Design, Construction & Installation Standards

for

Sanitary Sewer Projects

Norwich Public Utilities
16 South Golden Street
Norwich, CT 06360

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TABLE OF CONTENTS

SECTION 5.0 – SANITARY SEWER PUMP STATION

APPENDIX A – Sanitary Sewer Details

APPENDIX B – Sanitary Sewer Pump Station Details

Acronyms

AC	Acre
ADD	Average Day Demand (water)
ADF	Average Daily Flow (wastewater)
AF/YR	Acre-Feet per Year
ANSI	American National Standards Institute
APWA	American Public Works Association
ARV	Combination Air Release/Vacuum Valve
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BOP	Bottom of Pipe
C	Hazen-Williams Pipe Roughness Coefficient
CD and CDs	Construction Drawing(s)
CFS	Cubic Feet per Second
DA	Development Agreement
DIP	Ductile Iron Pipe
DIPRA	Ductile Iron Pipe Research Association
DP	Design Point
DU	Dwelling Unit
FDC	Fire Department Connection
FF	Fire Flow
FT	Feet
FPS	Feet per Second
GESC	Grading, Erosion and Sedimentation Control
GPAD	Gallons per Acre per Day
GPCD	Gallons per Capita per Day
GPD	Gallons per Day
GPM	Gallons per Minute
GPSD	Gallons per Student per Day
HGL	Hydraulic Grade Line
HP	High Point
I/I	Infiltration and Inflow
IBC	International Building Code
IFC	International Fire Code
INS	Institutional
IPC	International Plumbing Code
IRC	International Residential Code
ISDS	Individual Sewage Disposal System
ISO	Insurance Service Offices
LDP	Land Development Procedures
LP	Low Point
Max	Maximum
Min	Minimum
MDD	Maximum Day Demand
MG	Million Gallon

MGD	Million Gallons per Day
MJ	Mechanical Joint
NAVD	North American Vertical Datum
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
PCWA	Plum Creek Wastewater Authority
PD	Planned Development
PDF	Peak Design Flow or Portable Document Format
PDP	Planned Development Plan
PE	Professional Engineer
PF	Peaking Factor
PHD	Peak Hour Demand
PLS	Professional Land Surveyor
PRK	Park
PRV	Pressure Reducing Valve
PSI	Pounds per Square Inch
PUD	Planned Unit Development
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
RMF	Residential Multi-Family
RSF	Residential Single-Family
SCADA	Supervisory Control and Data Acquisition
SDP	Site Development Plan
SF	Square-Foot; Square Feet
SFE	Single Family Equivalent
SIA	Subdivision Improvement Agreement
STD	Standard
TB	Thrust Block
TOP	Top of Pipe
VFD	Variable Frequency Drive

1.0 GENERAL

1.01 SUMMARY

A. This section includes the material and installation information on sanitary sewer system pipe, force mains, and manholes and appurtenances. Details are included at the end of this section in Appendix A.

1.02 DESIGN REFERENCES

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

B. Sewer Regulations: Sewer Authority of the City of Norwich, Connecticut adopted February 26, 1974, March 27, 1984 and October 16, 2018 and as amended.

C. Specifications for Design and Construction of Roads, Sewers, Sidewalks and Related Public Improvements as adopted by the City of Norwich Public Works Department.

D. Guidelines for the Design of Wastewater Treatment Works, TR-16, 2016 Edition and as amended as prepared by the New England Interstate Water Pollution Control Commission.

E. State of Connecticut Public Health Code

1.03 SUBMITTALS FOR REVIEW

A. Product Data: provide data on pipe materials, pipefittings, valves and accessories.

B. Engineering Data: provide Design plans as defined herein. Pump station submittals shall include pump flow and head calculations, identifying pump curve, system curve and pump efficiency curve. Calculations shall indicate the TDH, GPM, Cycle times and where appropriate buoyancy calculations on the wet well and valve chamber.

C. Certificates:

1. Certify that field tests have been performed and that work meets or exceeds specified requirements.

1.04 PERMITS

A. No person(s) shall uncover, make any connection with, alter, repair, or disturb any public or private sewer main connected to NPU pipe, or appurtenances unless a valid permit shall have been duly issued by NPU.

B. Owner/Developers must first apply to NPU using the Permit to Connect application located in Appendix D. Upon NPU approval of all work, the Owner/Developer must then apply for Permit to Discharge; application located in Appendix D.

C. Permits shall only be issued to: (i) A licensed Contractor holding a valid State of Connecticut license to perform the unsupervised installation of sewer mains, services, and appurtenances; or, (ii) a person installing or repairing a sewer service pipe within the confines of a single-family residential lot owned and occupied by such person, as long as such person is the only one doing the work. Acceptable Contractor license categories shall be P-1, P-7 Plumbing & Piping contractors Licenses only.

D. For the extension of public sewers, no permit shall be issued, nor any connection made until a Developers Agreement has been approved and consummated with NPU.

E. Prior to issuance of any construction permit, the Developer/Contractor will be required to pay all outstanding fees, charges, assessments, and other conditions applicable to the sewer installation. In addition, the permittee shall obtain a Connecticut Underground Utility Permit (Call Before You Dig) number (811), and, when working outside the confines of private property, obtain an excavation permit from the proper regulatory agency.

F. No house connection may be constructed less than 5 feet horizontally from any underground gas, electric or telephone service, or less than 10 feet from a water service or main unless specifically approved by the appropriate Utility and NPU, or as noted in the State of Connecticut Public Health Code and as amended.

G. For private sewer extensions, licensed Contractors shall also be required to post with NPU a Certificate of Insurance. Exact insurance requirements will be provided by NPU Purchasing Department.

H. In all instances requiring that the permittee be a licensed Contractor, the Plumbing Contractor's License, Certificate of Insurance, and Surety Bond submitted to NPU shall be those of the Permittee only.

I. Extensions of public sewers requiring easements and/or agreements must have such easements and/or agreements approved, executed, and recorded on the Land Record prior to issuance of a permit for connection to the NPU system.

J. No trench containing a sewer main, service pipe, or other appurtenance shall be backfilled until the NPU inspector or his duly authorized agent has completed an inspection and found the work to conform to the requirements of NPU in all respects and to be satisfactory as to the quality of the workmanship and materials. The permittee shall notify the Inspector twenty-four hours before starting any work authorized under the permit. It shall be the responsibility of the Permittee to comply with any applicable safety requirements concerning the installation or repair of sewer mains, services, and/or appurtenances, and to provide the necessary safety equipment and conditions needed for inspection of such installations and/or repairs. The Inspector or his or her duly authorized agent may order all or any portion of the work to be halted, revoke such permit for the work, and/or refuse inspection for noncompliance with the applicable construction and/or safety requirements.

K. If any person who constructs, installs, alters, or repairs any sewer main, service pipe or appurtenance within NPU's jurisdiction is in violation of any section of these Specifications and/or any other Regulations of NPU or fails to give adequate notice to the Inspector for an inspection of the work, the Inspector may order all or any portion of the work to be halted and/or uncovered for inspection and approval.

L. Permits may be revoked and annulled by NPU's authorized representative for any violation of the Regulations of NPU, or suspended for a reasonable period of time, to permit NPU to make an investigation to determine if there has been a violation of the regulations.

M. The issuance of a permit does not authorize the Contractor or Permittee to operate valves, curb stops, or other appurtenances connected to NPU system.

N. The Contractor or Permittee is responsible for obtaining all State and City road opening permits as required.

1.05 SUBMITTALS AT PROJECT CLOSEOUT

A. Record actual locations of piping mains, manholes, connections and invert elevations for submittal to NPU.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 QUALITY ASSURANCE

A. Notify NPU a minimum of 48 hours prior to beginning work of this section.

B. System testing shall be executed in accordance with Section 3.02 herein.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products as per manufacturer's specifications.

1.08 DESIGN CRITERIA – MAINS AND SERVICES

This section presents the minimum technical criteria for the analysis and design of wastewater systems within the boundaries of the City of Norwich, including collection mains, sanitary sewer service lines, and the applicable appurtenances associated with these installations. Any special criteria beyond those contained herein, and as determined necessary by NPU, shall be discussed at the pre-application consultation.

It is the intent of this section to provide sufficiently detailed information to enable the Engineer to design the majority of wastewater system components associated with a typical project. The wastewater system shall be designed by a Registered Professional Engineer licensed in the State of Connecticut and shall conform to the most current technical standards available. It is assumed that any number of Engineers may be involved in the design, depending on the technical expertise necessary to design and certify the various components of the project. It is further assumed that sound engineering will be applied throughout the design process to produce standard of the industry designs that incorporate specific NPU input conveyed to the Engineer during the review process. Specific information will ultimately be required on the record drawings in accordance with the Record Drawing Checklist.

If there is a question or a concern regarding the design of any portion of the wastewater system that is not adequately addressed in this section, the Developer shall contact NPU to resolve all issues prior to proceeding with the design of any such component. Any variance from these Criteria must be approved by NPU.

A. *Sanitary Sewer Design Criteria:*

1. Average daily flow and peak flow for domestic, commercial and industrial generators are to be based on Engineering Documentation. Hydraulic design

of the sewer shall be based on the Manning formula for a pipe flowing 0.8 full at peak design flow capacity under open channel flow conditions at all points.

2. Slopes:

   A. All sewers shall be so designed and constructed to give a velocity when flowing full or not less than 2.0 feet per second (0.61m/s) based on Manning's formula using a "n" value of 0.013 constant with depth. Minimum slopes may be used only if absolutely necessary because of grade restrictions. Minimum slopes shall be in accordance with TR-16 (reference section 8.02.D).

   B. Select the pipe diameter and slope for the greatest practical velocities to minimize settling problems. The use of oversized sewers in order to justify flatter slopes is discouraged. If the proposed slope is less than the minimum slope of the smallest pipe, the design engineer should calculate the actual depths and velocities at minimum, average, and maximum day and peak hourly flow for each section of the sewer and submit this information to NPU.

   C. Sewers should be laid out with uniform slope between manholes.

   D. Velocities greater than 12 feet per second are not be permitted under any flow conditions, unless special provisions have been made to protect against displacement caused by erosion and impact.

   E. Securely anchor sewers on 15 percent slopes, or greater, to prevent displacement.

   F. Impervious dams within main line sewer trenches shall be required at the discretion of NPU.

3. The size and slope of the building sewer shall be subject to the approval of NPU, but in no event shall the diameter be less than six (6) inches. Building sewer shall be laid to a reasonable straight line and preferably at not less than 2% grade (1/4" per foot) except that where this is impractical or where a hardship would be created by such a grade the pipe may be laid to a grade of not less than 1% (1/8" per foot). Subject to the approval by the inspector, pipes larger than 6” diameter may be laid at a grade less than 1%. The building sewer shall be laid at uniform grade and in straight alignment insofar as possible. Changes in direction shall be made only with manholes or properly curved pipe and fittings, as approved by NPU. A cleanout shall be located a minimum of four (4) inches above the basement floor.

4. Proposed sewers shall be designed to provide the required capacity (peak flow, infiltration and other wastewater) to handle all projected flow from upper waste shed based on current zoning. The design flows shall be based on an average daily per capita flow of sewage of not less than 70 gallons per day. Allowances for inflow and infiltration shall be added to this valve in accordance with TR-16 (reference section 8.02.D). The capacity of the sewer shall be designed to accommodate a peak design flow of four (4) times the average daily flow at build-out of the drainage area based on the maximum density allowed by zoning, unless otherwise determined by the generally accepted ratios of peak to average daily flow and approved by NPU. The Developers engineer shall submit to the NPU a basis of design including average wastewater flow and/or water consumption data. Sanitary Sewer Systems shall be designed for 50 years and interceptor sewers for the ultimate tributary population (i.e. commercial, industrial and/or residential).

5. Sewers shall be laid at a minimum depth and no less than a minimum slope to ensure that residences will receive basement service without the need for individual wastewater pumps. Sewers located in the right-of-way or low areas shall be constructed at depth with no less than four (4) feet of cover. Building sewers shall be constructed with a minimum of 3'-0" cover using PVC pipe. Special cases will be reviewed on a case by case basis.

6. Manholes shall preferably be laid in the center of pavement when the sewer is under a paved roadway. If installed in a paved gutter area of a road where no other suitable alternative is available such as a shoulder area not subject to significant surface water flow, the manhole shall be provided with watertight frame and covers to exclude surface stormwater flows.

7. Minimum size of pipe for sanitary sewer is eight (8) inches; inside diameter Minimum size pipe for building sewers is six (6) inches inside diameter. Pipe shall be as a minimum SDR 35 PVC pipe.

8. Manholes shall be provided at all sewer junctions, end of lines, changes in direction, and changes in grade. All drop inlets to manholes shall be outside drop inlets. No inside drop inlets shall be allowed.

9. Manhole spacing shall not exceed 300 feet. Manholes not in pavement areas shall have locking rims set above grade a minimum of 2", and maximum of 4", to avoid stormwater inflow. Watertight covers shall be used as directed by NPU or its designated agent.

10. Sewers shall be laid with uniform slope between manholes. On long reaches with relatively flat slopes, provisions for odor control shall be

considered based on such factors as sewage temperature, pH ranges and/or dissolved oxygen levels. Alignment- All gravity sewers shall be laid with a straight alignment between manholes.

11. Commercial/Industrial Sites

    A. A manhole is required in the building sewer between the building and the main sanitary sewer line, located within the City right-of-way, for all buildings in an Industrial or Commercial Zone.

    B. If the waste discharge is greater than 5,000 gallons per day, or if discharge involves industrial process wastewater, then a DEP discharge permit shall be required.

    C. Use of public sewers, physical and chemical limitations are defined by the rules and regulations of NPU.

12. Wastewater Pumping Station: Developments should be served by gravity sewer whenever possible. If gravity sewer is not possible, a municipal wastewater pumping station as described in the technical specification and in conformance with TR-16 shall be provided. Design calculations shall be provided by a Professional Engineer licensed in the State of Connecticut.

13. Sewer Force Main (associated with municipal pump station)

    A. Force mains should measure a minimum of 4” in diameter. Smaller sizes (2-3”) may be considered by NPU.

    B. At design average flow, velocity in excess of 3 feet per second should be maintained.

    C. As far as possible, alignment and depth of force main should provide a constant upgrade profile.

    D. Pipe shall be placed with a minimum of 4 feet of cover.

    E. An automatic air release valve must be placed at all relative high points in the force main.

    F. Drain valves shall be placed at all relative low points in the force main. These valves must be connected to gravity sewers or be provided with connections for vacuum pumper trucks.

14. Low Pressure Sewers: At the discretion NPU, a low-pressure sewer system may be permitted in lieu of a municipal pumping station and shall have the following characteristics:

A. At design average flow, velocity in excess of 3 feet per second should be maintained in all pressure lines.

B. As far as possible, alignment and depth of force main should provide a constant upgrade profile.

C. Pipe shall be placed with a minimum of 4 feet of cover.

D. An automatic air release valve manhole must be placed at all relative high points in the force main.

E. Drain valves manholes shall be placed at all relative low points in the force main. These valves must be connected to gravity sewers or be provide with connections for vacuum pumper trucks.

F. In-line access manholes shall be placed at every change in pipe size.

G. Pipe shall be placed with a minimum of 4 feet of cover.

H. The pressure sewer system design shall be subject to the approval of NPU or its designated agent.

I. Design calculations shall be provided by a Professional Engineer licensed in the State of Connecticut.

15. Grinder Pumps: If minimum grade cannot be met for building service laterals the following information applies:

A. The installer/drain layer shall install a force main lateral, PVC Schedule 40 or greater – minimum 1¼-inch diameter, with a grinder pump. All connections are to be made with compression fittings.

B. Pumping equipment must include an integral grinder pump capable of handling a reasonable quantity of foreign objects such as a Hydromatic or Barnes grinder pump.

C. Access to the pump must be through an opening at the surface with a minimum inside diameter of 30". The size of the opening must allow for the performance of maintenance and repairs. The pump must be readily removable with a guide rail system and lifting chain and without the need for manual disconnection of piping.

D. Construction of the wet well must meet minimum strength specifications, be watertight and include a suitable self-sealing inlet flange for connection to the household gravity line. A smooth interior surface should ensure solids are fed in an upward flow to the pump.

The pump must create sufficient turbulence to keep the tank bottom free of deposits. Installation must prevent the entrance of groundwater.

E. A ball valve and full-ported check valve installed in the horizontal position must be installed on the discharge pipe.

F. Adequate screened ventilation must be provided.

G. Level sensing detecting devices must operate the pump and produce an audio high water alarm.

H. Electrical pump controls and alarms shall be made in strict accordance with prevailing electrical code.

I. The installation and maintenance of a grinder pump is the responsibility of the homeowner.

Design Flows

The tabulation below provides the Average Daily Flow (ADF) rates that shall be applied to compute the wastewater flows associated with the various types of land use within the development. Flows shall be computed for initial and full build-out phases of the development and shall be assigned to the appropriate design points within the model to accurately reflect the geographical distribution of land use throughout the site.

Wastewater System Average Daily Flow (ADF)

The demands noted in the table below represent the "winter time" or "dry weather" Average Daily Flow (ADF) with no allowance for infiltration and inflow (I/I). I/I shall be accounted for in accordance with the Peak Design Flow computation discussed in the sections to follow.

Regarding design flows for schools, planned school sizes shall be confirmed with the School District and documented in the Utility Report. The tabulated rates shown below shall be applied as appropriate, depending on the information provided by the School District.

Reasonable engineering judgment shall be used in determining the estimated ADF for commercial, industrial and institutional sites. Individual evaluation and justification shall be provided when the proposed use is not specifically represented in the table above, or when the proposed flows will be inconsistent with the tabulated values. Justification of all non-residential flows shall be addressed in the Utility Report.

Land Use	**Typical ADF/Unit**	**Typical SFEs/Unit**
Single Family Residential and Duplexes	200 gpd/dwelling unit	1.00/dwelling unit
Multi-Family Residential (Townhomes	130 gpd/dwelling unit	0.65/dwelling unit

and Condos)		
Retail/Offices	0.1 gpd/SF	0.0005/SF
Hotels/Motels	75 gpd/room	0.375/room
Restaurants	1.5 gpd/SF	0.0075/SF
Car Washes	5,000 gpd/acre	25.0/acre
Industrial/Other Commercial	600 gpd/acre	3.0/acre
Institutional	400 gpd/acre	2.0/acre
Churches	300 gpd/church	1.5/church
Irrigated Land	0 gpd/acre	0.0/acre
Rates for School Sizes:		
Elementary	5 gpd/student	0.025/student
Middle	10 gpd/student	0.050/
High	10 gpd/student	0.050/student

Peaking Factor
The portion of the Peak Design Flow calculation exclusive of I/I shall be determined by multiplying the ADF in the preceding section by a peaking factor (PF). The PF is a function of ADF, and shall be computed as follows:
PF = 3.65 x [(ADF)-0.168].

The maximum PF shall be 5.0, and ADF shall be expressed in units of million gallons per day (MGD).

Peak Design Flow Rate
The Peak Design Flow (PDF) shall be computed at all pertinent design points throughout the system and used to size the corresponding wastewater facilities. The PDF shall be determined by multiplying the ADF by the calculated peaking factor (PF), plus an I/I allowance equal to 10% of the ADF as expressed by the following formula:

PDF = peak base flow + I/I allowance = (ADF*PF) + (0.1*ADF)
Once computed, the PDF shall be used to determine the sizes of the facilities in accordance with the criteria established below.

Hydraulic Design
Wastewater systems shall be designed to provide a minimum velocity of 2.0 feet per second at the Peak Design Flow. In situations where the minimum velocity of 2.0 feet per second cannot be met, an explanation and justification shall be included in the Final Utility Report. The maximum velocity shall not exceed 10 feet per second. Drop manholes shall be provided to break steep slopes to limit the velocities in conformance with this criterion. Where drop manholes are impractical for velocity reduction, the sewer must be approved by variance and shall be of PVC or other abrasion resistant material approved by the Utilities Department.

Where actual flow will be much below normal for several years, the minimum velocity shall be achieved by suitable grades at the partial design flow rate. Care shall be taken to

design invert elevations at manholes in such a manner that the energy gradient is consistently falling in the direction of the flow.

Sanitary sewers shall be sized to convey the Peak Design Flow while flowing no more than 75 percent of the full pipe flow capacity. Computation of velocity of flow shall be based on a coefficient of roughness "n" in the Manning formula of 0.011 for PVC.

At all junctions where a smaller diameter main discharges in to a larger one, the invert of the larger sanitary sewer shall be lowered so that the energy gradients of the sewers at the junction are at the same level. Generally, this condition will be met by placing the 0.75 depth of flow in each sewer at the same elevation. No surcharging of sanitary sewer lines is allowed.

Pipe Sizes and Grades
Sanitary sewer mains shall be a minimum of 8 inches in diameter. Service lines shall be a minimum of 4 inches in diameter. The sanitary sewer shall be designed to carry the PDF within the ranges of grades shown below, unless otherwise approved by variance in accordance with Section 1.9. All changes in pipe size shall occur at a manhole.

Location
All sanitary sewer mains and appurtenances shall be installed in dedicated right-of-way or dedicated utility easements. Under no circumstances shall sanitary sewer mains or manholes be installed parallel to, and directly below, any concrete such as sidewalks, trails, curbs, or gutters. Mains designed within the street right-of-way shall be located in accordance with the Standard Details available on the NPU's website, unless otherwise approved in writing by the Utilities Department. In general, sanitary sewer mains shall be located in public streets near the center of the south or west lane wherever possible. Sanitary sewer mains and manholes shall not be located in vehicle wheel paths. Under no circumstances shall a main be closer than 5 feet from a gutter pan. Where narrow streets have been approved by the NPU with flowline-to-flowline widths of 28 feet, the utility layout may be modified in accordance with the Standard Details for "narrow" street sections.

Sanitary sewer lines and manholes shall not be located within detention pond areas. In areas of fill, sewer lines and manholes shall be subject to the requirements established in Section 4.4.10 of these Criteria.

Sewer Diameter	Minimum Grade	Maximum Grade
4-inch service line	2.0%	--
6-inch service line	2.0%	--
8 inch	0.40%	7.5%
10 inch	0.25%	5.5%
12 inch	0.22%	4.5%
15 inch	0.15%	3.5%
18 inch	0.11%	2.5%

21 inch	0.09%	2.0%
24 inch	0.08%	1.8%
27 inch	0.07%	1.5%
30 inch or larger	0.06%	1.3%

1.09 EASEMENTS

Sewer easements outside of street lines shall be a minimum of twenty (20) feet wide centered on the sanitary sewer main. For deep excavations (deeper than 8 feet from flow line), wider easements shall be required. It is the responsibility of the Developer to acquire these easements. For a "cross country" sewer line, a "roadway" ten (10) feet wide shall be provided. This roadway shall consist of a gravel base a minimum of 8" deep with a filter fabric (where required) and shall provide sufficient support for typical NPU maintenance vehicles. Four inches of topsoil, seeded and fertilized, shall be placed on top of the gravel. When a raised manhole is located within the "roadway", the roadway shall be widened to provide sufficient room for vehicles to pass on both sides of the structure. This may require additional easement area beyond the minimum twenty (20) foot requirement.

1.10 CONNECTION TO EXISTING MAINS (PUBLIC SEWERS)

Any newly installed sanitary sewer systems connected to an existing sanitary sewer main shall be plugged and secured until the following activities are accomplished:

A. All air testing meeting these standards have been completed.

B. An occupied facility is connected to the new line.

C. The new line is cleaned out (flushing and removal of all construction debris and foreign material).

D. The new line is TV inspected.

All joints and connections shall be properly made in compliance with the recommendations of the manufacturer of the product with NPU approval and shall be so constructed as to prevent any leakage of sewage from the lines or groundwater into the line. If joints or connections are found to be improperly made, they shall be pulled apart and remade, and approved by the inspector before backfilling the trench. No paint, varnish, or other coatings shall be permitted on the jointing material until after the joint has been tested and approved. A “push-on” type joint will be acceptable.

1.11 CONNECTION TO EXISTING MAINS (PRIVATE SEWERS & LATERALS)

On all construction (new, repairs, or replacements) within the City and on all connections within the City sewer system, the property owner is required to install, operate, and maintain a minimum of two cleanout plugs at the owner's expense. One cleanout must be located at the lateral pipe connection with the main line and one must be located before the building. These shall consist of a single or double wye branch with end of side cleanout and closed with a waterproof cap.

In the construction of household sewer connections, pipe shall be laid on an even-tamped foundation of coarse sand, fine gravel or ¾" crushed stone. Where wet or soft conditions prevail, ¾" crushed stone shall be used for foundation of all pipe. The backfill shall be thoroughly compacted by tamping or other approved methods up to the spring line of the pipe. Care must be taken during backfilling that the pipe is not injured or disturbed by stones or other material. Backfill material to a foot above the pipe shall be compactable materials, not frozen and free from clods of earth, stones larger than 2" in diameter, organic material, roots, stumps, peat and other unsuitable materials as directed by the inspector. The balance of backfill in trench shall be compactable, not frozen and free from stones larger than 4" in their largest dimension and other unsuitable material as directed by the inspector.

Where pipe is being laid at depths that may provide insufficient cover (generally less than 3 or 4 feet) to properly safeguard the pipe from physical damage due to superimposed loads, the drain layer shall use extra heavy cast iron pipe, ASTM 74-69 or ductile iron pipe, ANSI A 21.51 (as amended) as may be approved by NPU.

1.12 PROTECTION OF WATER SUPPLIES

Relation to Water Works Structures: Sewers shall be kept remote from public water supply wells or other potable water supply sources and structures as required by the Public Health Code.

No building sewer shall be construction with 25 feet of a water supply well. If a building sewer is constructed within 75 feet of a water supply well, it shall be constructed of extra heavy cast iron pipe ASTM 74-69, PVC schedule 40, ASTM D1785 or D2666, Ductile iron ANSI A21.51, PVC AWWA C900 (100 psi min) or as amended.

1.13 RELATION TO WATER MAINS

Horizontal Separation: Whenever possible sewers shall be laid at a minimum at least 10 feet, horizontally, from any existing or proposed water main. Should

local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if

A. It is laid in a separate trench, or if

B. It is laid in the same trench with the water mains located at one side on a bench of undistributed earth, and if

C. In either case, the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.

Vertical Separation: Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible. When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint cement lined ductile iron pipe or other equivalent based on water-tightness and by an approved method to assure water-tightness or both pipes shall be encased in concrete.

2.0 MATERIALS

2.01 SUMMARY

A. Building sewers shall be cast-iron soil pipe, ASTM Specification A75-69 (or as amended), vitrified clay sewer pipe ASTM Specifications C200-69G (or as amended), or PVC sewer pipe, ASTM Specification D-3034-SDR35 (or as amended) and shall be free from defects which may cause leakage either into or out of the pipe. Portland cement mortar joints shall not be permitted.

B. All materials specified shall be new and unused and meet the requirements specified herein and as required and approved by NPU. The Utility Company Details are located in Appendix J-4.

2.02 PRODUCTS

A. Pipe:

1. Polyvinyl Chloride (PVC) Sewer (Gravity pipe Flow): PVC Sewer Pipe shall be unplasticized polyvinyl chloride plastic gravity sewer pipe integral

wall bell and spigot joints. Pipe and fittings shall meet and/or exceed all of the requirements of A.S.T.M. Specification D 3034, latest revision, SDR 35, Type PSM. All pipe 18" through 24" shall be in full compliance with ASTM F-679. All pipe 18" through 24" shall be T-1 heavy wall and laying lengths shall be 13 feet plus or minus 1". All fittings and accessories shall be as manufactured and furnished by the pipe supplier and have bell and/or spigot configurations identical to that of the pipe.

2. Polyvinyl Chloride (PVC) Sewer (Pressure Pipe): Polyvinyl chloride Pressure Pipe (2”-4”) and fittings shall be class 200 with integral bell end assembled in accordance with the manufacturer's instructions. It shall conform to ASTM Standard Specification for Pressure Rated Pipe ASTM-2241, SDR-21 or schedule 40 PVC

3. High Density Polyethylene (HDPE) Sewer (Pressure Pipe) pipe may be used for sewer lines two (2) inches in diameter and less. HDPE pipe shall be manufactured in accordance with ASTM F714 and AWWA C906. Joints shall be connected by Butt Fusion methods in accordance with ASTM D2657. HDPE fittings shall be fully pressure rated to match the pipe DR pressure rating. All fittings shall be molded or fabricated by the same manufacturer as the pipe. HDPE fittings shall be joined using butt, heat fusion and/or electrofusion. Adhesives and solvent cements shall not be permitted. Flanged joints require a back-up ring and require coatings and cathodic protection from corrosion. Bolting materials shall have tensile strength equivalent to SAE Grade 3. Joining plain end PE pipe to bell-and-spigot or mechanical-joint fittings or pipe; external joint restraint shall be used and an internal stiffener is to be installed in the PE pipe end.

4. Ductile Iron (DI) Sewer: Ductile Iron pipe shall be furnished in accordance with ANSI/AWWA C150 / A21.50. The ductile iron pipe shall be class 52. Pipes shall have a normal laying length of at least 18-feet. Each length of pipe shall be cement lined and receive a factory applied interior and exterior coating of Kopper’s Bitumastic Super Service Black or an approved coating of equal specifications in accordance with ANSI A21.4. Ductile iron pipe shall be push-on type of joint that employs rubber gasket. Joints shall be in accordance with the latest ANSI standard for “Rubber Gasket joints for Ductile Iron Pressure Pipe and Fittings”, A21.11. Fittings shall be in accordance with ANSI 23.53 with mechanical joints. The fittings shall be coated inside and outside with a bituminous asphalt paint.

Aerial pipe shall be mechanical joint DIP or continuous weld, wrapped and coated steel pipe. Piers shall be placed at every joint directly behind the bell. Site conditions may dictate construction utilizing more stringent requirements than indicated in the standard detail. Anchor collars shall be constructed on the pipe whenever pipe grade is 20% or

greater. Restrainers may be used in lieu of collars when particular brand and method are determined equivalent.

B. Gravel bedding for PVC sanitary sewer pipe and force main shall be ¾" crushed stone. Crushed stone shall consist of hard, durable fragments of crushed rock and shall be free from clay, organic matter or other objectionable material. Crushed stone shall conform to the gradation table for ¾" crushed stone as specified in Article M.0101 of the Standard specifications. CT DOT Form 816 (Section 8.02, reference A).

C. Filter Fabric: The fabric shall be non-rotting, acid and alkali resistant and have sufficient strength and permeability for the purpose intended, including handling and backfilling operations.

D. Sewer Manhole: The sewer manhole materials shall be as follows:

1. Pre-cast reinforced concrete manhole sections shall conform to the latest A.S.T.M. specification C-478, with additional requirements as detailed on the contract drawings and specified herein. All pre-cast manhole units shall have rubber "O" ring joints.

2. Brick shall conform to the requirements of A.S.T.M. Designation C-32 latest revision, grade MA.

3. Concrete masonry units shall conform to the requirements of A.S.T.M. Designation C-139, latest revision. Block shall be eight-inch radial units. Corbel blocks shall be used for taper.

4. Mortar used for laying brick, blocks, bedding castings, parging the outside of manholes, and similar uses, and grout used for filling joints, voids, etc., shall, unless otherwise provided or ordered, by composed of one part Portland Cement and two parts sand of suitable fineness, measured and mixed, in general, by means and methods similar to those specified for concrete ingredients insofar as those requirements are applicable. However, if the quantity of mortar or grout to be mixed or used at one time or place is small, measurement by volume on the job and hand mixing in suitable watertight mortar beds will be permitted. Mortar containing lime may be used only as approved by the Utility Company. Mortar or richer cement content shall be used where required for the top surface finish of inverts. Coloring, hardening or similar materials shall be added where specially required.

5. Manhole frames and covers shall be as shown on the plans cast iron LeBaron model LA 264-2 or approved equal. Reference detail S-2 in Appendix A.

6. Flexible watertight pipe connections shall be KOR-N-SEAL or equal.

7. Pipe for manhole drops shall be PVC as specified above and new manhole drop connections shall be concrete encased on the outside of the manhole. Stainless steel strapping provided to anchor piping securely to the manhole.

8. Connections to existing sewer systems shall not may only be made with "Dog House" manholes with prior approval by NPU. When feasible, new manholes shall be installed while existing sewer flow is diverted.

E. Pipe Bedding shall consist of hard, clean, durable particles or fragments of ¾" crushed stone and shall be free from lumps of clay, organic matter or other objectionable material and compacted in maximum six (6") lifts. Compact to 95% maximum dry intensity per Method D of ASTM D 1557-66T. Gravel shall conform to the requirements of M.02.01.1 of the CT DOT Form 816 (reference 7.02 A). Reference trench detail S-1 in Appendix J-4.

Bedding requirements shall apply to wastewater lines only. They are considered minimum bedding requirements and as such, do not relieve the Engineer/Contractor of the responsibility to provide any additional bedding necessary for proper construction.

Bedding shall be carefully placed along the full width of the trench so that the pipe is true to line and grade of the pipe barrel. Bell holes shall provide so as to relieve pipe bells of all load, but small enough to ensure that support is provided throughout the length of pipe. Crushed stone embedment material shall conform and consist of hard, clean, durable particles or fragments of ¾" crushed stone and shall be free from lumps of clay, organic matter or other objectionable material and compacted in maximum six (6") lifts. Compact to 95% maximum dry intensity per Method D of ASTM D 1557-66T. Gravel shall conform to the requirements of M.02.01.1 of the CT DOT Form 816 (reference 7.02 A). Reference trench detail S-1 in Appendix A.

Class B Bedding shall be performed by first undercutting the trench an adequate amount to provide bedding under the pipe bell. The trench shall then be brought to grade with compacted crushed stone as specified above for the full width of the trench. The bedding material shall be placed in the zone four (4) inches below the pipe and the pipe laid to line and grade and backfilled with compacted crushed stone placed the full width of the trench up to one-half the outside diameter of the pipe. Select backfill placed in six (6) inch layers and compacted shall be the backfill from the spring line of

the pipe to 18 inches above the pipe. A minimum Class B Bedding shall be used for all plastic pipes.

Class C Bedding shall be performed by first undercutting the trench an adequate amount to provide bedding under the pipe bell. The trench shall then be brought to grade with compacted crushed stone as specified above for the full width of the trench. The bedding material shall be placed in the zone four (4) inches below the pipe and the pipe laid to line and grade and backfilled with compacted crushed stone placed the full width of the trench up to one-fourth the outside diameter of the pipe. Select backfill placed in six (6) inch layers and compacted shall be the backfill from the spring line of the pipe to 18 inches above the pipe. A minimum Class C Bedding shall be used for all ductile iron pipes when required by the City of Norwich.

F. Backfill material shall be free from refuse, frozen material, vegetable matter and stones larger the four (4) inches in any dimension and shall be as approved by NPU. Material resulting from rock or ledge excavation shall not be used. Backfill shall be placed in horizontal layers not in excess of twelve (12) inches in loose depth and shall have a moisture content such that the required degree of compaction may be obtained.

G. Bank Gravel shall be furnished by the Developer, placed and compacted as required and/or directed by NPU and/or site conditions. Bank Gravel shall consist of hard, durable stone and coarse sand free from refuse, frozen material, vegetable matter and stones larger the three (3) inches in any dimension and shall be compacted in maximum six (6) inch lifts and compacted as required/directed. The grading shall conform to the following requirements:

Square Sieve	Percent Passing by Weight
½ inch	70 maximum
No. 4	50 maximum
No. 200	5 maximum

3.00 EXECUTION

3.01 INSTALLATION

A. Trench excavation shall meet the requirements of trench excavation section in Section 4.03 of this specification. Pipe bedding shall conform to the Gravel/Sand Pipe Bedding section 2.02.B of this specification.

B. Sewer pipe, both main and lateral sewers, shall be laid as indicated on the approved plans. All pipe when in place shall be true to the line and grade

specified. Unless otherwise directed, all pipe shall be laid upgrade without any breaks of continuity in the line between manholes or other structures.

C. The Contractor shall provide laser beam type equipment at each pipe laying location within the project, for vertical and horizontal pipe alignment.

D. The pipe shall be bedded as detailed herein (reference detail S-1 in Appendix A) on the Contract plans and in accordance with these Contract specifications. The foundation of crushed stone shall be brought carefully to the proper grade for the barrel of the pipe, well tamped or compacted as may be directed and the pipe laid thereon. Grade of the stone bedding shall be checked at intervals of not more than three feet apart, immediately before pipe is laid upon it. The bedding shall be such that the barrel of the pipe will be evenly supported for its entire length except for a distance of not over four inches outside each end of each pipe joint.

E. All sanitary sewer pipe shall be laid in a trench free of water. The Contractor shall furnish all equipment necessary to keep trenches free of water during the laying of pipe.

F. Pipe shall be installed in accordance with the manufactures requirements and the details provided herein.

G. Open ends of sewers or pipe under construction shall be kept closed with temporary stoppers at night and during construction when they need not be open in order to exclude foreign matter and flows of water which might be detrimental to newly made joints or other portions of the work under construction. The newly installed sewer must be clean, and free from sediment and foreign objects when placed.

H. It is the intent of these specifications that leakage within the sanitary sewer system shall be reduced to a practical minimum, attainable only with first class workmanship. Leakage into or out of the sewer system shall not exceed 100 gallons per day per inch of pipe diameter per mile of sewer. The appropriate testing methods shall be used as specified below and shall be made upon completion of all pipe placement including service laterals.

3.02 TESTING REQUIREMENTS

A. Gravity Sewer Pipe

1. The method of exfiltration testing is the use of the pneumatic testing system in conformance with TR-16 (see reference Section 7.02 D) the Low Pressure Air Test for Sanitary Sewers as outlined in the ASCE

Proceedings, Volume 90, No. SA2, April 1964 and shall be used for gravity sewer lines.

TESTING GRAVITY PIPELINES

A. All gravity pipelines shall be tested for leakage by an infiltration or exfiltration test. Buried piping shall be tested by an infiltration test if the groundwater is more than 2-ft above the crown of the pipe for the full length of the section to be tested. Air testing may be used in lieu of an exfiltration test subject to approval of the Engineer.

B. Exfiltration Test

1. Leakage tests by exfiltration shall be made by creating a head in the pipeline to be tested by filling the line and either a manhole or temporary riser on one end of the line with water. The length of pipe to be tested shall be such that the head over the crown at the upstream end is not less than 2-ft and the head over the downstream crown is not more than 6-ft. The pipe shall be plugged by pneumatic bags or mechanical plugs in such a manner that the air can be released from the pipe while it is being filled with water. Before any measurements are made, the pipe shall be kept full of water long enough to allow absorption and the escape of any trapped air to take place. Following this, a test period of at least one hour shall begin. Provisions shall be made for measuring the amount of water required to maintain the water at a constant level during the test period.

2. If any joint shows an appreciable amount of leakage, the jointing material shall be removed and the joint repaired. If any pipe is defective, it shall be removed and replaced. If the quantity of water required to maintain a constant head in the pipe does not exceed 1.9 gallons per inch of diameter per day per 100-ft of pipe and if all the leakage is not confined to a few joints, workmanship shall be considered satisfactory.

C. Infiltration Test

1. Pipe shall be tested for infiltration after the backfill has been placed and the ground water allowed to return to normal elevation. The length of line to be tested shall be not less than the length between adjacent manholes and not more than the total length of each size of pipe. The allowable infiltration shall be 1.9 gallons per inch of diameter per day per 100-ft of pipe in each section tested. There shall be no gushing or spurting leaks.

2. If an inspection of the completed pipeline or any part thereof shows pipes or joints which allow noticeable infiltration of water, the defective work or material shall be replaced or repaired as directed.

3. Rates of infiltration shall be determined by means of V-notch weirs, pipe spigots, or by plugs in the end of the pipe installed in an approved manner and at such times and locations as may be directed by the Engineer.

D. When the pipeline to be tested is reinforced concrete pipe, the allowable leakage in the above tests shall be 4.7 gallons per inch of diameter per 100-ft of pipe.

E. Low Pressure Air Test

1. Low-pressure air tests shall be made with equipment specifically designed and manufactured for the purpose of testing pipelines using low-pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. All air used shall pass through a single control panel.

2. Install plugs at manholes. Brace plugs securely as required for safety and allow no one in the manholes while pressurizing the line or during the test.

3. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig. The internal air pressure in the sealed line shall not be allowed to exceed 8 psig. At least 2 minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig shall not be less than that shown in Table 1 of ASTM F1417.

4. If the pipe section does not pass the air test, sectionalize the section tested to determine the location of the leak. Once the leak has been located, repair and retest.

TESTING PRESSURE PIPELINES

F. All pressure pipelines shall be pressure and leakage tested. Pipelines shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure and this pressure maintained for at least 10 minutes. The leakage test shall be conducted at the maximum operating pressure as determined by the Engineer, and this pressure shall be maintained for at least two hours. The test pump and water supply shall be arranged to allow accurate measurement of the water required to maintain the test pressure. Where applicable, hydrant branch gate valves shall remain open during this test. The amount of leakage which will be permitted shall be in accordance with AWWA C600.

1. The Contractor shall furnish test plugs, test gauge, stopwatch, an air compressor, the personnel for conducting the test under direction of NPU.

2. Air shall be slowly supplied to the plugged pipe installation until pressure reaches 4.0 psi. At least two minutes shall be allowed for air pressure stabilization.

3. The rate of air loss shall then be determined by measuring the time interval required for pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that may be over the pipe).

4. The pipeline shall be considered acceptable when tested at an average pressure of 3.0 psi if:

   a) the total rate of air loss from any section tested in its entirety between manhole and cleanout structure does not exceed 2.0 CFM; or b) the section under test does not lose air at a rate greater than 0.0030 CFM per square foot of internal pipe surface.

5. In areas where ground water is known to exist above the top of the sewer, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately 10" long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 9.2 feet, then the added pressure will be 4 psig. This increases the 3.5 psig to 7.5 psig, and the 2.5 psig to 6.5 psig. The allowable drop of one pound and timing remain the same).

6. The requirements of this specification shall be considered satisfied if the time required in seconds for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) is not less than shown in the "Allowable Time Table".

ALLOWABLE TIME TABLE

Pipe Size	(Time) Minutes	Seconds
6"	2	15
8"	3	57
10"	4	43
12"	5	40

7. Sewers constructed under the Contract may be tested for infiltration in several separate sections, as these sections may be completed, or as and when NPU the Utility Company may direct. After any such section has been tested, NPU the Utility Company may, at his discretion, permit house connections to be made with such section of sewers and said sections may be used for drainage or other purpose without waiting until all sewers contemplated under the Contract have been completed and tested.

B. Sewer Force Main

1. Pressure testing and leakage testing shall be carried out in accordance with the appropriate paragraphs of Section 4 of ANSI/AWWA C600 with the following clarifications and qualifications.

   a. Unless otherwise permitted the testing shall be performed after either backfilling or partially backfilling the completed pipelines or sections thereof. Before testing, the Contractor shall submit, in writing, to NPU the Utility Company, his proposed method of testing the completed pipeline. Testing shall begin only after approval by NPU the Utility Company of the proposed methods. Testing of force mains shall be witnessed by NPU the Utility Company for approval. Any required coordination with NPU the Utility Company shall be the responsibility of the Contractor.

   b. A leakage test shall be conducted concurrently with the pressure test. The Contractor shall furnish the gage, pump, connections and all other necessary apparatus and shall furnish the necessary assistance to conduct the test.

   c. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

   d. No pipe installation will be accepted if the leakage is greater than

that determined by the following formula:

$$L=\frac{SD\sqrt{P}}{133,200}$$

Where: L=Allowable leakage in gallons/hour
S=Length of pipe tested in feet
D=Normal pipe diameter in inches
P=Average test pressure during leakage test in pounds per square inch, gauge

e. If any test of pipe laid discloses leakage greater than that specified above, the Contractor shall locate and repair the defective materials until the leakage is within the specified allowance. All visible leaks shall be repaired regardless of the amount of leakage.

2. Sewer Manhole:

a. All manhole steps shall be built into walls or the precast sections and set in straight alignments so as to form a continuous ladder with a maximum distance of 12 inches between steps.

b. Each section of the precast manhole shall have not more than two lifting holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with mortar after installation.

c. Precast base sections shall be installed on a firm stabilized foundation prepared similar to that required for the proper installation of the adjacent pipeline as described elsewhere in these contract specifications. The bell of the manhole base should be wiped clean, be free of all dirt and grit and liberally soaped in preparation for receiving the riser, cone or slab top section. Prior to snapping the gasket into the spigot groove of the riser or cone section, the gasket should be wiped clean and well soaped. The riser or cone section with gasket in place should then be lowered into the bell of the manhole base, taking care that no dirt gets into the joint or on the gasket. Additional riser or cone sections should be joined in a similar manner.

d. Knockouts in manhole riser sections, to allow the installation of pipes may be provided during manufacturing of the riser section and shall be provided only to the maximum allowable pipe size recommended by the manufacturer. Watertight pipe connections shall be cast or installed in the manhole base in accordance with the manufacturer's recommendations.

e. Invert channels shall be constructed of brick. Inverts shall be smooth and accurately shaped to a semi-circular bottom conforming to the inside of the adjacent sewer sections. Changes in direction of the sewer and entering branches shall have a circular curve of as large a radius as the manhole will permit or as shown on the Contract Plans.

f. Prior to their connection to an operating sewer system, all manholes shall be cleaned of all trash and debris and made fully operational by the Contractor. Prior to the final inspection of the project, all new and existing manholes within the construction limits that are part of the completed system shall be similarly cleaned and made operational by the Contractor.

g. Brick or block manholes shall only be constructed where shown on the Contract Drawings or where directed by NPU the Utility Company.

h. Manholes shall be built smooth, well-formed and watertight.

i. Until such time as frames and covers are set, manholes shall be kept covered with plank or temporary covering to protect persons, animals and prevent foreign substances from entering the manhole.

j. The Contractor shall not backfill around any brick or concrete block circular manhole until the masonry work has set for 48 hours or until ordered by NPU the Utility Company to backfill. The Contractor shall not permit any wheel load on any circular manhole until permission is granted by NPU the Utility Company. Backfilling and loadings on non-circular manholes shall be under the direction of NPU the Utility Company.

3.02 VIDEO INSPECTION

A. T.V. inspection shall be performed on all completed pipelines having an inside diameter of eight (8) inches or larger. Of particular concern is the location of tee or wye connections on the pipelines.

B. The Contractor shall examine all sections of pipelines prior to scheduling T.V. inspection to insure this work can be performed without delays. Any obstacles which hinder or prevent T.V. inspection work shall be removed by the Contractor prior to scheduling additional work.

C. The inspection shall be by a closed-circuit television and shall be performed in one section at a time between manholes, suitably isolated from the remainder

of the line by use of line plugs where necessary. It is anticipated that pipelines will not be in service prior to television investigation. However, in the event pipelines are in service, the Contractor shall have flows reduced to a minimum during inspection. Maximum allowable depth of flow for in-service pipes shall be less than: (1) for pipes over 15 inches in diameter or height, 15% of flow-full depth, (2) for pipes 15 inches or less in diameter or height, 25% of flow-full depth.

D. The television camera used for the inspection shall be specially designed and constructed for pipeline inspection and shall have its own lighting system which shall produce light levels from 50-100 foot candles. Picture quality shall be such as to produce a continuous 600 line resolution picture showing the entire periphery of the pipe. To insure picture stability, the equipment used shall be constructed in such a manner as to withstand shock and vibration.

E. An inspection record shall be kept which clearly shows the exact locations (stationing), in relation to the center line of the adjacent manhole, of each infiltration point, each point or location of a tee or wye connection or any other condition as required. Measurement for these locations shall be made at ground level.

F. The NPU reserves the right to take photographs from the television monitor. The NPU shall have an inspector with the television monitoring crew. No inspection shall be made without the presence of this Inspector unless otherwise approved by the NPU.

G. A continuous video and audio tape recording shall be made with each television inspection. The audio recording shall identify the run by lower and upper manhole or starting and ending point. Stationing will be given by audio recording at all points or interest and said points identified where possible. Stationing will be given by audio recording at intervals of no less than 10' in any event. The stationing at the end of the run versus the ground-measured distance from starting to ending points will be audio recorded.

H. The playback tape speed shall be not more than 12 ips on normal playback and shall not have less than 180 lines of resolution and/or be to the satisfaction of the NPU.

I. The video recorder shall have sound dubbing facilities that will permit audio track to be added to existing video recording.

J. The Contractor shall present all tapes to the NPU promptly after recording.

K. Ownership of the video tape shall remain with the NPU.

L. The Contractor shall keep records of all television investigation performed. These records shall be on a printed form showing the Owner's name, type of project, length of section, type of video equipment used and any special remarks concerning the condition of the line. Two (2) copies of each shall be submitted to the NPU upon completion of the inspection.

4.00 EXCAVATION AND BACKFILLING

4.01 SCOPE

This section covers all excavation, trenching and backfilling for pipelines.

4.02 EXISTING IMPROVEMENTS

The Contractor shall maintain in operating condition and protect from damage all existing improvements including utilities, roads, streets, sidewalks, drives, power and telephone lines, gas lines, water lines, sewers, gutters and other drains encountered, and repair to the satisfaction of the Engineer any aerial, surface or subsurface elements damaged during the course of the work. Where and if shown on the plans, the locations and existence or nonexistence of underground utilities are not guaranteed. The Contractor shall contact the "*Dig Safe*" utilities locate service to determine and/or verify such information prior to proceeding with the work. The Contractor shall make reasonable and satisfactory provisions for the maintenance of traffic on streets, drives, walkways and at street crossings and if necessary to provide temporary walkways and bridges for crossing of the open trench as directed. Work shall not commence within the City's rights-of-way until a Right-of-Way Encroachment Permit is obtained from the Public Works Department.

4.03 EXCAVATION

All excavations required for the installation of a building sewer shall be open trench work unless otherwise approved by NPU. Pipe laying and backfill shall be performed in accordance with ASTM Specifications F1668-08 (or as amended).

No trench containing a building drain or connection to the sanitary sewer shall be backfilled until NPU has completed an inspection and approved the work. The water level in the trench shall be maintained at a level below the sewer connection before the cap is removed and while the connection is being made and until such time as it has been inspected, approved and backfilled.

All excavations for building sewer installations shall be adequately guarded with barricades and lights so as to protect the public from hazard. Streets, sidewalks, parkways, and other public property disturbed in the course of the work shall be restored in a manner satisfactory to NPU.

All excavation of every description and of whatever substances encountered shall be performed to the depths indicated on the drawings or as specified herein.

Excavation shall be made by the open cut method except as otherwise specified or shown on the drawings. Excavation methods shall generally meet or exceed Occupational Safety and Health Administration (OSHA) construction industry standards.

All excavated materials not required for fill or backfill shall be removed and wasted as directed. The banks of shallow trenches shall be kept as nearly vertical as practicable and where required shall be properly sheeted and braced. Except where otherwise indicated, trench bottoms shall be not less than 12 inches wider nor more than 16 inches wider than the outside diameter of the pipe to be laid therein, and shall be excavated true to line, so that a clear space of not less than 6 inches nor more than 8 inches in width is provided on each side of the pipe.

Wastewater pipe shall be bedded per detail. Excavation for structures and other accessories shall be sufficient to leave at least 12 inches in the clear between their outer surfaces and the embankment or timber which may be used to hold the bank and protect them. Where damage is liable to result from withdrawing sheeting, the sheeting will be ordered to be left in place.

Except for sewer pipe bedding or at locations where excavation of rock from the bottoms of trenches is required, care shall be taken not to excavate below the depths indicated. Where rock excavation is required, the rock shall be excavated to a maximum overdepth of 4 inches below the normal required trench depth. The overdepth rock excavation and all excess trench excavation shall be backfilled with loose, moist earth, thoroughly tamped or with suitable sewer bedding material as appropriate for the type of pipe service. Rock is defined as materials which are so hard or cemented that the excavation of such material requires blasting. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials of common excavation shall be classified as rock excavation. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe, as determined by the Engineer or indicated on the drawings, is encountered in the trench bottom, such soil shall be removed to a depth required for the lengths designated by the Engineer, and the trench backfilled to trench bottom grade, as herein specified, with coarse sand, fine gravel, or other suitable material. Backfill with earth under structures will not be permitted and any unauthorized excess excavation below the levels indicated for the foundation of such structures shall be filled with sand, gravel, or concrete, as directed.

For sewer mains, the bottom of trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Bell holes shall be dug after the trench bottom has been graded. Bell holes shall be excavated only to an extent sufficient to permit accurate work in the making of the

joints and to ensure that the pipe, for a maximum of its length will rest upon the prepared bottom of the trench. Depressions for joints other than mechanical shall be made in accordance with the recommendations of the joint manufacturers for the particular joint used.

Grading and Stacking
All grading in the vicinity of trench excavation shall be controlled to prevent surface ground water from flowing into the trenches. Any water accumulated in the trenches shall be removed by pumping or by other approved methods. During excavation, material suitable for backfilling shall be stored in an orderly manner a minimum distance of one and one-half times the depth of the excavation back from the edges of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling, as determined by the Engineer, shall be removed from the job site and disposed of by the Contractor in a manner as approved by the Engineer.

Shoring and Sheeting
All shoring, sheeting, and bracing required to perform and protect the excavation and to safeguard employees and the public shall be performed. The failure of the Engineer to direct the placing of such protection shall not relieve the Contractor of his responsibility for damage resulting from its omission.

Whenever sheeting is driven to a depth below the elevation of the top of the pipe, that portion of the sheeting below the elevation of the top of the pipe shall not be disturbed or removed. Sheeting left in place shall be cut off not less than 1 foot below finished grade. No sheeting shall be removed until the excavation is substantially backfilled as hereinafter specified.

Water Removal
Where water is encountered, it shall be prevented from accumulating in excavated areas by pumping, well-pointing and pumping, or by other means approved by the Engineer as to capacity and effectiveness. Water removed from excavations shall be discharged at points where it will not cause injury to public or private property, or the work completed or in progress. All efforts to prevent sedimentation shall be made. Under no circumstances shall trench bottoms be prepared, pipes laid, or appurtenances installed in water. Water shall not be allowed to rise in unbackfilled excavations after pipe or structures have been placed.

Blasting
Explosives are to used only within legal limitations. Before explosives are used, all necessary permits for this work shall be secured and all precautions taken in the blasting operations to prevent damage to private or public property or to persons. The Contractor shall assume full liability for any damage that may occur during the use of explosives. No blast shall be set off within 50 feet of pipe already laid in the trench. Blasting may only be done by an approved, licensed

blaster. The excavation shall proceed in a conventional manner with satisfactory effort made to remove hard materials before the Engineer makes a determination of need for blasting. Pre-drilling and blasting will be allowed, if the Contractor can provide evidence for the Engineer's review that boring logs show the material cannot be excavated otherwise. Evidence will be provided for the Engineer's review and approval before pre-drilling and blasting is undertaken.

Tree Protection
Care shall be exercised to protect the roots of trees to be left standing. Within the branch spread of the tree, trench shall be opened only when the work can be installed immediately. Injured roots shall be pruned cleanly and backfill placed as soon as possible.

Backfilling
Trenches and other excavations shall not be backfilled until all required tests are performed and the work has been approved by the Engineer. The trenches shall be carefully backfilled with the excavated materials approved for backfilling consisting of earth, loam, sandy clay, sand, or other approved materials. No material shall be used for backfilling that contains mulch, other unstable materials, stones, blasted rock, broken concrete or pavement, or other hard materials having any dimension greater than 4 inches; or large clods of earth, debris, frozen earth or earth with an exceptionally high void content. Backfilling within the City's right-of-way shall conform to Connecticut Department of Transportation and City of Norwich specifications.

For backfill up to a level 2 feet over the top of pressure pipelines and 2 feet above the top of gravity pipelines, only selected materials shall be used. Select materials shall be finely divided material free from debris, organic material and stone, and may be suitable job excavated material or shall be provided by the Contractor from other sources. The backfill shall be placed in uniform layers not exceeding 6 inches in depth. Each layer shall be moistened and carefully and uniformly tamped with mechanical tampers or other suitable tools. Each layer shall be placed and tamped under the pipe haunches with care and thoroughness so as to eliminate the possibility of voids or lateral displacement.

The remainder of the backfill material shall then be placed and compacted above the level specified above. In areas not subject to traffic, the backfill shall be placed in 12 inch layers and each layer moistened and compacted to a density approximating that of the surrounding earth. Under roadways, driveways, paved areas, parking lots, along roadway shoulders and other areas subject to traffic, the backfill shall be placed in 6 inch layers and each layer moistened and compacted to density at least equal to that of the surrounding earth so that traffic can be resumed immediately after backfilling is completed. Any trenches which are improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted with the surface

restored to the required grade compaction. Along all portions of the trenches not located in roadways, the ground shall be graded to a reasonable uniformity and the mounding over the trenches left in a neat condition satisfactory to the Engineer.

Sheeting not specified to be left in place shall be removed as the backfilling progresses. Sheeting shall be removed in such a manner as to avoid caving of the trench. Voids left by the removal of sheeting and shoring shall be carefully filled and compacted. Where, in the opinion of the Engineer, damage is liable to result from withdrawing sheeting, the sheeting will be ordered to be left in place.

Boring and Jacking
Where required by the drawings, the pipeline will be installed in a steel casing, placed by boring and jacking. The size and thickness of the casing shall be determined by the design engineer. Where boring is required under highways, the materials and workmanship will be in accordance with the standards of the Connecticut Department of Transportation or local authority. Boring and jacking under railroads will be governed by the latest standards and those of the railroad involved. The steel casing shall be in accordance with ASTM A252 to the thicknesses shown on the drawings.

Pavement Removal and Replacement
Where necessary existing pavements shall be removed and replaced, the applicable specifications of the Connecticut Department of Transportation or local authority shall govern this work. Joints shall be sawed unless joints equally uniform in the opinion of the Engineer result from other means.

5.00 SANITARY SEWER PUMP STATION

5.01 SUMMARY

A. This section includes the installation information on complete pump stations including either 2” or 4” pumps. Details are included at the end of this section. in Appendix Section I-5. The intent of these specifications is to describe a station which meets the requirements of TR-16 (Reference Section 7.02 D) and is similar to other stations which NPU currently owns and operates. Items which are unclear should be addressed to NPU for clarification.

5.02 QUALITY CONTROL

A. The Contractor will take full responsibility for startup and operator training. The pump station manufacturer will warranty the station as a unit against defects in material and workmanship for one year from the date of startup.

5.03 SUBMITTALS

A. Shop drawings shall be submitted for approval for all material and equipment included in the pump station item. A minimum of three (3) sets of detailed engineered drawings shall be supplied to NPU for review.

5.04 MATERIALS

A. STRUCTURES

1. The wet well and valve chamber structures shall be precast concrete units to the grades on the contract drawings and shall meet the following requirements.

   a. Concrete shall be 5000 psi at 28 days.

   b. All precast structures shall be manufactured in accordance with the latest ASTM specification C-478.

   c. Design loading - ASSHTO - HS20 - 44.

   d. Construction joints of precast sections to be sealed with Butyl flexible joint sealant, conforming to ASTM C-443.

   e. Steel reinforcement shall conform to ASTM A-79, Grade 60 with 1" min. cover.

   f. Concrete shall be asphalt coated on the exterior and shall be watertight.

   g. Pipe penetrations shall be sealed by flexible watertight pipe boots as per ASTM C-923.

   h. The concrete wet well shall have a flat top with a cast in hatch as specified below.

   i. Electrical cable penetration through the pump chamber wall shall be "ROX system" or approved equal with the following clarification.
      (i.) One separate penetration shall be provided for the ultrasonic transducer.
      (ii.) One penetration shall accommodate remaining cables into the pump chamber.

   j. Valve Chamber shall include two (2) swing valves: Val-U-Matic with plunger or approved equal, two (2) 4" gate valves Resiler Wedge or

equal and a 3” Cam-lock bypass connection. Valves shall have a minimum of an 18-inch clearance in all directions.

2. Access Hatches

a. The hatches shall have a plate reinforced to HS-20 wheel load, mill finish, extruded aluminum frame incorporating a continuous concrete anchor. The doors shall open to 90 degrees and shall automatically lock with a stainless steel hold open arm with an aluminum release handle. The doors shall close flush with the frame. The lifting handle, hinges, and all fastening hardware shall be stainless steel. Hatches shall have provisions for locking with a padlock. The exterior of the doorframes where they contact the concrete shall be asphalt coated. Locking mechanism shall be flush mounted for vehicle traffic.

b. Wet well hatch shall be US Foundry Model AHS -30” x 48” spring assisted or approved equal and shall include a dual safety grate.

c. Valve chamber hatch shall be US Foundry Model AHS - 30” x 30” spring assisted or approved equal and shall include a ladder extension series LIB by Halliday Products or approved equal.

3. Odor Control

a. Unacceptable levels of odors may be produced at lift stations and within force mains due to excessive hydrogen sulfide generation. At a minimum, every lift station shall be designed to accommodate the necessary storage tanks and automatic chemical feed equipment for odor control and treatment.

5.05 PUMPS

A. 4” PUMPS

1. The pumps shall be of the centrifugal type, Myers, HOMA (model to be specified) slide rail type Non-Clog Submersible Pump or approved equal. All openings in the pump impeller and volute shall be large enough to pass a 3" sphere. The discharge flange shall be 4" standard.

2. The pump motor shall be of the submersible type. The motor shall be for 3 phase 208 volts.

3. The pump manufacturer shall warrant the pumps being supplied to the Utility Company NPU against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. In addition,

the manufacturer shall replace certain parts which shall become defective through normal use and wear on a progressive schedule of cost for a period of five (5) years; parts included are the mechanical seal, impeller, pump housing, wear ring and ball bearings.

4. The pump manufacturer shall furnish certified curves of pump performance that, in addition to pump characteristics shall also indicate graphically the relationships of horsepower and efficiency. The certified pump curves shall demonstrate the pumps capabilities over the entire range of expected pump operation.

5. The Contractor shall furnish and install submersible pumps capable of handling raw, unscreened sewage. Operating characteristics and installation details of the pumps shall be as indicated on the contract drawings. In the Submittals.

6. The design of the pumping system will be such that the pumping units will be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose, and no need for personnel to enter pump well.
7. Each pump shall be fitted with a corrosion-proof lifting, fitting and stainless steel chain of adequate strength and length to permit raising the pump for inspection and removal. Lifting devices shall be supported and held in place with stainless steel Kellems Grip or approved equal inside the wet well.

8. Mechanical seals: Carbon rotary/ceramic stationary, 300 series stainless steel metal parts, buna-n elastomers. Overload protection must be provided for in control panel. A running hour meter shall be supplied for each pump.

9. The inlet of the pump must be designed to provide protection against wear to the impeller. The impeller shall be of a non-clog design capable of passing 3” spherical solids, fibrous material, heavy sludge, and constructed with long throughway with no acute turns. The impellers shall be key-seated and held securely to the shaft by a streamlined locknut, or an equally efficient method which shall permit easy removal of the impeller and shall prevent loosening of the impeller on the shaft in the event of motor reversal.

10. All exposed fasteners on pumps and within wetwell shall be of 300 series stainless steel.

Pump Characteristics

1. Pumps shall be explosion proof and shall be able to pump the projected PDF for all existing and proposed development flows to be conveyed to the site.

2. Primary and secondary (backup) level control equipment for the operation of the pumps shall be provided. Primary level control shall be by a bubbler system with an Ultrasonic system as a secondary backup. Where such systems are electrical (e.g. float switches), they shall be approved for a Class I, Division 1, Groups C&D environment in accordance with all applicable Articles of the NEC.

3. The lift station shall be provided with multiple pump units programmed to alternate sequentially. Should only two units be provided, equal capacity is required, and each pump train shall be capable of handling the PDF. A third identical pump and motor shall be provided on a pallet for replacement in case of the failure of an installed pump and motor. Where three or more pumps are provided, they shall be individually sized to meet the PDF with any one pump out of service, and as appropriate for actual flow conditions under normal operations.

4. The station shall be designed such that the number of motor starts per hour shall not exceed 10, or the number of starts recommended by the motor manufacturer, whichever is less. Duplex pump operation and controllers shall be provided such that the lead and lag pump positions are alternated with each successive motor start.

5. Provisions acceptable to the City shall be made to facilitate the removal of pumps, motors, and other mechanical and electrical equipment. Typically, in wet well / dry well stations, a bridge crane shall be provided for removing pumps. In suction lift stations, slide or overhead rails with hoists for removing pumps shall be provided.

Pump Protection

Pumps handling raw wastewater shall be preceded by approved comminutors (a.k.a.: grinders or macerators) that are installed to protect the pumps from clogging damage by reducing the particle size of wastewater solids in the flow stream. The grinder shall be located in a lined vault or manhole that precedes the wet well. Raw wastewater approaching the lift station flows through the comminutor vault influent channel equipped with the grinder. In the event that the grinder must be taken out of service, slide gates shall be provided to direct the influent flow to a bypass bar screen. Furthermore, in the event that flow backs up upstream of the grinder, the influent channel wall shall be equipped with an overflow notch just upstream of the bar screen. Bar screens shall be stainless steel and shall be arranged to facilitate manual cleaning of the bar screen with a rake to be provided.

B. <u>2" PUMPS</u>

1. The pumps shall be of the centrifugal type, Myers, HOMA (model to

be specified) Grinder Pumps or approved equal. The discharge flange shall be 1-1/4". Pumps shall be equipped with lift-out check valve.

2. The pump motor shall be of the submersible type. The motor shall be for 3 phase 208 volts.

3. The pump shall be capable of operating over the full range of the performance curve without overloading the motor and causing any objectionable noise or vibration. All exposed fasteners shall be of 300 series stainless steel.

4. The pump manufacturer shall warrant the pumps being supplied to the Utility Company NPU against defects in workmanship and materials for one (1) year under normal use, operation and service. In addition, the manufacturer shall replace certain parts which shall become defective through normal use and wear on a progressive schedule of cost for five (5) years one (1) year; parts included are the mechanical seal, impeller, pump housing, wear ring and ball bearings.

5. The pump manufacturer shall furnish curves of pump performance that, in addition to pump characteristics shall also indicate graphically the relationships of horsepower and efficiency. The certified pump curves shall demonstrate the pumps capabilities over the entire range of expected pump operation.

6. The design of the pumping system will be such that the pumping units will be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose, and no need for personnel to enter pump well.

7. Each pump shall be fitted with a corrosion-proof lifting, fitting and stainless steel chain of adequate strength and length to permit raising the pump for inspection and removal.

8. The pumps shall be supplied with the seal sensor and sensor line. Mechanical seals: Carbon rotary/ceramic stationary, 300 series stainless steel metal parts, buna-n elastomers. Overload protection must be provided for in control panel.

9. The inlet of the pump must be designed to provide protection against wear to the impeller. The impellers shall be threaded and held securely to the shaft by a streamlined locknut, or an equally efficient method that shall permit easy removal of the impeller and shall prevent loosening of the impeller on the shaft.

10. All exposed fasteners on pumps and within wetwell shall be of 300 series stainless steel.

5.06 SLIDE RAILS

A. 4" PUMPS

1. The pumps shall be installed with two slide rail systems, equal to Myers model SRAX-44 (with the exception that pipe rails shall be 2" is size) so that either or both pumps can be removed without entering the wet well.

2. The slide rails shall include a ductile iron discharge base, a brass pump attaching and sealing plate, a brass pump guide plate, and a 4" cast iron flanged elbow.

3. A sealing plate shall be attached to the pump. A simple downward sliding motion of the pump and guide plate on the guide rails shall cause the unit to be automatically connected and sealed to the base. The open face of the sealing plate shall have a dovetailed groove machined into the face to hold an "O" ring. The "O" ring shall provide a leak-proof seal at all operating pressures.

4. The slide rail pipe shall be 2" schedule 40 stainless steel (2 per pump).

5. The weight of the pump shall bear solely on the discharge base and not on the guide rails. Rail systems that require the pump to be supported by legs, which might interfere with the flow of solids into the pump suction, shall not be considered equal.

6. The slide rail upper support shall be constructed entirely of stainless steel and shall be fixed to the concrete opening directly under the hatch with stainless steel anchors. All set screws and other hardware shall be stainless steel 304L or 316.

8. The pump shall be equipped with a stainless steel lifting bail. A 1/4" stainless steel lifting chain shall be attached to the guide plate with stainless steel eyebolt. The chain shall be at least 7' longer than necessary to reach the top of the wet well. The top of the chain shall be coiled and shall attach to a stainless steel hook welded to the upper slide rail bracket.

B. 2" PUMPS

1. The pumps shall be installed with two slide rail systems, equal to Myers model RWG-125 or approved equal so that either or both pumps can be removed without entering the wet well.

2. The slide rails shall be constructed entirely of corrosion resistant materials. Each slide rail shall have a cast red brass foot assembly with stainless steel set screws attached to the bottom of the concrete basin with stainless steel anchors.

3. The foot assembly shall serve as a bottom support for the slide rail pipe that shall be two pieces (per pump) of 1" stainless steel pipe.

4. The slide rail disconnect assembly shall be threaded 2". The disconnect shall be made of corrosion resistant, non-sparking red brass. The stationary half of the disconnect shall be female with a funnel top and shall be held to the slide rail pipe with stainless steel set screws. The sliding half of the disconnect shall be male, tapered to slide easily into the stationary piece, and shall have a 3/8" stainless steel eyebolt threaded into the top to attach the lifting chain. The seal shall be made by a Teflon coated BUNA-N O-ring which mounts into a groove in the male sliding half of the disconnect.

5. 3/16" stainless steel lifting chains will be installed. Each pump will have two chains: one attached to the pump and one to the sliding half of the disconnect. The top of both chains will attach to a stainless steel hook welded to the upper slide rail support.

6. A sealing plate shall be attached to the pump. A simple downward sliding motion of the pump and guide plate on the guide rails shall cause the unit to be automatically connected and sealed to the base. The open face of the sealing plate shall have a dovetailed groove machined into the face to hold an "O" ring. The "O" ring shall provide a leak-proof seal at all operating pressures.

7. The slide rail pipe shall be 1" schedule 40 stainless steel (2 per pump).

8. The weight of the pump shall bear solely on the discharge base and not on the guide rails. Rail systems that require the pump to be supported by legs, which might interfere with the flow of solids into the pump suction, shall not be considered equal.

9. The slide rail upper support shall be constructed entirely of stainless steel and shall be fixed to the concrete opening directly under the hatch with

stainless steel anchors. All set screws and other hardware shall be stainless steel.

5.07 VALVES

A. 4" PUMPS

1. The valves, except the backwater valve, shall be located in a separate concrete valve pit as shown on the drawings. All valves are to open left.

2. The check valves shall be 4" flanged swing type check valves. They shall have a cast iron ASTM A126 body and a totally encapsulated neoprene coated iron disc. The disc shall have an extremely low cracking pressure of less than 1/4 psi. The neoprene disc shall have a maintenance free hinge less design. The maximum pressure rating of the check valves shall be 200 psi. Check valves shall be iron body, bronze mounted, full opening with external operator and shall be valvematic swing flex check valve as manufactured by Valvematic.

3. The backwater valve shall be located in the wet well on the drain line from the valve pit as shown on the drawings. The valve shall be 2" PVC with a non-corrosive flexible PVC flapper. The valve shall have a plastic access cover secured to the valve body with four stainless steel bolts. Removing the access cover shall provide easy access to clean or replace the flapper.

4. Gate valves shall be iron body resilient-seated wedge valves with hand wheel (open-left) with fusion bonded epoxy coat and conform to AWWA C509 latest revision and shall equal the "Kennedy Ken-Seal".

B. 2" PUMPS

1. The check valves shall be a lift-out type check valve as manufactured by Myers.

2. The gate valves shall be of 2" threaded brass construction. The valves shall be full opening, solid disc, non-rising stem, with a 125 psi working pressure. The gate valves shall each have a stainless steel extended handle extending to within 6" of the top of the station. Each extended handle shall have a stainless steel upper support as shown on the drawings.

5.08 PIPE AND FITTINGS

A. 4" PUMPS

1. The 4" discharge pipe shall be mechanical joint ductile iron class 52 thickness per ANSI A21.10, A21.50, A21.51, AWWA C110, C150, C151. The lining shall be cement per ANSI A21.4, AWWA C104. Exterior coating to be bituminous 1 mil thickness.

2. The fittings shall be flanged cast iron per ANSI A21.10, AWWA C110. Flanges shall be 125# ANSI B16.1 faced and drilled. The fitting interior shall be cement lined with a bituminous exterior coating.

3. The pipe connections between the wet well and the valve pit shall be dresser type couplings. These shall be made of ductile iron ASTM A 536-80, The gaskets shall be virgin SBR per ASTM D 2000.

4. The drain line between the valve pit and the wet well shall be 2" PVC schedule 40 pipe. A 2" PVC floor drain with a bell trap shall be cast into the floor of the valve pit to prevent sewage gas from getting into the valve pit while allowing liquid to drain into the wet well.

B. 2" PUMPS

1. The discharge pipe and fittings shall be 2" PVC schedule 80. The fittings shall have solvent weld connections whenever possible. Socket type fittings shall meet ASTM D-2464, and threaded fittings shall meet ASTM D 2467. The schedule 80 PVC pipe shall meet ASTM D-1785.

2. The discharge pipe from each pump shall be supported with two stainless steel pipe supports, one horizontal and one vertical, as shown on the drawings.

5.09 PUMP CONTROLS

A. GENERAL

1. The Contractor shall furnish, install and test a complete control system, compatible to the constant speed submersible raw sewage pumps supplied under this contract.

2. The pump control equipment shall automatically start the lead pump when sewage in the wet well reaches a predetermined level. On a continued rising wet well level, the control shall start the second pump, and if a third predetermined level is reached, an alarm light mounted on the panel shall be activated and an alarm signal shall be transmitted over leased telephone lines to a remote alarm panel. The control shall shut off both pumps at a predetermined low level. On a continued dropping wet well level, an

additional alarm signal shall be tied into the low-level alarm. The elevations of these operating conditions are indicated on the contract drawings and the equipment is to be installed and adjusted to operate at these conditions; however, the equipment shall be capable of independent adjustment. The control shall automatically alternate the sequence of lead and lag pump for each pumping cycle. Pump motors shall be protected by magnetic overloads, with manual reset. In the event of pump overload, the alarm circuit shall be energized.

3. The pump control equipment shall be arranged to automatically start and operate after an interruption of electrical power for any reason what-so-ever and the subsequent resumption of electrical power whether by normal utility company or standby generator, provided that the pump controls were in an operating mode at the time of power interruption. When operating on standby generator electrical power only one pump shall be allowed to operate initially. Once the first pump is running, the second pump should be capable of running if needed. The basic device for the control shall be a 12-volt DC relay. Pump controls shall be suitable for the power supply in this specification.

4. The wastewater level in the wet well shall be measured by an ultrasonic transducer; the transducer shall be 6-degree. The liquid level control system shall be the Multi Range Plus 200 cone and transducer with a 50 foot cable as manufactured by Milltronics. The conduit run to the wet well must be 1" metallic not PVC, and the portion of conduit exposed within the wet well shall be stainless steel. The conduit must be run from the pump chamber directly to the Milltronic unit; the cable cannot be run through any other raceway. The exact location and mounting of the unit within wet well shall strictly conform to the manufacturers directions.

B. CONTROL PANEL

1. The Controller for the liquid level control system and the auto-transfer switch for the emergency generator (if applicable) shall be mounted in a weather proof Aluminum, Stainless steel or fiberglass double door outdoor enclosure", with a thickness of 0.125 inch and shall have a backing plate. The following equipment shall also be mounted within the equipment enclosure. The control panel enclosure shall be sized to accommodate all equipment. The control panel shall be as manufactured by Hoffman, Erpel or approved equal. The control panel enclosure shall also include but not be limited to the following equipment:

   a. Type L, 3 phase - 100 amp breaker, AIC 22000

   b. One load center with the following:

(i) 2 - single phase - 30 amp single phase breakers
(ii) 1 - 20 amp single phase breaker
(iii) 2 - 15 amp single phase breakers

c. A cabinet light by Hoffman CAT. #A-LTDB-1 or equal

d. 1-120 vac GFI receptacle

e. 725 watt, 120 vac stainless steel finstrip strip heater with thermostat, by Vulcan, CAT. #FS1510

f. 2 combination motor starters - 5 Hp (Alternate 1 – 2 HP)

g. 2-hand-off-auto switches to be located on combination motor starters.

h. 1-quindar QDTT90 transmitter with 1-quindar QDTR90 receiver, 1-QX1 power supply and 2 MTL-376 line protector line; frequency for telemetry system is 1375 Hz

i. All necessary wiring and brackets

j. All accessory relays to be either octagonal or 11 pin base with din rail mounting

2. If only single phase primary power is available, the following shall be included in the control panel: Variable frequency drive units (VFD) - Hp (to be determined) - 208 volt, three phase (Power to the specified pump motors shall be through appropriately sized Variable Frequency Drive units (for applicable motor voltage) which shall convert single phase power to three phase power. The AC primary and secondary lines of VFD units shall be equipped with fuses. VFD units shall be as manufactured by Allen Bradley, Mitsubishi, Woods ABB or equal.)

3. The control panel enclosure shall include all other items necessary if not specifically listed to form a complete and operating pump station system including telemetry system to be connected into the local system. All internal wiring shall be neat and color-coded. Each wire shall be a different color or stripe (except for ground) and all incoming wires shall terminate into an appropriate terminal block. The equipment shall be mounted in such a way to provide for easy future adjustment and access. A schematic diagram (showing wire color) shall be permanently fastened to the inside of the enclosure. An installation and service manual shall be included with the control panel.

5.10 GENERATOR

A. GENERAL

1. The Contractor shall furnish and install a natural gas or diesel (or approved equal) engine driven electric generator set, automatic transfer switch and all appurtenances necessary to make the equipment complete and operate as indicated on the drawings and as herein specified. The unit to be supplied shall have a kW rating as specified and shall be enclosed with a weather protective housing and be located on a concrete pad and elevated such the the finish grade of the pad will be four (4) inches above grade. If natural gas is not available, propane or diesel will be used. If diesel is used, the fuel tank shall be of non-corrosive double-walled construction.

B. GENERATOR SET

1. It is the intent of this specification to secure an emergency generator system that has been prototype tested, factory built, production tested, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and regulations. All equipment shall be new, of current production of a national firm which manufactures the generator and controls, transfer switch, and assembles the generator set as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained service personnel.

C. SUBMITTAL

1. Submittal shall include specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set, the transfer switch, and other remote devices if included elsewhere in these specifications.

D. TESTING

1. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer shall be responsible design prototype tests as described herein: Components of the emergency system, such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are

potentially damaging. Rather, similar design prototypes, which will not be sold, shall be used for these tests. Prototype test programs shall include the requirements of NFPA-110 and the following:

a. Maximum power (kW).

b. Maximum starting (kVA) at 35% instantaneous voltage dip.

c. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-22.40 and 16.40.

d. Governor speed regulation under steady state and transient conditions.

e. Voltage regulation and generator transient response.

f. Fuel consumption at 1/4, 1/2, 3/4, and full load.

g. Harmonic analysis, voltage waveform deviation, and telephone influence factor.

h. Three-phase line-to-line short circuit tests.

i. Cooling airflow.

j. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.

k. Endurance testing.

E. WARRANTY

1. The emergency generator system shall be warranted by the manufacturer for one year or 2,000 hours, whichever occurs first, from the date of the site start-up

F. PRODUCTS

1. The standby generator set shall be rated standby power defined as continuous operation for the duration of any power outage, 0.8 power factor, and shall be Kohler with a 4P4 generator frame or approved equal. Vibration isolators shall be provided between the engine-generator and welded steel base or between the base and the floor. The engine shall be fueled with natural gas.

2. Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Test shall include:

   a. Single-step load pickup.

   b. Transient and steady state governing.

   c. Safety shutdown device testing.

   d. Voltage regulation.

   e. Rated Power

   f. Maximum Power

3. Upon request, arrangements to witness this test will be made or a certified test record will be sent prior to shipment. The following accessories shall be provided:

   a. Overvoltage protection will shut down the unit after 1 second of 15% or more overvoltage.

   b. Battery rack, battery cables, 12-volt battery(ies) capable of delivering the minimum cold cranking Amps required at 0°F per SAE Standard J-537.

   c. Gasproof, seamless, stainless steel, flexible exhaust connector(s) ending in pipe thread.

   d. Flexible fuel line(s) rated 300°F and 100 psi ending in pipe thread.

   e. Engineer exhaust silencer, coated to be temperature and rust resistant, and rated for critical applications. Exhaust noise shall be limited to 85 dba as measured at 10 feet in a free-field environment.

   f. Block heater of proper wattage and voltage thermostatically controlled to maintain engine coolant at 90°F (32°C) to meet the start-up requirement of NFPA-99 or NFPA-110 Regulations.

   g. 10-Ampere automatic float and equalize battery charger with +-1% constant voltage regulation from no load to full load over +-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambients from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected. Optional alarm circuit board to meet the

requirements to NFPA-110 for low battery voltage, high battery voltage, and battery charger malfunction.

h. Steel weather-protective enclosure with removable or hinged side panels to allow inspection and maintenance. The enclosure shall be coated with ASA gray primer and two coats of high-gloss, weatherproof, sag resistant vinylac in the manufacturer's standard color through an electrical bonding process. The specified exhaust silencer shall be vibra-mounted on the roof of the enclosure.

G. EXECUTION

1. The equipment shall be installed as shown on the plans, in accordance with the manufacturer's recommendations and all applicable codes.

2. Site Tests: An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:

   a. Fuel, lubricating oil, and antifreeze (liquid cooled models) shall be checked for conformity to the manufacturer's recommendations under the environmental conditions present and expected.

   b. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. This shall include engine heaters, battery charger, generator strip heaters, remote annunciator, etc.

   c. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.

   d. Automatic start-up by means of simulated power outage to test remove-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination. Engine temperature, oil pressure and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test.

5.11 TRANSFER SWITCH

A. GENERAL

1. It is the intent of this specification to secure an automatic transfer switch that has been prototype tested, factory built, production tested, site tested, together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein. All equipment shall be new, of current production by a national firm which manufactures the generator and controls, transfer switch, and assembles the standby generator sets as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen. The automatic transfer switch shall conform to the requirements of NEMA Standard ICS 2-441 and Underwriters' Laboratories UL-1008 and shall be UL listed as follows:

    a. For use in emergency systems in accordance with Articles 517 and 700 of the National Electric Code.

    b. Rated in Amperes for total system transfer including control of motors, electric-discharge lamps, electric-heating and tungsten-filament lamp load. Switches rated above 400 Amperes shall be suitable for 30% or 400 Amperes tungsten-filament lamp load, whichever is higher.

B. SUBMITTAL

1. Submittal shall include specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch and the remote annunciator panel if it is included.

C. TESTING

1. Certified laboratory test data on a switch of the same design and rating shall be provided to confirm the following switching abilities:

    a. Overload and endurance per Tables 21.2 and 23.2 of UL-1008 when enclosed according to Paragraph 1.6.

    b. Temperature rise tests after the overload and endurance tests to confirm the ability of the transfer switches to carry their rated current within the allowable temperature limits of the insulation in contact with current carrying parts.

    c. No welding of contacts. Transfer switch must be operable to alternate source after the withstand current tests

d. Dielectric tests at 1960 Volts, rms, minimum after the withstand current test.

e. All production units should be subjected to the following factory tests:

(i) The complete automatic transfer switch shall be tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

(ii) The complete automatic transfer switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.

(iii) The control panel shall meet or exceed the voltage surge withstand capability in accordance with IEEE Standard 472-1974 (ANSI C37.90a-1974) and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

D. WARRANTY

1. The automatic transfer switch shall be warranted by the manufacturer for one year from the date of installation. Optional two-year and five-year warranties shall be available upon request.

E. PRODUCT

1. The automatic transfer switch shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of over current protection, voltage and X/R ratio as shown on the plans.

2. The automatic transfer switch shall consist of a power transfer module and a control module, interconnected to provide complete automatic operation. The automatic transfer switch shall be mechanically held and electrically operated by a single-solenoid mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty and be inherently double-throw. The switch shall be mechanically held and interlocked to ensure only one of two possible positions - normal or emergency. The automatic transfer switch shall be suitable for use with emergency sources such as an engine or turbine generator source or another utility source.

3. The control module shall be supplied with a protective cover and be mounted separately from the transfer switch for ease of maintenance.

Sensing and control logic shall be solid-state and mounted on plug-in printed circuit boards. Printed circuit boards shall be keyed to prevent incorrect installation. Interfacing relays shall be industrial-control-grade, plug-in type with dust covers and locking clips. The following shall also be provided for the control module.

4. For single-phase switches, the normal source voltage across live lines shall be monitored, and for three-phase switches all phases of the normal shall be monitored line-to-line. Close differential voltage sensing shall be provided. The pickup voltage shall be adjustable from 72% to 100% of nominal and the dropout voltage shall be adjustable from 72% to 98% of the pickup value. The transfer to emergency will be initiated upon reduction of the normal source to 85% of nominal voltage and retransfer to normal shall occur when normal source restores to 95% of nominal.

5. Neutral conductor terminal lugs as required for the System.

6. All movable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks. Automatic operation of the switch shall not require power from any source other than the line-to-line voltage of the source to which the switch is transferring.

7. Each automatic transfer switch shall include the following standard accessories:

   a. 1 (TDNE) Time delay on transfer from Normal to emergency (adjustable 0 to 60 seconds).

   b. 1 (TDES) Time delay on Engine starting (factory set at 3)

   c. 1 (TDEN) Time delay on transfer from Emergency to Normal adjustable 0-30 minutes).

   d. 1 Frequency/voltage relay for emergency source.

   e. 1 Test pushbutton to simulate a power failure on normal.

   f. 1 Disconnect plug to prevent automatic operation.

   g. 1 Main shaft auxiliary contact rated 10 ampere at 480V lone closed on normal and one closed on emergency)

F. SWITCH

1. 1 automatic transfer switch (model to be determined) mounted in a NEMA 1 type enclosure, sized to output of the generator, Kohler or approved equal with the following accessories:

   a. Plant exerciser adjustable over a 14-day period in 30-minute increments.

G. EXECUTION

1. The transfer switch shall be installed as shown on the plans, in accordance with the manufacturer's recommendations and all applicable.

2. Site Tests: An installation check and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination.

5.12 OTHER

A. POWER

1. Emergency and primary power (to be determined) shall be installed underground to the equipment enclosure cabinet via a 4" PVC conduit.

B. ALARMS

1. Dedicated line to 16 S. Golden Street, Norwich Public Utilities for details of alarm connection at the plant.

5.13 LEVEL CONTROL AND TELEMETRY WIRING

1. Level control and telemetry wiring shall conform to the Utility

Lift Station Site Improvements
Property Dedication

1. In order for the City to operate and maintain the lift station and associated facilities, adequately sized parcels shall be reserved by the Developer at appropriate locations approved by the Utilities Department. Lift station sites,

including utility easements, will not be considered as part of the City's public use or open space land dedication requirements.

2. Site selection for lift stations shall address all local, State and Federal regulations, including skyline, ridgeline, noise issues, odor control and ventilation measures, endangered species, and impacts to waters of the United States (Corps of Engineers).

   Applicants must supply the following property information:
   a. Legal Description (conducted by a Professional Licensed Surveyor).
   b. Zoning.
   c. Easement Provisions.
   d. Dedication to the City of Norwich (property and facility/structure(s) shall be deeded to the City).
   e. Address for billing purposes.

Site Configuration

1. The site shall accommodate facility layout for all current and future lift station facilities, odor control and ventilation facilities, enclosures, piping, buildings, driveways, electrical & control cabinets, generators, transformers, and appurtenant facilities.

2. Site layout shall accommodate outside high-voltage transformers.

3. The size of the site is dependent on the type of facility. The proposed site shall be approved by the Utilities Department during the Development Review Process. The minimum size and configuration of the site shall be that which will allow for efficient operation by the Utilities Department.

Site Amenities

1. Water service connection, meter, and backflow prevention shall be provided in compliance with City Utilities Department and Cross-Connection Control requirements.

2. Screening, landscaping and irrigation system design (temporary and permanent) shall conform to the City's Landscape and Irrigation Design requirements. Landscaping shall not hinder access, operations or maintenance of the facilities.

3. An exterior yard hydrant shall be supplied from the potable water system, including the service tap, metering equipment and required backflow prevention assemblies.

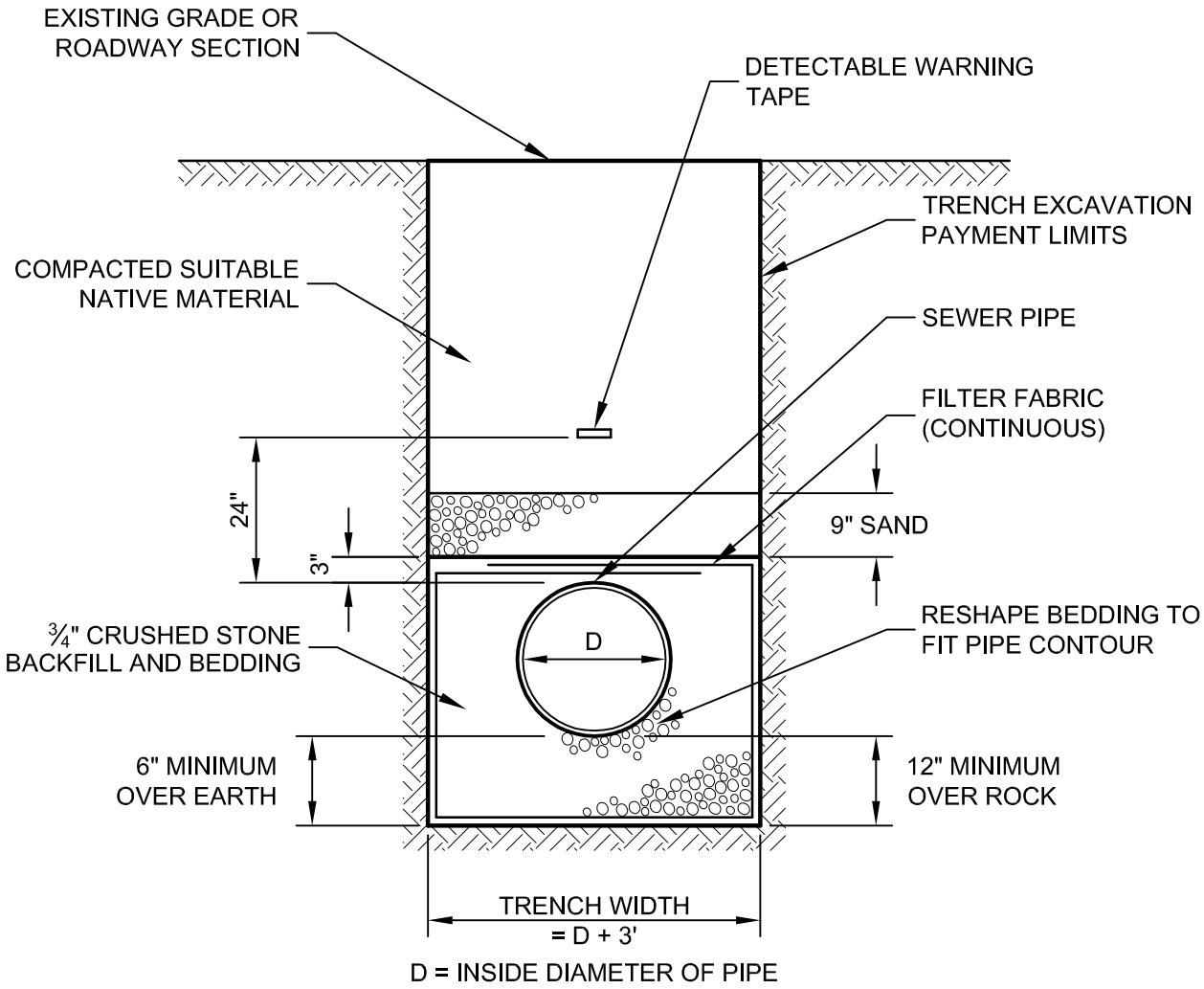
4. Access roads shall be a minimum of 15 feet wide with a clear width of 20 feet to accommodate maintenance and emergency vehicles. Access roads shall have a maximum longitudinal slope of 10% and a maximum cross-slope of 2%. A minimum radius of 250 feet to the road centerline shall be provided to accommodate a 65-foot tractor-trailer truck and the City's largest vacuum truck. The road surface shall be Class 6 Aggregate Base Course or asphalt, depending on slope, location and configuration. Materials and compaction shall conform to City Criteria. Typical access road cross sections are as follows:

5. Fencing shall be provided for site delineation and security of the facilities as directed by the Utilities Department. Access gates shall be provided to accommodate standard trucks and large maintenance vehicles, including tractor-trailers, and shall include entry equipment commensurate with the level of security necessary at the site. Fencing materials, height and style shall be selected as appropriate to blend into the surrounding neighborhood design and shall be subject to Utilities Department approval.

6. Consideration shall be given to private architectural control, including homeowner association and/or metropolitan district criteria; however, City Criteria shall govern over private development guidelines or requirements.

APPENDIX A

Sanitary Sewer Details



Dwg. No. S-1		Sanitary Sewer Trench Detail			Date: May 2014
Revision	Date	Drawn	Scale	Description	
Sanitary Sewer Construction Standards		Norwich Public Utilities			

Sanitary Sewer Construction Standards

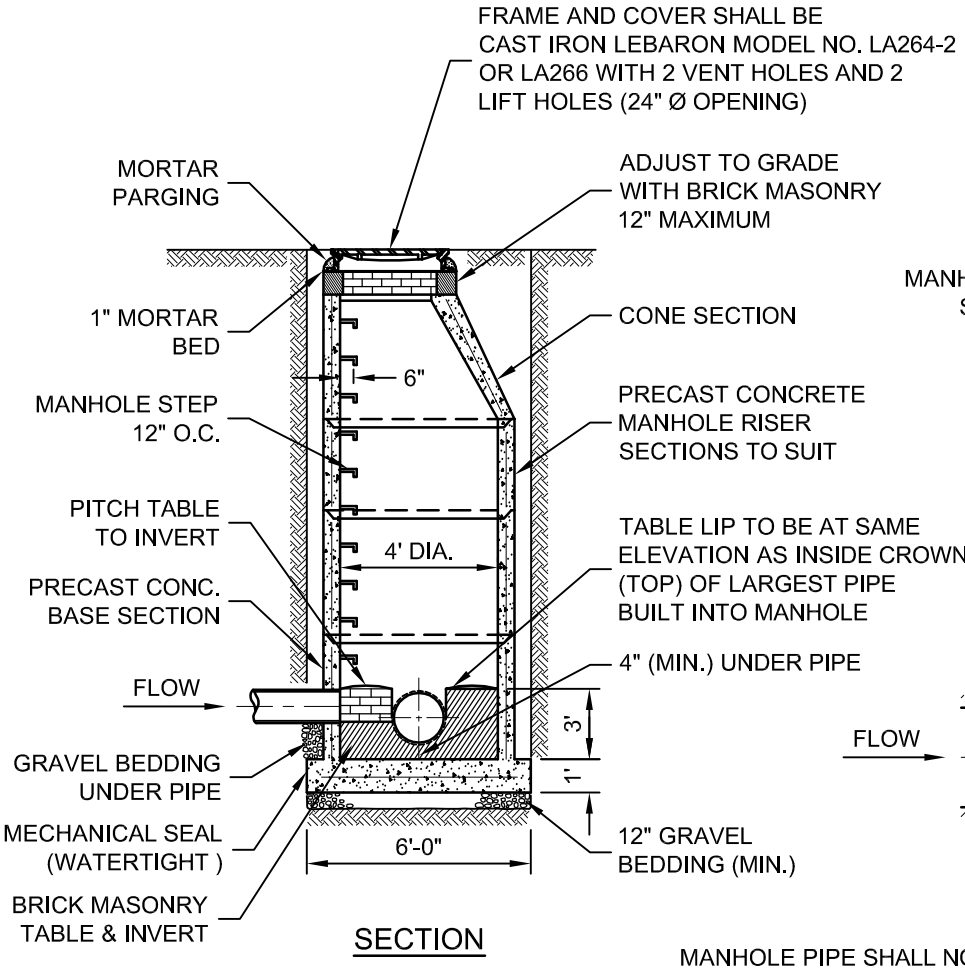
Norwich Public Utilities

Sanitary Sewer Manhole

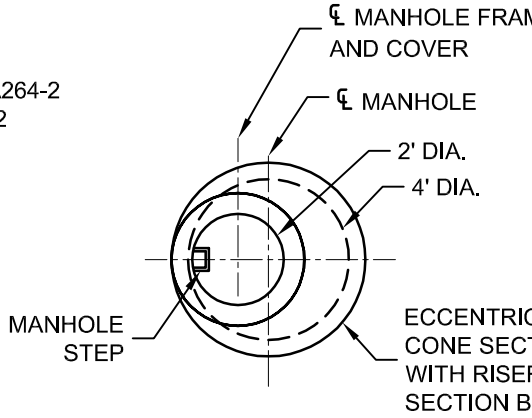
Dwg. No. S-2

Date: May 2014

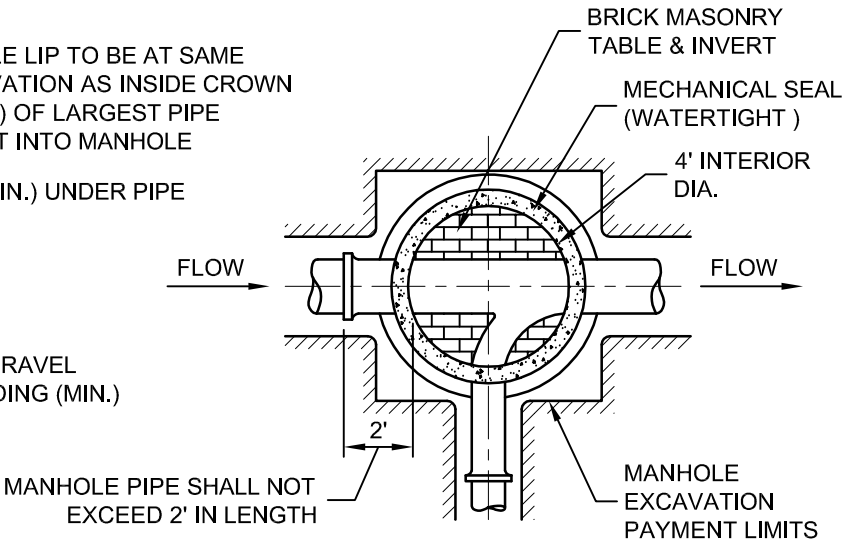
Revision	Date	Drawn	Scale	Description



SECTION



PLAN - CONE SECTION



PLAN - INVERT TABLE

NOTES:

1. ALL PIPES SHALL BE CUT FLUSH WITH INSIDE WALL OF STRUCTURE.
2. CONTRACTOR SHALL FILL LIFTING HOLES WITH MORTAR.
3. MANHOLE COVERS SHALL HAVE THE WORD "SEWER" CAST INTO THE CENTER IN 3" LETTERS.
4. THE OUTSIDE OF MANHOLE SECTIONS SHALL BE PAINTED WITH TWO COATS OF BITUMINOUS MATERIAL.

Norwich Public Utilities

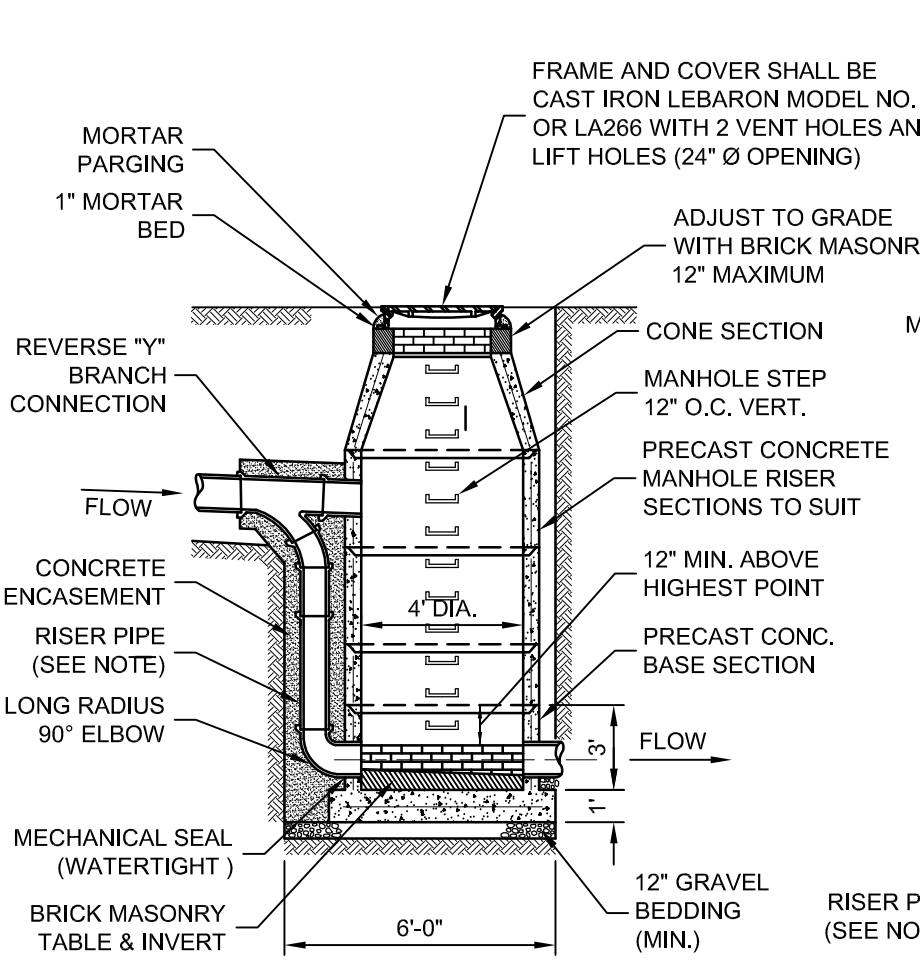
Sanitary Sewer Construction Standards

Sanitary Sewer Drop Manhole

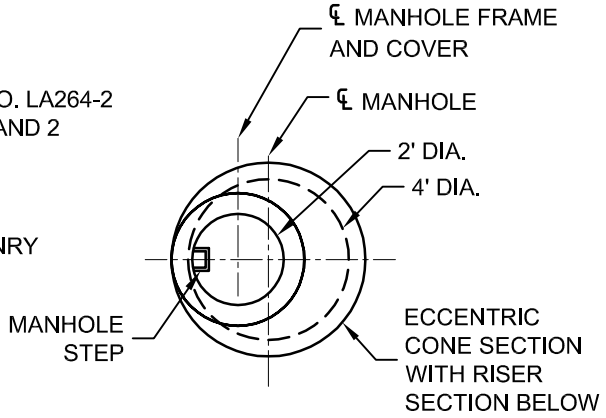
Dwg. No. S-3

Date: May 2014

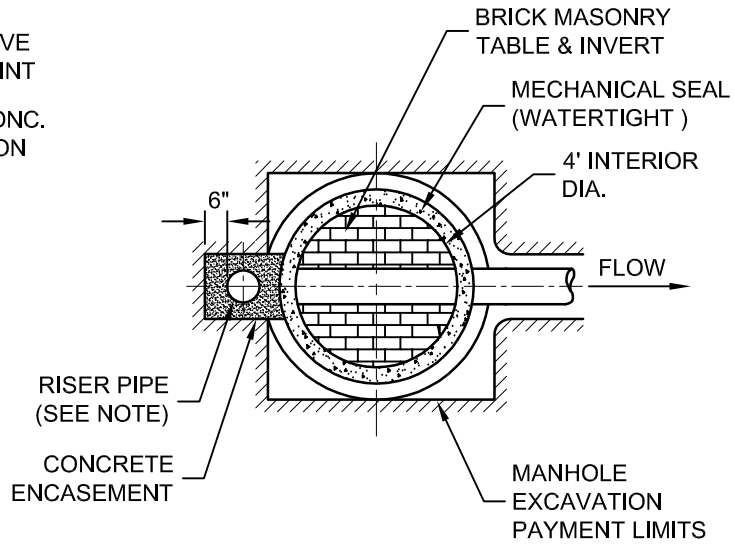
Description	Scale	Drawn	Date	Revision



SECTION

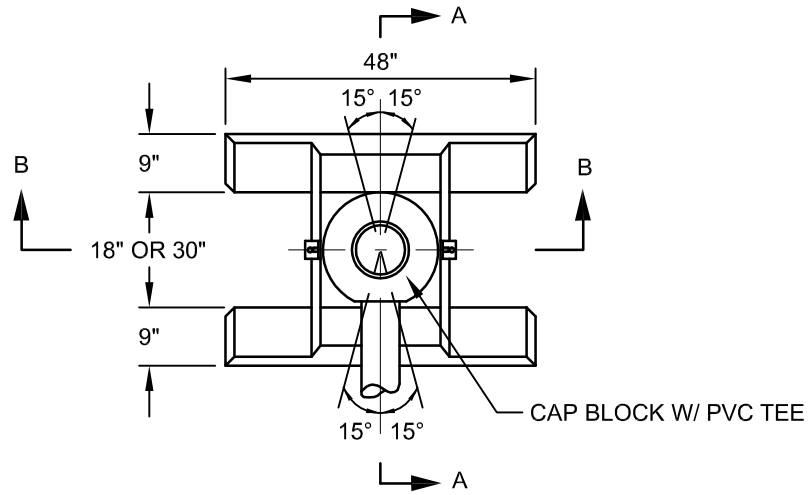


PLAN - CONE SECTION

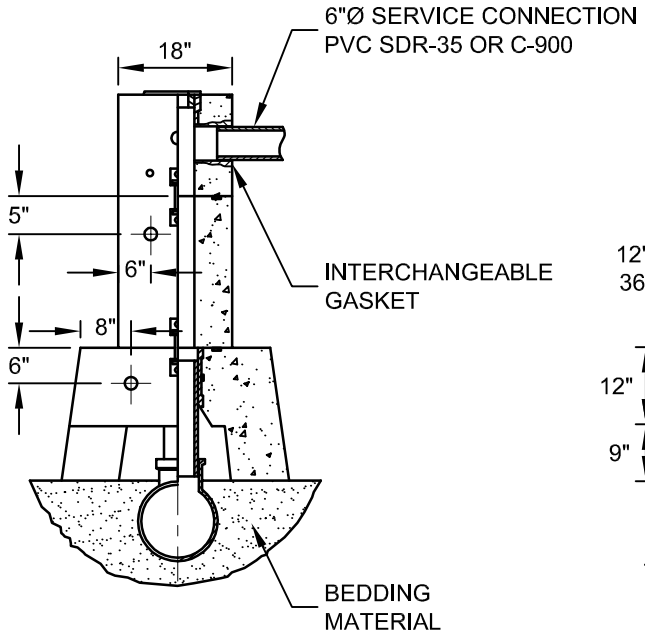


PLAN - INVERT TABLE

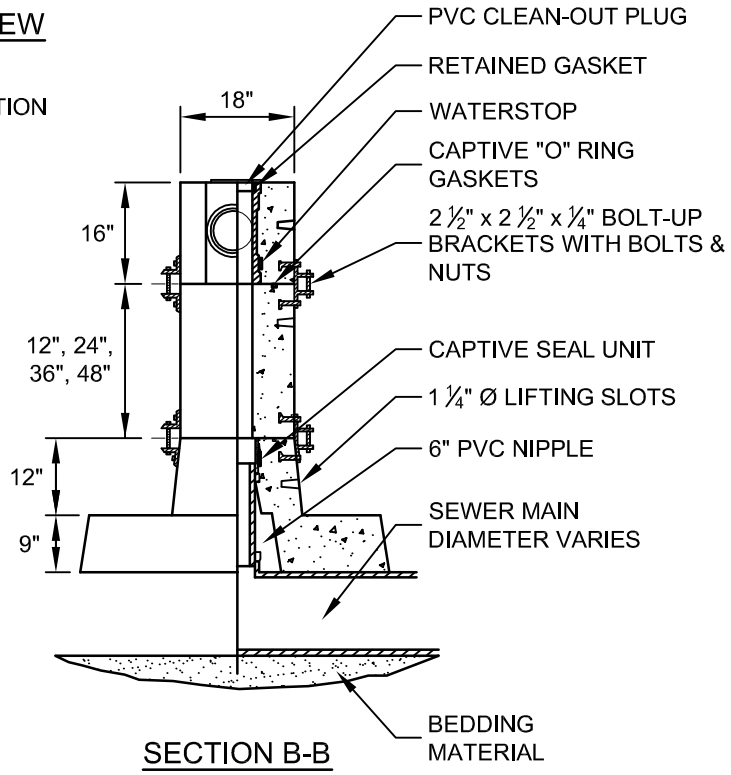
NOTE:
1. USE 8" RISER PIPE & BENDS FOR INCOMING SEWER OF 12" OR LESS.
2. USE 10" RISER PIPE & BENDS FOR INCOMING SEWER GREATER THAN 12".



PLAN VIEW



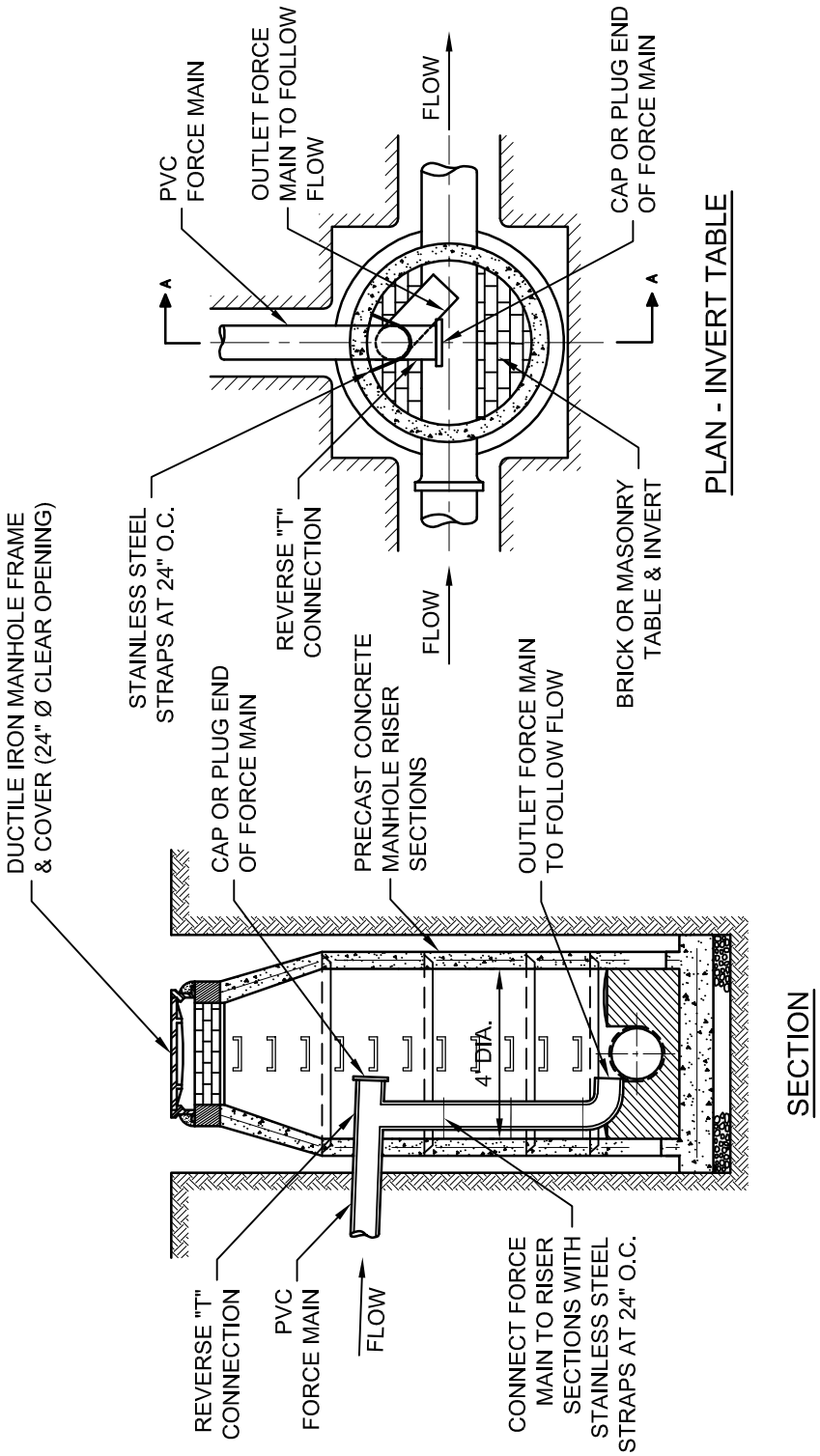
SECTION A-A



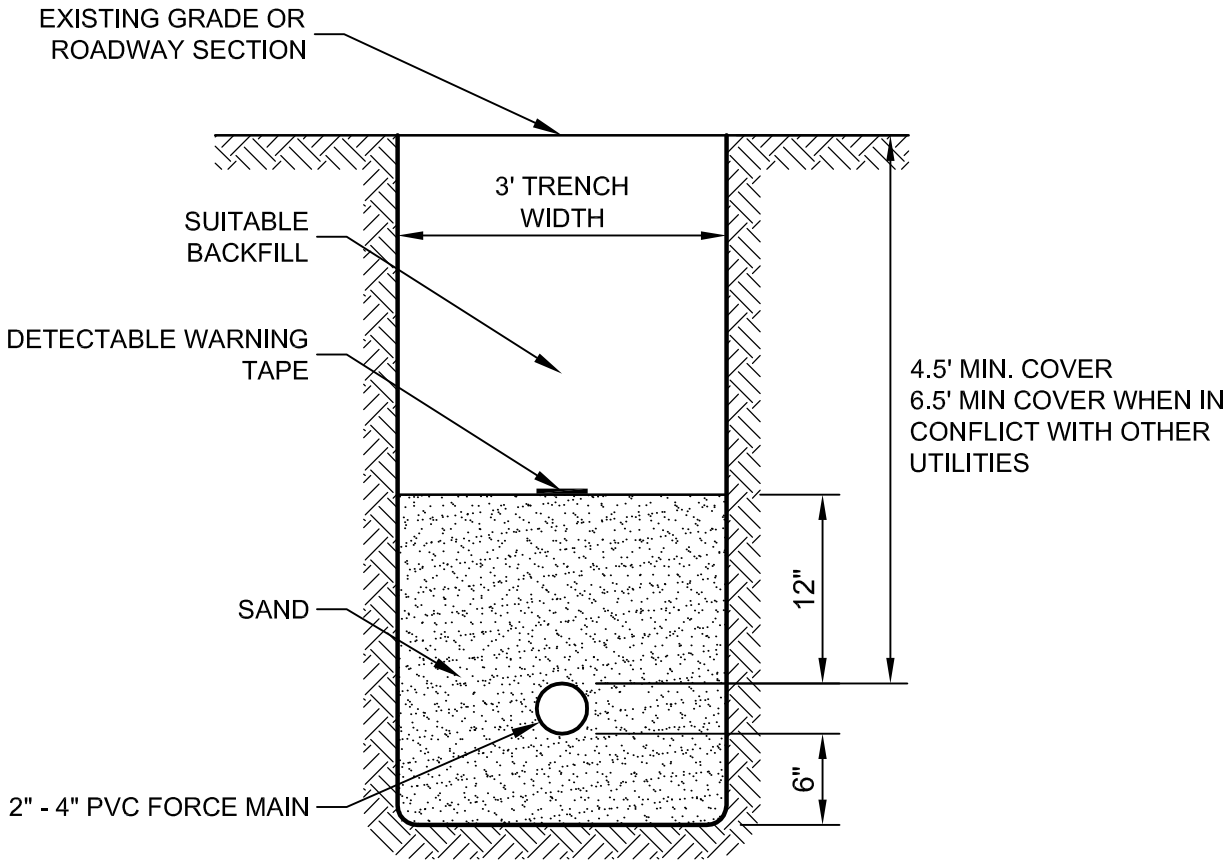
SECTION B-B

NOTES:
1. CONCRETE STRENGTH TO BE 5,000 PSI @ 28 DAYS WITH DENSITY OF 150 PCF
2. CEMENT PER ASTM C150-81
3. REINFORCING PER ASTM A615
4. PVC FOTTINGS PER ASTM D3034
5. MADE NY SUPERIOR PRODUCTS INC. OR APPROVED EQUAL.

Dwg. No. S-4		Precast Sewer Chimney			Date: May 2014
Revision	Date	Drawn	Scale	Description	
Sanitary Sewer Construction Standards		Norwich Public Utilities			



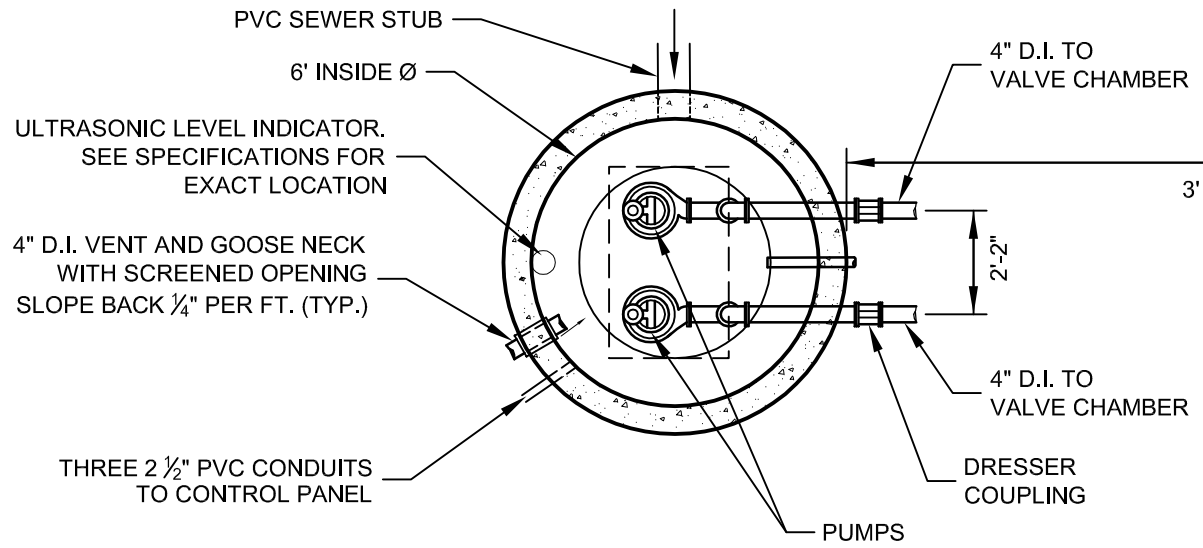
Dwg. No. S-5		Force Main Connection Into Standard Manhole			Date: May 2014
Revision	Date	Drawn	Scale	Description	
Sanitary Sewer Construction Standards		Norwich Public Utilities			



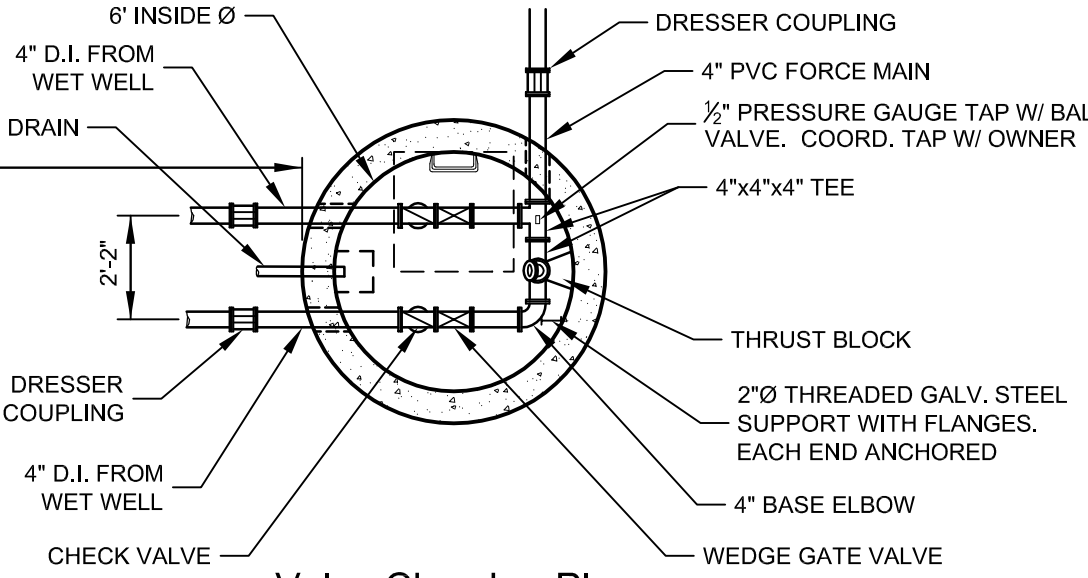
Dwg. No. S-6		Force Main Trench Detail			Date: May 2014
Revision	Date	Drawn	Scale	Description	
Sanitary Sewer Construction Standards		Norwich Public Utilities			

APPENDIX B

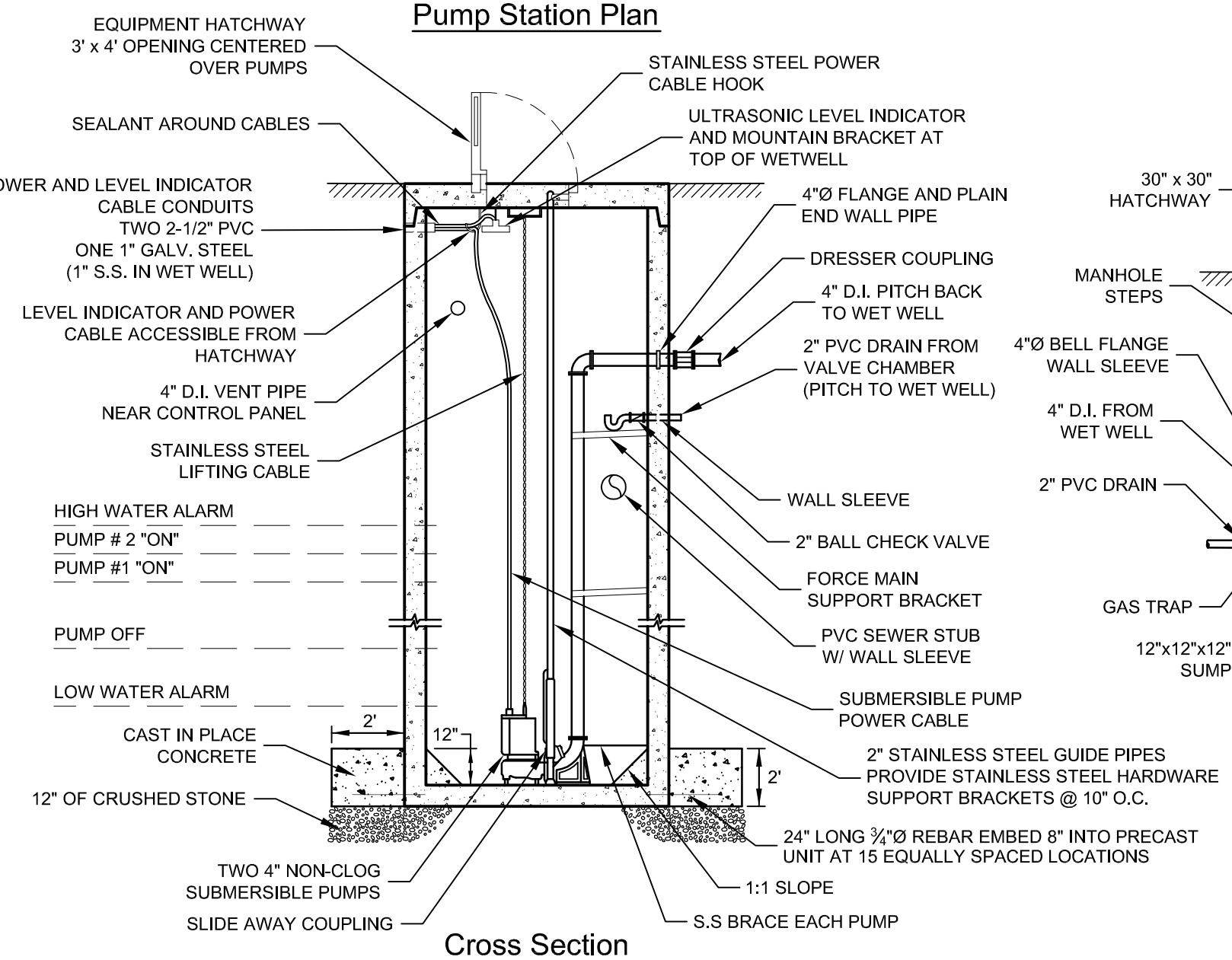
Sanitary Sewer Pump Station Details



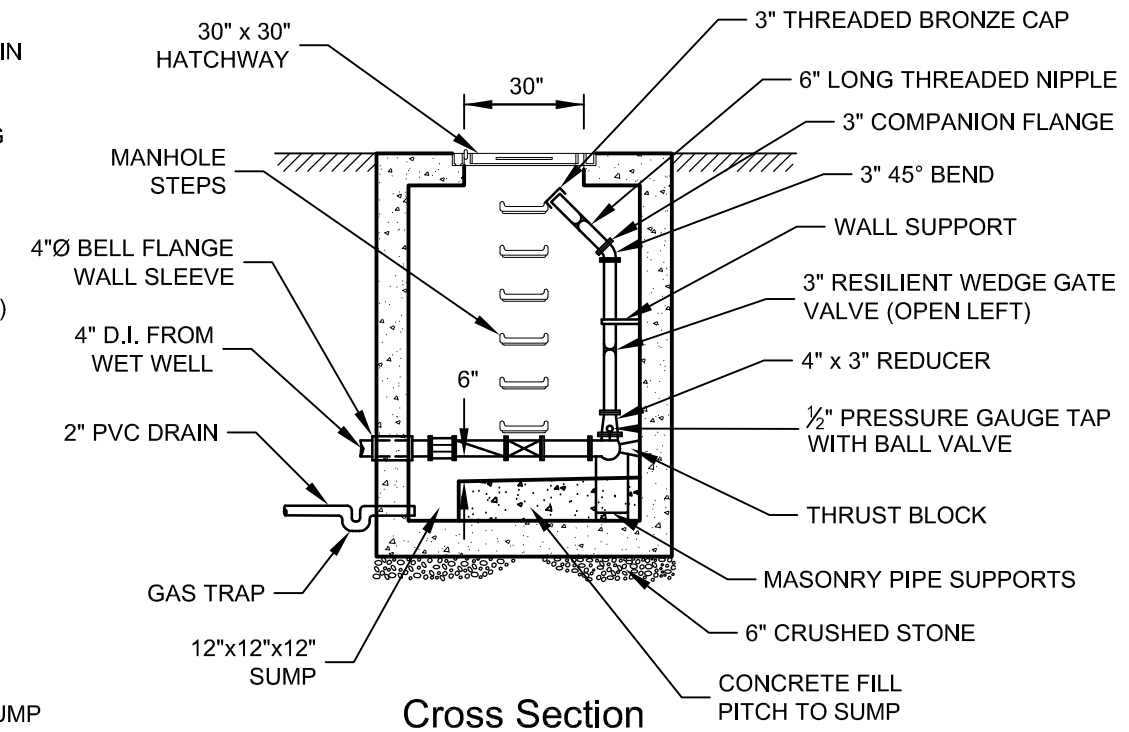
Pump Station Plan



Valve Chamber Plan



Cross Section



Cross Section

Date: May 2014

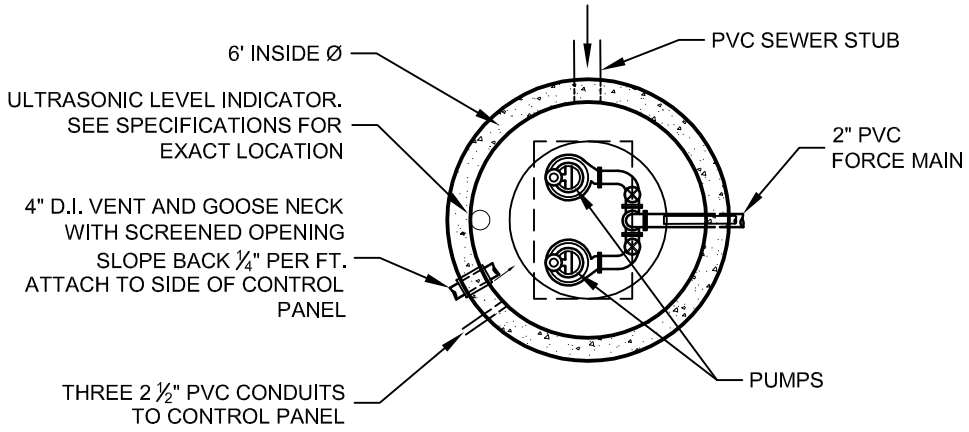
Sanitary Sewer Pump Station - 4" Force Main

Description	Scale	Drawn	Date	Revision

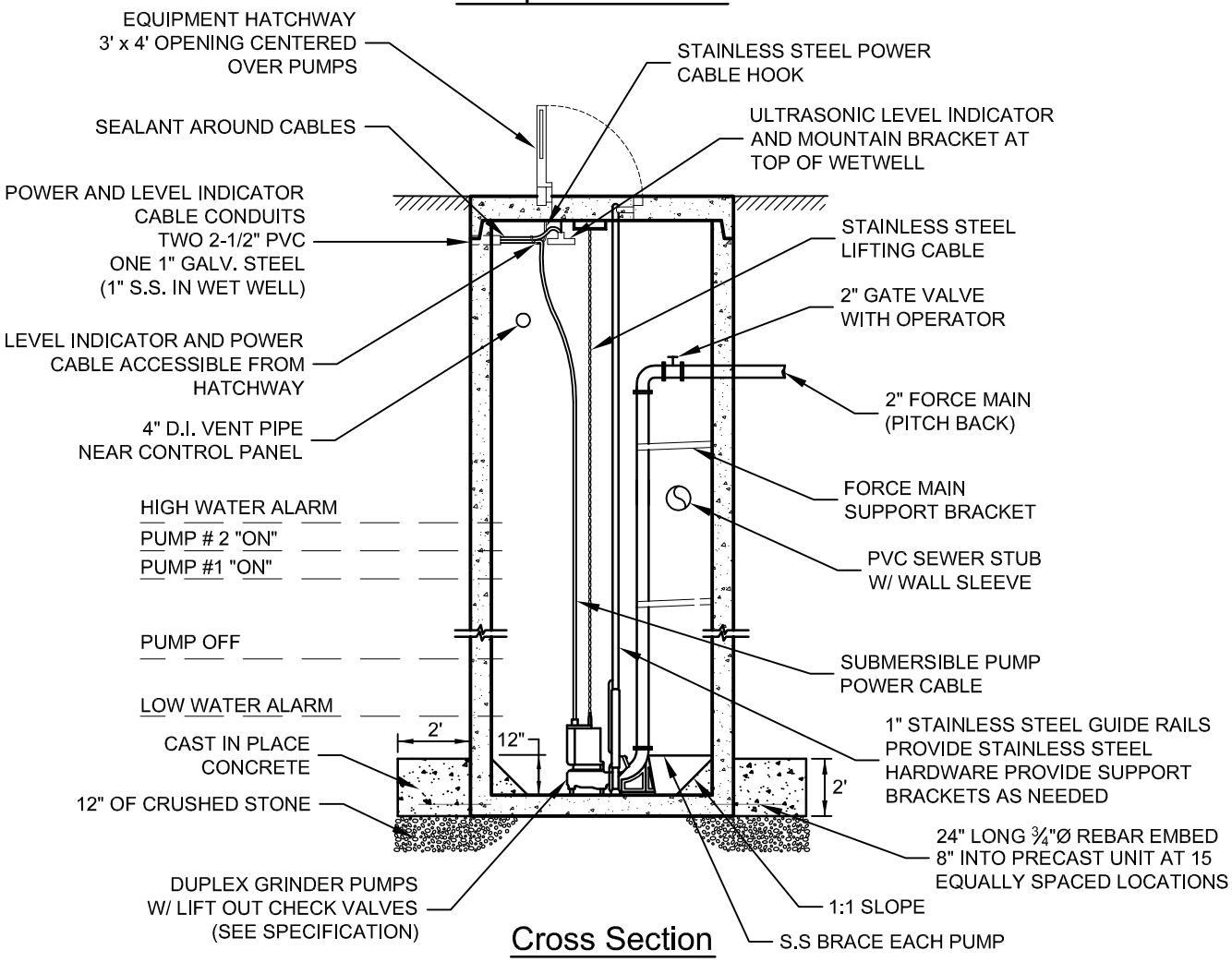
Dwg. No. PS-1

Norwich Public Utilities

Sanitary Sewer Construction Standards

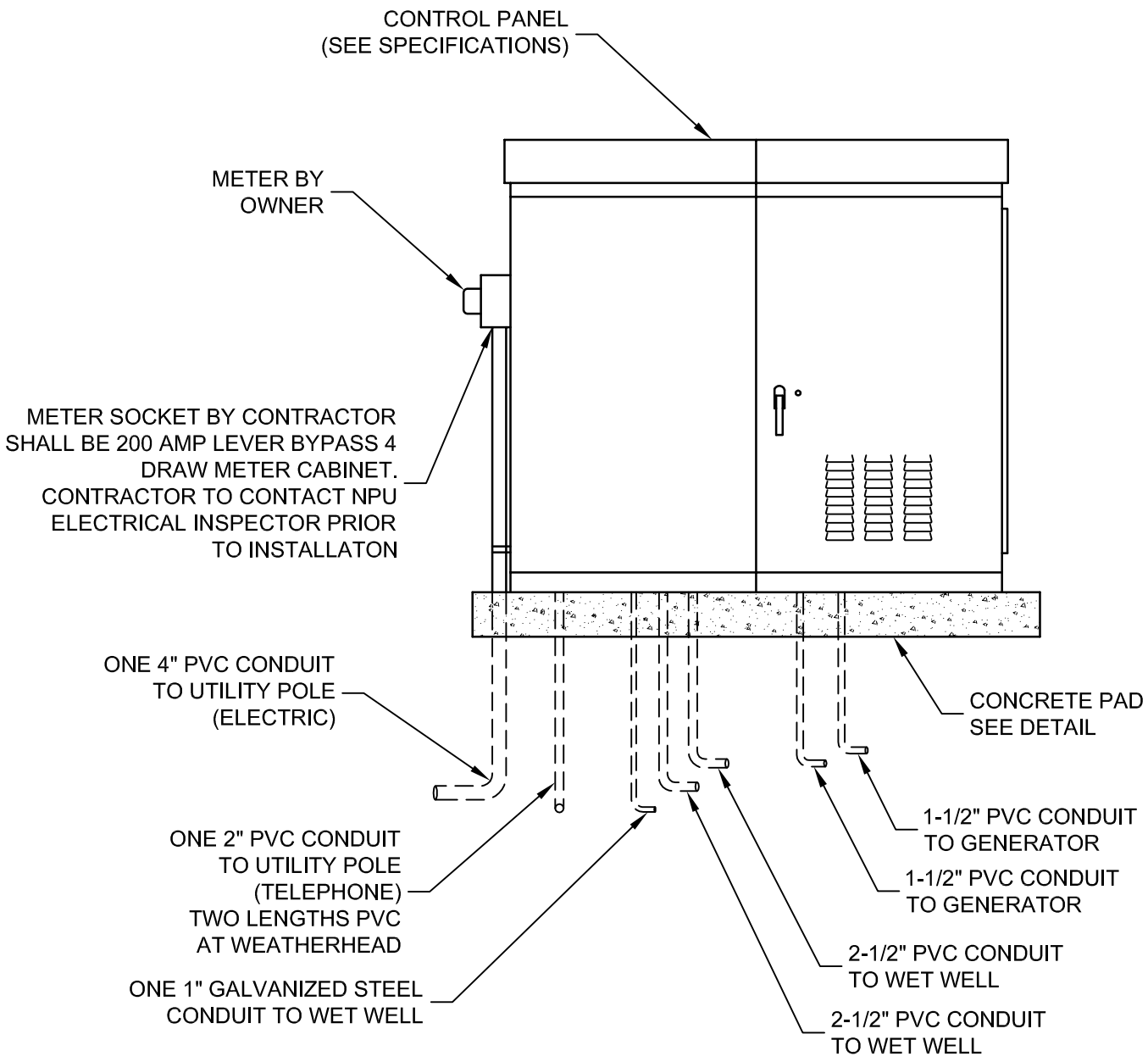


Pump Station Plan

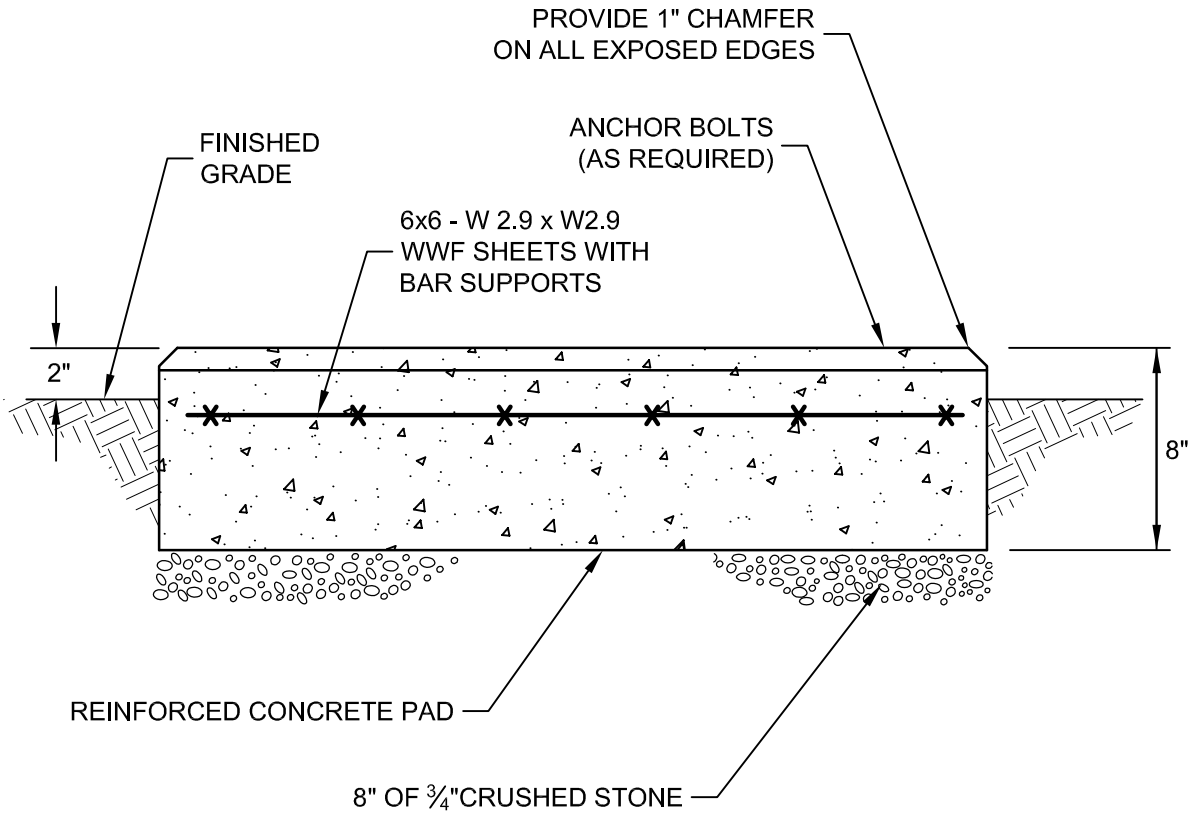


Cross Section

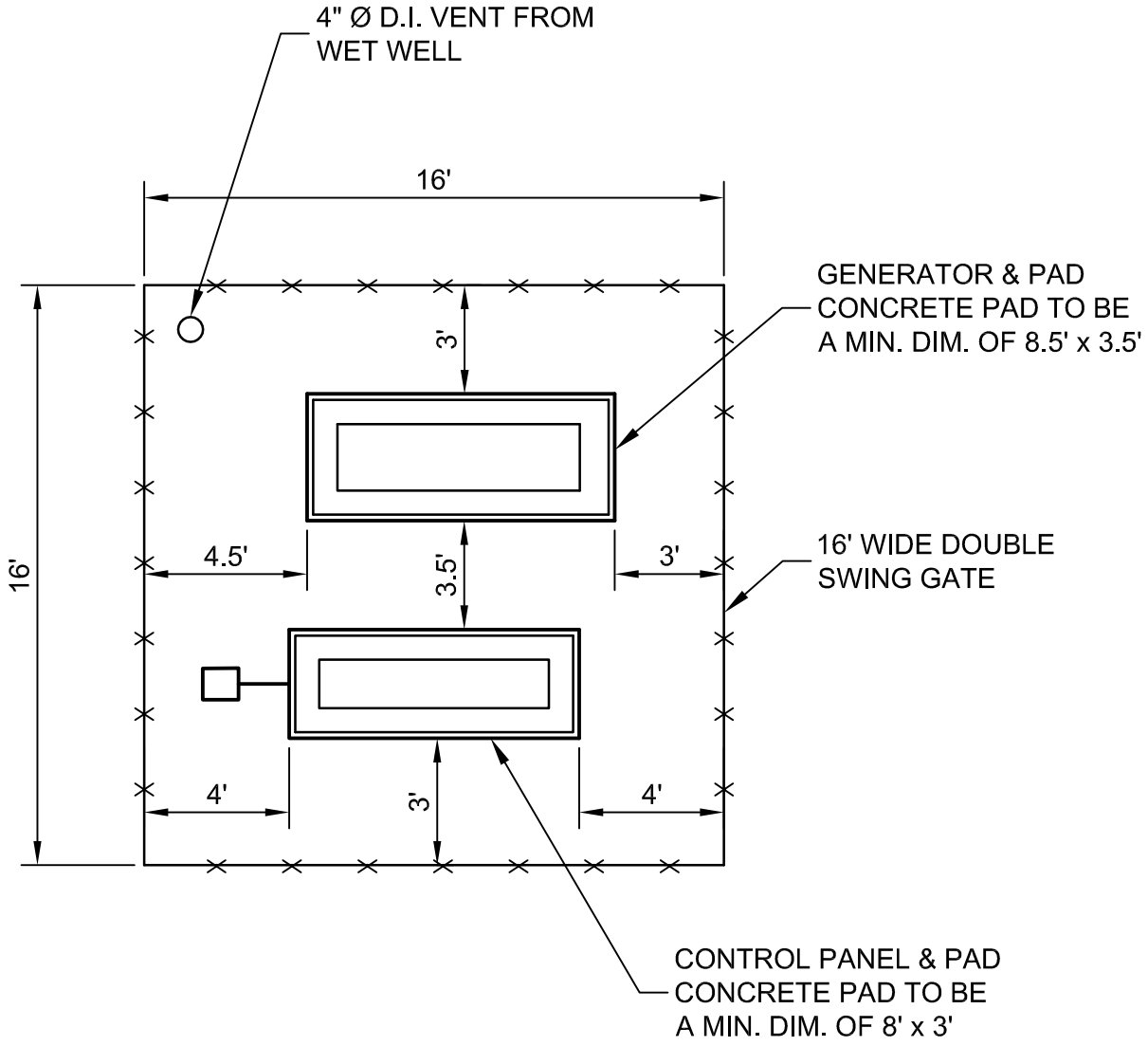
Dwg. No. PS-2		Sanitary Sewer Pump Station - 2" Force Main			Date: May 2014
Revision	Date	Drawn	Scale	Description	
Sanitary Sewer Construction Standards		Norwich Public Utilities			



Dwg. No. PS-3		Sanitary Sewer Pump Station Control Panel			Date: May 2014
Revision	Date	Drawn	Scale	Description	
Sanitary Sewer Construction Standards		Norwich Public Utilities			

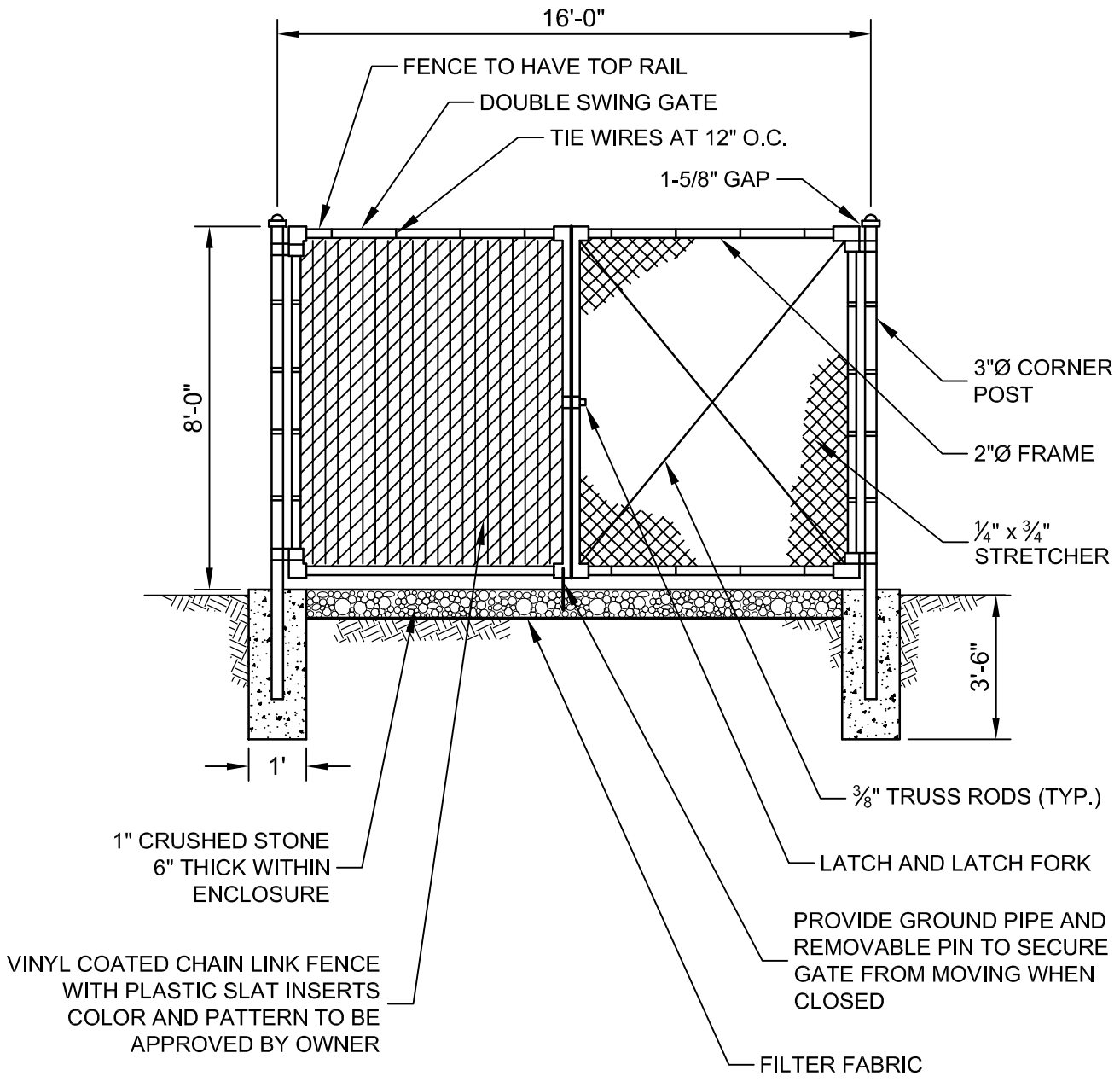


Dwg. No. PS-4		Generator and Control Panel Concrete Pad			Date: May 2014
Revision	Date	Drawn	Scale	Description	
Sanitary Sewer Construction Standards		Norwich Public Utilities			



Dwg. No. PS-5		Pump Station Equipment Enclosure Layout			Date: May 2014
Revision	Date	Drawn	Scale	Description	
Sanitary Sewer Construction Standards		Norwich Public Utilities			

NOTE:
CHAIN LINK FENCE MATERIALS AND CONSTRUCTION SHALL CONFORM TO SECTION M.10.15 AND SECTION 9.13.03 OF CTDOT STANDARD SPECIFICATION FORM 816 AS AMENDED



Dwg. No. PS-6		Pump Station Equipment Enclosure Fencing			Date: May 2014
Revision	Date	Drawn	Scale	Description	
Sanitary Sewer Construction Standards		Norwich Public Utilities			