BY: J.C.Z.

PLAN NO.
 EC-13



APPENDIX 1

TECHNICAL INFEASIBILITY DETERMINATION PROCESS AND POLICY

General

- A. In accordance with federal (ADA), state (28 CFR 35.151 & 2004 ADAAG) and the aforementioned Standards, each facility or portion thereof within the Town's right of way, for the use of a public entity that is constructed or altered shall be designed and constructed in such manner that the facility or portion thereof is readily accessible to and usable by individuals with disabilities.
- B. It is recognized that there are times when full compliance with federal and state laws and the Standards cannot be achieved due to structural impracticality, technical infeasibility, or would result in excessive and unreasonable costs without any substantial benefit to individuals with disabilities, collectively referred to as "needing a variance".
- C. State and federal regulations, while often the same, are not always identical. To simplify the process, the Commonwealth of Massachusetts-Department of Public Safety- Architectural Access Board Application for Variance- Curb Cuts/sidewalks, herein referred to as the "Variance Application" as modified in the attached copy to recognize PROWAG regulations is the basic application form for all variance requests in the right of way. For access to the application please visit: <http://www.mass.gov/eopss/consumer-prot-and-bus-lic/license-type/aab/variance-forms.htm>

Purpose

- A. To ensure that all pedestrian facilities within the town's right-of-way are designed, altered, and/or constructed, for the use of public entities, in accordance with the ADA, ADAAG, PROWAG, MAAB, and the Standards and to ensure that the construction and design is compliant to the maximum extent practicable as determined by the Town Engineer and Massachusetts Architectural Access Board (MAAB).
- B. To document TED's "in-house" procedure and policy to procure a variance from the regulations and standards as outlined below.
- C. To provide guidance to private developers or contractors working within the right of way of the town's procedure to permit a variance from federal and state regulations as well as these Standards.

Variance Process for "In-house" Design/Construction Projects

- A. All variance requests shall be made as soon as a non-compliant condition is recognized, preferably during the design phase. Sometimes the condition may not become apparent until construction is underway. Regardless of the project stage at which the non-compliant condition becomes apparent, it is the town's responsibility to prepare the Variance Application required to request approval from the MAAB.
- B. The Variance Application and the supporting documentation shall be submitted in both paper hard copy and compact disc (CD) format. The supporting documentation shall include plans (11x17 format), photographs, written estimate of the cost of work required to achieve full

compliance, and a narrative addressing the deficiencies or other areas of non-compliance that provides an explanation for supporting the proposed design.

- C. Variances shall be approved prior to work commencing. In situations where a non-compliant condition is recognized during the construction stage, variances shall be approved prior to completion of a non-compliant facility or portion thereof.
- D. As-built conditions and final inspections will be documented and the information shall be retained by Tyngsborough Engineering Department ensuring that construction was completed in compliance with approved plans.

Variance Process for Private Design/Construction Projects

- A. The process for variance requests shall be made as soon as a non-compliant condition is recognized, preferably in the design phase to avoid costly delays. Sometimes the condition may not become apparent until construction is underway. Regardless of the project stage at which the non-compliant condition becomes apparent, it is the project proponent's responsibility to prepare the Variance Application.
- B. The project proponent shall submit a pre-application sketch plan to the TED. The sketch plan shall require a technical review and comply, at a minimum, with the applicable sections of 1.2.1 of the Standards. The proponent is responsible to submit the plan with satisfactory detail which provides sufficient documentation that a determination of technical infeasibility can be adequately established by the town. Often, this will include greater detail than the minimum thresholds outlined in the aforementioned section.
- C. The project proponent shall submit a pre-application narrative to the TED. The narrative shall clearly outline the deficiencies or deviations from any ADA, ADAAG, PROWAG, MAAB regulations or the Standards and provide an explanation for supporting the proposed design variance based on impracticality, technical infeasibility, or would result in excessive and unreasonable costs.
- D. The project proponent shall submit a pre-application cost comparison to TED. The evaluation shall compare the cost estimate to construct the facility to full compliance with the cost estimate of the proposed design. The estimate shall be itemized utilizing estimated quantities and a unit cost.
- E. The project proponent shall allow a minimum of a two-week review period by the TED. The pre-application plan and narrative will be reviewed for completeness and a written (email, letter, etc.) correspondence will be provided with one of three determinations:
 - 1. Negative Determination – The project proponent will redesign the subject facility that complies with federal and state regulations as well as the Standards.
 - 2. Resubmittal Required – The project proponent will provide a re-submittal of the information with revisions as requested by the TED.
 - 3. Positive Determination – The project proponent will file the Variance Application as outlined in the procedure below.

Variance Application Procedure

- A. The Variance Application, filing fee (check/money order made payable to the “Commonwealth of Massachusetts”, and the supporting documentation shall be submitted in both paper hard copy and compact disc (CD) format. The supporting documentation shall include plans (11x17 format), photographs, written estimate of the cost of work required to achieve full compliance, and a narrative addressing the deficiencies or other areas of non-compliance that provides an explanation for supporting the proposed design.
- B. The application, both hard copy and CD, shall be submitted to the following:
 - 1. Commonwealth of Massachusetts-Department of Public Safety, Architectural Access Board
 - 2. Town Engineer
 - 3. Building Commissioner
 - 4. Town Administration Office
 - 5. Boston Center for Independent Living
- C. The project proponent shall then submit a copy of the MAAB’s decision and shall be submitted to the Town’s approving authority for the project.
- D. Work may commence only when the conditional permit is issued by the approving department.