CORRESPONDENCE # H-3
SELECTMEN'S MEETING
11-14-19

ELIOT MUNICIPAL SEWER SYSTEM
ELIOT, MAINE

SEWER STANDARDS

Adopted Nov. 14, 2019

Richard Donhauser, Chairman

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John Murphy, Secretary

Philip Lytle, Selectman

Robert McPherson, Selectman

Select Board
Town of Eliot, Maine

Eliot Municipal Sewer System

Sewer Standards

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1. SEWER STANDARDS OBJECTIVES

The objectives of the sewer standards are as follows:

- Protect the health, safety and welfare of the public in dealing with wastewater management.

- Establish lines of communication between the Town of Eliot (TOE) Department of Public Works (DPW), Developers, and other stakeholders.

- Establish standards for sewerage facilities within the Town, including non-public sewers connected to the public system.

- Ensure that sewers that are proposed to be accepted by the TOE are designed and constructed to a standard acceptable to the TOE.

- Ensure that sewers which are not owned or maintained by the Town (portions beyond the public sewer main) but are connected to the Town sewer are constructed to a minimum standard to prevent adverse impacts to the TOE sewer system.

- The requirements of this standard does not supersede other requirements of the Town's Sewer Use Ordinance (SUO). In the case of conflicts between other sections of the SUO and this standard, the more stringent standard shall apply.

2. FEES

2.1 Plan Review Fee

*See the Town of Eliot Regulations for fee schedule.

Note: The Town may elect to have the project reviewed by an independent third party for conformance to these standards as well as any applicable local, state, or federal environmental guidelines at the expense of the Owner/Applicant. Fee will be project specific depending on the size and scope of the project and shall be the responsibility of the Owner/Applicant.

2.2 Construction Observation Fee

The Town may elect to require additional Construction Observation by an independent third party at the expense of the Owner/Applicant. Additional observation fees will be project specific depending on size and scope of the project. Generally the Town's Code Enforcement Officer (COE) will inspect internal building plumbing to 5' outside the building foundation. The Department of Public Works or their agent will observe installation of will observe installation of other sewers.

3. SUBMISSIONS

3.1 Design Review Submissions

3.1.1 Location Map

The project location map shall be drawn to a size adequate to show the relationship of the proposed project within the Town. The location map should include street names in the vicinity of the project and be drawn to scale.

3.1.2 Project Description and Sewer Allocation Request

A project description shall be provided identifying the number and type of units proposed to be connected to the Town's sewer. The Owner/Applicant shall complete a sewer allocation request in accordance with the process in the SUO.

3.1.3 Design Plans and Calculations

Design plans and calculations shall submitted to the Town for review consistent with the requirements of the *Building Sewer Connection Permit* process described in the SUO.

3.2 Construction Submissions/Requirements

3.2.1 Final Approved Plans

Two sets of the final approved plans shall be provided to the Town of Eliot.

3.2.2 Estimated Construction Costs

The applicant will be required to provide a construction cost estimate for all sewerage improvements for the purposes of determining the construction observation fee (see section 1.2). The construction cost estimate will be reviewed by the Town.

3.2.3 Permits

The applicant shall obtain all necessary permits prior to the work. Note that any excavation within roadway Right-Of-Ways (ROWs) require a Road Opening Permit from the Department of Public Works.

3.2.4 Qualified Contractor

The applicant shall identify the contractor that they propose for the work. The contractor shall be from the Town's qualified sewer contractor list. Contractors wishing to be listed on the Town's qualified sewer contactor list shall submit a qualifications package to the Superintendent for consideration that includes:

- List of equipment (including required health and safety)
- References from recently completed projects
- Experience

3.2.5 Pre-Construction Conference

A pre-construction conference shall be held prior to the construction of approved plans. The pre-construction conference will be coordinated by the TOE or its engineer. The pre-construction conference will outline the lines of communication throughout the construction of the sewerage facilities.

3.2.6 Construction Schedule

The applicant shall provide the TOE with an anticipated construction schedule for the construction of sewerage facilities prior to construction.

3.2.7 Shop Drawings

Detailed shop drawings, data and literature for fabricated materials or equipment incorporated in the work shall be submitted for review for general compliance with the Town's rules and regulations. At a minimum shop drawings for the following items shall be provided prior to construction.

- Sewer Manholes, frames and covers
- Sewer pipe (gravity sewer/force main/service laterals)
- Pipe boots
- Pipe fittings
- Pumping stations & controls (all components)

3.2.8 Notification

The Contractor shall notify the Town no less than forty eight (48) hours prior to the construction of sewerage facilities. Failure to do so may prevent Town representatives from inspecting the facilities and a Certificate of Occupancy may not be issued.

3.2.9 Testing

Testing for the following items is required and shall be witnessed by the Town (or its representative). Documentation of the testing is to be provided by the testing agency.

- Gravity sewer leakage, alignment, and deflection testing
- Force main pressure/leakage testing
- Manhole leakage testing
- Service lateral testing from road right of way to the structure may be required by the Town.
- All testing shall be witnessed by the Town (or its representative).
- Failure to appropriately schedule inspections or failure to provide required documentation may prevent a Certificate of Occupancy to be issued.

4. GENERAL CONDITIONS

4.1 Project Coordination

4.1.1 Responsibilities – Owner

The Owner shall require that their engineering consultant be responsible for the following:

- Preparation of complete construction drawings, details and specifications;
- The stakeout of the system and benchmarks for elevations (based on USGS MSL 1929 DATUM) before construction;
- Decisions relating to field changes and whether the design intent of the system is still being met

The owner should be aware that the costs incurred by the Town are directly related to the time it takes an engineer and contractor to design and construct the proposed system. To keep the Town's resultant charges to a minimum, the Owner should assure him/herself through appropriate inquiry that his/her engineer is registered in Maine. Additionally, his/her contractor shall be financially qualified to perform the work in a competent and timely manner. The design and construction shall conform to the Town's Rules and Regulations and the approved Drawings.

4.1.2 Responsibilities – Town of Eliot

The Town is responsible for the following:

- Conducting a pre-construction conference to establish the chain of command between the Owner and his/her engineering consultant, the Owner's Contractor, the Town and Town Representatives. However, the costs for these services shall be borne by the Owner (Section 2).
- Providing Construction Observation Services by the Town's Engineer or other representative to observe the sewer construction for conformance with the technical requirements of the Town's Sewer Standards (this document) as well as the approved plans. However, the costs for these services shall be borne by the Owner (Section 2).

The Town's field representative is not responsible for the Contractor's means, controls, techniques, sequences, procedures of construction, its jobsite safety programs or practices, including occupational health and safety, or failure to perform the work in accordance with the approved plans.

The Town's field representative is not at the site to assume the function(s) or responsibilities of the Owner or his consultants and shall not be responsible for making direct field decisions that affect the construction. The Town's field representative is there to observe the conformity of the construction with the technical requirements of the Town's Sewer Standards (this document) and the approved plans.

Should the Town's field representative observe faulty or non-specified materials being used in the work, or construction work which does not meet the requirements of the Town's Sewer Standards (this document) or the approved plans, the field representative will inform the Contractor's supervisor in writing that the work or materials do not comply and that the Town shall not permit the connection of the project into the public sewer. Copies of the memo shall be given to the Town for their file and for transmittal to the Owner and the Owner's Contractor. If the faulty materials are not replaced or the improper construction corrected, connection of the project into the public sewer shall not be permitted until the materials are replaced or the construction corrected.

4.2 Applicable Codes

The Owner shall comply with the current edition of all local, State, and national codes applicable to the proposed construction including but not limited to the following:

- Town of Eliot – Land Use Ordinance
- Maine Department of Transportation
- Maine Department of Environmental Protection
- OSHA – National Occupational Safety and Health Act.
- BOCA – Building Officials and Code Administrators – "Basic Building Codes"
- Associated General Contractors of America – "Manual of Accident Prevention in Construction"
- "Dig-Safe"
- National Electric Code
- Where a conflict exists between two different ordinances or codes having jurisdiction, the more stringent of the two shall apply.

5. CONNECTION TO SEWER

Prior to connecting to the sewer, the following shall be provided.

5.1 Service Lateral Tie Sheets

The Owner shall supply to the Town, accurate sewer service lateral tie sheets. The tie sheets shall include the following information and shall be provided on the tie sheet as provided in Appendix B of these standards. A tie sheet shall generally include the following information:

- Locations (horizontal and vertical) of all house service connections, encountered and/or newly installed and the location of capped or plugged ends of these same house service lines.
- Ties to permanent structures (a minimum of three ties shall be provided).
- Length and depth of the service lateral.
- Size and material of service lateral.
- Date of installation.

5.2 Testing Documentation

The Owner shall provide documentation of the following testing.

- Gravity sewer leakage, alignment, and deflection testing
- Force main pressure/leakage testing
- Manhole leakage testing
- Service lateral testing from road right of way to the main line

5.3 Easements

Sewer easements to be granted to the Town shall be recorded and a copy provided to the Town.

5.4 Application and Fees

Prior to individual sewer services connecting to the sewer, the applicant shall submit an application and pay the entrance, connection and inspection fees for the property (or lots) to be served prior to the TOE allowing connection to the sewer. The fees shall be determined by the Town.

5.5 Restrictions on Sewer Service Installation

No sewer service shall be installed between the dates of December 1st and April 1st unless authorized in writing by the Town.

6. ACCEPTANCE OF SEWER EXTENSION

No new private wastewater collection systems shall be constructed in Town. All new wastewater collection systems (which convey flow from more than 1 residence/building/unit) shall be constructed to the Town's specifications/requirements and shall become the property of the Town with all necessary easements upon completion and acceptance. Prior to the acceptance of the sewers by the Town, the following shall be provided:

6.1 Record Drawings

The Owner shall supply to the Town, accurate, reproducible (hard copy and electronic, i.e. PDF) record drawings of the completed construction. The Owner shall also provide an electronic copy of the drawings in AutoCAD (version to be specified at time of submittal). The record drawings should indicate any changes to the Drawings made during construction including the following:

- Record the location (horizontal and vertical) of sewers encountered or newly installed and the location of utilities within the excavation limits.
- Record the locations (horizontal and vertical) of all house service connections encountered and/or newly installed and the location of capped or plugged ends of these same house service lines.
- Record ties to service laterals. Ties shall be to permanent structures (minimum of three).
- Record length and depth of service lateral.
- Ledge encountered.
- Size and material description of al sewers installed (mains and laterals).
- Tie Sheets.

6.2 Television Inspection Report and Video

Television inspection shall be conducted one year following the completion of the sewer installation. Sewer lines shall be cleaned and flushed prior to television inspection. A written report shall be provided. Condition of the sewer shall be documented. A video shall be provided in DVD format with CCTV log in accordance with PACP standards. Documentation shall include the following:

- Length of sewer
- Sewer material and size
- Distance from manhole to manhole
- Distance from manhole to service lateral

All CCTV inspection work and repairs necessary as a result of the television inspection shall be conducted at no cost to the Town.

7. DESIGN CRITERIA

7.1 Related Documents

A. Guides for the Design of Wastewater Treatment Works, TR-16, New England Interstate Water Pollution Control Commission, 1998.

B. Gravity Sanitary Sewer Design and Construction, Water Environment Federation (WEF) – Manual of Practice – No. FD-5, latest edition.

7.2 Description of Work

A. Design of extensions to the Town of Eliot Municipal Sewer System shall generally follow the recommendations given in the above guidance documents unless otherwise required in this document.

B. These guidelines and specifications have been prepared to assist owners, their consulting engineers, and contractors to design and construct sewer system extensions, and sewer work on private sites that are acceptable to the Town.

C. These guidelines apply to most subdivision-type sewer extensions and site plans. If, in the opinion of the Town, the proposed project exceeds the scope of these guidelines, the Owner and the Owner's Engineer shall seek specific guidance from other sources.

7.3 Design Criteria

The Owner should refer to specific specifications within this document for further details regarding sewerage improvements. The following table is an overview of the general requirements of the Town.

DESIGN CRITERIA	
Design Flows	
Design Flow	Design flow shall be calculated at 120 gpd/residential unit (unless otherwise approved/required by the Town) plus 300 gpd/in-dia/mile of new sewer (infiltration). Peaking factors to be determined using TR-16, Figure 2-1. For average daily flows less than 0.1 mgd, the curve shall be extrapolated in a straight line.
Gravity Sewers	

DESIGN CRITERIA	
Allowable Manhole Spacing	300 feet – this distance may be reduced at the discretion of the Town depending upon the sewer location.
Gravity Sewer Material	SDR 35 PVC. Other materials may be accepted upon written request by the Owner if special field conditions warrant
Sizing	Pipe shall be 8" minimum diameter or sized as required to carry proposed design flows. Sewer service laterals shall be 6" diameter
Lateral Cleanouts	2-way lateral cleanouts shall be provided at the R.O.W. for each service lateral
Minimum Sewer Depth	6 feet in roadways, 4 feet in cross country locations
Separation from Public Water Supply Utility	10' (min.) horizontal, 18" (min.) below for conventional pipe materials (SDR 35 PVC). If separation must be reduced due to existing parameters, pressure pipe shall be used.
Slope Minimum	
Sewer Size	**Minimum Slope in Feet per Foot (m/m)***
Sewer Service Lateral (6")	0.02
8 inches (200 mm)	0.004
10 inches (250 mm)	0.0028
12 inches (300 mm)	0.0022
	*See TR-16 (latest edition) for pipe sizes exceeding 12" dia.
Pumping Stations	
Minimum Force Main Velocity	3 ft/s
Force Main Material	SDR 26 PVC minimum pressure rating
Force Main Bypass Manhole	All pumping stations shall include a force main bypass manhole located immediately outside the pumping station wetwell, equipped with fittings and appurtenances for connecting emergency bypass pumps to the force main.
Self Priming Pumping Stations	All pumping stations > 100 gpm shall be self-priming Gorman-Rupp above ground pumping systems, or approved equal. The pumps and controls shall be located in a building that is constructed of material consistent with the surrounding architecture.
Submersible Pumping Stations	All pumping stations < 100 gpm may be submersible pumping stations. All submersible pumping stations shall have a separate valve structure. All electrical controls shall be housed in a structure sufficient for an operator to enter and be out of the weather.
Flow Measurement	Pumping stations > 100 gpm shall utilize a magnetic flowmeter to

DESIGN CRITERIA	
	measure flow from the pumping station. Pumping stations < 100 gpm may utilize the level control system to measure flow from the pumping station.
Automatic Dialer/Modem	All pumping stations shall be equipped with an automatic dialer/modem to contact the responsible operator.
Back-up Alarm	All pumping stations shall be equipped with a battery backup high water alarm.
Vent	All pumping station wet wells shall be equipped with a vent to control odors.
Emergency Power	
Generators	All pumping stations shall be equipped with a standby generator. All pumping stations where the development is on municipal water shall be equipped with a standby generator. All pumping stations where the development is served by an on-site water source and the on-site water source is on standby generation shall be equipped with a standby generator. All generators shall be enclosed in a building constructed of material consistent with the surrounding architecture.
Operation & Maintenance	
Maintenance Contract	All pumping stations that are not taken over by the Town are required to have maintenance contracts. The maintenance contract shall be required as part of the Association Covenants and a copy of the maintenance agreement shall be provided annually to the Town.
Operation & Maintenance	All systems shall comply with Operation and Maintenance requirements set for by the Town's Sewer Ordinance

Note: Low pressure sewer systems are not permitted unless specifically authorized by the Town.

8. TRENCH EXCAVATION – EARTH

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Trench excavation work in earth includes the removal of sand, gravel, existing utilities, ashes, loam, clay, swamp muck, trolley tracks, soft or disintegrated rock or hard pan which can be removed with a backhoe, or a combination of such materials, and boulders measuring less than two cubic yards for the installation of pipes and appurtenant structures.

2. All trench excavation shall be classed as earth or ledge.

PART 2 - PRODUCTS

A. Unsuitable Material:

1. Unsuitable material encountered above the indicated grade shall be removed and replaced with material as specified in Section 10 of these standards.

2. Unsuitable material encountered below the indicated invert grade shall be removed and replaced with thoroughly compacted bank-run gravel and screened gravel or crushed stone bedding material as specified in Section 10 of these standards.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. General:

1. Unless otherwise specifically directed or permitted by the Engineer, begin excavation at the low end sewer lines and proceed upgrade.

2. Perform excavation for force mains and water mains in a logical sequence.

B. Amount of Excavation:

1. Trench width: See Sewer Standard Details in Appendix C.

2. Trench depth: As See Sewer Standard Details in Appendix C.

3. Unauthorized Excavation:

a. Backfill to the specified grade, any excavation beyond the limits stated above (unless specifically ordered otherwise by the Engineer) with thoroughly compacted crushed stone or screened gravel.

C. Shoring and Bracing:

As the excavation progresses, install such shoring and bracing necessary to prevent caving and sliding and to meet the requirements of the State and OSHA safety standards.

D. Dewatering:

The Contractor shall obtain all necessary Town, State and Federal permits associated with excavation dewatering. All required treatment of dewatering water prior to disposal shall be the responsibility of the Contractor. Under no circumstances shall dewatering water be discharged to the sanitary sewer.

9. TRENCH EXCAVATION – LEDGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Trench excavation work in ledge includes the removal of ledge and rock required for the installation of pipes and/or structures.

2. "Ledge" and "rock" includes any natural compound, natural mixture, and chemical element required to be excavated that, in the opinion of the Town, can be removed from its existing position and state only by blasting, drilling and blasting, wedging, drilling and wedging, wedging and breaking with power hand tools, or by extending the use of an approved excavating machine beyond normal and design wear and tear. No boulder, ledge, slab, or other single piece of excavated material less than two cubic yards in total volume shall be considered to be rock unless, in the opinion of the Town, it must be removed from its existing position by one of the methods mentioned above.

3. All trench excavation shall be classed as earth or ledge.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PERFORMANCE

A. General:

1. Unless otherwise specifically directed or permitted by the Town, begin excavation at the low end of sewer lines and proceed upgrade.

2. Perform excavation for force mains and/or water mains in a logical sequence.

B. Amount of Excavation:

1. Trench width: See Sewer Standard Details in Appendix C.

2. Trench depth: See Sewer Standard Details in Appendix C.

3. Unauthorized Excavation:

a. Backfill to the specified grade, any excavation beyond the limits stated above (unless specifically ordered otherwise by the Town) with thoroughly compacted crushed stone or screened gravel.

C. Shoring and Bracing:

As the excavation progresses, install such shoring and bracing necessary to prevent caving and sliding and to meet the requirements of the State and OSHA safety standards.

D. Dewatering:

The Contractor shall obtain all necessary Town, State and Federal permits associated with excavation dewatering. All required treatment of dewatering water prior to disposal shall be the responsibility of the Contractor. Under no circumstances shall dewatering water be discharged to the sanitary sewer.

10. BORROW, BEDDING AND BASE COURSE MATERIAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Provide, place and compact borrow and bedding material in authorized excavation(s) below normal depth and in other locations(s) as shown on the Drawings and/or as directed by the Town and/or as specified herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gravel Borrow:

1. Well graded granular material suitable for placement in authorized excavations below the bottom of the bedding layer to replace deficient excavated material, for road construction, pipeline construction, and other designate uses.

B. Screened Gravel or Crushed Stone (Bedding Material):

1. Screened gravel or crushed stone shall be well graded in size from 1/4 inch to 3/4 inch and conform to ASTM C33 stone size No. 67.

2. Clean, hard, and durable particles or fragments.

3. Sieve Analysis:

Sieve Designation	% Passing by Weight Square Opening
1"	100
3/4"	90-100
3/8"	20- 55
No. 4	0- 10
No. 8	0- 5
No. 200	1% Max.

C. Special Well Graded Bank-Run Sand and Gravel Sub-Bedding (filter) Material:

1. Well graded granular bank-run sand and gravel material for use below the bedding material as a filter and for stabilization.

2. Sieve Analysis:

Sieve Designation	% Passing by Weight Square Opening
3"	100
No. 4	50-100
No. 20	10- 60
No. 100	0- 10
No. 200	0- 5

D. Sand: (Sand Blanket Bedding)

1. Clean, hard and durable particles or fragments.

2. Sieve Analysis:

Sieve Designation	% Passing by Weight Square Opening
3/8"	100
No. 4	95-100
No. 16	50- 85
No. 50	10- 30
No. 100	2- 10

E. Common Borrow:

1. Consist of earth suitable for embankment construction; free from frozen material, perishable rubbish, peat and other unsuitable material.

2. The moisture content shall be sufficient to provide the required compaction and stable embankment. In no case shall the moisture content exceed 4 percent above optimum.

3. The optimum moisture content shall be determined in accordance with AASHTO T 180, Method C or D.

F. Crushed Gravel Material (Crushed Gravel Base Course):

1. Well graded granular crushed gravel material for use as a crushed gravel base. At least 50% of material retained on the 1 inch sieve shall have a fractured face.

2. Sieve Analysis:

Sieve Designation	% Passing by Weight Square Opening
3 inches	100
2 inches	95-100
1 inch	55-85
No. 4	27-52
No. 200	0-12 (of the sand portion)

G. Bank Run Gravel (Gravel subbase course):

1. Crushed ledge or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. At least 50 percent by weight of the material coarser than the No. 4 sieve shall have at least one fractured face as tested by AASHTO T 335.

2. Sieve Analysis:

Sieve Designation	% Passing by Weight Square Opening
4 inches	100
3 inches	90-100
2 inches	75-100
1 inch	50-80
1/2 inch	30-60
No. 4	15-40
No. 200	0-6.0

PART 3 – EXECUTION

3.1 INSTALLATION

A. Place screened gravel, crushed rock, crushed stone, gravel borrow or sand in layers of uniform thickness not greater than 6 inches.

B. Thoroughly compact each layer by means of a suitable vibrator or mechanical tamper.

11. BACKFILLING, COMPACTION, CONTROL & TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Backfilling work includes backfilling trenches and/or excavation around structures with suitable material removed in the course of excavating and other suitable material.

1.2 QUALITY ASSURANCE

A. Where backfill is required and/or where shown on the Drawings, compact fill to an in place density not less than 95 percent of the maximum density of the material in accordance with ASTM D1557 Method "B". Proctor tests will be required where the backfill material has changed or is substantially different from existing adjoining material.

B. Determine in place density in accordance with ASTM D1556 or by other methods as approved by the Town.

C. Have density testing performed by an independent soils laboratory as approved by the Engineer.

D. Locations of tests (when applicable):

1. Average of one test between each manhole for interceptor sewer and trunk lines.

2. Average of two tests between each manhole for sewer laterals.

3. Average of one test on each side of each structure.

5. Average of two tests for each slab on grade.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Excavated Material:

1. Free from large clods of earth.

2. Free from stones and rock fragments over 50 lbs.

B. Frozen Material:

1. Do not backfill with, or on, frozen materials.

2. Remove, or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.

C. Wet Material:

1. Do not mechanically or hand compact material that is, in the opinion of the Town, too wet.

2. Do not continue backfilling until the previously placed and new materials have dried sufficiently to permit proper compaction.

D. Gravel Borrow:

1. When original excavated material is, in the opinion of the Town, unsuitable, use only approved gravel borrow for backfilling.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. General:

1. Provide and place all necessary backfill material.

2. Do not allow large masses of backfill to be dropped into the excavation, as from a grab bucket, in such a manner that may endanger pipes and structures.

3. Place material in a manner that will prevent stones and lumps from becoming nested.

4. Completely fill all voids between stones with fine material.

5. Do not place backfill on or against new concrete until it has attained sufficient strength to support loads without distortion, cracking, and other damage.

6. Deposit backfill material evenly on all sides of structures to avoid unequal soil pressures.

B. Sheeting:

1. Leave sheeting in place when damage is likely to result from its withdrawal.

2. Completely fill with suitable material and thoroughly compact all voids left by the removal of sheeting.

C. Backfilling in Paved Areas:

1. Backfill trenches in streets and other paved areas by moistening and compacting each layer to a density at least equal to that of the adjoining original material.

2. Backfill in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value for paving immediately after backfilling is completed.

3. Where required, place excavated material, that is acceptable to the Engineer for surfacing or pavement subbase, at the top of the backfill to the depths as needed to adequately support pavement.

D. Backfilling Trenches in Nonpaved Areas:

1. Grade the ground to a reasonable uniformity.

2. Leave the mounding over the trenches in a uniform and neat condition, satisfactory to the Town.

E. Bedding & Backfilling of Pipelines:

1. Install pipe bedding and cushion and primary backfill in accordance with the Borrow and Bedding Section in these Specifications.

2. Deposit and thoroughly compact the remainder of the backfill in 12 inch layers.

F. Placing and Compacting Backfill:

1. Tamping:

a. Deposit and spread the backfill material in uniform parallel layers not exceeding 8 inches thick.

b. Tamp each layer as required to obtain a thoroughly compacted mass.

c. If necessary, furnish and use an adequate number of power driven tampers, each weighing at least 20 lbs.

2. Rolling:

a. Compact material by rolling only when the width and depth of the excavation are sufficient to accommodate the rollers, dozers, mechanical tampers, or other similar powered equipment, as may prove to be acceptable, and when it can be performed without causing damage to pipes installed in the excavation.

b. Deposit and spread the backfill material in uniform parallel layers not exceeding 8 inches thick.

c. Roll each layer as required to obtain a thoroughly compacted mass.

3. The following methods of placing and compacting backfill will not be permitted:

a. Jetting

b. Puddling

G. Improper Backfill

1. When, in the opinion of the Town, excavation and trenches have been improperly backfilled, and when settlement occurs, reopen the excavation to the depth required, as directed by the Town.

2. Refill and compact the excavation or trench with suitable material and restore the surface to the required grade and condition.

12. MANHOLES, COVERS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install manholes, cast iron frames and covers.

1.2 QUALITY ASSURANCE

A. Construct all manholes of a quality to withstand loads of 8 tons (H-20 loading) without failure for a period of time in excess of 25 years.

B. Construct all manholes of a quality to prevent leakage in excess of 1 gallon per day per vertical foot of manhole.

C. Construct all manholes throughout the entire project from the same materials.

D. All castings shall be at least Class 30 conforming to ASTM Standard Specifications for Gray Iron Casting, Designation A40.

E. All essential details of design shall be as shown in the standard detail in Appendix C.

F. Frames and covers shall be Maine Standard.

G. Masonry: See specification Section MDOT Standard Specification 604.

H. Waterproofing:

1. Acceptable Manufacturers:

a. Submit to the Town for approval.

1.3 SUBMITTALS TO THE TOWN

B. A description of all methods of jointing.

C. All Certificates of Compliance.

D. Provide Fabrication Schedule that shows:

a. Orientation and elevation of opening.

b. Section dimensions and assembly order.

PART 2 - PRODUCTS

2.1 PRECAST MANHOLE SECTIONS

A General

1. Risers and tops shall be precast reinforced or non-reinforced concrete, or cast-in-place reinforced or non-reinforced concrete.

2. Manhole bases shall be monolithic to a point 6 inches above the crown of the incoming pipe and shall be constructed of reinforced or non-reinforced concrete.

3. Use concrete that conforms to the requirements in Section 604 of the M.D.O.T. Standard Specifications for manhole bases and cast-in-place manholes.

4. Use reinforcing steel for cast-in-place concrete that conforms to the requirements of the M.D.O.T. Standard Specifications.

5. Construct pipe to manhole joints that are approved by the Maine Department of Environmental Protection. In general, use approved non-shrinking mortar or elastomeric or mastic like sealants to unsure these joints are watertight.

6. Do not install manhole steps.

7. All sewer manhole covers shall be 24 inches in diameter (clear opening) unless shown otherwise on the Drawings and have the letter "S" or the word "SEWER" in 3-inch letters cast into the top surface.

8. All castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended.

9. Contact surfaces of covers and frame seats shall be machined at the foundry before shipment to prevent rocking of covers in any orientation.

10. All castings shall be thoroughly cleaned and subject to a careful hammer inspection.

11. Prior to being shipped from the foundry, castings shall be sandblasted.

12. Repair all coatings that have been damaged in transit or handling to the satisfaction of the Town.

B. Openings:

1. Provide openings in the risers to receive pipes entering the manhole.

2. Make openings at the manufacturing plant.

3. Size: To provide a uniform annular space between the outside wall of pipe and riser.

4. Location: To permit setting of the entering pipes at the correct elevations.

5. Openings shall have a flexible watertight union between pipe and the manhole base.

    a. Cast into the manhole base and sized to the type of pipe being used.

    b. Type of flexible joint being used shall be approved by the Town. Install materials according to the Manufacturer's instructions.

        1. Lock Joint Flexible Manhole Sleeve made by Interpace Corporation.

        2. Kor N Seal made by National Pollution Control System, Inc.

        3. Link Seal by Thunderline Corporation (Wayne, MI).

        4. Approved Equal.

C. Joints:

1. Joint gaskets to be flexible self-seating butyl rubber joint sealant installed according to manufacturer's recommendations. For cold weather applications, use adhesive with joint sealant as recommended by manufacturer.

    Acceptable Materials:

    a. Kent-Seal No. 2

    b. Ram-Nek

    c. Or equivalent.

2. Joints between precast sections shall conform to related standards and manufacturer's instructions.

3. All manholes greater than 6 ft. diameter and all manholes used as wet wells, valve pits and other dry-pit type structures shall be installed with exterior joint

collars. The joint collar shall be installed according to the manufacturer's instructions. Acceptable materials:

a. MacWrap exterior joint sealer as manufactured by Mar-Mac Manufacturing Company.

b. Or equivalent.

D. Waterproofing:

1. The exterior surface of all manholes shall be given two coats of bituminous waterproofing material.

2. The coating shall be applied after the manholes have cured adequately and can be applied by brush or spray in accordance with the manufacturer's written instruction.

3. Sufficient time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.

2.2 FRAMES AND COVERS

A. Standard Units:

1. Shall be "Maine Standard". Acceptable alternative includes PAMREX 24" Manhole frame and cover for H20 wheel loading by Certainteed.

2. Made of cast iron conforming to ASTM A48-76, Class 30 minimum.

3. Have machined bearing surfaces to prevent rocking.

4. Castings shall be smooth with no sharp edges.

5. Constructed to support an HS-20 wheel loading.

6. Dimensions and Style shall conform to the Drawings; Standard castings differing in non-essential details are subject to approval by the Town:

a. Covers - solid 3-inch letters diamond pattern.

b. Frame - 24-inch diameter clear opening, with flange bracing ribs.

7 Minimum weight of frame and cover shall be 325 lbs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manhole Bases:

1. Place bases on a 6-inch layer of compacted bedding consisting of crushed stone and/or natural stone graded to the following specifications:

Sieve Designation	% Passing by Weight Square Opening
1"	100
3/4"	90-100
3/8"	20-55
No. 4	0-10
No. 8	0- 5

2. Properly dewater the excavation while placing the bedding material and placing the structure or concrete.

3. Use waterstops at the horizontal joint of cast-in-place manholes.

B. Construct inlet and outlet stubs as shown in the standard details in Appendix C.

C. Invert Channels:

1. Construct smooth and semicircular in shape conforming to the inside of the adjacent sewer section.

2. Make changes in direction of flow with smooth curves having a radius as large as permitted by the size of the manhole.

3. Stop the pipes at the inside face of the manhole where changes of direction occur.

4. Form invert channels as shown in the standard details in Appendix C.

5. Slope the floor of the manhole outside the flow channel as shown in the standard details in Appendix C.

D. Precast Risers and Tops:

1. Use the appropriate combinations of risers and top lengths.

2. Seal joints with an approved type mastic.

3. Test the manhole as soon as practical after installation.

4. Perform jointing in accordance with the manufacturer's recommendations and as approved by the Town.

5. Install risers and tops level and plumb.

6. Do not permit water to rise over newly made joints until after inspection by the Town.

7. Make all joints watertight.

8. Solidly fill annular spaces around pipes entering the manholes with non-shrink mortar.

9. When necessary, core openings carefully to prevent damage to risers and tops.

10. Cutting opening shall not be allowed without the expressed written permission of the Town.

E. Cast-In-Place Manholes:

1. Place a special plastic waterstop in the joint between the base and the sides of all manholes.

2. Obtain the Town's approval of the type of waterstop and the installation.

3. Cast all pipes entering the manholes in accordance with pipe manufacture recommendations.

F. Drop Manholes:

1. No free drop shall be permitted at the pipe inlet.

2. Where the vertical distance between inlet and outlet pipe inverts exceeds 24 inches, construct a drop manhole as shown in the standard details in Appendix C.

G. Adjustment to Grade: If necessary, adjust tops of manholes to grade, a maximum of 12 inches, with brick masonry.

H. Set manhole frames with the tops conforming accurately to the grade of the pavement or finished ground surface.

I. Set frames concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange at the frame shall be completely filled and made watertight.

J. Place a thick ring of mortar extending to the outer edge of the masonry all around and on the top of the bottom flange.

K. Finish the mortar so that it will be smooth and have a slight slope to shed water away from the frame.

L. When the work on each manhole is complete, clean the frame seat and set the cover in place.

3.2 LEAKAGE TESTS

A. General:

1. Perform vacuum tests on all manholes.

2. Exfiltration tests on manholes shall be performed in case of vacuum test failure or may be submitted as a substitution with approval by the Town.

4. The Town or the Town's field representative shall observe tests.

5. Repairs to manholes found to leak by any test method shall be performed both inside and outside the structure by a method approved by the Town.

B. Preparation:

1. After manholes have been assembled in place, fill and point all lifting holes.

2. If the manhole is to be backfilled before testing, fill those exterior joints within 6 feet of the ground surface with an approved non-shrink mortar.

3. Test all manholes with pipes and or stubs installed. Testing with through pipes to be removed and replaces is not acceptable.

4. Manholes in which the pipe to manhole connection is disassembled after testing shall be retested at the Contractors expense.

5. Make the tests prior to placing the shelves and inverts and before filling and pointing the horizontal joints below the 6-foot depth line.

6. Suitably plug all pipes and other openings into the manholes.

C. Test Procedure: Vacuum

1. Use only an approved testing machine.

   a. National Pollution Control, Inc.

   b. Or equal.

2. Securely brace all plugs.

3. Check cone section to insure good seal with Test Machine Bladder.

4. Bring test vacuum to 10 in. Hg gauge.

   a. Time:

      Manholes 0'-10' - 2 minutes

      Manholes 10'-15'- 2.5 minutes

      Manholes 15'-25'- 3 minutes

   b. Allowable leakage is 1" Hg or less per times given.

   c. If pressure drop exceeds 1" Hg in the required time, the manhole shall be repaired and retested.

   d. If the manhole fails after being repaired, the manhole shall be "Water Exfiltration Tested" according to the criteria of the specification.

5. When a leak is identified, repair the area from both inside and out by a method approved by the Town. Methods to be considered include parging with hydraulic cement and pressure application of polyurethane grout.

D. Backfilling:

1. Manhole testing may be conducted either before or after backfilling around the manhole. However, if the Contractor elects to backfill prior to testing, for any reason, it shall be at Contractor's own risk and it shall be incumbent upon the Contractor to determine the reason for any failure of the test.

2. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It shall be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete.

3. If the manhole test fails, lower the water table and carry out the exfiltration test specified above.

E. Accident Prevention: Following the satisfactory completion of the leakage test, place the frame and cover on the top, or provide other means of preventing accidental entry by unauthorized persons, children, animals, etc., until ready to make final adjustment to grade.

13. PIPE & PIPE FITTINGS – GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, install, support and test pipe and pipe fittings.

1.2 SUBMITTALS

A. Submit shop drawings.

B. Submit manufacturer's "Certification of Conformance" that pipe and pipe fittings meet or exceed the requirements of these Standards.

1.3 DELIVERY, STORAGE AND HANDLING

A. Exercise care during loading, transporting, unloading, and handling to prevent damage of any nature to interior and exterior surfaces of pipe and fittings.

B. Do not drop pipe and fittings.

C. Store materials on the project site in enclosures or under protective coverings in accordance with manufacturer's recommendations.

D. Assure that materials are kept clean and dry.

E. Do not store materials directly on the ground.

F. Follow manufacturer's specific instructions, recommendations and requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Marking Tape

1. Shall be coded in accordance with the NPWA Standards.

2. Shall be indelibly marked indicating the type of utility it is placed over.

3. Shall be three (3) inches wide Terra Tape Sentry Line 1350 (Detachable) by Reef Industries, Houston, TX, or approved equal.

B. Pipe Lubricant or glue

1. Use only lubricants or glues suitable for the type of pipe and application.

PART 3 - EXECUTION

3.1 INSPECTION

A. Provide all labor and equipment necessary to assist the Town to inspect pipe, fittings, gaskets, and other materials.

1. This shall include all air quality testing equipment, harnesses and manlifts necessary to comply with the appropriate OSHA regulation.

2. The Contractor shall comply with the regulations and policies regarding below grade or confined space entry.

B. Carefully inspect all materials at the time of delivery and just prior to installation.

C. Carefully inspect all pipe and fittings for:

1. Defects and damage.

2. Deviations beyond allowable tolerances for joint dimensions.

3. Removal of debris and foreign matter.

D. Examine areas and structures to receive piping for:

1. Defects, such as weak structural components that adversely affect the execution and quality of work.

2. Deviations beyond allowable tolerances for pipe clearances.

E. All materials and methods not meeting the requirements of these Standards shall be rejected.

F. Immediately remove all rejected materials from the project site.

G. Start work only when conditions are corrected to the satisfaction of the Town.

3.2 INSTALLATION

A. General:

1. Install all pipe and fittings in strict accordance with the manufacturer's instructions and recommendations.

2. Install all pipes and fittings in accordance with the lines and grades shown on the Drawings and as required for a complete installation.

3. Install adapters, approved by the Town, when connecting pipes constructed from different materials.

B. Installation and Trenches:

1. Firmly support the pipe and fittings on bedding material as shown on the Drawings and as specified in these Standards.

   a. Where the subgrade material is unsuitable to support the pipe, over-excavate the unsuitable material and replace the same with suitable gravel or granular borrow.

   b. If the subgrade material encountered consists of saturated clays or silts, the Town may direct the installation of the bedding material and pipe inside a construction fabric wrap.

2. Do not permanently support the pipe or fittings on saddles, blocking stones, or any material which does not provide firm and uniform bearing along the outside length of the pipe.

3. Thoroughly compact the material under the pipe to obtain a substantial unyielding bed shaped to fully support the pipe.

4. Excavate suitable holes for the joints so that only the barrel of the pipe receives bearing pressure from the supporting material after placement.

5. Lay each pipe length so it forms a close joint with the adjoining length and bring inverts to the required grade.

6. Set the pipe true to line and grade. Use a transit for line. Use a laser beam aligner for grade.

7. Do not drive the pipe down to grade by striking it with a shovel handle, timber, rammer or any other unyielding object.

8. Make all pipe joints watertight and no sand, silt, clay or soil of any description entering the pipeline at the joints.

9. Immediately after making a joint, fill the holes for the joint with bedding material, and compact.

10. When each pipe length has been properly set, place and compact enough of the bedding material between the pipe and the sides of the trench to hold the pipe in correct alignment.

11. After filling the sides of the trench, place and lightly tamp bedding material to complete the bedding as shown on the Drawings.

12. Take all necessary precautions to prevent flotation of the pipe in the trench.

13. Where there is evidence of water or soil entering the pipeline, repair the defects to the satisfaction of the Town.

C. Temporary Plugs:

1. When pipe installation work in trenches is not in progress, close open ends of the pipe with temporary watertight plugs.

2. If water is in the trench when work is resumed, do not remove plugs until all danger of water entering the pipe is eliminated.

3. Do not use the pipe lines as conductors for trench drainage during construction.

D. Protection of Water Supplies:

1. There shall be no physical connection between a public or private potable water supply system and a sewer.

2. Sewer shall be a minimum of ten feet horizontally unless approved by the Town or the Town's Engineer.

3. Whenever sewers must cross water mains, the sewer shall be constructed as follows:

a. Sewer pipe shall be class 52 ductile iron or PVC pressure rated pipe (DR-25 min. or SDR-26 min.) for a minimum distance of 9 feet each side of the crossing.

b. Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1-1/2 times working pressure for force mains and joints shall not be located within 9 feet of the crossing.

c. Vertical separation of sewer and water main shall not be less than 18".

3.3 CLEANING AND TESTING

A. Cleaning and Testing Piping - General:

1. Thoroughly clean all piping prior to testing. Remove all dirt, dust, oil, grease and other foreign material. Exercise care while cleaning to avoid damage to linings and coatings.

2. When the installation is complete, test all pipelines, including service laterals, in the presence of the Town and the plumbing or building inspector in accordance with the requirements of the local and state plumbing codes and the appropriate Sections of these Standards.

3. Equipment: Supply all labor, equipment, materials, gages, and pumps required to conduct the tests.

4. Retesting: Perform all retesting required due to failure to the complete satisfaction of the Town.

5. The Town or the Town's field representative will observe all tests.

B. Sewer Lines:

1. Outside Sewer Lines: Test with a low pressure air test, a visual inspection, and for PVC or other flexible piping, test with a deflectometer after suitable settling time has elapsed, in accordance with Section 15 of these specifications.

2. Building Interior Sewer System: Clean and test in accordance with the local and State plumbing requirements.

C. All Other Piping Systems:

1. Pressure Test:

   a. Perform a pressure test for all other piping systems at 1-1/2 times maximum system pressure, or at the maximum working pressure of the piping system.

   b. Tests shall be hydrostatic water, or air pressure as specified or as approved by the Town.

2. Cleaning: Perform all specialized cleaning as specified or required by system.

14. PVC SEWER PIPE & FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, install and test PVC pipe.

1.2 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of five (5) years experience in the manufacture of PVC sewer pipe.

1.3 SUBMITTALS TO THE TOWN

A. Submit manufacturer's literature, test reports, and certificates.

1.4 DELIVERY, STORAGE & HANDLING

A. Deliver as job progress requires and store on a smooth bed to prevent point loading.

B. Stack pipe in accordance with manufacturer's instructions.

C. Exercise extra care when handling.

1.5 INSPECTION

A. Provide all labor necessary to assist the Town to inspect pipe, fittings, gaskets, and other materials.

B. Carefully inspect all materials at the time of delivery and just prior to installation.

C. Carefully inspect all pipe and fittings for:

1. Defects and damage.

2. Deviations beyond allowable tolerances for joint dimensions.

3. Removal of debris and foreign matter.

D. Examine areas and structures to receive piping for:

1. Defects, such as weak structural components that adversely affect the execution and quality of work.

2. Deviations beyond allowable tolerances for pipe clearances.

E. All materials and methods not meeting these requirements.

F. Immediately remove all rejected materials from the project site.

G. Start work only when conditions are corrected to the satisfaction of the Town.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe & Fittings:

1. Type - Polyvinylchloride (PVC) plastic pipe with integral bell and spigot joints. Polymer compounding and classification shall be in accordance with ASTM D1784 (Class 12454-B).

2. Gravity Sewers:

   a. 4" - 15" nominal diameter sizes shall conform to ASTM D3034 and SDR=35.

   b. 18" - 36" nominal diameter sizes shall conform to ASTM F679 (wall thickness T-1).

   c. 42" – 48" nominal diameters shall conform to ASTM 794.

3. Pressure Sewers shall conform to ASTM D2241 and D1784, Class 12454-B, with maximum SDR=26. A safety factor of 2.5 shall be used for pressure rating determination.

4. Furnish straight pipe in standard laying lengths, 12.5 and 20 feet for 18" diameter and less, 12 and 19.5 feet for 21", 24" and 27" diameter.

5. Furnish fittings of approved equal to the pipe and having bell and spigot configuration identical to that of the pipe.

6. No saddles or Ferncos shall be used. Sewer repairs, new connections, and other sewer work shall include only ASTM compliant gasketed fittings.

B. Joints:

1. Type - Flexible elastomeric seal conforming to ASTM D3212 with push-on bell and spigot.

2. Gaskets shall conform to ASTM F477.

3. Rubber rings for pressure sewer shall conform to ASTM D1869 and ASTM F477.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with the manufacturer's written instructions and as shown in the standard details in Appendix C.

B. Exercise extra care during winter construction as pipes impact strength is lower.

C. Prior to backfilling, exercise extra care to maintain water level in open excavation below the pipe invert to avoid flotation of pipe already set to line and grade.

3.2 CLEANING AND TESTING

A. Clean and test PVC pipes: Refer to Section 15 of these standards.

15. FINAL PVC SEWER TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. All sewers, manholes, and appurtenant work, in order to be eligible for approval by the Town, shall be subjected to tests that will determine the degree of watertightness and horizontal and vertical alignment.

2. Final sewer testing work includes the performance of testing and inspecting each and every length of sewer pipe, pipe joints and each item of appurtenant construction.

3. Perform testing at a time approved by the Town, which may be during the construction operations, after completion of a substantial and convenient section of the work, or after the completion of all pipe laying operations.

4. Provide all labor, pumps, pipes, connections, gages, measuring devices and all other necessary apparatus to conduct tests.

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

3.1 PERFORMANCE

A. General:

1. Thoroughly clean all sewer lines to be tested, in a manner and to the extent acceptable to the Town, prior to initiating test procedures.

2. Perform all tests and inspections only under the direct observation of the Town or the Town's field representative and in accordance with the requirements of State and Town Standards.

3. Prior to construction, inform the Town of the planned sewer testing pattern.

4. Remedial Work:

a. Perform all work necessary to correct deficiencies discovered as a result of testing and/or inspections.

b. Completely retest all portions of the original construction on which remedial work has been performed.

c. Perform all remedial work and retesting in a manner and at a time approved by the Town.

B. Line Acceptance Tests (Gravity sewers):

1. Test all gravity sewer lines for leakage by conducting a low pressure air test conforming to ASTM C-828. Conduct all tests after the tees or saddles and service connections have been installed to the limit indicated on the Contract Drawings. Conduct all tests after backfilling the sewer line trenches.

2. Equipment:

a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

c. All air used shall pass through a single central panel.

d. Connect 3 individual hoses:

(1) From the control panel to the pneumatic plugs for inflation,

(2) From the control panel to the sealed sewer line for introducing the low pressure air.

(3) From the sealed sewer line to the control panel for continually monitoring the air pressure rise in the sealed line.

3. Groundwater Conditions:

a. In areas where groundwater exists, and at the time of installing the sewer line, install a 1/2 inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sewer lines entering the manhole.

b. Immediately prior to performing the line acceptance test, determine the height of groundwater by removing the groundwater test pipe cap,

blowing air through the pipe nipple into the ground to clear it, and then connecting a clear plastic tube to the nipple.

c. Hold the tube vertically and measure the height in feet. Divide this height by 2.3 to establish the pounds of groundwater pressure to be added to the air pressure test readings. (Example: Height of water is 11-1/2 feet, added groundwater pressure is 5 psig, minimum air pressure is 3.5 psig; therefore, the total minimum acceptable pressure is 8.5 psig.)

4. Testing Pneumatic Plugs:

a. Seal test all pneumatic plugs prior to using them in the actual test.

b. Lay one length of pipe on the ground and seal both ends with the pneumatic plugs to the tested.

c. Pressurize the sealed pipe to 5 psig.

d. The pneumatic plugs are acceptable if they remain in place without bracing.

5. Testing Sewer Pipeline:

a. After the sewer pipe has been cleaned and the pneumatic plugs checked, place the plugs in the sewer line at each manhole and inflate them.

b. Introduce low pressure air into the sealed sewer pipeline until the air pressure reaches 4 psig greater than the average groundwater pressure.

c. Allow a minimum of 2 minutes for the air pressure to stabilize to a minimum of 3.5 psig greater than the groundwater pressure.

d. After the stabilization period, disconnect the air hose from the control panel to the air supply.

e. The pipeline will be acceptable if the pressure decrease is not greater than 1/2 psig in the time stated in the following table.

TABLE 1

Pipe Diameter (inches)	Minimum Time (min)	Length for Min. Time (feet)	Time for Longer Lengths* (sec)
4	1:53	597	.190L
6	2:50	398	.427L
8	3:47	298	.760L
10	4:43	239	1.187L
12	5:50	199	1.709L
15	7:05	156	2.671L
18	8:30	133	3.846L
21	9:55	114	5.235L
24	11:20	99	6.837L
27	12:45	88	8.653L
30	14:10	80	10.683L
33	15:35	72	12.926L
36	17:00	66	15.384L

*Applies to pipe runs greater than those listed in column 3.

L = Actual length of pipe being tested.

6. Test Results:

   a. If the installation fails the low pressure air test, determine the source of leakage.

   b. Replace all defective materials and/or workmanship and repeat low pressure test at no additional cost to the Owner.

   c. Repairs shall only be made with prior approval of the Town in accordance with a method acceptable to the Town.

C. Alignment Tests (Gravity Sewers):

1. Perform tests for the correctness of horizontal and vertical alignment on each and every length of gravity sewer pipeline between manholes.

2. Beam a source of light, acceptable to the Town, through the pipe line and directly observe the light in the manhole at the opposite end of each test section.

D. Deflection Tests:

1. Deflection test all PVC pipe.

2. Perform test by using a deflectometer.

3. Maximum deflection: 5 percent.

4. Testing limits and test gauge diameter for plastic pipe:

   a. Acceptance limit for deflection tests of installed flexible sewer pipe, listed in Table 2 shall be 5% of average inside diameter. A test shall be conducted after a minimum of thirty days following installation.

TABLE 2 - PVC Materials

D 3034	Solid Wall	4" - 15"
F 679	Solid Wall	18" - 36"
F 789	Solid Wall	4" - 18"
F 794	Ribbed Wall	18" - 48"
F 949	Corrugated	4" - 8"

   b. The deflection gauge diameter (G) for this test shall be determined by the following formula:

      G = .929 D inches (nominal)

      where D is the average inside diameter given in the 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) inches

      where t = the minimum solid wall thickness

      D' = the average outside diameter

   c. All PVC pipe is to be gauged and the results are to be recorded and the owner is to be provided written results.

   d. Limits of installed deflection for other flexible pipe materials shall not exceed the above for PVC.

E. Force Main Test:

   1. Pressure Test:

a. Perform testing in accordance with Section 5 of AWWA Standard C600, latest edition, at a pressure equal to 150 psi of the design operating total dynamic head.

b. The section of pipe to be tested shall be filled with water of approved quality, and all air shall be expelled from the pipe. If blowoffs are not available at high points for releasing air the Contractor shall make the necessary excavations, backfilling and taps at such points and shall plug said holes after completion of the test.

c. The section under test shall be maintained full of water for a period of 24 hours prior to the combined pressure and leakage test being applied. Perform a pressure test for all other piping systems at 1-1/2 times maximum system pressure, or at the maximum working pressure of the piping system, or at a pressure indicated in the appropriate Sections of this Specification.

d. While maintaining this pressure, the Contractor shall make a leakage test by metering the flow of water into the pipe. If the average leakage during a two-hour period on buried pipelines exceeds a rate of 10 gallons per inch of diameter per 24 hours per mile of pipeline the section shall be considered as having failed the test. All pipes within structures and chambers and all flanged joints shall be no visible leakage.

e. If the section fails to pass the pressure and leakage test, the Contractor shall do everything necessary to locate, uncover, and repair or replace the defective pipe, fitting, or joint, all at his own expense and without extension of time for completion of the work. Additional tests and repairs shall be made until the section passes the specified test.

f. Tests shall be hydrostatic.

2. Connection to Work by Others

a. If work involves connection of pipe lines to pipes or structures provided by others, pressure test pipe lines prior to making the connection.

b. After successfully passing the pipe line pressure test, make the necessary connections to the work by others, and pressure test the connection.

c. The connection shall be pressurized to the pipe line test pressure, for a minimum of 4 hours. The connection shall have no visible leakage.

d. Correct any leakage and retest until connection passes.

3. Cleaning: Perform all specialized cleaning as specified or required by system.

4. Television Inspection: Perform television inspection one year following the completion of the sewer. Provide documentation as outlined in Section 5.1.2 of these Standards.

16. SELF-PRIMING PUMPING STATIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work included: Furnish and install a factory built, base mounted pumping station with duplex self-priming pumps.

B. The following specifications are provided as a guide. Complete information regarding the pumping station design and specified components shall be submitted to the Town for review.

1.2 SYSTEM DESCRIPTION

A. Furnish and install one factory built base mounted, automatic pumping station. The station shall be complete with all equipment specified herein, factory assembled on a common steel base.

B. No new private wastewater pumping stations or force mains shall be constructed in Town. All new wastewater pumping stations and force mains shall be constructed to the Town's specifications/requirements and shall become the property of the Town upon completion and acceptance.

1.3 PERFORMANCE CRITERIA

A. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. Provide suction and discharge sizes. Provide the following information for each pump:

Capacity (GPM)	_____
Total Dynamic Head (FT)	_____
Total Dynamic Suction Lift(FT)	_____
Total Dynamic Discharge Head (FT)	_____
Maximum Repriming Lift (FT)	_____
Maximum Static Suction Lift (FT)	_____
Total Discharge Static Head (FT)	_____
Total Static Head (FT)	_____
Motor Horsepower	_____
Voltage	_____
Phase	_____
Hertz	_____

B. Voltage tolerance shall be plus or minus 10 percent. Control voltage shall not exceed 132 volts.

1.4 SUBMITTALS TO THE TOWN

A. Product Data

1. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and liquid level control shall be fully described.

B. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for station. Contractor piping connections and station access clearances shall be dimensioned relative to the station centerline. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.

C. Operations Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.

2. Documentation shall be specific to the pumping station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

a. Functional description of each major component, complete with operating instructions.

b. Instructions for operating pumps and pump controls in all modes of operation.

c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

d. Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.

e. Electrical schematic diagram of the pump station circuits shall be in accordance with NMTBA and JIC standards. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

f. Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.

3. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications and supplied to the Superintendent upon completion of the pumping station. Updates and revisions to the submitted O&M manual shall be performed as requested by the Superintendent prior to acceptance.

1.5 QUALITY ASSURANCE

A. Acceptable Manufacturer:

1. Gorham-Rupp, Inc., Mansfield, Ohio

2. Substitutions may be reviewed by the Town. However, the Town is under no obligation to accept alternatives.

B. Pump manufacturer shall have a minimum of ten (10) years of experience manufacturing wastewater pumping stations.

C. The pumps and pumping station manufacturer must be certified to ISO 9001 by an accredited certification agency.

D. Reprime Performance

1. Each pump must be capable of a reprime lift as specified while operating at the selected speed. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one-half of the liquid remaining in the pump casing. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition. Reprime performance must be confirmed with the following test set-up:

    a. Repeatability of performance shall be demonstrated by testing five consecutive reprime cycles. Full pump capacity (flow) shall be achieved within five minutes during each cycle.

    b. Liquid to be used for reprime test shall be water.

2. Upon request from the engineer, certified reprime performance test results, prepared by the manufacturer, and certified by a registered professional engineer, shall be submitted for approval prior to shipment.

E. Factory System Test

    1. All components including the pumps, motors, valves, piping and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall duplicate actual performance anticipated for the complete station.

F. The manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

1.6 MANUFACTURER'S WARRANTY

A. The pump station manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.

1. All equipment, apparatus, and parts furnished shall be warranted for five (5) years, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, O-rings, etc. The pump station manufacturer shall be solely responsible for warranty of the station and all components.

2. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the owner.

B. It is not intended that the station manufacturer assume liability for consequential damages or contingent liabilities arising from failure of any vendor supplied product or part which fails to properly operate, however caused. Consequential damages resulting from defects in design, or delays in delivery are also beyond the manufacturer's scope of liability.

C. The warranty shall become effective upon the acceptance by the Owner.

PART 2 - PRODUCTS

2.1. UNITARY RESPONSIBILITY

A. In order to unify responsibility for proper operation of the complete pumping station, it is the intent of these Specifications that all system components be furnished by a single supplier (unitary source). The pumping station must be of standard catalog design, totally warranted by the manufacturer.

2.2. MANUFACTURER

A. The specifications and project drawings depict equipment and materials manufactured by The Gorman-Rupp Company for purposes of describing the quality and performance requirements which are deemed most suitable for the service anticipated. Equipment shall be Gorman-Rupp.

2.3. UNIT BASE

A. The unit base shall comprise a base plate, perimeter flange, and reinforcements.

2.4. PUMP DESIGN

A. Pumps shall be horizontal, self-priming centrifugal Gorman-Rupp Super T Series pump, designed specifically for handling raw, unscreened, domestic sanitary sewage.

B. Provide a Pump Drain Kit

C. Provide Spare Parts Kit:

1. The following minimum spare parts shall be furnished with the pump station:

   a. One pump mechanical seal
   b. Required cover plate O-Ring(s)
   c. One rotating assembly O-Ring
   d. One set of impeller clearance adjustment shims (if required)

2.5 VALVES AND PIPING

A. Each pump shall be equipped with a full flow type check valve, capable of passing a 3" spherical solid, with flanged ends and be fitted with an external lever and spring. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

B. A 3-way plug valve must allow either or both pumps to be isolated from the force main. Valve shall pass 3" spherical solids. The plug valve shall be non-lubricated, tapered type. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall have a locking device to hold the plug in the desired position.

C. Automatic air release valves:

1. An automatic air release valve shall be furnished for each pump designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming cycle or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visual indication of valve closure, and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable.

2. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms, if used, shall be of fabric reinforced neoprene or similar inert material.

3. A cleanout port, three inches in diameter, shall be provided for ease of inspection, cleanout, and service.

4. Valves shall be field adjustable for varying discharge heads.

5. Connection of the air release valves to the station piping shall include stainless steel fittings.

D. Gauge Kit

1. A gauge kit shall be supplied for each pump. Suction pressure must be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge. Gauges to be at least 4 inches in diameter, graduated in feet water column. Rated accuracy shall be 1% of full scale reading. Compound gauge shall be graduated -34 to +34 feet water column minimum. Pressure gauge to be graduated 0 to 140 feet water column minimum.

2. Gauges to be factory mounted on a resilient panel with frame assembly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, including a shutoff valve for each gauge line at the point of connection to suction and discharge pipes.

E. Piping

1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.

2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.

3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.

4. Bolt holes shall be in angular alignment within 1/2 degrees between flanges. Flanges shall be faced with a gasket finish having concentric grooves a minimum of 0.01 inch deep by approximately 0.03 inch wide, with a minimum of three grooves on any given surface spaced a maximum of 1/4 inch apart.

F. Supports and Thrust Blocks

1. Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

2.6. ELECTRICAL CONTROL COMPONENTS

A. The pump station control panel will be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.

B. Panel Enclosure:

1. Electrical control equipment shall be mounted within a NEMA 1 stainless steel, dead front type, control enclosure. Door shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on a removable steel back panel secured to enclosure with collar studs.

2. All control devices and instruments shall be mounted using threaded fasteners, and shall be clearly labeled to indicate function.

C. Control Panel UL Label Requirement:

1. Pump station controls shall conform to third party safety certification. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The enclosure, and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures.

D. Branch Components:

1. Motor branch components to be of highest industrial quality, secured to the sub-plate with machine screws and lockwashers. Mounting holes shall be drilled and tapped; self-tapping screws shall not be used to mount any component.

2. Circuit Breakers and Operating Mechanisms

a. A properly sized heavy duty circuit breaker, with RMS shall be furnished for each pump motor. The circuit breakers must be sealed by the manufacturer after calibration to prevent tampering.

b. An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position.

3. An open frame, across-the-line, NEMA rated magnetic starter with under-voltage release, and overload protection on all three phases, shall be furnished for each pump motor. Starters of NEMA size 1 and above shall allow addition of at least two auxiliary contacts. Starters rated "0", "00", or fractional size, are not acceptable. Power contacts to be double-break type made of cadmium oxide silver. Coils to be epoxy molded for protection from moisture and corrosive atmospheres. Contacts and coils shall be easily replaceable without removing the starter from its mounted position. Each starter shall have a metal mounting plate for durability.

4. Overload relays shall be solid-state block type, having visual trip indication with trip-free operation. Electrically resetting the overload will cause one (1) normally open and one (1) normally closed isolated alarm/control contact to reset, thus re-establishing a control circuit. Trip setting shall be governed by solid-state circuitry and adjustable current setting. Trip classes shall be 10, 15 and 20. Additional features to include phase loss protection, selectable jam/stall protection and selectable ground fault protection.

5. An overload reset pushbutton, mounted through the control panel door, shall permit resetting the overload relays without opening the control panel door.

E. Secondary Lightning Arrestor:

1. The control panel shall be equipped with a secondary lightning arrestor to minimize damage to the pump motors and control from transient voltage surges. The arrestor shall utilize silicon-oxide encapsulated in a non-conductive housing. The arrestor shall have a current rating of 60,000 Amps, and a Joule rating of 1500.

F. Phase Monitor:

1. The control panel shall be equipped to monitor the incoming power and shut down the pump when required to protect the motor(s) from damage caused by voltage less than 83% of nominal. The motor(s) shall automatically restart when power conditions return to normal.

G. Pump Start Delay:

1. The control circuit for pump #2 shall be equipped with a time delay to prevent simultaneous motor starts.

H. Auxiliary Power Transformer:

1. The lift station shall be equipped with a 3 KVA step-down transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment. The primary and secondary side of the transformer to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position.

I. Control Circuit:

1. A normal duty thermal-magnetic circuit breaker shall protect all control circuits by interrupting control power.

2. Pump mode selector switches shall permit manual start or stop of each pump individually, or permit automatic operation under control of the liquid level control system. Manual operation shall override all shutdown systems, except the motor overload relays. Selector switches to be heavy duty, oil-tight design with contacts rated NEMA A300 minimum.

3. Pump alternation shall be integral to the liquid level controller. Provisions for automatic alternation or manual selection shall also be integral to the liquid level controller.

4. Six digit elapsed time meter (non-reset type) shall be connected to each motor starter to indicate total running time of each pump in "hours" and "tenths of hours". An integral pilot light shall be wired in parallel to indicate that the motor is energized and should be running.

5. A high pump temperature protection circuit shall override the level control and shut down the pump motor(s) when required to protect the pump from excessive temperature. A thermostat shall be mounted on each pump casing and connected to a high pump temperature shutdown circuit. If casing temperature rises to a level sufficient to cause damage, the thermostat causes the pump shutdown circuit to interrupt power to the motor. A visible indicator located on the control panel door shall indicate motor stopped due to high pump temperature. The motor shall remain locked out until the pump has cooled and circuit has been manually reset. Automatic reset of this circuit is not acceptable.

6. A duplex ground fault receptacle providing 115 VAC, 60 Hz, single phase current, will be mounted on the side of the control enclosure. Receptacle circuit shall be protected by a 15 ampere thermal-magnetic circuit breaker.

7. Wiring:

   a. The pump station, as furnished by the manufacturer, shall be completely wired, except for power feed lines to the branch circuit breakers and final connections to remote alarm devices.

   b. All wiring, workmanship, and schematic wiring diagrams shall comply with applicable standards and specifications of the National Electric Code (NEC).

   c. All user serviceable wiring shall be type MTW or THW, 600 volts, color coded as follows:

1)	Line and Load Circuits, AC or DC power	Black
2)	AC Control Circuit Less Than Line Voltage	Red
3)	DC Control Circuit.	Blue
4)	Interlock Control Circuit from external source	Yellow
5)	Equipment Grounding Conductor	Green
6)	Current Carrying Ground.	White
7)	Hot With Circuit Breaker Open.	Orange

   d. Control circuit wiring inside the panel, with exception of internal wiring of individual components, shall be 16 gauge minimum, type MTW or THW, 600 volts. Power wiring to be 14 gauge minimum. Motor branch wiring shall be 10 gauge minimum.

   e. Motor branch and other power conductors shall not be loaded above 60 degrees C temperature rating, on circuits of 100 amperes

or less, nor above 75 degrees C on circuits over 100 amperes. Wires must be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be ring tongue type with nylon insulated shanks. All wires on the sub-plate shall be bundled and tied. All wires extending from components mounted on door shall terminate at a terminal block mounted on the back panel. All wiring outside the panel shall be routed through conduit.

f. Control wires connected to door mounted components must be tied and bundled in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall allow the door to swing full open without undue stress or abrasion. Bundles shall be held on each side of hinge by mechanical fastening devices.

8. Conduit:

a. Factory installed conduit shall conform to following requirements:

1) All conduit and fittings to be UL listed.
2) Liquid tight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.
3) Conduit to be supported in accordance with articles 346, 347, and 350 of the National Electric Code (NEC).
4) Conduit shall be sized according to the NEC.

9. Grounding

a. Station manufacturer shall ground all electrical equipment inside the pump station to the control panel back plate. All paint must be removed from the grounding mounting surface before making final connection.

b. The contractor shall provide an earth driven ground connection to the pump station at the main grounding lug in accordance with the National Electric Code (NEC).

10. Equipment Marking

a. Permanent corrosion resistant name plate(s) shall be attached to the control and include following information:

1) Equipment serial number
2) Supply voltage, phase and frequency
3) Current rating of the minimum main conductor
4) Electrical wiring diagram number
5) Motor horsepower and full load current
6) Motor overload heater element
7) Motor circuit breaker trip current rating
8) Name and location of equipment manufacturer

b. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.

c. Switches, indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

2.7 LIQUID LEVEL CONTROL

A. The manufacturer of the liquid level control system must be certified to ISO 9001 by an accredited certification agency.

B. The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.

C. The level control system shall be capable of operating as either an air bubbler type level control system, submersible transducer type system, or ultrasonic transmitter type system.

D. The level control system shall utilize alternation to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle, or in the event of excessive run time.

E. The level control system shall utilize an electronic pressure switch which shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the electronic pressure switch shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the electronic pressure switch shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the electronic pressure switch shall start the second pump when the liquid

reaches the "lag pump start level" so that both pumps are operating. These levels shall be adjustable as described below.

1. The electronic pressure switch shall include integral components to perform all pressure sensing, signal conditioning, EMI and RFI suppression, DC power supply and 120 volt outputs. Comparators shall be solid state, and shall be integrated with other components to perform as described below.

2. The electronic pressure switch shall be capable of operating on a supply voltage of 12VDC in an ambient temperature range of -10 degrees C (14 degrees F) through 55 degrees C (131 degrees F). Control range shall be 0 to 12.0 feet of water with an overall repeat accuracy of (plus/minus) 0.1 feet of water. Memory shall be retained using a non-volatile lithium battery back-up.

3. The electronic pressure switch shall consist of the following integral components: pressure sensor, display, electronic comparators and output relays.

    a. The internal pressure sensor shall be a strain gauge transducer and shall receive an input pressure from the air bubbler system. The transducer shall convert the input to a proportional electrical signal for distribution to the display and electronic comparators. The transducer output shall be filtered to prevent control response to level pulsations or surges. The transducer range shall be 0-15 PSI, temperature compensated from -40 degrees C (-40 degrees F) through 85 degrees C (185 degrees F), with a repeat accuracy of (plus/minus) 0.25% full scale about a fixed temperature. Transducer overpressure rating shall be 3 times full scale.

    b. The electronic pressure switch shall incorporate a digital back lighted LCD panel display which, upon operator selection, shall indicate liquid level in the wet well, and the preset start and stop level for both lead and lag pump. The display shall include twenty (20), 0.19" high alpha-numeric characters calibrated to read out directly in feet of water, accurate to within one-tenth foot (0.1 foot), with a full scale indication of not less than 12 feet. The display shall be easily convertible to indicate English or metric units.

    c. Level adjustments shall be electronic comparator set-points to control the levels at which the lead and lag pumps start and stop.

Each of the level settings shall be easily adjustable with the use of membrane type switches, and accessible to the operator without opening any cover panel on the electronic pressure switch. Controls shall be provided to permit the operator to read the selected levels on the display. Such adjustments shall not require hard wiring, the use of electronic test equipment, artificial level simulation or introduction of pressure to the electronic pressure switch.

d. Each output relay in the electronic pressure switch shall be solid state. Each relay input shall be optically isolated from its output and shall incorporate zero crossover switching to provide high immunity to electrical noise. The "ON" state of each relay shall be indicated by illumination of a light emitting diode. The output of each relay shall be individually fused providing overload and short circuit protection. Each output relay shall have an inductive load rating equivalent to one NEMA size 4 contactor. A pilot relay shall be incorporated for loads greater than a size 4 contactor.

4. The electronic pressure switch shall be equipped with an output board which shall include LED status indicators and a connector with cable for connection to the main unit.

5. The electronic pressure switch shall be equipped with pump start delay(s) preset at a fixed delay time of five (5) seconds.

6. Circuit design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.

7. The electronic pressure switch shall be equipped with a simulator system capable of performing system cycle testing functions.

8. The electronic pressure switch shall be capable of controlling liquid levels in either a pump up or pump down application.

9. The electronic pressure switch shall have internal capability of providing automatic alternation, manual selection of pump sequence operation, and alternation in the event of 1-199 hours excessive run time.

10. The electronic pressure switch shall be equipped with a security access code to prevent accidental set-up changes and provide liquid level set-point lock-out.

11. The electronic pressure switch shall be equipped with one (1) 0-33 ft. W.C. input, one (1) scalable analog input of either 0-5VDC, 0-10VDC, or 4-20mA, and one (1) 4-20mA scalable output. Output is powered by 10VDC supply. Load resistance for 4-20mA output shall be 100-400 ohms.

12. The electronic pressure switch shall include a DC power supply to convert 120VAC control power to 12VDC EPS power. The power supply shall be 500 mA (6W) minimum and be UL listed Class II power limited power supply.

13. The electronic pressure switch shall be equipped with an electronic comparator and solid state output relay to alert maintenance personnel to a high liquid level in the wet well. An indicator, visible on the front of the control panel, shall indicate that a high wet well level exists. The alarm signal shall be maintained until the wet well level has been lowered and the circuit has been manually reset. High water alarm shall be furnished with a dry contact wired to terminal blocks.

14. The electronic pressure switch shall be equipped with an electronic comparator and solid state output relay to alert maintenance personnel to a low liquid level in the wet well. An indicator, visible on the front of the control panel, shall indicate that a low wet well level exists. The alarm signal shall be maintained until the cause for the low wet well level has been corrected and the circuit has been manually reset. A low liquid level condition shall disable both pump motors. When the wet well rises above the low level point, both pump motors shall be automatically enabled. Low water alarm shall be furnished with a dry contact wired to terminal blocks.

F. An alarm silence pushbutton and relay shall be provided to permit maintenance personnel to de-energize the audible alarm device while corrective actions are under way. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be oil tight design with contacts rated NEMA A300 minimum.

G. High Level Alarm Back-Up Float Switch

1. A polypropylene encased mercury float switch, with integral molded cable, stainless steel mounting hardware, and a junction box (Class 1, Div. 1, Group C&D) shall be provided. The float switch shall be field mounted adjacent to the wet well access hatch. It shall be field wired to an intrinsically safe barrier relay in the pump control panel. Float switch activation shall back-up the high level control system operation and shall

also provide an output (dry contact) for activation of Owner's alarm equipment.

PART 3 - EXECUTION

3.1. EXAMINATION

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Station manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect complete pump station and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

3.2. INSTALLATION

A. Install, level, align, and lubricate pump station. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. Suction pipe connections are vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.

C. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

D. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

E. After all anchor bolts, piping and control connections are installed, completely fill the grout dam in the pump station base with non-shrink grout.

3.3. FIELD QUALITY CONTROL

A. Operational Test

1. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

2. After construction debris and foreign material has been removed form the wet well, contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

B. Manufacturer's Start-up Services

1. Co-ordinate station start-up with manufacturer's technical representative. The representative or factory service technician will inspect the completed installation. He will calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

2. One day minimum shall be provided for startup, testing, and training of pumping station operator personnel by the manufacturer's representative.

3.4. CLEANING

A. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.

3.5. PROTECTION

A. The pump station should be placed into service immediately. If operation is delayed, drain water from pumps and piping. Open motor circuit breakers and protect station controls and interior equipment from cold and moisture.

17. SUMBERSIBLE WASTEWATER PUMPING STATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, install and test the complete (factory built) submersible pumping stations and all appurtenances necessary to make a complete and operable system.

B. The following specifications are provided as a guide. Complete information regarding the pumping station design and specified components shall be submitted to the Town for review.

C. No new private wastewater pumping stations or force mains shall be constructed in Town. All new wastewater pumping stations and force mains shall be constructed to the Town's specifications/requirements and shall become the property of the Town upon completion and acceptance.

1.2 QUALITY ASSURANCE

A. General:

1. The Contractor shall furnish all materials and equipment complete in all details and ready for operation for the intended purpose.

2. Equipment design, construction and installation in accordance with best practice and methods and conforming to the standards of the Hydraulic Institute.

3. All equipment and accessories shall be the manufacturer's latest and proven design.

4. All parts of the equipment shall be amply proportioned for long, continuous, and uninterrupted service.

5. Suitable provisions shall be made for easy access for service and replacement of parts.

6. Workmanship shall be first class in all respects.

B. Qualifications of the Manufacturer:

1. Minimum of 5 years experience in the design and manufacture of submersible pumping stations.

2. The submersible pumping station complete with all appurtenances forms and integrated system, and as such shall be supplied by one submersible vortex pumping station manufacturer who shall provide all the equipment and appurtenances, regardless of manufacturer. The Contractor shall be responsible for the satisfactory operation of the entire system.

3. Pumping station installations that have proven reliable in similar applications over the last 5 years.

1.3 SUBMITTALS TO THE TOWN

A. The Contractor shall submit the following for the Town's review:

1. Complete layout drawings illustrating all construction details and dimensions including any manufacturer instructions on installation or handling.

2. Shop drawings, manufacturer's literature, maintenance data, and operating instructions. Submersible pumping station manufacturer shall integrate all required shop drawings into a common submittal package. Updates and revisions to the submitted O&M manual shall be performed as requested by the Superintendent prior to acceptance.

3. Pump manufacturer performance curves showing total head, pump input, horsepower, and pump efficiency over the specified capacity range of each pump.

4. Submit calculations demonstrating that the pumping station has a factor of safety of at least 1.2 against flotation assuming the groundwater level is at finish grade and the wet well is empty.

5. Submit confirmation that the environmental operating conditions of all components will be adequately met by the enclosure.

6. Control panel detail and mounting pedestal.

1.4 GUARANTEE

A. The Contractor shall obtain a guarantee by the submersible pumping station manufacturer, in the name of the Owner.

B. The Contractor shall obtain a 1-year guarantee from the pump manufacturer, in the name of the Owner, against defects in workmanship and materials, covering parts and labor.

C. The Contractor shall obtain a 1-year guarantee from the access hatch manufacturer, in the name of the Owner, against defects in workman-ship and materials, covering parts and labor.

PART 2 - PART 2 - PRODUCTS

2.1 GENERAL

A. The packaged pumping stations shall be the product of established, reputable firms regularly engaged in the manufacture and fabrication of these systems. All pumping stations specified shall be from a single manufacturer and fabricator. Acceptable Manufactures are:

1. ITT Flygt

2. Or approved equal

B. Pumping units shall draw sewerage from a wet well and discharge into a force main against a total dynamic head as specified.

C. The pumps shall be controlled automatically by a level measurement system, which is actuated by the change in wet well level. All equipment for the station shall be performed automatically.

D. The pumping stations shall consist of cylindrical wet well in which the following principal items of equipment shall be factory installed: sewage pumps, slide rail system, valves, internal piping, automatic level controller, flow meters, and all internal wiring. The main control panel, circuit breakers, motor starters, and alarm system shall be situated in a weatherproof NEMA 4X control panel mounted securely on a concrete pad.

E. The pumping stations shall be an explosion-proof system.

2.2 PUMP STATION STRUCTURE

A. General: The pumping stations, as shown on the drawings, shall be housed in a precast concrete wet well. A single leaf locking access hatch shall provide access to the wet wells. All dimensions shall be as shown on the standard details.

B. Reinforced Concrete: Structural reinforced concrete for the pumping station shall meet the following specifications: Concrete Compressive Strength: Minimum 5,000 psi at 28 days.

C. Reinforcing steel: ASTM A-82, ASTM A-185, ASTM A-496, or ASTM A-615 Gr. 60. Minimum cover for reinforcement shall be 1½ inches. Lap in reinforcement shall be a minimum of 2 cross wires at splices for mesh wire. Walls and floors shall be monolithically poured with a minimum concrete thickness of 6 inches. Where openings are required, additional reinforcement

shall be provided to compensate for resultant diminished strength of concrete structure.

D. Joint Design: Horizontal joints between sections of the precast concrete pumping station shall be designed for water tightness. Joint design shall be mechanical with neoprene gasket and grout seal or other approved method joining consistent with requirements of water tightness and permanence. Shop drawings showing intended method of joining shall be submitted to the Town. Contractor shall also submit documentary proof that material to be used under this specification has been employed for similar applications for a period of not less than 3 years.

E. Assembly and Alignment: The equipment, piping, wiring, etc., of the pump station shall be preassembled in the shop to the maximum extent practicable.

F. Waterproofing: All below ground exterior surfaces shall be coated with 2 coats of Koppers Bitumastic 300-M coal-tar epoxy, or approved equivalent. The interior of the wet well shall be coated with 2 coats of Koppers Bitumastic 2300-M coal-tar epoxy, or approved equivalent.

G. Painting and Waterproofing:

1. All precast concrete shall be waterproofed in compliance with Section 12 of these standards.

2. The pumps shall be factory finished with coats of paint filler and enamel or other acceptable treatment customary with the manufacturer and suitable for the intended service.

3. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.

4. Above grade ferrous surfaces, including the wet well vent and control panel, shall receive at a minimum one coat of a rust inhibitive primer with a minimum dry film thickness of 1.5 mils and two coats of an alkyd coating with a minimum dry film thickness of 2 mils per coat.

5. Other ferrous surfaces, including piping and fittings, shall receive one shop coat of a rust inhibitive primer and two field coats of a polyamide epoxy with a minimum dry film thickness of 5 mils per coat. The polyamide epoxy shall be 200HB epoxy with a minimum dry film thickness of 5 mils per coat. The polyamide epoxy shall be 200HB epoxy made by Koppers Co., Inc. Or 60 Series Hi-Build Epoxoline made by Tnemec or equivalent. The rust inhibitive primer shall be compatible with and made by the same manufacturer of the field coats.

6. All coatings shall be applied in accordance with the manufacturer's written instructions. Coatings damaged in shipment or installation shall be cleaned and touched up in the field with the same materials as original coatings.

H. Access Hatch: The single leaf access frame and cover shall have a 1/4-inch thick, mill finish, and extruded aluminum frame, incorporating embedded anchor plates. The door panel shall be 1/4-inch aluminum diamond plate, reinforced to withstand a live load of 300-lbs/square foot. Door shall open to 90° and automatically lock with a T-316 stainless steel hold open arm with aluminum release handle. Door shall close flush with the frame. Hinges and all fastening hardware shall be T-316 stainless steel. Unit shall lock with a non-corrosive locking bar and have a non-corrosive handle.

2.3 SEWERAGE PUMPS

A. Requirements: Furnish and install two- (2) submersible wastewater pump(s). Pumps shall be equipped with submersible electric motors and 25-feet of submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards. Each pump shall be fitted with 25-feet of stainless steel lifting cable.

B. Pump Design: The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well.

Provide the following information for each pump.

Capacity (GPM) _____
Total Dynamic Head (FT) _____
Total Static Head (FT) _____

C. Pump Construction: Major pump components shall be of gray cast iron, ASTM A-48, Class 30B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All exterior metal surfaces coming into contact with the sewerage, that are not stainless steel or brass, shall be protected by a factory applied spray coating of alkyd primer and a synthetic resin enamel finish.

D. O-Rings: All O-Rings shall be of Nitrile Rubber. The lifting handle shall be galvanized steel. Cast iron impellers shall be sprayed with primer.

E. Motor:

1. The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, and NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 155°C (311°F). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of

40°C (104°F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. The motor and pump shall be designed and assembled by the same manufacturer.

2. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

F. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.Bearings: The pump shaft shall rotate on two single row ball bearings. Motor bearings shall be permanently grease lubricated.

G. Pump Shaft: Pump and motor shaft shall be the same unit. The motor shaft shall be composed of carbon steel under the rotor laminations and the pump shaft shall be of stainless steel. The pump shaft is an extension of the motor shaft; couplings shall not be acceptable.

H. Impeller: The Impeller(s) shall be of gray cast iron, dynamically balanced, open vortexing design.

I. Volute: Pump volute(s) shall be single-piece gray cast iron, Class 30B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Wear rings shall not be required. Minimum inlet and discharge size shall be as specified.

2.4 SEWERAGE PUMP APPENDATURES

A. Cable Seal Entry: The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. A JUNCTION BOX SHALL BE COMPLETELY SEALED OFF FROM THE PUMPED MEDIA. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

B. Automatic Discharge Connection: Each pump shall be furnished with a submersible discharge connection system to permit removal and installation of the pump without the necessity of an operator entering the wet well. The design must insure an automatic and firm connection of the pump to the discharge piping when lowered into place.

C. Base plate: A gray iron cast base with integral guide rail pilots shall be provided along with all hardware and anchor bolts required for permanent installation to the wet well floor. The base shall be designed with an integral 90° elbow, or adapt to a commercially available elbow for connection to the vertical discharge piping utilizing standard ANSI 125 lb. flanges. The base shall be mated with mal tar epoxy for corrosion resistance. The manufacturer shall provide all necessary drawings to insure proper installation and alignment of base plate within the sump.

D. Discharge Connection: Each pump shall be provided with a replaceable ductile iron slide rail guide shoe attached to pump discharge flange. A replaceable neoprene seal shall be provided as an integral part of the guide shoe to form a seal with the base plate connection and eliminate the possibility of leakage and erosive wear during operation. The seal shall contact mating faces in a static position and shall have adequate flexibility to flex under pumping pressure to increase seal efficiency. Metal-to-metal contact at the discharge connection shall not be acceptable.

E. Guide Rail System and Method of Operation: Two (2) lengths of pipe 1¼ inch, schedule 40, 304 stainless steel guide-rail shall be furnish and install for each pump. Upper guide rail pilots, and a lifting cable shall be furnished and installed for each pump. Bottom pilots shall be an integral part of the base plate for ease of installation and proper alignment. The guide shoe shall direct the pump down two vertical guide rails and onto the discharge connection in a simple lineal movement. The buildup of sludge and grease on guide rails shall not present problems during the lifting operation. The guide shoe shall be designed with integral hooks at the top to transmit full weight of the pumps to the base plate flange. No portion of the pumps shall be supported directly on the bottom of the wet well, guide rails, or lifting cable. The lifting cable shall consist of a stainless steel braided wire cable attached to the pump lifting bails. An eyelet shall be provided at the upper end of this cable for attaching to the wet well access frame. All bolts, machine screws, nuts, washers, and lock washers for complete assembly of access cover, guide rails, and discharge elbow shall be 304 stainless steel.

2.5 SPARE PARTS

A. The following minimum spare parts shall be furnished with the pumping stations:

1. Two (2) spare mechanical pump seals (complete), and with it, all gaskets, seals, sleeves, O-Rings and packing required to be replaced during replacement of the seal.

2. Two (2) sets of impeller clearance adjustment shims

3. Two (2) quarts of seal lubricant

2.6 VALVES AND PIPING

A. Check Valves (non-submerged) located Horizontally or Vertically (2½-inches and smaller): Check valves installed on SDR25 PVC, Schedule 40 black or galvanized steel and cast or ductile iron pipelines, which are 2½ inches and smaller shall be swing checks with bronze body, screwed and rated for 150 psi WSP and 300 psi WOG.

B. Check Valves (non-submerged) located Horizontally (3-inches and greater): Check valves installed on SDR25 PVC, Schedule 40 black or galvanized steel and cast or ductile iron pipelines 3-inches in diameter and larger shall be flanged, iron body, bronze mounted, single disk, full flow type swing check valves with rubber to metal seating. Valve clapper shall be cast iron, bronze face, and shall swing completely clear of waterway, when valve is fully open. Horizontal Check Valves shall be supplied with outside lever and weight.

C. Gate valves installed on SDR 25 PVC, Schedule 40 black or galvanized steel, and cast or ductile iron pipelines, 3-inches in diameter and larger shall be flanged, iron body, bronze mounted, double disk, parallel seat outside-screw-and-yoke type gates with wheel operator. Gate valves shall conform to the material requirements of AWWA Specification C500, Federal Specification WW-V-58b, Type II, Class I and shall be designed for 150 psi working pressure, 300-psi hydrostatic test

pressure, non-shock. Flanges shall be B16.1/125 lb. Holes maybe either drilled or tapped for threads to suit individual installation requirements.

D. Gate valves installed on SDR 25 PVC, Schedule 40 black or galvanized steel, and cast or ductile iron pipelines 2 ½ inches and smaller shall be solid wedge disc, rising stem, with bronze body, screwed and rated for 150 psi WSP and 300 psi WOG. All bronze gate valves shall meet Federal Specification WW-V-51 F, Type IV, Class B.

E. Piping:

1. All piping within the pumping stations shall be flanged Class 51 ductile iron pipe and fittings, complying with ANSI A21.6 (AWWA C101), Class 22 thickness, and ANSI A21.1. Division 15. (Refer to Section 02610 and 02611).

2. Flanges shall be Class 125 and complying with ANSI B16.1.

3. Pipe and flanges shall be threaded to ANSI B2.1 pipe thread and suitable thread sealant applied before assembling flange to pipe.

4. Flanged-to-flexible connection devices shall be provided for each discharge connection, to relieve misalignment and stresses.

F. Discharge Pressure Gages: A tap with stopcock and oil filled diaphragm shall be provided for the discharge pressure gage shown on drawings. Each Pumping Station shall be equipped with a discharge pressure gage suitable for full submergence in sewerage and installed with a ½ inch bronze isolating stopcock and oil filled stainless steel diaphragm. The gauge shall be at least 2½-inches in diameter and graduated from 0 to 60 psig, and be clearly visible from the access hatch. All gages shall have a shatter resistant tempered glass face and be completely watertight and suitable for submergence.

G. All buried pipe connections to pump station shall have a sleeve type connection with restraining glands.

H. All pipes shall be adequately supported to resist thrust.

I. All pipelines shall be pressure tested for water tightness.

J. Transition Couplings:

1. The pipe couplings shall be of a gasketed, sleeve-type with outside diameter to properly fit the pipe. Each coupling shall consist of one (1) carbon steel middle ring 5 inches in length, two (2) ductile iron followers, two (2) rubber-compounded wedge section gaskets and sufficient track-head steel bolts to properly compress the gaskets.

2. The middle ring and followers of the coupling shall be true circular sections free from irregularities, flat spots or surface defects. They shall be formed from mill sections with the follower-ring section of such design as to provide

confinement of the gasket. After welding, they shall be tested by cold expanding a minimum of 1% beyond the yield point.

3. The coupling bolts shall be of the elliptical-neck, track-head design with rolled threads. The manufacturer shall supply information as to the recommended torque to which the bolts shall be tightened. All boltholes in the followers shall be oval for greater strength.

4. The gaskets of the coupling shall be composed of a crude or synthetic rubber base compound with other products to produce a material which will not deteriorate from age, from heat, or exposure to air under normal storage conditions. It shall also possess the quality of resilience and ability to resist cold flow of the material so that the joint will remain sealed and tight indefinitely when subject to shock, vibration or other adjustment of the pipeline.

5. The coupling shall be assembled on the job in a manner to insure permanently tight joints under all reasonable conditions of expansion, contraction, shifting, and settlement, unavoidable variations in trench gradient, etc. The coupling shall be Dresser; Style 162, as manufactured by Dresser Manufacturing, Bradford, PA, or equal and the necessary quantity shall be furnished.

2.7 ELECTRICAL CONTROL COMPONENTS

A. Automatic Controls:

1. The control and operation of the pumps shall be by means of a conductance actuated control system, which shall sense the wet well level, the run position of the pumps (on/off), the actuate alarms, and the set elevations.

2. The controls shall be arranged to start and stop the lead and lag pumps at the wet well levels indicated on the Drawings.

3. Motor Starters.

4. All starters shall have thermal overload protection in each phase.

5. The pump controls shall include a solid state, adjustable time delay relay to prevent both pumps starting simultaneously after a power failure. Time delay shall be continuously adjustable from .1 to 10 seconds.

6. A six digit, non-resetable, run time meter reading 0.1 hour increments shall be furnished at record operation of each pump individually and both pumps when running simultaneously.

7. "Run" and "Ready to Run" transformer type indicator lights shall be provided for each pump. Lights shall be controlled by means of motor started auxiliary contacts.

8. Two (2) intrinsically safe barriers shall be supplied and each shall be furnished in the control panels at the pumping stations.

9. A manual reset and silence alarm system shall be furnished and installed as specified.

10. The alarm system shall activate indicator lights located in the control panel with a flashing outside light and bell for any of the following conditions:
    a) High water - Wet Well
    b) Low water - Wet Well
    c) Loss of power supply
    d) Phase failure
    e) Pump seal failure
    f) Motor thermal overload trip

11. An indicator light shall be provided for each of the above conditions with manual reset button. The interruption of normal power, transfer to battery backup, and retransfer to normal power after its restoration shall not change alarm indicator light status.

12. The exterior alarm light, bell, and alarm indicator lights shall be powered by means of a suitable 12-volt D.C. power supply with standby battery pack. Lead-calcium type batteries shall be supplied. The battery pack shall have sufficient capacity to power the load for a period of 8 hours at a battery voltage not below 87 1/2% of nominal voltage. The batteries shall be protected from excessive discharge by an automatic low voltage battery cut out circuit. Cut out to be at least at 85% of nominal battery voltage. Connect power supply to dedicated 120V, 20 A circuit. Provide sizing calculations with submittal.

13. Power supply shall provide means for keeping the battery pack at constant state of full charge readiness. Power supply shall have capacity to recharge batteries to full charge within 16 hours even under an alarm condition.

14. The outside light shall be a weatherproof, vandal proof bracket fixture with red polycarbonate globe. The outside light shall be a strobe type, 12-volt and shall be Federal Signal 131 series or equivalent.

15. The alarm bell shall be vibratory, weatherproof type, have a vandal resistant guard, and be rated for 12 volt DC operation. Bell shall be Federal Signal 600 series or equivalent.

16. Each alarm point shall be provided with an auxiliary relay and all relay contacts shall be wired independently to a terminal strip for field wiring to a dialer. Power failure alarm circuitry shall be tied into a telephone dialer system and wired to automatically call the responsible person if the modem fails to respond in 10 minutes. The terminal strip shall provide terminals for a test switch to simulate alarm conditions.

17. Independent high and low level float switch alarms shall be wired through intrinsically safe relays to the pump control panel. These float switches shall provide Independent pump control if the conductance probe fails.

B. Control Panel:

1. All electrical equipment necessary for the automatic controls and alarm systems as specified shall be mounted within a common NEMA Type 4X SS enclosure with stainless steel hardware, along with all electrical equipment specified in this section. Panel shall contain U/L label as a custom control system based on its components and assembly.

2. The enclosure shall be provided with a suitable lockable-hinged access door and quick open stainless steel latching devices (screwed or bolt type devices are unacceptable.)

3. The NEMA 4X control panel shall have a hinged dead front with SEPERATE NEMA 1 enclosures to house individual control circuitry. The NEMA 1 enclosures shall have cutout faces to allow operable management of the control displays and keypads. Grouped together inside the NEMA 4X enclosure, convenient to the operator, shall be all circuit breaker handles with lockouts, selector switches, alarm silence switch, indicator lights, all reset buttons, run time meters, flow meter signal converter, LCD display, and 120 volt 20 amp weather proof convenience outlet. All devices shall be clearly labeled. The main circuit breaker and individual pump circuit breakers shall have operating handles mounted through an inner NEMA 1 enclosure and shall have a lock arrangement that prevents the inner door from being opened when the breaker is in the ON position. Switches shall be padlockable "OFF".

4. Control panel circuitry and electrical switchgear housed in NEMA 1 enclosures shall be mounted securely to 3/4-inch plywood backboards, which in turn shall be mounted to 6 inch by 6-inch posts as shown on the Drawings.

5. Plywood shall be 3/4-inch thick Marine grade EXT - APA. Trim all edges with 1/4 inch by 3/4-inch solid pine glued and nailed. Paint backboard with one coat exterior primer and two coats of exterior acrylic latex paint.

6. 6 inch by 6-inch post shall be standard pressure treated (0.4 PCF CCA) dimension lumber.

7. All fastenings shall be hot dipped galvanized. No cut edges after galvanizing or cadmium plated fittings will be permitted.

8. Thermal-magnetic circuit breakers shall be provided for each motor, control, and auxiliary circuit and one for incoming power. Provide 20 amp, 120-volt circuit breaker shall be sized according to the ampacity of the conductors. All branch breakers shall be sized per the National Electrical Code.

9. Provide a 120-volt, 20-ampere duplex ground fault type weatherproof receptacle mounted inside the panel to be supplied through its own separate circuit breaker.

10. Panel shall be furnished with one 230/120 volt, single phase, three wire, 60 Hz, power feeder. Provide surge arrestors sized according to feeder size. Supply all control and power transformers necessary to make panel functional. All transformers shall have both primary legs and all "hot" secondary legs fused. One secondary leg shall be grounded.

11. Provide phase failure protection for motors by providing one relay to monitor incoming line and a cut out for each pump. Provide other auxiliary contacts as specified herein. Phase failure relay shall be adjustable time delay type.

12. A terminal strip with box type connectors shall be supplied to make all power and control connections. All terminals shall be clearly marked for easy identification. A ground terminal strip shall also be provided. At least 20 percent of terminals supplied shall be spare.

13. A complete panel-wiring diagram shall be encased in a clear reseal able plastic pouch and shall be mounted on the inside surface of the access door.

14. The outside alarm light shall be mounted on the top of the panel and the bell on the side of the panel, unless otherwise indicated on the Drawings. Mounting shall be in such a way as to permit easy removal in the event of failure and yet maintain the NEMA rating of the panel. 120-volt AC pilot lights shall be transformer type.

15. Indicator lights within the control panel shall be heavy duty, oil tight type with glass lenses. They shall be provided with chrome-plated metal or anodized aluminum mounting rings and nameplates.

16. Control panel enclosure shall be insulated on the inside of all exterior surfaces with 1" thick rigid fiberglass insulation having a maximum thermal conductivity ("k" value) of 0.35 BTU -in/hr-ft^2 -°F. The insulation shall be finished with manufacturer's standard all service jacket (ASJ). Coverings containing foil will not be acceptable.

17. Control panel shall come equipped with a built-in heater and adjustable thermostat. Heater shall be sized to maintain 40°F inside panel with an outside ambient temperature of -20°F and a 15-MPH wind. The heater shall include a means of mechanically circulating the air within the enclosure to prevent hot spots. Thermostat shall measure air temperature, not surface temperature. Heater shall be similar to Hoffman Engineering Co. Series D-AH or approved equal.

18. Panel must be fitted with a grounded barrier between power and intrinsically safe circuits.

19. Suggested Spare parts:

a) Two (2) Control switches of each type complete with contact blocks.
b) Twenty (20) indicator lamp bulbs.
c) Two (2) O/L Blocks.
d) Two (2) Strobe bulbs.

20. Parts shall be inside panel contained in such a way to protect from breakage.

21. Motor starters shall be FVNR type, 120-volt control, complete with overload protection. Overload relay shall have a N.O. isolated contact (close on trip) to activate alarm indicator on panel and provide output to City's remote dialer. Motor starters shall be size 1 as a minimum. Half size rated starters will not be approved.

22. Auxiliary relays shall be Allen Bradley 700F style (not plug-in), or approved equal.

C. Wiring:

1. The pumping station control panels shall be completely wired at the factory in accordance with the latest edition of National Electrical Code.

2. All wiring in the pumping station control panels shall be color coded and numbered and indicated on the wiring diagram, by the manufacturer.

3. All wiring outside the panel shall be in rigid conduit to the wet well. Provide insulated connecting cable consistent with Class I Division 1, Group D hazardous locations in the wet well. Conduit seals shall be installed at the control panel outlet. Sewerage pump motors shall have leads installed at the control panel outlet. Sewerage pump motor shall have leads installed in liquid-tight flexible cable.

4. Sufficient flexible conduit shall be provided on the motors to allow the motors to be removed without detaching the power leads.

5. A one-line schematic diagram on the Drawings indicates the electrical service of the pump stations.

PART 3 - PART 3 – EXECUTION

3.1 INSTALLATION

A. Installation of the submersible vortex pumping stations and related appurtenances shall be done in accordance with written instructions provided by the submersible vortex pumping station manufacturer.

B. The Contractor shall provide for the supervisory service of the submersible vortex pumping stations. This shall include manufacturer's factory trained engineer and other personnel, who are specifically trained on the type of equipment supplied to assist the Contractor in installation of the pumping stations, and related appurtenances.

C. The completed pumping stations shall be given a test of all equipment to check for excessive vibration, for leaks in the piping or seals, and for correct operation of all auxiliary equipment. All adjustments shall be made so that the station is ready for operation.

D. A factory-trained engineer shall instruct operating personnel in the operation and maintenance of the equipment.

E. Exfiltration Test Prior to Backfilling.

3.2 FIELD QUALITY CONTROL

A. After installation of the equipment is complete, the Contractor will operate and test each unit in the presence of the Town.

B. The Contractor shall provide all labor, piping, equipment, and materials necessary for conducting tests.

C. The Contractor shall check the motors and insulation for moisture content and defects.

D. The Contractor shall operate each pump unit to demonstrate its ability to pump without excessive vibration, motor overloading, or overheating. During the test the Contractor shall record head, capacity, and motor input at the various rating points specified.

E. Each pump shall be operated for a sufficient period to permit thorough observation of all pump components and to check for correct operation of the automatic control system and auxiliary equipment. The automatic controls shall be adjusted under such actual operating conditions to start and stop the pumps at the approximated levels required by the conditions. A 24-Hour operating period shall be required before acceptance.

F. Since sufficient sewerage will not be available for the test, Contractor shall provide water for testing.

G. After installation, all piping shall be tested for tightness in an acceptable manner. Should leaks be found, faulty joints shall be repaired, even to the extent of disassembling and remaking the joint, and all defective pipe and fittings shall be removed and replace in a manner satisfactory to the Town.

H. Repeat tests until results obtained meet the Town's approval.

3.3 FINAL ADJUSTMENT

A. Make all adjustments necessary to place equipment in satisfactory working order made at the time of testing.

3.4 START-UP SERVICE

A. The Contractor shall make certain that permanent electrical power is properly installed into the station control panels, the entrance switch functions and all items of equipment shipped loose are properly and permanently installed.

B. The Contractor shall then arrange for the services of a representative of the stations manufacturer to check the installation, place the stations into operation, and give operating and maintenance instructions. The contractor shall notify all firms involved in the station installations and request that they have a representative in attendance for start up.

The station manufacturer shall provide the services of a factory trained representative for a period of one day at the pumping stations to perform initial start up of the pumping stations and to instruct operating personnel in the operation and maintenance of the equipment and to demonstrate satisfactorily the performance of each piece of equipment.

18. STANDBY GENERATOR

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work under this section includes the furnishing and installation of a standby generator system for each pump station site.

1.2 QUALITY ASSURANCE

A. Manufacturer: Provide system from one (1) manufacturer.

B. Warranty: Five (5) year comprehensive extended coverage warranty from date of installation on entire standby power system by the system manufacturer, inclusive of parts, labor, travel expenses, etc., without deductibles.

C. NEC Compliance: Comply with applicable standby generator requirements of NEC.

D. NFPA Compliance: Comply with applicable requirements of NFPA requirements of NFPA 37, "Installation and Use of Stationary Combustion Engines and Gas Turbine". Also fully conform to NFPA 110, "Emergency and Standby Power Systems".

E. UL Compliance: Provide standby generator components which are UL listed and labeled.

F. ANSI/NEMA Compliance: Comply with applicable requirements of ANSI/NEMA MG 1, "Motors and Generators", and MG2, "Safety Standards for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators".

G. IEEE Compliance: Comply with applicable portions of IEEE Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to standby power.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data, operation and maintenance instruction, and manufacturer's product warranty.

B. Shop Drawings: Submit dimensioned DRAWINGS and wiring diagrams of generator units and accessories including start-stop stations, and instruments,

showing accurately scaled generator set layout and its spatial relationship to associated equipment, and connections to remote equipment. Provide manufacturers computer size verification for each unit per loads as indicated in 2.1 B. below.

PART 2 - PRODUCTS

2.1 GENERAL SYSTEM REQUIREMENTS

A. Pump Station Buildings

1. Generator shall start one pump, then provide power to other components (Step #1).

2. Start second pump (step #2).

3. System Components: Provide entire system furnished by generator manufacturer.

   a. Propane (LP) gas or Diesel engine driven generator.
   b. Engine start/stop controls.
   c. Automatic transfer switch.
   d. Mounted accessories as specified.
   e. Properly sized black plastic nameplates with engraved white letters to identify all relays, components, etc.

4. Performance Certification: Provide certification of the following by an independent testing lab:

   a. Full power rating.
   b. Stability.
   c. Voltage and frequency regulation.
   d. All other certification per NFPA 110.

5. Starting Capability: Unit capable of starting after extended periods at -25°F.

6. Harmonic Interferences: Voltage register & electronic governor shall be designed to be immune to SCR and other non-linear load interferences. Generator shall be capable of full capacity with load harmonic distortion caused by SCR and other non-linear loads.

2.2 STANDBY GENERATORS

A. Provide Onan generators or approved equal by Caterpillar.

B. Controls: Generator mounted control panel for unit with panel lights, safety devices, and engine starting controls which include, but are not limited to:

1. Battery charge rate ammeter
2. Oil pressure gauge
3. Water temperature gauge
4. Run-stop-remote switch
5. AC voltmeter
6. Voltage adjusting rheostat
7. High water temperature cutout
8. Emergency latch-relay with manual reset and indicator light
9. Cranking limiter
10. Manual reset circuit breaker (NEMA 1)
11. Automatic overspeed shutdown
12. Control contacts to control inlet and outlet air dampers

NOTE: The Contractor shall include the ONAN Power Command Control, microprocessor-based digital control system on each machine (unless the manufacturer indicated in writing that this feature will not be made available due to machine rating).

B. Equipment: Provide the following for each unit.

1. Muffler, critical
2. Flexible seamless exhaust connection - insulated
3. Vibration isolators
4. Lube oil filter
5. Fuel filters
6. Battery cables
7. Battery rack
8. Battery charger, float type
9. Air cleaner
10. 12 volt, heavy duty, cold weather starting battery
11. Air discharge duct adapter
12. Block heater
13. Flexible fuel supply and/or return line connections

14. Engine coolant level switch cutout
15. Main output circuit breaker – U/L listed and labeled for Service Entrance Duty.

2.3 AUTOMATIC TRANSFER SWITCH

A. General: UL listed (standard 924) for all classes of load.

B. Operation:

1. Sequence as follows:

   a. Sense complete loss of power on any phase and signal generator to start.
   b. When emergency attains a minimum of 90% of rated speed and voltage, transfer load to emergency power.
   c. Transfer load to normal power when normal power is restored; signal generator to stop.
   d. Note: It is intended that transfers shall incorporate a "dead band" time in the neutral position in all operations.

3. Obtain operating current for load transfer from source to which load is to be transferred.

4. Emergency power malfunction: Automatically disconnect load to allow generator to restart with no connect load. Reconnect emergency power when 90% of rates speed and voltage is attained.

E. Features:

1. Disconnect device: Device to electrically disconnect control section from transfer switch to permit safe access for maintenance or service during normal operation.

2. Test switch: Simulate power outage for operational test of engine, alternator and load transfer control.

3. Float type battery charger: Fused with adjustable charge rate with milliammeter.

4. Cranking limiter: (24/12 volt, 2 wire start) fail to start protection for generator starting system.

5. Operation and selector switch; (24/12 volt, 2 wire start) fail to permit operation of generator at the control site. Provide check, stop, automatic and handcrank functions.

6. Undervoltage Protection: Monitor normal power source and start emergency power on partial loss of power on any phase where feedback voltages exist. Provides devices: solid-state voltage sensitive, calibrated dial adjustment, temperature compensated for a maximum deviation of +/- 2 volts from -25°F to +175°F.

7. Time delay to start emergency power: Provide to prevent emergency power from starting during normal voltage fluctuations, adjustable from 1.5 to 15 seconds.

8. Time delay to pick up load: Provide to allow emergency power to operate for a period of time before accepting load, adjustable 5 to 50 seconds.

9. Time delay to retransfer load:

    a. Provide to delay transfer of load to normal power to override initial voltage fluctuations of returning normal power and to provide a minimum period of operating time for emergency power.
    b. Bypass time delay if emergency power fails during delay period; retransfer load immediately to normal power.
    c. Adjustment: 2 to 60 minutes

10. Time delay to stop emergency power: Provide to allow engine to run unloaded before being shut down after load has been retransferred to normal power, adjustable 2 to 60 minutes.

11. Indicating lights: Provide an enclosure door, label to indicate transfer switch position.

    a. Green - normal source
    b. Red - emergency source

12. Automatic engineer exerciser: Provide built-in to exercise generator weekly for adjustable time periods. Loads to be transferred under exercise mode. Provide circuitry to inhibit "Power Failure" and/or "Generator Run" alarm annunciation under automatic exerciser operation - unless both conditions do simultaneously exist.

13. Provide added auxiliary contacts rated not less than 10 Amperes at 120v AC for purposes required below. Contacts shall be N.O. or N.C. as required for control interface.

    a. Alarm
    b. Field Assigned use (1)
    c. Spare (2)

14. Note: Transfers to emergency and from emergency to normal shall have a deadband period to ensure residual voltages have decayed before new power source is applied.

F. Rating and Performance

1. Continuous duty in non-ventilated NEMA 1 enclosure.

2. Load: All classes of load including inductive and non-inductive at 600 volts; tungsten lamp load at 250 volts.

3. Close on inrush current of 20 times continuous rating without welding or excessive burning of the contacts.

4. Load switching capability: 15 times continuous rating.

5. Cycles of operation: 600 cycles at rated current at a rate of 6 cycles per minute. One cycle: One complete opening and closing of both sets of contacts in inrush current 10 times continuous rating.

G. Withstand Ratings:

1. Switch withstand rating based on manufacturer's published U/L listing of acceptable protective devices (which limit any fault currents to within switches published withstand rating) must be provided. Contractor and vendor must provide written certification that new circuit protective devices ahead of the transfer switches provide proper protection. If they do not do so, the required appropriate devices will be provided and installed under this specification section.

H. Construction:

1. General: No wearing surfaces or moving parts requiring routing lubrication or maintenance.

2. Enclosure: NEMA 1 for indoor installation; key operated door locks, swing-out service panel, pre-punched for future addition of control components.

3. Interlocking: Mechanical and electrical interlocking to prevent simultaneous energizing of load by normal and emergency power.

4. Contacts: Double break design for fast arc suppression, solid silver cadmium, completely enclosed in heat resistant contact chambers.

2.4 GENERATOR EXHAUST

A. Provide generator exhaust in compliance with manufacturers recommendations. Solid, seamless, welded piping system. Use long radius bends only. Provide condensate trap with drain petcock. Provide ventilated thimbles through ceilings and walls. Provide insulation to all exposed exhaust pipe surface inside the generator building.

2.5 MISCELLANEOUS

A. Anchor Bolts: Galvanized steel, as recommended by the generator manufacturer.

2.6 FUEL SYSTEM

A. General Contractor to coordinate with Owner's designated fuel supplier. Tank shall be selected by these parties to provide a minimum of 24 hour generator operation at full load with an outdoor ambient temperature of -20° F. Generator Manufacturer's representative shall assist in sizing storage facility if requested to do so.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated, in accordance with the equipment manufacturer's written instructions, and with recognized industry practice. Comply with NFPA and NEMA standards.

B. Coordinate with other WORK, including fuel tanks, piping and accessories.

C. Connect fuel piping to standby generator equipment as indicated, and comply with manufacturer's written instructions where not otherwise indicated. Flexible connections are required.

D. Provide initial fuel tank fill after all tests are complete.

E. Provide initial radiator fill with glycol mixture set for -30°F or lower.

3.2 GROUNDING

A. Provide equipment grounding of engine-generator system in accordance with applicable sections of National Electric Code.

3.3 TESTING

A. After building circuitry has been energized with normal power source, test engine-generator to demonstrate standby capability and compliance with requirements. Correct malfunctioning units, then retest to demonstrate compliance. Test shall conform to NFPA 110 requirements for system specified. If field load bank test is not required, manufacturer must provide factory test reports or a unit of the same rating and model as is provided for the project.

APPENDIX A

Town of Eliot Application to Connect to Sewer

Town of Eliot
Connection to Public Sewer Application

Tax Map # _____

Lot # _____

PROPERTY ADDRESS:

_____

OWNERS NAME:

_____

ADDRESS:

_____

TELEPHONE # CELL PHONE #

_____

EXISTING USE OF PROPERTY:

	VACANT LOT
	SINGLE FAMILY HOME
	DUPLEX OR MULTI # APTS _____
	OTHER

PROPOSED USE OF PROPERTY:

	SINGLE FAMILY
	ADU
	DUPLEX OR MULTI # APTS _____
	OTHER

	SYSTEM DEVELOPMENT CHARGE (SDC)	
	INSPECTION FEE	

DATE PAID: _____ CHK NUMBER: _____ TOTAL PAID: _____

_____ DATE: _____

PROPERTY OWNER/REPRESENTATIVE

_____ DATE: _____

CEO AUTHORIZED SIGNATURE

INSPECTION DATE: _____

C/O DATE ISSUED: _____

INSPECTED BY: _____

Sewer Account #: _____

Quarterly Billing to Begin: _____

APPENDIX B

Sewer Service Lateral Tie Sheet

Street Address:_____
Date Installed:_____

SEWER LATERAL DATA SHEET

Job Title: _____
Owner: _____
Contractor: _____
Street: _____

Lateral to Serve_____
STA_____ Length_____
Size_____ Material_____
_____(LF) from down/up stream manhole #_____

1. Connection to Main Sewer: Wye _____ Chimney _____ (VF) Other _____
   Sewer Main: _____

2. General Comments:_____
   _____
   _____
   _____
   _____

3. Sketch (Location End and Depth Lateral). A minimum of THREE ties to permanent structures are required.

CHECKS AND APPROVED

_____ Owner's Representative

_____ Contractor's Representative

APPENDIX C

Town of Eliot Standard Details

STANDARD MANHOLE NOTES:

1. IT IS THE INTENTION THAT THE MANHOLE, INCLUDING ALL COMPONENT PARTS, HAVE ADEQUATE SPACE, STRENGTH, AND LEAKPROOF QUALITIES CONSIDERED NECESSARY BY THE MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION (MDEP) FOR THE INTENDED SERVICE. SPACE REQUIREMENTS AND CONFIGURATIONS SHALL BE AS SHOWN ON THE DRAWING. MANHOLES MAY BE AN ASSEMBLY OF PRECAST SECTIONS, WITH STEEL REINFORCEMENT. IN ANY APPROVED MANHOLE, THE COMPLETE STRUCTURE SHALL BE OF SUCH MATERIAL AND QUALITY AS TO WITHSTAND LOADS OF 8 TONS (H-20LOADING) WITHOUT FAILURE, AND TO PREVENT LEAKAGE, CONTINUOUSLY FOR THE LIFE OF THE STRUCTURE. A PERIOD GENERALLY IN EXCESS OF 50 YEARS IS TO BE UNDERSTOOD IN BOTH CASES.

2. BARRELS AND CONE SECTIONS: SHALL BE PRECAST REINFORCED CONCRETE.

3. PRECAST CONCRETE: BARREL SECTIONS, CONES, AND BASES SHALL CONFORM TO ASTM C478.

4. LEAKAGE TEST: SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIFICATIONS. INVERT AND SHELF TO BE PLACED AFTER LEAKAGE TEST.

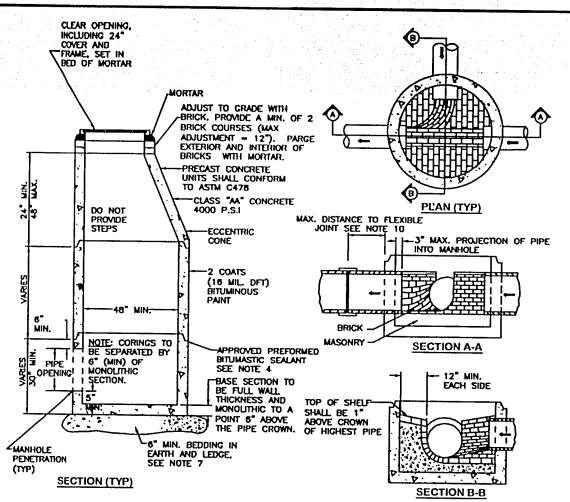
5. INVERTS AND SHELVES: MANHOLES SHALL HAVE A BRICK PAVED SHELF AND INVERT, CONSTRUCTED TO CONFORM TO THE SIZE OF PIPE AND FLOW. CARE SHALL BE TAKEN TO INSURE THAT THE BRICK INVERT IS A SMOOTH AND CONTINUATION OF THE SEWER INVERT. INVERT BRICKS SHALL BE LAID ON EDGE. AT CHANGES IN DIRECTION, THE INVERTS SHALL BE LAID OUT IN CURVES OF THE LONGEST POSSIBLE TANGENT TO THE CENTER LINE OF THE SEWER PIPES. SHELVES SHALL BE CONSTRUCTED TO AN ELEVATION OF 1" ABOVE THE HIGHEST PIPE CROWN AND SLOPE TO DRAIN TOWARD THE FLOWING THROUGH CHANNEL. UNDERLAYMENT OF INVERT AND SHELF SHALL CONSIST OF BRICK MASONRY.

6. FRAMES AND COVERS: MANHOLE FRAMES AND COVERS SHALL BE OF HEAVY DUTY DESIGN, MANUFACTURED IN USA, AND PROVIDE A 24-INCH CLEAR OPENING. A 3-INCH (MINIMUM HEIGHT) LETTER "S" FOR SEWERS SHALL BE PLAINLY CAST INTO THE CENTER OF EACH COVER. ACCEPTABLE ALTERNATIVE INCLUDES PAMREX FRAME AND COVER BY CERTAINTEED.

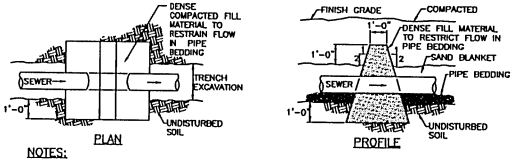
7. BEDDING: SCREENED GRAVEL AND/OR CRUSHED STONE FREE FROM CLAY, LOAM, ORGANIC MATTER AND MEETING ASTM C33. STONE SIZE NO. 67.
   100% PASSING 1 INCH SCREEN — 0-10% PASSING #4 SIEVE
   90-100% PASSING 3/4 INCH SCREEN — 0- 5% PASSING #8 SIEVE
   20- 55% PASSING 3/8 INCH SCREEN
   WHERE ORDERED BY THE ENGINEER AND APPROVED BY THE TOWN TO STABILIZE THE BASE. SCREENED GRAVEL OR CRUSHED STONE 1-1/2 INCH TO 1/2 INCH MAY BE USED.

8. SHALLOW MANHOLE: IN LIEU OF A CONE SECTION, WHEN MANHOLE IS LESS THAN 6 FEET, A REINFORCED CONCRETE SLAB COVER HAVING AN ECCENTRIC ENTRANCE AND CAPABLE OF SUPPORTING H-20 LOADS MAY BE USED.

9. FLEXIBLE JOINT: A FLEXIBLE JOINT SHALL BE PROVIDED WITHIN THE FOLLOWING DISTANCES:
   RCP AND CI PIPE - ALL SIZES - 48"
   AC AND VC PIPE - UP THROUGH 12" DIA. - 18"
   AC AND VC PIPE - LARGER THAN 12" DIA. - 36"
   DI PIPE - NONE REQUIRED
   PVC (ASTM 3034) - UP THROUGH 15" DIA. - NONE REQUIRED
   PVC (ASTM F679) - LARGER THAN 15" DIA. - 48"/60"
   PVC (ASTM F789) - ALL SIZES - 48"/60"
   ABS (ASTM D2680) - ALL SIZES - SAME AS VC ABOVE.

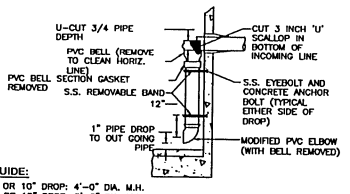


SEWER MANHOLE
NOT TO SCALE



NOTES:
1. TRENCH DRAINS TO BE AT LOCATIONS SHOWN ON THE PLAN OR AS DIRECTED TO CONTROL BACK WATER IN STONE BEDDING.
2. A RELIEF DRAIN PIPE SLOPED AND OUTLETTED TO AN APPROPRIATE SURFACE DRAINAGE COURSE SHALL BE INSTALLED FROM THE UPSTREAM SIDE AT THE TRENCH DAM.

TRENCH DAM
NOT TO SCALE



SIZE GUIDE:
1-8" OR 10" DROP: 4'-0" DIA. M.H.
2-8" OR 10" DROP: 5'-0" DIA. M.H.
1-12" DROP: 5'-0" DIA. M.H.
1-15" DROP: 5'-0" DIA. M.H.

DROP MANHOLE
NOT TO SCALE

GRAVITY SEWER TRENCH NOTES:

1. ORDERED EXCAVATION OF UNSUITABLE MATERIAL BELOW GRADE: BACKFILL AS STATED IN THE TECHNICAL SPECIFICATIONS OR AS SHOWN ON THE DRAWINGS.

2. BEDDING: SEE NOTE 7 OF STANDARD MANHOLE NOTES.

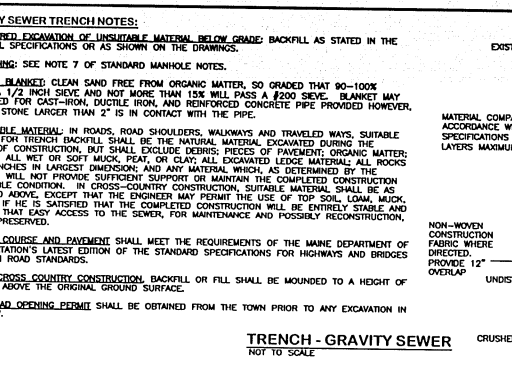
3. SAND BLANKET: CLEAN SAND FREE FROM ORGANIC MATTER, SO GRADED THAT 90-100% PASSES A 1/2 INCH SIEVE AND NOT MORE THAN 15% WILL PASS A #200 SIEVE. BLANKET MAY BE OMITTED FOR CAST-IRON, DUCTILE IRON, AND REINFORCED CONCRETE PIPE PROVIDED HOWEVER, THAT NO STONE LARGER THAN 2" IS IN CONTACT WITH THE PIPE.

4. SUITABLE MATERIAL: IN ROADS, ROAD SHOULDERS, WALKWAYS AND TRAVELED WAYS, SUITABLE MATERIAL FOR TRENCH BACKFILL SHALL BE THE NATURAL MATERIAL EXCAVATED DURING THE COURSE OF CONSTRUCTION, BUT SHALL EXCLUDE DEBRIS; PIECES OF PAVEMENT; ORGANIC MATTER; TOP SOIL; ALL WET OR SOFT MUCK, PEAT, OR CLAY; ALL EXCAVATED LEDGE MATERIAL; ALL ROCKS OVER 6 INCHES IN LARGEST DIMENSION; AND ANY MATERIAL WHICH, AS DETERMINED BY THE ENGINEER, WILL NOT PROVIDE SUFFICIENT SUPPORT OR MAINTAIN THE COMPLETED CONSTRUCTION IN A STABLE CONDITION. IN CROSS-COUNTRY CONSTRUCTION, SUITABLE MATERIAL SHALL BE AS DESCRIBED ABOVE, EXCEPT THAT THE ENGINEER MAY PERMIT THE USE OF TOP SOIL, LOAM, MUCK, OR PEAT, IF HE IS SATISFIED THAT THE COMPLETED CONSTRUCTION WILL BE ENTIRELY STABLE AND PROVIDED THAT EASY ACCESS TO THE SEWER, FOR MAINTENANCE AND POSSIBLY RECONSTRUCTION, WILL BE PRESERVED.

5. BASE COURSE AND PAVEMENT SHALL MEET THE REQUIREMENTS OF THE MAINE DEPARTMENT OF TRANSPORTATION'S LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES AND TOWN ROAD STANDARDS.

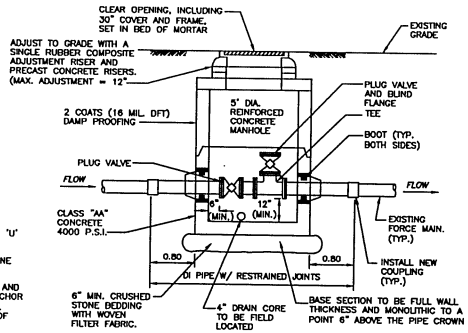
6. FOR CROSS COUNTRY CONSTRUCTION, BACKFILL OR FILL SHALL BE MOUNDED TO A HEIGHT OF 6 INCHES ABOVE THE ORIGINAL GROUND SURFACE.

7. A ROAD OPENING PERMIT SHALL BE OBTAINED FROM THE TOWN PRIOR TO ANY EXCAVATION IN THE R.O.W.

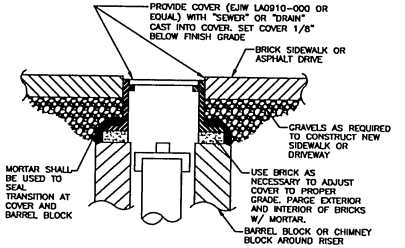


TRENCH - GRAVITY SEWER
NOT TO SCALE

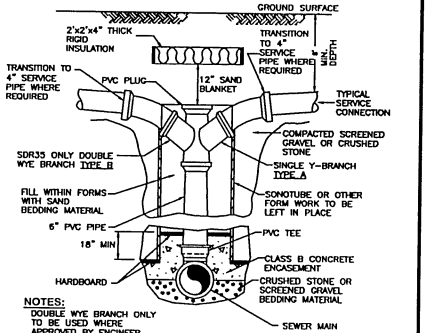
TRENCH SECTION (TYP)



PUMPING STATION BYPASS MANHOLE DETAIL
NOT TO SCALE



CAST IRON COVER FOR SERVICE CLEANOUT IN PAVED AREAS
NOT TO SCALE



NOTES:
DOUBLE WYE BRANCH ONLY TO BE USED WHERE APPROVED BY ENGINEER

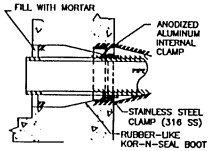
CHIMNEY
NOT TO SCALE

JOINTING AND SEALING NOTES

1. PIPE TO MANHOLE JOINTS SHALL BE ONLY AS APPROVED BY THE ENGINEER AND TOWN AND IN GENERAL, WILL DEPEND UPON AN ELASTOMERIC SEALANT FOR WATERTIGHTNESS.

2. FOR BITUMASTIC TYPE JOINTS THE AMOUNT OF SEALANT SHALL BE SUFFICIENT TO FILL AT LEAST 75% OF THE JOINT CAVITY. APPROVED BITUMASTIC SEALANTS: RAM-NEK E Z KENT SEAL NO.2

3. ALL GASKETS, SEALANTS, MORTAR, ETC., SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS WRITTEN INSTRUCTIONS.



KOR-N-SEAL JOINT SLEEVE (OR EQUAL)

MANHOLE PENETRATIONS
NOT TO SCALE

SERVICE CONNECTION NOTES:

1. SEE DETAILS FOR SERVICE CONNECTION REQUIREMENTS.

2. SERVICE CONNECTION SHALL BE INSTALLED BELOW WATER MAIN WHERE POSSIBLE.

3. CLEANOUTS SHALL BE INSTALLED AT EACH SERVICE CONNECTION.

4. REBAR SHALL BE PLACED AT SIDE OF CLEANOUT.

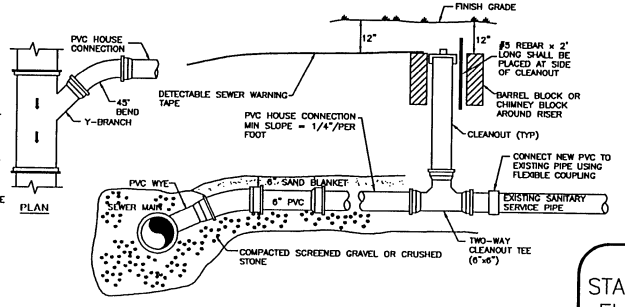
5. CLEANOUT SHALL BE USED TO PLUG AND TEST ALL NEW LATERALS WITH MINIMAL INTERRUPTION TO OPERATION OF HOMEOWNER SANITARY SYSTEM.

6. CLEANOUT RISER PIPE AND FITTINGS SHALL BE INCIDENTAL AND SHALL NOT BE CONSIDERED FOR PAYMENT.

7. CLEANOUTS SHALL BE PLACED EVERY 75 FEET AND AT BENDS IN PIPING.

8. SADDLES SHALL NOT BE USED TO CONNECT SERVICE CONNECTIONS TO THE MAIN. ONLY GASKETED FACTORY JOINTS WILL BE ACCEPTED.

9. A ROAD OPENING PERMIT SHALL BE OBTAINED FROM THE TOWN PRIOR TO ANY EXCAVATION IN THE R.O.W.



SERVICE CONNECTION
NOT TO SCALE

NOT TO SCALE

STANDARD SEWER DETAILS ELIOT MUNICIPAL SEWER SYSTEM	SEWER DETAILS	DATE Feb 2016 FIGURE