

2006

CONSTRUCTION STANDARDS



TOWN OF MERRIMACK

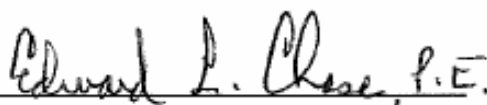
NEW HAMPSHIRE

Per Merrimack Code of Ordinances

Section: 61-2. A – D

APPROVED: 
Deputy Director of Public Works

APRIL 17, 2006
Date

APPROVED: 
Director of Public Works

April 17, 2006
Date

2006 Construction Standards

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**TOWN OF MERRIMACK
CONSTRUCTION STANDARDS
2006**

I. REFERENCES

All work performed in the Town of Merrimack, New Hampshire shall conform to the requirements of the latest edition of this manual and the following standards:

- A.** Standard Specifications and Drawings for Road and Bridge Construction of the New Hampshire Department of Transportation, as most recently adopted.
- B.** Construction Standards for Sanitary Sewer and Water Supply Systems of the New Hampshire Water Supply and Pollution Control Division.
- C.** Administrative Rules for the Permitting of Driveways and other Accesses to the State Highway System, NHDOT, Bureau of Highway Maintenance.
- D.** Manual on Uniform Traffic Control Devices for Streets and Highways, published by the United States Department of Transportation, Federal Highway Administration.
- E.** Requirements of the Department of Public Works Permit To Work Within the Right-of-Way.
- F.** Subdivision and Site Plan Regulations, and the Code of Ordinances of the Town of Merrimack, New Hampshire.

Should conflicting requirements be found among these standards, the more stringent shall govern.

II. GENERAL REQUIREMENTS

A. SITE CONDITIONS

The Contractor shall promptly notify the Director of Public Works* in writing of any unusual conditions such as:

- 1. Subsurface or latent physical conditions at the site differing materially from those indicated on the approved plans;

2. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent to work of the character provided for in the approved plans, or;
3. Encounters with a utility, whether damaged or simply unearthed, should that utility be mislocated or not shown on the approved plans.

* NOTE: When "Director of Public Works" is specified herein, it shall be interpreted as the Director or his Agent.

B. DIG SAFE

The Contractor shall be responsible for contacting Dig Safe 1-888-344-7233 (**1-888-DIG-SAFE**) at least 72 hours prior to commencement of work as required by statute. The location of all utility facilities shall be determined sufficiently ahead of excavation work to avoid damage and permit their relocation if necessary.

C. CONTROL OF THE WORK

1. Responsibility of Contractor :

The Contractor is responsible for the construction of all improvements as shown on the approved plans. The Contractor shall employ a competent construction supervisor or management team capable of establishing and maintaining all horizontal and vertical layout control, bench marks and structure locations to assure that all improvements will conform to the locations, lines, levels, and grades as indicated on the approved plans. Should site conditions warrant modifications to the approved plans, such changes shall be approved by the Director of Public Works prior to commencement of the work.

2. Compliance to Requirements:

The Contractor shall provide all Town staff safe access to the work for the purpose of ascertaining that the work is in accordance with the requirements, even to the extent of uncovering or taking down portions of finished work.

D. BACKFILL AND COMPACTION

1. All backfill material adjacent to pipes shall be compacted in layers not exceeding 12-inches of compacted thickness, by pneumatic tampers, vibratory compactors or rolling compactors. Care shall be exercised to thoroughly compact the backfill under the haunches of pipe and to assure that the backfill soil is in intimate contact with the sides of pipe. Material in

the trench backfill shall be compacted to not less than 95 percent of American Association of State Highway and Transportation Officials (AASHTO) T180, Modified Proctor. Nuclear density testing methods will be governed by ASTM D2922.

2. Backfill and fill material used in roads, travel ways and shoulders shall be natural material excavated from the trench during construction excluding: all debris, pieces of pavement, organic material, all wet or soft muck, peat or clay, all excavated ledge material, or rocks over 6-inches in largest dimension, or any material not approved by the Director of Public Works. Materials shall be backfilled from the blanketing material over pipe to the base of the roadway structural box and compacted in layers not to exceed 12-inches in compacted thickness by mechanical compaction means described above. Compaction testing shall be ordered at the expense of the Contractor if deemed necessary by the Director of Public Works. Water jetting or ponding methods of compaction shall not be allowed.

3. Deep excavations or excavations through areas of unsuitable material:

The Contractor may be required to perform extraordinary construction methods when encountering deep excavations or unsuitable materials. Alternate materials may be required to prevent long-term deflection in these areas; yet pipe materials shall remain continuous between structures. Compaction testing of the backfill material may be required at the discretion of the Director of Public Works or his Agent. This testing shall be performed at a minimum of 200-foot intervals to assure proper compaction in roadway sections. Any required testing shall be performed at the expense of the Contractor.

E. CONFINED SPACE ENTRY

1. Definition:

Confined spaces normally include tanks, vessels of any type, underground pump stations, manholes and catch basins, vaults, meter pits, chemical storage areas, pipe chases, etc. Under certain conditions, such as the presence of soil contamination or organic deposits, even open construction trenches may pertain.

2. Policy Requirements:

Should any Contractor, Skilled Trade Worker, or Private Individual find it necessary to enter a confined space owned, maintained or operated by the Town of Merrimack they must comply with the Confined Space Entry Policy, Department of Labor Administrative Rules for Safety & Health, Section LAB 1403.15 Confined Space Entry.

Should a Town employee be required on a private site the Owner will be responsible to comply with the Town of Merrimack's Confined Space Entry Policy.

F. MAINTENANCE OF TRAFFIC

1. Scope:

This work shall consist of providing and maintaining safe and passable traffic accommodations for public travel, preventing dust nuisance, furnishing, erecting and maintaining construction signs, barricades, delineator lights, flashers and other warning devices as shown on the plans or as required by the Director of Public Works. All traffic control devices used on street and highway construction, maintenance, utility or incident management operations shall conform to the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways.

2. Construction Requirements:

A Town Excavation Permit is required of all Contractors performing work within a public street. A DIG SAFE Request Number is needed for an Excavation Permit. The Contractor shall provide and maintain a sufficient surface for at least one lane traffic of a minimum 12-feet in width controlled by the use of flaggers or uniformed officers, 2-way radios or pilot vehicles. Construction materials or equipment shall not be left within the public right-of-way during work suspensions.

3. Construction Signs:

All construction signs, barricades and warning devices shall be installed prior to the commencement of work activities and shall be free of chipping or damage that may render the device unsatisfactory or detract from reflectiveness. All construction signs as shown on the plans or as ordered by the Director of Public Works shall be erected on posts, barricades or easels so that all text is horizontal. At any time during the life of the project, at the discretion of the Director of Public Works, any sign, barricade or warning device that is damaged, disfigured or found to be in unserviceable condition shall be required to be replaced at the cost of the Contractor. Programmable message boards shall be provided by the Contractor as directed by the DPW Director.

Should a detour be necessary, all required signing to adequately direct traffic back to the traveled route shall be in place prior to the start of the work. The Contractor, or his Engineer shall prepare a detailed detour plan per MUTCD guidelines, and submit two (2) copies to the Director for review and approval prior to instituting the detour activities.

4. Barricades:

Barricades and delineators shall be placed wherever necessary for the protection of public travel. Such hazards as pits and open trenches, drop offs, exceptionally rough stretches of the traveled way and all obstructions shall be barricaded in an acceptable manner. Where sidewalks or other pedestrian ways are disturbed, a safe, alternative path shall be provided.

5. Lighting:

Lighting devices shall be placed so they are clearly visible. Adequate artificial lighting shall be provided on construction projects to clearly reveal all hazards during night hours. Flagger stations and hazards shall be lighted from sunset to sunrise should night working hours be approved.

6. Dust Control:

Dust laying shall be performed in an approved manner, generally by use of water or calcium chloride application and shall be continued on a regular basis whenever necessary or as ordered by the Director of Public Works. The Contractor shall be responsible for the control of dust during work suspension periods. The Contractor shall provide names/phone numbers of his personnel who are responsible for dust control/maintenance of traffic after hours.

III. SANITARY SEWER

See Town of Merrimack Department of Public Works Wastewater Treatment Facility Sanitary Sewer Engineering Standards as most recently adopted.

IV. STORM DRAIN SYSTEMS

A. MATERIALS

1. Reinforced Concrete Pipe:

a. Conformance to standard specifications:

The minimum pipe inside diameter for storm drain systems accepting roadway run-off shall be 12". Pipe shall conform to the standard specifications for reinforced concrete culvert and storm drain. Pipe shall be Class IV 3000D typically or Class V 3750D

when required due to extra depth or loading.

b. Gasketed pipe joints:

Gasketed pipe joints are required for all Town installations and shall conform to ASTM Specification C443 for joints on circular concrete storm drain and culvert pipe using rubber gaskets.

c. Fittings and accessories:

Fittings and accessories must be approved by the Director of Public Works prior to installation.

d. Storage and handling:

Storage and handling of drainage pipe shall meet the same requirements as for sanitary sewer pipe.

2. High Density Polyethylene Pipe (HDPE):

This product must be designed for the intended application and should it be installed under traffic load conditions it must meet H-20 live load requirements. The manufacturer must recommend the material for:

a. Closed main-line storm drain systems.

b. Open-ended culvert installations utilizing concrete headwalls. Smooth interior corrugated polyethylene pipe must meet or exceed the following requirements.

1. Gasketed pipe joints:

A watertight joint must meet or exceed concrete pipe standards ASTM C924, C969, and C1103. The pipe system must utilize a bell and spigot type joint design or a solid collar system to eliminate displacement and deformation at the joint. Joint integrity must meet ASTM Designation: D-3212.

2. Compatability:

Concentric corrugations or a smooth exterior is necessary to mate the pipe to concrete structures utilizing neoprene boot systems that maintain a water-tight seal.

3. Handling:

Pipe must be moved and stored as flat and level as practicable.

3. Polyvinyl Chloride (PVC) Pipe:

- a. Pipe and fittings shall conform to ASTM D-3034 and shall be SDR 35. Joint compression rings shall be of an oil resistant rubber type, elastomeric seals conforming to ASTM D-3212, or flexible elastomeric seals conforming to ASTM 3212.
- b. For use in culvert installations concrete headwalls are required.

High Density Polyethylene & PVC Pipe used in conjunction with concrete masonry structures may require special treatment to assure a water-tight seal. Manufacturers recommendations must be followed to assure long-term performance.

4. Structures:

- a. Catch basins:

All structures shall be designed for H-20 loading and shall be so certified by the manufacturer.

Eight-inch walled structures are preferred due to their compatibility with masonry units, i.e., barrel block and brick.

For five-inch thick, steel reinforced structures, a neoprene boot to securely seal the pipe stub in the opening, is required.

Eccentric or Concentric conical top sections are required as illustrated on the standard details. Slab top sections shall be used only when the distance from top of grate to top of pipe is less than 48". Slab tops shall have an eccentric 24" Φ opening.

Every catch basin is required to have a 3-foot sump as measured from the bottom of the outlet pipe to the floor of the structure. The sump shall be a solid pre-cast unit. Should a center hole be cast in the base it must be plugged with mortar.

Catch basins shall be accurately located to insure that the frame is flush to the curb and centered over the structure.

Although catch basins may not be required to be tested for water tightness, infiltration is not acceptable.

Should site conditions require modifications to structure openings, only methods approved in advance by the Director such as core drilling or sawing will be accepted. Openings in slab tops shall not be altered.

All PVC pipe connections to structures (such as under-drain and footing drains) must be cored and booted to assure a secure seal.

b. Frames and grates:

Cast iron frames shall be NHDOT Standard Catch Basin Type B with Alternate 1 Grate, as detailed on Plate 1 of the New Hampshire Standard Sheet No. 3-A. All castings are to be North American made.

c. Drain Manholes:

Drain manholes shall be of similar construction to catch basins with the exceptions that:

1. Brick invert and shelves are required and shall be constructed to sanitary sewer standard; with the exception that the brick invert will only extend to the mid-diameter of the pipe.
2. 30" opening top section is required and;
3. New Hampshire Standard Manhole frame and cover as detailed on Plate 4 of State Standard No. 3-B.

d. Underdrain:

Underdrain, if not detailed on the approved plans, may be required should site conditions warrant. Seasonal high water table must be kept to a minimum of 2-feet below subgrade across the roadway section. Should the water table be encountered during subgrade preparation, an appropriate engineering solution must be submitted for approval to correct the situation. Underdrain runs shall not exceed 300 feet in length and shall outlet in a catch basin or daylight in a swale as appropriate.

PVC pipe meeting SDR-35 requirement or other straight pipe designated for roadway underdrain of a 6" minimum diameter is acceptable. Coiled slotted house foundation underdrain is not acceptable for roadway construction.

Underdrain shall be bedded in crushed stone wrapped in the appropriate geotextile fabric as detailed in the typical drawings.

e. Underdrain Flushing Basins:

Underdrain flushing basins conform to the NHDOT Standard shall be installed at the upstream end of each run of underdrain.

B. CONSTRUCTION REQUIREMENTS

1. Storm drain systems:

Storm drain systems must meet the same general requirements for construction as described for sanitary sewers. All storm drain manholes will have brick inverts. Crude methods for grade and alignment control will not be allowed; such as the use of line levels, carpentry levels, hand levels, batter boards, string lines or “by eye”.

- a. Proper catch basin location is essential to assure compatibility with finished roadway curb installations.
- b. Crushed stone, crushed gravel or granular backfill is required under the load bearing section of all storm drain pipe as site conditions warrant from the undisturbed stable soil to the mid-diameter of the pipe. Granular fill over the pipe may be required should the excavated material be too “bony” and threaten to injure the pipe.
- c. Should unsuitable soils be encountered in the excavated trench all material will be removed and replaced with granular fill to the limits as directed by the Director of Public Works.
- d. Standard drain structures shall be required at every change in vertical grade or horizontal pipe alignment.
- e. Finish grate setting to be defined.

C. DRAIN LATERALS

1. Storm drain service taps will be accomplished using a “Tee” connection at the main.
2. Drain Service Laterals (4” & 6” PVC) should be bedded in ¾” crushed stone from the top of the pipe to 4” below the invert.
3. Drain clean outs for house service connections shall be installed at the building foundation or as directed by the Town’s Inspector.

4. Foundation drain “carrying” pipe – (pipe directed away from the foundation wall) shall be PVC SDR 35.
5. Building foundation drains that discharge to daylight shall have a rodent proof end grate installed at the out-flow end of the pipe.
6. Should a building foundation perimeter drain discharge near a pond, streambed, or an area subject to flooding then a check valve shall be installed at a minimum of 4 feet before the outlet.
7. A simple head wall of stone or concrete shall be built at the outlet of all small drains that discharge to daylight.
8. Shallow drains (less than 4-feet of cover) may require frost protection should they cross under paved areas.
9. For sump pump installations: 1-1/2” or 2” - 200# test coiled plastic tubing can be used to carry ground water from the foundation drain.
10. A cast iron cleanout box with a cover marked “drain” is required over 4” & 6” drain cleanouts – see Detail D-6 for appropriate sizes.

D. INSPECTIONS AND TEST REQUIREMENTS

1. Inspection:

Town engineering consultants will be used for inspection and shall be paid for by the Developer / Contractor. The Director of Public Works shall approve all inspections.

2. Visual Inspections:

Visual inspections of drainpipe will be performed to assure proper installation. Pipelines are required to be true to grade and alignment from structure to structure. Pipe must be sound and flawless. Cracked, chipped or deformed pipe must be replaced.

3. Infiltration:

Storm drain systems are inspected for infiltration visually. Should infiltration be observed, (other than minor wetness), repair or replacement will be required.

4. Observation for Uniformity of Flow:

Water used to flush lines will be observed for uniformity of flow through each pipeline from structure to structure.

5. Deflection Test:

Deflection test will be required on all flexible pipe. Concrete and ductile iron are considered to be rigid pipe.

6. Video Inspections:

Town of Merrimack DPW reserves the right to require all storm drain systems to pass video camera inspection prior to acceptance.

All cost associated with inspection shall be the responsibility of the Contractor.

E. PONDS, SWALES AND MISCELLANEOUS DRAINAGE TREATMENT

1. Slope Stabilization:

Maximum slopes for earthen structures intended for vegetation shall be 3:1. Where slopes are to be mowed such as in detention ponds, the maximum slope shall be 4:1 with 6:1 desired. Geotextile fabrics or other approved alternatives may be required to prevent erosion should field conditions necessitate.

2. Rip-Rap Requirements:

Where indicated or required to stabilize a particular slope or water course, rip-rap shall consist of: approved quarry stone, or broken rock of size, shape, and durable quality, reasonably free of thin or elongated pieces; and graded to satisfy field conditions as approved by the Director of Public Works.

3. Safety Barriers:

Perimeter fencing is required where hazardous conditions are identified. A 6-foot minimum height chain link fence with a 14-foot access gate and roadway shall be constructed, using standard chain link.

V. ROAD CONSTRUCTION

A. CLEARING AND GRUBBING

The entire width between slope lines shall be cleared of all stumps, brush, roots, boulders, unstable material and trees not intended for

preservation.

B. SUBGRADE PREPARATION

1. Blasting Operations:

a. Slopes:

When blasting is required, the required slopes or configuration shown on the plans shall be produced in a safe and stable condition.

b. Authority to prohibit blasting:

The Director of Public Works shall at all times have the authority to prohibit or halt the contractor's blasting operations if it is apparent that: Through the methods being employed the required slopes are not being attained; or the safety or convenience of the public is being jeopardized.

c. Seismic monitoring:

Frequency and acceleration monitoring will be required should adjacent structures be threatened.

d. Seismic monitoring:

Frequency and acceleration monitoring will be required should adjacent structures be threatened.

2. Unsuitable Material:

a. Removal of unsuitable material:

Where excavation to the designed elevation results in a subgrade or slope of clay, peat, muck or other unstable material, the Contractor shall remove the unstable material to the depth necessary to attain a solid foundation.

b. Backfilling:

Backfilling shall be done with approved materials and shall meet the requirements for: sand, gravel, broken rock or any combination thereof.

3. Rock fragments:

Rock fragments in fill shall be placed in layers not in excess of 2-feet. The lifts shall be placed in such a manner as to close all void. Earth shall be placed in layers to the full width of the roadway, generally parallel to the finish grade. The layers shall not exceed 12-inches of loose depth. Each layer shall be spread to a uniform thickness and compacted to the required density. Continuous grading or shaping shall be carried out concurrently with the compactive effort to assure uniform density throughout each layer of material.

C. **BASE MATERIALS**

1. Applications:

Prior to the placement of any road base material, all underground utility crossings shall be accomplished, with trenches properly compacted.

2. Bank Run Gravel: (NHDOT Item 304.2)

a. Requirements:

Bank run gravel shall be a natural material, mined from stratified deposits of durable stone and coarse sand as follows:

<u>Sieve Size</u>	<u>% Passing</u>	<u>% Retained</u>
No. 4	25-70	30-75
No. 200	0 – 12 *	

* % of material passing the No. 4 sieve.

b. Maximum Stone Size:

Maximum stone size shall be 6-inches in any dimension for a 12-inch compacted lift.

c. Oversized Stones:

Large stones removed from the gravel box may be used for slope fill when properly placed.

3. Crushed Gravel: (NHDOT Item 304.3)

a. Gradation for crushed gravel:

Crushed gravel shall consist of processed gravel of durable stone with the excess sand removed to conform to the following gradation:

<u>Sieve Size</u>	<u>% Passing</u>
3-Inch	100
2-Inch	95-100
1-Inch	55-85
No. 4	27-52
No. 200	0-12 *

* % of material passing the No. 4 sieve

At least 50% of the material retained on the 1-inch sieve shall have a fractured face.

b. Application:

Crushed gravel shall be placed after the gravel course has been thoroughly compacted. Crushed gravel shall be placed in lifts not to exceed 12-inches in depth. It shall be shaped true to the grade and cross-section as shown on the typical section.

c. Compaction:

Compaction of subgrade, gravel and crushed gravel shall be done with an approved vibratory roller. Water shall be applied as necessary to adjust the moisture content to optimum. The materials shall be compacted and rolled until the density requirements are met. When vibratory equipment is being operated, the amplitude of vibrations shall be adjusted as necessary to avoid causing damage to adjacent buildings and property.

4. Test Requirements:

a. Density Testing:

The density of gravel and crushed gravel shall be determined by AASHTO T191 (Sand Cone Method), or AASHTO T238 and T239 (Nuclear Methods). The density shall be not less than 95 percent of the maximum density determined in accordance with AASHTO T180 (Modified Proctor Density), and performed at a minimum of 300 ft. between tests. Nuclear density methods will be governed by ASTM D2922.

b. Testing Prior to Placement of Pavement:

All testing shall be performed and certified reports provided to the Director of Public Works prior to the placement of any pavement. The contractor shall provide an as-built survey of the crushed gravel, with survey elevations taken at the centerline and left and right edges of the travel way at each 50-foot construction survey station. Work shall be performed and stamped by a NH Licensed Land Surveyor or NHPE. No pavement shall be placed where gradation, compaction or as-built information fail to meet the requirements of this section.

c. Testing at Contractor's Expense:

All testing required by the Director of Public Works shall be done at the Contractor's expense and by an approved testing agency.

d. Contaminated Material:

Previously tested and accepted materials contaminated by earthen, organic or other foreign material or degraded by hauling equipment to such an extent that the material ceases to meet the requirements, shall be removed and replaced.

**TOWN OF MERRIMACK
DEPARTMENT OF PUBLIC WORKS
WASTEWATER TREATMENT FACILITY
SANITARY SEWER ENGINEERING STANDARDS**

2006



Issued by
**TOWN OF MERRIMACK
PUBLIC WORKS DEPARTMENT
Wastewater Division**

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CHAPTER S1 - GENERAL REQUIREMENTS

S1-01 GENERAL

These Engineering Standards set forth minimum standards for the planning, design, and construction of sanitary sewer collection facilities.

The Sewer Use Ordinance adopted March 2000 and Chapter 158 of the Town of Merrimack Code, is the basis for these engineering Standards and State of New Hampshire Department of Environmental Services (NHDES) Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities.

Although these standards are intended to apply to physical development within the Town, the standards will not apply for all situations. Compliance with these standards does not relieve the designer of the responsibility to apply conservative and sound professional judgement. These are minimum standards and are intended to assist, but not substitute for competent work by design professionals. The Town may at its sole discretion due to special conditions and/or environmental constraints, require more stringent requirements than would normally be required under these standards.

S1-02 DEFINITIONS

The following terms as used in this document shall be defined and interpreted as follows:

“Contractor”

The person, partnership, firm or corporation contracting to do the work under these Documents. The term shall also include the Contractor's agents, employees and subcontractors.

“Details or Additional Drawings”

All details or drawings prepared to further explain or amplify the plans, or for the revision of the same, all as herein provided.

“Developer”

Any individual, company, partnership, joint venture, corporation, association, society or group that has made, or intends to make, application to the Town for permission to construct a sanitary sewer system connection, or extension, to the Town's sanitary sewer system.

“Engineer”

The Town of Merrimack Director of Public Works or his duly authorized assistants, which includes Consultant Engineer and/or Inspectors.

“Equipment”

The machinery, accessories, appurtenances, and manufactured articles to be furnished and/or installed under the Project.

“Material or Materials”

These words shall be construed to embrace machinery, manufactured articles, materials of construction (fabricated or otherwise) and any other classes of material to be furnished in connection with the Project.

“Or Equal”

Any manufactured article, material, method, or work which, in the opinion of the Engineer, is equally desirable or suitable for the purposes intended in these standards, as compared with similar articles specifically mentioned herein.

“Plans”

All official drawings or reproductions of drawings made or to be made pertaining to the work provided for in the permit or developer extension agreement.

“Project”

The structure or improvement to be constructed in whole or in part.

“Reference Specifications”

Reference specifications shall mean the technical specifications of other agencies incorporated or referred to herein.

“Specification”

The specifications shall mean the prescribed directions, requirements, explanations, terms and provisions pertaining to the various features of the work to be done, or manner and method of performance. They also include directions, requirements, and explanations as set forth on the plans.

“Standard Details”

State of New Hampshire standard detail drawing and any additional details required by the Town of Merrimack.

“Standard Specifications”

New Hampshire Department of Environmental Services (NHDES), Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities.

“Words and Phrases”

Whenever the words, “as directed”, “as required”, “as permitted”, or words of like effect are used, it shall be understood that the direction, requirement or permission of the Engineer is intended. The words, “sufficient”, “necessary”, “proper”, and the like shall mean sufficient, necessary or proper in the judgment of the Engineer. The words, “approved”, “acceptable”, “satisfactory”, or words of like import shall mean approved by or acceptable to the Engineer.

Work

The work necessary to manufacture and deliver machinery, equipment and material and/or the furnishing of all labor, tools, material, equipment, construction equipment, working drawings, where required, and other, necessities for the construction or erection of the structures shown and called for in the plans, specifications and permit/Developer Extension Agreement, and the act of constructing or erecting said structures complete.

S1-03 REFERENCES

Wherever references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user, the following acronyms or abbreviations which may appear, shall have the meanings indicated herein:

AASHTO	American Association of the State Highway and Transportation Officials.
ANSI	American National Standards Institute, Inc.
NHDES	New Hampshire Department of Environmental Services
APWA	American Public Works Association
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
DOH	Department of Health

S1-04 GOVERNMENTAL AGENCY REQUIREMENTS

All construction on Town or State roads or right-of-way shall be done in accordance with the agency's standards and requirements and in accordance with the franchise and/or permit requirements. The Contractor is responsible to determine these requirements prior to construction.

Where conflict exists between these Standards and permit requirements, the most stringent permit requirements shall take precedence.

CHAPTER S2 - PLAN SUBMITTAL**TABLE OF CONTENTS**

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CHAPTER S2 - PLAN SUBMITTAL

S2-01 GENERAL

Following these standards to design the sanitary sewer system will help ensure a timely review of the proposed project.

S2-02 DEVIATIONS

S2-02.1 General

The Developer may propose a deviation from the Standards. A non-standard system may take longer to review. The Developer acknowledges these risks when submitting a non-standard system for review.

S2-02.2 Deviation Criteria

Requests for deviations which are site or project specific, shall be reviewed by the Town and it's consultant. The Town's decision to grant, deny, or modify the proposed deviation shall be based upon evidence that the deviation request meets the following criteria:

- A. The change will achieve the intended result through a comparable or even superior design; and
- B. The change will not adversely affect safety and/or operation; and
- C. The change will not adversely affect maintainability.

S2-03 ERRORS AND OMISSIONS

Any errors or omissions in the approved plans or information used as a basis for such approvals may constitute grounds for withdrawal of any approvals and/or stoppage of any or all of the permitted work as determined by the Town. It shall be the responsibility of the Developer to show cause why such work should continue, and make such changes in plans that may be required by the Town before the plans are reapproved.

S2-04 PLANS**S2-04.1 General**

Sewer construction plans shall be printed on 24"x36" sheets. All drawings shall be dimensioned in English units. Drawings shall contain the following information:

S2-04.2 Cover Sheet

A cover sheet shall be provided for sewer plans consisting of three or more pages or where project plans include water, street, or other improvements. The following information shall be provided on the cover sheet, or on the first page of the drawings where no cover sheet is used:

- a. Date
- b. Vicinity map showing location of project and overall sewer system.
- c. Schedule of quantities listed by size and pipe material.
- d. North arrow
- e. Project benchmark and basis of bearing. Benchmark elevation shall be referenced to the nearest existing manhole invert.
- f. General notes to include the following:
 1. Construction shall be performed in accordance with, Standard Specifications and Standard Drawings, as last revised.
 2. Contractor shall notify Department of Public Works forty-eight (48) hours in advance of construction.
- g. Design engineer's name, address, and signed stamp clearly showing the expiration date. Engineer shall be a registered professional engineer in the State of New Hampshire.
- h. Owner/Developer's name and address.

S2-04.2.2 Profile

Profile views shall be provided for all sewer main line. Profile views shall be on the same sheet as the associated plan view and shall include the following information.

- a. Class of backfill;
- b. Size, slope, length, and class of pipe
- c. Manhole rim and invert elevations;
- d. Horizontal and vertical scale [maximum horizontal scale 1" = 50', vertical exaggeration as appropriate to show detail];
- e. Utility crossing with vertical distance between proposed sewer and existing or proposed utility shown;
- f. Existing ground profile;
- g. Match line when profile covers more than one page;
- h. Profile stationing to coincide with plan stationing.

S2-04.3 Plan View

Plan views shall be provided for all sewer main line. Plan views shall be on the same sheet as the associated profile view and shall include the following information:

- a. Drawing scale, maximum scale, (1" = 50');
- b. Map block and tax lot numbers for areas to be served and adjacent properties. For subdivisions or partitions, the tax lot number of the parcel to be divided should be shown;
- c. Existing utilities, wells, and structures;
- d. Street names, right-of-way centerlines;
- e. Property lines and easements. Easements should show all bearings and distances and a book and page reference;
- f. Distance from sewer centerline to centerline of right-of-way. Manholes shall be referenced to the centerline of the right-of-way and the road station;
- g. Sewer stationing shall begin at the lowest downstream manhole. Sewer mains within the right-of-way may use road stationing with offsets. Outside the right-of-way sewer stationing should be independent of the road stationing;
- h. Manholes shall be numbered in consecutive order, starting from the downstream manhole, and shall be referenced by sewer stationing that coincides with the profile stationing; 0+00 should be at manhole where connecting to existing system occurs;
- i. New manholes over existing mains shall be dimensioned to the closest downstream manhole.
- j. Location of all service laterals, referenced by sewer station;
- k. Town limits, zoning boundary, if applicable;

- l. Legend (utilities and other lines shall be differentiated by using varying line types and thickness);
- m. Proposed finished floor elevations;
- n. Boring hole locations, if applicable.

S2-04.3.1 Sanitary Sewer General Plan Notes

The following is a listing of General Notes that should be incorporated on the first sanitary sewer plan sheet. All the notes on the list may not pertain to every project. The Developer should include only those notes that are relevant to the project and may omit non-relevant notes. However, do not renumber the remaining General Notes. If additional notes are needed for specific aspects, they should be added after the General Notes.

Sanitary Sewer General Notes:

- 1. A Preconstruction conference shall be held on all projects by the Town of Merrimack Community Development Department, at least fifteen (15) days prior to any construction work being performed. No construction will be allowed to start until this requirement is met. Contractor shall have all permits and requirements in place prior to meeting. Contractor should bring copies of all permits, etc., to meeting. All utilities involved should be represented at meeting. Also, contractor, developer, and site superintendent should attend
- 2. All work shall conform to Town of Merrimack Standards and the (NHDES) State of New Hampshire Standards for Sewerage and Wastewater Treatment Facilities latest revision.
- 3. All new manholes shall have a minimum inside diameter of 48" and shall conform to the State of New Hampshire Standard Details.
- 4. Sanitary sewer pipe shall be PVC conforming to ASTM-D3034 SDR 35. Bedding and backfill shall be as shown in the Standard Details.
- 5. Where shown as C900-PVC, the sewer pipe shall be pressure class 150 (DR 18) conforming to AWWA C900.
- 6. All lateral sewers shall be 6" diameter pipe at a minimum 2% slope. Laterals from property line to home shall be 4" with cleanout at property line. All commercial laterals are 6" from main to building with cleanouts as directed by Building Inspector.

7. Lateral sewer stations are referenced from nearest downstream manhole.
8. Lot corners must be set and side sewer locations verified in the field prior to construction. Property owner must be involved in final location.
9. All lateral sewer stubs shall be capped with a watertight plug. Plug location shall be marked with a 2 x 4 stake, 12 feet long, with one end buried at depth of the plug invert and extending at least 3 feet vertically out of the ground. The portion of stake above ground shall be painted green and marked with the word "SEWER" and the depth from pipe invert to ground surface. Connect pipe to stake with an 8-gauge wire at or above finished ground level.
10. The locations of all existing utilities shown hereon have been established by field survey or obtained from available records and should therefore be considered approximate only and not necessarily complete. It is the sole responsibility of the contractor to independently verify the accuracy of all utility locations shown, and to further discover and avoid any other utilities not shown hereon which may be affected by the implementation of this plan.
11. All testing and connections to existing sewer mains shall be done in the presence of a representative of the Town of Merrimack unless an independent testing can be utilized.
12. All trenches shall be compacted prior to testing sewer lines for acceptance.
13. Lateral sewer shall be tested for acceptance at the same time the main sewer is tested.
14. Tops of manholes within public rights-of-way shall not be adjusted to final grade until just prior to paving.
15. All manholes in unpaved areas shall include a concrete seal around adjusting rings per Standard Detail.
16. Contractor shall adjust all manhole rims to flush with final finished grades, unless otherwise shown.
17. All sewer main extensions within the public right-of-way or in easements must be "staked" by survey for "line and grade".

18. Contractor shall install, at all connections to existing down stream manholes, screens or plugs to prevent foreign materials from entering existing sanitary sewer system. Screens or plugs shall remain in place throughout the duration of construction and shall be removed along with collected debris at the time of final inspection and in the presence of a representative of the Town of Merrimack.
19. Surface restoration of existing asphalt pavement shall be as required by the right-of-way use permit.
20. Contractor shall maintain a minimum of ten feet (10') horizontal separation between all water and sewer lines. Any conflicts shall be reported to the Utility and the Engineer prior to construction.
21. It shall be the contractor's responsibility to insure that no conflicts exist between sanitary sewer lines and proposed or existing utilities prior to construction.
22. Minimum cover over sewer pipe shall be six feet.
23. Before commencement of trenching, the Contractor shall provide filter fabric for all downhill storm drain inlets and catch basins, that will receive runoff from the project site. The Contractor shall periodically inspect the condition of all filter fabric and replace as necessary. For all construction during the rainy season, downhill basins and inlets must be protected with catch basin inserts. Simply placing filter fabric under the grate is not acceptable.
24. Later sewer demolition shall be performed prior to removal of building foundation. The lateral sewer for each building shall be excavated and removed from the house connection to the edge of the public right-of-way, or property line. The Contractor shall cap the end of the lateral sewer to remain in place. Lateral sewer demolition shall be performed in the presence of the Town of Merrimack Sewer Inspector.
25. Avoid crossing water or sewer mains at highly acute angles. The smallest angle measure between utilities should be 45 to 90 degrees.
26. At points where existing thrust blocking is found, minimum clearance between the concrete blocking and other buried utilities or structures shall be 5 feet.
27. Where new utility line crosses below an existing AC main, the AC pipe shall be replaced with DI pipe to 5 feet past each side of the trench. Alternatively, where directed by the Engineer, the trench shall be backfilled with controlled density fill (CDF, also known as flowable fill) from bottom of trench to bottom of the AC main.

CHAPTER S3 - SEWER PLANNING/DESIGN STANDARDS

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CHAPTER S3 - SEWER PLANNING/DESIGN STANDARDS

S3-00 APPLICABILITY

S3-00.1 General

- A. If public sewer is located within 200 feet of the proposed dwelling/dwellings, the owner is required to extend and connect onto the public system
- B. If public sewer is not available, the owner is required to acquire necessary Health Department approval prior to a building permit being issued by the Town.
- C. Sanitary sewers shall be designed to serve all lots, including lateral connections between the trunk sewer and the property line being served.
- D. A Preconstruction conference shall be held on all sewer projects by the Town of Merrimack Community Development Department at least fifteen (15) days prior to any construction work being performed. The contractor's superintendent/foreman shall also attend this meeting. If superintendent/foreman cannot attend, then the developer or contractor's representative shall submit a letter to the Town that the superintendent/foreman has been informed of items discussed at this meeting.
- E. Under no circumstances shall storm water, surface water, ground water, roof runoff, subsurface drainage or untreated industrial process water be discharged into any public sanitary sewer system.

S3-01 PLANNING CRITERIA

S3-01.1 Serve to Extreme of Property

Ensure adjacent properties can be provided sewer service (extend to extreme of property and design for the ultimate development of the tributary areas).

Sewer service shall be provided by a gravity system (unless approved by the Town).

S3-01.2 Demand Projections

Demand projections shall be elevated by the design engineer and all calculations submitted for review.

A. Unit Demands

Residential -	70 gallons per capita per day (GPCD)
Commercial -	20 GPCD

B. Population Densities

3.5 People per single-family unit
2.0 People per multi-family unit

C. Peaking Factors

The peaking factor will be determined by using the State of New Hampshire Standards of Design and Construction for Sewage and Wastewater Treatment Facilities.

S3-01.3 Infiltration/Inflow (I/I) Allowances

- A. The Inflow/Infiltration will be determined by using the State of New Hampshire Standards of Design and Construction for Sewage and Wastewater Treatment Facilities.
- B. On existing sewer systems, I/I allowance shall be determined through analysis.

S3-01.4 Wastewater Application Permit

- A. All commercial and industrial users must complete a wastewater application permit. These can be obtained through the Pretreatment Manager at the Merrimack Wastewater Treatment Facility located on Mast Road, telephone 883-8196.
- B. Upon final approval from the Planning Board any connection that meets the NHDES requirements (see below) must submit a discharge permit request. The requirements are as follows:
 - 1. Any proposed wastewater connection in excess of 5,000 gal./day.

2. Engineering designs for new sewerage facilities, whether public or privately owned and regardless of design flow, must be submitted to New Hampshire Department of Environmental Services for review/approval action at least 30 days prior to construction. Design submittals must be accompanied by fee payment as based on project design flow rate – \$0.10 per gal./day for design flows up to 10,000 gal./day, and an additional \$0.05 per gal./day for any flows in excess thereof. Checks should be made out to Treasurer State of New Hampshire.
3. All proposed discharges of industrial waters to a municipal sewer are subject to NHDES review and permit requirements regardless of quantity or quality.
4. The application must be completed and submitted through the Wastewater Treatment Facility along with check, three (3) sets of stamped plans and specifications.

S3-02 DESIGN CRITERIA

- A. The adequacy of the existing sanitary sewer system receiving flows from the proposed project shall be determined at the preliminary stage to preclude unnecessary revisions to construction plans.

The designer shall provide calculations for the sanitary sewer system (on-site and off-site for both existing and proposed conditions as required) to the points of connection to the Town's sanitary sewer system.

- B. Tributary Population

Sewerage facilities shall be designed for the estimated ultimate tributary population. Consideration shall be given to domestic, commercial, institutional, and industrial wastes in determining the capacity of the system. The design shall be based on approved estimates of anticipated populations and flows for a period of 50 years hence, or the entire watershed shall be assumed to be completely developed according to the Comprehensive Plan and/or Sewer Master Plan, whichever provides the greater sewerage flow, unless the Director of Public Works approves otherwise.

C. Sewage Flow

1. Determining the average design flow shall be the first step in the sizing of sanitary sewerage systems. Actual design quantities may be substituted for the average design flows, provided supporting data is furnished to and approved by the Director of Public Works.
2. Sewers shall be designed to carry a peak flow when full as determined by applying the appropriate peak flow factor to the average design flow.
3. Ventilation of gravity sewer systems shall be provided where continuous watertight sections greater than 1,000 feet in length occur.

D. Location of Sewers and Manholes

1. In general, sewer lines and manholes shall be located within legally established public streets or right-of-way wherever possible. If sewers cannot be located in right-of-way or public streets, then access easements to all manholes, sewer line and laterals shall be provided.
 - a. Manholes should be located along the centerline of streets when possible but always beyond the spread of stormwater gutter flow.
 - b. The horizontal and vertical separation between sewers and waterlines shall be in accordance with the requirements of State of New Hampshire Design and Construction Standards, and Merrimack Construction Standards (see section S3-06).
 - c. Sanitary sewers shall be designed such that they do not create skewed crossings with other utilities with an acute angle of less than 45 degrees, 90 degrees is preferred. Where skewed crossings are unavoidable due to existing utilities and involves any pipe larger than 24 inches in diameter, the crossing must be specifically designed and construction details provided.
 - d. A table of bearings and distances shall be provided on all construction drawings for sanitary sewer construction, in order to accurately locate the utility. The table of bearings and distances is not required on early submissions, but is required prior to final plan approval. The engineer or surveyor will supply cut-sheets for the installation of all sewer systems.

- e. Plan and profile of the sanitary sewer system is required.
 - f. The deflection angle from the inflow pipe to the outflow pipe at any junction shall not be less than 90 degrees unless approved in writing by the Director of Public Works.
 - g. A table of lateral elevations at cleanout invert and minimum building sewer elevations shall be included in plans. Building sewer elevation shall be a minimum of two feet above cleanout invert elevation.
2. Manholes for access to sewer lines shall be provided at:
- a. All points of change in alignment;
 - b. All points of change in grade.
 - c. At the terminal end of the sanitary sewer line.
 - d. At intervals not exceeding 300 feet on all sewers.
 - e. A sampling manhole will be required for all non-residential users. The sampling manhole may be used in lieu of the required cleanout at the property/easement line.
3. When it is necessary, due to steep slopes, increased velocity, or invert elevation differences equal to or greater than 24 inches, a drop connection shall be employed. The maximum difference in elevation between the influent and effluent flows within the manhole itself shall be six inches. The minimum diameter manhole for use with an inside drop connection shall be five feet. Only one inside drop shall be installed per five-foot diameter manhole. Two inside drop connections may be made in a six-foot diameter manhole. See section S3-04 Manholes.
4. Outside drop manhole connections are acceptable but inside drop manholes are preferred.
5. Manholes for sewers up to 16 inches in diameter shall not be less than four feet inside diameter (except inside drops, see 3 above). Manholes for sewers up to 36 inches shall have an inside diameter of not less than five feet. If hydraulic characteristics do not permit use of a four-foot inside diameter manhole, then a five-foot diameter manhole or special manhole detail must be provided.

6. When designing new sewers to tie into existing sewers, the connection shall be made by one of the following methods:
 - a. Connection to an existing manhole – Connection to the existing manhole must be configured so that the invert of the new tie-in is not established lower than the existing invert.
 - b. New in-line manhole – The new manhole shall be set after removal of the existing pipe and installation of proper bedding material. The invert of the base section shall match the slope of the removed pipe. Outlet pipe shall be connected to the manhole boot. Inlet connection shall be made with a 6-foot pipe stub connected to the manhole boot and to the existing pipe by a Ferco coupling or approved equal. This method will require pumping of existing flows during installation. Testing shall be by the vacuum test method.
7. All new sanitary sewer manholes shall be reinforced-precast concrete in accordance with ASTM-C478 consisting of precast concentric riser reinforced sections, an eccentric conical or flat top section, and a base section conforming with the typical manhole, per State specifications.
 - a. The connection of sanitary sewer lines shall be made only at manholes. The type of material must be the same from manhole to manhole. Connections to existing manholes shall be made by a method approved by Engineer.
 - b. Sewer lines crossing streams shall be Class 52 Ductile Iron pipe, C900-DR 14 PVC or equivalent and concrete encased. Reference Detail Drawings. Pipe shall be provided with a minimum of one foot of cover over the concrete encasement where the stream is located in rock and three feet minimum cover where the stream is located in other materials. The cover requirements may be lessened with the approval of the Director of Public Works in an area that will not interfere with future improvements to the channel bottom.

- c. Sewer lines shall not be located within stormwater management impoundment areas unless there is no alternative. The Director of Public Works may approve sewer lines within a stormwater management impoundment area only if such sewer lines are designed and constructed to site-specific conditions that will protect the sewer line for a period of 100 years.
 - d. Inverted siphons shall not be less than two (2) barrels, with a minimum pipe size of six inches (6) and shall be provided with necessary appurtenances for convenient flushing and maintenance; the manholes shall be designed to facilitate cleaning; and, in general, sufficient head shall be provided and pipe sizes selected to secure velocities of at least 3.0 feet per second for average flows. The inlet and outlet details shall be arranged so that normal flow is diverted to one (1) barrel so that either barrel may be removed for service or cleaning.
8. Sewer located in areas of unstable soil conditions or other special circumstances may need to be encased in concrete, relocated, or redesigned as required by the Director of Public Works.

E. Sanitary Sewer Lateral Cleanouts

- 1. Sanitary sewer cleanouts will be:
 - a. Located at the property line or sanitary sewer easement line contiguous to the property.
 - b. A traffic bearing type cleanout box is required if located in pavement areas.
 - c. Minimum slope for service lateral shall be 2 percent. Maximum slope of service lateral shall be 45 degrees within public easements or right-of-ways.
 - d. The offset angle of the lateral to run off the sewer main shall not exceed 45 degrees.

F. Minimum Sewer Size

No public sanitary sewer main shall be less than eight (8) inches in diameter except for sewer force mains.

G. Hydraulic Criteria

The design and determination of sewer size shall be based on the following conditions:

1. Sewers shall have a uniform slope and alignment between manholes.
2. At all manholes where a smaller diameter sewer discharges into a larger one, the invert of the larger sewer shall be lowered so that the energy gradients of sewers at junction are at the same level. Generally, this condition will be met by placing the 0.8 depth of flow or diameter in each sewer at the same elevation.
3. Sewer shall be designed to be free-flowing with the hydraulic grade below the crown and with hydraulic slopes sufficient to provide an average velocity of not less than 2.0 feet per second when running full to maintain cleansing flow. Computations of velocity of flow shall be based on a PVC pipe coefficient of roughness “n” in the Manning formula of $n = 0.013$.
4. In no case shall terminal lines with less than 20 residential connections have a slope of less than one percent unless approved by the Director of Public Works.
5. The maximum permissible velocity occurring with average flow shall be ten (10) feet per second (before applying peak flow factor).
6. In general, the following are minimum slopes in feet per hundred feet to be provided for pipes flowing at full depth to one-half of full depth:

Sewer Size (Inches)	Minimum Slope (Feet per 100 Feet)
8	0.004
10	0.0028
12	0.0022
15	0.0015
16	0.0014
18	0.0012
21	0.0010
24	0.0008
27	0.0007
30	0.0006
36	0.0005

7. Benches in terminal manholes are not required.

7.a. Minimum Permissible Depth

All sewer mains and service laterals shall have a minimum cover of six (6) feet in roadway and four (4) feet in cross-country sewers.

8. In general, the maximum allowable depth to inverts of various types and sizes of pipe is dependent on different types of bedding, earth loading, and live loading. Pipes with less than minimum cover and pipe with cover greater than eighteen (18) feet require pipe strength calculations to be submitted with the design. The maximum depth for all types of pipe shall be in accordance with manufacturer's specifications and recommendations.

9. Slope Anchorage

Concrete anchors shall be placed on sanitary sewer lines with grades of 20 percent or greater. Minimum anchorage shall be provided such that anchors are not located over 36 feet center to center on grades from 20 to 35 percent. The maximum grade for sanitary sewers shall be 35 percent with anchorage unless otherwise approved in writing by the Director of Public Works.

10. In general, the pipe diameter of sewers shall increase continually with increase in tributary flow. Where steep slopes would permit the use of reduced pipe size and construction cost savings can be derived, the pipe size may be reduced one size at a manhole; however, appropriate hydraulic allowances shall be made for head loss of entry, increased velocity, and the effect of velocity retardation at the lower end where the flow will be on a flatter slope. Prior written approval of the Director of Public Works is required for reduction in line sizes. Requests should be accompanied by calculations.

H. Sanitary Sewer Force Mains

1. The minimum size for force mains shall be four inches except when using grinder pumps.
2. At pumping capacity, a minimum velocity of two feet per second shall be maintained.
3. An air relief shall be placed at the necessary high points in the force main to release trapped air.

4. Maximum velocity shall be eight feet per second.
5. All force mains shall connect to a cleanout with a drop stack connection at the right-of-way or easement line. From there the flow shall be gravity into the public system.
6. All pipe used for force mains shall be pressure type with pressure type joints. (PVC SDR 21, CL 200 minimal)
7. Anchorage shall be provided where deemed necessary by the Director of Public Works.
8. Receiving gravity flow sewage system shall be analyzed for adequacy to handle peak force main discharges.
9. Locator wire shall be installed with all force main PVC pipe. Minimum U.S. standard gauge 12 solid copper. Director of Public Works may require heavier gauge wire in depths of greater than 6 feet.

I. Sewage Pump Stations

1. Private sewage pump stations (i.e., those stations not accepted into the Town sewer inventory and privately maintained) may be approved by the Director of Public Works under the following conditions:
 - a. Private sewer pump stations shall meet the construction requirements of the BOCA Code and may only accept flows from private sewer systems limited to:
 - a1. Building laterals
 - a2. Collector laterals
 - a3. Private sewer systems entirely on a single lot of record
2. Public sewage pump stations shall be required whenever the pump station accepts flow from more than one lot of record or as required to be reviewed by State of New Hampshire DES standards of Design and Construction for Sewage and Wastewater Treatment Facilities, 1997 or latest revision. Public sewage pump stations must conform to the following:

- a. Pump stations will not be allowed where an acceptable alternative gravity route exists.
- b. All public pump stations shall be located on Town property.
- c. The design criteria and equipment specifications must meet the requirements of the State of New Hampshire standards of Design and Construction for Sewage and Wastewater Treatment Facilities, 1997 or latest revision.
- d. The design calculations for the sewage pump station and force main shall be submitted for review. This design shall address:
 - d1. Design flow from the subdivision and ultimate sewer shed
 - d2. Force main TDH and velocities
 - d3. Pump Curve
 - d4. Wet well size
 - d5. Holding times in wet well and force main relative to septicity
 - d6. Piping configuration
 - d7. Specifications including electrical
 - d8. Operating conditions and setting of pump station between initial and ultimate flows.
- e. Minimum of 2 hours of storage at average flow must be provided.
- f. Pump station design shall be Gorham – Rupp suction or equivalent.
- g. Pumping Station Design Criteria

Station Type	Influent Flow Range (gpm)	Maximum TDH**	Maximum Motor Horsepower
Packaged Wet Well	Up to 3000 gpm	Up to 45 feet	100 HP @ 1450 rpm
Vertical Centrifugal	No restrictions	No restrictions	No restrictions
Submersible	Up to 2000 gpm	Up to 160 feet	100 HP @ 1800 rpm

- h. Tandem pumping may be allowed where low flow, high TDH conditions exist, with expressed written permission from the Director of Public Works.
- i. All pumps regardless of station type, will be non-clogging, capable of passing a minimum 3” diameter sphere. VFD control for centrifugal pumps where possible.
- j. Lift stations are not allowed in the street right-of-way.

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** TDH = Total Dynamic Head – Submittal of calculations required.

- k. Provide a 12' wide access road with a 14' wide rolling gate preferred where possible, to allow service vehicle to parked off the street and clear of any sidewalks. Turnarounds are required for stations constructed along heavily traveled streets. Provide service vehicle access to wet well.
- l. Provide a reinforced concrete base slab sized adequately to counteract buoyancy. Provide supporting calculations.
- m. Provide a single surface pad over the site that incorporates lift station access, wet well access and supporting generator and fuel supply tanks, as necessary.
- n. Provide restrained flexible couplings on all outlet piping within 2 feet of the station wall.
- o. Provide reinforced concrete supports for pipes between wet wells, where appropriate.
- p. Wet well size will be based on good sanitary engineering practices. Minimum of 2 hours of storage at average flow must be provided. Provide resilient-seat gate valve on-line to wet well.
- q. Provide 6" PVC emergency by-pass system consisting of a suction line and a discharge line and a standpipe equipped with a cap and cam-lock connector. Bypass will be located in a vault. Standpipe connects to force main through an AWWA resilient seat gate valve with stainless steel trim and a check valve. The suction and discharge lines will have gate valves for isolation. Adequately support all piping.
- r. Provide 1" minimum water service with reduced pressure backflow preventor and piping insulation.
- s. Provide re-keyable locks for all padlock applications.
- t. Provide fall protection device for ladders that include winch and center post. Winch will be Miller M 52-50ss or approved equal. Center post will be Uni-Hoist Arm #UH 504-24 with top and back rollers or approved equal. Provide non-skid surface on ladder.
- u. Provide spare pump and air release valve prior to acceptance.
- v. Provide calculations to determine the need for hydrogen sulfide suppression in force main.
- w. All hardware in wet wells should be 316SS, hangers, brackets, nuts, bolts, etc.

J. Pumping Equipment

- a. Provide a minimum of two (2) pumps and controls to alternate lead and lag pumping. Where required by the Director of Public Works, 3 or more pumps may be required in a lead, lag standby arrangement.
- b. For each type of pump, provide one spare rotating mechanism to replace each pump type.
- c. Provide one set of routine service replacement parts such as wear rings, bearings, flapper valves and seals for the pumps.
- d. Provide calculations used to determine the capacity of wet well and the specifications for the pumps.
- e. Provide hour meters for each pump that records pump run time, only if the motor is operating.
- f. Provide a magnetic flow meter on the discharge of the pump station. Meters may be in an approved vault. Display will be installed in pump station.

K. Packaged Wet Well

Above ground lift station is preferred. Examples would be Pearson Road and Heron Cove. Contact Merrimack Wastewater Treatment Facility for more details.

L. Lift Station Piping and Valving

- a. All internal lift station piping will be flanged, except as discussed in b.
- b. All lift station pipes will have flexible connections (Victaulic or Dresser) to allow for disassembly.
- c. All main piping will have manual vents and drains to allow draining of sewage prior to piping disassembly.
- d. Resilient seat gate valves in manholes will be used for station wet-well isolation.
- e. Cast iron non-lubricated eccentric plug valves with worm gear operators will be used for pump isolation valves. Valves will have stainless steel bearing, nickel seats, neoprene faced plugs and nitrile-butadine packing. If space does not permit isolation valves for each pump, use 3-way valves.
- f. Main pump check valves will be cast iron swing checks with external lever return. Check valve will not be installed in the vertical. Disc will be 316 stainless steel or cast iron with bronze trim. Pivot arm and bearing will be 316 stainless steel or cast iron with bronze trim. Pivot arm will be 316 stainless steel or bronze. Seat will be field replaceable with neoprene facing.

M. Electrical Equipment

- a. Free standing electrical service and transfer switch will be heavy duty electrical weatherproof enclosure mounted in a manner acceptable to the Director of Public Works a minimum of 24" above the ground. Provide a concrete pad around steel supports. Enclosure and equipment to be provided by Tesco, Challenger, Cutler-Hammer, or Square D. Provide 110-volt duplex, GFI, receptacle in a weatherproof box. The box will have 316 stainless steel hinges and hardware and will be factory primed and field painted per Town of Merrimack requirements. Enclosures to be epoxy-coated.
- b. Provide Killark connector for mobile generator with manual transfer switch. Generator plug will be a minimum of 36-inches above ground.
- c. Provide an exterior light in accordance with current electrical codes. Provide 12" diameter pole mounted luminaries at 120V, 70W HPS.
- d. Provide OSHA approved mat in front of all indoor control panels.
- e. Provide ability to operate station with one pump removed for maintenance, by utilizing a local-remote switch and no parallel switching in order to allow for proper lockout procedures. Provide local disconnect at motor per NEC.
- f. Provide 25% additional spare wires and 2" conduits or oversize conduits to meet ultimate station capacity.
- g. Drivers will be Allen-Bradley or approved equal and provided with solid-state smart type motor starters with a pump control option used to provide ramp starting and stopping for motors. The controller will have the following start modes: soft start with selectable kick-starters, current limit and full voltage. Provide building temperature thermostat and wiring to connect to PLS with building temperature ability at the town SCADA computer.

N. Telemetry

a. Control Panels

All control panels will have the following general features:

1. Panels and enclosures will have NEMA ratings as shown on the drawings. In general the NEMA ratings will be
 - a. NEMA 3 316 SS for outside installations. Include sun shield.
 - b. NEMA 12 for protected installations inside buildings.

2. Panel design will incorporate the following features:

- a. Provide lamp with switch.
- b. Provide a 120 VAC duplex convenience outlet.
- c. Provide heating and cooling to maintain internal components within operating tolerances and to avoid condensation.
- d. Provide 120 VAC uninterruptible power supply (UPS) or an equivalent. DC voltage system sized for 150% of peak load for all internal panel components for a minimum of 30 minutes runtime.
- e. Provide radio communications system compatible with the Town's current SCADA system. See Wastewater Treatment Facility personnel for specific frequency and any changes.
- f. Provide high temperature switch (alarm) for the control panel.

O. Programmable Logic Controller (PLC)

Provide a programmable logic to perform monitoring and control of the facility. Provide a large or small PLC as shown on the drawings or specified in the contract documents.

- a. For PLC applications, provide Allen-Bradley SLL 5/04.
- b. All PLC's will utilize the following features:
 1. All analog inputs will be isolated with 4-20 mA current signal isolators.
 2. All analog outputs will be isolated with 4-20 mA current signal isolators.
 3. Provide an operator interface panel.
 4. Provide input and output points as defined in the specifications and drawings.
 5. Provide 205 spare analog and digital I/O's.

P. Panel Mounted Devices

- a. 24 VDC Power supplies: Power supplies will be linear, open frame supplies with a minimum capacity of 3.0 Amp. Manufactured by Acopian, Power One, or Solo.
- b. Relays: Relays will be SPDT with a minimum 10 Amp rating by Idec, Potter & Brumfield, Tuck or Allen-Bradley.

- c. Signal Insulators: Current isolators and converters will be by M-Systems, Wago, or Wilkerson.
- d. Terminal Block System: Terminal blocks, fuse blocks, and disconnect blocks, will be by M-Systems, Wago, Wilkerson, or Allen-Bradley.
- e. Temperature Switch: Temperature switch will be used to monitor internal panel temperature for high temperature conditions. Range will be 0–250 degrees F. Provide cooling fan.
- f. Interior Lighting: Provide all control panels with a fluorescent interior light of the same approximate width of the control panel located along the top of the panel. Provide light with a separate light switch.
- g. UPS: Provide an Uninterruptible Power Supply sized for 150% of calculated load with sufficient battery backup time for 30 minutes of operation. Provide American Power Conversion or Best Power Products.
- h. Selectors and Pushbuttons: Provide corrosion resistant selectors and pushbuttons by Allen-Bradley or Square-D.

Q. Wet Well Level Measurements

- a. Provide continuous (analog) wet well level measurement by use of a reactive air cell bubbler system. Mount bubbler system components (compressors, pressure transmitter, valves, etc.) in control panel. Monitor air cell 6" above the wet well floor. Use 304 or 316 SS tubing for all piping.
- b. Use differential pressure transmitter for pressure (level) measurement on the bubbler system. Use Rosemont model 1151 smart pressure transmitter or Endress & Hauser model PMD 320. Provide 0.5 inch NPT block and shutoff valves. Provide 0.5 inch NPT three valve manifold for calibration.
- c. Use duplex air compressors with manual alternation. Use WISA model 110 compressor or equal capable of supplying 5 psi air at 100 cfm.
- d. Provide a normally open solenoid valve on the air supply line that can be used to build up pressure and supply a burst of air to clear the air cell periodically. Provide protection for controller.
- e. Provide float for high high-level contact.

R. Record Drawings and Operations & Maintenance Documentation

- a. As-Built Drawings: Provide as-built drawings showing physical location of components. Provide loop drawings (end-to-end wiring diagrams) meeting the ISA S5.4 standards with minimum required items plus optional items. Provide 3 copies of all drawings and an electronic version.

b. Provide O & M Manuals for Hardware

1. Cover equipment comprising the system in the hardware instruction manuals for all equipment including third party equipment, provide as part of the SCADA system. Provide instructions for operation and maintenance of the installed system, as well as operation and maintenance instructions for the individual equipment units comprising the system.
2. Standard hardware manuals will be acceptable, provided that errata sheets are included to reflect the specific equipment provided.
3. Electronic CD-ROM hardware manuals are acceptable.
4. Provide 3 copies of O&M manuals plus an electronic copy when available.

c. Provide O&M manuals for software.

1. Provide complete, organized, and standardized documentation for operation centers, RTUs, PLCs, and other software provided as part of the SCADA system. In general, structure the documentation such that each level develops a different degree of detail. Begin with a broad approach (systems manual), focus on smaller pieces of the overall system (system documentation) and finally pinpoint the finest detail (program detail).
2. Fully annotate every PLC program.
3. Provide three (3) copies of software O&M manuals plus an electronic copy when applicable.

S. Testing Requirements

- a. Factory Acceptance Test (FAT): Fully test all SCADA at the contractors facilities prior to shipping, installing, reprogramming, or reconfiguring the Town's SCADA equipment. The purpose of the testing is to verify compliance with the specifications and to correct deficiencies at the contractor's facility and not in the field. Insofar as practical, test the functional, performance, and interface requirements. Test each control loop from terminal strips to the PLC.
- b. Site Acceptance Test (SAT): After installation, fully test all SCADA components to verify compliance with specifications. Insofar as practical, test the functional, performance, and interface requirements. Test each control loop from the instrument or terminal strip, through the PLC, to the Town's SCADA system. Tune all control loops. Test all control strategies.

- c. Operational Availability Demonstrations (OAD): The OAD is a 90-day period of time during which the SCADA system will be utilized by the Town in day-to-day operations. Its purpose is to test the SCADA system stability and completeness over time. Start the OAD upon written notice from the Town and after successful completion of field-testing. The OAD is considered successful if the system availability is 99.8 percent or better. The OAD will be restarted or repeated if availability is less than 99.8 percent. Final completion will not be granted until OAD is passed.

T. Programming and Configuration Services

- a. Configure the PLCs based on the configuration drawings, P&IDs, the Process Control Narratives and functionality as specified in other sections. Include all necessary constant and variables required to meet the specifications whether shown on drawings or not. Provide a fully functioning control system.
- b. The Contractor will conduct coordination meetings at the town site during the configuration and programming program on a periodic basis as needed but at least twice during the project. The purpose of the meetings is to solicit input from and coordinate activities, a forecast of future activities, and discuss any problem areas.
- c. Use diagrams in ladder rung format for the PLC program documentation system. Show all input devices near the left “power rail” and all outputs near the right “power rail”. The diagrams will show all device codes and functional descriptions shown on the drawings and will also show PLC reference codes and I/O assembly codes, module numbers, and terminal numbers. Provide source code for all operator interface programming; amply annotate to explain the operation. Include I/O tag numbers in rung or device annotations. Use control strategy numbers to identify PLC program sections. Alternative programming techniques may be used if approved in writing by the Director of Public Works.
- d. Organize and structure all PLC programs to aid in software maintenance and modification. Organize each PLC program into a three level “outline” structure consisting of strategies, equipment items (or sub-strategies), and “functions”. Each PLC strategy consists of the logic associated one piece of mechanical equipment (or “functions” will be the smallest subdivision of programs and will consist of functions, subroutines, or short algorithms requiring roughly five to ten rings of ladder logic. Ladder logic will be used for all PLC programming unless otherwise approved in writing by the Town.

- e. PLC programming will be thoroughly documented. Each contact, coil, timer, function block, or other rung item will be annotated in the program listing with the internal item number (i.e., coil number, contact number, etc.); and a brief description of the items function. External tags will be the input or output tag number from the PLC I/O schedule or for points created in a PLC and transmitted to (or from) the central computer system, the tag number used in the central computer.

U. Standby Generator

- a. Provide permanently installed, natural gas fueled Kohler or approved equal generator with automatic transfer switch, manual transfer switch, and load bank connection. Provide Crouse Hinds E0400-1686 Posi-lok load bank receptacles to test generator for output and generator break in. The design engineer must verify gas pressure and fuel demand with generator manufacturer prior to review of submittal. The engine manufacturer must certify that the engine is designed to operate on natural gas and propane. Generator will be shipped from the factory with Town approved color.
- b. Submit generator-sizing calculations for Town approval. Sizing calculations will assume loading based on lead pump running, lag pump starting and full operation of all electrical at the site. Generator will run at 100% of nameplate current for 4 hours on primary fuel supply using Town owned bank.
- c. Provide automatic backup propane fuel capacity and 24-hour supply of fuel. Propane tank to be painted with town approved color.
- d. Obtain fire department approval for site of backup fuel tank.
- e. Provide instrumentation
 - 1. Generator voltage, frequency, and amp meters;
 - 2. Oil pressure gauge;
 - 3. Battery voltmeter;
 - 4. Temperature gauge;
 - 5. Hour meter;
 - 6. External batter with trickle charge;
 - 7. Dry contacts for telemetry – showing generator running.
- f. Provide automatic shut-off and alarms:
 - 1. Low engine oil pressure;
 - 2. High engine temperature;
 - 3. Over speed;
 - 4. Over crank.

- g. Locate exhaust away from dry well ventilation and provide stainless steel rain cap. Insulate exhaust stack from generator enclosure or roofing material.
- h. Provide sound attenuation as necessary to meet or exceed Town noise standards for location. Attenuation may include silencers, insulation and/or enclosure. Provide ambient noise measurements and calculations demonstrating compliance.

V. Gas Monitoring System

- a. Provide a permanent gas monitoring system.
- b. Monitoring system will monitor for lack of oxygen, lower explosive limit, and hydrogen sulfide.
- c. The monitoring system will be tied to the telemetry system alarms.
- d. Manufacturer will be MSA or an approved equal.

W. Details Required on Improvement Plans

- a. Site plan location of power pole, transfer switch, emergency generator, emergency fuel supply, control panel, wet well, ground slab, driveway, fencing, water service, emergency suction / discharge boxes. Provide site grading and drainage details.
- b. Wet well: Influent piping (standard inside drop manhole); suction piping (min. 6" off bottom of manhole); emergency suction line; bubbler line including connection hardware; water/alarm levels (pump on, off, low level, high level), redundant high water float switch.
- c. Emergency Power: Electrical details specified to include size and material of conduit, switchgear, telemetry compatibility. Electrical details will include power source, meter location, cabinetry. Wiring diagrams will depict connection to and between PG&E, transfer switch, emergency generator as shown in the attached single-line diagram.
- d. Force main discharge details.

X. Record Drawings and Manuals

- a. Provide three (3) copies of record drawings and an electronic copy in AutoCAD latest version.
- b. Provide three (3) copies of O&M Manuals plus an electronic copy when available.

S3-03 GENERAL DESIGN STANDARDS

- A. All lengths and dimensions shall be horizontal distances, no slope distances on plans.
- B. If working in existing streets, indicate type of pavement restoration required, or refer to right-of-way permit.
- C. Dimension existing and new main locations from construction baseline using stations and offsets.
- D. Determine how surrounding development will affect design (e.g. serve to extreme of property).
- E. On plans show existing manholes or give reference distances to existing manholes near project including manhole number and invert/rim elevations.
- F. Existing sewer lines to be abandoned shall be filled completely with controlled density fill; or removed.
- G. Manholes connected to lines being abandoned, shall be rechanneled by rebuilding invert.

S3-04 MAIN LINES**S3.04.1 Minimum Pipe Size**

Minimum pipe size shall be 8 inches.

S3-04.2 Pipe Slope

Sewer Size (Inches)	Minimum Slope (Feet per 100 Feet)
8	0.004
10	0.0028
12	0.0022
15	0.0015
16	0.0014
18	0.0012
21	0.0010
24	0.0008
27	0.0007
30	0.0006
36	0.0005

Maximum main line slope shall not induce velocities greater than 10 feet per second under daily peak flows.

S3-04.3 Design Drawings and Technical Specifications

- A. Design drawings and technical specifications for proposed new or modified publicly or privately owned sewage and wastewater treatment facilities shall be submitted to the department for approval in accordance with these rules.
- B. Design drawings and technical specifications shall be submitted for any proposed sewer which serves more than one building or which requires a manhole at the connection, and for any proposed pumping station which serves more than one building or has a capacity in excess of 50 gpm.
- C. Design drawings and technical specifications submitted to the department for review and approval action shall be prepared by, or under the direct supervision of, a New Hampshire licensed professional engineer.
- D. All design drawings shall bear:
 - 1. A title citing the project name, location, and owner;
 - 2. The scale;
 - 3. The north arrow; and

4. The name and signature of the design engineer and land surveyor, and the imprint of his/her registration seal.
- E. The design drawings shall be clear, legible and drawn to a standard scale, which permits all necessary information to be plainly shown.
- F. The design drawings shall not be larger than 24 inches x 36 inches in dimension
- G. A vertical datum shall be indicated and, if different from the national geodetic vertical datum of the United States Geological Survey, its relationship thereto shall be noted.
- H. The locations and logs of any test borings shall be shown on the plans or included in the specifications.
- I. Sets of design drawings and technical specifications required to be submitted shall be as follows:
 1. Two sets for initial review and three sets after final Planning Board approval, along with paperwork and check to be submitted to the State of New Hampshire. See section Se-01.4 - B
- J. The following information shall be submitted by the engineer:
 1. A general map showing the location of the project with respect to municipal boundaries;
 2. Detail plan and profile sheets of all proposed sewers and force mains;
 3. Details of construction of manholes, siphons, and other sewer appurtenances;
 4. General and detail plans for treatment plants and pumping stations;
 5. Technical specifications for all proposed construction; and
 6. Design calculations and parameters used for sizing the unit processes and components.

S3-04.4 Design Drawings for Sewers

Design drawings for proposed sewers shall, in addition to the requirements above, include the following:

- A. The topography and elevation of existing or proposed streets;
- B. The locations of all streams and water surfaces, including their direction of flow and high/low water surface elevations;
- C. Contour lines;
- D. The boundary lines of the municipality, sewer district or other area to be sewered;
- E. The location, size, and direction of flow of all existing and proposed sanitary sewers;
- F. A title block located in the lower right hand corner of the sheet to include:
 - 1. The title;
 - 2. The name of the owner;
 - 3. The name of the consultant;
 - 4. The date of the original issue and all revisions; and
 - 5. The initials of the designer, draftsman, checker, and responsible engineer.
 - 6. Plans must be stamped and signed by an engineer and land surveyor certified in the State of New Hampshire.
- G. Insets and detail sections with the scale shown directly beneath their subtitles;
- H. Plan and profile views in which the plan view is placed at the top;
- I. Plans shall show the title, date and scale, and shall show clearly the location of:
 - 1. All existing structures affecting the project and all existing or proposed sewers;

2. Treatment works;
 3. Existing and proposed sewer outlets;
 4. The north arrow; and
 5. The boundary lines.
- J. The locations of existing, proposed and future sewers as differentiated by appropriate symbols or designations;
- K. All topographical symbols and conventions used shall be as employed by the United States Geological Survey;
- L. The horizontal distance or stationing between manholes, grades in feet, slope of pipe, and sewer sizes, types, and class, shall be shown. Arrows shall be drawn to indicate the direction of flow;
- M. All sewer appurtenances shall be depicted by symbols and referenced by a legend. Detail drawings of all sewer appurtenances shall accompany the detail sewer plans;
- N. Profiles shall indicate:
1. All manholes with manhole identification numbers;
 2. Existing and proposed utilities with elevations;
 3. Siphons;
 4. Pumping stations; and
 5. In the case of stream crossings, the elevations of streambeds, normal flow lines, high and low water elevations, and the type of pipe.

- O. The sizes and gradients of sewers, surface elevations, first floor house elevations, and sewer inverts shall be shown at or between each manhole;
- P. Profiles shall include borings and groundwater level and, except for special details, they shall be drawn to standard scales with a ratio of 10 horizontal to 1 vertical, which shall be indicated on each sheet.
- Q. Finish grade elevations shall be shown. Elevations of manhole inverts shall be shown to the nearest 0.01 foot;
- R. All elevations shall be referenced to a standard datum, and the datum used shall be indicated on the plans;
- S. The engineer shall specify any special precautions or methods of construction necessary to prevent surface water pollution.

S3-04.5 Design Drawings for Sewage Pump Stations

- A. A location plan shall be submitted for projects involving construction or revision of pumping stations.
- B. The location plan shall include the following information:
 - 1. The location and extent of the tributary area;
 - 2. Any municipal boundaries within the tributary area; and
 - 3. The location of the pumping station and force main, and all elevations.
- C. Detail plans shall be submitted including the following:
 - 1. A contour map of the proposed pump stations site;
 - 2. Existing pumping station, location, and elevations;
 - 3. Proposed pumping station, including provisions for installation of future pumps or ejectors; and
 - 4. Elevation of high water at the site and maximum elevation of sewage in the collection system.

S3-04.6 Plan View

- A. List pipe length, size, and material along side of pipe, e.g. 150 L.F.- 8" PVC.
- B. Pipe length is to be based on horizontal distance between center of manholes.
- C. Indicate direction of flow with arrows on end of pipe entering manhole.

S3-04.7 Profile View

- A. List pipe length, size, material and slope to 4 decimal places (ft per ft), e.g. 150 L.F. - 8" PVC S=0.0125. Pipe material can be listed in Table in lieu of listing on profile.
- B. Slope is based on I.E. OUT of upstream manhole, I.E. INTO downstream manhole and horizontal distance between center of manholes.

S3-05 **MANHOLES**

- A. Maximum distance between manholes shall be 300 feet.
- B. All manhole covers shall be set flush with ground surface, except where otherwise designated by the Engineer.
- C. Existing and Terminal Manholes:

When connecting to an existing manhole, all requirements of these Engineering Standards must be met. The design shall call-out all necessary revisions to the existing manhole, or if the existing manhole cannot be renovated to meet the standards, the manhole shall be removed and replaced with a conforming structure.

- When there is a potential for future main line extension from terminal manhole, position side sewer connections to manhole to avoid conflict with future main line connection to manhole.
- Terminal manholes shall not be channeled.
- D. Where sewer connects to manhole, invert of sewer shall be equal to or above main sewer crown, but not to exceed 18" above invert of main sewer.

- E. Invert elevation across manhole shall be from 0.1 ft to 0.2 ft. In areas with sewer main slopes less than 0.005 ft/ft, lesser drops are allowed, to be determined by the Director of Public Works. Maximum allowable drop in invert elevation across the manhole shall be 1.0 ft.

The minimum angle between the incoming and the outgoing pipe shall be 90°; pipe shall be radial with the center of manhole.

The above configurations shall provide adequate shelves and room for maintenance and performing video inspections.

- F. Channels shall be centered in manhole.
- G. Any manhole less than 6' deep (rim to invert) shall be a flat top H20 loading. All other manholes shall be provided with eccentric cone.
- H. Frames and Covers – 48" manholes shall have a 30" clear opening. 60" manholes with an inside drop shall have a clear opening of 36". Also, 60" manhole 14' deep or greater shall have 36" clear opening due to confined space regulation.
- I. Drop Manholes
- Minimum height of drop is 2.0'.
 - Inside drop structure is required on new manholes. These structures shall be 5' diameter with 36" clear opening frame and cover.
 - Inside drop structure is allowed on connections to existing manholes.
- J. Internal Drop Schedule
1. For 4'-0" diameter manholes, one 10" internal drop pipe.
 2. For 5' diameter manholes, one 15" diameter or two 10" diameter pipes.
 3. Larger diameter manholes will be reviewed on an individual basis.

S3-06 PIPE CLASS - PROTECTION – COVER

- A. PolyVinyl Chloride (PVC) pipe class designation:

All sewer pipe shall be SDR 35 PVC conforming to ASTM D3034, unless otherwise determined by the Town.

Depth of cover over SDR 35 PVC pipe shall be 4' minimum and 20' maximum. Pipe depths outside this range will require use of pressure class PVC conforming to AWWA C900 (dimension ratio 18 or less) or DI pipe.

- B. PVC pipe shall be encased in a steel or ductile iron casing when crossing under improvements where the ability to remove and replace pipe without disturbance to the improvement is needed.

Casings shall extend a minimum of 5' past each edge of the improvement, or a distance equal to the depth of pipe, whichever is greater. The carrier pipe shall be supported by casing spacers where casing length exceeds 10'.

Minimum clearance between bottom of structure and top of pipe or casing shall be 2'. The trench shall be backfilled with crushed rock ½" when clearance is less than 3'.

- C. Ductile iron pipe, class 52, shall be used only where required by the Town.

S3-07 CLEARANCES - OTHER UTILITIES

- A. All clearances listed below are from edge-to-edge of each pipe.
- B. Water services and sewer stubs shall have at least 10' horizontal clearance and 18" vertical.
- C. Check for crossing or parallel utilities. Maintain minimum vertical and horizontal clearances. Avoid crossing at highly acute angles (the smallest angle measure between utilities should be between 45 and 90 degrees).

D. Horizontal clearances from sanitary sewer:

Cable TV	5'
Gas	5'
Power	10'
Storm	5'
Telephone, Fiber Optic	10'
Water	10'

E. Vertical clearances from sanitary sewer:

Cable TV	18"
Gas	18"
Power	18"
Storm	18"
Telephone, Fiber Optic	18"
Water	18"

F. Where sewer crosses above or below watermain, one full length of sewer pipe shall be used with the pipes centered for maximum joint separation. Depending on circumstances, use of DI pipe and concrete encasement may be required.

G. Send letter and preliminary plan to existing utilities to inform them of new construction. Request as-built information and incorporate into plans. At minimum the following utilities should be contacted:

Cable television
 Natural gas
 Power
 Storm drainage (Highway)
 Telephone, Fiber Optic
 Water
 Wastewater

S3-08 CONNECTIONS TO EXISTING SYSTEM

- A. New sewer mains (8" and larger) shall connect to existing sewer main at existing manholes, or with new manhole on existing sewer.
- B. When connect to existing manhole, core-drill opening for pipe and rechannel manhole base.
- C. If manhole has stub, remove and use new pipe, or as directed by Engineer.
- D. Connections to end of existing pipe:
 - If end of pipe is known to have a bell, and new pipe is same material as existing, plans can specify connection by inserting spigot of new pipe into existing bell end, with "donut" gasket.
 - If existing line is plain end, or must be cut, plans shall specify use of a coupling to connect new and existing lines.
- E. Approved couplings for use on sewer mains include:

Ductile iron mechanical couplings (equal to ROMAC) on ductile iron, concrete, vitrified clay, or pipes with differing materials or diameters.

On PVC or PE mains, PVC or PE couplings with compatible dimension ratio and gaskets to connect new and existing pipes shall be used.

Where a section of existing PVC pipe is replaced by "dropping-in" a new section of PVC pipe, the connections to existing pipe shall be made with PVC closure couplings (slip couplings).

S3-09 FATS, OILS, GREASE SEPARATION (per Sewer Use Ordinance)

S3-08.1 Oil/Water Separator

Whenever an industrial or commercial business generates mineral/petroleum oils to be discharged to the sanitary sewer, pretreatment is required. An oil/water separation device shall be installed by the property owner as specified on various Standard Details.

Selection and sizing of an oil/water separator shall be subject to approval of the Town. Water discharged from any oil/water separator to the sanitary sewer system shall not contain petroleum oil, non-biodegradable cutting oil or mineral products, and shall be in compliance with the Town of Merrimack regulations for discharge to the sanitary sewer.

- A. Sizing of a separator facility shall be based upon maximum available flow to the separator and provision of a forty-five minute retention time in the separator at that flow, with a minimum capacity of at least 100 gallons.
- B. The oil/water separator shall be covered with removable sections. Access and inspection covers, weighing not more than 30 lbs. and with suitable handholds, are to be provided directly above inspection “tee” and oil/grit collection compartments.
- C. Allowable materials for construction are as follows:
 - ▶ Tank - concrete
 - ▶ Baffles - concrete, steel plate
- E. The separator shall be located within 20 feet of drive for access by maintenance vehicle.
- F. A sampling tee shall be located on the outlet with a minimum 18-inch drop below the invert. Access to the separator shall be maintained free for inspection and compliance determination sampling at all times.
- G. When pretreatment is no longer required, the inlet and outlet pipes shall be permanently plugged, the separation chambers pumped out, and the vault removed, or filled with compacted crushed rock or controlled density fill.

S3-09.2 Grease Interceptor

Whenever a commercial and/or retail food preparation operation, regardless of size, generates animal/vegetable fats, oils or grease (F.O.G.) waste, which causes a visible sheen or accumulations in the effluent, to be discharged to the sanitary sewer, pretreatment is required. A grease interception device as specified by various Town of Merrimack, and/or the owner shall install other biological, chemical, or other pretreatment approved by the Town of Merrimack. Effluent discharged from any grease interceptor shall not contain a visible sheen or accumulations of F.O.G., and shall be in compliance with the Town of Merrimack regulations for discharge to the sanitary sewer.

- A. Size and design of the grease interceptor shall conform to the uniform plumbing code, and shall be subject to approval by the Building Inspector/Plumbing Inspector. Minimum capacity shall be 600 gallons except as noted by the Town of Merrimack.
- B. Fixtures in the kitchen area, which discharge wastewater containing grease, are to be connected to the grease interceptor. Such fixtures include dishwashers, pot sinks, range woks, janitor's sink, floor sinks. Toilets, urinals, and wash basins shall not flow through the interceptor.
- C. The interceptor shall be located outside the building within twenty feet of drive for access by maintenance vehicles.
- D. The interceptor shall be filled with clean water prior to start-up of system.
- E. Allowable materials for construction are as follows:
 - ▶ Tank - concrete
 - ▶ Baffles - concrete, plastic
- F. Access to the interceptor shall be maintained free for inspection and compliance determination sampling at all times.
- G. When pretreatment is no longer required, the inlet and outlet pipes shall be permanently plugged, the separation chambers pumped out, and the vault removed, or filled with sand.

S3-10 EASEMENTS

- A. Show easements on all plans and identify bearings and distances.
- B. Show easements on all private property. If easement is defined as a constant width on each side of sewer main, then show a segment of the easement and label as typical (typ).
- C. All easements shall be a minimum of 20' in width, or twice the depth of pipe, whichever is greater. Temporary "construction easements" may be required beyond the 20-foot permanent easement.
- D. Also see "Building Setback Requirements".
- E. An easement must be provided over any public sanitary sewer when it is installed outside a public right-of-way. Easements must be built to allow access by maintenance equipment such as a vactor truck.
- F. The easement must be a minimum of 20' wide if it only contains a sewer main or 40' wide (or wider) if it contains another facility, such as water, storm drain, or other utility. The easement will be dedicated as a "public sewer easement" if it contains sewer only. It will be dedicated as a "public utilities easement" if it contains other facilities as well.
- G. Easements must be configured to encompass all publicly maintained appurtenances, and will be generally centered over the facility. Separate access easements may be required depending on site conditions. When sanitary sewers are to be installed along a property line the easement will be laid out on the property line dividing the easement equally on each property.
- H. All property restrictions placed as a result of dedication of easements will be so noted on the supplemental sheet of the Subdivision plans, or on the Easement Deed if the easement is not dedicated as part of a subdivision. Typical required notes as applicable are:
 - 1. No structures may encroach on, above, or below the surface of the ground in any public easement. This includes footings of foundations, eaves from the roof of any adjacent structure, pools, ponds, or outbuildings on slabs or foundations. Decks, sheds, or other structures which may be easily removed for maintenance of the sewer system may be allowed at the discretion of the Director of Public Works.

2. No trees may be planted in a public sewer easement without first obtaining approval of the Director of Public Works. Trees may be allowed to the extent that damage to the sewer system does not occur from root intrusion and adequate access can be provided for maintenance and repair vehicles.
3. The Town of Merrimack will take due caution when performing maintenance or repair of sewer systems in easements, but will not be responsible for repairs or replacement of trees, landscaping or structures not specifically approved by the Director of Public Works.

S3-11 ACCESS ROADS

- A. Clear access must be provided and maintained to all structures on the sewer system:
 1. All-weather vehicle access roads are required to every structure on the sewer system. Access roads must be a minimum of 20' in width and must be provided with turnarounds when the backup distance for any maintenance vehicle exceeds 100'.
 2. The design of access roads must be included with the sewer system design plans. At a minimum, the design will conform to the requirements of Standard For Gravel Roads. Include adequate drainage measures in the design to prevent damage to the access roads from storm water.
 3. Gates must be provided for access through any fence crossing a public sewer easement. Where vehicular access is required for maintenance, minimum 20' wide gates must be provided with sliding gates preferred. Where vehicular access is not required, 4' wide gates for pedestrian access must be provided and will be located to permit visual access between sewer structures.
 4. The maximum grade allowed at any point on an access road is 15%. The maximum cross-slope for any access road is 5%.

S3-12 LATERAL SEWERS

- A. Lateral sewer stub shall extend from main line to property line. 6" pipe shall be used inside the public right-of-way (unless expected flows require larger size line).
- B. 4" minimum pipe may be used inside private property, for residential lateral sewers from end of 6" stub to building, for a single connection contained within the lot.

Commercial lateral sewers shall be a minimum 6" pipe.

For multi-family developments, lateral sewers for each separate building must be at least 6-inches in diameter. For those buildings serving over ten units or for lateral sewers serving more than one building, lateral sewers shall be a minimum of 8-inches in diameter and must connect to a manhole.

- C. Lateral sewer shall have minimum 6' of cover at property line. Greater depths may be required where elevation of lowest floor to be served is lower than surface elevation at property line. Ensure that stub can serve all property by gravity flow.
- D. Provide a single stub to "low" end of each lot, and show invert elevation of each stub on the plan. Uniform Plumbing Code may also require a backwater valve. Stub location should also be coordinated with homeowner.
- E. Lateral sewers shall connect to main sewers with a wye rather than a tee, unless otherwise approved by the Engineer. Lateral sewer stubs shall run perpendicular to the sewer main, in the right-of-way. On plan, indicate station of lateral sewer wye from nearest downstream manhole. Also indicate length of lateral sewer stub from main to plug at end of line. Call out invert at plugged-end of stub.
- F. Minimum side sewer slope shall be 2 percent.
- G. All lateral sewer clean-outs on commercial and multi-family projects shall include at-grade access with covers. Cleanouts shall be same diameter as lateral.
- H. Maximum distance between lateral sewer clean-outs shall be 100 feet.

CHAPTER S4 - SEWER MATERIALS

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CHAPTER S4 - SEWER MATERIALS

S4-01 GENERAL

All materials shall be new and undamaged. The same manufacturer of each item shall be used throughout the work.

Where reference is made to other specifications, it shall be the latest revision at the time of construction, except as noted on the plans or herein.

All materials not specifically referenced shall comply with applicable sections of ASTM, AWWA or the APWA/Standards of Design and Construction for Sewerage & Wastewater Treatment Facilities, 1997 or latest revision.

All materials used must meet NH Department of Environmental Services regulations and Town of Merrimack requirements.

S4-02 GRAVITY SEWER PIPE & FITTINGS

6" to 15" Diameter PVC Pipe:

All PVC pipe and fittings shall be integral wall bell and spigot, rubber gasket joint, unplasticized PolyVinyl Chloride (PVC) pipe. All PVC pipe shall have a minimum "pipe stiffness" of 46 psi at 5 percent deflection at 73 degrees F when tested in accordance with ASTM Designation D2412, external loading properties of plastic pipe; and a minimum impact strength based on ASTM D3034.

All PVC sewer pipe and fittings manufacture and installation shall meet or exceed the ASTM recommended specifications D3034, SDR 35, unless otherwise specified, and all installation shall be in strict compliance with the manufacturer's directions. All pipe shall be clearly marked with the date of manufacture. All pipes shall be provided with a reference mark for proper spigot insertion. Joint gaskets shall be fabricated from a compound of which the basic polymer shall be a synthetic rubber consisting of styrene, butadiene, polyisoprene or any combination thereof and shall meet the requirements of ASTM D-3212.

18" to 27" Diameter PVC Pipe:

All PVC pipe and fittings shall be integral wall bell and spigot, rubber gasket joint, unplasticized PolyVinyl Chloride (PVC) pipe. All PVC pipe shall have a minimum "pipe stiffness" of 46 psi at 5 percent deflection at 73 degrees F when tested in accordance with ASTM Designation D2412, external loading properties of plastic pipe; and a minimum impact strength based on ASTM F679.

All PVC sewer pipe and fittings manufacture and installation shall meet or exceed the ASTM recommended specifications F679 for thickness class T-1, unless otherwise specified, and all installations shall be in strict compliance with the manufacturer's directions. All pipes shall be clearly marked with the date of manufacture. There shall be no reduction in pipe wall thickness at the bell as a result of bell formation. All pipes shall be provided with a reference mark for proper spigot insertion. Joint gaskets shall be fabricated from a compound of which the basic polymer shall be a synthetic rubber consisting of styrene, butadiene, polyisoprene or any combination thereof and shall meet the requirements of ASTM D-3212.

AWWA C900 PVC Pipe:

Where indicated on the plans, gravity sewer pipe shall be manufactured in accordance with AWWA Standard C900, with the following additional requirements or exceptions.

4" through 12" nominal diameter PVC pipe shall be furnished in cast iron pipe equivalent outside diameters.

C900 PVC pipe shall be pressure class 150 (DR 18) unless otherwise called for in the plan. Pipe joints shall be manufactured using an integral bell with an elastomeric gasket push-on type joint. Elastomeric gaskets shall conform to ASTM F477. All fittings shall be PVC, compatible with C900 PVC pipe class called for in the plan, unless otherwise approved. PVC fittings shall conform to AWWA C900 with respect to joint dimensions and physical properties.

S4-03 PRESSURE SEWER PIPE

PVC pressure pipe shall conform to AWWA C900 pressure class 100 (DR 25) unless otherwise called for in the plan. Joints shall be made up as recommended by the pipe manufacturer for pressure pipe.

PVC fittings compatible with AWWA C900 pipe, or ductile iron fittings, when allowed, shall conform to these specifications.

S4-04 PLUGS

All open ends shall be sealed with a plug or material and gasket material approved by the Town. The plug shall be able to withstand all test pressures without leakage.

S4-05 BOLTS IN PIPING

Bolts shall be malleable iron, Cor-ten, or stainless steel.

Bolts and nuts for flanged pipe and fittings shall conform in size and length with ANSI/AWWA C115/A21.15. T-bolts shall be malleable iron Cor-ten in accordance with ANSI/AWWA C111/A21.11. Stainless steel bolts shall meet the requirements of ASTM A-307, Grade A. Shackle rods, nuts and washers shall be hot-dipped galvanized in accordance with AASHTO M 232 and coated thoroughly with asphaltic material.

Stainless steel nuts, bolts and washers shall be type 304.

S4-06 FLANGE GASKETS

Gasket Material shall be neoprene, Buna N. chlorinated butyl, or cloth inserted rubber.

S4-07 MANHOLES

Manholes shall be precast concrete sections with a confined O-ring rubber gasket joints per ASTM C-478 and ASTM C-443 with either a precast base or a cast-in-place base made from a 3,000 psi structural concrete. All structure shall be reinforced concrete.

Concrete adjustment rings shall conform to the ASTM C-32, Grade MA.

Mortar used shall be composed of one part cement to two parts of sand.

Outside drop structures shall be constructed with AWWA C900 pipe and fittings, DR 18. Inside drop structures shall be constructed of ASTM D3034, SDR 35 PVC pipe and fittings.

S4-08 MANHOLE FRAME & COVER

Ductile iron and cast iron frames and covers shall conform to the standard specifications, as modified herein. All covers shall have SEWER written in 3" letters.

Casting shall conform to the requirements of ASTM A-536, Grade 80-55-06 for ductile iron and ASTM A-30, Class 25 for cast iron, and shall be free of porosity, shrinkage cavities, cold shuts, or cracks, or any surface defects which would impair serviceability. Repair of defects by welding or by the use of smooth-on or similar material will not be permitted.

Manhole frames and covers shall be machine-finished or ground-on seating surfaces so as to assure non-rocking fit in any position and interchangeability. At the request of the Town, there shall be made available at the foundry standard rings and standard covers for use by inspectors in testing fit and seating.

When bolt-locking covers are required, the locking bolts shall be 5/8" - 11 NC stainless steel type 304 socket (allen) head bolts, 2 inches long.

All structure 14' or deeper or structure with an inside drop, requires a clear opening of 36". All others are 32" clear opening.

S4-09 CONCRETE BEDDING & BLOCKING

Bedding, blocking, or encasement concrete shall be mixed from materials acceptable to the Engineer and shall have a 30-day compressive strength of not less than 2,500 psi. The mix shall contain five (5) sacks of cement per cubic yard and shall be of such consistency that the slump is between 1 inch and 5 inches. All concrete shall be mechanically mixed.

S4-10 OIL/WATER SEPARATOR

Oil/Water separator vaults shall be of precast concrete construction.

Cement concrete shall have a minimum 28-day compressive strength of 4500 pounds per square inch.

Deformed bars for steel reinforcement shall be in accordance with ASTM A615, grade 60. Welded-wire fabric reinforcement shall be in accordance with ASTM A185, grade 65. All interior piping shall be PVC sized to match side sewer line size. Baffles and weir shall be 1/2-inch thick steel plates galvanized in accordance with ASTM A123. Vault cover shall include one (1) 24-inch square diamond plate access door and two (2) 12-inch square diamond plate inspection covers centered over outlet tee and inlet. Cover shall be designed for AASHTO H-20 load. See the Standard Details for vault sizes and miscellaneous details.

S4-11 GREASE INTERCEPTOR

Grease Interceptor Vaults shall be of precast concrete construction. Cement concrete shall have a minimum 28-day compressive strength of 4500 pounds per square inch.

Deformed bars for steel reinforcement shall be in accordance with ASTM A615, grade 60. Welded-wire fabric reinforcement shall be in accordance with ASTM A185, grade 65. All interior piping shall be PVC sized to match side sewer line size.

Interior baffle shall be precast reinforced concrete, 4 inches thick. Concrete baffle shall be secured in place by slotted vault walls or with stainless steel angels as shown in the Standard Detail.

Vault cover shall include 32-inch clear opening manhole covers and frames located over inspection tees. Manhole covers shall not allow passage of air or gases. Vault cover shall be designed for AASHTO H-20 load with 30% impact factor.

S4-12 BACKWATER VALVE

Backwater check valve installed on 4" to 8" diameter lateral sewers shall be rubber flapper swing type check valve. Flapper shall be constructed from steel reinforced rubber with 45-durometer standard rubber hardness. Valve seat shall be at 45° angle to direction of flow. Flow area through valve shall equal full pipe area. Valve body shall be cast iron with flanged ends and bolted over to allow removal of flapper without removing valve from line.

S4-13 BARRIER FENCE

Barrier Mesh shall be manufactured from Low Density Polyethylene, stabilized against U.V. degradation, and with a special selection of pigments to ensure optimum visual performance under harsh weather conditions.

Barrier Mesh shall be corrosion-free and resistant to salt water and most chemicals.

Barrier Mesh shall present a visual target area of approximately 0.5 square meter per square meter of mesh.

S4-14 GRAVEL

- A. Bedding gravel shall consist of either clean sand/gravel mixture as specified in State of New Hampshire specifications.
- B. Select Trench Backfill shall be as specified in Env-Ws 720.05 K “Standards of Design and Construction for Sewage and Wastewater Treatment Facilities”, Sept. 1997, or latest revision.

S4-15 CONTROLLED DENSITY FILL (FLOWABLE FILL)

Controlled density fill (CDF aka, flowable fill) shall be a mixture of Portland Cement, aggregates and water. It shall be proportioned to provide a gouty, non-segregating, free flowing, self-consolidating and excavatable material that will result in a non-settling fill, which has measurable unconfined compressive strength.

Materials testing shall be with unconfined compressive test cylinders. Test data may be either laboratory trial batch test data or field test data.

Alternate mix designs may be required at the Engineer's discretion.

The unconfined compressive strength at 28 days shall be a minimum of 50 psi and a maximum of 100 psi. Material shall be sand/grout slurry proportioned to be hand-excavatable after long-term strength gain.

Materials shall meet the requirements of the following sections of the Standard Specifications:

- Portland Cement
- Fine Aggregate for Portland Cement Concrete
- Admixture for Concrete
- Fly Ash
- Water

Controlled density fill shall meet the following requirements:

Controlled Density Fill

<u>Ingredients</u>	<u>Amount per Cu. Yd.</u>
Portland Cement	50 lb.
Aggregates Class 1 or 2	3300 lb.
Air Entrainment Admixture	Per Manufacturer's recommendations
Fly Ash Class F	300 lb.
Water	300 lb. (maximum)

The material consistency shall be flowable (approx. slump 3-10 inches). If requested by the Contractor, the proportions may be adjusted with the approval of the Engineer.

CHAPTER S5 - SEWER METHODS OF CONSTRUCTION

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CHAPTER S5 - SEWER METHODS OF CONSTRUCTION

S5-01 GENERAL CONSTRUCTION REQUIREMENTS

The improvements shall be constructed as shown on the plans and in accordance with these Standards, Standard Details, and Standard Specifications. Manufacturer's equipment shall be installed in compliance with specifications of the manufacturer, except where a higher quality of workmanship is required by the plans and specifications. All materials and work shall be in strict accordance with any applicable regulations of the State, and local authorities. The Contractor shall arrange for such inspection by these agencies as may be required and shall submit evidence of their approval, if requested by the Engineer.

S5-01.1 Alignment & Staking

All work done under a Project shall be to the lines shown on the plans, or to approved revisions.

S5-01.2 Inspections & Tests

- A. The Engineer shall, at all times, have access to the work for the purpose of inspecting and testing, and the Contractor shall provide proper facilities for such access and such inspection and testing.
- B. If any work is covered up without approval or consent of the Engineer, it must, if required by the Engineer, be uncovered for inspection.
- C. Before a performance test is to be observed by the Engineer, the Contractor shall make whatever preliminary tests are necessary to assure that the material and/or equipment are in accordance with the plans and specifications.
- D. Written notice of deficiencies, adequately describing the same, shall be given to the Contractor upon completion of each inspection and the Contractor shall correct such deficiencies within seven days of the notice and before final inspection will be made by the Engineer, unless otherwise approved.

S5.02 GRADE ESTABLISHMENT

Sewer grades shall be established by means of laser beam, lines, poles, plumb bobs or other means approved by the Design Engineer. The grades shall be checked at periodic intervals as directed by the Engineer and at completion of each run of pipe.

If the Contractor chooses to use a laser beam the equipment and methods shall meet the approval of the Engineer. Laser beam alignment and grade shall as a minimum be verified at a point 50 feet from the laser.

The Contractor shall replace all monuments, right-of-way markers, property stakes, etc., that are removed or disturbed, to the satisfaction of the Engineer.

S5.03 TESTING REQUIREMENTS -- GENERAL

Inspection will be required during the installation of sewer main, wyes, structures and building of inverts. All installation shall be in compliance with "State of New Hampshire Standards of Design for Sewage and Wastewater Treatment Facilities", September 1997 or latest revision.

- A. Final sewer testing work includes the performance of testing and inspection each run of pipe, or each gravity main or force main and each item of appurtenant construction.
- B. Perform testing at a time approved by the engineer, which may be during the construction operation, after completion of a substantial and convenient section of the work, or after the completion of the laying of 1,000 feet of pipe.
- C. Provide all labor, pumps, connections, gauges, measuring devices and all other necessary apparatus to conduct tests. All equipment must be appropriate calibration certification.
- D. Testing may be done by a qualified independent testing organization or by the contractor. In either case testing shall conform to the requirements outlined in the "State of New Hampshire Standards of Design for Wastewater Treatment Facilities", latest revision, and the requirements of the Town of Merrimack contained herein.
- E. All portions of the sewer system including sewers, manholes, force mains and appurtenant work in order to be eligible for approval by the Engineer, shall be tested for water tightness by the use of either water or low- pressure air. The rate of infiltration or exfiltration shall not exceed 100 gallons per inch of pipe diameter per mile of pipe, for sizes up to 48": 200 gallons per inch of pipe diameter per mile over 48". Each section of pipe shall meet the above criterion. There shall be no

more than 1,000 feet of untested sewer constructed at any time. Force mains shall be tested in accordance with section 4 of the American Water Works Association Standard C 600 "Installation of Cast Iron Water Main"; at a pressure equal to 150% of the design cooperating dynamic head. Low-pressure air tests shall be to ASTM C828. As an alternative to the infiltration and exfiltration tests on manholes, a vacuum pressure test may be carried out to the criterion in Section S5.05 & S5.06, below.

- F. Immediately following the pipe cleaning, the pipe installation shall be tested with low-pressure air. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 pounds per square inch greater than the average backpressure of any groundwater that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization before proceeding further.

S5.04 FIELD QUALITY CONTROL

- A. All leakage tests shall be completed and approved prior to placing of permanent resurfacing.
- B. All sewers, manholes, and appurtenant work, in order to be eligible for approval by the Engineer, shall be subject to tests that will determine the degree of water tightness and horizontal and vertical alignment.
- C. Thoroughly clean and/or flush all sewer lines to be tested, in a manner and to the extent acceptable to the engineer, prior to initiating test procedures.
- D. Perform all tests only under the direct supervision of the Engineer in accordance with local and state regulations.
- E. Perform testing by test patterns determined or approved by the Engineer.
- F. Remedial Work
 - 1. Perform all work necessary to correct deficiencies discovered as a result of testing and/or inspection under the direct supervision of the Engineer.
 - 2. Completely retest all portions of the original construction on which remedial work has been performed.

S5.05 SEWER LINE ACCEPTANCE TESTS

- A. Each section of sewer shall be tested between successive manholes by plugging and bracing all opening in the sewer mainline and the upper ends of all house connections sewers.
- B. Gauges – The gauges utilized for the test shall be of a scale and range equivalent to 2.5 inch diameter, 0-15 psi range (0.2 psi maximum increments). Gauges supplied by the contractor shall be tested for accuracy and shall have a current certification of accuracy from an approved agency. The gauge for vacuum tests shall meet the above certification requirements also.
- C. Pneumatic Plugs – Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected. Also plugs shall resist internal test pressure.
- D. Central/Control Panel – All air used shall pass through a single central panel.
- E. Connect three individual hoses: From the control panel to the pneumatic plug for infiltration. From the control panel to the sealed sewer line for introducing the low-pressure air. From the sealed sewer line to the control panel for continually monitoring the air pressure rise in the sealed line.

S5.06 TESTING SEWER PIPELINE AND MANHOLES

- A. Low-pressure air tests shall be in compliance with ASTM C 828 and State of New Hampshire Standards for Sewage and Wastewater Treatment Facilities.

Low-pressure air test – The equipment used shall conform to the requirements in Section 5.05 above. The line shall be pressurized to 4.0 psi. The line will be allowed to stabilize to between 3.5 psi and 4.0 psi for a period of no less than five (5) minutes. If necessary, air shall be added to the line to maintain the pressure above 3.5 psi. After the stabilization period, the valve controlling the air shall be closed. When the line pressure drops to 3.5 psi, commence timing with a stopwatch. The stopwatch shall be allowed to run until such time as a line pressure drops to 2.5 psi, the watch shall be stopped and the time lapse compared with allowable time laps in these specifications for the pipe size and leakage allowance specified by the engineer (see Table 1 included). If the time lapse is greater than that specified, the section undergoing test shall have passed, and the test may be discontinued at that time. If the time is less than that specified, the line has not passed the test; and the contractor/developer will be required to correct the condition causing the failure and prepare the line for retest.

If the pipeline to be tested is beneath the groundwater level, the test pressure shall be increased 0.0433 psi for each foot the groundwater level is above the pipe.

- B. Manhole - Initial vacuum gauge test vacuum shall be 10" Hg. Test hold time for a 1" Hg. vacuum drop shall be as follows:

At least 2 minutes for a 10' deep manhole;

At least 2 ½ minutes for a 10' to 15' deep manhole;

At least 3 minutes for a 15' to 25' deep manhole.

- C. Deflection tests and test gauge diameter for plastic pipe, shall be 7 ½% of average inside diameter. A test shall be conducted after a minimum of thirty (30) days following installation.

The deflection gauge diameter for this test (G), shall be determined by the following formula: $G = .925$ inches (nominal) where D is the average inside diameter given in applicable ASTM standard. In the cases where inside diameters are not given, they shall be determined by the following formula:

$$D = D' - 2(1.06 t) \text{ inches}$$

where t = maximum solid wall thickness

D' = the average outside diameter

Limits of installed deflection for other flexible pipe materials shall not exceed the above for PVC. Trench compaction shall be by rolling or mechanical tamping.

S5.07 TV INSPECTION

- A. The Developer shall provide the Town with a videotape inspection of all sanitary sewers prior to final project acceptance. The video shall include the following at a minimum; identify each manhole, distance to each lateral and total distance from manhole to manhole. The video shall be completed only after 30 days have elapsed.
- B. If defects are found during the two-year warranty period, the Town may also require that the Developer provide videotape inspection of any or all sanitary sewers before expiration of the warranty.
- C. The Contractor shall correct all deficiencies found during television inspection.
- D. Town representative should be onsite to witness video.

- E. Video cannot be done until 30 days after the last run of pipe has been installed.
- F. Pipe shall be cleaned by use of proper sewer cleaning equipment such as a vactor truck, etc. Flushing of line by running water is not acceptable. It is strongly suggested the cleaning take place while the video equipment is on site to ensure the pipe is clean enough for video acceptance.

S5.08 INSPECTION OF APPURTENANT INSTALLATIONS

- A. Completely inspect, at a time determined by the Engineer, all manholes and inlets to ascertain their compliance with drawings and specifications.
- B. Provide access to each manhole and inlet and check the following characteristics:
 - 1. Slope and finish of invert channels.
 - 2. Water-tightness and finish of masonry structures.
 - 3. Elevation and attachment of frames, covers, and opening.

S5.09 PROCEDURES FOR REVISION OF APPROVED PLANS

Any deviation from the approved plans or specification affecting capacity, flow or operation of units shall be approved in accordance with these rules in writing before such changes are made. Plans or specifications so revised shall be submitted at least thirty (30) days in advance of any construction work which will be affected by such changes, to permit time for review and approval. Structural revisions or other changes not affecting capacity, flows, or operation are permitted during construction but only as approved changes in accordance with these rules. As-built plans shall be submitted to the division at the completion of work.

S5.10 ACCEPTANCE OF SEWERS

Upon completion of the installation and testing of the sewer system and the building of inverts, the Contractor/Developer will submit three (3) sets of "As-Built Plans" appropriately stamped by the engineer of record or the design engineer for the project. One set shall be in AutoCAD and two sets in printed format. Upon receipt of the above plans, the Town will conduct a review and the Director of Public Works will inform the Contractor/Developer of the acceptance or rejection of the system and in the case of rejection the reason for said rejection. **No paving shall take place until the above has been completed.**

S5.11 TESTING OF PRESSURE SEWER MAINS

Prior to acceptance of the project, the pressure line shall be subjected to a test in accordance with Section 4 of the American Water Works Association Standard C 600 “Installation of Cast Iron Water Main”; at a pressure equal to 150% of the design dynamic head. The Contractor before final acceptance of the project shall remedy any leaks of imperfections developing or occurring under the test pressure. Leakage shall be measured by approved means. Test pressure shall be maintained while the entire installation is inspected. The Contractor shall provide all necessary equipment and shall perform all work connected with the tests. Insofar as is practical, test shall be made with pipe joints and fittings exposed for inspection. Maximum allowable leakage shall be .05 gallons per hour per inch of pipe diameter per 100 feet of pipe.

S5.12 INSPECTION

Town engineering consultants will be used for inspection and shall be paid for by the Developer / Contractor. All inspections shall be approved by the Director of Public Works.

Table I
Leakage Allowance
Testing for one pipe diameter only

Length (ft.)	6"	8"	10"	12"	15"	18"	21"	24"	30"
25	0:10	0:18	0:22	0:27	0:31	0:36	0:45	0:53	1:12
50	0:20	0:36	0:45	0:53	1:03	1:12	1:29	1:47	2:23
75	0:30	0:53	1:07	1:20	1:34	1:48	2:14	2:40	3:35
100	0:40	1:11	1:29	1:47	2:05	2:24	2:58	3:34	4:46
125	0:50	1:29	1:51	2:14	2:37	3:00	3:43	4:27	5:58
150	1:00	1:47	2:14	2:40	3:08	3:36	4:28	5:21	7:09
175	1:10	2:05	2:36	3:07	3:39	4:12	5:12	6:14	8:21
200	1:20	2:22	2:58	3:34	4:10	4:48	5:57	7:07	9:32
225	1:30	2:40	3:20	4:00	4:42	5:25	6:42	8:01	10:44
250	1:40	2:58	3:43	4:27	5:13	6:01	7:26	8:54	11:56
275	1:50	3:16	4:05	4:54	5:44	6:37	8:11	9:48	13:07
300	2:00	3:34	4:27	5:21	6:16	7:13	8:55	10:41	14:19
350	2:20	4:09	5:12	6:14	7:18	8:25	10:25	12:28	16:42
400	2:40	4:45	5:56	7:07	8:21	9:37	11:54	14:15	19:05
450	3:00	5:21	6:41	8:01	9:23	10:49	13:23	16:02	21:28
500	3:20	5:56	7:25	8:54	10:26	12:01	14:52	17:48	23:51

Note: Leakage allowance based on equations from ASTM C-828.
Specification Time (Min.:Sec.) required for pressure drop from 3-1/2 psi to 3.0 psi.

S5-13 MANHOLE EXCAVATION

Excavation for precast manholes shall be sufficient to provide a minimum of 12 inches between the manhole and the side of the excavation. The excavation shall be kept free from water until jointing has been completed. Surface water shall be diverted so as not to enter the excavation. The contractor shall maintain sufficient pumping equipment on the job to insure that these provisions are carried out.

S5-14 PIPE LAYING

Pipe laying shall be in accordance with the following.

Each pipe shall be laid with bells upgrade with the invert of the pipe to the alignment and grade shown on the plans. Care shall be exercised to insure close concentric joints and a smooth invert. Open ends of pipe and fittings shall be temporarily blocked and covered when laying is not in progress.

Water shall not be allowed in the trench during the pipe laying, joint making, and as long thereafter as is necessary, in the judgement of the Engineer, for the type of joint being used.

Existing sewage flow shall be diverted away from the segment being worked on by method approved by the Engineer.

Adjustment to the line and grade shall be done by scraping away or filling in and tamping material under the body of the pipe. Adjustment to the line and grade by wedging and blocking shall not be permitted.

The pipe shall be lowered into the trench by methods recommended by manufacturer or any other suitable means. The pipe shall not be dropped or handled roughly. The pipe shall be checked for cracks and defects prior to use and any defective pipe rejected.

Wyes, and standing services shall be installed as shown on the Standard Details and at such locations as are shown on the plans or as otherwise directed by the Engineer. These items shall not be backfilled until the Contractor has recorded their exact location.

Pipe laying shall start from the lowest point unless otherwise approved by the Engineer.

Slip lining shall be performed as per recommended procedure by manufacturer, as per details and as approved by the Engineer.

S5-15 ALIGNMENT TOLERANCE

The maximum tolerance from true line and grade shall be as follows:

Maximum deviation from established line and grade shall not be greater than one thirty-second ($1/32$) inch per inch of pipe diameter and not to exceed one-half ($1/2$) inch.

No adverse grade in any pipe length will be permitted.

The difference in deviation from true line and grade between any two successive joints shall not exceed $1/3$ of the amounts specified above.

S5-16 JOINTS

Joint material shall be used in accordance with the recommendations of the manufacturer. Pipe handling after the gasket has been affixed shall be carefully controlled to avoid bumping the gasket and, thus knocking it out of position or contaminating it with dirt or other foreign material. Any gasket so disturbed shall be removed cleaned, re-lubricated and replaced.

Care shall be taken to properly align the pipe before joints are forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling, as required to minimize lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Pipe deflection and straightening shall be held to a very minimum once the joint is home to prevent creep of the joint.

Sufficient pressure shall be applied in making the joint to assure that the joint is home as defined in the standard installation instructions provided by the pipe manufacturer. Sufficient restraint shall be applied to the line to assure the joints once home are held so, by tamping fill material under and alongside the pipe or otherwise. At the end of the day's work, the last pipe shall be blocked in such a manner as may be required to prevent creep during down time.

S5-17 PRESSURE SEWER MAINS AND VALVES

S5-17.1 Pressure Main Installation

Pressure pipe as specified on the plans shall be installed as recommended by the pipe manufacturer. Pressure sewer mains shall be laid so that no high point exists except at the discharge manhole or an air release assembly.

S5-17.2 Valve Installation

Before installation, valves shall be cleaned of all foreign material. Such blocking as the Engineer may deem necessary shall be provided. The valve and valve box shall be set plumb with the valve box centered on the valve. Valves shall be opened and shut under pressure to check operation without leakage. Where valve operating nut is more than three feet below finished grade, a stem extension conforming to the Water Standard Detail must be installed.

The top of the valve box base section shall be located a minimum of 6" and maximum of 9" below finished grade. A polyethylene sheet, 8-mils thick, shall be placed between the top and base valve box sections to prevent metal-to-metal contact where the sections overlap.

Valve box top sections shall be adjusted flush with the finished pavement and, in those areas to be excavated for future roadway grades, enough adjustment shall be provided in the valve box to allow the top of the box to be adjusted to the required grade.

S5-17.3 Valve Box Marker Installation

Concrete marker posts shall be painted with two coats Rust-Oleum No. 2766 Hi-Gloss white paint. The marker shall be set on a line through the valve at right angles to the centerline of the road. The marker shall generally be set on the property line unless the Engineer decides another location is safer or more conspicuous. Distance to the valves shall be nearly stenciled on the post with 2-inch numerals. Valve markers shall be installed only in unimproved or unpaved areas.

S5-18 PIPE BEDDING

Pipe shall be placed on a prepared subgrade of imported material at least 6 inches deep below the barrel of the pipe and filled around the pipe to the spring line for all pipe sizes of 27 inches in diameter and smaller, and 8 inches deep for all pipe sizes of 30 inches and larger. Pipe in ledge requires 12". After preparation of the subgrade, bell holes shall be excavated so the pipe, when laid, will have a uniform bearing under the full length of the pipe. The Contractor shall be responsible for adequate support and bedding for the pipe. The trench shall be hand backfilled and compacted from the spring line of the pipe to six inches above the top of the pipe. The material shall be placed in 6-inch layers and compacted to no less than 95 percent of the maximum theoretical density as measured by ASTM D-1557 prior to placement of the next layer.

Where the undisturbed trench below the 6 inch bedding is unstable, the unstable materials shall be removed and backfilled with foundation gravel and/or bedding gravel as necessary to produce a stable foundation upon which to place the bedding. The Contractor shall be responsible for providing a stable foundation for placing of the bedding.

Boulders, rocks, and other obstructions (except roots of existing trees to be saved) shall be entirely removed or cut out the full width of the trench and to a depth 6 inches below the pipe bottom and backfilled as provided above.

Whenever the trench is excavated below the depth required for proper bedding, it shall be backfilled with bedding gravel and compacted, as provided above for bedding gravel.

Use Concrete Encasement in accordance with the Standard Detail only upon direction of the Engineer.

S5-19 LATERAL SEWERS

Lateral sewer locations as shown on the plan are approximate only.

All existing services shall be maintained during construction.

All existing lateral sewers shall be reconnected or replaced immediately after the trunk is laid. When replacing an existing trunk, lateral sewers shall be reconnected after the main is tested, when feasible.

Where applicable, all specifications contained herein for sewer materials and construction shall be held to apply to lateral sewers. Invert of the lateral sewer at the end of the stub shall be as shown on the plan or as directed by the Engineer.

Ends of the lateral sewer stubs shall be marked with a 2 x 4 stake, 12 feet long, with one end buried at the depth of the stub-end invert and extending vertically out of the ground. The portion of the stake above ground shall be painted green and marked with the word "SEWER" and the depth from pipe invert to ground surface.

Slope of lateral sewers shall not be less than two percent (2%). All lateral sewer plugs shall be blocked.

Where change in slope is greater than two inches per foot, standard 1/8 bends shall be used.

S5-20 MANHOLES

Manholes shall be constructed as shown in the Standard Details for standard manholes and drop manholes. Manholes shall be of precast reinforced concrete. Manhole ring and covers shall be adjusted to the elevation required by the Engineer prior to final acceptance of the work.

The manhole base slab shall be placed on firm soil. If the foundation material is inadequate, the Contractor shall use foundation gravel or bedding concrete under the normal base to support the manhole.

The outside and inside of manhole adjusting bricks and the joints of any non-gasketed precast concrete sections shall be thoroughly wetted and completely filled with mortar, plastered and troweled smooth with 3/4" of mortar in order to attain a watertight surface.

Mortar shall be placed between each level of adjusting bricks, riser rings, top of cone section, and bottom of iron ring.

All lift holes, if any, on precast items shall be completely filled with nonshrink mortar, smoothed both inside and out, to insure water-tightness. All steel loops, if any, on precast section must be removed, flush with the manhole wall. The stubs shall be covered with mortar and smoothed. Rough, uneven surfaces will not be permitted.

Channels shall be made to conform accurately to the sewer grade and shall be brought together smoothly with well-rounded junction, satisfactory to the Engineer. The channels shall be built using all brick and mortar poured after the inlet and outlet pipes have been laid and firmly grouted into place at the proper elevation. Allowances shall be made for a minimum of one-tenth foot (0.1') drop in elevation across the manhole in the direction of flow. The maximum allowable drop in invert elevation across the manhole in the direction of flow shall be 1.0 foot. Channel sides shall be carried up vertically from the invert to top of the various pipes. The shelf shall be warped evenly and sloped 1" per foot to drain. Rough, uneven surfaces will not be permitted. Channels shall be constructed to allow the installation and use of a mechanical plug of the appropriate size.

All rigid pipe entering or leaving the manhole shall be provided with flexible joints within twelve inches (12") of the manhole structure and shall be placed on firmly compacted bedding. Special care shall be taken to see that the openings through which pipes enter the structure are completely and firmly filled with mortar from the outside to ensure water-tightness. All PVC pipe connections to manholes shall be made with gasketed coupling as approved by the Engineer.

S5-21 CONNECTION TO EXISTING MANHOLE

Connection to existing manhole shall be accomplished in such a manner that all existing services are maintained, that no refuse, broken brick, concrete or other extraneous matter enter into the existing sewer. The outfall shall be plugged or screened throughout the contractors operation at the Engineer's option.

A circular opening shall be carefully core drilled in the manhole barrel on the proper alignment so that the new sewer will be in line with the center of the manhole, and at the height which will allow the new sewer to be placed at the proper grade. The opening shall be of such size as to provide clearance of not less than one (1) or more than three (3) inches between the outside of the pipe and the manhole wall. Pipe connections, channel forming, grouting of pipe and backfilling shall be as specified previously for standard manholes.

No additional pipe shall be connected until final set of the grout has occurred. When additional pipe is connected, care shall be taken to avoid shocks or other undue strains to the grouted pipe.

Any opening resulting from removal of existing pipe shall be filled with mortar to provide a watertight seal, unless new pipe is to be reconnected to that opening.

When any new sewer is connected to an existing manhole, the manhole shall be reconstructed to conform to current standards.

Upward adjustments of old, existing manholes must be done with all new parts.

S5-22 CLEANING & FLUSHING

Prior to pipe testing, all pipes shall be cleaned in the following manner:

The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe to be tested. The ball may, at the option of the Contractor, be used without a tag line; or a rope or cord may be fastened to the ball to enable the Contractor to know and control its position at all times. The ball shall be placed in the last cleanout or manhole on the pipe to be cleaned and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or wedged debris or damaged pipe stops the ball, the Contractor shall remove the obstruction.

S5-23 Future Use

S5-24 TESTING OF PRESSURE SEWER MAINS

See Section S5.03

S5-25 OIL/WATER SEPARATOR

Detailed shop drawings must be submitted for approval by Director of Public Works. Oil/water separators shall be constructed as shown on submitted plans. Excavation for precast vault shall be sufficient to provide a minimum of 12 inches between the vault and the side of the excavation. Vault shall be placed at proper depth to set vault cover flush with finish grade. If additional depth of cover is required over inlet or outlet piping, vault riser sections shall be installed to raise vault cover a maximum of 24 inches.

The oil/water separator shall be placed on firm soil. If the foundation material is inadequate, the Contractor shall use foundation gravel or bedding concrete under the normal base to support the separator.

Vault shall be placed and set plumb so as to provide vertical sides. The completed separator shall be rigid and watertight.

Joints of precast concrete sections shall be thoroughly wetted and completely filled with mortar, plastered and troweled smooth with 3/4" of mortar in order to attain a watertight surface.

All lift holes, if any, on precast items shall be completely filled with expanding mortar and smoothed both inside and out, to insure water-tightness. All steel loops, if any, on precast section must be removed, flush with the vault wall. The stubs shall be covered with mortar and smoothed. Rough, uneven surfaces will not be permitted. Precast vault shall be provided with 8-inch diameter knockouts at all pipe openings or have openings core-drilled prior to installation.

All rigid pipe entering or leaving the structure shall be provided with flexible joints within twelve inches (12") of the manhole structure and shall be placed on firmly compacted bedding. Special care shall be taken to see that the openings through which pipes enter the structure are completely and firmly filled with mortar from the outside to ensure water-tightness. All PVC pipe connections to vault shall be made with gasketed coupling as approved by the Town.

S5-26 GREASE INTERCEPTOR

Detailed shop drawings must be submitted for approval by Director of Public Works. Grease interceptors shall be constructed as shown on plans submitted. Excavation for precast vault shall be sufficient to provide a minimum of 12 inches (12") between the vault and the side of the excavation.

32-inch (32") diameter manhole frame and cover shall be adjusted to the elevation required by the Engineer prior to final acceptance of the work. Adjusting rings shall be manufactured from precast reinforced concrete. Total height of rings shall be from 8 inches (8") minimum to 20 inches (20") maximum.

The grease interceptor shall be placed on firm soil. If the foundation material is inadequate, the Contractor shall use foundation gravel or bedding concrete under the normal base to support the interceptor.

Vault shall be placed and set plumb so as to provide vertical sides. The completed interceptor shall be rigid and watertight.

The outside and inside of manhole adjusting rings, joints of precast concrete sections and the perimeter of precast baffle shall be thoroughly wetted and completely filled with mortar, plastered and troweled smooth with 3/4" of mortar in order to attain a watertight surface.

All lift holes, if any, on precast items shall be completely filled with expanding mortar, smoothed both inside and out, to insure water-tightness. All steel loops, if any, on precast section must be removed, flush with the vault wall. The stubs shall be covered with mortar and smoothed. Rough, uneven surfaces will not be permitted.

Precast vault and baffle shall be provided with 8-inch (8") diameter knockouts at all pipe openings or have openings core-drilled prior to installation.

All rigid pipe entering or leaving the structure shall be provided with flexible joints within twelve inches (12") of the manhole structure and shall be placed on firmly compacted bedding. Special care shall be taken to see that the openings through which pipes enter the structure are completely and firmly filled with mortar from the outside to ensure water-tightness. All PVC pipe connections to vault and baffle shall be made with gasketed coupling as approved by the Town.

S5-27 COMMERCIAL CLEAN-OUT WITH TEST SAMPLING TEE (if needed)

Test sampling tees shall be placed outside the building no more than 24 inches (24") downstream of a clean-out extended to grade, enclosed in a cast concrete meter box. The enclosure shall be supported on minimum 2-inch thick gravel base. The capped orifice shall be a maximum of 4 inches (4") from finished grade. The sampling tee shall be installed so that it opens in a direction at right angles to and vertically above the flow of the pipe. The sampling tee shall be accessible at all times for compliance determination sampling.

The clean out shall be brought to grade and provided with a cast iron ring and cover imbedded in class "C" concrete as shown in the Standard Detail.

S5-28 BACKWATER VALVE

Check valve assembly shall be installed on lateral sewers at locations as shown on the plan or as indicated in the Sewer Use Ordinance, or as directed by the Engineer.

S5-29 PRECONSTRUCTION PHOTOS FOR ALL PROJECTS

Before commencing any construction work as described in the plans and specifications, the Contractor shall provide photographs of pre-existing conditions of the area that will be disturbed during construction operations.

Photographs will be obtained as follows:

1. Every 25 feet interval in easements.
2. Every 50 feet interval in paved areas.
3. And any other location as directed by the Engineer.

The photographs shall be taken with a 35mm camera, developed in 5" x 7" color prints, contained in albums, catalogued, and cross-referenced.

S5-30 UNDERGROUND UTILITIES

The plans show the approximate locations of various existing utilities known to the Engineer, such as gas lines, water mains, storm drainage, power lines, telephone lines, television cables, and other obstructions based on information obtained from various sources. This information is not guaranteed to be accurate, and the Contractor is directed to check for interferences and obstructions by inquiry from the different utilities and by underground exploration ahead of his regular excavation.

The Contractor shall request field locates and notify the owners of underground facilities about the scheduled commencement of excavation through DIG SAFE (1-888-344-7233), <http://www.digsafe.com>.

If the Utility is not included in the one-number locator service, notice shall be provided individually to those owners of underground facilities known to or suspected of having underground facilities within the area of proposed excavation.

Notice shall be made to owners of underground utilities not less than two (2) business days or more than ten (10) business days prior to scheduled date of commencement of excavation.

The Contractor shall excavate around and under service pipes with special care and shall support and maintain them in service. Where it is necessary to cut, move or reconnect any service lines, arrangements shall be made with the respective utility and property owner.

S5-31 CONSTRUCTION ON EASEMENTS

All work on easements shall be performed strictly in accordance with easement provisions. Easements shall be restored equal to or better than original condition. The Contractor shall do no work on easement areas until specifically authorized by the Engineer.

S5-32 DUST CONTROL

The Contractor shall sprinkle water as necessary to keep the dust down. This sprinkling shall be maintained until the project is accepted. Sprinkling shall be kept to a minimum and shall not produce runoff from the site. On paved streets, if dust becomes a nuisance when backfilling is completed, the Contractor shall vacuum sweep the portions of streets being used for traffic. Flushing of streets shall not be permitted without prior Town approval.

S5-33 BARRIER FENCE

Where indicated on the Plans, a bright orange safety fence shall be placed parallel to the silt fence, 2 feet nearer to the construction activity. Minimum fence material height shall be 2 feet. Top of fence shall be located 3 feet above ground.

The barrier fence shall be supported as recommended by the manufacturer and as directed by the Engineer.

S5-34 TRENCH EXCAVATION

Before commencement of trenching provide siltation control for all downhill storm drain catch basins. Plastic sheeting must be available on-site. In case of rain any stockpiled material must be covered and secured.

Clearing and grubbing limits may be established by the Engineer for certain areas and the Contractor shall confine his operations within those limits. Debris resulting from the clearing and grubbing shall be disposed of by the Contractor.

Trenches shall be excavated to the line and grade designated by the Engineer and in accordance with the Standard Details. Trenches shall comply with OSHA and State of New Hampshire requirements regarding worker safety. The trench width at the top of the pipe shall be 30 inches for pipe up to and including 12 inch inside diameter and the outside diameter of the pipe barrel plus 16 inches for pipe larger than 12 inch inside diameter. Where higher strength pipe or special bedding is required because of excess trench width, it shall be furnished.

The trench shall be kept free from water until joining has been completed. Surface water shall be diverted so as not to enter the trench. The Contractor shall maintain sufficient pumping equipment on the job to insure that these provisions are carried out. The Contractor shall perform all excavation of every description and of whatever substance encountered as part of his trench excavation cost. Unsuitable material below the depth of the bedding shall be removed and replaced with satisfactory materials as determined by the Engineer.

Trenching operations shall not proceed more than 100 feet in advance of pipe laying except with written approval of the Engineer.

When trenching operations take place in the public right-of-way, the pavement, and all other improvements, shall be restored as required by the Right-Of-Way Permit.

S5-35 SHEETING & SHORING

The Contractor shall provide and install sheeting and shoring as necessary to protect workmen, the work and existing utilities and other properties in compliance with OSHA and State of New Hampshire requirements. All sheeting and shoring above the pipe shall be removed prior to backfilling. Sheeting below the top of the pipe may be cut off and left in place.

Removal of the sheeting and shoring shall be accomplished in such a manner that there will be no damage to the work or to the other properties.

S5-36 TRENCH DEWATERING

When water is encountered to a degree that a successful trenching and pipe laying operation is hampered, dewatering will be the responsibility of the Contractor. Determination of the method to be used to dewater trenched areas will be the responsibility of the Contractor, but any method used must be in accordance with the specifications and requirements of the Town of Merrimack and State of New Hampshire.

S5-37 TRENCH BACKFILL AND COMPACTION

Compaction of backfill from the bottom of the trench to the top of the pipe shall be as specified under pipe bedding. Compaction of the remainder of the backfill shall, at the minimum, meet the requirements of the State of New Hampshire, and Town of Merrimack Construction Standards.

Backfill shall not be deposited in the trench in any manner which will damage or disturb the pipe or the initial backfill. Compaction of the backfill may be obtained by tamping, rolling or otherwise, as specified by the Engineer. The Contractor shall provide the services of a testing laboratory acceptable to the Engineer to perform in place density tests to show that the specified density has been obtained. The approval of the compaction method and the achievement of the specified density shall, in no way, relieve the Contractor of responsibility for all repairs caused by settlement of the backfill prior to acceptance and during the two-year period after acceptance of the project.

Where the excavated materials cannot be compacted as specified, the Contractor shall replace the excavated material with approved imported gravel. (Testing Certificate Required)

Compaction of backfill material may be accomplished by mechanical tamper, by vibrating, by a combination of these methods, as approved by Engineer.

Unless otherwise provided, compaction of backfill shall meet the following requirements:

Paved Areas

- A. Trench restoration shall be either by a patch or overlay method as required and noted on the Right-Of-Way permit. When a patch method is used the trench limits shall be sawcut prior to the final patch.
- B. All trench and pavement cuts shall be made by sawcuts. The sawcuts shall be a minimum of 1 foot (1') outside the trench width. If the permit requires an overlay then the Contractor may use a jackhammer for the cutting of the existing pavement.
- C. All trenching shall be backfilled with either crushed surfacing materials conforming to Section 4-04 of the Standard Specifications. All trench backfill materials shall be compacted to ninety-five percent (95%) maximum dry density, as determined by ASTM D-1557, and State of New Hampshire Specifications.

If the existing material is determined by the Engineer to be suitable for backfill, the Contractor may use the native material.

Backfill compaction shall be performed in 8 to 12 inch lifts. The Developer shall perform compaction tests in four-foot (4') increments maximum. The test results shall be given to the Engineer for review and approval prior to paving. Tests shall be performed at maximum intervals of 50 feet along the length of the trench.

Unimproved Areas

In trenches through unimproved areas, pipe shall be bedded as specified. The remaining backfill shall be compacted to a minimum of ninety percent (90%) of maximum dry density, as determined by ASTM D-1557, and State of New Hampshire Specifications.

S5-38 ADJUST EXISTING STRUCTURE TO GRADE

S5-38.1 Manhole and Clean-out Adjustment

Existing manholes and clean-outs affected by the overlay as shown in the Plan shall be adjusted to grade within three working days of overlay.

Adjustment of existing manholes shall be in accordance with State of New Hampshire specifications. Clean-outs adjusted to grade shall conform to the Standard Detail.

S5-39 ABANDONING FACILITIES

S5-39.1 Abandoning Pipe In Place

The Contractor shall completely fill the pipeline to be abandoned with sand, concrete, or controlled density fill; or remove it.

If the pipe is asbestos cement, Contractor must comply with all State regulations during removal process and submit plans showing location of abandoned asbestos cement per State requirement (one set for the State and one set for the Town).

S5-39.2 Abandoning Structures

Abandonment of structures shall be completed only after piped systems have been properly abandoned. Structures within the public right-of-way, a public easement or which is part of the publicly owned and maintained system must be:

- < removed completely according to Town requirement; or
- < abandoned according to Town requirements leaving only the base section in place.

provided no conflicts with new utilities or improvements arise.

S5-40 LAWN REMOVAL AND REPLACEMENT

Any lawn damaged by the Contractor outside of limits shown on the plan shall be restored to conditions existing prior to construction; contractor shall take care to limit the area of disturbance.

When lawn removal and replacement is called for, a sufficient width (at least 2' wider than outside width of backhoe wheels or tracks) of lawn turf shall be removed prior to beginning excavation so that heavy equipment does not run over the lawn.

The area of the sod to be removed shall be laid out in squares or strips of such size as to provide easy handling and matching. The sod shall then be carefully cut along these lines to a depth of four (4) inches, taking care to keep cuts straight and strips of the same width. After the sod has been cut vertically, it shall be removed to a uniform depth of approximately three (3) inches with an approved type of sod cutter.

This operation shall be performed in such manner as to ensure uniform thickness of sod throughout the operation.

Prior to installation of new sod, the scalped area shall be carefully shaped to proper grade and be thoroughly compacted. Wherever the construction operations have resulted in the placement of unsuitable or poorer soils in the area to be resodded, the surface shall be left low and covered with topsoil.

The finished grade, after shaping and compacting the topsoil, shall be thoroughly dampened prior to and immediately before replacing the sod. The sod shall be replaced to the required grade, taking care to butt each piece tightly against the adjacent one. Upon completion, the sod shall be dampened and rolled with a lawn roller.

All tools used shall be of the type specially designed for the work and be satisfactory to the Engineer.

Sod shall be a 4-way blend of Ryegrasses or equivalent approved by the Engineer.

S5-41 STATE HIGHWAY AND RAILROAD CROSSINGS

Arrangements should be made directly by Contractor with the appropriate agency. Town should receive copies of all correspondence and permits or easements issued for our records. These documents should go to the Director of Public Works.

S5-42 BORING AND JACKING STEEL CASING

The Contractor shall verify the vertical and horizontal location of existing utilities. If required to avoid conflicts and maintain minimum clearances, adjustment shall be made to the grade of the casing.

The pipe shall be bored and jacked where indicated. The Contractor shall remove or penetrate all obstructions encountered. If groundwater is found to be a problem during boring operations, the Contractor shall do all that is necessary to control the flow sufficiently to protect the excavation, pipe and equipment so that the work is not impaired. Any pipe damaged during the boring and jacking operation shall be repaired by the Contractor in a manner approved by the Engineer.

Special care shall be taken during the installation of the bored and jacked pipe to insure that no settlement or caving be caused to the above surface. Any such caving caused by the placement of the pipe shall be the Contractor's responsibility and he shall repair any area so affected as directed by the Engineer.

During the jacking operations, particular care shall be exercised to prevent caving ahead of the pipe which will cause voids outside of the pipe. If voids exist, the Contractor shall drill through the wall of the pipe and fill the voids with a pumped cement grout. All voids shall be filled to the satisfaction of the Engineer.

The carrier pipe shall be installed in the casing as shown on the drawings. Where length of the casing exceeds 10 feet, the Contractor shall support carrier pipe with casing spacers as shown in the Standard Detail. The casing pipe shall not be backfilled with sand and grout. The casing ends shall be sealed with manufactured rubber end seal device.

Boring pits shall be backfilled with select native material and compacted to 95% maximum dry density as determined by ASTM D-1557. The Contractor shall provide sufficient select backfill material to make up for the rejected material.

All disturbed ground shall be restored to its original condition or better.

S5-43 WORKING WITH ASBESTOS CEMENT PIPE

When working with asbestos cement pipe, the Contractor is required to maintain workers' exposure to asbestos material at or below the exposure limit as prescribed in State of New Hampshire/Federal Guidelines and Certification. Contractor should check with State to obtain any State of New Hampshire permits and approval required.

S5-44 CONTROLLED DENSITY FILL (FLOWABLE FILL)

CDF can be proportioned to be flowable, non-segregating, or excavatable by hand or machine. Desired flowability shall be achieved with the following guidelines:

Low Flowability	below 6-inch slump
Normal Flowability	6 - 8-inch slump
High Flowability	8-inch slump or greater

CDF shall be placed by any reasonable means into the area to be filled.

CDF patching, mixing and placing may be started if weather conditions are favorable, when the temperature is at 34 degrees F and rising. At the time of placement, CDF must have a temperature of at least 40 degrees F. Mixing and placing shall stop when temperature is 38 degrees F. or less and falling. Each filling stage shall be as continuous an operation as is practicable. CDF shall not be placed on frozen ground.

Trench section to be filled with CDF shall be contained at either end of trench section by bulkhead or earth fill.

When used to support existing asbestos cement (A.C.) pipe, the flowable CDF shall be brought up uniformly to the spring line of the A.C. pipe, as shown on the plans, or as directed by the Engineer.

Contractor shall provide steel plates to span utility trenches and prevent traffic contact with CDF for at least 24 hours after placement or until CDF is compacted or hardened to prevent rutting by construction equipment or traffic.

CHAPTER S6 - LATERAL SEWER REGULATIONS

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CHAPTER S6 - LATERAL SEWER REGULATIONS

S6-01 GENERAL

The following requirements govern lateral sewer construction in the Town of Merrimack. These standards apply to sewerage facilities from the point of connection to the public sewer system (end of a lateral sewer stub, mainline tee, or a hole-cut into a sewer main) to the property line.

S6-02 CONNECTION REQUIRED

Whenever connection to the Town system is required, the property owner shall remove any connection to a cesspool, septic tank, or other on-site wastewater disposal facilities and direct connection should be made to the Town system. Former facilities must be abandoned per Town Health Department regulations and New Hampshire Department of Environmental Services requirements.

S6-03 DRAINLAYER LICENSE

S6-03.1 Application Requirements

To obtain a DrainLayer's license from the Town, an applicant must:

Possess a State License.

Certify that he or she has read and understands the contents of this regulation.

Post a bond in the amount as required by the Director of Public Works (\$10,000.00 minimum) for the benefit of the Town of Merrimack.

File with the Town a Certificate of Insurance certifying that the applicant possesses public liability insurance and with a provision that such insurance may not be canceled without at least thirty days advance written notice to the Utility. Insurance requirements for side sewer contractors are listed below.

Pay all license fees required by the Town.

Obtain Permit to Work in Right-Of-Way from Department of Public Works.

S6-03.2 Insurance Requirements

The Contractor shall procure and maintain for the duration of the license insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or subcontractors. The cost of such insurance shall be paid by the Contractor. Insurance shall meet or exceed the following unless otherwise approved by the Town. Questions regarding insurance requirements can be discussed with the Town's Finance Administrator.

A. Minimum Scope of Insurance

1. Insurance Services Office Commercial General Liability covering Comprehensive General Liability, Broad Form Comprehensive General Liability.
2. Automobile Liability "any auto", for activities involving other than incidental personal auto usage.

B. Minimum Levels of Insurance

1. Comprehensive or Commercial General Liability: \$1,000,000 (min.)* combined single limit per occurrence for bodily injury, personal injury and property damage.
2. Automobile Liability: \$1,000,000 (min.)* combined single limit per accident for bodily injury and property damage.

*** Per current Town of Merrimack requirements.**

C. Deductibles and Self-Insured Retentions

Any deductibles or self-insured retentions must be declared to and approved by the Town. In the event the deductibles or self-insured retentions are not acceptable to the Town, the Town reserves the right to negotiate with the Contractor for changes in coverage deductibles or self-insured retentions; or alternatively, require the Contractor to provide evidence of other security guaranteeing payment of losses and related investigations, claim administration and defense expenses.

D. Other Provisions

Wherever possible, the policies are to contain, or be endorsed to contain, the following provisions:

1. General or Commercial Liability and Automobile Liability Coverages

- a. The Town, its officials, employees and volunteers are to be covered as additional insureds as respects: liability arising out of activities performed by or on behalf of the Contractor; products and completed operations of the Contractor; premises owned, leased or used by the Contractor; or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the Town, its officials, employees or volunteers.
- b. The Contractor's insurance shall be primary insurance as respects the Town, its officials, employees and volunteers. Any insurance or self-insurance maintained by the Town, its, employees or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.
- c. Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the Town, its officials, employees or volunteers.
- d. Coverage shall state that the Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

2. All Coverages

Each insurance policy required by this clause shall state that coverage shall not be canceled by either party except after thirty (30) days prior written notice has been given to the Town.

E. Acceptability of Insurers

Insurance is to be placed with insurers acceptable to the Town.

F. Verification of Coverage

Contractor shall furnish the Town with certificates of insurance affecting coverage required by this clause. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf and shall name the Town as an "additional insured". The certificates are to be received and approved by the Town before work commences. The Town reserves the right to require complete, certified copies of all required insurance policies at any time.

G. Subcontractors

Contractor shall include all subcontractors as insureds under its policies or shall require subcontractors to provide their own coverage. All coverages for subcontractors shall be subject to all of the requirements stated herein.

S6-03.3 Responsibility of Lateral Sewer Contractor

The licensed lateral sewer contractor shall be responsible for complying with all requirements of the Town related to lateral sewer construction, for any and all actions or omissions of his employees, and for any damage done to existing utilities encountered during any excavation.

S6-03.4 Permit Revocation

A Permit to Work in the Right-Of-Way license issued by the Town may be suspended or revoked by the Town for cause.

S6-04 LATERAL SEWER PERMIT

S6-04.1 Requirements

In making application for a lateral sewer connection, the owner or lateral sewer contractor shall furnish the Town with a drawing showing:

- A. The size and location of structures on the property.

- B. The full course of the proposed side sewer from the public sewer in the street to the structure

Any street opening permits required to complete installation of a lateral sewer must be obtained prior to acceptance of the permit application.

The Applicant must show that any easements that may be required for installation of the lateral sewer have been obtained and recorded with the Town.

All permit fees required by the Town must be paid prior to work starting.

S6-04.2 Restrictions

- A. Authorization for lateral sewer connection will be given before the public or private sewer system is accepted by the Town.
- B. No work shall be started on any private or lateral sewer without authorization.
- C. No licensed drain layer/sewer contractor shall do any sewer work under any other person's permit.
- D. No lateral sewer work shall be done without approval and inspection by the Town.

S6-04.3 Work on Private Property

A licensed drain layer is the only one to install and repair sewer service connection.

S6-04.4 Work on Public Property

Only a licensed drain layer may be authorized a permit for lateral sewer work in a public right-of-way.

S6-04.5 Old Lateral Sewers For New Buildings

When an existing structure is removed and new structure is constructed, and any existing lateral sewer that does not meet the current requirements of the Town shall be replaced.

S6-04.6 Other Permits Required

The issuance of a drain layer permit by the Town shall not relieve the permit holder from the responsibility of obtaining such other permits or licenses as may be required by the Town and State.

S6-04.7 Posting Permits

Contractor must have all necessary permits on site before job starts and they should be made available upon request.

S6-05 HOLD HARMLESS

- A. Contractor shall protect, defend, indemnify and save harmless Town, its officers, employees and agents from any and all costs, claims, judgments or awards of damages, arising out of or in any way resulting from the negligent acts or omissions of Contractor, its officers, employees and agents.
- B. Town shall protect, defend, indemnify and save harmless Contractor, its officers, employees and agents from any and all costs, claims, judgments or awards of damages, arising out of or in any way resulting from the negligent acts or omissions of Town, its officers, employees or agents.

S6-06 GENERAL UTILITY NOTIFICATION REQUIREMENTS

All lateral sewer cleaning contractors and/or plumbers, lateral sewer contractors, and owners shall notify the Merrimack Wastewater Treatment Facility at 883-8196 of such operations prior to cleaning existing Lateral sewers (as distinguished from plumbing and septic tank facilities).

S6-07 GENERAL CONSTRUCTION REQUIREMENTS

S6-07.1 General

All materials and methods of construction for lateral sewers shall be equal to those used for sewer mainline construction, unless otherwise listed herein.

S6-07.2 Restoration of Right-of-Ways

It shall be the responsibility of the Contractor to cut the road surface, dig a trench, lay the pipe, make the connection to the wye or tee, backfill the trench and restore the roadway surfacing and vegetation within the limits of any thoroughfare or right-of-way, public or private. Such work shall be performed as quickly and with as little hindrance to traffic as possible, and in strict accordance with the requirements of the Town and Right-Of-Way Permit.

S6-07.3 Inspections

After the sewer tie-in is authorized, arrangements for inspection of a sewer installation shall be made with the Wastewater Treatment Facility and Building Inspector's Office, 24 hours in advance by the sewer contractor. The Town reserves the right to set the time for inspections.

An extra charge shall be made by the Town for each visit to any person who requests any inspection after regular hours on a workday, or on a weekend or holiday. The lateral sewer contractor will be billed for hours beyond that included in the permit fee.

S6-07.4 Site Safety

The following requirements shall apply to safety practices to be followed by licensed lateral sewer contractors while performing permitted side sewer work in the utility service area:

Barricades - Before beginning excavation in a public area there shall be at the site sufficient barricades to properly protect the work. All shall be in compliance with Manual on Uniform Traffic Control Devices, latest revision.

Trench Covering - All excavations or trenches within a public area or within four feet of a public area must be temporarily covered at night and during hours of work site inactivity.

Ditch Pumps - During pipe laying, a pump shall be available at the site.

Shoring - The Contractor shall have immediately available for use sufficient shoring to adequately protect workers where unstable ground conditions are encountered, in accordance with OSHA and State of New Hampshire requirements.

Flagger - A flagger must be posted whenever work is underway in a public thoroughfare where a uniformed Police Officer is not required or as directed in Right-Of-Way Permit.

S6-07.5 Site Clean-up

The sewer contractor shall remove all debris and excess excavation and shall repair all damage, public or private, in kind immediately after backfilling.

S6-07.6 Failure to Restore Excavations

If any excavation is left open beyond a reasonable length of time, the Town may cause the excavation to be backfilled and the public way restored. Any cost incurred in such work shall be charged to the owner or sewer contractor in charge of such work, and shall be payable immediately to the Town upon written notification of the amount thereof given to the contractor or posted at the location of the work.

S6-07.7 Failure to Complete Lateral Sewer Work

If any work done under a sewer permit is not in accordance with provisions of the requirements of the Town and if the Contractor or person doing the work fails and/or refuses to properly construct and complete such work, notice of such failure or refusal shall be given to the owner or occupant of the property. The Town may cause the work to be stopped. If the work, in the opinion of the Town, constitutes a hazard to public safety, health or the public sewer, such work may be completed by the Town. The cost of such work and any materials and administrative services necessary therefor shall be charged to the owner and/or Contractor and shall be payable by the owner and/or contractor immediately upon written notice given by the Town of the amount thereof or by posting a notice thereof on the premises.

Such cost shall constitute a civil debt owing to the Town jointly and severally by the persons who have been given notice as herein provided. The debt shall be collectable in the same manner as any other civil debt owing to the Town, including attachment of the contractor's sewer bond.

S6-08 LATERAL SEWER FITTINGS REQUIREMENTS**S6-08.1 Bends and Wyes**

All changes of direction shall be made with bends, wye branches or a combination of wye branch and bends.

S6-08.2 Lateral Sewer Clean-Outs

The following specifications shall apply for all lateral sewer cleanouts.

- A. All changes of direction greater than forty-five degrees will be made with a wye branch and bends as required. Where wye branches are used, the straight through opening is to be used as the cleanout.
- B. Cleanouts, including those for commercial properties shall be installed at locations designated by the Town but in no case shall distance between cleanouts exceed one hundred feet.
- C. A cleanout shall be the same diameter as the pipe down grade to which it connects.
- D. On long runs of pipe, manholes may be installed, or be required, in lieu of cleanouts.
- E. Suitable rings and covers of a type designated by the Town shall be used for all cleanouts on commercial and multi-family property.
- F. All cleanouts not in paved areas shall extend to within a minimum of eighteen inches of ground surface.
- G. Contractor shall provide swing ties to cleanouts and shall provide drawing to Town.

S6-08.3 Lateral Sewer Acceptance

It shall be the responsibility of the sewer contractor to install all risers, cleanouts, casting, etc., required before the installation will be approved by the Town.

S6-9 CONNECTION REQUIREMENTS

S6-9.1 Pipe Cut-Ins

The sewer contractor shall make all other connections to main lines. The pipe cut-in shall be carefully made and all broken pieces removed. If the pipe becomes cracked during the cut-in, the damaged section shall be replaced with a wye branch, tee, or the section of pipe shall be replaced.

Connections to ductile or cast iron will be accomplished by tee cut-ins using metallic mechanical couplings adaptable to the size and type of pipe on gravity mains.

S6-9.2 Connections

All connections must be clean and visible during inspection.

S6-10 EXCAVATIONS

S6-10.1 Main Sewer Check

The licensed side sewer contractor must check the depth of the main sewer at manholes on each side of wye location before starting to excavate for lateral sewer.

S6-10.2 Prospecting For Stub

If the wye, tee, stub, or riser is not located at the measurements as furnished, the Contractor shall prospect four feet in all directions from the distance and depth given. If such prospecting fails to disclose the stub, the Contractor shall immediately contact the Town and report the circumstances. Upon receipt of such report, a Town representative will promptly visit the site and render further assistance.

S6-11 LAYING PIPE**S6-11.1 Grade**

All sewers shall be layed true to grade with the bell up grade.

S6-11.2 Foundation Clearance

Lateral sewers parallel to the foundation wall of any building shall be layed not less than thirty inches therefrom.

S6-11.3 Minimum Cover for Side Sewer

Minimum cover required shall be 6' to property lines.

- A. On private property where less than minimum cover can be maintained, approvals may be obtained from the Building Inspector for installing by using alternate pipe materials, approved by Town.

S6-12 INSPECTION AND TESTING**S6-12.1 Covering Work**

No trench shall be filled nor any sewer covered until the work has been inspected and approved by the Town.

S6-14 SPECIAL REQUIREMENTS**S6-14.1 Gravity Flow**

In any structure in which the plumbing is too low to permit gravity flow to the utility system or private sewer, the sewage shall be lifted by artificial means and discharged into the utility system or private sewer. When only the lower floor of a structure is too low for gravity flow, the remaining floors must flow by gravity.

S6-14.2 Pumped Lateral Sewers

All pump installations must meet all building and plumbing codes.

S6-14.3 Hydraulic Gradient

In any structure where the plumbing drain is two feet (2') or less below the rim of the next upstream manhole, a backwater valve and a holding tank may be required per the Uniform Plumbing Code.

S6-14.4 Backwater Valves

Wherever a situation exists involving an unusual danger of backup, a backwater valve is required. The effective operation of the backwater sewage valve shall be the responsibility of the owner of the lateral sewer. Before any installation of this nature is made, the owner will be required to comply with provisions of this regulation concerning the agreement to save the Town harmless from damage or injury. (See section S4-12)

S6-14.7 Sampling Manholes

When required by the Town, the property owner shall install and maintain at their expense a manhole in the lateral sewer to facilitate observation, sampling, and measurement of the wastes therein. Such a manhole shall be located, if feasible, where it is accessible and safely entered from a public street. It shall be constructed and installed in accordance with plans approved by the Town and shall be arranged so that flow measuring and sampling equipment and a shutoff gate or a screen may be conveniently installed.

S6-15 LATERAL SEWER DEMOLITION

Lateral sewer demolition shall be performed prior to removal of building foundation. The side sewer for each building shall be excavated and removed from the house connection to the property line or the main as specified by the Town. The Contractor shall cap the end of the lateral sewer to remain in place. Lateral sewer demolition shall be performed in the presence of the Town Inspector. The Contractor shall take measurement and a plan sketch showing location of remaining stub will be given to the Town, two copies (one to Wastewater Treatment Facility and one to Building Inspector's Office).

S6-16 SPECIFICATIONS NOT COVERED BY THESE REGULATIONS

In the event a construction or installation specification relating to sewers is not covered by this regulation, the Town may require compliance with other manuals or standards as it sees fit.

MERRIMACK

TRAFFIC

SIGNALS



U.S. Department
of Transportation
**Federal Highway
Administration**

Memorandum

Subject: **ACTION**: Conversion of Traffic and Pedestrian Signals to
Light-Emitting Diode (LED) Technology

Date: **February 6, 2006**

From: Jeffrey F. Paniati /s/ ***Jeffrey F. Paniati***
Associate Administrator for Operations

Reply to
Attn. of: HOTM-1

To: Divisions Administrators

The Energy Policy Act of 2005, passed last August at about the same time as SAFETEA-LU, contains provisions related to energy efficiency requirements for traffic and pedestrian signals in section 135. The intent of these provisions is to promote energy conservation by facilitating the conversion of traffic and pedestrian signal equipment from incandescent bulb technology to light-emitting diode (LED) technology. These provisions require that traffic and pedestrian signal modules manufactured or imported after January 1, 2006 meet or exceed specific energy efficiency requirements, which currently can only be met by equipment using LED technology. The legislation does not impact existing stock of product on hand by either suppliers or public agencies, and does not cover replacement parts for signals that use traditional incandescent technology. Further, public agencies that own and operate traffic signals are not required to retrofit their incandescent signal equipment.

Staff from the Office of Operations have been working closely over the past several weeks with staff from the Department of Energy (DOE), AASHTO, the National Electrical Manufacturers Association (NEMA), the Institute of Transportation Engineers (ITE) and the American Public Works Association (APWA) to ensure that there is a shared understanding of the Energy Policy Act requirements and their potential impact on public agencies that own and operate traffic signals. Because there is no requirement to replace existing traffic signals using incandescent technology with LED technology and since the availability of incandescent replacement parts will not immediately be adversely affected, we believe the impacts will not be severe. Based on surveys conducted by ITE and AASHTO, a large proportion of new traffic signal installations are already being designed to use LED technology and conversion of existing traffic and pedestrian signals is also progressing at a rapid pace across the United States because of the significant energy cost savings that can be realized. The primary challenges associated with conversion projects appear to be the availability of funding for the capital costs associated with purchase of new equipment and resolution of some technical issues associated with interfacing LED technology with older traffic signal equipment.



We request your assistance in alerting the owners and operators of traffic signals in your State to the Energy Policy Act requirements and their implications. To facilitate this, attached is the following material:

- A copy of section 135 of the Energy Policy Act (pages 31-41). The material pertaining to this issue is found on pages 33, 35, and 38.
- A copy of the October 18, 2005 *Federal Register* notice from DOE outlining changes to 10 CFR to implement the legislative requirements contained in section 135 of the Energy Policy Act.
- A copy of relevant material from the EPA EnergyStar program.
- A copy of the current ITE specification covering LED traffic signal equipment (an update to this standard is expected to be published later in 2006).
- Summary points regarding this issue prepared following a stakeholder meeting on this issue held January 12, 2006 in Washington, DC .

Please share this information with stakeholders in your State. Please also let stakeholders know that there will be a national webcast sponsored by the National Transportation Operations Coalition (NTOC) on February 23, 2006 to share information on this issue. Interested parties should visit http://www.ntoctalks.com/web_casts.php to register. A discussion forum will also be held at the ITE Technical Conference in San Antonio on March 20. For meeting information, visit www.ite.org. We are still considering the need to pursue additional outreach sessions or development of technical guidance on this subject.

For additional policy information on this issue, please contact Jeff Lindley at (202) 366-1285. For technical assistance from the Resource Center, please contact Martin Knopp at (708) 283-3514.

Attachments

cc: Directors of Field Services, Joyce Curtis, Operations Council

TECHNICAL SPECIFICATIONS

SPECIAL PROVISION

To Section 616 (NHDOT Standard Specifications)
Traffic Signals

All proposed traffic signal work shall conform to the New Hampshire Department of Transportation (NHDOT) 2002 Standard Specifications for Road and Bridge Construction, the *Manual on Uniform Traffic Control Devices 2003 Edition*, or as amended in these documents.

Add to Description:

1.3 This work shall consist of furnishing and installing traffic signals with coordination capabilities, vehicle detection, emergency vehicle preemption signal systems and all work necessary to make the installation complete, at the following locations:

- Location #1
- Location #2
- Location #3
- Location #4

These intersections shall be coordinated, with the system master to be installed at Location #X. This work shall be completed as shown on the plans, described in the Special Provisions, or as ordered.

1.4 The traffic signal cabinets shall be supplied and installed with the capability to provide a complete and operational closed loop signal system as described in these specifications and/or in accordance with manufacturer recommendations.

Amend 2.2.1 to read:

2.2.1 Housings. Housings shall be constructed of polycarbonate with a smooth outer surface and shall be capable of holding the optical units securely in place. Housing shall be adaptable for pedestal, bracket, or rigid mast-arm vertical or horizontal mounting. The assembled housing shall be dustproof and moisture proof. Each housing shall be equipped with a hinged door of polycarbonate to hold the LED indication of the optical units. The doors shall be designed to insure uniform pressure around the door frame when closed. Doors shall be fastened by hinged wing nuts assemblies or other approved fasteners. Unless otherwise indicated on the plans, lenses shall be furnished with approved sun shield visors, not less than 250 mm (10 in) in length. If longer visors than those specified above are deemed necessary, they shall be furnished and installed. All traffic signals shall be furnished with a 125 mm (5 in) louvered, polycarbonate backplate. Backplates shall be fastened with stainless steel hex head slotted screws and a 5 by 19 mm (3/16" by 3/4") stainless steel fender washer. Where specified as 'black', traffic signal housing and backplates shall be black (federal color #27038).

Amend the first sentence in 2.2.2 to read:

Housing adapters for pedestal mounting shall be constructed of cast iron.

Add to 2.2.2:

2.2.2.1 Signal Face Arrangement. Signal faces shall be arranged vertically in 3,4 or 5 sections.

Amend 2.2.3 to read:

2.2.3 Mast arm brackets. Mast arm brackets shall be Astro-Brac, or approved equal.

Add to 2.2.5:

2.2.5.3 All new signal head modules shall be of the 12-inch LED type, GELcore™ brand, or approved equal.

Amend 2.3.1 to read:

2.3.1 General. Pedestrian signal heads shall be of the LED type conforming to the Institute of Transportation Engineers Standard for Adjustable Face Pedestrian Signal Heads. All heads shall be square in shape.

Amend the first sentence in 2.3.2 to read:

Housings shall be black, one piece die cast aluminum alloy complete with top, bottom, sides, and back. Black, polycarbonate housings are also acceptable.

Amend 2.3.3 to read:

2.3.3 Pedestrian Indications. The pedestrian signal heads shall be furnished complete with a symbolic LED hand/man overlay with full image.

Amend 2.3.4 to read:

2.3.4 Pedestrian Detectors. Pedestrian pushbuttons shall be installed at 33 inches above the walking surface or in accordance with the most recent publication of “The Americans with disabilities Act Accessibility Guidelines for Buildings and facilities (ADAAG)”.

Amend the last sentence in 2.4.1 to read:

Minimum clearance to the bottom of the overhead signal housings shall be 4.7 m (15.5 feet).

Amend 2.5.1 to read:

2.5.1 General. The controller shall operate on 120 volt, 60 hertz (cycle) alternating current, and shall be delivered completely wired and enclosed in a weatherproof cabinet. All components shall be new, and unless noted, the use of solid state components shall be required. Controllers shall be programmable, menu driven, traffic actuated complying with NEMA Standards TS-1 (TS-2 Type 2 controller), with time base coordination module, overlaps internally generated by means of an overlap card as per NEMA Standard TS-1, with wire jumpers on a printed circuit board, internal emergency vehicle preemption module with “D” connector harness and capable of providing an exclusive pedestrian phase as part of one phase. ***Controllers shall be Eagle brand.*** Grounding shall be provided with use of a grounding system installed per manufacturer’s specifications. The cabinet shall have provisions for communications allowing remote operation of the intersection.

Amend the last sentence in 2.5.1.2.1 to read:

When all of the above procedures have been completed, the performing technician shall document with a signature the results on the approved form as approved by the Town of Merrimack, DPW.

Add to 2.5.2.3:

2.5.2.3.1 The controller cabinet shall be equipped with a door open switch, which shall be connected to the traffic controller, allowing for remote monitoring when the cabinet door is opened. All events shall eventually be logged in the master controller database for remote alarm and retrieval.

2.5.2.3.2 The controller cabinet foundation shall have a 3’ x 3’ concrete pad on the door side of the cabinet (if sidewalk is not available). Door side of the cabinet shall face away from the intersection unless otherwise shown on the plans.

Amend the first sentence in 2.5.2.4 to read:

Where specified as ‘black’, the exterior of the cabinet shall be black (federal color #27038).

Amend the first sentence in 2.5.2.19 to read:

Emergency vehicle preemption shall be activated by optical detection equipment, manufactured exclusively by 3M (Opticom), latest approved models for each component.

Amend 2.5.2.19.4 to read:

2.5.2.19.4 Optical detector locations shall be field-verified by the Town of Merrimack Fire Department, DPW and Contractor to assure optimum reception for emergency vehicles and to insure that the preemption system is fully operational. The location of each optical receiver is shown on the plans, but may be moved for optimum reception. Optical detector cable shall run unspliced from the optical detector head to the controller cabinet using proposed conduits and pull boxes, unless otherwise depicted on the plans.

Add to 2.5.2:

2.5.2.20 The controller cabinet shall contain a telephone modem and telephone isolation board wired for communication between the master On Street Arterial System controller (located at Location #X) and the local controller as well as communicating between the Town of Merrimack Department of Public Works. Communication interconnect shall be connected by a quick connect R66 type telephone connector with integral lightning protectors. The communication line shall also have a EDCO PC642-008 type surge protector wired in series.

Add to 2.6:

2.6.2 (Added to this section)]

Service	A.W.G.#
(h) closed Loop Interconnect Cable	IMSA 60-2, 3 Pair 19 AWG Solid (60-4 shall be used for aerial installation)

2.6.4 All interconnect cables shall be terminated on a terminal block and protected with EDCO PC642-008D surge suppressors. All unused interconnect conductors shall terminate and interface with a 66 BLOCK utilized to punch out wires.

2.6.5 Interconnection cable between the master On Street Arterial System controller and the local controller shall be two twisted pairs of voice-grade telephone cable.

Add to 2.6.3:

2.6.3.2 When applicable, the existing detection system shall be retained as long as possible during construction activities. Each intersection detector (6' x 50' quadrupole) shall have its own separate lead-in brought back to the cabinet and connected to its own detector amplifier channel.

Add to the end of 2.6.3.1:

The following color code striping will be used to identify the closed loop system detector cables:

Closed Loop System Detector – Orange

The cable shall be marked by tape striping to indicate the system detector. For example, system detector one will have one stripe, and so on.

Amend 2.8 to read:

2.8 Painting. Prior to erection and assembly the entire traffic or pedestrian signal housing and visors shall be checked for damaged paint and repaired/painted as necessary.

Amend 3.1.1 to read:

3.1.1 A preconstruction meeting with the Contractor, signal subcontractor, Engineer and Town of Merrimack Department of Public Works shall be arranged not less than three days prior to the start of signal installation, to resolve any problems.

Amend the first sentence in 3.1.2 to read:

The signal subcontractor shall notify the Town of Merrimack Department of Public Works no less than three days prior to the following:

Add to Construction Requirements:

3.2.1 Prior to final acceptance of the construction, the Contractor, together with the Engineer, shall inspect the traffic signal system, mast arms and poles, and denote any damaged or missing parts. Damaged or missing parts shall be repaired/replaced as directed by the Engineer.

3.2.1.1 Any damage to the traffic signal system after the inspection, but before final written acceptance of the construction/installation by the Town of Merrimack shall be repaired/replaced as directed by the Engineer and at the Contractor's expense.

3.2.1.2 All existing signal equipment not being retained shall be salvaged to the Town of Merrimack Department of Public Works, or disposed of at their direction.

3.2.1.3 Damaged galvanized surfaces shall be repaired by applying an organic zinc repair paint conforming to ASTM A780. Galvanizing repair paint shall have 75% zinc minimum by weight and shall be brush applied. The thickness of the repair coat shall not be less than the coating thickness required by AASHTO M 111 or M 232, but not less than 3 mils (75 microns) DFT. Repaired galvanized surfaces shall be painted over using black (federal color #27038) paint. Repair touch-up using aerosol spray, silver paint, bright paint, brite paint, or aluminum paint shall not be permitted.

Amend 3.4.1 to read:

The void created by the leveling nuts between the foundation and the base plate of the structure shall not be filled with grout unless otherwise directed.

Amend 3.4.2 to read:

No sealant of any kind shall be used between the controller cabinet and its foundation unless otherwise directed.

Amend the last sentence in 3.6.7 to read:

The Contractor shall also be responsible for all service charges until the signals are accepted for operational use by the Town of Merrimack.

Add to the end of 3.11:

A grounding system will be installed at the location of the controller cabinet and installed per manufacturer's specifications.

Amend 3.12 to read:

3.12 Painting. All paint shall conform to Section 708 unless otherwise specified. The following colors of enamel shall be used.

(a) Controller Cabinet	Outside: Black;	Inside: White
(b) Housings	Black	
(c) Visors	Inside: Black	Outside: Black
(d) Meter Box	Same color as mounting.	

The appropriate federal color number corresponding to the colors listed above are described in Section 708.01. After the signals have been completely installed, two coats of enamel shall be applied to all unpainted or scratched surfaces after the surface has been lightly sanded to remove gloss.

Add to 3.12:

3.12.1 All galvanized surfaces shall be powder coat painted as per manufacturer's specifications using the colors specified in 3.12.

Amend the last sentence in 3.13.2 to read:

The minimum time shall be approved by the Town of Merrimack DPW Director, or his representative.

Add to 3.13:

3.13.3 Emergency Preemptors:

3.13.3.1 The emergency preemptors, when actuated, shall immediately terminate the current vehicular phase being displayed as the right-of-way, following the programmed minimum green interval, and clearance phases of normal duration. The pedestrian walk and clearance intervals shall not be abbreviated for emergency vehicle preemption. This should be followed by green indications in the direction of travel by emergency vehicle, for the phases shown on the plans. The confirmation strobe shall be illuminated while any emergency vehicle preemption green is called.

3.13.3.2 Upon release of emergency preemption, the controller shall return to phases 2 and 6, unless otherwise noted on the plans.

3.13.3.3 Sufficient contacts on relay shall be used to force the controller into preemption and provide correct voltage to the highway signals.

3.13.3.4 The Contractor shall coordinate with the Director of Public Works to insure that the emergency vehicle preemption system is fully operational and in conformance with the Town of Merrimack's existing emitter equipment and their desired settings. The preemption phase shall run for a minimum time as specified by the DPW Director (or his representative).

Amend 3.15 to read:

3.15 Operation. The Contractor shall commence the operation of the signal system only when permitted by the Director of Public Works.

Add to Construction Requirements:

3.17 Signal timing/System Programming. Signals shall be interconnected with an On Street Arterial Control System operated and monitored via telephone communications. The master controller shall be located at XXX intersection. The system shall be interconnected using communication cable (Item 616.122) through new interconnect conduit as shown on the plans.

3.17.1 The Contractor shall install all isolated controller data including timing parameters into the new controllers. System coordination data as shown on the plans will be installed by the Contractor.

3.17.2 Monitoring and operating shall be from either the master controller and/or the Department of Public Works office.

3.17.3 Prior to the final inspection, the Contractor shall have a preliminary review with the DPW representative to review and comment on the system.

3.17.4 The Contractor shall provide the Town of Merrimack with a final hard copy of all programmable data.

Amend 4.1 to read:

4.1 Traffic signals will be measured as a unit, including furnishing and installing an emergency vehicle preemption signal system and all components and labor for interconnect cabling and reliable traffic signal communications/coordination. Where more than one unit is specified in the contract, separate item numbers will appear for each separate and complete unit.

Add to Method of Measurement:

4.2 Components damaged due to the Contractor's operations or negligence shall be repaired/replaced at the Contractor's expense.

Amend 5.1 to read:

5.1 The accepted quantity of traffic signals and emergency preemption system will be paid for at the contract lump sum price complete in place.

TECHNICAL SPECIFICATIONS

SPECIAL PROVISION

To Section 616 (NHDOT Standard Specifications)
Traffic Signals

Item 616.101 or (Item 616.191) – Traffic Signals or (Alterations to Traffic Signals)

This special provision provides for the reconstruction of the existing traffic signal system at the intersection of XXX with XXX in Merrimack, NH. The system will be coordinated with the following intersections:

- Location #1
- Location #2
- Location #3

GENERAL:

All provisions of section 616, except as modified or changed below, shall apply.

1. The Contractor shall be responsible for signal operation and maintenance once any feature of the signal is disturbed. The contractor shall furnish the contract Administrator, Department of Public Works with names and phones numbers of persons to be contacted in case of a malfunction.
2. The Contractor shall be responsible for the dismantling and removing of the existing traffic control system. All equipment shall be salvaged to the Town of Merrimack Department of Public Works.
3. The initial power hookup will be paid for by the Contractor; the power costs for operating the traffic signal will be paid for by the Town of Merrimack (or, the existing power source shall be retained).
4. The work at this intersection includes the modification of the existing traffic control system. Work includes, but is not limited to, the installation of new mast arms, signal heads, pedestrian signal heads, pedestrian push buttons, vehicle detection, emergency preemption equipment, a traffic signal controller/cabinet, pull boxes, a system loop, traffic signal conduit, and all other ancillary equipment necessary to provide a complete and functional traffic control system. The Contractor shall locate the proposed structure locations per the plans and provided survey control.
5. All interconnect cable shall be labeled and terminated on a terminal panel protected with EDCO PCD642-008D surge suppressers.
6. All system detectors shall be terminated on a separate panel from the main detector panel.

Add to 2.1:

- X - 8-phase programmable, menu driven, traffic – actuated signal controller complying with NEMA Standard TS-1 (TS-2 type-2 controller) specifications with internal time base coordination, internal fire preemption and overlaps internally programmed by means of software. The traffic controller shall be an Eagle Model EPAC 300, furnished in a P Type cabinet including telemetry harness and panel and 12 in. extension base.
- X - Closed loop system master compatible with the proposed controller and telephone drop to complete communications to Department of Public Works in Merrimack, NH.
- X - On-Street Model, US Robotics 56 KB or approved equal.
- X - Rectangular roadway loop detectors, 3 turns 6.0 ft. x 6.0 ft. as per plan.
- X - Quadrupole roadway loop detectors, 6.0 ft. x 50 ft., with 2-4-2 turns as per plan.
- X - Dual Channel, rack mounted loop detector amplifiers, self-tuning, Canoga / 3M Model C422T, Naztec, Inc. Model 722 TXC, or Peek / Sarasota Model 222T GP6 or an approved equal.
- X - One-way, three-section, black, 12 in. polycarbonate signal heads with LED modules, mounted on mast arms with Veped Astro-Bracs, with 5 inch louvered backplate.
- X - One-way, three-section, black, 12 in. pedestal post-mounted polycarbonate signal heads with LED modules, with 5 inch louvered backplate.
- X - One-way, four-section, black, 12 in. polycarbonate signal heads with LED modules, mounted on mast arms with Veped Astro-Bracs, with 5 inch louvered backplate.
- X - Black (federal color #27038) meter pedestal with 30 amps disconnect switch, Phaff and Kendall Model CP 314 only.
- X - Black (federal color #27038) powder coat painted galvanized-steel mast arm pole, the signal arm shall be XX ft. Mast arm pole shall be manufactured by Union Metal Corp. or approved equal.
- X - Black 8 ft. (federal color #27038) powder coat painted galvanized-steel Phaff and Kendall signal pole, model SP 104.
- X - Black 10 ft. (federal color #27038) powder coat painted galvanized-steel Phaff and Kendall signal pole, model SP 114.

- X - Opticom fire Preempter Phase Selector, Model 754, with a Model 760 Card Rack, or approved equal.
- X - Opticom confirmation strobe.
- X - Opticom receivers Model 711 or approved equal.
- X - Black, 12-inch solid LED symbolic bi-modal pedestrian signals, bracket or post top mounted.
- X - Pedestrian push buttons and signs, Pelco model SE-2037-08 and Pelco Model SF-1018-05, or equal.
- X - R10-12, 24 inch by 30 inch, "Left Turn Yield on Green" (Green Ball).
- X - 24 inch by 24 inch LED "No Turn On Red" sign, mast arm mounted, with all wiring and relays. National sign and signal brand, or approved equal.

TECHNICAL SPECIFICATIONS

SPECIAL PROVISION

To Section 616 (NHDOT Standard Specifications)
Traffic Signals

Item 616.122– Communications Cable

Add to Description:

1.5 This work shall consist of the Contractor furnishing and installing a complete communications cable network for the proposed closed loop traffic signal control system, as shown on the plans and in accordance with this Special Provision, or as ordered. This includes, but is not limited to, installing cable in underground conduits; furnishing and installing terminal facilities in controller cabinets and connecting the underground cable to the terminals; and installing lightning protection. As part of this project, the following locations in the Town of Merrimack shall be included in the closed loop system:

- Location #1
- Location #2
- Location #3
- Location #4

Add to 2.6:

2.6.6 Interconnect cable shall be IMSA 60-2 communications cables (IMSA 60-4 for aerial installations). Conductors shall be stranded copper #19 AWG. Cable shall contain three pair, gel-filled, copper-shielded wire.

Add to 3.7

3.7.5 Cable shall be terminated only on the terminal strips provided in the controller cabinets.

3.7.6 all interconnect cable installed shall be identified with permanently attached plastic labels at each controller cabinet. The labels shall either be embossed or printed with permanent non-fading ink, indicating the name of the intersection that is at the other end of the cable and bearing the legend “TRAFFIC INTERCONNECT CABLE”.

Add to Method of Measurement:

4.3 Communications cable will be measured by the linear foot to the nearest whole foot.

Add to Basis of Payment:

5.4 The accepted quantity of communications cable will be paid for at the Contract Unit Price per linear foot complete in place, including installing cable in underground conduits, furnishing and installing terminal facilities in controller cabinets and connecting the underground cable to the terminals, and installing lightning protection.

Add to Pay items and Units

616.122	Communications Cable	Linear Foot
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**CONSTRUCTION PROCEDURES
FOR
TOWN HIGHWAYS**

**DEPARTMENT OF PUBLIC WORKS
MERRIMACK, NEW HAMPSHIRE**

**TELEPHONE 603-424-5137
FAX 603-424-3890**

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1. SCOPE

The purpose of this document is to set forth procedures for all entities, working within or affecting the Town's Class IV, Class V, and Class VI highways as defined in RSA 22915 that are not working directly for the Town. Work is defined in any activity that alters any physical feature within the right-of-way, and includes, but is not limited to, trimming vegetation, installing utility poles or replacing utility lines, any form of excavation and backfill, removing or reconstructing any surface.

2. EXCLUSIONS

This policy does not apply to Merrimack residents maintaining vegetation on slopes of public rights-of-way on Class V and Class VI highways immediately adjacent to their property.

3. PERMIT REQUIRED

Prior to any activity associated with work to be performed within Class IV, Class V, and Class VI highways, the party wishing to perform the work shall make application to and receive a permit from the Department of Public Works. The Director of Public Works or his designee will coordinate and schedule a Preconstruction Conference prior to the issuance of the Right-Of-Way Permit and start of construction for any public improvements.

The Engineer-of-Record will be required to furnish multiple plan sets, marked "Approved for Construction" and stamped by a NH Professional Engineer. A Utility Plan, showing proposed locations of all water, power, telephone, cable tv, etc. Overhead/underground facilities will be required at or before the Preconstruction Conference. Permit Applications are available at the Public Works Highway Division, Turkey Hill Road, from 7 P:00 a.m. to 3:00 p.m., and the Public works Administration Office, 12 Bishop Street, from 8:30 a.m. to 4:30 p.m., normal business days. All completed Permit Applications and related documents, as required herein, are to be returned to the Public Works Administration Office. Permit application is found in Appendix A.

4. SURETY REQUIRED

For any work that will temporarily alter any Class IV, Class V or Class VI highway, or related feature, including, but not limited to, roadside vegetation or related feature, the party wishing to perform the work will post Surety in the amount approved by the Director of Public Works in a form approved by the Finance Administrator. The Surety will be provided to the Town prior to the issuance of any permit. A Bond Estimate Form is found in Appendix B. The Bond Estimate form shall be submitted with the Permit Application.

5. INSURANCE REQUIRED

Prior to receiving a work within any Class IV, Class V, or Class VI highway, the party wishing to perform the work shall submit current insurance certificates of coverage for the following types of insurance and in the following amounts.

<u>COVERAGE</u>	<u>LIMITS</u>
Workers Compensation	Statutory
Employers Liability	\$100,000 each occurrence
Public Liability	\$2,000,000 combined single limit
Automobile Liability	\$1,000,000 combined single limit

6. PUBLIC NOTICE REQUIRED

For any work that will involve the trimming or removal of trees, excavation, or removal or placement of pavement on a Class IV or Class V highway, the party wishing to perform the work will submit a list of all Merrimack residents and their current mailing addresses that immediately abut or are within 250 feet of the highway where the work is to be performed as part of the Permit Application. The Department of Public Works will notify via *First Class Mail*, those residents of the proposed work a minimum of 10 calendar days prior to the start of the work. Prior to receiving a permit, the party wishing to perform the work shall reimburse the Town \$1.00 for each Notice mailed.

7. TRAFFIC CONTROL AND UNIFORM OFFICER

For any work that involves the placement of construction equipment, vehicles, or personnel within the travel way of a Class IV or Class V highway, the party wishing to perform the work shall submit three copies of a Traffic Control Plan. The Traffic Control Plan shall be in accordance with Part VI of the Manual on Uniform Traffic Control Devices, latest edition, and Section 619 of the Standard Specifications for Road and Bridge Construction, latest edition, published by the New Hampshire Department of Transportation. The Traffic Control Plan will show proposed signage, its location, proposed use of flaggers and uniformed officers. The plan will be reviewed by the Police Chief and Public Works Director. Uniformed officers shall be required for any work performed on the following:

- Amherst Road
- Baboosic Lake Road
- Back River Road
- Bedford Road
- Continental Boulevard
- Daniel Webster Highway
- Naticook Road
- Turkey Hill Road

Uniformed officers may be required at other locations as required by the Police Chief. Coordination, scheduling, and reimbursement of uniform officers shall be with the Police Chief, or his designee.

8. BLASTING PERMIT REQUIRED

For any work within a Class IV, Class V, or Class VI highway where blasting may be required, the party wishing to perform the work shall secure a permit and related documents from the Merrimack Fire Department. The fee for the permit is \$100.00. A copy of the Blasting Permit shall be submitted with the Permit Application. See Appendix C.

9. INSPECTION FEES

Construction projects initiated by a private Developer will require inspection by the Town's Consulting Engineer, coordinated through the Department of Public Works. For the Department of Public Works to retain an Engineer or Inspector to perform the inspection, the party wishing to perform the work will deposit funds in an amount approved by the Director of Public Works in an escrow account to reimburse the Town for this cost of this service. Should it be necessary for Town forces to perform work outside their normal duty hours, the party performing the work shall reimburse the Town for all incurred overtime costs.

10. QUALITY ASSURANCE

All work performed within Class IV, Class V, or Class VI highways shall meet the requirements of the Department of Public Works.

11. SUPERINTENDENT REQUIRED

For any work performed within a Class IV, Class V, or Class VI highway, the party wishing to perform the work will appoint a superintendent who is in responsible charge to have the work performed. A telephone number where the Superintendent may be contacted at any time shall be provided to the Department of Public Works, Police Department, and Fire Department seventy-two (72) hours prior to performing any work.

12. COORDINATION REQUIRED

For any work performed within a Class IV, Class V, or Class VI highway, the party wishing to perform the work, and his superintendent, shall coordinate and schedule their activities through the Department of Public Works prior to performing any work involving the trimming or removal of trees, excavation, or removal or placement of pavement, a preconstruction meeting will be held. General Department of Public Works Construction Procedures are found in Appendix D.

APPENDIX A



**TOWN OF MERRIMACK, N.H.
DEPARTMENT OF PUBLIC WORKS
RIGHT-OF-WAY PERMIT**

PERMIT #: 06-_____

DATE: _____

ARTICLE I – AUTHORITY

Pursuant to the State of New Hampshire RSA 236:9 (Supp) and RSA 236:14 and the Town of Merrimack Sub-Division Regulations permit is issued to perform work in the **RIGHT-OF-WAY** at the following location for the purpose of:

(location): _____

(purpose): _____

ARTICLE II – GENERAL CONDITIONS

- A. Construction Procedures for Town highways are a part of this permit and are available at the Department of Public Works.
- B. In areas where pavement is to be excavated, it shall be cut and removed to produce clean, uniform edges without damage to remaining pavement. Any area of undermined remaining pavement, unintentionally occurring as a result of the work, shall be cut and removed to produce clean, uniform vertical edges on existing base material. Any pavement damaged by blasting, excavation or other construction related activity, will be cut and removed to provide clean, uniform, vertical edges with no damage to undisturbed pavement.
- C. The Contractor shall put in place sheeting/shoring as may be required to support the sides of the excavation and to prevent the movement of earth other than that intended to be disturbed for the excavation.
- D. All water pumped or drained from the worksite shall be disposed in a manner suitable to the Department of Public Works and without damage to pavements, other surfaces or property.
- E. Where ledge is to be removed by blasting, all laws of the state and federal agencies shall be complied with along with any additional instruction of the Fire Chief. No blasting shall be performed without twenty-four (24) hours notice being given to the Fire Chief, and the issuance of a blasting permit.
- F. All backfill material in excavations will be compacted at or near optimum moisture content, in layers not exceeding 12 inches in compacted thickness, using either pneumatic or vibratory compactors. The material will be compacted to at least 98% of the maximum density of soil determined by current tests for Moisture-Density Relationships of Soils, ASTM, D1557, Method D.
- G. Backfill material will be material excavated during the course of construction, but excluding pieces of pavement, frozen material, organic matter, topsoil, muck, peat or clay, rocks over six inches in the largest dimension.

Class "A" crushed gravel, (as described in NH Standard Specifications) equal to a depth of the existing gravel base course or 12 inches, whichever is greater, shall be placed in layers not exceeding 6 inches loose depth and thoroughly compacted.

Cold mix or cold patch shall be immediately placed in the trench area as temporary pavement. The cold patch shall be placed at a slightly higher grade than the adjacent pavement to allow for settlement, material will be placed to a full depth of existing pavement or 3 (three) inches, whichever is greater. After suitable exposure of temporary patch to traffic compaction, permanent pavement will be placed in accordance with Article IV of this permit.

- H. Daily telephone notification of work to Highway Division Construction Inspection (603-423-8551) will be required as will be the minimum notification of twenty-four (24) hours in advance of making the temporary and permanent pavement repairs.
- I. Hours of work, Monday through Friday, 7:00 am to 7:00 pm unless otherwise noticed under ARTICLE IV , Section B.

ARTICLE III – SURETY REQUIRED

For any work that will temporarily alter any portion of any **Town right-of-Way** or related feature, but not limited to roadside vegetation or related feature, the Contractor shall post surety in the amount approved by the Director of Public Works in a form approved by the Finance Administrator prior to the issuance of a permit.

ARTICLE IV – INSURANCE REQUIRED

The Contractor shall submit current insurance certificates, indicating the Town as an additional insured, or coverage of the following types of insurance and in the following amounts:

COVERAGE	LIMITS
Workers Compensation	Statutory
Employer Liability	\$100,000 Each Occurrence
Public Liability	\$2,000,000 Combined Single Limit
Automobile Liability	\$1,000,000 Combined Single Limit

ARTICLE V – TRAFFIC AND SAFETY

- A. The maximum length of trench to be open at one time shall be no more than 300 feet. Suitable entrance and exit to properties abutting the street shall be maintained at all times. Two-way traffic will be maintained nights, weekends and holidays.
- B. Traffic must be maintained during the performance of the work. **NO** street closure will be allowed without prior permission from the Department of Public Works and Police Department upon approval of traffic control / detour route plan submitted by the Contractor. Work zones will be protected by suitable barricades, warning signs, cones and flag persons during the day and proper lighting at night. Certified ATTSA or equivalent flag persons will be provided by the Contractor whenever two-way traffic cannot be maintained, or at the request of the Department of Public Works during any time that the Department of Public Works deems them necessary.
- C. For any work involving the placement of construction, equipment, vehicles or personnel within the travel way, the Contractor shall submit three (3) copies of a traffic control plan prepared in accordance with Part VI of the **Manual on Uniform Traffic Control Devices**, latest edition, and Section 619 of the **Standard Specifications for Road and Bridge Construction**, latest edition.
- D. Uniformed Officers shall be required for any work performed in the following R.O.W. locations unless waived by the Merrimack Police Department. Additional locations may require Officers as deemed necessary by the Police Chief:

Amherst Road	Continental Boulevard	Naticook Road	Turkey Hill Road
Baboosic Lake Road	Daniel Webster Hwy.	Peaslee Road	Wire Road
Back River Road	Joppa Road	Seaverns Bridge Road	Bedford Road
Manchester Street	Tinker Road		

ARTICLE IV – SPECIAL CONDITIONS

- A. The Contractor will be responsible to notify **DIG SAFE** per state law requirements prior to any type of excavation in the Right-Of-Way. As Merrimack Village Water District (water) and Merrimack Wastewater Treatment Facility (sewer) are not part of New Hampshire DIG SAFE, it is the Contractor's responsibility to notify them separately.
- B. The Contractor will not trim, cut or in any way disturb any trees or shrubbery within the Right-Of-Way without the approval of the Department of Public Works.
- C. The Contractor will be responsible to in a reasonable amount of time, restore any disturbed area to equal or better condition to than prior to commencement to work.
- D. By Case Conditions:

ARTICLE V – RESPONSIBILITY

The Contractor agrees to save harmless the Town of Merrimack from any and all claims arising from the construction of the work.

The Contractor agrees to assume such additional cost as the Department of Public Works may incur by reason of failure to perform the work in the prescribed required manner. Duration of responsibility will be two (2) years from completion of permanent repair.

Permission for the requested work within the Merrimack Right-Of-Way is granted, subject to the instruction, regulations and conditions of this agreement. The undersigned hereby acknowledges receipt of copy of permit and agrees to comply with requirements.

Permit effective date:	Permit expiration date:
_____	_____
Contractor _____	Business Phone: _____
Authorized Agent _____	Date: _____
Signature _____	
Emergency Contact _____	Phone #: _____
Person _____	
Permit Issued By _____	Permanent Repair Date: _____

Distribution: Original – DPW, Copy – Permittee, Police Dept.

(The Contractor will be responsible to maintain a copy of this permit on worksite at all times of operations.)

APPENDIX B

TOWN OF MERRIMACK ROAD BOND ESTIMATE FORM

Subdivision Name	Developer Name			
Street Name	Engineer Name			
Street Length	Street Construction Length			

Clearing and grubbing (201)		LF @ \$		=	
Common roadway excavation (203)		CY @ \$		=	
Roadway rock excavation (203)		CY @ \$		=	
Common structure excavation (206)		CY @ \$		=	
Rock structure excavation (206)		CY @ \$		=	
Drainage Swales (grass) (206)		LF @ \$		=	
Drainage swale (rock lined)		LF @ \$		=	
Bank run gravel – 12" thick (304)		LF @ \$		=	
Crushed gravel – 6" thick (304)		LF @ \$		=	
Crushed gravel – 9" thick (304)		LF @ \$		=	
Sand (if required) 12" thick (304)		LF @ \$		=	
Hot bituminous pavement 2" binder (403)		LF @ \$		=	
Hot bituminous pavement 2 ½" binder (403)		LF @ \$		=	
Hot bituminous pavement 1" wearing course (403)		LF @ \$		=	
Hot bituminous pavement 1 ½" wearing course (403)		LF @ \$		=	
Driveway Aprons – 12' wide		EA @ \$		=	
STORM DRAIN (603)					
Concrete	12" diameter		LF @ \$		
	15" diameter		LF @ \$		
	18" diameter		LF @ \$		
	24" diameter		LF @ \$		
	30" diameter		LF @ \$		
HDPE	12" diameter		LF @ \$		
	15" diameter		LF @ \$		
	18" diameter		LF @ \$		
	24" diameter		LF @ \$		
Catch basins	4' diameter (604)		VF @ \$		
	5' diameter		VF @ \$		
Poly liners for Catch basins			EA @ \$		
Drain MH	4' diameter		VF @ \$		
	5' diameter		VF @ \$		
Headwalls	12" – 18" pipe		EA @ \$		
	24" – 30" pipe		EA @ \$		
6" Underdrain (605)			LF @ \$		
Flushing Basins			EA @ \$		
Retention / Detention Basins			EA @ \$		
Sanitary Sewer					
8" PVC SDR 35 Main			LF @ \$		
10" PVC SDR 35 Main			LF @ \$		
6" House Service incl. Cleanout			EA @ \$		
4' diameter SMH			VF @ \$		
Tie new sewer to existing SMH			EA @ \$		

Page Subtotal

\$

	Previous	Page Subtotal	\$
Sanitary Sewer			
8" PVC SDR 35 Main	LF @ \$	=	
10" PVC SDR 35 Main	LF @ \$	=	
6" House Service incl. Cleanout	EA @ \$	=	
4" diameter SMH	VF @ \$	=	
Tie new sewer to existing SMH	EA @ \$	=	
Water			
Tapping Main	EA @ \$	=	
____" Main	LF @ \$	=	
____" Valve	EA @ \$	=	
Hydrant incl. Lateral and Valve	EA @ \$	=	
____" Service incl. Tap and curbstop	EA @ \$	=	
Test and chlorinate	LS @ \$		
Utility conduits – elec. Phone, TV	LF @ \$	=	
Beam guard rail (606)	LF @ \$	=	
BGR terminal unit	EA @ \$	=	
Cape Cod Berm (609)	LF @ \$	=	
Straight granite curb	LF @ \$	=	
Signs (street, stop, etc.)	LS @ \$		
Thermoplastic pavement markings	LF @ \$	=	
Traffic Signals	LS @ \$		
Street lights	EA @ \$	=	
Sidewalk incl. Crushed gravel base (608)			
2" bit. – 5' wide	LF @ \$	=	
6" conc. – 5' wide	LF @ \$	=	
Fabric for slope or channel stabilization	SY @ \$	=	
Loam & turf establishment	SY @ \$	=	
Silt Fence	LF @ \$	=	
Silt Fence Removal	LF @ \$	=	
Granite bounds	EA @ \$	=	
As-Built Drawings	LF @ \$	=	
	Subtotal (a)		
Contingencies (15% Subtotal (a))			
	Subtotal (b)		
Engineering (8% of Subtotal (b))			
Construction Supervision (7% of Subtotal (b))			
	Current Cost		
Escalation Adjustment: Current Cost x _____ years @ 6%			
	TOTAL BOND AMOUNT		

I hereby certify that, in addition to any work already completed, the following statement and itemized unit costs will complete all improvements required by the Merrimack Planning board for the subject street:

Public Works Director	Date	Planning Board Chairman	Date
Consultant Engineer	Date	Const. Services	Date

* Connotes applicable section of "Standard Specifications for Road and Bridge Construction", State of New Hampshire Department of Public Works and Highway, 2004 edition.

Notes:

- (1) The developer will be required to submit "as-built" information concerning the location of all utilities in the street and entrance to lots prior to the laying of the base coat of pavement.
- (2) All lump sum items require detail backup.

**TOWN OF MERRIMACK
ROAD BOND ESTIMATE ITEMS AND UNIT PRICES**

Item	Unit	Unit Price	Comments
Clearing and grubbing (201)	LF	\$ 8.00	Measured along c/l of road
Common roadway excavation	CY	8.00	Submit calculations
Roadway rock excavation (203)	CY	25.00	Submit calculations
Common structure excavation (206)	CY	18.00	Add to drain and sewer cost over 5' deep
Rock structure excavation (206)	CY	100.00	Add quantity below subgrade for all utilities
Drainage swales (grass) (206)	LF	15.00	
Drainage swale (rock lined)	LF	40.00	
Bank run gravel – 12" thick (304)	LF	19.00	
Crushed gravel – 6" thick (304)	LF	12.00	
Crushed gravel – 9" thick (304)	LF	18.00	
Sand (if required) 12" thick (304)	LF	18.00	
Hot bit. Pave. 2" binder (403)	LF	17.20	
Hot bit. Pave. 2 ½" binder (403)	LF	21.50	
Hot. Bit. Pave. 1" wearing course (403)	LF	8.00	
Hot bit. Pave. 1 ½" wearing course (403)	LF	12.00	
Driveway aprons – 12' wide	EA	500.00	
Storm Drain (603)			
Concrete – 12" diameter	LF	40.00	
15" diameter	LF	45.00	
18" diameter	LF	50.00	
24" diameter	LF	65.00	
30" diameter	LF	80.00	
HDPE 12" diameter	LF	30.00	
15" diameter	LF	35.00	
18" diameter	LF	40.00	
24" diameter	LF	55.00	
Catch basins 4' diameter (604)	VF	210.00	\$1,600.00 min.
5' diameter	VF	250.00	\$2,000.00 min.
Poly liners for CB's	EA	200.00	
Drain MH 4' diameter	VF	250.00	\$2,000.00 min.
5' diameter	VF	300.00	\$2,500.00 min.
Headwalls 12" – 18" pipe	EA	1,000.00	
24" – 30" pipe	EA	2,000.00	
6" Underdrain (605)	LF	20.00	
Flushing basins	EA	450.00	
Retention/detention basins	EA		Submit detailed calculations
Sanitary Sewer			
8" PVC SDR 35 Main	LF	70.00	
10" PVC SDR 35 Main	LF	80.00	
6" house service incl. Cleanout	EA	1,275.00	
4' diameter SMH	VF	300.00	\$2,500.00 minimum
Tie new sewer to exist. SMH	EA	1,500.00	

4/17/06

**TOWN OF MERRIMACK
ROAD BOND ESTIMATE ITEMS AND UNIT PRICES**

Item	Unit	Unit Price	Comments
Water			
Tapping main	EA		Provide itemized cost est. to MVD for review and approval.
" Main	LF		
" Valve	EA		
Hydrant incl. Lateral and valve	EA		
" Service incl. Tap and curbstop	EA		
Test and chlorinate	LS		
Utility conduits – elec., phone, TV	LF	60.00	
Beam guard rail (606)	LF	20.00	
BGR terminal unit	EA	2,500.00	
Cape Cod Berm (609)	LF	5.00	
Straight granite curb	LF	25.00	
Signs (street, stop, etc.)	LS		\$250.00 per intersection min.
Thermoplastic pavement markings	LF	2.00	\$500.00 per intersection min.
Traffic Signals	LS		To be agreed
Street lights	EA	1,500.00	
Sidewalk incl. Cr. gravel base (608)			
2" bit. – 5' wide	LF	11.50	
6" conc. – 5' wide	LF	26.50	
Fabric for slope or channel stabil.	SY	2.00	
Loam and turf establishment	SY	4.00	
Silt Fence	LF	4.00	
Silt fence removal	LF	3.00	
Granite bounds	EA	350.00	
As-built drawings	LF	4.00	\$5,000.00 min.

4/17/06

APPENDIX C



MFR
P.O. Box 130
432 DW HIGHWAY
Merrimack, NH 03054
603-424-3690



Blasting Permit

NUMBER _____ DATE _____

BLASTING COMPANY _____

OCCUPANCY ADDRESS _____

LOCATION OF BLASTING _____

SURVEY REQUIRED YES _____ NO _____

DATE(S) PERMIT IS VALID FOR: From: _____ To: _____

I, the undersigned permittee, understand the law, rules, and regulations of the Town of Merrimack and my responsibility under the terms of this permit.

Signature of Permittee _____
NH STATE LICENSE # _____
NAME: _____
ADDRESS: _____
TELEPHONE: _____
FIRE CHIEFS OR DESIGNEE: _____
DATE ISSUED: _____

Blasting must be conducted with compliance to State Law Rules and Regulations, BOCA Basic Fire Prevention Code 1990 Article 26 and the Town of Merrimack Rules, Revised 11/17/92.

THIS PERMIT DOES NOT TAKE THE PLACE OF ANY LICENSE REQUIRED BY LAW AND IS NOT TRANSFERABLE. ANY CHANGE IN THE USE OR OCCUPANCY OR PREMISES SHALL REQUIRE A NEW PERMIT.

THIS PERMIT MUST AT ALL TIMES BE KEPT ON THE PREMISES MENTIONED ABOVE.

\$100.00 Blasting Fee, effective April 15, 1995.

Please make all checks payable to Merrimack Fire Rescue.

Merrimack Fire Rescue

Fee Schedule

Approved by Board of Selectmen

Reports Request	
• Ambulance Reports	• \$15.00 each
• Fire Reports (No cost to residential)	• \$25.00 each
All requests for reports must be submitted in writing to the Town of Merrimack, Department of Fire Rescue, PO Box 130, Merrimack New Hampshire 03054 to the attention of the Office Manager. Payment must be made at the time of the request.	

Permit Inspections Oil/Propane Burner	
• Residential Permits and Inspections	• \$30.00 each
• Commercial Permits and Inspections	• \$100.00 each
This permit shall be obtained prior to the installation of the oil or propane burner device. The permit can be acquired at the Merrimack Fire Station located at 432 Daniel Webster Highway, between the hours of 8:00 am and 3:30 pm Monday through Friday excluding holidays. Please contact the Merrimack Office of the Fire Marshal for specific installation requirements.	

Blasting Permits	
• Initial Permit (Issued by the week max 5 days)	• \$100.00
• Permit Extension (additional day after the first 5-five)	• \$10.00 per day (renewal before current permit expiration)
The Blasting Permit shall be obtained by the licensed person who will be conducting the blasting activities at the approved site. The exact location of the blasting must be provided indicating the address, including Tax Map and Lot numbers. If there will be multiple blasting areas that the permit will cover the blasting contractor shall be responsible to provide a site map indicating the exact location(s) of each blast site. The blasting contractor shall have the permit available onsite at all times and follow all State of New Hampshire Regulations and the Town of Merrimack Blasting Requirements. There will be no blasting allowed on weekends, any holidays. Blasting operations can only be conducted between the hours of 8:30 am to 6:00 pm.	

Building Plan Review	
• Less than 10,000 square feet	• \$100.00
• 10,000 square feet or more	• \$150.00 plus \$10.00 per every 1000 sq ft over
All building plans shall be submitted to the Town of Merrimack Community Development Department who will record and document the information and then forward the plans to the Office of the Fire Marshal for review and comments. Payment is required to be made at the time of submittal	

Site Plan Reviews	
--------------------------	--

<ul style="list-style-type: none"> • Residential (single or two family home) 	<ul style="list-style-type: none"> • \$25.00
<ul style="list-style-type: none"> • Commercial/Industrial/Complex (for each review). 	<ul style="list-style-type: none"> • \$50.00
<p>All site plans shall be submitted to the Town of Merrimack Community Development Department who will record and document the information and then forward the plans to the Office of the Fire Marshal for review and comments. Payment is required to be made at the time of submittal.</p>	

Permit Fire Alarm System Plan Review & Inspection <ul style="list-style-type: none"> • New Installations / Modifications / Expansions / Removals (Commercial, Industrial) • Fire Alarm System Inspection & Test • Resubmitted for incomplete documentation 	<ul style="list-style-type: none"> • \$1.00 per device (minimum \$50.00) • \$50.00 each inspection • \$1.00 per device (minimum \$50.00)
<p>All fire alarm/detection plans shall be submitted directly to the Town of Merrimack, Department of Fire Rescue, Office of the Fire Marshal. These plans shall meet the requirements of Fire Alarm/Detection System Plan Conditions published by the Office of the Fire Marshal.</p> <p>Payment is required at the time of the submittal.</p> <p>All prints and associated documentation will be stamped by the Merrimack Office of the Fire Marshal and shall be kept at the building site at all times. All inspections on the system shall be conducted with reference to the stamped approved prints and documentation. Failure to have the stamped print on site during any inspections will prevent the system from signoff and approval.</p>	

Permit Fire Suppression System Plan Review and Inspection <ul style="list-style-type: none"> • New Installations / Modifications / Expansions / Removals (Commercial, Industrial) • Rough Sprinkler Inspection or Reinspection • Final Sprinkler Inspection & Test or Reinspection..... • Resubmitted for incomplete documentation 	<ul style="list-style-type: none"> • \$1.00 per device (minimum \$50.00) • \$50.00 each inspection • \$50.00 each inspection • \$1.00 per device (minimum \$50.00)
<p>All fire suppression plans shall be submitted directly to the Town of Merrimack, Department of Fire Rescue, Office of the Fire Marshal. The plans shall meet the requirements of Fire Suppression System Plan Conditions published by the Office of the Fire Marshal.</p> <p>Payment is required at the time of the submittal.</p> <p>All prints and associated documentation will be stamped by the Merrimack Office of the Fire Marshal and shall be kept onsite at all times. All inspections on the system shall be conducted with reference to the stamped approved prints and documentation. Failure to have the stamped print on site during any inspections will prevent the system from signoff and approval.</p>	

Inspections Tanks / Hazardous Materials	Permit Fees
<ul style="list-style-type: none"> Underground / Aboveground Tank Removals (less than 800 gallons, water capacity). Requires inspection prior to removal and after removal Reinspections (Hazards, Violations, Unsafe conditions) ... 	<ul style="list-style-type: none"> \$25.00 \$50.00 each
<p>This permit and additional requirements shall be obtained from the Merrimack, Office of the Fire Marshal prior to the installation or removal of an UST or AST. The permit can be acquired at the Merrimack Fire Station located at 432 Daniel Webster Highway, between the hours of 8:00 am and 3:30 pm Monday through Friday excluding holidays.</p> <p>All fees must be paid prior to issuance of the permit.</p> <p>All site environmental monitoring shall be provided to the Merrimack Office of the Fire Marshal for proper documentation.</p>	

Permit Inspections Organic Fuels Dispensing	
<ul style="list-style-type: none"> Bulk Chemical Storage (Greater than 500 gallons) Gas Stations, Service Stations, Auto Garages, Junk Yards, Auto Body Shops Commercial Propane Tanks (Bulk Plants, Tank Farms) ... Commercial Propane Tanks (refill, replacement stations) Commercial Oil Tanks (Bulk Oil Storage) Reinspections (Hazards, Violations, Unsafe conditions) ... 	<ul style="list-style-type: none"> \$25.00 Inspection \$25.00 Inspection \$25.00 Inspection \$25.00 Inspection \$25.00 Inspection \$50.00
<p>The permit inspections will be scheduled with The Town of Merrimack, Department of Fire Rescue Office of the Fire Marshal, Fire Inspector and the property owner or representative. Payment shall be made prior to the inspection.</p>	

Permit Inspections: Place of Assembly	
<ul style="list-style-type: none"> Assembly Areas Less than 100 Occupant Load..... Assembly Areas 100 or greater Occupant Load Reinspections (Hazards, Violations, Unsafe conditions) ... 	<ul style="list-style-type: none"> \$25.00 (Annual Inspection) \$100.00 (Annual Inspection) \$50.00
<p>The permit inspections shall be scheduled with The Town of Merrimack, Department of Fire Rescue Office of the Fire Marshal, Fire Inspector and the property owner or representative. Payment shall be made prior to the inspection.</p>	

Permit Inspections: Health and Care Facilities	
<ul style="list-style-type: none"> Day Care, In-home Day Care, Adult Care Hospice, Residential Board and Care Nursing Home Reinspections (Hazards, Violations, Unsafe conditions) ... 	<ul style="list-style-type: none"> \$25.00 Annual Inspection \$25.00 Annual Inspection \$25.00 Annual Inspection \$50.00
<p>The permit inspections will be scheduled with The Town of Merrimack, Department of Fire Rescue Office of the Fire Marshal, Fire Inspector and the property owner or representative. Payment shall be made prior to the inspection..</p>	

Permit Inspection Special Events	
<ul style="list-style-type: none"> Carnival, Carnival with Rides, Fair, Festival, Food..... Outside Event with Greater than 200 people Tent(s) 600 square feet and greater (20' X 30') or an 	<ul style="list-style-type: none"> \$100.00 Initial Inspection \$25.00 Initial Inspection

<ul style="list-style-type: none"> accumulation of greater than 1000 square feet covered. • Reinspections (Hazards, Violations, Unsafe conditions) ... 	<ul style="list-style-type: none"> • \$50.00 Initial Inspection each • \$50.00 each
The permit inspections will be scheduled with The Town of Merrimack, Department of Fire Rescue Office of the Fire Marshal and the property owner or representative. Payment shall be made prior to the inspection.	

Permit Inspections: Certificate of Occupancy <ul style="list-style-type: none"> • Residential • Commercial / Residential less than 10,000 square feet..... • Commercial / Residential 10,000 square feet or greater ... • Reinspections (Hazards, Violations, Unsafe conditions) 	<ul style="list-style-type: none"> • \$25.00 per each unit • \$250.00 per building, \$25.00 for each unit • \$500.00 per building, \$25.00 for each unit • \$50.00 each
The permit inspections will be scheduled with The Town of Merrimack, Department of Fire Rescue Office of the Fire Marshal, Fire Inspector with the property owner or representative. Payment shall be made prior to the inspection.	

MERRIMACK FIRE DEPARTMENT
EXPLOSIVES & BLASTING RULES

1. Permits are required in accordance with the BOCA Basic Fire Prevention Code 1990, Article 26.

Permits – F2600.2

2. Bond Required for blasting. Certificates of Insurance F2600.3
3. Storage of explosives F2602.
4. Transportation of explosives F2603.
5. Storage of blasting agents F2604.
6. Transportation of blasting agents F2605.
7. Blasting F2607.

Time of day	2607.1
Personnel	2607.2
Clearance of Site	2607.3
Notice	2607.4
Responsibility (Safety & Warning)	2607.5
Precautions	2607.6
Congested Areas	2607.7

In addition, the Town of Merrimack requires that:

1. All permit applicants must comply with all State of New Hampshire Rules and Regulations.
2. A survey of the area buildings shall be the responsibility of the blasting firm on everything within 250 feet when deemed necessary by the Fire Official. This distance may be extended.
3. Proof of State of New Hampshire licenses, and certificate of competency shall be supplied to the Fire Department at time of application for the permit.

NOTE: Only those persons who have copies of licenses on file with the department shall be allowed to do blasting.

4. Copy of Certificate of Insurance is to be supplied to the Fire Department. Certificate holder to be listed as “Town of Merrimack”, c/o Merrimack Fire Department, Box 130, Merrimack, NH 03054. Certificate is to be signed by a New Hampshire Agent.
5. A site plan showing where the blasts are to occur shall be supplied to the Fire Department. Location of storage magazine to be shown if applicable.
6. All blasting magazines to be identified by proper N.F.P.A. and D.O.T. signage.

7. A copy of the seismograph of blasts shall be supplied to the Fire Department where applicable.
8. The Fire Department reserves the right to have personnel on site to monitor the blast for our records.

NOTE: Fire Department may require company to hire off duty fire personnel to monitor if blasts are to occur several times during the day. Blasting company would be required to sign contract with Town for this service.

9. 24-Hour notice must be given to the Fire Department prior to any blasting. Phone number is 424-3690. A waiver for this rule may be obtained under certain conditions.
10. One-hour notice via a phone call shall be given to the Fire Department prior to execution of the blast.
11. Blaster shall be required to notify residents of blast at least one hour prior to the execution of the blast, if requested by any resident.
12. Any violation of the rules may result in the permit being revoked.

Note: Permits can be obtained at the Central Fire Station, Monday through Friday, between the hours of 8 a.m. and 4 p.m.

APPENDIX D

**APPENDIX D
TOWN OF MERRIMACK
CONSTRUCTION RELATED REGULATIONS**

1. Prior to commencement of construction a permit must be obtained from the Highway Division for the purpose of work within Town highways as noted in this Policy.
2. The Contractor shall notify dig Safe and provide the Town with the Dig Safe numbers. In addition, the Merrimack Village Water District and the Merrimack Wastewater Treatment Facility must be given seventy-two (72) hours notice prior to starting construction.
3. The above requirements do not supersede or amend requirements of state Statutes concerning notification of all utilities.
4. Prior to commencement of construction with the public way the Contractor/Developer must notify the Merrimack Police Department, Merrimack Fire Department, and the Merrimack Ambulance / Rescue Service.
5. All bonds and inspection fees must be posted prior to any work being performed.
6.
 - a) Inspections of the related construction are performed on the roadway and various utilities whether they are to be public or private.
 - b) A preconstruction meeting will be held prior to any construction to discuss the work to be performed and details of these inspections.
7. Twenty-four (24) hour notice shall be provided when an inspection is requested.
8. Inspection must be requested for the following road constructions:
 - a. **Clearing and Grubbing** – refer to State of New Hampshire Standard Specifications for Road and Bridge Construction, Section 201 – Clearing and Grubbing.
 - b. **Muck Excavation and Unsuitable Material** – refer to State of New Hampshire Standard Specifications for Road and Bridge Construction, Section 203 – Excavation and Embankment.
 - c. **Compaction and Density Test** – at his own expense, the Contractor will supply to the Town of Merrimack, Highway Division, compaction and density tests performed by an independent testing company. The tests shall be performed on the following: subgrade, in place gravel grade, and in place crushed gravel grade. These compaction and density tests must meet State of New Hampshire Standard Specifications for Road and Bridge Construction, Section 203 – Excavation and Embankment, and Section 304 – Aggregate Base Course, latest edition.
 - d. **Gradation and Proctor Tests** – at his own expense, the Contractor will supply to the Town of Merrimack, Highway Division, test results done by an independent testing company. These tests will be performed on subgrade, gravel grade and crushed gravel grade. Test results must meet State of New Hampshire Standard Specifications for Road and Bridge Construction, Section 304 – Aggregate Base Course, latest edition.

- e. **Construction Survey** – The Contractor shall provide survey stakes at each 50' station along the proposed roadway. At a minimum, the stakes shall be clearly marked with the roadway station, offset from centerline and centerline finish grade elevation. Bent, broken or loose stakes shall be replaced. No inspection for acceptance will be performed without the appropriate staking construction survey.
 - f. Initial placement of fill in a fill section.
 - g. Approval of subgrade.
 - h. Approval of bank run gravel grade.
 - i. Approval of crush gravel grade.
 - j. Prior to commencement of paving and after inspection and preliminary approval of crush gravel grade, a road centerline profile survey must be made in the field and one (1) paper copy showing the plot and stamped by the Owner's engineer must be submitted to the Director of Public Works for his review, to verify that constructed grades are consistent and in conformance with design grades. The maximum tolerance allowed shall be ½" (.04 feet) from the design grade.
 - k. Prior to placing hot bituminous base paving.
 - l. Prior to placing hot bituminous cap and berm.
 - m. Prior to placing hot bituminous final paving.
 - n. Approval of pipe/drainage between structures.
9. All work shall be performed in accordance with State of New Hampshire Standard Specifications for Road and Bridge Construction.
10. For a change in design, the design engineer of record shall make the request, in writing, to the Director of Public Works for construction.
11. **Sewer Connections and New Main Line Sanitary Sewer** – The Highway Division must be given a 24-hour notice prior to any sewer service connection to existing sewer mains, so proper inspection fee for these services. If a sewer connection must be done on a recently paved street with the three year moratorium not to disturb a newly paved surface the Contractor will be charged \$15.00 per sq. yd. For infrared repairs.

All newly constructed sewers in the Town of Merrimack, whether public or private, must have a Town inspector present during construction of these sewers. The Town will be reimbursed for hourly inspection fees, amount to be determined at the time of the sewer construction project.

Adopted this 3rd day of April, 1997.

Merrimack Board of Selectmen

Carolyn B. Whitlock

R. L. Christensen

John J. Thompson

W. H. McFarlane

MERRIMACK DPW – HIGHWAY DIVISION**REQUIREMENTS FOR RESIDENTIAL CERTIFICATE OF OCCUPANCY
(New Subdivision)**

- ✓ Binder course pavement completed on street or phase on which lot is located;
- ✓ Grading completed from edge of pavement to right-of-way line and all surfaces stabilized;
- ✓ Closed drainage completed including adjustment of all casting to binder pavement grade – castings shall be temporarily set flush or below existing pavement surface;
- ✓ Open drainage completed including headwalls and stabilization of all swales and detention or retention basins;
- ✓ Satisfactory completion of all utility work certified by utility owner;
- ✓ All street bounds (property corner and street layout) installed or bonded;
- ✓ Where sidewalk is required along the lot frontage, the binder pavement course shall have been completed along the entire length of the street or phase as appropriate;
- ✓ Asphalt berm or curb shall be in place as necessary to provide erosion control;
- ✓ “Stop bars” completed on all paved streets;
- ✓ Permanent street sign shall be installed – four-inch high reflective white letters on six-inch high green extruded aluminum. Space shall be reserved to the left of the street name for a five-inch diameter Town seal to be installed by DPW after the road has been accepted.
- ✓ Stop signs installed in accordance with the MUTCD;
- ✓ Required street lighting installed and operational;
- ✓ All required offsite improvements completed;
- ✓ Any additional items specifically required by the approved plans shall be complete.

Town of Merrimack
Department of Public Works
May 2006

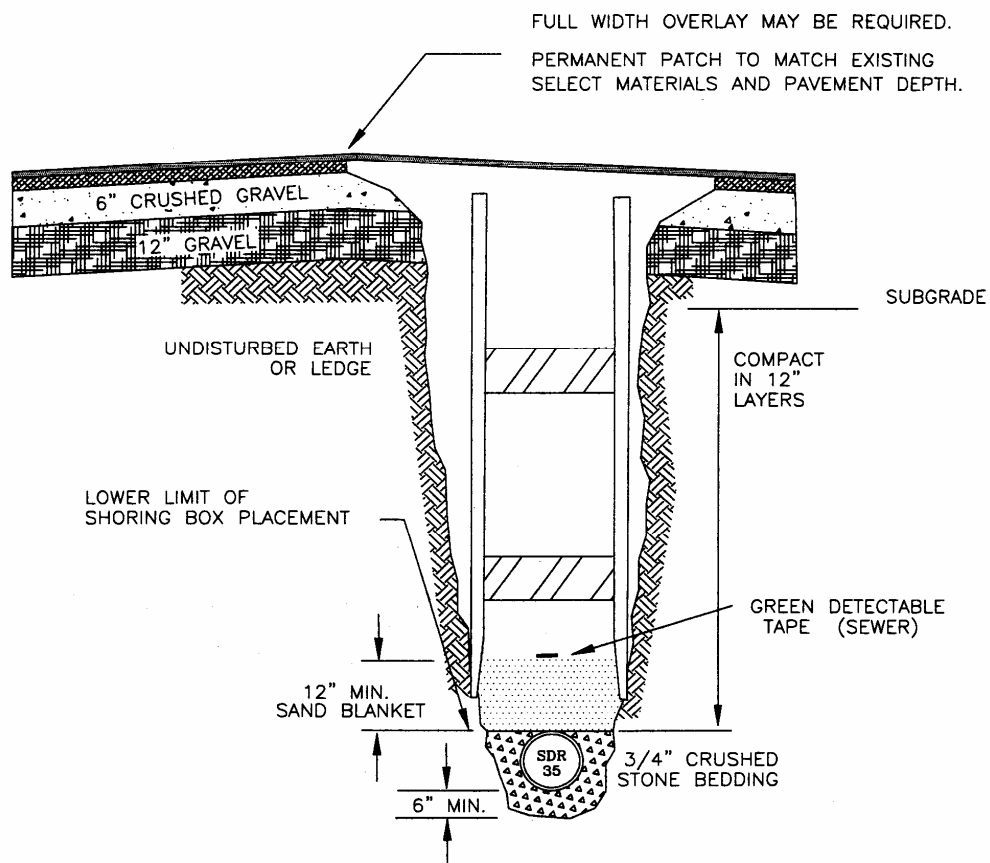
Minimum Content for As-Built Drawings of Streets and Utilities

1. Sheet size shall be 22" X 34"
2. Scale shall be 1" = 50', 1" = 40', 1" = 30', or 1" = 20'
3. Profiles of street centerlines and/or utility lines shall be drawn at the same scale as plan with vertical exaggeration of one tenth of horizontal scale.
4. Details to be shown:
 - Horizontal alignment of centerline with tie-in to centerline of intersecting streets, location of street right-of-way bounds, edge of rights-of-way and easements to the town outside the street right-of-way, and front property corner markers;
 - At one hundred (100) foot minimum intervals provide elevations along centerline, edge of pavement, and top and top of roadway side slopes;
 - Location and elevation of benchmarks and retaining walls;
 - Location of all visible roadway components including but not limited to guardrail, fencing, gates, drive aprons, sidewalks, traffic signals, traffic signs, handicap ramps, curbing, street lights, water cisterns;
 - Location and elevation of all roadway appurtenances including but not limited to drainage retention ponds, drainage swales, pipes, water quality structures, etc. within or outside the street right-of-way;
 - Location of water mains, valves, hydrants, blow-offs, water shut-offs, bends, service stubs and other water main components. Indicate pipe size and material of mains and service stubs;
 - Location of sanitary sewer mains and storm sewer mains. Show rim elevations, invert elevations and locations of catch basins, drainage manholes, sanitary sewer manholes, cleanouts, headwalls, fix-end sections, culverts and service stubs. Show pipe connections between structures and service stubs with pipe size and type
 - Location of private utilities including but not limited to natural gas mains, electric, telephone and cable conduit. Show mains, utility poles, transformer pads, junction boxes, and service stubs;
 - Location, type and size of street trees.
5. Plans shall be sealed and signed by a licensed land surveyor.
6. Electronic submittals (AutoCAD) in addition to paper plans are required.

**CONSTRUCTION
DETAILS**

SANITARY SEWER

TRENCH SECTION

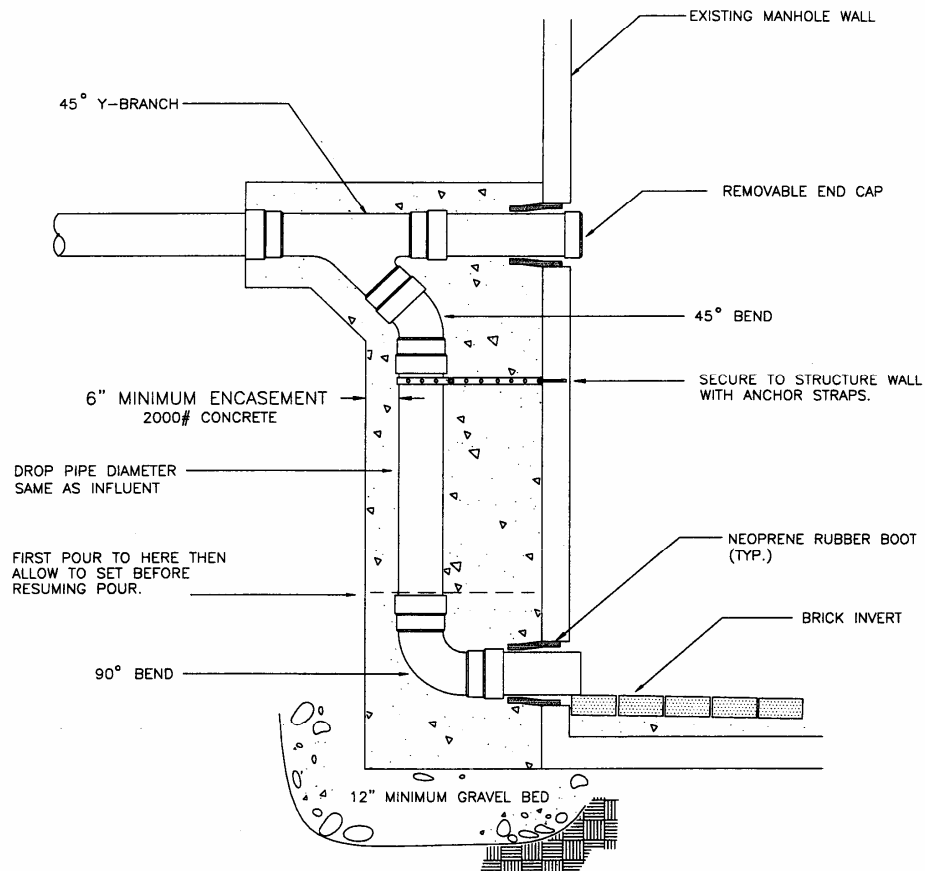


PVC PIPE INSTALLATION

NOTE: for sanitary sewers at depths greater than 15-feet; in questionable soils/groundwater issues; or for other specialized needs, ductile iron or other pipe materials may be required.

Sanitary Sewer

PVC OUTSIDE DROP MANHOLE



Sanitary Sewer

INSIDE DROP MANHOLE

NOTES:

DROP TO MATCH INLET DIAMETER

MANHOLES SHALL BE CONSTRUCTED IN ACCORDANCE TO THE CITY OF CONCORD STANDARDS FOR SANITARY MANHOLE CONSTRUCTION.

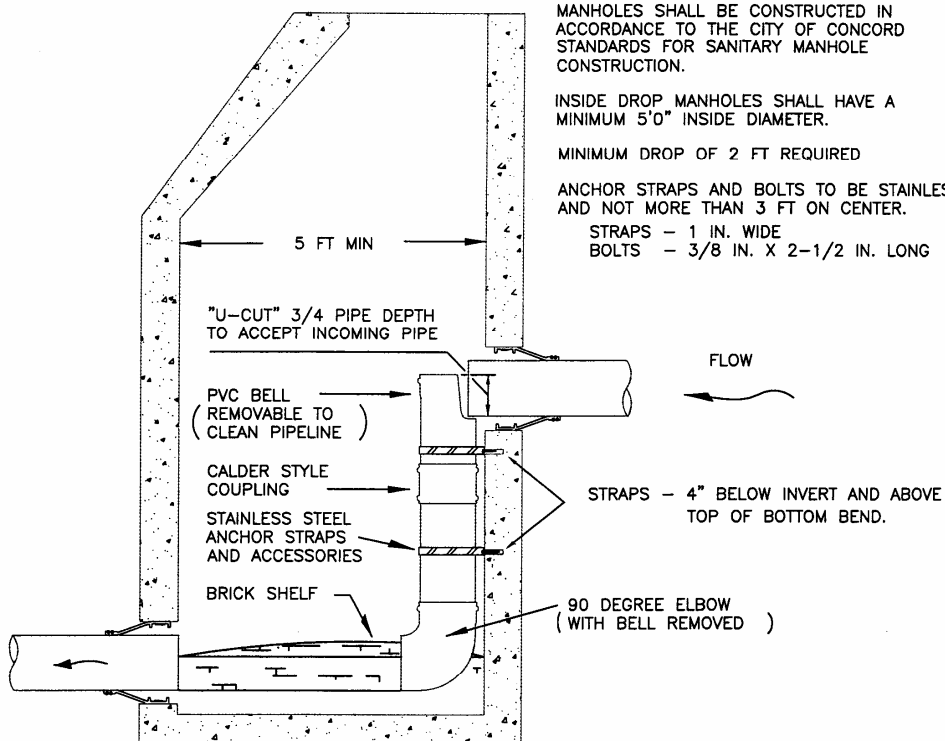
INSIDE DROP MANHOLES SHALL HAVE A MINIMUM 5'0" INSIDE DIAMETER.

MINIMUM DROP OF 2 FT REQUIRED

ANCHOR STRAPS AND BOLTS TO BE STAINLESS AND NOT MORE THAN 3 FT ON CENTER.

STRAPS - 1 IN. WIDE

BOLTS - 3/8 IN. X 2-1/2 IN. LONG

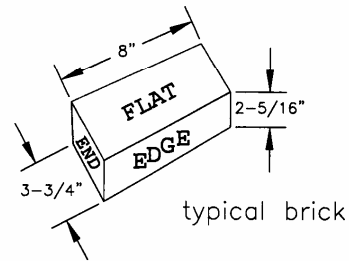


SANITARY & STORM DRAIN BRICK SHELF CONSTRUCTION

For mains 8" to 15"
invert through
lower half of pipe

For mains 16" or greater
invert constructed to
top of pipe

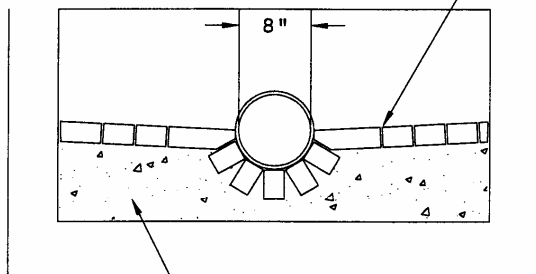
(8" PVC shown)



ASTM Designation: C 321-93

maintain trough width
through structure

brick masonry
with flat tooled joints
3/8" maximum



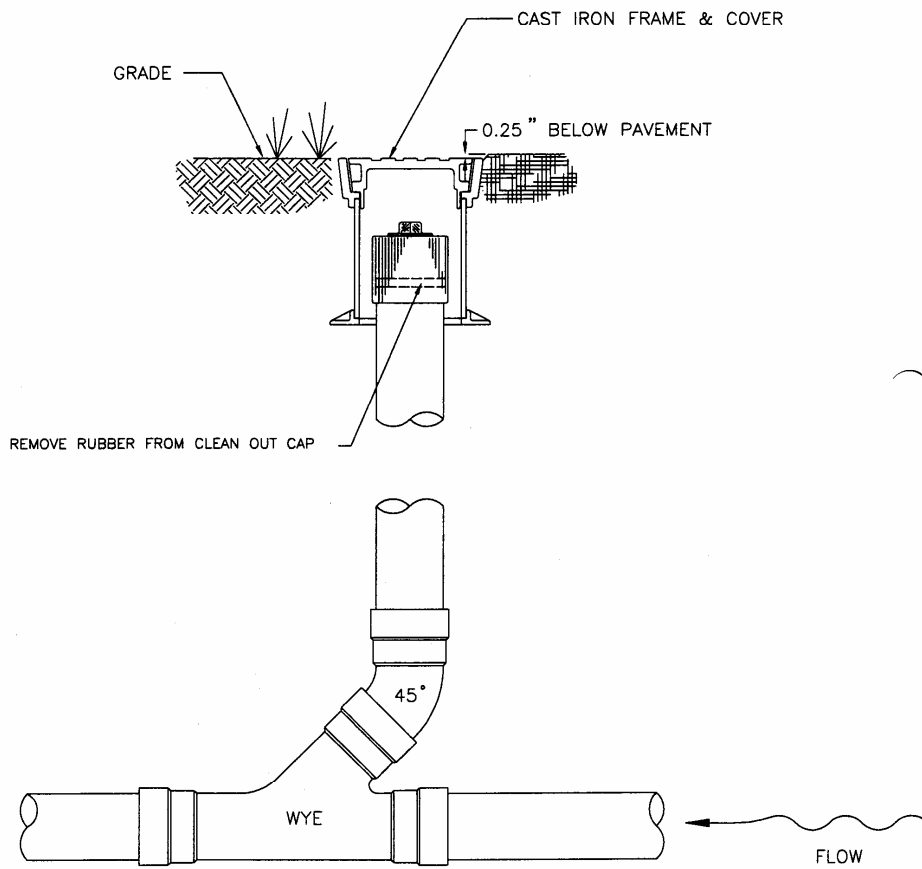
brick masonry

And mortar

8" pipe	-	7 brick to midpoint
10" pipe	-	7 brick it midpoint
12" pipe	-	9 brick to midpoint
15" pipe	-	11 brick to midpoint

SANITARY SEWER**CLEAN OUTS ON SERVICE LATERALS**

6" Diameter

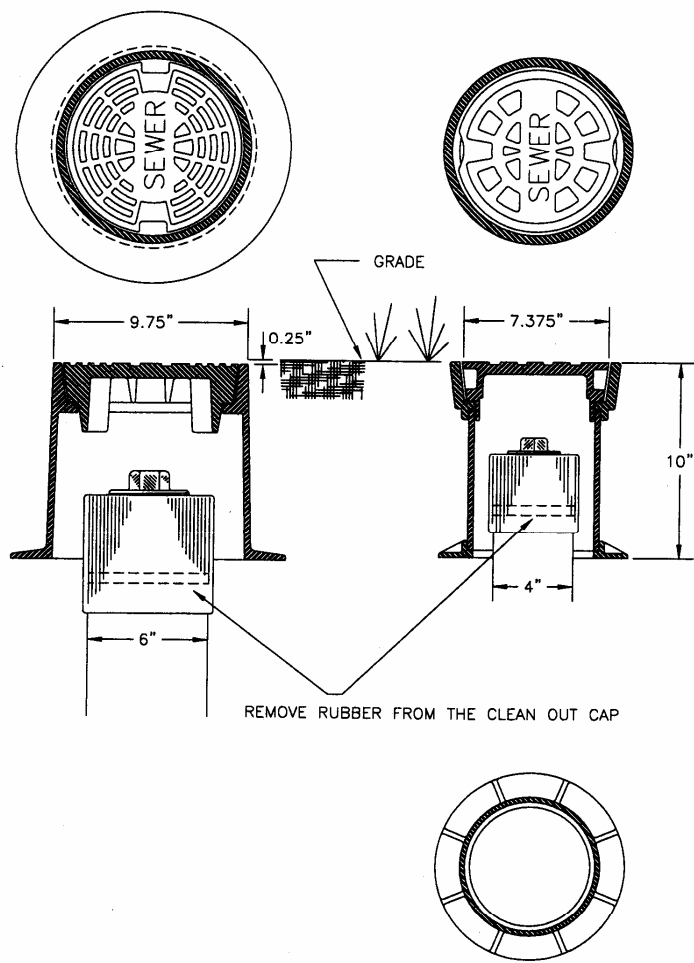


SVS_C02002

Sanitary Sewer Service Lateral

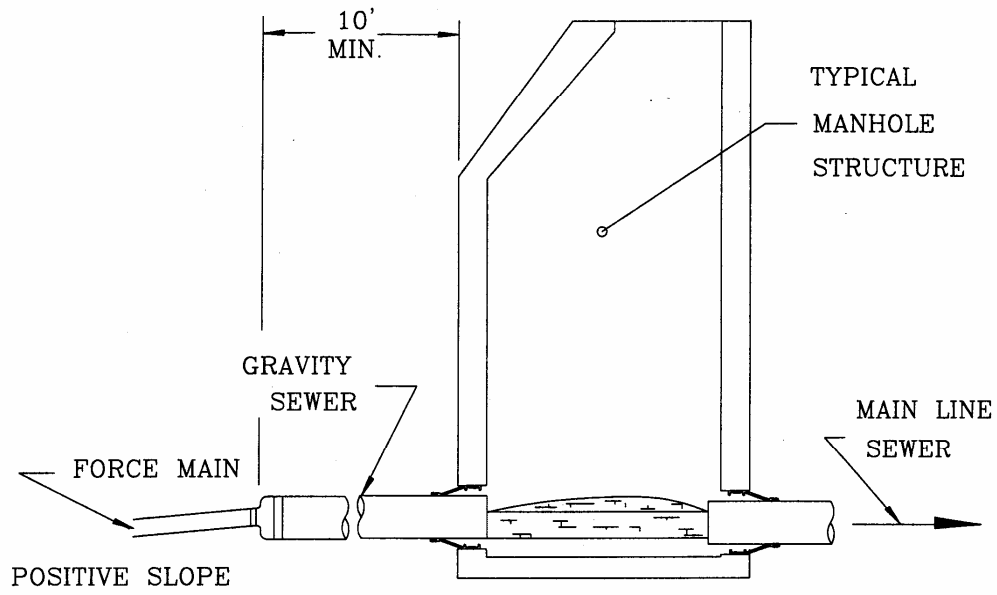
CLEANOUT COVERS

6" Diameter (Std.)



Sanitary Sewer

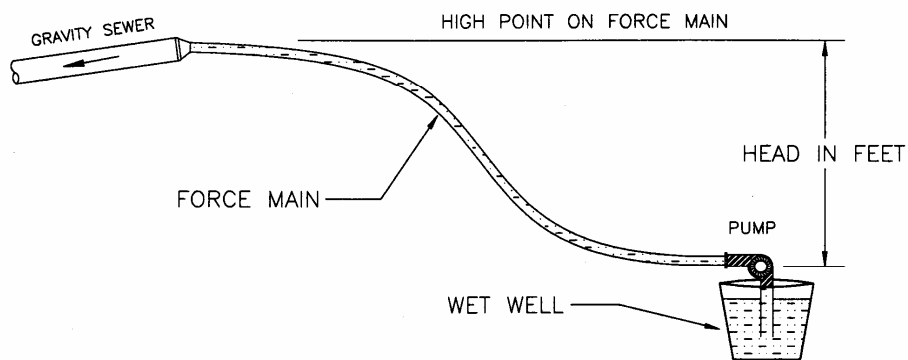
TYPICAL FORCE MAIN CONNECTION



Sanitary Sewer

FORCE MAIN TESTING

(PRESSURE TEST REQUIREMENTS)



$$\text{Pressure (PSI)} = \text{HEAD} \times 1.5 \text{ (Safety Factor)} / 2.31 \text{ feet per \#}$$

EXAMPLE:

Head = 80 FT

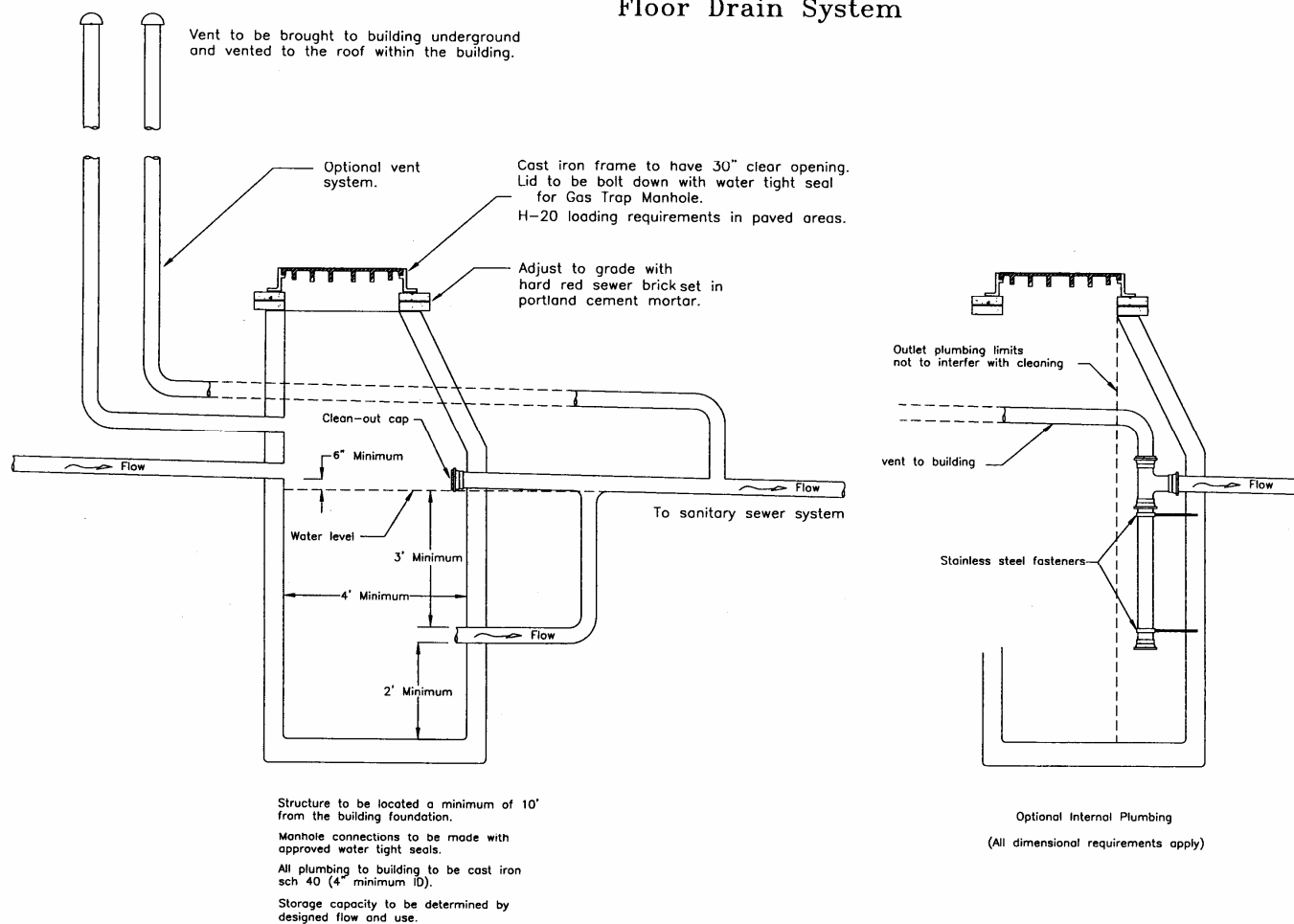
$$80 \text{ FT} \times 1.5 / 2.31 \text{ ft per \#} = 51.95 \text{ PSI}$$

Round up to nearest 10# = 60 PSI

Force Main Test Pressure to be 60 PSI

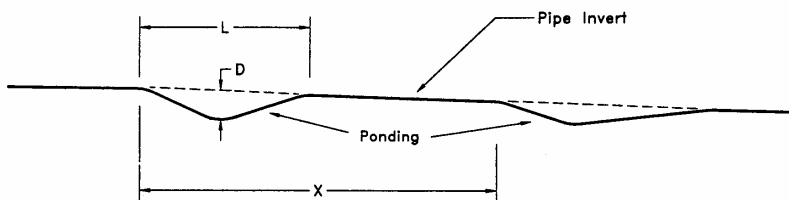
GREASE INTERCEPTOR STRUCTURE

for
Floor Drain System



LIMITS OF SAGS
IN PVC
SANITARY SEWER PIPE

Pipe Diameter	Maximum Allowable Depth (D) of Sag	Maximum Allowable Length (L) of Sag	Minimum Allowable Distance (X) between Sags
4"	NONE	NONE	NONE
6"	NONE	NONE	NONE
8"	1/2"	4 FT	40 FT
10"	1/2"	6 FT	60 FT
12" & Larger	1/2"	8 FT	80 FT



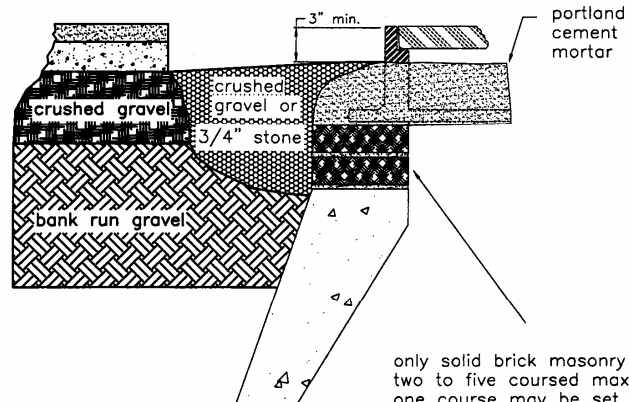
NOTE:

4" and 6" lines are typically used for service connections and are laid at a minimum of 1/4 inch and 1/8 inch per foot respectively to eliminate problems.

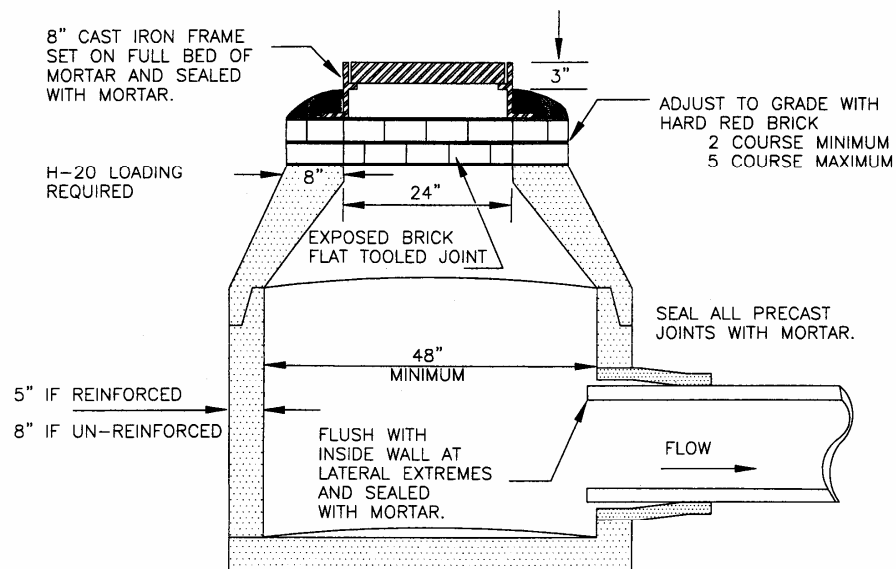
Catch Basins / Drop Inlets

ADJUSTING FRAMES TO GRADE

catch basins to be $1/4"$ below pavement
manholes to be $1/8"$ below pavement



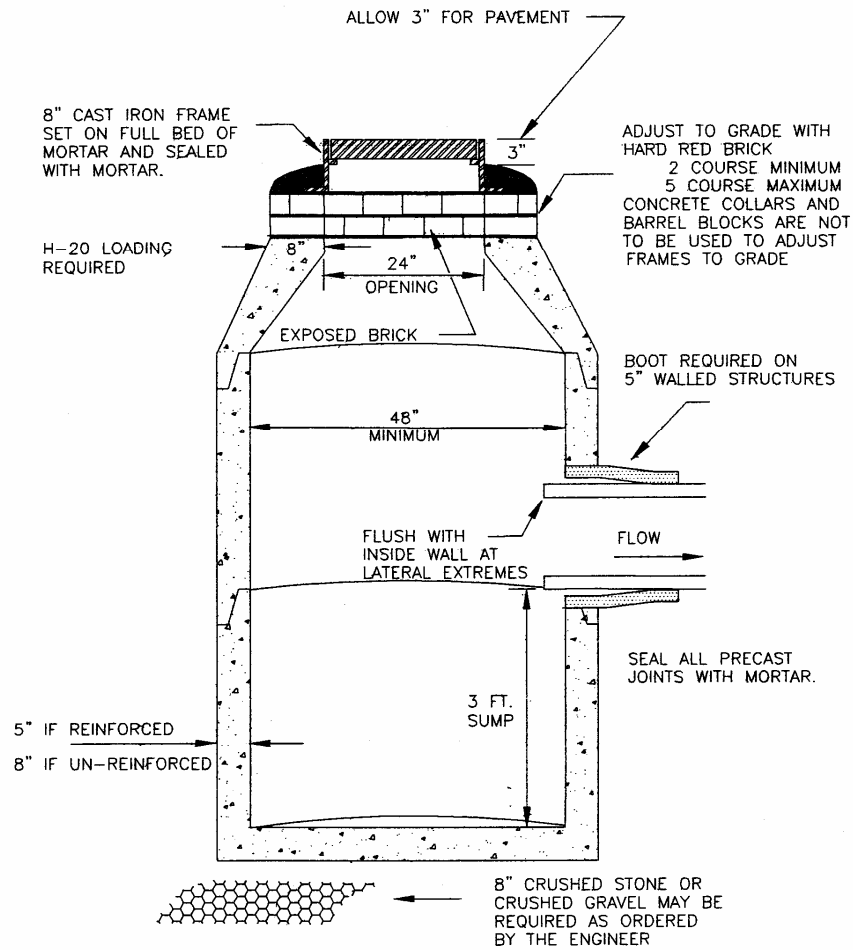
only solid brick masonry allowed.
two to five coursed maximum.
one course may be set on edge.
concrete collars and barrel
blocks are not to be used to
adjust frames to grade.



DROP INLET

02002

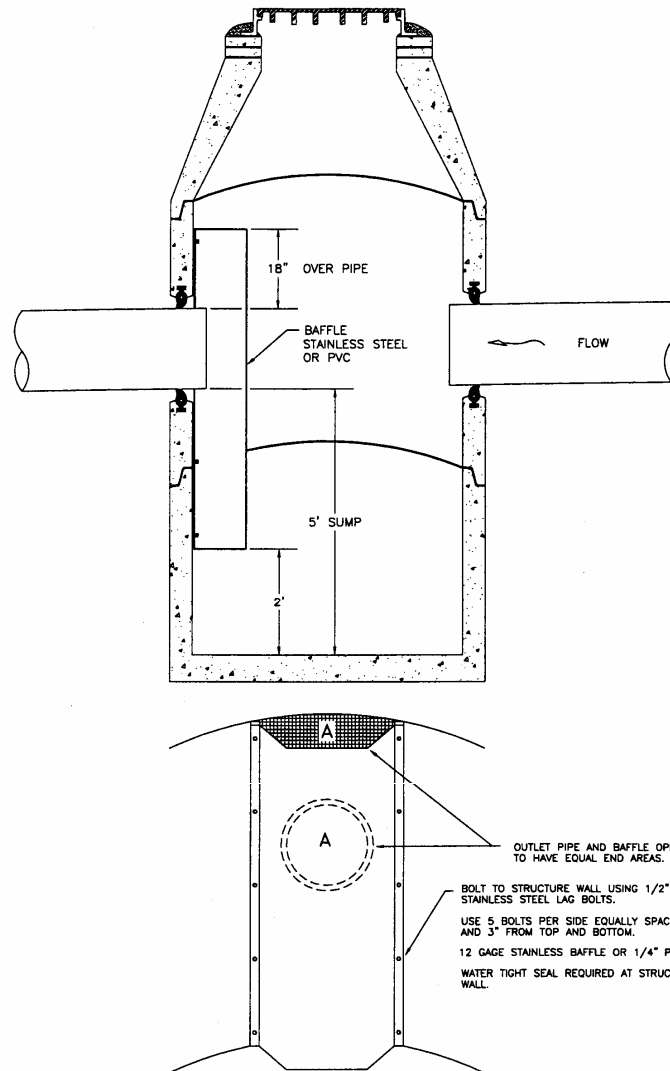
CATCH BASIN



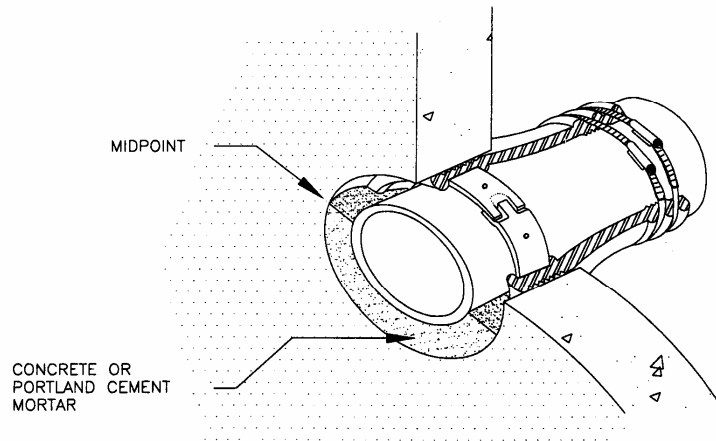
CB_ST02002

Storm Drainage

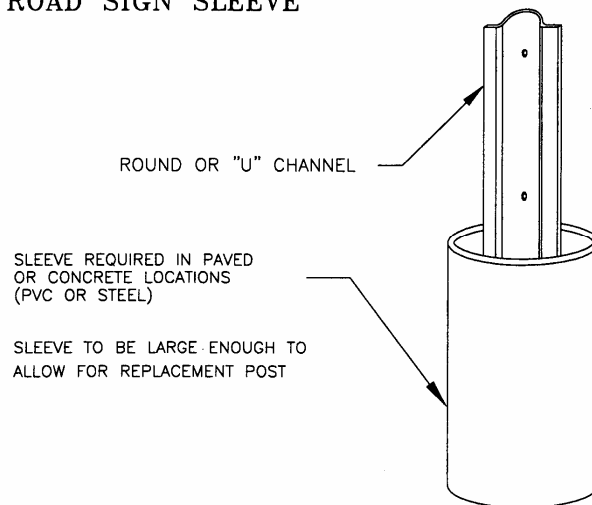
OIL & SEDIMENT CONTROL BARRIER (STORM DRAIN SYSTEMS)



**FLEXIBLE SEAL
PIPE TO STRUCTURE**
(STORM DRAIN ONLY)

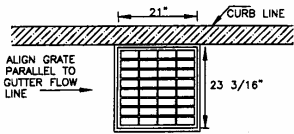


ROAD SIGN SLEEVE

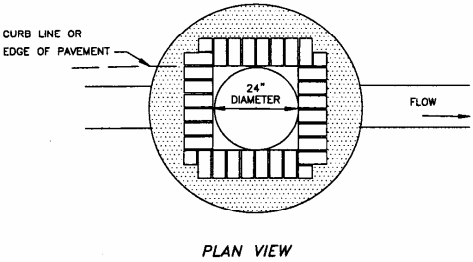


FRAME AND GRATE
CONFIGURATION

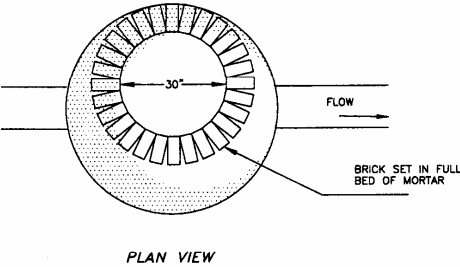
TYPE B ALTERNATE 1 FRAME & GRATE
3 FLANGED FOR CURB INSTALLATIONS



GRATE TO BE CAST IRON

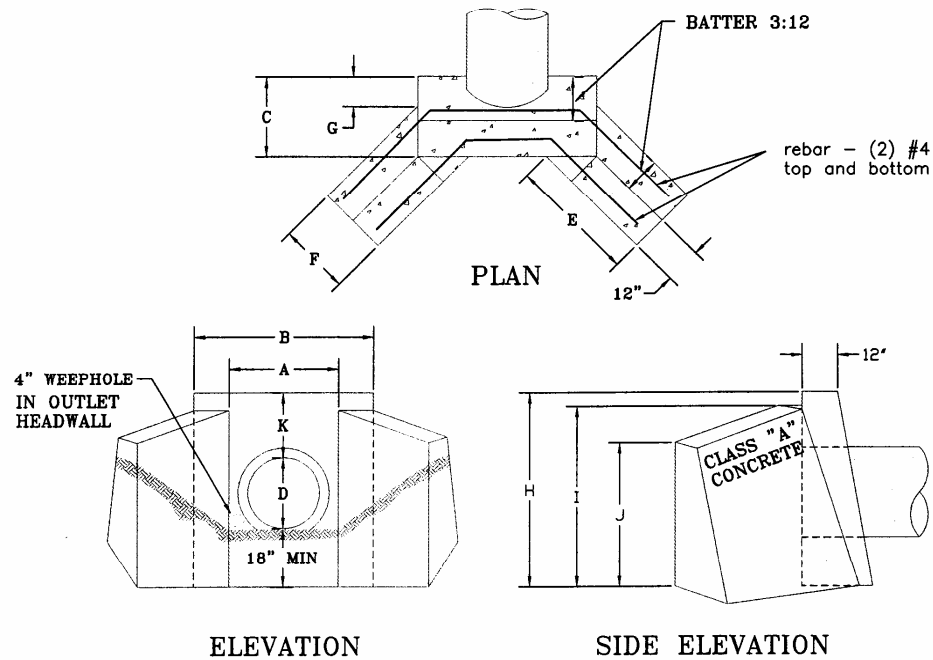


30 INCH COVER
BRICK WORK



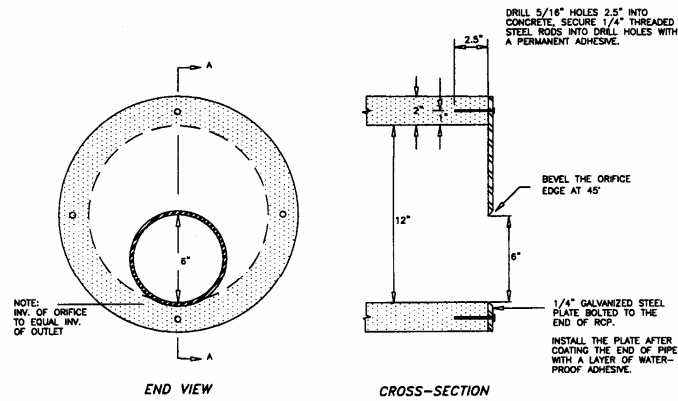
Storm Drainage

HEADWALL WITH 45 DEGREE WINGS



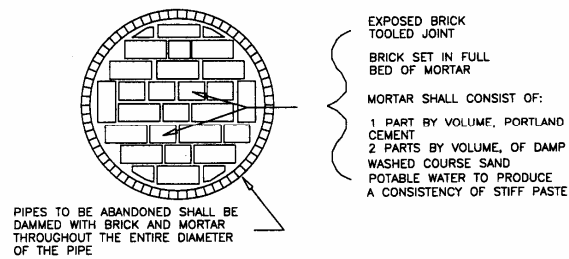
	A	B	C	E	F	G	H	I	J	K
12"	1'-6"	4'-0"	2'-0"	3'-0"	1'-9"	8"	4'-0"	3'-8"	2'-8"	1'-3"
15"	1'-9"	4'-4"	2'-1"	3'-2"	1'-10"	7"	4'-2"	3'-10"	3'-0"	1'-6"
18"	2'-0"	4'-10"	2'-2"	3'-4"	1'-11"	6"	4'-6"	4'-0"	3'-4"	1'-6"
24"	2'-6"	5'-4"	2'-3"	3'-6"	2'-0"	5"	5'-0"	4'-6"	3'-10"	1'-6"
30"	3'-1"	5'-11"	2'-4"	4'-0"	2'-1"	4"	5'-6"	5'-0"	4'-1"	1'-6"
36"	3'-8"	6'-6"	2'-6"	4'-6"	2'-3"	3"	6'-0"	5'-6"	4'-4"	1'-6"
42"	4'-3"	7'-1"	2'-8"	5'-2"	2'-4"	2"	6'-9"	6'-0"	4'-10"	1'-9"
48"	4'-10"	7'-8"	2'-9"	5'-10"	2'-5"	1"	7'-0"	6'-6"	5'-1"	1'-9"
54"	5'-5"	8'-3"	2'-11"	6'-6"	2'-6"	0"	7'-9"	7'-0"	5'-4"	1'-9"
60"	6'-0"	8'-10"	3'-1"	7'-4"	2'-8"	0"	8'-3"	7'-6"	5'-8"	1'-9"
66"	6'-7"	9'-5"	3'-2"	8'-2"	2'-9"	0"	8'-9"	8'-0"	5'-11"	1'-9"
72"	7'-2"	10'-0"	3'-4"	9'-0"	2'-10"	0"	9'-3"	8'-6"	6'-3"	1'-9"

DETENTION POND OUTLET ORIFICE



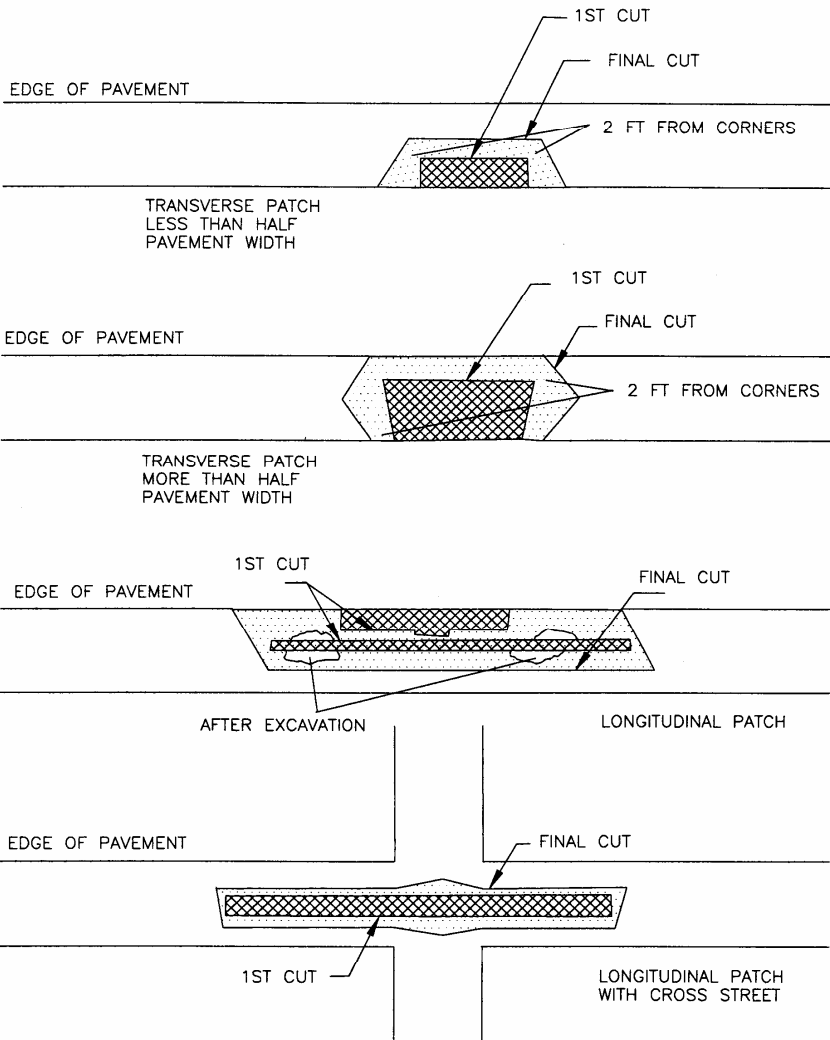
PIPE ABANDONMENT

DOUBLE BRICK WALL FOR PIPE DIAMETERS 24" AND GREATER



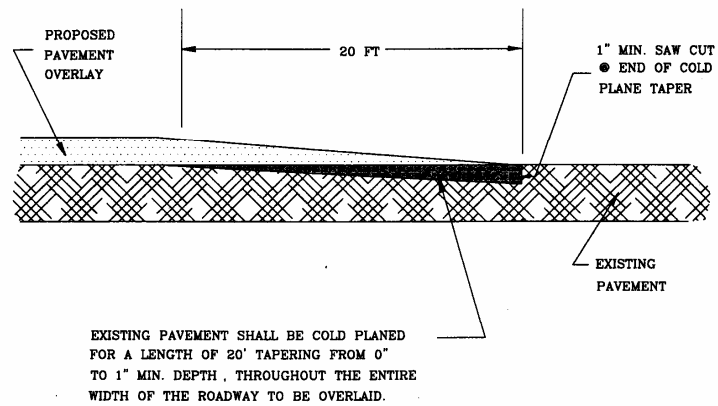
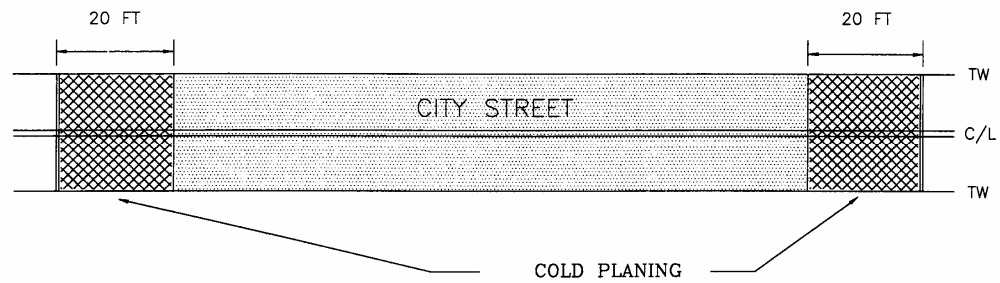
Pavement Patching

SAWCUT REQUIREMENTS



CAMBRIDGE

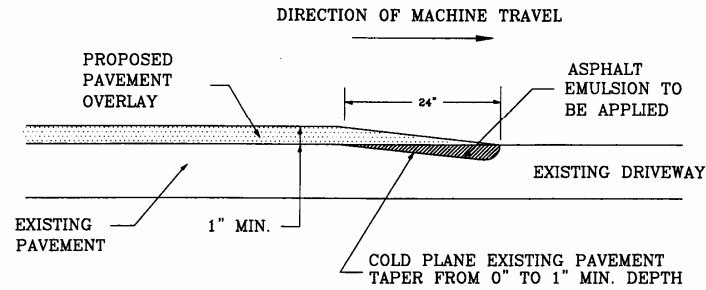
PAVEMENT OVERLAY



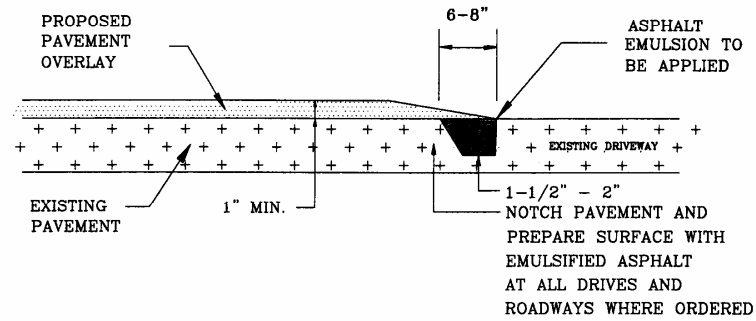
DETAIL OF END SECTION

caldelara2002

PAVEMENT JOINTS AT DRIVEWAYS



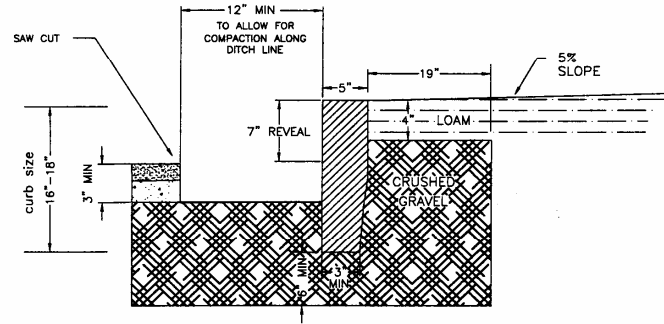
COLD PLANING METHOD



PAVEMENT BREAKER - KEY IN

Granite

CURB REQUIREMENTS

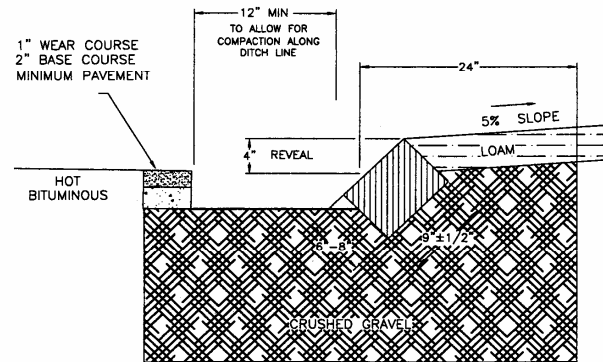


Radius	Max. length
21'	3'
22' - 28'	4'
29' - 35'	5'
36' - 42'	6'
43' - 49'	7'
50' - 56'	8'
57' - 60'	9'
over 60'	10'

VERTICAL GRANITE CURB

MIN. LENGTH OF CURB STONES 3FT.
MAX. LENGTH OF CURB STONES 10FT.
MAX. LENGTH OF STRAIGHT CURB STONES LAID ON CURVES SEE CHART

NOTE: ADJOINING STONES SHALL HAVE THE SAME OR APPROXIMATE LENGTH.



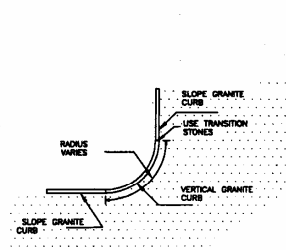
Radius for stones with square joints	Maximum length
16' - 28'	6" - 1'
29' - 41'	2'
42' - 55'	3'
56' - 68'	4'
69' - 82'	5'
83' - 96'	6'
97' - 110'	7'
over 110'	8'

SLOPE GRANITE CURB

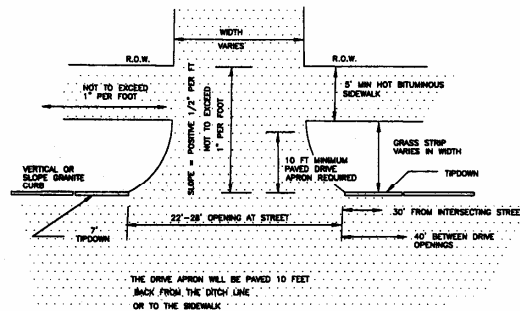
MIN. LENGTH OF STRAIGHT CURB STONES 18"
MAX. LENGTH OF STRAIGHT CURB STONES 8FT
MAX. LENGTH OF STRAIGHT CURB STONES LAID ON CURVES SEE CHART

**FINISH SURFACE AND TOLERANCES
FOR GRANITE CURBING**

TYPE	AREA	FINISH SURFACE	TOLERANCE, INCHES
VERTICAL GRANITE CURB	TOP	5 INCHES WIDE OR AS SHOWN OTHERWISE, SAWN TRUE PLANE. FRONT AND BACK ARRIS LINES PITCHED STRAIGHT AND PARALLEL.	+ 1/8 - 1/8
	FRONT FACE	RIGHT ANGLE TO TOP, APPROX. TRUE PLANE. NO DRILL HOLES SHOWING IN TOP 10 INCHES.	+ 1 - 1/2
	BACK FACE (exposed)	PLANE PARALLEL WITH FRONT FACE STRAIGHT SPLIT TO 1-1/2 INCHES BELOW THE EXPOSED SURFACE. NO LARGER THAN 1/4 INCH SEGMENT OF DRILL HOLES SHOWING IN ARRIS LINES.	+ 1 - 1
SLOPED GRANITE CURB	TOP (concealed)	BELOW 1-1/2 INCHES FROM EXPOSED SURFACE.	+ 1-1/2 - 1-1/2
	BOTTOM	APPROXIMATELY PARALLEL TO TOP. MINIMUM WIDTH: 3 INCHES.	SEE PLANS
	ENDS (exposed)	SQUARE WITH PLANES OF TOP AND FACE.	
	JOINTS (exposed) (concealed)	OPTIMUM WIDTH: 1 INCH TO BREAK BACK NO MORE THAN	+ 3/4 - 3/4
	LENGHTS OF STONES	3 FEET TO 10 FEET WITH 50% OF SECTIONS TO BE 5 FEET OR GREATER, OR AS INDICATED.	



**LOW DENSITY DISTRICT
CURB DETAIL AT
INTERSECTION**



DRIVEWAY & SIDEWALK DETAIL

**PROJECT NAME
NUMBER**

November 29, 2005

SPECIAL PROVISION**SECTION 608 – SIDEWALK****Item 608.54 – Detectable Warning Devices, Cast Iron**

This Special Provision provides for Item 608.54 and neither modifies nor amends any provisions of this section unless specifically noted.

Description

1.1 This work shall consist of furnishing and installing a detectable warning surface and accessories on sidewalk ramps at locations shown on the plans, as specified herein, or as ordered including any and all required surface preparation. Detectable warnings shall be installed at sidewalk ramps where a sidewalk crosses a vehicular way, excluding unsignalized driveway crossings. Detectable warnings shall measure 24 in (600 mm) in the direction of travel and extend the full width of the sidewalk ramp and the edge nearest the curbline shall be located 6 to 8 in (150 to 200 mm) from the face of curbline.

Materials**2.1 Detectable Warning Devices:**

2.1.1 Material. Detectable warning devices shall be gray cast iron conforming to AASHTO M105 and AASHTO M306 as manufactured by East Jordan Iron Works, Inc., 301 Spring Street, East Jordan, Michigan 49727, www.ejiw.com (Phone: (800) 626-4653), or Neenah Foundry Company, 2121 Brooks Avenue, Neenah, Wisconsin 54956 www.NFCO.com (Phone: (800) 558-5075) distributed in New Hampshire by Waste, Incorporated, Route 106, Concord, New Hampshire 03301 www.wasteinc.com (Phone: (603) 224-6596), or approved equal.

2.1.2 Color. Cast iron panels shall have no surface coating, and shall be allowed to transition to their natural patina.

2.1.3 Detectable Warning Panel Truncated Dome Geometry:

2.1.3.1 Detectable warning devices shall be in full compliance with ADAAG guidelines (Title 49 DFR Transportation, Part 37.9 Standard for Accessible Transportation Facilities, Appendix A, Section 4.29.2- Detectable Warning on Walking Surfaces).

2.1.3.2 Size and spacing for truncated domes shall be as follows: base diameter of nominal 0.9 in (23 mm), top diameter of nominal 0.4 in (10 mm), height of nominal 0.2 in (5 mm), with a center to center spacing of nominal 2.35 in (60 mm).

2.1.3.3 The truncated domes shall be arranged in a grid pattern and shall align properly from panel to panel.

Construction Requirements

3.1 The Contractor shall submit manufacturer's descriptive literature for materials specified in accordance with 105.02.

3.2 Transport, storage, and handling of products shall be in accordance with manufacturer's instructions.

3.3 Install detectable warning devices and any anchoring hardware in accordance with manufacturer's instructions. Panels shall be set into a bed of 4 in (100 mm) wet unreinforced concrete.

3.4 Use a combination of available panel widths as manufactured to cover the full sidewalk ramp width to the extent practicable. Field cutting of panels is not permitted.

3.5 Care shall be taken to ensure the safety of pedestrians when sidewalks must remain in service during construction.

Method of Measurement

4.1 Detectable Warning Devices will be measured by the square yard (square meter) to the nearest 0.1 of a square yard (square meter).

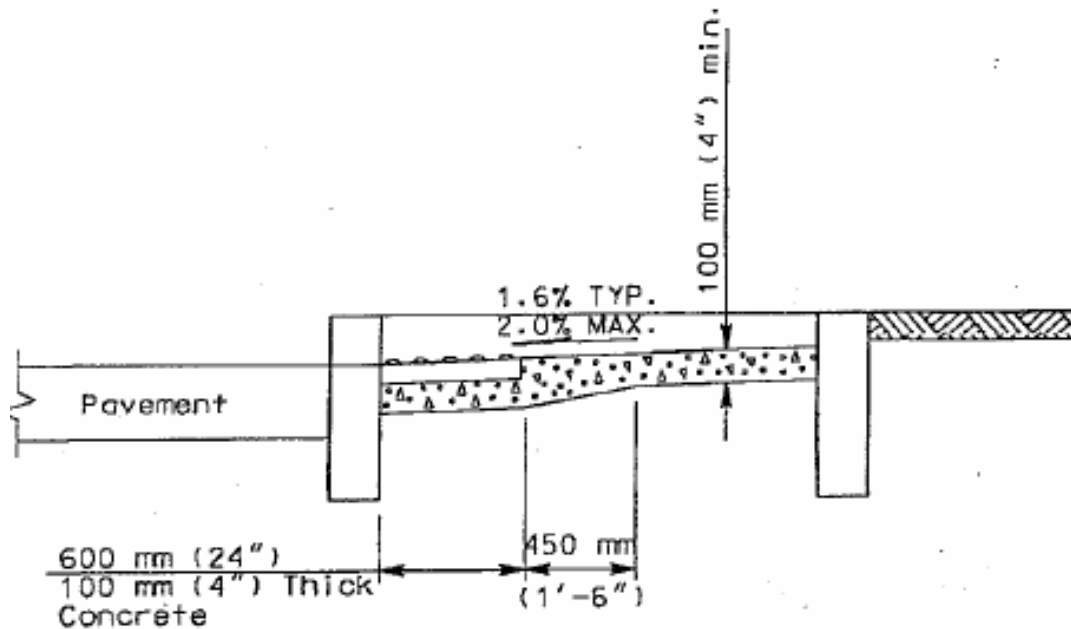
Basis of Payment

5.1 Detectable Warning Devices will be paid for at the contract unit price per square yard (square meter) complete in place including accessories, anchoring hardware and any required surface preparation.

Pay Item and Unit

608.54 Detectable Warning Devices, Cast Iron

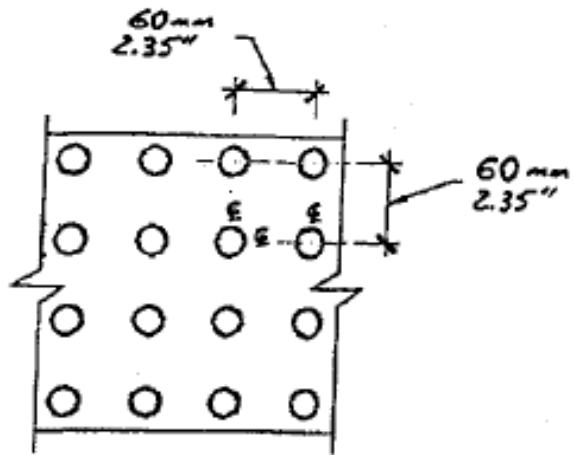
Square Yard (Square Meter)



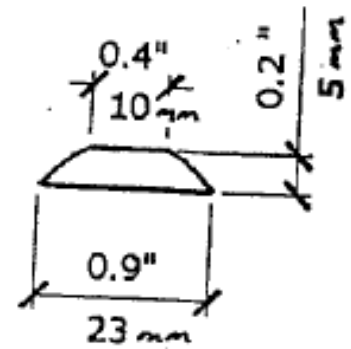
SECTION

GENERAL NOTES

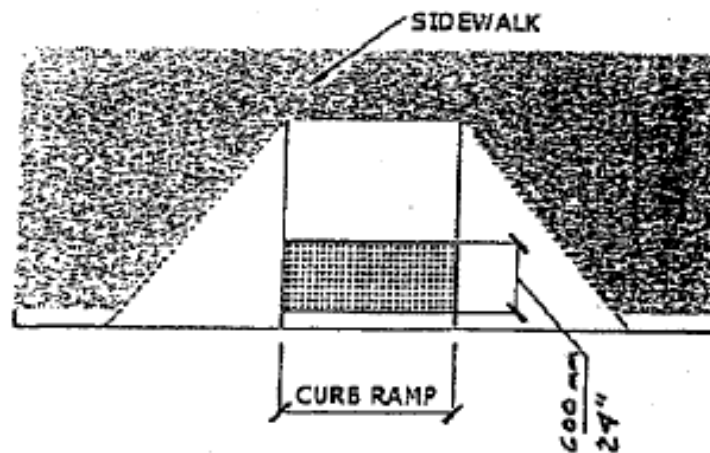
1. THE MAXIMUM RUNNING SLOPE OF ANY SIDEWALK CURB RAMP IS 12:1. THE MAXIMUM CROSS SLOPE IS 2%. THE SLOPE OF THE LANDING SHALL NOT EXCEED 2% IN ANY DIRECTION.
2. TRANSITIONS SHALL BE FLUSH AND FREE OF ABRUPT CHANGES. ROADWAY SHOULDER SLOPES ADJOINING SIDEWALK CURB RAMP SHALL BE A MAXIMUM OF 5% (FULL WIDTH) FOR A DISTANCE OF 600 mm (2 FT.) FROM THE ROADWAY CURBLINE.
3. INTERCEPT DRAINAGE ALONG THE CURB IN ADVANCE OF SIDEWALK CURB RAMP OR LANDINGS. CATCH BASINS, MANHOLES, ETC. SHALL NOT BE LOCATED IN, OR AT THE BASE OF, SIDEWALK CURB RAMP OR LANDINGS.
4. THE BOTTOM OF THE SIDEWALK CURB RAMP OR LANDING, EXCLUSIVE OF THE FLARED SIDES, SHALL BE WHOLLY CONTAINED WITHIN THE CROSSWALK MARKINGS.
5. THE SURFACE OF A PERPENDICULAR SIDEWALK CURB RAMP OR THE LANDING OF A PARALLEL SIDEWALK CURB RAMP SHALL CONTRAST VISUALLY WITH THE ADJOINING SIDEWALK SURFACE. EITHER ASPHALT/LIGHT-COLORED CONCRETE OR LIGHT-COLORED CONCRETE/DARK-STAINED CONCRETE. THE CONCRETE SURFACE SHALL BE SLIP RESISTANT.
6. INSTALL DETECTABLE WARNINGS (TRUNCATED DOMES) AT THE LOCATIONS SHOWN. DETECTABLE WARNINGS SHALL MEASURE 600 mm (24") IN THE DIRECTION OF TRAVEL AND EXTEND THE FULL WIDTH OF THE SIDEWALK RAMP, AND THE EDGE NEAREST THE CURBLINE SHALL BE LOCATED 150 mm TO 200 mm (6"-8") FROM THE FACE OF CURBLINE.



Dome Spacing



Dome Section



Illustrates 24" deep detectable warning located near the street edge of the curb ramp.

Transition Ramp with Detectable Warning