



Town of Nantucket Sewer Standards and Specifications

June 2020

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List of Revisions

Date Issued	Revision
June 2020	Original Issuance

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Executive Summary

The purpose of these Sanitary Sewer Specifications is to set forth the criteria to be used in the design and construction of sanitary sewer mains (i.e. gravity sewer pipes and force mains) and pump stations. All public and private sewer collection system capital improvement or expansion projects shall submit site-specific design packages as required herein, to the Town of Nantucket for approval and acceptance. These specifications shall also service as the basis for the Nantucket Planning Board or their authorized representative.

The approval and construction process requires coordination with different entities of the Town of Nantucket. Below defines the various nomenclature used in this document for such entities:

Town: The Government of the Town of Nantucket

Director: The Sewer Department Sewer Director

Public Works Director: The (Department) of Public Work Director

Engineer: Agent of the Sewer Department (including Engineer of Record, or Inspector)

This document cites references to industry standard specifications (e.g. America Society for Testing and Materials {ASTM}, American Association of State Highway Transportation Officials {AASHTO}, etc.) and the Massachusetts Department of Transportation Standard Specifications for Highways and Bridges

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1.00 General Provisions

1.01 Scope

- A. Unless otherwise indicated, all standards apply to both the public and private sewer systems. Described in these sections are the general design standards that are to be followed by all parties in preparing subdivision, utility extension, and utility replacement plans for the Town of Nantucket. These design standards will ensure that the citizens of Nantucket will continue to have a quality sewer collection system.
- B. Sewage collection systems shall be designed separately from stormwater systems. Sewage collection systems shall not allow for the introduction of: rain water (i.e. catch basins, area drains, driveway drains, flat roof drain, downspouts, etc.); noncontract cooling water; groundwater (i.e. foundation drains, sump pumps); or any other source of inflow or infiltration.

1.02 Easements

- A. All public sanitary sewer mains shall be installed within dedicated street rights-of-way and/or Town of Nantucket dedicated sanitary sewer easements.
 - 1. When sanitary sewer mains are installed in a street Rights-of-Way, they shall be located in the center of the pavement or Right-of-Way, where practical.
 - 2. Sanitary sewer mains shall be centered in the easement.
- B. Under special conditions, temporary construction easements may be required upon approval of the Sewer Department.
- C. The minimum Right-of-Way/easement width for a sanitary sewer main is 20 feet, measuring 10-feet each side of the manhole or pipe centerline. Such easements are to be recorded as "Town of Nantucket Utility Easement".
 - 1. Larger size easements may be required based upon the depth of installation or other consideration as determined by the Sewer Department and the Engineers.
- D. The Developer shall acquire all off-site easements that are dedicated to the Town of Nantucket. These off-site easements shall be recorded by map and by deed of easement prior to construction approval. Plan and elevation drawings of all access roads shall be shown on the plans prior to approval.
 - 1. The off-site easements shall have functional access to public Right-of-Way and all sewer easement boundaries must be field staked and flagged by the Developer's surveyor and at the Developer's expense.

1.03 Submittal of Plans

- A. General: The provisions stipulated in this section are general in nature and shall be considered as applicable to all parts of these specifications including any supplements and revisions. All pump stations, sewer mains and appurtenances shall be designed by a Registered Professional Engineer, experienced in the design of such facilities and duly licensed to practice in the State of Massachusetts and all plans shall bear the original seal of a Registered Professional Engineer.
- B. Plan approval:
 - 1. Plan and Profile Drawings shall be prepared, signed, sealed, and dated by a Professional Engineer registered in the State of Massachusetts. Design of improvements must be based upon actual field verification by the Engineer of existing utilities. The Drawings shall be submitted in an electronic format (e.g. pdf). Sheets shall: be 22-inch by 34-in full-sized (11-inch by 17-inch half-sized); show the various elements of the utility mains; and include:
 - a. An Overall Utility Plan Layout on a single sheet with scale no smaller than 1 inch = 200 feet.
 - b. The Utility Drawings shall be on separate sheets, free of landscaping and other details not pertinent to the utility design. The water and sewer drawings may be on the same sheets.
 - c. A separate Landscaping Plan must also be submitted showing any proposed landscaping in relation to all proposed water or sewer utilities or easements. All adjacent tracts and topographic information must be shown on the Landscaping Plan.
 - d. A paper submittal of the Plan Set for projects with Construction Estimates exceeding \$1,000,000.
 - 2. Effective Date: Should circumstances warrant changes to the approved plans or specifications, the proposed revision must be submitted, and approval must be obtained from the Director, the Nantucket Planning Board or their Designee. Copies will then be provided to the Contractor, Developer, and the Developer's Engineer. No Work shall proceed on that portion of the project being revised until said revisions are submitted, approved, and distributed. Minor deviations from the Plans or Specifications may be by written permission from the Director of the Nantucket Sewer Department or Director of the Wannacomet Water (or the respective representative on the job).
- C. Sealed Record Plans; Certified surveyed Record Plans and Profiles, sealed by a Professional Land Surveyor, shall be furnished to the Sewer Department by the Engineer upon completion and prior to acceptance of the public main by the Town of Nantucket and at completion of private systems. The surveyed Records Plans shall be supplied to the Sewer Department prior to the issuance of the letter of acceptance
 - 1. The surveyed Records Plans shall include accurate information regarding; pipe size; pipe material; pipe length; manhole size; invert and rim elevations; and accurate alignment and location of the constructed sewer mains, manholes, pump stations, clean-outs, and services (including service stubs); and all other information included on the original design plans. The

surveyed Record Plans shall have Massachusetts Geodetic Survey grid coordinates (NAD83) to all manholes and mains along with the depth information. The sewer permit number will also be provided on the plans.

2. Certified surveyed Record Plans for sewer shall be provided in a digital format for utilities. The digital file needs to show the overall sewer system layout along with the property or subdivision boundaries and connecting manhole. The sewer collection system should show the same elements listed in Paragraph 1.03.C.1. The digital file should be delivered in DXF format. If this is not possible, then DWG, DGN and SHP are also acceptable formats.
 3. Provide the Town with two sets of Record Plans at the completion of the project (one set to the Planning Board, and one set to the Director).
- D. General Acceptance: The Developer or the Developer's representative must notify the Sewer Department in writing, before installation and for scheduling inspection. Once the project is complete, a punch list and inspection are scheduled for deficient items. Once the deficient items are repaired and/or replaced to meet Town of Nantucket standards and specifications, the Developer/representative shall submit the following items to the Town of Nantucket Sewer Department:
1. A Professional Engineer's certified statement of the cost of the public utilities installed;
 2. A Professional Engineer's certified statement indicating that the Work has been built in accordance with the approved set of construction plans;
 3. A release of liens statement from the Owner/Developer stating that all materials and workmanship associated with the sewer main has been paid in full;
 4. Certified surveyed Record Plans and Profiles shall be furnished by the Engineer upon completion and acceptance by the Town of Nantucket as stated above;
 5. A statement from the Developer ensuring a one-year written warranty to the Town of Nantucket prior to issuance of the letter of acceptance;
 6. A recorded map to the Town of Nantucket showing all public rights-of-way and easements;
 7. The Engineer shall keep a copy of the Record Plans on file indefinitely.
- E. Final Acceptance: Prior to acceptance of the sewer system by the Town, a letter of credit from the owner will be required of 110% of the value until the one-year warranty period expires.

1.04 Protection of Existing Utilities and Property

- A. General: The Contractor shall notify Dig Safe at 1-888-DIG-SAFE and all utility companies and interested parties prior to commencement of Work to ensure that there will not be interruptions of services during construction. The Contractor shall be liable, for all damages to existing structures, public or private, and shall hold the Town harmless from any liability or expense for injuries, damages, or repairs to such facilities.

- B. Responsibility for repair: Should the utility be damaged in the construction operations, the Contractor shall immediately notify the owner of such utility, and unless authorized by the owner of the utility, the Contractor shall not attempt to make repairs.
- C. Property Protection: Trees, fences, poles and all other property shall be protected unless their removal is authorized. Any property not authorized for removal, but damaged by the Contractor, shall be restored by the Contractor to the owner's satisfaction. Existing manholes within the work zone and outside of the pavement shall be protected by orange safety fence. At no time is Work, storage of material or construction access to occur on private property unless the Work is within a recorded easement or with prior written authorization.

1.05 Protection of Water Supply

- A. There shall be no physical connections between a Building Sewer and the Water Supply System or appurtenances thereto which would permit the passage of any polluted water into the water supply system.
- B. Sewers shall be separated at least 10 feet horizontally and 2 feet vertically from any existing or proposed water line. The distance shall be measured exterior wall-to-exterior wall. In cases where it is not practical or allowable to maintain this horizontal and vertical separation, the Town may consider the installation of the sewer closer to the water line, provided that:
 - 1. The water line is in a separate trench, or on an undisturbed earth shelf located to one side of the sewer.
 - 2. The elevation of the bottom of the water line shall be at least 18 inches above the top of the sewer line.
 - a. In the event the water pipe must cross below the sewer, the bottom of the sewer line shall be at least 24 inches above the top of the water line. The sewer pipe shall be encased in a sleeve extending 10 feet in both directions of the crossing. Adequate structural support shall be provided for the sewer to prevent damage to the water line.
 - 3. Both the water and sewer pipe must be ductile iron for a length of ten feet in both directions of the crossing.
 - 4. It is the Contractor's responsibility to upgrade both lines to ductile iron regardless of whether either the water or sewer line previously exists for the entire length of the separation discrepancy.
 - 5. All crossings within these vertical clearances shall be filled with Class I material (crushed stone).
- C. Building sewer services crossing water mains shall be separated at least 18 inches vertically from the existing or proposed water line. The distance measured shall be from outside diameter to outside diameter. This shall be the case where the water main is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible

from the water line joints. Where a water line crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water line.

1. When it is impossible to obtain proper horizontal and vertical separation, the Contractor shall completely encase any joints in the sewer pipe which falls within 10 feet horizontally from the centerline of the water main or service with three inches of 3,000 PSI concrete using a form (not free flow). This encasement must be inspected by the Engineer prior to backfill. Based on existing or anticipated field conditions, the Nantucket Sewer Department or Wannacomet Water Company may require additional concrete encasement.

D. The Director must approve any variances in these clearances.

1.06 Site Preparation, Erosion Prevention, and Sediment Control

A. Clearing the Right of Way: Where clearing of the Right of Way is necessary, it shall be completed prior to the start of the trenching. Trees and brush shall be cut as near to the surface of the ground as practicable and piled for disposal. Contractor shall remove all organic material, grub stumps and strip loam & subsoil to granular mineral material. The Contractor shall observe all State laws relating to fire permits and local regulations relating to burning such materials. Under no conditions shall excavated materials be permitted to cover brush or trees prior to clearing and disposal in accordance with MassDOT Section 101.

B. Erosion control measures shall be performed by the Contractor, conforming to the requirements of, and in accordance with plans approved by the State of Massachusetts Department of Environmental Protection: the Conservation Commission, Town of Nantucket; and as per the Erosion Control Plan portion of the construction drawings and these specifications. The Contractor shall not allow mud and debris to accumulate in the streets. The Sedimentation and Erosion Control Plan and permit shall remain on site at all times. Should the Contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to the entry into any storm drain or stream. All materials used for erosion control shall be approved by the Engineer prior to installation by the Contractor.

C. Temporary and permanent erosion control measures shall be shown on the plans. Temporary and permanent erosion control Work shall be coordinated throughout the project to provide effective and continuous erosion control throughout construction and post construction, which minimizes siltation of streams, lakes, reservoirs, other water impoundments, ground surface, or other property. Seeding and mulching shall be carried out immediately behind construction.

D. Temporary erosion control measures shall include but not be limited to swaled easements, silt fences, crushed stone check dam devices, silt basins (sedimentation traps), mulching, earth berms, and rip-rap.

E. Permanent erosion control measures shall include but not be limited to swaled easements, rip-rap, and seeding of disturbed areas.

F. Erosion and siltation shall be controlled on projects by using: swales to control run-off and convey run-off to controlled discharge points; silt fences, rip-rap, crushed stone, and earth berms

to contain silt; pipe culverts where major access or haul roads cross drainage ditches or streams; silt basins where pipe lines cross drainage ditches or streams; and seeding and mulching that shall be performed as soon after pipe installation as possible. When temporary measures are removed after completion of the project, the disturbed area must be stabilized, as required by the approved Erosion Control and Sedimentation Plan.

- G. All temporary erosion control measures must be removed and disposed of by the Contractor within the one-year anniversary date of the completion of the project, but after the establishment of ground cover. Failure of the Developer/Owner/Contractor to remove these devices may result in the Town removing the devices and assessing the Developer/Owner.

1.07 Water Resource Protection

- A. Well Areas Zone II: Any sewers within 1,000 feet of a Public Water Supply or 50 feet of a domestic well, shall be of watertight construction. At a minimum, schedule 40 PVC pipe with solvent weld joints shall be used.
 - 1. For all parts of new sewer connections within a designated Zone II area, only hard connections will be allowed (see Section 3.3.D). No flexible rubber connections shall be permissible, unless approved by the Wannacomet Water Company Director and the Nantucket Sewer Department Director.
- B. Location of Sewers in Streams: Sewers shall be designed to minimize the number of stream crossings.
 - 1. Cover Depth: The top of all sewers entering or crossing a stream shall be sufficiently below the natural bottom of the stream bed to protect the sewer line. The following cover requirements shall be met:
 - a. One (1) foot of cover where the sewer is located in rock.
 - b. Three (3) feet of cover in other material. In major streams, more than 3 feet of cover shall be required.
 - c. In paved stream channels, the top of the sewer line shall be at least 1 foot below the channel pavement.
 - 2. Horizontal Location: Sewers located along streams shall be located sufficiently outside of the stream bed to allow for stream widening in the future and for the prevention of siltation during construction.
 - 3. Structures.: Locate sewer manholes or other structures outside of streams whenever possible. Where structures must be located in a stream, the manholes shall not interfere with the free discharge of flood flows or navigation in the stream. The manholes' covers shall be no lower than 1 above the 100-year flood elevation level.
 - 4. Alignment: Sewers shall cross streams perpendicular to the flow without a change in grade.

5. **Materials:** Sewers entering or crossing streams shall be watertight and free from changes in alignment or grade. Joints shall be restrained to prevent movement from stream forces. Ball-and-socket or restrained joints designed for hard service applications shall be provided. Backfill materials shall be stone, coarse aggregate, washed gravel, or other materials that will not readily erode, cause siltation, damage pipe during backfill, or corrode the pipe.
- C. **Wetland/Stream Buffers:** Conditions of MassDEP permits shall be strictly followed to the satisfaction of Nantucket Conservation Commission.

1.08 Contractor Responsibilities

- A. **Encroachment Contracts and Permits**
1. Prior to actual construction, the Contractor/Engineer shall acquire the necessary encroachments from MassDOT when working within the rights-of-way of State system roads or highways. A copy of the Permit to Access State Highways shall be kept on the job site at all times.
 2. The Contractor/Engineer shall be responsible for securing all other local and State and Federal permits required for the utility construction. The Contractor must have an approved set of permitted construction plans on site at all times.
- B. **Construction Water:** Contractors are responsible for adequate construction water for their job sites. The Town of Nantucket Sewer Department does not provide free or otherwise unmetered construction water for any construction project. Contractors are responsible for requesting a hydrant meter from Wannacomet Water Company (deposit required). Hydrant meters may only be moved with the express written permission of the Wannacomet Water Company. **Note: Individuals using water unmetered and/or unauthorized by the Wannacomet Water Company will be prosecuted to the fullest extent of the law.**
- C. **Cleaning Sewer Lines:** At the conclusion of the Work, the Licensed Utility Installer (L.U.I.) shall thoroughly clean all pipelines by washing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline by installing a screening device that will prevent any debris from entering the public sewer system or a section of the sewer works already approved. If after this cleaning, obstructions remain, they shall be removed using an alternate means. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Town Inspector will examine the pipes for leaks. If any defective pipes or joints are discovered, they shall be repaired or replaced as directed by the Town Inspector.
- D. **Manhole Cleaning:** All new manholes shall be thoroughly cleaned of all silt, debris, and foreign matter of any kind, prior to final inspection.
- E. **Guarantee:** The Contractor shall guarantee all material, equipment, and workmanship for a period of at least one year after Final Acceptance by the Town of Nantucket. The Sewer

Department is responsible for the issuance of final acceptance letters of sewer utilities by the Town of Nantucket.

F. Sewer Main and Service Abandonment:

1. Abandonment Investigation: Prior to abandoning existing sewer mains, manholes, or services, verify the absence of any live services/pipe by temporarily plugging the downstream end for a period of 7 days. If wastewater has accumulated, determine source(s) by means of internal television inspection, smoke testing, or dye testing and reconnect to the new collection system.
2. Sewer Main: For pipes 6 inches or 8 inches in diameter, cap the upstream end, the downstream end, and any points of discontinued pipe in that segment, with a masonry plug. For pipes 10 inches in diameter and larger, cap the downstream end and fill the pipe with Controlled Density Fill (CDF) (see Section 2.00). Pump CDF into pipe at the upstream manhole (or at discontinued sections of pipe and progress upgradient), Completely fill the pipe length. Estimate the quantity of CFD required to fill the segment and investigate when less than 80% of the estimated quantity fills the pipe, or if it requires more than 110% of the estimated quantity to complete the abandonment. Correct any remaining voids in the pipe, or CFD exfiltration outside of the abandoned pipe.
3. Manholes/Vaults: Remove the casting, chimney, top/cone, and barrel down to a minimum of 5 feet below grade. Verify remaining penetrations have been capped/plugged. Fill the interior of the remaining portion of the structure with CDF (see Section 2.00). Alternatively drill (4) 2-inch holes in the bottom of the structure and fill with Select Sand (see Section 2.03). Backfill the trench above the abandoned structure base in accordance with Section 2.00 herein. Deliver the existing casting to the Nantucket Sewer Department.
4. Sewer Services: Existing building lateral pipes to be abandoned shall be removed from the main, to the Right-of Way line, and shall be disposed of properly. For services connected to factory stubs, carefully separate the lateral pipe and cap the end of the factory stub. For services connected via saddles, remove the existing saddle and replace with a 360-degree stainless steel repair sleeve.
5. Abandonment must be performed in accordance with a plan approved by the Sewer Department
6. Service and main abandonment require inspection by the Sewer Department at (508) 228-7200 X7801.

2.00 Trenching

2.01 Excavation and Preparation

- A. Scope: This section covers excavation, trenching, and backfill for the structures, pipelines and appurtenances.
- B. General: Except where shown otherwise on approved drawings, and except when the Director or Public Works Director gives written permission to do otherwise, all trench excavations shall be made by open cut to the depth required to construct the pipeline as shown on the drawings.
 - 1. Where depth of ditch and other conditions will allow, tunneling, boring or jacking may be required under sidewalks, curb and gutter, or other structures. Written permission from the Public Works Director must be obtained prior to any tunneling or jacking. In no case will tunneling be permitted for distances greater than 10 feet. When jacking is permitted, only persons experienced in that Work, using suitable equipment, shall perform the jacking operation.
 - 2. The length of trench permitted to be open at any one time may be limited when, in the opinion of the Town, such limitation is necessary for the safety and convenience of the public.
 - 3. Topsoil shall be removed and piled separately for use in finish grading the grounds.
 - 4. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks to avoid overloading and to prevent slides or cave-ins.
 - 5. All excavated materials not suitable for backfill shall be removed from the site at the Contractor's expense.
- C. Prior to any excavation or construction, the Contractor shall be responsible to contact DIGSAFE for the location of all existing utilities in the field. If help is needed in locating utilities operated by the Sewer Department, the Contractor should contact the Town of Nantucket Sewer Department (508) 228-7200 x 7801.
- D. Pavement Removal:
 - 1. All bituminous and concrete pavements, regardless of the thickness, shall be saw-cut prior to excavation of trenches. Width of the pavement cut shall be at least six (6) inches greater than the required width of the trench at ground surface on each side. The use of mechanical zipper, pulverizing or other types of milling equipment maybe used in place of saw cutting the full width of the excavations.
 - 2. Pavement removed during excavation shall be piled separately from the earth spoil and removed from the site and shall not be used in backfilling the trench.

E. Cobblestone Removal: Streets surfaced with cobblestones or pavers shall have the stones or pavers carefully removed and stored for later installation matching existing conditions.

F. Trench Width

1. In all cases, trench width shall be confined to dedicated Right-of-Way for public thoroughfares or within areas for which construction easements have been obtained, unless special arrangements have been made with the affected property owners beforehand and approved by the Nantucket Sewer Department.
2. Trenches shall be excavated to the width necessary to permit the pipe to be properly bedded, laid and jointed, and backfill materials placed as specified in this section. No trench shall have a width of less than the outside diameter of the pipe plus 12 inches. The maximum clear trench width measured one foot above the top of the pipe barrel shall not be greater than that shown in the following table unless otherwise specified.
3. In the event the above stated maximum trench widths are exceeded either through accident or otherwise and if the Director or Public Works Director determines that the design loadings of the pipe will be exceeded, the Contractor will be required to use pipe of a stronger class. The cost of such remedial measures shall be entirely at the Contractor's expense.

Table 2-1 Trench Width Table

Pipe Diameter (inches)	Maximum Trench (inches)	Pipe Diameter (inches)	Maximum Trench (inches)
8	28	30	56
10	30	33	60
12	33	36	68
15	36	42	75
18	40	48	82
21	44	54	89
24	48	60	96
27	52		

4. Shoring, Sheet piling, and Boxing of Trenches: Whenever necessary to prevent caving during excavation in gravel, sandy soil, or other unstable material, the trench shall be adequately sheeted and braced. Failure to comply with proper applicable OSHA standards with regards to sheeting, shoring, or bracing, shall be cause for a Notice of Violation. All sheeting, shoring, and bracing of trenches shall conform to those standard requirements.

5. Sidewall sloping: In the event that sidewalls of the trench are sloped to meet safety requirements, the sloping shall terminate at a depth not less than one foot above the top of the pipe barrel, and from that point down the trench width shall be limited to that shown in Table 2-1.

G. Excavated Materials

1. During trench excavation, the Contractor shall place the excavated material, so it will not obstruct a traveled roadway or street and, unless otherwise approved by the Public Works Director.
2. When the excavation is in firm earth, care shall be taken to avoid excavation below the established grade. All unauthorized excavation below that established depth made without the written authorization of the Director shall be refilled with approved material and compacted by and at the expense of the Contractor.
3. Where excavation is required under paved areas, including streets, bike paths, and sidewalks, the pavement shall be cut in such a manner as to resulting in a smooth, straight cut edge with a vertical face that is a minimum of 6 inches beyond the trench wall. The maximum width of pavement removed shall not exceed 10 feet, except as may be otherwise allowed for large pipe diameters. Replacement of subbase, base and pavement surface shall be by the Contractor and shall be equal to or better than the materials removed. All replacement materials and procedures shall be subject to the inspection and approval of the Nantucket Sewer Department.

H. Trench Depth: Excavate to a depth that permits placement of pipe at the invert elevation and sloped indicated on the Plans or established by the Design Engineer. Account for the thickness of the pipe material, and the manhole base as delivered on-site. Also account for the following bedding classifications:

1. Type A: The trench bottom is machine excavated slightly above bottom of the infrastructure to be installed (e.g. pipe, manhole). The graded trench bottom is cut by hand. Bell holes are dug, and the pipe bears uniformly along its entire length. Where the trench bottom is inadvertently cut below grade, it shall be filled to grade with an approved material and thoroughly.
2. Type B: The trench bottom is undercut to facilitate placing and compacting approved bedding material. The thickness of the infrastructure bedding shall be in accordance with Section 3.0, 4.0, 5.0 herein.

I. Unsuitable trench bottom: In case soft or otherwise unsuitable foundation material is encountered in the trench bottom, such soil shall be removed to a depth as directed by the Engineer. It shall be replaced with backfill material approved by the Engineer and compacted as specified in this section and in accordance with Trench Details appended herein, to provide a suitable foundation for the pipe.

J. Removal of Water: The Contractor shall provide and maintain ample means and devices with which to promptly remove and properly dispose of all water, including flow from existing sewer

lines, that is entering the trench. Keep all excavations free of water from the time the trench is being prepared for the pipe placement, during the placement, through the inspection, until finally the backfill above the pipe has been completed accordingly.

1. If the Contractor wishes to dewater into the Town's storm drainage system, the Nantucket Department of Public Works must approve any and all means for the transfer, treatment and disposal thereof before any discharge occurs. The Contractor shall dispose of the water and or sewage in accordance with State and local regulations. Precautions against sedimentation control must be maintained at all times.
 2. In trenches where water is present or dewatering is required, the trench shall be stabilized with crushed stone (i.e. AASHTO #57).
 3. If groundwater enters the trench as it is being excavated, only enough trench shall be opened so as to permit the laying of one joint of pipe
 4. When the Contractor encounters material during trench excavation, at the opinion of the Engineer, Director, or Public Works Director, is unsuitable (i.e. "muck"), this material shall be replaced with material that is considered suitable prior to the pipe laying operations. In this case, construction fabrics may be required to prevent the migration of bedding material away from the pipe. Water shall be filtered prior to discharge to prevent sediments from escaping the site. The Contractor shall discharge said water in a manner not to erode the soil.
 5. The water shall be pumped out of the trench or build check dams to keep it out of the ditch in such a manner as not to cause injury to the public health, private property or the Work in progress. Erosion control measures shall be taken during this pumping.
- K. Sheeting or bracing shall be used wherever necessary to prevent failure of the trench banks. All sheeting shall conform to AASHTO and OSHA safety standards. The decision of the Engineer relative to bracing for the protection of Town property shall be binding upon the Contractor. The removal of sheeting shall be done in such a manner as to minimize the loss of friction between the backfill and trench walls.
- L. Trench excavation shall conform to the line and depth shown on the plans. The trench shall be properly braced and shored so the workers may work safely and efficiently. When water is being pumped from the trench, the pump discharge shall follow natural drainage channels, drains or storm sewers. In no case may trench water or groundwater be pumped into or allowed to enter the sanitary sewer system. See erosion control section (Section 1.06) for appropriate siltation prevention measures prior to pumping.
- M. Pipe clearance in rock shall be a minimum of 6 inches on each side and bottom for mains 15 inches in diameter and less. For larger size mains, the minimum clearance shall be 9 inches on the sides and bottom.
- N. If unstable conditions are encountered, the trench shall conform to the requirements as stated in these specifications.

O. Asbestos Handling: The existing collection system has segments of asbestos cement pipe. Working in the vicinity of, performing selective demolition on, or removing the pipe requires specific excavation and handling procedures as stipulated by State Regulation 310 CMR 7.00; Air Pollution Control. Specifically, 310 CMR 7.15: U Asbestos establishes surveying, notification, containment, removal, packaging, transportation, disposal, equipment decontamination, and reporting procedures, Handling and disposing asbestos cement pipe shall be in accordance with 310 CMR 7.15.

1. The following MassDEP website contains links to the asbestos-related regulation, policies, notification forms, shipping record templates, and other resources:

<https://www.mass.gov/guides/massdep-asbestos-construction-demolition-notifications>

2.02 Bedding, Backfill, and Surface Restoration Materials

- A. Crushed Stone: Material for pipe base shall be 3/4 inch minus crushed stone (AASHTO #57), having reasonably even gradation from coarse to fine, in accordance with the MassDOT Section 230.61 and Material M2.01.4.
- B. Gravel for Trench Backfill: Gravel for trench backfill shall be clean pit run gravel, crushed rock or gravel having a reasonable even gradation from coarse to fine. The maximum size shall be four (4) inches.
- C. Aggregate Base Course: ABC shall meet the requirements of MassDOT Material M2.01.7 “Dense Graded Crushed Stone”.
- D. Bituminous Concrete: Asphaltic concrete shall be Hot Mix Asphalt conforming to the requirements of MassDOT Section 450, Section 460, and Material M3.00.0.
 1. Standard Asphalt Binder Grade shall be in accordance with MassDOT Material M3.01.1. However, Asphalt Binder Grade for Recycled Asphalt Materials shall be used if the Hot Mix Asphalt contains recycled material (MassDOT Material M3.01.3).
 2. Aggregate gradation for the “Base Course” shall be in accordance with SUPERPAVE Base Course – 25.0 (SBC – 25.0) as specified in MassDOT Material M3.11.0.
 3. Aggregate gradation for the “Surface Course” shall be in accordance with SUPERPAVE Surface Course – 12.5 (SSC-12.5) as specified in MassDOT Material M3.11.0.
 4. Any recycled aggregate shall be in accordance with MassDOT Material M3.11.2.
 5. Bituminous driveways, sidewalks, berms and curb shall conform to MassDOT Material M3.11.6.
- E. Controlled Density Fill: Controlled Density Fill (CDF) shall be a mixture of Portland cement, fly ash (or suitable substitute as approved by Town), aggregates, water and admixtures proportioned to provide a non-segregating, self-consolidating, free-flowing and excavatable material that will

result in a hardened, dense, non-settling fill. CDF shall conform to the requirements of MassDOT Material M4.08.0 (Category 2E – Flowable (Excavatable)).

- F. Select Fill: The source of Select Fill can be either excavated material or off-site borrow, but shall be geotechnically stable and conform to the four classes below:
1. Class I - Angular, 6 to 40mm (1/4 to 1 1/2 inch), graded stone, including various fill materials that have regional significance such as coral, slag, cinders, and crushed stone and crushed shells. This differs from crushed stone (AASHTO #57) with the inclusion of regionally significant material.
 2. Class II - Coarse sands and gravels with maximum particle size of 40mm (1 1/2 inch), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types *GW*, *GP*, *SW* and *SP* are included in this class,
 - *GW* = well graded gravel
 - *GP* = poorly graded gravel
 - *SW* = well graded sand
 - *SP* = poorly graded sand.
 3. Class III - Fine sand and clay type gravel, including fine sands, sand clay mixtures and gravel-clay mixtures. Soil Types *GM*, *GC*, *SM* and *SC* are included in this class.
 - *GM* = silty gravel
 - *GC* = clayey gravel
 - *SM* = silty sand
 - *SC* = clayey sand.
 4. Class IV - Silt, silt clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types *MH*, *ML*, *CH* and *CL* are included in this class. **These materials are not recommended for bedding, haunching or initial backfill on PVC pipes.**
 - *MH* = silt soil with high liquid limit
 - *ML* = silt soil with low liquid limit
 - *CH* = clayey soil with high liquid limit
 - *CL* = clayey soil with low liquid limit.
- G. No rock, boulders, or stones 4 inches or larger shall be included in the backfill.
- H. Off-site borrow or imported material must be approved by the Nantucket Sewer Department prior to placement. Material shall be: granular fill; gravel; rock; or combinations thereof, free of humus, organic matter, vegetative matter, frozen material, clods, sticks, debris, and shall contain no stones having a dimension greater than four (4) inches. Sand or pea stone will not be an approved backfill material.
- I. Curbing: Existing granite curb shall be reused. Mortar used for pointing granite curb shall be in accordance with MassDOT Material M4.02.15
- J. Concrete: Cast-in-Place Concrete shall meet the following requirements:

1. Portland Cement: Type I or Type II conforming to ASTM C150. Total alkalis in cement shall not exceed 0.6%;
 2. Aggregate: Coarse aggregate size ASHTO #57 or #67 conforming to ASTM C33;
 3. Air Entrained Agent: Conform to ASTM C260;
 4. Admixtures: Conform to ASTM C494;
 5. Compressive Strength (28-day): 4,000 psi;
 6. Slump: 4-inch nominal (unless high range water reducing admixture is used);
 7. Water/Cement Ratio: 0.45 (max.);
 8. Air Content: 6% \pm 1.5%;
- K. Cobblestones and Concrete Pavers: Existing cobblestones and concrete pavers shall be reused.
- L. Brick Pavers: Existing brick pavers shall be reused to the extent possible. If, however, new pavers are required, they shall match the dimensions and color of the existing brick. Pavers shall be manufactured by Stiles and Hart (S+H), Belden, Glen Gary, or equal.
- M. Brick Sidewalk Edging: Edging shall be galvanized steel interlocking paver restraints that is ¼-in thick with stakes for anchoring.
- N. Stone Dust: Stone Dust shall conform to the following gradation requirements:
- | <u>Sieve Size</u> | <u>Percent Passing by Weight</u> |
|-------------------|----------------------------------|
| No. 4 | 100 |
| No. 50 | 90 |
| No. 100 | 65 |
- O. Select Sand: Dry sand shall meet the requirements of MassDOT Material M1.04.0 (Type a).
- P. Detectable Warning Panels: Panels shall be in accordance with MassDOT Detail E 107.6.5.

2.03 Backfill and Compaction

- A. Sections 3.0, 4.0, 5.0 and 6.0 herein specify pipe and structures bedding requirements.
- B. No backfill shall be placed on or against structures, pipes, or any other masonry until a visual inspection has been performed by the Nantucket Sewer Department or its authorized agent.
- C. Placement of backfill material shall include the working of material to achieve suitable moisture content and compaction to the specified density in accordance with the MassDOT Section 150.64.
- D. Material for backfilling shall be approved by the inspector. In areas where settlement or bearing capacity are not a major consideration, the Engineer may give permission for a low grade of material to be backfilled from a point two foot above the top of the pipe, but in no event will excavated rock larger than four inches at any point be used for backfill material

- E. Where proposed backfill material is unsuitable, in the opinion of the Director or Public Works Director, the Contractor may be directed to remove and dispose of the unsuitable material and provide material suitable to the Director or Public Works Director.
- F. Trench Backfill Compaction: After the Contractor has backfilled the pipe zone of the trench as required, or placed the complete manhole or structure, backfill the balance of the trench, and mechanically compact in 6-inch lifts. For trenches within roadways or where the supporting capacity of the soil is of prime consideration compact each layer to 95% of maximum density, and compact to 85% to 90% in all other areas. Where fill is required, use Class II Select Fill.
 - 1. Laboratory determination of maximum soil density will follow the procedure of AASHTO T99-86.
 - 2. Field determination of the density of the soil in place shall follow the procedure of AASHTO T191- 86 or T204-86.
 - 3. The result of any one test may be a minimum of 90% of maximum density, but the average of any three tests in an area shall be 95% of maximum density. All tests shall be conducted at the direction of the Town of Nantucket Inspector, borne by the Contractor with the provision that the Town of Nantucket will test an area two times only where both tests fail. The Contractor shall then be required to submit satisfactory evidence that the performed compaction meets the specifications.
- G. Controlled Density Fill: CDF is approved as an alternative to “Gravel for Trench Backfill” and as an alternative to “Select Fill” and may be used at any location on the project at the option of the contractor for stabilization material, trench backfill material and pavement base material.
 - 1. Controlled Density Fill shall be used as backfill material associated with: outside drop manholes; any construction in paved roadways having been surfaced within five (5) years, any construction in **all high-traffic roadways and intersections**; or at the discretion of the Director or Public Works Director. Any proposed alternate backfilling process shall be approved in writing prior to commencing Work.
 - 2. Contractor shall provide steel plates k-36 steel (k-56 recommended) to span trenches or otherwise prevent traffic or construction equipment coming in contact with CDF until the CDF has hardened sufficiently to prevent rutting. Contractor shall provide cold patch on all edges of steel plates used for vehicular transition in any affected area.
- H. The placement of fill dirt around and over existing sanitary sewer mains above the pre-existing ground elevation is prohibited and may only be approved upon written request to the Director. It is illegal to damage, cover or bury a sanitary sewer manhole of the Town of Nantucket.
- I. A cash bond to be determined by Nantucket Public Works, is to be posted for trenches that do not require flowable fill (CDF). After a period of one year, or at the discretion of the Nantucket Sewer Department, the Contractor must place Permanent Pavement. After such a time the Nantucket Sewer Department will inspect the Work and determine if the bond shall be released.

1. Any settlement of the trench or ditch during the above referenced time frame shall be considered the result of improper compaction and shall be corrected at no expense to the Town by the contractor.

J. Cast-in-Place Concrete for Miscellaneous Earthwork

1. Cast-in-place concrete as specified herein shall be used for miscellaneous earthwork items such as thrust blocks, granite curb bracing, temporary road surfaces, and concrete sidewalks, etc. General concrete placement is as follows.
 - a. Concrete quality, mixing, and placing shall meet the requirements of ACI-318 Chapter 5.
 - b. Concrete shall be moist cured by continuously wetting and using burlap, or equal, for a minimum of 5 days. Curing shall begin immediately after removing forms or screeding horizontal surfaces, concurrent with finishing operation.
 - c. Exposed corners shall be chamfered $\frac{3}{4}$ -inch.
 - d. Testing strength, slump, and air content shall be in accordance with ASTM C31, ASTM C39, ASTM C143, ASTM C172, and ASTM C231. One sample set for compression testing shall consist of (8) 4-in x 8-in cylinders taken for each placement in excess of 5 cubic yards with a minimum of one sample for each day of concrete placement.

2.04 Surface Restoration

- A. All disturbed surfaces and property thereon, shall be restored to a condition equal to that existing before construction began, and the Contractor shall maintain and be responsible for all ditches, paved streets, curbs, gutters and/or sidewalks until the Contractor's one year warranty expires (commencing on Final Acceptance).
- B. It is suggested the Developer/Contractor video the proposed construction area prior to beginning Work.
- C. All easements will be seeded in accordance with the approved Sedimentation and Erosion Control Plan, and left so conventional mowers can mow them, unless approved by the Director or unless MassDEP requires some other form of rip-rap or other specified material.
 1. In remote areas, easements will be seeded with a quality fescue grass. In residential areas, easements will be seeded with approved grass seed mix unless directed otherwise by the Director.
 2. The Contractor shall guarantee a good uniform stand of grass and shall reseed any bare or thin spots.
- D. Temporary and Permanent Pavement:
 1. After the trench has been backfilled and compacted according to the design specifications, the Contractor shall bring the trench to a smooth even grade at the proper depth below the existing surface to provide for the required depth of pavement.

2. Place, grade, and compact Aggregate Base Course in accordance with Pavement Detail appended herein and MassDOT Section 402.
3. Asphalt compaction shall be done with a gasoline or diesel-powered smooth drum asphalt roller in accordance with MassDOT Section 450 and Material M3.12.
4. Temporary Paving: Place temporary trench patch using bituminous concrete in accordance with the Pavement Detail appended herein and MassDOT Section 472. Maintain temporary patch for the duration specified by the Director. After which place Final Paving.
5. Final Paving:
 - a. Cold Plane and Overlay: Plane the top 1.5 inches of the existing pavement for the full width of the roadway for the longitudinal distance of the area disturbed by the associated trench Work or as set forth in the Street Opening Permit issued by the Nantucket Public Works Department. Place bituminous concrete in accordance with the Pavement Detail appended herein and MassDOT Section 472. Full width roadway reclamation is preferred in municipal infrastructure replacement projects unless otherwise approved in writing prior to bidding and or award of project.
 - b. Permanent Paving: Saw-cut the existing pavement to a straight line and remove any pavement that has been damaged during Work as required by the Director. The entire existing paved surface shall be cleaned before resurfacing commences. The trench shall be repaired per the specifications set forth in the Street Opening Permit issued by the Nantucket Public Works Department. Grade and compact subbase, and place bituminous concrete in accordance with the Pavement Detail appended herein and MassDOT Section 450.
6. Adjust Castings: In cases where there is a differential greater than 0.25 inches between the temporary or permanent road surface grade and a utility casting, that casting shall be adjusted to be flush with the surrounding grade.
 - a. The Contractor shall adjust municipality-owned castings. Castings owned by private utilities shall be raised by their own forces. The Contractor shall be responsible for coordination this Work.
 - b. The method of adjusting these castings shall be as follows:
 - i. Cut around catch basin or manhole castings a minimum of 8 inches from casting outer edge;
 - ii. Excavate asphalt and road subbase. Demolish existing masonry chimney. Replace chimney with appropriately sized rubber grade adjustment ring and set casting to appropriate grade in accordance with Section 5.00;
 - iii. Backfill with suitable material and compact as specified herein;
 - iv. Place temporary or permanent Hot Mix Asphalt wearing course as specified herein.
 - c. In some cases, raising of castings may not be required as directed by the Engineer, Director, Public Works Director. The road surface may be planed and regraded. Chip and remove the existing road surface a minimum of 12 inches around the casting. New

Hot Mix Asphalt binder shall be placed and compacted around the casting to approximately 1 ½ inches below the top rim of the casting, then the Hot Mix Asphalt wearing course shall be sloped down to the level of the casting as specified herein.

- d. The method of adjust valve boxes shall be as follows:
 - i. Cut around valve box a minimum of 8 inches from casting outer edge;
 - ii. Excavate as required and adjust casting to appropriate grade;
 - iii. Place mortar collar around casting to approximately 1 ½ inches below the top rim of the casting;
 - iv. Place temporary or permanent Hot Mix Asphalt wearing course as specified herein.
 - e. Castings which need to be adjusted to complete permanent paving shall be done immediately prior to paving.
7. Pavement Markings: Replace pavement markings removed or covered in carrying out Work, and as required by the Engineer or Public Works Director. Marking shall match those of the existing unless indicated by the Public Works Director. Stripe no sooner than 48 hours after completion of permanent paving. The markings shall be 4 inches wide, white or yellow, single or double lines, as required, in accordance with MassDOT Section 860.
- a. If temporary Hot Mix Asphalt wearing course is anticipated to be in place for longer than 30 days, or where required by the Engineer, temporary markings shall be placed.

E. Cobblestone and Paver Roadways:

1. After the trench has been backfilled and compacted according to the design specifications, the Contractor shall bring the trench to a smooth even grade at the proper depth below the existing surface to provide for the required depth of cobblestone or paver roadway.
2. Place, grade, and compact Aggregate Base Course in accordance with Pavement Detail herein and MassDOT Section 402.
3. A bed of stone dust shall be placed over the prepared Aggregate Base Course to the width and compacted thickness shown on the Pavement Details appended herein, formed true to crown and grade.
4. The existing cobblestones or pavers shall then be reset on the bedding, formed true to pitch and grade of the surrounding roadway. Sweep mixture of dry Select Sand (3 parts) and cement (1 part) into and fill the vertical joints and fog with water. The surface shall be vibrated with a lightweight plate compactor. Sweep sand/cement mix, fog, and compact for a maximum of five days (five times) until all the joints are full.

- F. Resetting or Replacing Curb: The curbing subbase shall consist of Aggregate Base Course placed, compacted, and formed true to pitch and grade to a thickness that is in accordance with MassDOT Section 501.61 and to the configuration indicated on MassDOT Detail E106.3.0. The granite curb pieces and concrete blocking shall be placed in accordance with MassDOT Section 500 and to the configuration indicated on Mass DOT Detail E106.3.0.

- G. Hot Mix Asphalt Sidewalk and Driveway Aprons: The finished Hot Mix Asphalt sidewalk and driveway aprons subbase shall consist of Aggregate Base Course placed, compacted, and formed true to pitch and grade to a thickness that is in accordance with MassDOT Section 701.60. Hot Mix Asphalt sidewalks and driveway aprons shall be placed, compacted, and formed true to pitch and grade to a thickness that is in accordance with MassDOT Section 701.62 and the MassDOT E 107 Detail Series.
- H. Brick Sidewalk and Driveway Aprons: The finished brick sidewalk and driveway apron subbase shall consist of Select Sand placed, compacted, and formed true to pitch and grade to a thickness of 4 inches. Existing brick pavers shall then be reset on the bedding, formed true to pitch and grade of the surrounding sidewalk or driveway apron. Sweep mixture of dry Select Sand (3 parts) and cement (1 part) into and fill the vertical joints and fog with water. The surface shall be vibrated with a lightweight plate compactor. Sweep sand/cement mix, fog, and compact for a maximum of five days (five times) until all the joints are full.
- I. Concrete Sidewalk and Driveway Aprons: The finished concrete sidewalk or driveway apron subbase shall consist of Aggregate Base Course placed, compacted, and formed true to pitch and grade to a thickness that is in accordance with MassDOT Section 701.60. Concrete sidewalks and driveway aprons shall be placed and formed true to pitch and grade to a thickness that is in accordance with MassDOT Section 701.61 and the MassDOT E 107 Detail Series.
- J. Wheelchair Ramps: The finished Wheelchair Ramp subbase shall be consistent to that of the sidewalk material (i.e. Hot Mix Asphalt, concrete or brick) as indicated herein true to pitch and grade. Wheelchair ramps shall be consistent to that of the sidewalk material (i.e. Hot Mix Asphalt, concrete, or brick) as indicated herein and to the configuration indicated on the MassDOT E 107 Detail Series. Install Detectable Warning Panels in accordance with the MassDOT E 107 Detail Series.

3.00 Gravity Sewers

3.01 Design Flows

- A. Submit a detailed description of the procedures used for calculating sewer design flow to the Director. Include the following Design Factors:
 - 1. Peak hourly sewage flow
 - 2. Additional peak flows of industrial and commercial wastes
 - 3. Maximum groundwater infiltration
 - 4. Topography of the immediate area
 - 5. Difficulty of installation
- B. Design Period: Sewage collection systems shall be designed for a life span of 50 years.
- C. Design Flow: Interceptor and local sewers shall be designed to handle the maximum capacity of uses in the drainage area as determined by the Director .
- D. Massachusetts 310 CMR 15.000, Title 5, shall be used for calculating the design flow for sewers. If 310 CMR 15.000, Title 5, does not have a flow rate for the proposed use, the following methods may be used with the approval of the Nantucket Sewer Department:
 - 1. Flow Related to Water Consumption: When available, use existing sewage flow and/or water consumption data as a basis for sewer design. If such data are not available, using flow data from a similar community or users;
 - 2. Per Capita Flow: Where actual flow data cannot be obtained, base residential flows from new collection systems on an average daily per capita flow of not less than 70 gallons per day.

3.02 Sewer Pipeline Design

- A. Size the sewer pipe such that the design flows shall be to half full or 50% capacity for the maximum depth of flow for all grades.
 - 1. No gravity sewer shall be less than 8 inches in diameter.
 - 2. Sewer size design shall be based on the flows established in Paragraph 3.01.D including a peak/average ratio of 2.5. This ratio includes an allowance for infiltration.
- B. Depth: In general, sewers shall be deep enough to drain basement fixtures and to prevent freezing. Water-tight insulation shall be provided for sewers that cannot be placed deep enough to prevent freezing. For house connection chimneys, vertical pipe shall be used when the sewer main is greater than or equal to 12 feet deep.

1. All sewer mains in traffic areas shall have a minimum cover of 5 feet measured from finished grade in traffic areas to the pipe crown unless ductile iron pipe is provided in Class I bedding. Then the minimum cover shall be three feet.
 2. Mains and services in non-traffic areas shall have a minimum cover of 3 feet (measured from top of finished grade) to the pipe crown.
 3. Sewer mains and services shall be no deeper than 12 feet unless approved by the Director. For installations deeper than 12 feet, ductile iron pipe shall be used for mains and services. Note, cast iron may also be used for 4-inch services.
- C. Buoyancy: Where high groundwater conditions are anticipated, the buoyancy of sewers shall be considered, and the floatation of pipe shall be prevented with appropriate design and construction of the sewer.
- D. Minimum Slopes: All sewers shall be designed and constructed to give a velocity (when flowing full) of not less than 2.0 feet per second based on Manning’s formula using an “n” value of 0.013. The Director may permit the use of other “n” values if deemed justified on the basis of research or field data. Refer to the latest MassDEP document entitled “Minimum Design Criteria for the permitting of Gravity Sewers”. The following minimum slopes shall only be used if absolutely necessary because of grade restrictions; however, greater slopes are desirable.

Table 3-1 Minimum Slope in Percentage

4 inches	1.05
6 inches	0.60
8 inches (203 mm)	0.40
10 inches (254 mm)	0.28
12 inches (305 mm)	0.22
14 inches (356 mm)	0.17
15 inches (381 mm)	0.15
16 inches (406 mm)	0.14
18 inches (457 mm)	0.12
21 inches (533 mm)	0.10
24 inches (610 mm)	0.08
27 inches (686 mm)	0.067
30 inches (762 mm)	0.058
36 inches (914 mm)	0.046
42 inches (1067 mm)	0.037

1. The use of oversized sewers in order to facilitate flatter slopes is not permitted.
- E. Slope Between Manholes: Sewers shall be laid out with uniform slope between manholes.

- F. High Velocity Protection: Velocities greater than 12 feet per second shall not be permitted under any flow conditions, unless the Director approves special provisions that will protect against pipe erosion and impact.
 - 1. Steep Slope Protection: Any grades which exceed the maximum of 10% must be approved by the Director and must be accompanied with details of a high velocity manhole. Any time the grade is greater than 15%; ductile iron pipe shall be used with high velocity blocking (anchoring) to prevent displacement.
- G. Impervious Dams: Impervious dams shall be installed every 300 feet to control the flow of groundwater within the pipe bedding material, when:
 - 1. The surrounding native material is considerably less impervious than the pipe bedding material;
 - 2. The pipe bedding could produce a hydraulic head of 25 feet on the pipe gaskets and joints during periods of high groundwater flow; and/or
 - 3. The sewer is constructed downstream of a waterway or wetland crossings.
- H. Pipe diameter changes shall occur only in a manhole with the pipe crowns matching providing a minimum drop of approximately 0.10 feet between inverts for straight pipe runs and 0.20 feet for bends greater than 45-degrees.
- I. For sewer extensions, extend the mains to the farthest property line of the tract where necessary to serve adjoining properties with gravity sewer along natural drainage patterns. In all instances, plans shall show the total area in acres draining to the uppermost bounds of the tract on any established watercourse. Additional sewer extensions may be required if the Sewer Department determines adjacent property can be served from extensions from the proposed site. The depth of sewer mains shall be great enough to serve adjoining property, allowing for sufficient grade on the service line. Lateral connections are to be into manhole barrels (not the cone section) or into the top quarter of sewer mains.

3.03 Pipe and Fitting Materials

- A. The pipe shall be of the size and type indicated on the plans and shall conform to the appropriate specifications detailed below.
- B. PVC Sewer Pipe: Pipe and fittings shall be smooth-walled inside and out and must be Polyvinyl Chloride (PVC) and must conform to either ASTM D3034 (SDR 35); or ASTM D1785 (Sch 40 or 80). All pipe must have a minimum tensile strength of 34.50 Mpa as defined by ASTM D1784.
 - 1. SDR rating is the ratio of the outside diameter to the pipe wall thickness.
 - 2. Joints shall be push-on type with elastomeric gaskets conforming to ASTM F477.

- C. Ductile Iron Sewer Pipe: Pipe and fittings must meet ASTM A746; or AWWA C-151. Exterior asphaltic coatings shall meet AWWA C-151. Interior linings shall be either asphaltic meeting AWWA C-151, or ceramic epoxy.
 - 1. Joints shall be push-on type with rubber gaskets conforming to AWWA C111.
- D. Service Branch Fittings: Full-body wye-branches are the preferred fittings for services. Tapped services may be approved by the Director.
 - 1. Tapped fittings shall consist of a rubber sleeve contoured to closely fit the curvature of the tapped pipe and have circumferential lip to fit over the thickness of that pipe, restricting axial movement; a 6-in PVC pipe stub; and a 316 stainless steel band clamp. Manufacture shall offer a product that can fit tapped pipe of various diameters and material.
 - 2. Pipe saddles with band clamps around the sewer main shall not be permitted.
- E. Low Pressure Sewers: Low-pressure pipe shall be 1¼- through 3-in PVC (pressure class 200) conforming to ASTM D2241. Push-on joints shall conform to ASTM D3139 and F477 with approved thrust restraint. Gaskets shall be compatible with the sewer environment.
 - 1. Fittings shall be PVC and match the pressure classification of the pipe with which it is connected. Bell ends shall conform to ASTM D3139.
- F. Axial Pipe Couplings: Flexible rubber couplings shall be made of elastomeric polyvinyl chloride (PVC) this is tough and resilient: suitable for buried service: and be unaffected by soil conditions, sewage, and ultraviolet rays. Double stainless-steel band clamps shall secure the coupling to the pipes to form a seal which is leakproof to infiltration and exfiltration (i.e. provide 4 band clamps for each coupling). The coupling size shall be suitable for connecting the intended piping together and be offered in models that joint different pipe materials (e.g. PVC-to-Vitrified Clay, Asbestos Concrete-to-Ductile Iron) and different diameters (e.g. join 10-inch pipe to 12-in pipe).
 - 1. A one-part polyurethane sealant shall be applied circumferentially between the pipe exterior and the coupling, creating a watertight seal. The adhesive shall be marine grade, high strength, and have a tensile strength greater than 500 psi. The adhesive shall also be used on 360° stainless-steel repair sleeves installed when abandoning service laterals.

3.04 Installation

- A. Refer to Section 2.00 for trenching and surface restoration.
- B. All sewer crossings under State roads shall be made in accordance with the requirements of applicable MassDOT permits.
- C. In accordance with Section 1.04 herein, protection shall be afforded to all underground and surface structures using methods acceptable to the Director or Engineer. This protection shall be furnished at the expense of the Contractor.

- D. The Contractor shall layout own Work and be responsible for the execution of the Work to such lines and grades to comply with the specifications stated herein.
1. Sewer pipe shall be laid in full lengths as manufactured and shall be laid on a constant grade and in a straight alignment from manhole-to-manhole, or manhole-to-cleanout, and be verified with a laser unless another method is approved by the Director.
 2. Wherever possible, pipe shall not be installed with elbows or bends. A manhole shall be located at every change in grade or horizontal alignment, but no more than three hundred (300) feet apart.
 3. Force mains shall be installed at the minimum depth indicated on the Plans.
 4. In no case shall sewer mains have less than 3-feet of cover unless the piping material is ductile iron.
 5. No deviations from line and grade shall be made, unless the Sewer Department or Engineer has approved them and they have been identified on the construction drawings initialed by the individual authorizing the change and on the Record Plans.
- E. Sewer Pipe shall be connected to concrete manholes by means of an approved coupling with an elastomeric gasket, an approved waterstop or flexible sleeve. Use of Portland Cement grout for connecting PVC Sewer Pipe to manholes will not be permitted, unless previously authorized by the Town Engineer.
- F. The installation of sewer pipe shall commence at the lowest point along the sewer and shall proceed so that the spigot end of the section being laid is placed into the bell end of the pipe already laid.
1. Exceptions to this provision will be considered on a case by case basis when requested in writing by the Owner of the development at the time construction plans are submitted to the Town of Nantucket for review and approval.
 - a. The development owner must agree to hold the Town of Nantucket harmless, and must accept full responsibility for compliance with state and federal regulations of the Clean Water Act, including any associated penalties which could reach up to \$25,000/day, for the release of wastewater from sanitary sewer to the environment, which are not connected to existing sewer due to the granting of an exception to the pipe laying sequence required in the Sewer Department Specifications.
 - b. The development owner must further agree to not request building permits, if an exception is granted for that portion of the development, until connecting sewer is constructed and accepted by the Town of Nantucket.
- G. Subsurface explorations shall be made by the Contractor where it is necessary to determine the location of existing pipes, valves, or other underground structures.
- H. Maintaining Service. When replacing or extending sanitary sewer mains, the Contractor shall maintain existing service to all property being served.

- I. Service Connections: The Contractor shall place service lateral Wyes at the locations indicated on the Plans or specified by the Engineer. Final service lateral locations may be determined in the field after consultation with the property owner. The 6-inch side outlet shall be installed at an angle of approximately 45 degrees above the horizontal (circumferentially).
 - 1. See Section 4.04 herein, for further lateral connection requirements.
- J. Preparation of Sewer Pipe: All pipes and fittings shall be carefully inspected before being laid and no cracked, broken, or defective pipe or fittings shall be used in the Work. The ends of the pipe shall be cleaned with a brush, washed, and thoroughly scrubbed where necessary to remove dirt or other foreign material. Extreme care shall be exercised to ensure that the inside surfaces of the bell are smooth and free from any projections which would interfere with the assembly or water tightness of the joint. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.
 - 1. Pipe ends shall be plugged at the end of each workday or when Work is temporarily stopped. The plugs shall be watertight, so the water and debris will be kept out.
- K. Sewer Construction Plugs: Mechanical plugs (non-pneumatic) must be installed throughout the time of construction of any sanitary sewer extension. Plugs are to be installed on the downstream end of the new main at the first manhole from the existing tie-in and maintained until final acceptance. All plugs must be securely tied off with steel cable within the manhole and must have a secure marking attached to the plug indicating the utility Contractor to whom the plug belongs. All plugs must be monitored during construction to ensure the plug is functioning as required. Prior to removing the plug, all accumulated water/debris must be removed and disposed properly by the Contractor. All plugs must be removed by the Contractor upon acceptance that the sewer facilities are sufficient and functionally complete as to accept flow, and PRIOR to placing the upstream pipe into service and/or accepting any flow of sewage.
- L. No de-watering of the trench shall take place into the sewer pipe or any appurtenance.
- M. While working on any part of an existing sewer main, the Contractor shall maintain the existing sewage flow. No discharge of sewage to the storm drains will be allowed. Construction requiring existing sewer flow to be pumped from existing manholes shall be the responsibility of the Contractor and must be approved prior to proceeding by the Sewer Department Director or the Town of Nantucket Inspector.
- N. Preparation of Trench: Bedding support for sewer pipe shall provide uniform bearing for the pipe barrel along its entire length by digging bell holes. Material shall be placed to make a firm, flat bottom and leveled to the approximate flow line grade. Then compacted in advance of placing the pipe. The thickness of the bedding layer below the pipe shall be in accordance with Trench Details appended herein.
- O. After the bedding has been properly graded and bedded, the pipe and accessories shall be carefully lowered into the trench by approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe and accessories shall be removed from the job. All damaged pipe shall be replaced at the expense of the Contractor.

- P. Laying and jointing of pipe shall be done according to manufacturer's recommendation with care being taken to provide uniform bearing for the pipe. Bell and spigot of pipe shall be cleaned and properly lubricated where a mechanical joint or a "push on" type joint is employed. Each piece shall be laid in such a manner as to form a closed concentric joint with the adjoining pipe to prevent any offsets in the flowline.
- Q. Laying Ductile Iron Sewer Pipe. Ductile iron pipe shall be installed in accordance with the requirements of AWWA Standard C-600-87.
- R. The Engineer shall inspect any and all piping before backfilling occurs.
- S. Following the placement of each pipe, the bedding material shall be placed at the haunch up to the centerline of the pipe and properly chinked in accordance with the Trench Details appended herein. Care shall be taken to work the haunch well under the bottom of the pipe. The haunch shall be tamped to 95% standard Proctor density in six-inch lifts.
- T. For PVC sewer installations, Select Fill material may be allowed for the bedding if the Contractor can verify that this type of soil is native to the site by having soil tests made by a soil-testing agency.
 - 1. Soil sample borings shall be taken as directed by the Engineer to a depth equal to or greater than the trench bottom elevation shown on the plans or in the specs. The results must be approved by the Director prior to pipe installation. The bedding and backfilling shall be in conformance with the various soil classes are defined Section 2.02 herein.
 - 2. Select soil compacted to 90% of maximum Proctor Density shall reach to a point one foot above the top of the pipe.
- U. Backfilling shall be in accordance with Section 2.03 herein.
- V. Where conditions are, in the opinion of the Director or Engineer, unsuitable for laying pipe because of weather or trench conditions, the Contractor shall be required to cease Work until permission is given by the Director or Engineer for Work to commence again, providing such conditions have been corrected
- W. Acceptance of the installed pipe segments shall be in accordance with Section 9.00 herein.

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4.00 Building Sewers and Connections

4.01 Building Sewers

- A. Building gravity sewer service pipes must be a minimum of: 4-inches in diameter for single family residential connections; 6-inches in diameter pipe for multi-family, commercial or industrial connections; or as the Director may determine.
 - 1. Building services that are 4 inches in diameter from the building foundation to the property line, shall increase to 6 inches in diameter to connect to the sewer service stub.
- B. Newly installed sewer service pipes shall be of the material indicated in Section 3.03 herein.
 - 1. The cover depth-dependent pipe material (including cleanouts) shall be in accordance with Section 3.02.B herein.
 - 2. Where installation by boring is specified, ductile iron pipe shall be used.
- C. See Section 3.03 for branch connection material requirements.
- D. Cleanouts: Each individual building sewer must have a watertight vertical wye cleanout located: 10 feet from the building's exterior wall; at all locations where the pipe size, slope, or direction changes; and at the property line. Additional cleanouts are required every 100 feet, or at the discretion of the Director. The cleanout shall be brought to within 4 inches below final grade, except for paved surfaces, (bituminous concrete, concrete, paving blocks, etc.), then the cover shall be flush with the finished surface.
 - 1. Sewer cleanouts at the property line shall be placed 1 foot inside of the Right-of-Way or dedicated easement provided that it does not conflict with any other utilities, but it must be a minimum of 18 inches off the edge of any paved surface or other surface intended for the vehicles to travel on.
 - 2. Cleanouts shall be sealed with removable, re-useable threaded screw-in plug or screw-on cap.
 - 3. If the material is PVC, then it must be equipped with a bronze cap to facilitate future locating, if buried. Clean out caps shall be set 3 inches above finished grade.
- E. All cleanouts must be the same diameter as the horizontal building sewer into which the cleanout is connected (minimum of 4 inches).
- F. Building sewers must maintain a minimum cover (from finished grade to top of pipe) of 3 feet. The Town will not accept building service installed with less than 3 feet of cover in a Right-of-Way or easement unless prior permission has been obtained by the Engineer.
 - 1. Where an existing sewer pipe exits an existing building with less than 3 feet of cover, the Contractor shall install the connection as to meet the minimum cover requirements in the

shortest longitudinal distance possible. Watertight insulation shall be provided for services that cannot be placed below the 3 feet minimum depth.

4.02 Future Connections

- A. Sewer designs must account for flows from all possible future extensions or development within the immediate drainage area in conformance with Town planning documents.
- B. Persons constructing sewer main extensions must provide provision for connections at all properties crossed by the extension as follows:
 - 1. For gravity lines, provide a 6-inch stub (minimum) to the property line of each lot. A full size Tee with cleanout cap shall be brought to the surface, with a capped stubbed service and shall be located by GPS.
 - 2. For Low Pressure Sewer Force Mains, provide a 1 ¼-inch stub (minimum) to the property line of each lot. Cap and locate the stubbed service by GPS.
 - 3. For sewer main extensions within the sewer easement, stubs may be located at or near the main.
- C. A standard 2-inch x 4-inch timber stake with the top painted green must be installed at the end of the plugged line and recorded with the Nantucket Sewer Department.
 - 1. If a new main is installed in an easement on private property, the Wye outlet shall be plugged and marked with the green stake.
 - 2. Whenever the main sewer is installed in the street Right-of-Way, the Contractor shall extend the service connection from the Wye branch to the property line of the building to be served, or to the point designated on the approved Plan or by the Engineer. Plug the 6-inch stub and mark with the green stake.

4.03 Installers Qualifications

- A. Only Town of Nantucket Approved Licensed Utility Installers (LUIs) will be permitted to construct or repair sewers services. A list of LUIs may be obtained from the Nantucket Sewer Department.
 - 1. The Director may approve other licensed contractors to perform sewer Work on a case-by-case basis.
 - 2. Any sewer not installed by an LUI or a Nantucket Sewer Department approved Licensed Contractor, will be rejected.
 - 3. LUIs shall not sub-contract sewer installation Work to anyone other than another LUI, or Nantucket Sewer Department approved Licensed Contractor.

- B. Pursuant to Chapter 336-22 of the Nantucket Town Code, failure to comply with this provision may lead to a Notice of Violation for the Licensed Contractor and may result in loss of such License.

4.04 Installation

- A. Refer to Section 2.00 for trenching and surface restoration.
- B. Refer to Section 3.00 for general pipe installation requirements.
- C. Refer to Service Lateral Connection Detail appended herein.
- D. Sewer Service Work within Public Right-of-Way/Easement:
 - 1. Unless otherwise specified on the Plans or directed by the Engineer, each service reconnection shall be laid in a straight line and gradient from the Wye to the end of the existing service connection at the property line. Service connections shall be laid in accordance with Table 3-1, unless otherwise authorized by the Director, or shown on the approved Plans.
 - 2. All 6-inch sewer services shall be connected to the main by means of an in-line wye fitting (preferred), or tapped directly into 8-, 10-, and 12-inch mains.
 - a. For tapped or cut in services to the Town's sewer main, rubber saddle T's or Y's are NOT permitted unless by written permission by the Director or designee. The preferred type connection that uses insertion type fittings that use mechanical circle type saw cutter designed for the particular use, rendering a smooth and uniform cut with no damage to the main, and which retrieves the coupon; or by other means approved by the Director or Engineer.
 - b. All laterals tapped on newly constructed mains shall be air tested with the main before any plumber connections are made.
 - 3. All sanitary sewer service connections larger than 6 inches shall be made into manholes only, which may require the installation of a manhole on the main.
 - a. Service penetration holes shall be core drilled and not "punched" out.
 - b. The maximum vertical drop for a service into a manhole shall be 24 inches. When the drop exceeds 24 inches, then it shall be the responsibility of the Contractor to install an interior or exterior drop connection in accordance with the Section 5.01 herein.
 - c. Lateral connections at manholes shall into the barrel, not the cone section.
 - d. All laterals tied to a newly constructed manhole shall be vacuum tested with the manhole or conduct a separate air or water head test before any plumber connects are made.
 - 4. In no case will the Contractor be required to extend the service connection on to private property without first obtaining consent by the property owner.

E. Sewer Service Work on Private Property:

1. Unless otherwise specified on the Plans or directed by the Engineer, each service shall be laid in a straight line and gradient from the plugged stub (cleanout at the property line or the stub in an easement) to the building foundation. No service connection shall be laid on a grade consistent with Table 3-1, unless otherwise authorized by the Director, or shown on the approved Plans.
2. The private portion of the service lateral shall be in accordance with Section 4.01 herein with regard to material, diameter, and depth.

F. Where laterals are bored, the face of the bore cut shall be a distance of five feet from the edge of the pavement on either side, unless approval to the contrary is given by the Director.

G. All laterals shall be left exposed until the inspectors can verify the installation of each plug. It is the Contractors responsibility to coordinate these inspections with the Town of Nantucket Sewer Department Laterals which are covered up prior to inspection shall be subject to excavation at the Contractors expense to provide for a visual inspection

5.00 Manholes and Cleanouts

5.01 Design

- A. Manholes shall be installed at the end of each line; at all changes in grade, size, or alignment; and at all pipe intersections. Distances between manholes shall not be greater than 300 feet for sewers measuring 15 inches or less in diameter, or 400 feet for sewers 18-30 inches in diameter. Greater distances may be permitted for larger sewers but only with prior approval of the Director.
 - 1. Junction manholes on low pressure sewers shall be installed at all pipe intersections.
- B. Manhole shall be constructed at the location and to the elevations indicated on the drawings.
- C. The top of the manhole cover shall be one foot above the 100-year flood elevation level, or be sealed. Sealed manholes must be vented every 1000 feet.
 - 1. Regardless of the rim elevation's elevation to the 100-year flood plan, the final elevation of the manhole rim shall be 6 inches above grade for a landscaped or cross-country setting, or at finished road or sidewalk grade.
 - a. Manholes which extend above grade shall have a flat top. The top surface shall be large enough to accommodate the cover lifting device and the cover.
- D. Top Section:
 - 1. Precast cones shall be eccentric with a minimum wall thickness of 5 inches and reinforcement similar to that of manhole sections. The top and bottom joints of the cones shall be parallel.
 - a. The internal diameter of four-foot manhole barrel shall be maintained to a distance of not more than four feet below finished grade. From that point, the manhole barrel shall be tapered to the thirty-inch internal diameter, as shown on the standard manhole drawing.
 - b. The internal diameter of five-foot manhole barrels shall be maintained to a distance of not more than six feet below finished grade. From that point, the manhole barrel shall be tapered to the thirty-inch internal diameter.
 - 2. Flat tops shall be installed in cases of shallow sewer main or lateral penetrations, or cross-country locations in which the manhole frame is set above grade.
- E. Precast Manhole Sections: Precast concrete sections for manholes shall be minimum of 48 inches in interior diameter.
 - 1. The following minimum manhole diameter criteria shall be dependent upon the size of mains and depth of installation. The larger manhole sizes will be required if either the main size or the depth warrants:

Table 5-1 Manhole Sizing Guide

Diameter Manhole	Main Size	Depth of Installation
4' - 0"	8" to 12"	0' to 12'
5' - 0"	15" to 30"	12' to 20'
6' - 0"	36" to 54"	20' and greater

2. Manhole sizes must be clearly identified on the construction plans. Each manhole must be of consistent diameter throughout its height.
- F. Precast Concrete Bases: Any manhole having a depth greater than 9 feet shall have an extended base.
1. However, an extended bases may be used to minimize the manhole diameter when a larger manhole is required because of the depth. In which case, the diameter of the main shall dictate the manhole diameter.
 2. Where high groundwater conditions are anticipated, the manholes shall be designed and constructed to prevent floatation for a worst-case scenario during construction. Extended manhole bases may also be used as ballast to prevent its floatation when installed where high ground water is encountered.
 3. Manhole bases shall be approved and inspected by the Engineer prior to installation.
- G. Doghouse”, or cast-base-around-pipe manholes shall be designed by the Contractor and submitted to the Director for approval. General guidelines for the cast-in-place base consist of:
1. Prepare and grade the Subgrade material adjacent to the existing pipe to remain then place and compact the manhole bedding per Section 5.03 herein.
 2. Refer to Section 2.03 herein for general concrete placement requirements.
 3. Place/erect cast-in-place base rebar, forms, accessories, concrete, and finishes.
 4. Allow the manhole base to cure 5 days prior to placing precast sections upon it. Seal the annular space around the pipe penetration.
 5. Sawcut the top half of the existing pipe-to-remain to facilitate access to the sewer and remove the coupon.
- H. All interceptor manholes or manholes receiving a sanitary sewer force main discharge shall be internally lined with a coating that prevents hydrogen sulfide corrosion as approved by the Director or Engineer.
- I. Drop manholes shall be constructed with interior drop connection when a sewer pipe penetration is more than 24 inches above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is between 6 and 24 inches, the invert shall be filleted to prevent solids deposition (i.e. flow is directed to the manhole invert).

1. Interior drop connections shall be used provided the manhole has the area to facilitate safe access into the manhole with the inside drop in place and shall be approved by the Director. The minimum barrel diameter to accommodate an interior drop connection shall be 5 feet.
 - a. The inside drop connection shall be secured to the interior wall of the manhole and shall provide access for cleaning as it enters the manhole at the top. Corrosion resistant anchors shall be used to attach the drop pipe to the inside surface of the manhole barrel.
 - b. Internal drop pipes and fittings shall be PVC plastic sewer pipe in compliance with ASTM D2241.
 2. If approved by the Director, exterior drop connections may be used and shall be encased in concrete and shall provide access for cleaning as the sewer enters the manhole at the top of the drop connection
- J. The manufacturer shall submit drawings showing the reinforcing, pipe openings and other details for approval by the Sewer Department Director. Also, the manufacturer shall provide certified test reports indicating that the materials comply with the requirements of ASTM C478.

5.02 Materials

- A. Manholes shall conform to the Sewer Manhole Detail appended herein.
- B. Concrete used in the construction of the manhole base, barrels, and top, and other structures specified shall be so proportioned and mixed as to meet a 3,000-psi compression test after 28 days.
 1. Cement used in masonry or reinforced concrete units shall be Type-I, CSA normal, meeting ASTM C150, unless otherwise approved by the Engineer.
 2. Concrete shall be only plant-mixed or transit-mixed concrete conforming to ASTM C33 as to aggregates and to ASTM C94 for ready-mixed concrete.
 3. Concrete shall be of three types as based on 28-day compressive strength:

Table 5-2 Concrete Strength

Type AA	4,500 psi
Type A	3,000 psi
Type B	2,500 psi

4. Concrete shall be air-entrained, unless specified otherwise, with 4 to 6% air. Retarders and accelerators shall be used only as directed by the Engineer.
5. Steel reinforcing for concrete structures shall meet requirements of ASTM A615 for Grade 60 steel reinforcement. All bars shall be deformed (not smooth) and be from domestic mills.

- C. Precast Reinforced Concrete Manholes. The eccentric manholes shall be designed and manufactured in accordance with ASTM C478. Manhole diameters shall be 4, 5, or 6 feet in diameter as determined by the Table 5-1 herein and have a 6-inch minimum base. A flexible rubber boot shall be supplied with the manholes to tie the pipe to the barrel section. These gaskets and clamps shall meet the requirements of ASTM C923.
- D. Manhole Blockouts / Plugged Boot: Provide manhole blockouts and or plugged boots for sewer extensions as shown on the plan or as required by the Nantucket Sewer Department. The intent of the blockout is to provide a means by which future sewer lines can be connected to the manhole with a minimum of inconvenience. The method of construction shall provide a watertight blockout and shall be approved by the Engineer. Construct invert channels to the manhole wall at the blockout in accordance with the invert elevation directed by the design Engineer.
- E. Joints: All shiplap (or male and female) joints in the precast wall, including the joint at the top of the base, shall conform to ASTM C443; except that joint taper shall not exceed 3-1/2 degrees. The precast sections shall be provided with a special groove (cast into the male end) to receive and hold the gasket in position during joint assembly.
1. All joints between sections shall be sealed with “O” ring rubber gasket, meeting the same specifications as pipe joint gaskets, or adhesive butyl joint sealant completely filling the joint.
 2. After joint assembly, the gap between sections shall be packed on the inside and outside with: Masterflow 713 by Master Builders; Dry Pack Grout by Euclid Chemical; or Five Star Grout by U.S. Grout Corp., and shall be troweled smooth so that no projections remain on the inside.
 3. All exterior joints shall be wrapped with a 9-inch wide water seal satisfying ASTM C877. Three varieties are available (Type I – Rubber and Mastic Bands; Type II – Plastic Film and Mesh Reinforced Mastic Bands; and Type III – Chemically-Bonded Adhesive Butyl Bands). Wraps shall be EZ-Wrap by Press-Seal Corp; ConSeal CS-212 by Concrete Sealant Inc; Cretex External Wrap by Cretex Specialty Products; or equal.
 4. No holes shall be cut into the manhole section closer than 6 inches from joint surfaces.
- F. Pipe Connectors: Flexible rubber boot shall be supplied with the manholes to tie the pipe to the barrel section to allow for differential settlement of the pipe and the manhole. These watertight gaskets and stainless steel clamps shall meet the requirements of ASTM C923.
- G. Manhole Bench: All benches in manholes shall be made of red brick masonry.
- H. Mortar used for sewer structures shall conform to ASTM specification C144 as to aggregate and strength. No mortar that has stood beyond forty- five minutes shall be used. Proportion by volume for different kinds of Work shall be:

Table 5-3 Mortar Proportion by Volume

Brick Masonry	1 part cement to 2 parts sand
Pointing	1 part cement to 1 part sand

- I. Steps for precast manholes shall be of 0.5-inch steel reinforced copolymer polypropylene plastic, or approved equal, conforming to ASTM C-478, and OSHA requirements. All steps within a manhole shall be of the same design, type and size. Mixing of unmatched steps within the same manhole is not permitted. Steps are to be cast in or grouted solid into the precast units, bolted-on type is not acceptable. Loose steps shall be cause for rejection of that manhole cone or section.
 - 1. Steps shall be manufactured by M.A. Industries, Inc., American Step Company, Inc., Meadow Burke, or equal
 - 2. Steps shall also be provided on outside of raised manholes when top elevation is greater than 3 feet above existing ground elevation.

- J. Manhole frames and covers shall be made from tough, close-grained, gray iron free from blowholes, shrinkage, and cold shuts, meeting the requirements of ASTM A48. All covers must be domestically cast and so indicated by manufacturer name and “USA” in castings (castings manufactured outside the United States will not be accepted).
 - 1. The cover shall provide a minimum access diameter of 24 inches (i.e. 26-inch cover).
 - 2. When located in a traveled area (road or sidewalk), the manhole frame and cover shall be heavy duty cast iron (Class 35). When located in a lawn or in a field, the manhole frame and cover may be lighter duty cast iron (Class 30).
 - 3. The mating surfaces shall be machined. The cover shall not rock in the frame.
 - 4. Infiltration between the cover and frame shall be prevented by proper design and construction. Covers shall have a maximum of two (2) pick holes.
 - a. Manholes located in areas subject to flood shall be supplied with HDPE infiltration pans that are placed between the casting frame and cover as manufactured by: Cretex Specialty Products; No Flow in Flow; The Rainstopper; or equal. Pans shall be equipped with strap to facilitate its placement and removal.
 - 5. Covers shall have “SEWER” cast into the face.
 - 6. Manholes which extend above grade shall have a flat top with the frame cast into the slab. The top surface shall be large enough to accommodate the cover lifting device and the cover.

- K. Special Fittings: The wyes, tees, and bends used in the construction of the drop manholes assembly shall be either PVC or ductile iron matching the adjoining pipe. The pipe and fittings shall conform to the specifications herein. Exterior drop manhole assemblies shall be encased in CDF, or as required by the Director.

- L. Exterior Dampproofing: Bituminous dampproofing shall be non-asbestos, fibered mastic conforming to ASTM D1227, Type II consistent with 220AF by Karnak Corp.; HE789 by Henry Company; SEALMASTIC Emulsion by W.R. Meadows; or equal. The waterproofing product shall not mar or interfere with the specified exterior finish for these structures.
- M. Rubber Grade Rings: Rubber rings shall be offered in various thicknesses in flat and tapered models that match the clear opening of the manhole casting. A polyurethane or polyester adhesive/sealant shall create watertight seal between the joining materials (e.g. cast iron, rubber, concrete). Grade rings shall be Pro-ring by Cretex; Infra-riser by EJCO; Flex-O-Ring by American Highway Products; or equal.
- N. Interior Epoxy Coating: The structural protective coating system shall be a non-toxic, 100% solids, solvent-less, 2-part epoxy resin system consistent with S301 System by Warren Environment; Raven 405 System by Raven Lining Systems; CPP Sprayliner MH by Epoxytec; or equal.
 - 1. The epoxy coating system shall be continuously bonded to all brick, mortar, concrete; chemical sealant, grout, pipe, and other surfaces in accordance with ASTM D4541. The cured surface shall be impenetrable, preventing infiltration in the manhole and also be resistant to chemicals, compounds, and elements commonly found in sanitary sewers and storm drains.
 - 2. Substrate repair materials shall be compatible with the epoxy coating system and be capable of filling gaps/holes and stopping infiltration that which exceed the tolerances allowed for proper epoxy coating installation.
- O. Vent Stack: Above-grade vent stack and odor control canister for sealed sewer manholes shall be constructed of a durable material resistant to sulfide and weather corrosion. The odor control scrubber shall contain replaceable media capable of removing 99% of Hydrogen Sulfide in an airstream with a 10-ppm concentration. Vent and scrubber selection are subject to Town approval.

5.03 Installation

- A. Refer to Section 2.00 for trenching and surface restoration.
- B. All sewer crossings under State roads shall be made in accordance with the requirements of applicable MassDOT permits.
- C. In accordance with Section 1.04 herein, protection shall be afforded to all underground and surface structures using methods acceptable to the Director or Engineer. This protection shall be furnished at the expense of the Contractor.
- D. Preparation of Trench: Bedding support for manholes and structures shall provide uniform bearing of the surface area of the structure's base. Material shall be placed to make a firm, flat bottom and leveled. Then compacted in advance of place the base section. The thickness of the

of the bedding layer below the manhole shall be in accordance with the Sewer Manhole Detail appended herein.

- E. After the bedding has been properly graded and bedded, the manhole sections shall be carefully lowered into the trench by approved methods. Under no circumstances shall the pieces be dropped into the trench. All damaged sections shall be removed from the job. All damaged manholes are structures shall be replaced at the expense of the Contractor.
- F. Fabricate and install manholes and structures such that the cone section shall not extend closer than eight inches and not more than 16 inches from the top of the manhole cover. Install rubber grade rings such that the top of castings will be flush with the grade of the temporary or permanent paving surface. Stack ring(s) and secure joints with adhesive/sealant in accordance with the manufacturer's instructions. No more than 3 courses of rings shall be allowed to adjust casting to grade.
- G. All holes in sections used for handling the sections shall be thoroughly plugged with mortar. Mortar shall be one part cement to 1 1/2 parts sand, mixed slightly damp to the touch (just short of "balling"), hammered onto the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.
- H. The Contractor shall furnish two coats of waterproofing over the entire exterior surface of concrete manholes and structures, total a minimum dry film thickness of 16 mils. Factory applied coatings shall be touched up as necessary after placement of the manhole. Cast-in-place structures shall receive field coats in accordance with the manufacturer's instructions. Dampproofing and shall be applied to dry surfaces under proper weather conditions prior to backfilling
- I. Manhole pipe channels shall be constructed with a width equal to that of the penetrating pipe interior diameter, and a height equal to the springline. The flow channel through the manholes shall conform in shape and slope to that of the sewers entering and leaving the manholes. The invert shall be brushed and troweled that a minimum energy loss occurs in the manhole from invert roughness.
 - 1. Provide a minimum 0.1-foot drop through the manhole. When curved flow channels are required, including branch inlets, increase minimum slopes to maintain acceptable velocities.
 - 2. Provide benches on each side of every manhole channel. They shall start at the top of the channel and slope upward to the manhole walls at an angle in accordance with the Sewer Manhole Detail appended herein. No lateral sewer, service connection, or drop manhole pipe should discharge onto the surface of the bench.
 - 3. At the time of installation, bricks shall be moistened by a suitable means until they are neither so dry as to absorb water from the mortar, nor so wet as to be slippery when laid.
 - 4. Each brick shall be laid as a header in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and shall be thoroughly bonded as directed.

5. Side inverts shall be curved and main inverts (where direction changes) shall be laid out in smooth curves of the longest possible radius which is tangent to the center line of adjoining pipe
6. "Bowl" shaped invert will not be allowed.
7. At the discretion of the Contractor, manholes on private property may have a piped invert. Utilize 45-degree bends (2 bends to comprise a 90-degree bend) and a straight section no less than 24 inches in length. A concrete table shall be poured and shaped so as to provide positive drainage to the manhole invert, and a cut-out provided in the center section PVC.
- J. Pipes penetrations into existing manholes shall be core drilled and sealed with a rubber boot per the manufacturer's written instructions.
- K. Manhole steps shall be cast in, or grouted solid into the precast section at the interval indicated on the Sewer Manhole Detail herein. Align vertically and place where not in conflict with the pipe penetrations.
- L. Vent stacks for sealed sewer manholes shall be installed in accordance with Section 5.01 herein. Above-grade vent shall be placed out of the vehicular and pedestrian travel way. Location and approval are subject Town approval.
- M. The Engineer shall inspect assembled structure before backfilling occurs.
- N. The initial and final backfill shall be in accordance with Section 2.03 herein.
- O. Application of Interior Epoxy Coating System
 1. Conduct substrate inspection and surface preparation in accordance with the manufacturer's recommendations.
 2. Install epoxy product in accordance with the manufacture's instructions using approved equipment. Apply the necessary coats to obtain a minimum thickness of 0.25 inches (250mils).
 3. After lining has cured, visually inspect for evidence of infiltration. Confirm absence of pinholes, voids, delamination, etc. via Holiday Testing. Conduct two Bond Tests per manhole in accordance with ASTM D4541.
- P. Acceptance of the installed manhole or structure shall be in accordance with Section 9.04 herein.

6.00 Pump Stations and Force Mains

6.01 Basic Requirements

- A. Force Main Pipe Material: Force main pipe material shall as specified in Section 3.03:
- B. Velocity: At design average flow, the force main velocity shall maintain a minimum of 3 feet per second.
- C. When the daily average design detention time, in the force main, exceeds 20 minutes, the manhole and sewer line receiving the force main discharge or the sewage shall be treated so that corrosion of the manhole and the exiting line are prevented. The corrosion is caused by sulfuric acid biochemically produced from hydrogen sulfide anaerobically produced in the force main.
- D. Variable Terrain: As far as possible, the alignment and depth of a force main should provide a constant upgrade profile. All force mains shall be designed and installed so that a minimum of 5 feet of cover material is over the crown (top) of the pipe at all times.
- E. Air Relief Valve: An automatic air relief valve shall be placed at all relative high points in the force main and at 400 feet intervals on level force main runs. All air relief valves shall be protected from freezing.
- F. Drain Valves: Drain valves at all relative low points in the force main shall be provided. These valves shall be connected to gravity sewers or provided with connections for vacuum pumper trucks. All drain valves shall be protected from freezing.
- G. Termination: Force mains shall enter the gravity sewer at a point not more than 2 feet above the flow line of the receiving manhole.
- H. Testing: Leakage Testing shall be in accordance with Section 9.02 herein.

6.02 Design

- A. A sewage pumping station shall handle the projected peak sewage flows of its tributary sewer collection system, as recommended by TR-16, Guides for the Design of Wastewater Treatment Works (Technical Report #16) and the Hydraulic Institute's recommended standards for pumping stations. This information may be included in a Comprehensive Management Plan or other engineering report and any applicable updates or amendments. Pumping stations shall accommodate future expansion, when in the opinion of the Director it is appropriate.
- B. Site Layout: Stations shall be readily accessible to personnel and service vehicles during all weather conditions.

- C. Flood Protection: Wastewater pumping stations shall be protected from physical damage by the 100-year flood elevation and shall remain fully operational and accessible during the 100-year flood. All entrances and/or non-sealable openings of the station shall be a minimum of one foot above the 100-year flood elevation. These flood elevations shall be determined from the Federal Emergency Management Agency, the U.S. Army Corps of Engineers, and from Local regulations and ordinances.
- D. Environmental Considerations: Wastewater pumping stations shall be sensitive to the environmental conditions of the site. Visual impacts, architectural style, security, noise levels, odor control, and landscaping shall be considered carefully in station design and shall be reviewed and approved by the Director.
- E. Types of Stations: Wastewater pumping stations fall into three categories: Wet well/Drywell; Submersible; or Suction Lift. The preferred type of station is the Suction Lift type. The Director may approve other types under certain circumstances.
- F. Structural Design: Stations shall withstand earthquake loads and uplift forces from high groundwater conditions.
- G. Separation: Wet wells and drywells, including their superstructure, shall be completely isolated. Common walls shall be sealed against gas leaks.
- H. Equipment Removal: Provisions shall be made for removing all equipment (i.e., pumps, motors, mechanical screens, motor control centers, etc.) from the station. Access openings, hatches, and/or skylights shall be sized accordingly. Permanent hoisting devices shall be provided, as necessary.
- I. Substructure: Station substructures shall be constructed of reinforced concrete, either cast-in-place or precast.
- J. Access: The designer shall minimize areas designated as confined space and shall indicate which spaces meet the definition of a Confined Space on the Drawings. Suitable, safe, and separate means of access shall be provided for drywells and wet wells. Stairways and/or steps are required for drywells and wet wells containing either bar screens or mechanical equipment that requires inspection or maintenance. A landing with railings shall be provided for stairways or ladders for every 10 vertical feet. Local, State and Federal safety codes shall govern in all cases.
- K. Pumps: As a minimum, two pumps shall be provided, with each pump being capable of handling peak design flows. Where three or more pumps are provided, the overall station capacity shall be capable of at least handling peak design flow when any one pump is out of service.
- L. Pump Design: Pumps shall be designed specifically for wastewater use and shall be non-clogging and as allowed by the Director.
- M. Incoming Wastewater and Discharge Rate: Pump stations shall balance the rate of incoming wastewater with the rate discharged.

- N. Each pump shall have an individual intake valve.
- O. Pump suction and discharge openings shall be a minimum of 4 inches in diameter.
- P. Centrifugal Pumps: Centrifugal pumps shall be used in drywell/wet well pump stations. The pump casing and suction elbow shall be provided with a clean-out access port. Impellers shall be enclosed or semi-open. To ensure primed pump conditions, the wet well level shall not drop below the centerline of the pump impeller under normal operating conditions.
- Q. Submersible Pumps: Submersible pumping stations may be used when, in the opinion of the Director, circumstances warrant. It shall be possible to remove and replace the submersible pumps without dewatering the wet well to disconnect the piping. Pumps shall be of the pull-up design, using a lifting cable and guides for pump removal. The pump shall be connected to the fixed discharge piping with a self-locking coupling. Shaft seal failure or potential seal failure detection alarms shall be provided. Submersible pumps may also be used in a wet well/drywell configuration, with the Director's approval.
- R. Suction Lift Pumps: Suction pumps shall be self- or vacuum-priming.
- S. Location of Pumping Controls: The pump equipment compartment shall be above grade, or offset, and shall be isolated from the wet well to prevent humid and corrosive sewer atmospheres from entering the equipment compartment. Access to the wet well shall not be located in the equipment compartment. Valves shall not be located in the wet well.
- T. Self-priming Pumps: Self-priming pumps shall be capable of rapid priming at the Lead Pump-On Elevation. Such self-priming and repriming shall be accomplished automatically under design operating conditions. Suction piping shall not exceed the size of the pump suction and shall not exceed 25 feet in total length. Priming lift at the Lead Pump-On Elevation shall include a Safety Factor of at least 4 feet from the maximum allowable priming lift for the specific equipment at design operating conditions. The combined total of the Dynamic Suction Lift at the Pump-Off Elevation and required Net Positive Suction Head at design operating conditions shall not exceed 22 feet.
- U. Vacuum-priming Pumps: Vacuum-priming pump stations shall be equipped with dual vacuum pumps capable of automatically removing all air from the suction lift pump. The vacuum pumps shall be adequately protected from sewage damage. The combined total of the Dynamic Suction Lift at the Pump-off Elevation and required Net Positive Suction Head at design operating conditions shall not exceed 22 feet.
- V. Divided Wet wells: Wet wells shall be divided into two sections that are properly interconnected and gated to facilitate isolation for repair and cleaning.
- W. Storage Capacity: The effective storage capacity of the wet well shall be based upon the recommended number of pump starts per hour, and the design filling time. The effective volume of the wet well shall be based on a filling time of 30 minutes under design average-daily-flow rates. To determine the frequency of starts used for design, refer to the pump manufacturer's warranty.

- X. Where tributary wastewater flows are anticipated to be significantly less than the design average flow, provisions should be made so that the filling time under initial conditions does not exceed 30 minutes (i.e., providing a divided wet well or shortening the wet well operation range). In addition, the duration of storage time in the pump station and force main does not result in septic conditions in the system or the release of objectionable odors to the environment.
- Y. Pump Protection: Pumps shall be protected from large solids by readily accessible mechanically cleaned bar racks (screens) or combination device located at the wet well influent. Bar racks should have clear opening not exceeding 1.25 inches unless pneumatic ejectors are used, or special devices are installed to protect the pumps from clogging or damage.
- Z. Floor Slope: The wet well floor shall have a minimum slope of 1-to-1 to the hopper bottom. The horizontal area of the hopper bottom shall be no greater than is needed for proper installation and function of the wet well inlet, considering the optimal velocity at the suction bell.
- AA. Vortexes: The wet well and suction inlet configuration for dry-pit pumps shall eliminate the possibility of vortexes. The required submergence of the intake valves shall be determined for the dry pit pump's location. Intake bells should be flared, with the inlet opening facing down. Every effort shall be made to minimize flow rotation in the wet well.
- BB. Sewage Channels: If sewage channels are located in wet wells, they shall be covered with nonskid, corrosion-resistant grating. They shall be installed flush with a floor, and capable of supporting anticipated loads. All channels shall be designed to drain when not in use. Where the side walls meet the floor of the channel, fillets shall be provided.
- CC. Inlet Sewers: Sewer piping entering a drywell shall not have air in the pump suction line.
- DD. All wall penetrations between the wet and drywells shall withstand gas leaks and be located as high as possible to prevent overflow from the wet well to the drywell.
- EE. Drywells: Automatic heating and dehumidifying equipment shall be provided in all drywells. The electrical requirements shall meet those outlined in subsequent paragraphs of this section.
- FF. Drywell Draining: A sump pump shall be provided in the drywell to remove extraneous water. The discharge pipe of the sump pump shall be equipped with dual check valves and shall be pumped from the drywell into the wet well above the high-water level. Water ejectors connected to a potable water supply shall not be permitted. All floor and walkway surfaces shall slope to a point of drainage. Pump seal leakage shall be piped or channeled directly to the sump.
- GG. Valves. Suitable shutoff valves shall be placed on the suction and discharge lines of each pump (except on submersible and vacuum-primed pumps). A suitable check valve shall be placed on a section of each discharge line between the shutoff valve and the pump. Valves shall have grease fittings and be serviceable, and shall not be located in wet wells.

HH. Unless adequate space is available in a dry pit pump room, valves on the discharge piping (including flow meters, if required) shall be in a separate precast concrete vault.

II. Every pump station shall include appropriate valves and quick disconnects to allow the Town to bypass the existing pumping equipment and valves. The piping shall allow the Town to install temporary piping into the wet well, and discharge to a location downstream of the check and shutoff valves.

6.03 Controls

A. All pump stations, grinder pump stations, vacuum sewer stations, and other sewer handling facilities that are required by the Director, shall be connected to the Sewer Departments' Supervisory Control and Data Acquisition (SCADA) System.

B. All sensing, alarm, and SCADA system devices shall be of the same type, configuration, and function as that used by the Town Departments. Each pumping station shall have its own screen display, processor logic controller (PLC), and communications equipment for the SCADA system and shall also display the required monitoring controls and alarm on the all SCADA system screens of the sewer systems.

C. Level Sensing Devices: Level sensing devices shall not be adversely affected by flows entering the wet well or by the suction of the pumps. The pumps shall be automatically alternated. Running-time meters shall be installed at all pumping stations for each pump.

D. Alarm Systems: Alarm systems shall be provided for all pumping stations. At a minimum, the alarm system shall be activated in any one of the following cases:

1. High water in the wet well;
2. Low water in the wet well;
3. Loss of one or more phases of power supply;
4. High water level in the Pump Room (i.e. Drywell) sump;
5. Loss of the alarm transmission or communications;
6. Loss of air pressure in the bubbler tube system/level sensing trouble or failure;
7. Standby power failure
8. Malfunction of the pump (e.g. leak detection and temperature alarms);
9. Smoke/fire alarms;
10. Surge suppressor failure;
11. PLC processor failed;
12. PLC low battery; and

13. Three spare connections

6.04 Ventilation

- A. General: Adequate ventilation shall be provided for all pumping stations. Where the pump pit is below the ground surface, mechanical ventilation is required. When screens or mechanical equipment requiring maintenance or inspection in the wet well, provide means of adequate air exchange. The wet and dry well ventilation systems shall not be connected. In pits more than 15 feet deep, multiple inlets and outlets shall be installed. Switches for the operation of ventilation equipment shall be marked and located conveniently. If odors are a problem, an odor control system shall be installed.
- B. Wet well: Ventilation may be either continuous or intermittent. For continuous ventilation, at least 12 air changes per hour shall be provided. For intermittent ventilation, at least 30 air changed per hour shall be provided. Heating shall be installed where needed.
- C. Drywells: Ventilation shall be continuous. Heating and dehumidification are required. At least 6 complete air changes per hour shall be provided.

6.05 Flow Measurement

- A. Suitable devices for measuring wastewater flow and power consumption that are approved by the Director shall be installed in all pump stations.

6.06 Water Supply

- A. Water under pressure shall be provided for cleaning the pumping station or for other facility operation (e.g. bathrooms, if applicable) . If a public water supply is used, a Reduced Pressure Zone (RPZ) backflow preventer or other approved device shall be installed on the water service entering the station. No other potable water supply, or piping systems/fixtures shall be connected to the systems that are supplied by the public water supply.

6.07 Electrical

- A. Electric Equipment: Electrical systems shall be designed and installed in strict conformance with the latest edition of the National Electrical Code. Electrical equipment in enclosed places where gas may accumulate shall be noncorrosive and in compliance with the National Electrical Code requirements for Class 1, Division 1, Group D locations.
- B. Submersible Pump Motors: Electrical supply and control circuits shall allow disconnection at a junction box located at, or accessible from outside, the wet well. Terminals and connectors shall have watertight seals located outside of the wet well and shall be protected by separate strain relief.

- C. The motor control center shall be located outside of the wet well and protected by a conduit seal or other appropriate sealing method meeting the requirements of the National Electrical Code for Class 1. Division 2 locations.
- D. Drywell pump motors shall meet the requirements of the National Electrical Code for Class 1 Division 2 locations.
- E. Submersible pump motors that are totally submerged during the pumping cycle are not required to protect against explosions.
- F. Power cords for pump motor shall be flexible and serviceable under conditions of extra hard use. Ground fault interruption protection shall deenergize the circuit in the event of any failure in the electrical integrity of the cable.
- G. Power cord terminal fittings shall be provided with strain relief appurtenances and shall facilitate field connecting.

6.08 Emergency Power

- A. When the Director deems it is necessary, an independent diesel, natural gas or propane engine-generator shall be provided for electrically driven pumps. This source shall be automatically activated when, any phase of the power supply fails, or upon any fluctuation in voltage. Installation shall comply with all applicable requirements of the National Electrical Code.
- B. Small Pumping Stations: When the Director agrees that a small pump station does not require a permanent alternative power supply, electrical connections for portable standby generator or pneumatic connection for portable air compressor shall be installed as approved by the Director. Portable or towable generators shall be provided if a permanent unit is not feasible.
- C. Controls: Provisions shall be made for automatic and manual startup and cut-in. The controls shall be such that upon automatic startup under emergency conditions, shutdown can be accomplished only manually, except in conditions that would damage the generator or engine.
- D. Size.: Unit size shall be sufficient to start up and run all pumps needed to handle peak flows as well as lighting, ventilation, pump controls, and the sump pump.
- E. Exerciser: The engine controls shall be equipped with an automatic exerciser that may be set on any selected schedule to start the generator, to run it under no-load conditions, and to shut it off without activating the alarm system.
- F. Noise Attenuation: Noise attenuation components must be incorporated in the design to produce no more than 60 decibels (db) of noise at the property line.

6.09 Safety

- A. Adequate provisions shall be made to protect the operator and visitors from hazards. The design and construction of pumping stations shall meet all prescribed local, state, and federal safety laws and codes. Safety provisions shall include the following:
1. Handrails at openings, stairways, and other hazardous areas;
 2. Guards around the belt drives, gears, rotating shafts, and moving equipment;
 3. Warning signs as appropriate;
 4. Provisions for power lockout controls at all pumps and equipment;
 5. Eye wash stations where chemicals are used;
 6. Adequate lighting in all areas of the pumping station;
 7. Provisions for confined space entry in accordance with OSHA and regulatory agency requirements;
 8. First aid equipment; and
 9. Fire extinguisher.

6.10 Aesthetics

- A. The proposed architectural features and aesthetics of all above-ground structures and enclosures shall be submitted for approval by the Nantucket Historic District Commission (Planning & Land Use Services).

6.11 Odor Control

- A. Odor control equipment may be required by the Director, depending on the siting of the pumping station and force main discharge point.

7.00 Low-Pressure Sewers

7.01 Limitation on Low-Pressure Sewers

- A. Low-pressure sewer (LPS) services are prohibited except in existing pressure sewer collection system areas or by specific written approval of the Director. At the point where the private pressure system connects to the Town's collection system, the connection point must meet any and all current standards of the State and Town minimum design standards as indicated in the most recent amended rules by the Massachusetts Department of Environmental Protection (MassDEP); the Town Sewer Department Specifications; and/or the Massachusetts State Plumbing Code, whichever is the more stringent.

7.02 System Design

- A. Low Pressure Sewer Systems shall be designed by a Professional Engineer licensed in the Commonwealth of Massachusetts. All designs and drawings must be stamped and submitted to the Director for review and approval.

7.03 Low Pressure Sewer System

- A. The Town has standardized on the Barnes EcoTRAN™ System where a property can not discharge to the Town's collection system via a gravity building service pipe. Other LPS systems will be considered for approval on an "or equal" basis provided these units meet or exceeds the following features and flow capacities of the EcoTRAN™ System.
 - 1. The system shall offer various models that can either satisfy high head or high flow demands.
 - a. High-Head characteristics: 0 gpm @ 200 ft; to 27 gpm @ 140 ft.
 - b. High-Flow characteristics: 0 gpm @ 100 ft; to 55 gpm @ 55 ft.
 - 2. The inlet fitting shall accommodate a 4-in gravity pipe. The outlet fitting shall accommodate 1 ¼-in pressure piping. The pump discharge pipe shall have an insulation valve and check valve.
 - 3. The centrifugal pump shall macerate (i.e. grind) solids commonly found in domestic sewer (e.g. organics, paper, etc.) to a size that will not clog the discharge piping.
 - 4. The serviceable components of the wet well/pump pit (e.g. pumps, valves, level sensor) shall be accessible from the surface and be designed to facilitate removal/replacement via quick disconnect couplings and means of lifting.
 - 5. The system shall provide means of integrating the anti-floatation method into the wet well housing.

6. The wet well shall have a vent and means of venting in flood plain installations.
 7. System components shall be constructed of non-corrosive materials (e.g. plastics, rubber, bronze, brass, fiberglass, stainless steel, etc.).
 8. The level sensing equipment shall be pressure sensing or ultrasonic.
 9. The wet well/pump pit shall offer an optional decorative cover.
 10. The system shall include a remote, NEMA 4X, alarm panel that can be mounted to a building exterior. The panel shall house the circuit breakers; level and pump alarm light and horn; alarm silencer; busbar; and optional generator receptacle and automatic transfer switch. The system shall also have an optional indoor alarm to notify of wet well level and pump alarms via smart devices or email.
 11. The wet well/pump pit cover and alarm panel shall have a means of locking for security.
 12. The system shall offer a 24-month warranty.
- B. When sizing LPS Systems, refer to Section 3.01.D herein, regarding household sewer generation estimates.
- C. For pump station discharge piping that exceeds 100 feet (as measured from pump pit to Low Pressure Sewer Force Main in the street), a flush port is required and shall be located on private property.
1. A flush port shall consist of: a buried handhole constructed of material commensurate to the live and dead loads at the surface; the pump station discharge piping passing through the handhole; an isolation ball valve on the discharge piping; and flushing ports (a ball valve connected to a vertical tee on the discharge pipe, that is compatible with a flushing hose nozzle) located on either side of the isolation ball valve.

7.04 Low Pressure Sewer System Installation

- A. Install LPS System in accordance with the manufacture's written instructions.
- B. Refer to Section 3.00 for LPS piping material and installation requirements.
 1. Piping with a curved alignment or joint offset shall be installed in accordance with the limits of the manufacturer's recommendations.

7.05 Low Pressure Sewer System Acceptance

- A. Conduct Acceptance Testing in accordance with Section 9.03.

8.00 Grease Recovery Devices

8.01 Grease Recovery Device:

- A. The Town has standardized on the **Goslyn™** Grease Recovery Device (GRD) where fats, oils, and grease (FOG) removal is required as a precondition to discharging waste effluent from kitchen sinks and dishwashers to the sewer system. Other GRDs will be considered for approval on an “or equal” basis provided these unit meets or exceeds the features and flow capacities for removing FOG as the Goslyn™ Grease Recovery Device.
 1. The GRD is an Automatic Grease Recovery Device that does not hold grease within its separation tank and cannot be surcharged by simultaneous discharge of multiple sinks. It has no moving parts, timers or scrapers to clog up, accepts very hot effluents, and has a thermostatically controlled tank heater to ensure animal fats remain fluid. The system is actuated by the pressure exerted by incoming effluent which serves to eject the fats, oils, and grease from the separation tank.
- B. When sizing each GSD, the cumulative total volumes of the sinks and equipment draining into a GSD is not critical in the determination of its required flow capacity. The desired time taken to empty the sinks becomes the determining factor, together with the layout of the kitchen such as where the lines of above-floor drainage are interrupted by circulation routes, or the invert of the drain line becomes too low to enter the GSD.
- C. A further consideration is the desirability to reduce the length of the “at risk” drain lines to site the GRD as close to the sinks as practical and so minimize the risk of animal fats setting out in the drain line. The outflow from the GSD must meet all plumbing codes as to stack and venting configurations. It is important that the outflow from any GSD device has a pipe diameter equal to or greater than the GSD’s outlet, and no restrictions.
- D. The guide below lists the Goslyn™ GSD models most likely to be used in a commercial kitchen. Larger sized Goslyn™ GSD Models (50, 75, 100, 200 GPM and higher) are available for food processing facilities and industrial scale operations:
 1. GOS 40 and GOS 40 LP (10 gpm):
 - a. Rinse sink + Dishwasher + slop sink; or
 - b. Single double or three compartment sink + slop sink;
 - c. Either of the above + Combi oven + Wok + Rotisserie.
 - d. Low profile unit for under sinks and where drain lines are low.
 2. GOS 60 LP (15gpm):
 - a. Rinse sink + Dishwasher + slop sink; or

- b. Single double or three compartment sink + slop sink.
 - c. Either of the above + Combi oven + Wok + Rotisserie.
3. GOS 80 and GOS 80 LP (25gpm):
- a. Rinse sink + dishwasher + single, double or three compartment sink + Combi oven + Wok + Rotisserie + slop sink.
 - b. Low profile unit where GOS 80 inlet invert is too high.
- E. Consult the distributor listed below for design and dimension details. The Goslyn™ GSD units are distributed by:
- Dunegrass Corporation:
Phone: 212-427-8227
Contact: Ted McKay
sales@dunegrasscorporation.com
- F. Install grease recovery device in accordance with the manufacture's written instructions.
- G. External Grease Interceptors shall be required for all commercial, industrial, and multi-family units in excess of four (4) units. Grease Interceptors shall be properly designed, sized and installed to facilitate proper access to perform maintenance and pumping. The External Grease Interceptor design specifications shall be submitted to the Director.

9.00 Testing and Inspection

9.01 Sewer Pipe Testing

- A. The L.U.I. shall test the first section of pipeline as soon as it is installed to demonstrate that the Work conforms to these specifications. The initial section shall not be less than five hundred (500) feet and not more than one thousand (1000) feet of pipeline. Testing of pipe shall closely follow pipe laying.
- B. The scheduling of deflection and pressure and leakage tests shall be as approved and attended by the Engineer or Director.
- C. For all sewer pipe pressure tests, the L.U.I. shall furnish an air or water test pump, an air or water meter, and suitable pressure gauge. The L.U.I. shall also furnish all labor and materials required to install suitable temporary testing plugs or caps for the pipeline and perform the test. The meter and gauge shall be installed by the L.U.I. in such a manner that all air or water entering the section under the test will be measured, the pressure in the section indicated, and they shall be kept in use throughout all tests.
 - 1. The pressure test gauge shall have been recently calibrated, and a copy of the calibration results shall be made available to the Director prior to testing.
- D. Before the Town accepts any sewer segment, the L.U.I. shall provide television footage of the entire sewer including point of connection to an existing sewer or pumping station. Television inspection shall be performed by a firm specializing in this work and shall produce the following information:
 - 1. A continuous videotape recording of the entire length of pipe being inspected. The tape shall include location of each section, direction of camera travel, a commentary of the pipe's condition, and various irregularities found and lateral connections.
 - 2. The section of pipe being televised shall be visually indicated at least once every 50 ft.
 - 3. Documentation on television logs and voice recorded on tape shall consist of the following information:
 - a. Distance from the numbered manhole (point of beginning) on each sewer section to the location of the specific condition being inspected.
 - b. Angular orientation of all above conditions inside pipe (e.g. leak at 10:00, service connection at 3:00).
 - c. Sewer size, material, and joint spacing.
- E. Deflection. Deflection tests shall be performed on all flexible pipes. The tests shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the pipe system. No pipe shall exceed a deflection of 5 percent. If deflection exceeds 5

percent, the pipe shall be replaced. The rigid ball or mandrel used for the deflection test shall have a diameter of not less than 95 percent of the base inside diameter or the average inside diameter of the pipe as specified by ASTM D2122 Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings. The tests shall be performed without mechanical pulling devices.

- F. Air Testing. The Town requires air testing for new pipe without connections to existing services in lieu of the exfiltration or infiltration tests. The L.U.I. shall submit his proposed method of air testing to the Director for approval. All air testing shall be performed in accordance with the procedures described in ASTM C828 for clay pipe or those procedures approved by the Director, and shall be specifically designed and manufactured for testing pipelines with low-pressure air and shall be provided with an air regulator valve or air safety valve set to prevent the air pressure in the pipeline from exceeding ten (10) psi. If the results of the air test are unsatisfactory, the L.U.I. shall locate and repair the defective sewer pipe and perform additional testing until the sewer pipe passes the air test at no additional cost to the Owner. If site conditions are not conducive to air test, as determined by the Director, the L.U.I. will be required to perform an exfiltration and/or an infiltration test as outlined below.
1. All sections to be tested shall be cleaned and flushed, and shall have been backfilled, prior to testing.
 2. Before pressure is applied to the line all connections shall be firmly plugged. Before the test period starts, the air shall be given sufficient time to cool to ambient temperature in the test section.
 3. Air shall be added until the internal pressure of the test section is raised to approximately 4.0 PSIG. The air pressure test shall be based on the time, measured in seconds, for a 1.0 PSIG pressure drop from 3.5 PSIG. Acceptance is based on limits tabulated in the Table 1 of ASTM C828.
 4. If the test section is below groundwater, the test pressure shall be increased by an amount sufficient to compensate for groundwater hydrostatic pressure, however, the test pressure shall not exceed 10 PSI.
- G. Exfiltration Test. If for any reason, approved by the Director, air testing can not be performed, the Director shall require exfiltration testing for new pipe without connections to existing services. Leakage tests by exfiltration shall be made before or after backfilling at the discretion and under the supervision of the Town Inspector. The length of pipe to be tested shall not exceed 1,000 feet and be such that the head over the crown at the upstream pipe is not less than two (2) feet and the head over the downstream pipe crown is not more than six (6) feet.
1. The pipe shall be plugged, by pneumatic bags or mechanical plugs, in such a manner that the air can be released from the pipe while it is being filled with water.
 2. Before any measurements are made, the pipe shall be kept full of water long enough to allow absorption of water and the escape of any trapped air.

3. Following this, a test period of at least two hours shall begin. Provisions shall be made for measuring the amount of water required to maintain the water at a constant level during the minimum two (2) hours test period. .
 4. If the water required to maintain a constant level in the pipe does not exceed twenty-five (25) gallons per nominal diameter, in inches, per 24 hours per mile of pipe and if all leakage is not confined to a few joints, workmanship shall be considered satisfactory.
 5. If the amount of leakage indicates defective joints or broken pipes, they shall be corrected or replaced. If any joint shows an appreciable amount of leakage, the joining material shall be removed and replaced
- H. Infiltration Test. If for any reason, approved by the Director, air testing and exfiltration testing can not be performed, the Director shall require infiltration testing be performed for new pipe without connections to existing services.
1. Pipe shall be tested for infiltration after backfill has been placed and the ground water allowed to return to normal elevation.
 2. Infiltration tests shall be made only under the supervision of the Engineer.
 3. The length of line to be tested shall be not less than the length between adjacent manholes and not more than the total length of each size pipe and shall not exceed 1000 feet.
 4. The allowable infiltration shall be 25 gallons per inch diameter, per day per mile of pipe in each section tested as determined by means of V-Notch weirs, pipe spigots, or by plugs in the end of the pipe to be furnished and installed by the L.U.I., in an approved manner, and at such times and locations as may be directed by the Town Inspector.
- I. There shall be no gushing or spurting leaks. If an inspection of the completed sewer or any part thereof shows pipes or joints which allow noticeable infiltration of water, the defective Work or material shall be replaced or repaired.

9.02 Force Main Testing

- A. The sewer force main pipe shall be given pressure and leakage tests in sections of specified lengths as approved by the Director.
- B. The scheduling of pressure and leakage tests shall be as approved and attended by the Engineer or Director.
- C. For these tests, the L.U.I. shall furnish a water test pump, water meter, and a pressure gauge. The L.U.I. shall also furnish all labor and equipment to install suitable temporary testing plugs or caps for the pipeline and to perform the tests. The meter and gauge shall be installed by the L.U.I. in such a manner that all water entering the section under the test will be measured, the pressure in the section indicated, and they shall be kept in use throughout all tests.

1. The pressure test gauge shall have been recently calibrated, and a copy of the calibration results shall be made available to the Director prior to testing.
- D. The section of pipe to be tested shall be filled by pumping water into it and opening the air release valves and expelling all air from the pipe. If air release assemblies are not available at high points for releasing air, the L.U.I. shall perform: all excavation(s); make the necessary tap(s) at such highpoint(s); plug said holes of the tapping saddles after completion of the test with brass or bronze plug(s); and backfill the excavation(s).
- E. The L.U.I. shall conduct a leakage test by metering the flow of water into the pipe while maintaining (in the section being tested) a pressure equal to 1.5 times the highest pressure to which the pipe will be subjected under normal conditions of service or 150 psi, whichever is greater. This shall be done by placing the section under pressure by pumping.
- F. The lengths of joint to be used in determining the allowable leakage shall be based on the nominal diameter of the pipe. The allowable leakage shall be less than 11.65 gallons per inch diameter per day per mile of force main tested, maintaining a pressure within ± 5 psi for a minimum of 2 hours duration. If the results of the pressure test are unsatisfactory, the L.U.I. shall locate and repair the defective pipe, fitting, or joint and perform additional testing until the force main passes the pressure test, at no additional cost to the Owner.
- G. If, in the judgment of the Director, it is impracticable to follow the foregoing procedure exactly, modifications in the procedures may be made if approved by the Director, but in any event the L.U.I. shall be responsible for the ultimate tightness of the line within the above leakage requirements with no allowances for leakage from valves.

9.03 Low Pressure Sewer Testing

- A. The sewer low pressure pipe shall be given pressure and leakage tests in sections of specified lengths as approved by the Director.
- B. The scheduling of pressure and leakage tests shall be as approved and attended by the Engineer or Director.
- C. For these tests, the L.U.I. shall furnish a water test pump, water meter, and suitable pressure gage. The L.U.I. shall also furnish all labor and equipment required to install suitable temporary testing plugs or caps for the pipeline and perform the test. The meter and gauge shall be installed by the L.U.I. in such a manner that all water entering the section under the test will be measured, the pressure in the section indicated, and they shall be kept in use throughout all tests.
 1. The pressure test gauge shall have been recently calibrated, and a copy of the calibration results shall be made available to the Director prior to testing.
- D. The section of pipe to be tested shall be filled by pumping water into it and opening the air release valves and expelling all air from the pipe. If air release assemblies are not available at high points for releasing air, the L.U.I. shall perform: all excavation(s); make necessary tap(s)

at such highpoint(s); plug said holes of the tapping saddles after completion of the test with brass or bronze plug(s); and backfill the excavation(s).

- E. The L.U.I. shall conduct a leakage test by metering the flow of water into the pipe while maintaining (in the section being tested) a pressure equal to 1.5 times the highest pressure to which the pipe will be subjected under normal conditions of service or 100 psi whichever is greater. This shall be done by placing the section under pressure by pumping.
- F. The lengths of joint to be used in determining the allowable leakage shall be based on the nominal diameter of the pipe. The allowable leakage shall be less than 11.65 gallons per inch diameter per day per mile of pipe tested, maintaining a pressure within ± 5 psi for a minimum of 2 hours duration. If the results of the pressure tests are unsatisfactory, the L.U.I. shall locate and repair the defective pipe, fitting, or joint and perform additional testing until the low pressure sewer passes the pressure test, at no additional cost to the Owner.
- G. If, in the judgment of the Director, it is impracticable to follow the foregoing procedure exactly, modifications in the procedures may be made if approved by the Director, but in any event the L.U.I. is responsible for the ultimate tightness of the line within the above leakage requirements with no allowances for leakage from valves.

9.04 Manhole Testing

- A. Leakage tests shall be made and observed by the Town Inspector on each manhole. The test shall be the exfiltration test or vacuum test as described below.
- B. The scheduling of pressure and leakage tests shall be as approved and attended by the Engineer or Director.
- C. For these tests, the L.U.I. shall furnish an air or water test pump, an air or water meter, and suitable pressure gage. The L.U.I. shall also furnish all labor and materials required to install suitable temporary testing plugs or caps for the pipeline, and perform the test. The meter and gauge shall be installed by the L.U.I. in such a manner that all air withdrawn from or all water entering the manhole under the test will be measured and indicated for the duration of the test.
 - 1. The pressure test gauge shall have been recently calibrated, and a copy of the calibration results shall be made available to the Director prior to testing.
- D. After the manhole has been assembled in place, all lifting holes and exterior joints surface shall be filled and pointed with an approved non-shrinking mortar. The test shall be made prior to placing the shelf and invert and before filling and pointing the interior horizontal joints. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitable plugged and the plugs braced to prevent blow out.
- E. Exfiltration Testing: After the manhole has been prepared for testing it shall then be filled with water to the top of the cone section.

1. If the excavation has not been backfilled and observation indicates no visible leakage that is, no water visible moving down the outside surface of the manhole, the manhole may be considered to be satisfactory water-tight.
 2. If the test, as described is unsatisfactory, as determined by the Engineer or Director or if the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted, if the Contractor so wishes, to allow for absorption.
 - a. At the end of this period the manhole shall be refilled to the top of the cone and the measuring time of at least 2 hours shall begin. This amount shall be extrapolated to a 24-hour rate and the leakage determined based on depth.
 - b. The leakage for each manhole shall not exceed one gallon per vertical foot per day.
 3. If the manhole fails this requirement, but the leakage does not exceed three (3) gallons per vertical foot per day, repairs by approved methods may be directed by the Town Inspector to bring the leakage within the allowable rate of one (1) gallon per foot per day.
 4. Leakage due to a defective section or joint or exceeding the three (3) gallon vertical foot per day, shall be the cause for the rejection of the manhole. It shall be the L.U.I.'s responsibility to uncover the manhole, as necessary, and to disassemble, reconstruct, or replace it as directed by the Engineer.
 5. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed and the invert constructed.
 6. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorptions, etc. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, the L.U.I. shall take any steps necessary to assure the Town Inspector that the water table is below the bottom of the manhole throughout the test
 - a. If the groundwater table is above the highest joint in the manhole, and there is no leakage into the manhole, as determined by the Town Inspector, such a test can be used to evaluate the water-tightness of the manhole. However, if the Town Inspector is not satisfied, the Contractor shall lower the water table and carry out the test as described hereinbefore.
- F. Vacuum Testing: After the manhole has been prepared for testing, the L.U.I. shall set the vacuum testing equipment. The test shall be based on the time, measured in seconds, for the vacuum to decrease from 10 inches of mercury to 9 inches of mercury for manholes.
1. Acceptance of manholes is based on the following:

Table 9-1 Manhole Acceptance

Manhole	Manhole Diameter	Time to Drop 1"Hg
10 ft or less	4 ft	120 seconds
10 ft to 15 ft	4 ft	150 seconds
15 ft to 25 ft	4 ft	180 seconds

NOTE: For 5-ft diameter manholes, add 30 seconds to the times above. For 6-ft diameter manholes, add 60 seconds to the times above.

- G. If the results of the manhole test are unsatisfactory (the allowable gallons or the time is less than that tabulated above), the L.U.I. shall repair the defective manhole section(s) and perform additional testing until the manhole passes the leakage test at no additional cost to the Owner.

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10.00 Safety and Traffic Control

10.01 General Construction Safety

- A. The Contractor and any Sub-contractors shall be responsible for the total compliance with all Federal, State and Local ordinances, laws and regulations as related to safe construction practices and for protecting the employees and the public's health and safety.
- B. The Contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.
- C. The Town of Nantucket shall not be responsible for Contractor's adherence to OSHA regulations and standards. However, the Town of Nantucket may report known violations or unsafe practices to the appropriate enforcement agency.
- D. The Contractor shall furnish safety equipment necessary to inspect the Work including, but not limited to ladders, confined space entry tripod/harness, gas detectors/oxygen sensors, blowers, etc.
- E. **Under no circumstances shall any roadway or driveway be blocked overnight without prior written permission from the Town and/or property owner.** The roadway shall be open for access to residents, businesses, emergency vehicles, garbage pick-up, school buses etc. The Contractor shall notify the Sewer Department, School Bus Garage, and Emergency Services of any temporary road closings and/or detours.
- F. If conditions permit, streets and roadways shall be kept open to at least one-way traffic, or as directed by the Nantucket Police Department

10.02 Traffic Control

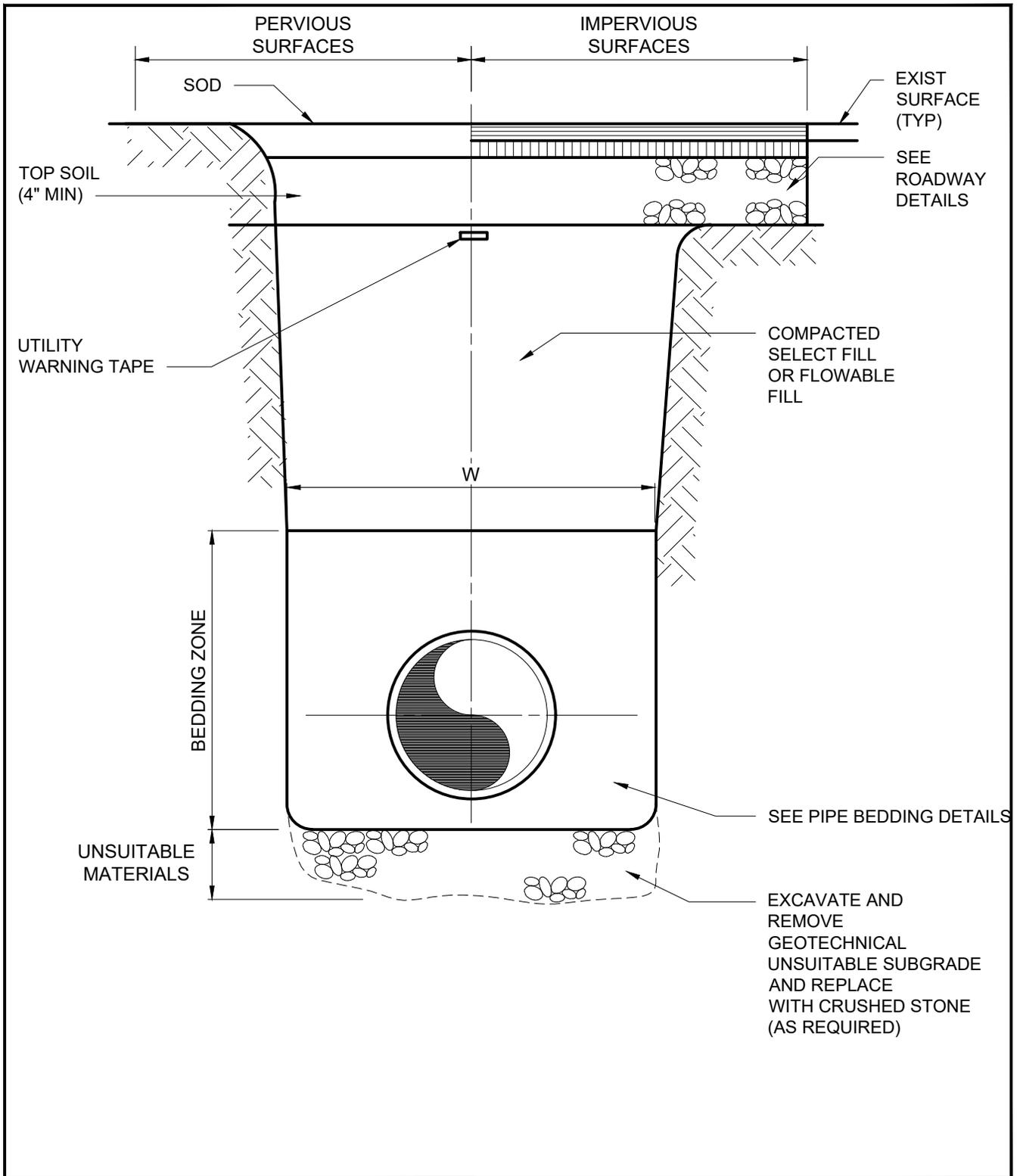
- A. Signs, barricades, warning lights, guard rails and flaggers shall be employed as necessary when construction endangers either vehicular or pedestrian traffic. These devices shall remain in place until the traffic may proceed normally again. The Contractor shall hold the Town harmless for any damages or injuries caused by the construction of sewer mains.
- B. Detours shall be set up and maintained by the Contractor under the direction of the Town et and/or MassDOT. Notice must be given a week in advance of the detour so that necessary notification of the traveling public may be made by the Contractor to the public. The Contractor will furnish all barricades, signs, lights and other safety devices to protect the construction. The Contractor is in no way relieved of liability for providing this protection because others approve the detour.
- C. Construction work zone signs and signing procedures shall conform to the Manual of Uniform Traffic Control Devices (MUTCD) supplements and to all applicable Federal, State

and Local codes. The Contractor shall be responsible for securing the necessary permits for all Work to be performed in the public rights-of-way.

- D. Safety and convenience of the public necessitate that all Work, including excavation, be done in such a manner as to cause minimum traffic interruption for, both pedestrians and vehicles (including cycles). Utilities such as fire hydrants, valves, etc., shall be accessible at all times. Gutters and drains shall be left open and clear at all times, and the Contractor shall be responsible for all drainage around his Work. Unless specifically waived by the Town, provisions shall be made to maintain vehicular traffic on all streets in which Work is in progress, and suitable walkways shall be maintained for pedestrian travel.
- E. Should extended wet weather occur during construction, the Contractor shall be responsible for any additional stone to be installed to ensure the roadway is passable.

Appendix A: Nantucket Sewer Department Standard Details

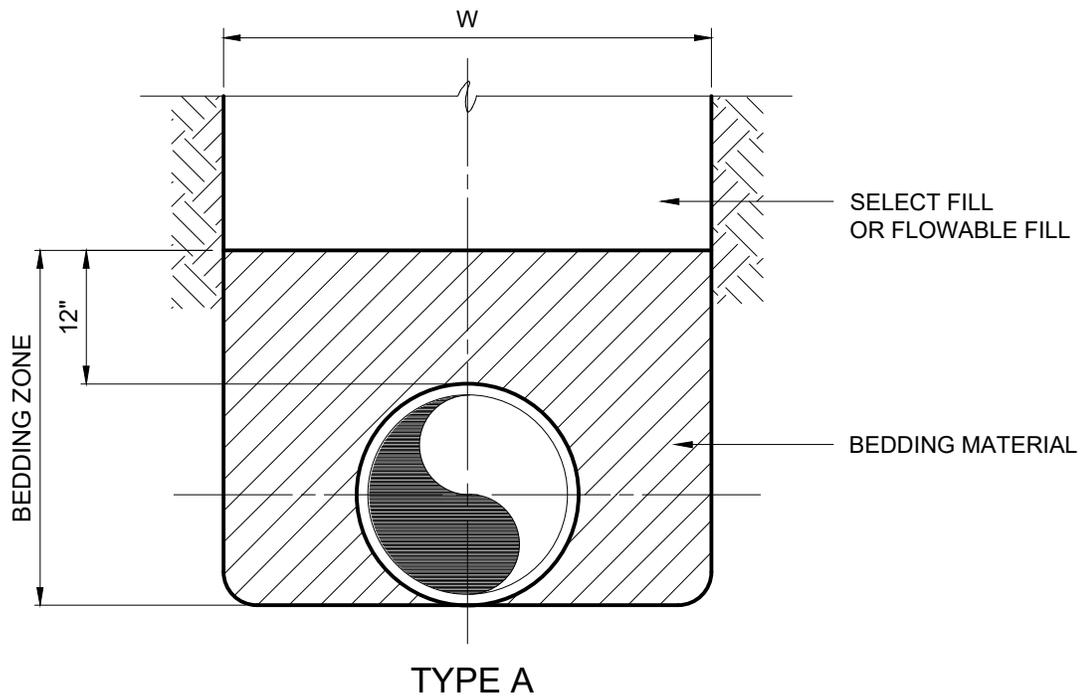
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TOWN OF NANTUCKET

STANDARD DETAILS

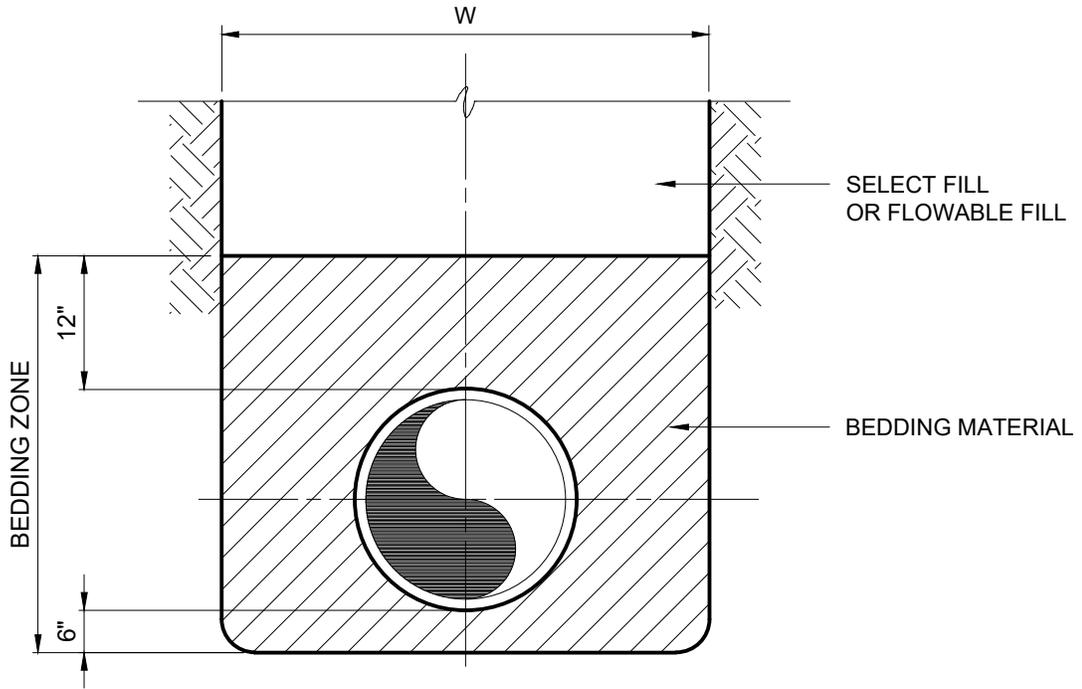
TYPICAL TRENCH
NOT TO SCALE



TOWN OF NANTUCKET

STANDARD DETAILS

TYPE A PIPE BEDDING MATERIAL
NOT TO SCALE



TYPE B

BEDDING SCHEDULE		
PIPE MATERIAL	BEDDING TYPE	BEDDING MATERIAL
PVC	B	SELECT SAND
RCP	B	CRUSHED STONE
DIP (GRAVITY)	B	SELECT SAND

SEE SECTION 2.00 TRENCHING FOR MATERIAL DESCRIPTION



TOWN OF NANTUCKET

STANDARD DETAILS

TYPE B PIPE BEDDING MATERIAL
NOT TO SCALE

TRENCH EXCAVATION LIMITS		
INTERNAL DIAMETER OF PIPE	W WIDTH OF TRENCH	
	MAX	MIN
4"-6"	3'-9"	2'-0"
8"-10"	3'-9"	2'-2"
12"	3'-9"	O.D.+2'
14"-16"	4'-2"	O.D.+2'
18"	4'-4"	O.D.+2'
20",21"	4'-8"	O.D.+2'
24"	4'-11"	O.D.+2'
27"	5'-9"	O.D.+2'
30"	6'-7"	O.D.+2'
36"	7'-4"	O.D.+2'

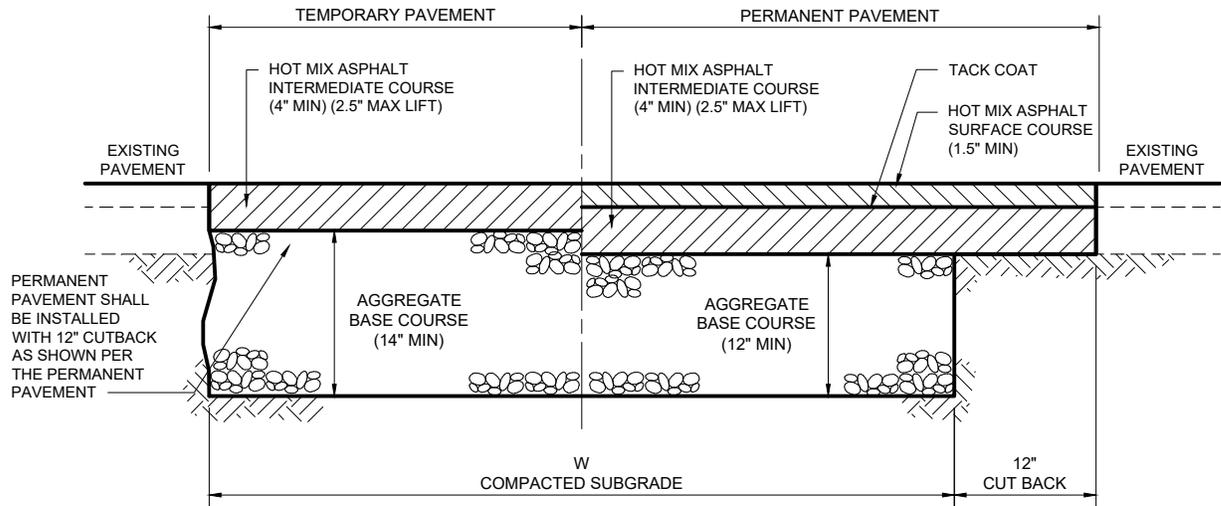


TOWN OF NANTUCKET

STANDARD DETAILS

TYPICAL TRENCH EXCAVATION LIMITS

NOT TO SCALE

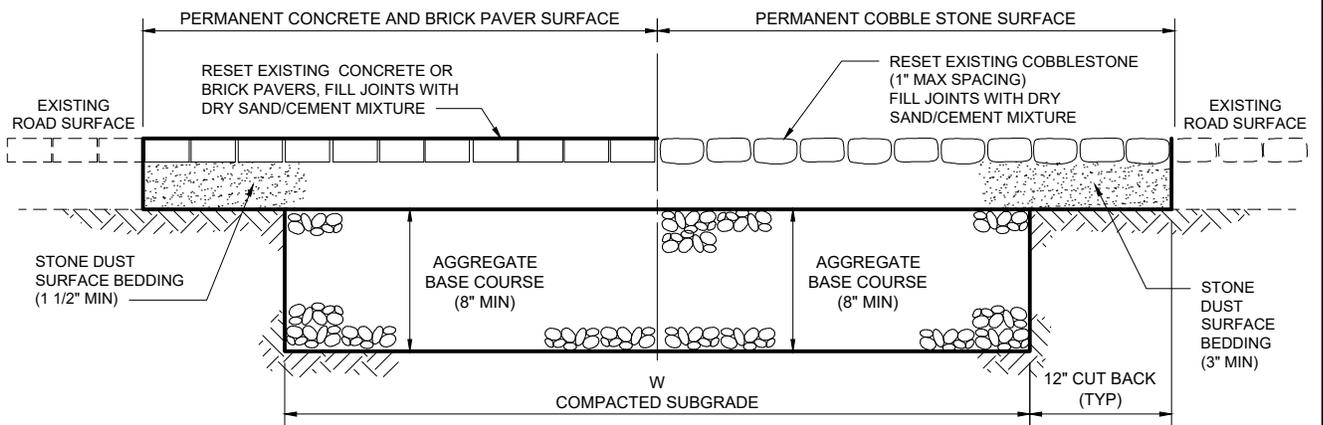


TOWN OF NANTUCKET

STANDARD DETAILS

BITUMINOUS PAVEMENT

NOT TO SCALE

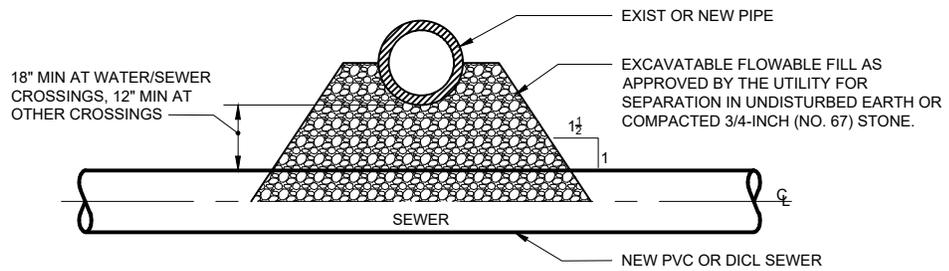
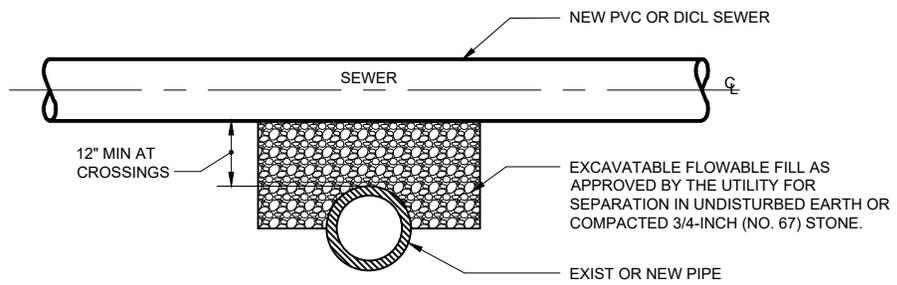


TOWN OF NANTUCKET

STANDARD DETAILS

ALTERNATIVE ROAD SURFACES

NOT TO SCALE

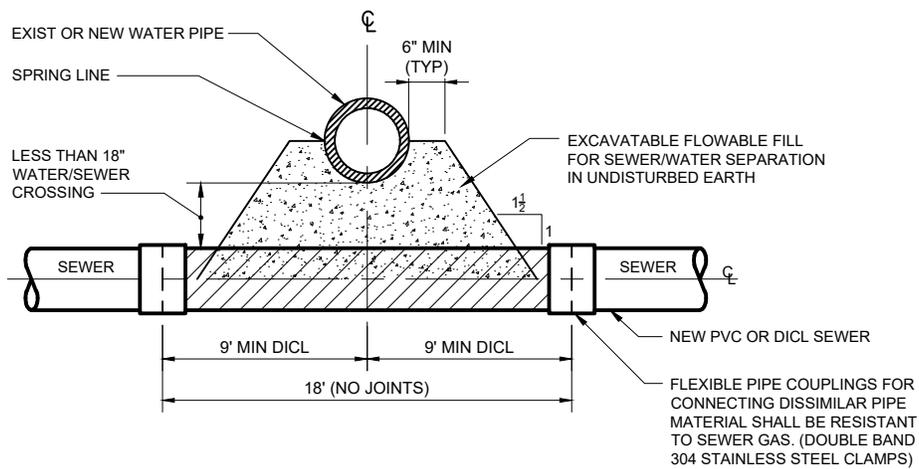


TOWN OF NANTUCKET

STANDARD DETAILS

VERTICAL SEPARATION GREATER
THAN 18" BETWEEN PIPES

NOT TO SCALE



TOWN OF NANTUCKET

STANDARD DETAILS

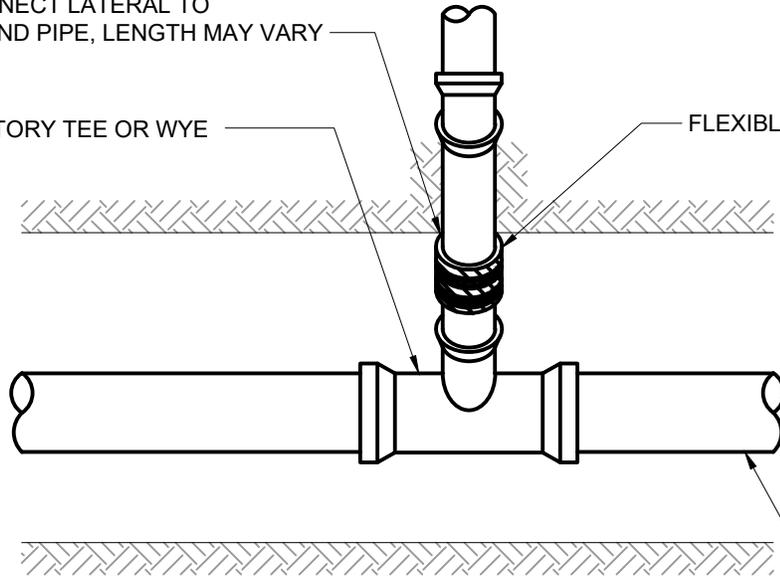
VERTICAL SEPARATION LESS THAN 18" BETWEEN WATER AND SEWER

NOT TO SCALE

CONNECT LATERAL TO
SOUND PIPE, LENGTH MAY VARY

FACTORY TEE OR WYE

FLEXIBLE COUPLING



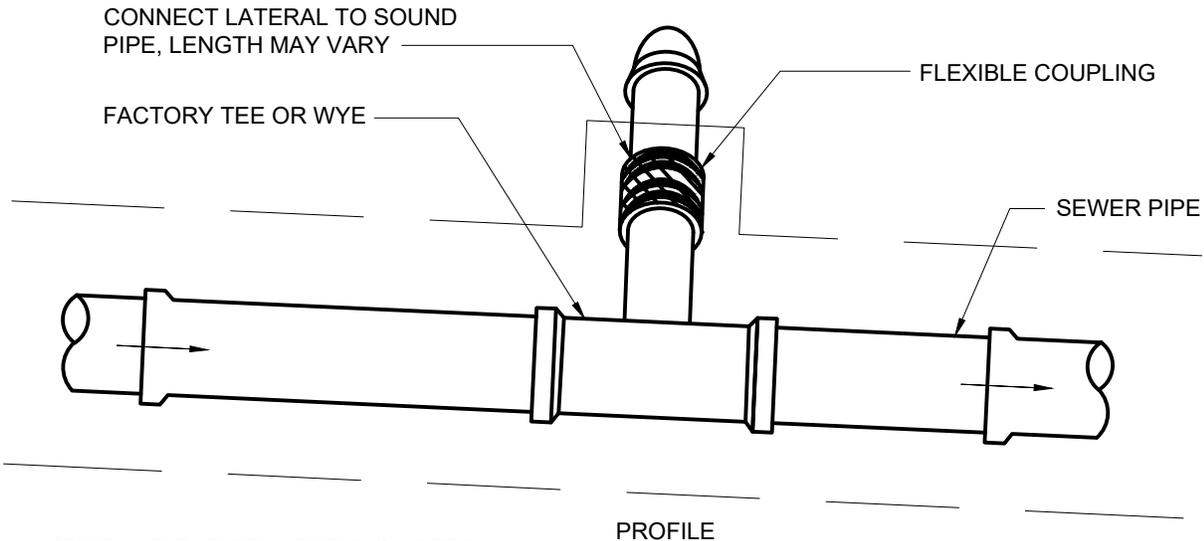
SEWER PIPE

PLAN

CONNECT LATERAL TO SOUND
PIPE, LENGTH MAY VARY

FACTORY TEE OR WYE

FLEXIBLE COUPLING



SEWER PIPE

PROFILE

(PIPE AND TAP CONNECTION) NOTES:

1. TEE OR WYE SHALL BE INSTALLED BETWEEN 0 TO 60 DEGREES AS NEEDED TO MEET THE EXISTING PRIVATE SANITARY LATERAL. WYES SHALL BE ORIENTED TO POINT TOWARDS THE DIRECTION OF MAIN LINE FLOW.
2. THE DIMENSIONS SHOWN ON THIS DRAWING ARE ONLY INTENDED TO DEFINE THE LIMITS FOR BACKFILL MATERIAL. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO "LAY BACK" THE TRENCH WALLS TO WHATEVER FLATNESS OF SLOPE IS NECESSARY TO PROVIDE SAFE WORKING CONDITIONS.
3. SEE TRENCH DETAILS FOR BEDDING AND BACKFILL REQUIREMENTS.
4. FLEXIBLE PIPE COUPLINGS SHALL INCLUDE DOUBLE 304 STAINLESS STEEL BANDS PER SIDE.

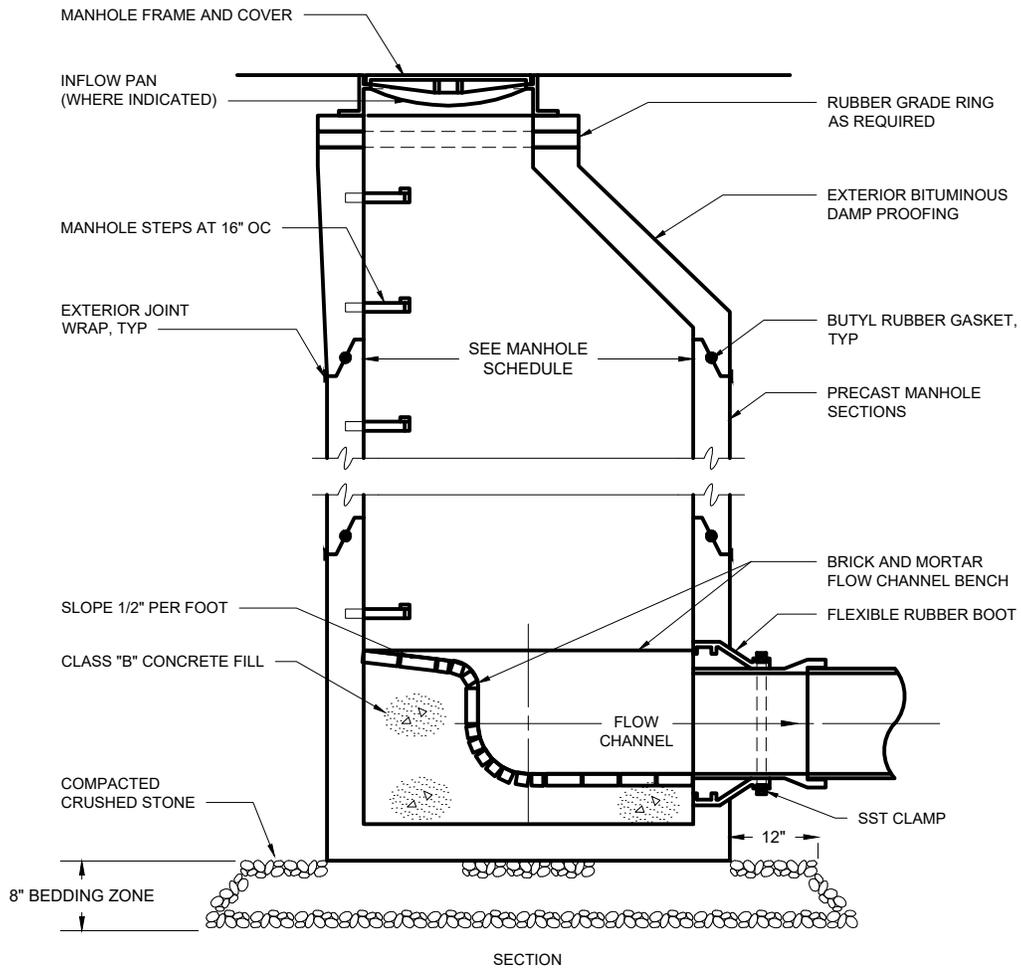


TOWN OF NANTUCKET

STANDARD DETAILS

SEWER LATERAL CONNECTION DETAIL

NOT TO SCALE



TOWN OF NANTUCKET

STANDARD DETAILS

SEWER MANHOLE DETAIL SECTION

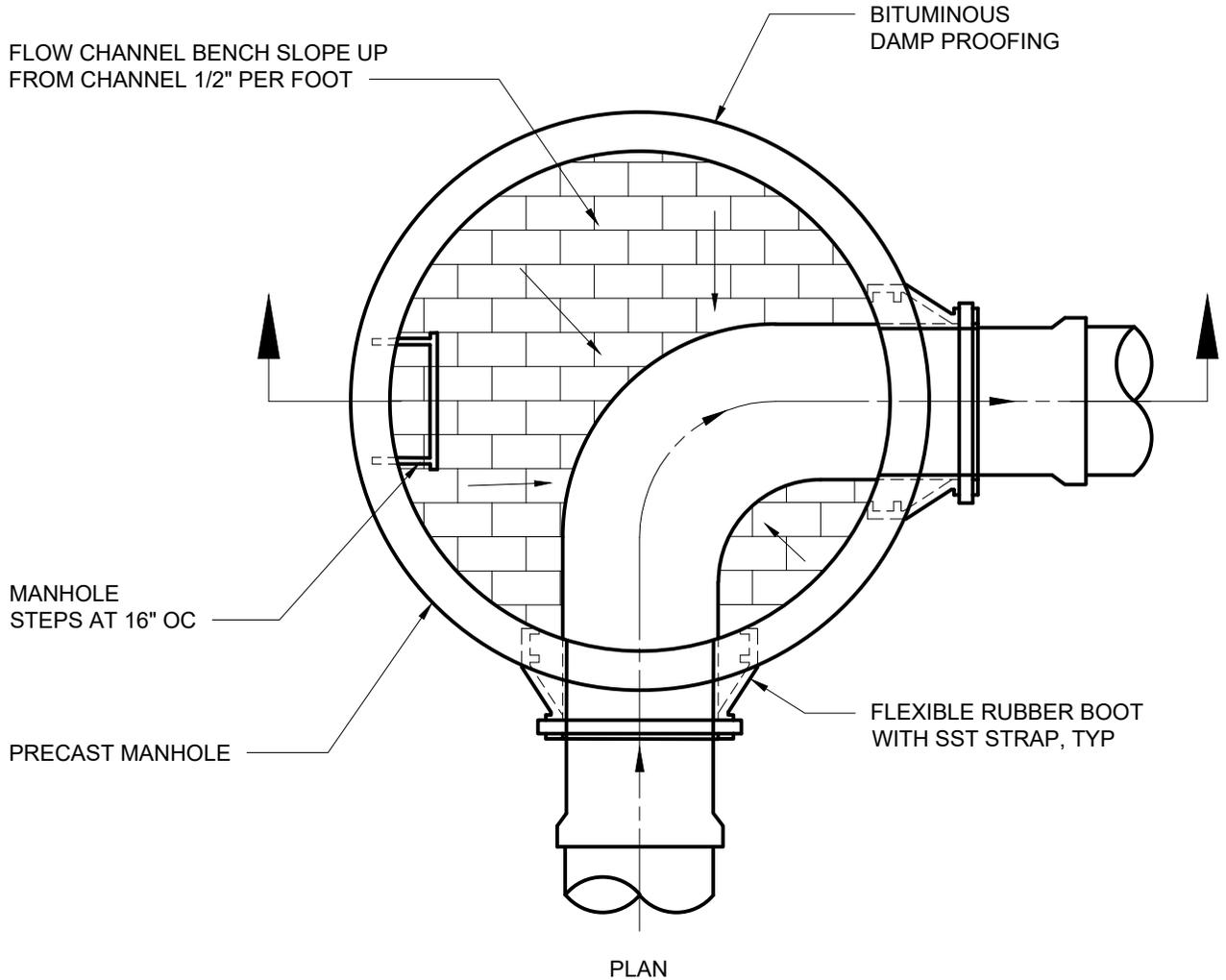
NOT TO SCALE

MANHOLE SCHEDULE

ALL MANHOLES SHALL BE 4-FOOT UNLESS OTHERWISE NOTED.

MANHOLE WALL THICKNESS

INTERIOR DIAMETER	MIN. WALL THICKNESS
4-FEET	5-INCHES
5-FEET	6-INCHES
6-FEET	7-INCHES
8-FEET	9-INCHES



TOWN OF NANTUCKET

STANDARD DETAILS

SEWER MANHOLE DETAIL SECTION

NOT TO SCALE

INFLOW PAN
(WHERE INDICATED)

H-20 REINFORCEMENT

EXTERIOR JOINT
WRAP, TYP

MANHOLE
FRAME AND COVER

RUBBER GRADE RING
AS REQUIRED

BUTYL RUBBER
GASKET, TYP

SEE MANHOLE
SCHEDULE

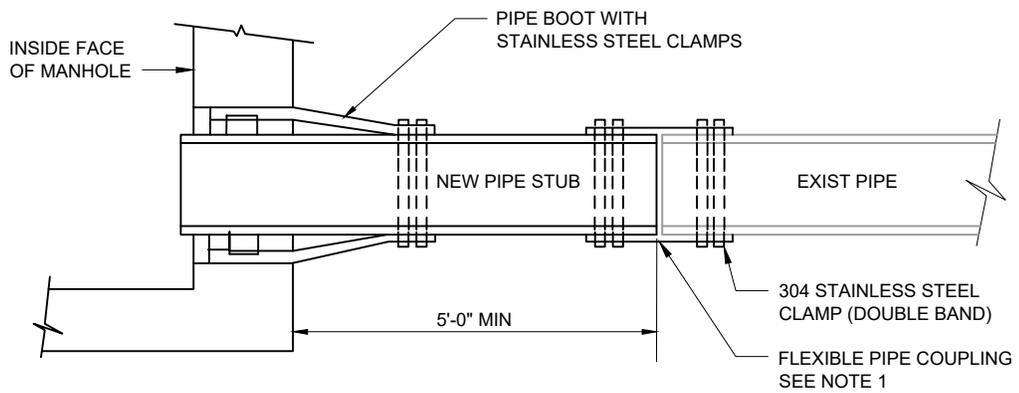


TOWN OF NANTUCKET

STANDARD DETAILS

FLAT TOP MANHOLE DETAIL

NOT TO SCALE



NOTES:

1. FLEXIBLE PIPE COUPLINGS FOR CONNECTING DISSIMILAR PIPE MATERIALS SHALL BE RESISTANT TO SEWER GAS.



TOWN OF NANTUCKET

STANDARD DETAILS

MANHOLE PIPE CONNECTION DETAIL
NOT TO SCALE