Standard Specifications
Town of Whitestown, Indiana

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INTRODUCTION

The "Standard Specifications – Town of Whitestown" have been prepared to identify the Town's minimum criteria for utility and street construction within its jurisdiction.

This Specification Manual is to be used in conjunction with the Town's standard detail drawings in the preparation of construction plans.

All construction projects which are to become part of the Town's system, to be operated and maintained by the Town, shall conform to these standards. Construction drawings and specifications must be approved by the Town and a written permit obtained in accordance with existing ordinances before construction begins. In addition, sanitary sewer and water main projects must be submitted to the Indiana Department of Environmental Management (IDEM) for approval. The Town will not approve a sanitary sewer or water main project for construction until an approval from IDEM is received.

These standards were prepared with the intent of obtaining high quality construction consistent with accepted industry practices and specifications. As new materials become available and acceptable, the standards may be revised and updated.

- All sanitary sewer, pump station and water facilities shall meet the requirements of "Recommended Standards for Wastewater Facilities" and "Recommended Standards for Water Facilities" (commonly referred to as "10 States Standards").
- An authorized Town representative must be present to witness all tests required by these standards or other standards referenced herein.

TECHNICAL SPECIFICATIONS

DIVISION 2

SITE WORK

SECTION 02025 - EXISTING UTILITIES AND STRUCTURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

It is the responsibility of the Developer and Contractor to avoid and protect existing utilities within the project area. Existing utilities shall be shown on the plans as needed to minimize conflicts as much as possible.

1.02 NOTIFICATION OF UTILITIES

CONTRACTOR shall notify all utility companies that construction for the work under this Contract will pass through the areas where their services exist. Notification to the utilities must be made in a sufficient amount of time in advance (**min. 72 hours**) prior to start of any construction work in the affected areas.

Indiana Underground Plant Protection Service (IUPPS)
"Holey Moley"
1-800-382-5544

PART 2 - PRODUCTS

2.01 MATERIALS

Materials for temporary support, adequate protection, and maintenance for all underground and surface utility structures, drains, sewer and other obstructions encountered in the progress of the work shall be furnished by the CONTRACTOR at his own expense.

PART 3 - EXECUTION

3.01 OBSTRUCTIONS BY OTHER UTILITY STRUCTURES

Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to main sewers, or drains, the obstruction shall be permanently supported, relocated, removed or reconstructed by the CONTRACTOR in cooperation with the owners of such utility structures. Before proceeding the CONTRACTOR must reach an agreement with the TOWN and said utility on method to avoid obstruction.

No deviation shall be made from the approved line or depth except with the consent of the TOWN.

3.02 REPAIRS

Existing pipes or conduits crossing the trench, or otherwise exposed, shall be adequately braced and supported to prevent trench settlement from disrupting the line or grade of the pipe or conduit. Utility services broken or damaged shall be repaired at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Temporary arrangements, as approved by the TOWN, may be used until any damaged items can be permanently repaired. All items damaged or destroyed by construction and subsequently repaired must be properly maintained by the CONTRACTOR.

3.03 RELOCATION

Where it is necessary to relocate an existing utility or structure, the work shall be done in such a manner as is necessary to restore it to a condition equal to that of the original facility. No such relocation shall be done until approval is received from the owner of the utility or structure being changed.

3.04 SEPARATION OF WATER MAINS, SANITARY SEWER AND STORM SEWERS

A. General

The following factors should be considered in providing adequate separation:

(1) Materials and type of joints for water and sewer pipes,

(2) Soil conditions,

(3) Service and branch connections into the water main and sewer line,

(4) Compensating variations in horizontal and vertical separations,

(5) Space for repair and alterations of water and sewer pipes,

(6) Off-setting of pipes around manholes.

B. Parallel Installation

Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the State Environmental protection Agency may allow deviation on a case-by-case basis. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

C. Crossings

Whenever water mains must cross building drains, storm drains, or sanitary sewers, the water main shall be laid at such an elevation that the bottom of the water main is 18 inches above the top of the drain or sewer. This vertical separation shall be maintained

for the portion of the water main located within 10 feet horizontally of any sewer or drain it crosses. The 10 feet is to be measured as a perpendicular distance from the drain or sewer line to the water line.

D. Exception

When it is impossible to obtain the proper horizontal and vertical separation as stipulated above, the TOWN is to be notified. If allowed by the TOWN, both the water main and sewer line shall be constructed of cast iron, ductile iron, galvanized steel or protected steel pipe having mechanical joints. Other types of joints of equal or greater integrity may be used at the discretion of the TOWN after consultation with the State Environmental Protection Agency. Thermoplastic pipe may be used provided mechanical or solvent weld pipe joints are used. These shall be pressure-tested to assure water tightness before backfilling. Where water mains must cross under a sewer, additional protection shall be provided by:

(1) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line,

(2) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line,

(3) That the length of the water line be centered at the point of the crossing so that the joints shall be equidistant and as far as possible from the sewer.

Through the TOWN the State Environmental Protection Agency shall be consulted when any of the above conditions cannot be met to discuss the use of double casing or concrete encasement of sewer and/or water lines as possible alternatives.

END OF SECTION

SECTION 02110 - SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

This Section includes, but is not limited to, the following:

1. Protection of existing trees indicated to remain.
2. Removal of trees and other vegetation.
3. Topsoil stripping.
4. Clearing and grubbing.
5. Removing above-grade improvements.
6. Removing below-grade improvements.

1.03 PROJECT CONDITIONS

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements to remain in place.

   1. Protect improvements on adjoining properties and on Owner's property.

   2. Restore damaged improvements to their original condition, as acceptable to Owner.

C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

   1. Provide protection for roots over 1-1/2 inch in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

2. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in a manner acceptable to TOWN. Employ a licensed arborist to repair damage to trees and shrubs.

3. Replace trees that cannot be repaired and restored to full-growth status, as determined by arborist.

D. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or directed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 SITE CLEARING

A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.

1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.

1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.

a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

2. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.

3. Dispose of unsuitable or excess topsoil as specified for disposal of waste material.

C. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated.to be left standing.

1. Completely remove stumps, roots, and other debris protruding through ground surface.

2. Use only hand methods for grubbing inside drip line of trees indicated to remain.

3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

   a. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.

D. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

END OF SECTION

SECTION 02210 - TRENCHING BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.01 SUBMITTALS

All non-standard materials to be used for backfill, including common fill and bedding materials, shall be approved by TOWN prior to placing the materials in the pipe trench. All backfill and bedding materials whether obtained from the trench excavation or from an off-site source must be tested as directed by the TOWN.

Samples of the materials shall be submitted to an approved testing agency for analysis. The test results and report stating that the materials meet the requirements of these Specifications and the Specifications of Federal, State and local authorities (where applicable) shall be submitted to the TOWN for approval prior to placing the materials in the pipe trench.

PART 2 - PRODUCTS

2.01 BACKFILL MATERIAL

Native material for backfilling shall be earth materials entirely free from vegetation, trash, lumber, frozen, soft or organic materials. No stones or rock larger than 3 inches will be permitted in the backfill:

If material obtained from the trench excavation is insufficient to complete the backfill, the CONTRACTOR shall obtain suitable fill materials from an off-site source.

2.02 BEDDING MATERIAL

Materials used for bedding and the haunch around the pipe shall be course to fine sandy natural soil material with maximum stone size of 1-inch. The material shall conform to ASTM D 2487 "Standard Method for Classification of Soils for Engineering Purposes" using the "Unified Soil Classification System", except where a higher standard is required elsewhere or by rules or regulations of Federal, State or local governmental bodies having jurisdiction over the site of the Work.

The material shall meet the Class I or Class II designation. Soil types GW, GP, SW and SP, non-cohesive, well graded and containing some fines are included in this Class. Where voids, finer grained soils or movement may allow migration of this material, a filter fabric as directed by the TOWN will be used in the trench bottom and sides before the select fill bedding is placed.

Bedding material may be obtained from the trench excavation provided it has been tested in accordance with the requirements of Section 2210.1.01 above and approved by the TOWN. If the approved material obtained from the trench excavations insufficient to complete the bedding, the CONTRACTOR shall obtain the necessary tested is approved bedding materials from an off-site source.

2.03 FILTER FABRIC

Filter fabric shall be non-woven, synthetic fiber material with sieve design to not permit the select material in the pipe bedding and haunching to migrate into the surrounding soils. The material shall have a minimum thickness of 15 mils, tensile strength of 130 lbs., elongation at break of 64% and trapezoidal tear strength of 70 lbs.

PART 3 - EXECUTION

3.01 CONSTRUCTION EQUIPMENT

Where mains are located in or adjacent to pavements, all backfilling and materials handling equipment shall have rubber tires. Crawler equipment shall be permitted when there is no danger of damaging pavement. It is the CONTRACTOR's responsibility, to repair, at his expense, any damages due to the use of any equipment to complete the work.

3.02 NOISE, DUST AND ODOR CONTROL

The CONTRACTOR's construction activities shall be conducted so as to eliminate all unnecessary noise, dust and odors.

3.03 PROTECTION OF TREES

Special care shall be taken to avoid damage to trees and their root system. Machine excavation shall not be used when, in the opinion of the TOWN, it would endanger the tree. In general, where the line of trench falls within the limits of the limb spread, headers are required across the trench to protect the tree. The operation of all equipment, particularly when employing booms, the storage of materials, and the disposition of excavation shall be conducted in a manner which will not injure trees, trucks, branches or their roots unless such trees are designated for removal.

3.04 TRENCH SUPPORT

Unsupported open cut excavation for mains will not be permitted where trenching may cause danger to life, unnecessary damage to street pavement, trees, structures, poles, utilities, or other private or public property. During the progress of the work, whenever and wherever it is necessary, the CONTRACTOR shall, at his expense, support the sides of the excavation by adequate and suitable sheeting, shoring, bracing or other approved means. Such trench support materials and equipment shall be maintained and remain in place until backfilling operations have progressed to the point where the supports may be withdrawn without endangering property.

3.05 TRENCH EXCAVATION AND BOTTOM PREPARATION

A. General Excavation

General excavation shall consist of the satisfactory removal and disposal of all materials taken from within the limits of the Work contracted, meaning the material lying between he original ground line and the finished ground line as shown on the Drawings regardless of whether the original ground line is exposed to air or is covered by water. Excavation below existing ground line to enable any required construction or removals is included. It is distinctly understood that any reference to earth, rock, silt, debris or other materials on the Drawings or in the Specifications is solely for the OWNER's information and shall not be taken as an indication of classified excavation or the quantity of earth, rock, silt, debris or other material encountered.

All excavation shall be made to the lines and grades indicated on the Drawings or established in the field by the TOWN.

Excess excavated materials and excavated materials unsuitable for backfilling shall be properly disposed of by the CONTRACTOR clear of the site. The CONTRACTOR shall furnish to TOWN satisfactory evidence that an appropriate disposal site will be used.

B. Rock Excavation

If the Contract includes a unit price for rock excavation, the excavation shall include the removal, hauling, stockpiling and/or proper disposal of all material required to be excavated which requires systematic blasting, barring and wedging for removal, boulders or loose rock of one cubic yard or more in volume, and material which cannot be loosened or broken down by ripping in a single pass with a hydraulic ripper or other devices and equipment designed to remove rock. No payment will be made for rock removal unless the CONTRACTOR gives prompt notice to the TOWN upon encountering such material and prior to its removal. The TOWN's determination as to whether the material meets the definition or rock and TOWN's measurement of the volume of rock removal for which the CONTRACTOR is entitled to payment will be final and conclusive.

C. Blasting Rock

The CONTRACTOR must notify TOWN, in advance, of his intention to use blasting. The TOWN will require evidence that the proposed blasting will comply fully with Laws or Regulations.

No blasting of rock shall be done where limited or prohibited by any Federal, State or local laws or regulations or in violation of any limitation or restriction contained in any right-of-way or wherever specifically prohibited in any Drawing or other Contract Document; nor will any such blasting be done within forty (40) feet of any pipe or structure without specific permission for the TOWN. Blasts shall be properly covered and the pipe or structure properly protected. Warning shall be given to all persons in the vicinity. Blasting shall be at the risk of the CONTRACTOR who shall be liable for all damages to persons or property. Necessary permits shall be secured and paid for by the CONTRACTOR. It is the CONTRACTOR's responsibility to perform whatever pre-blast surveys and investigations may be required by the circumstances and/or by Federal, State or local laws.

D. Trench Width

Widths of trenches shall be held to a minimum to accommodate the pipe and appurtenances. The trench width shall be measured at the top of the pipe barrel and shall conform to the following limits:

Earth

Minimum: Outside diameter of the pipe barrel plus 8 inches, i.e., 4 inches each side.

Maximum: Nominal pipe diameter plus 24 inches.

Rock

Minimum: Outside diameter of the pipe barrel plus 24 inches, i.e., 12 inches each side.

Maximum: Normal pipe diameter plus 30 inches.

E. Excessive Trench Width

If, for any reason the trench width exceeds the maximum trench width defined in paragraph D, "Trench Width", the CONTRACTOR shall provide additional bedding and backfill material as specified in Section 2210.2.02 to fill the additional width of trench.

F. Trench Depth

1. General All trenches shall provide for the minimum cover indicated on the plans over the top of the pipe barrel to the top of the finished grade of the roadway unless otherwise authorized by the TOWN.

2. Earth The trench shall be excavated to the depth required, so as to provide a uniform and continuous bearing and support for the pipe barrel on the required bedding at every point between joints, except that it will be permissible to disturb the finished trench bottom over a maximum length of 18 inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. When required, bell holes shall be provided. The finished trench bottom shall be accurately prepared by means of hand tools.

3. Rock Where excavation is made in rock or boulders, the trench shall be excavated 8 inches below the pipe barrel for pipe 12 inches in diameter or less, and 12 inches below the pipe barrel for 16 inch diameter pipe and larger. All loose material shall be removed from the trench bottom. After preparation of the trench bottom, a pipe bed shall be prepared using bedding material as specified in Section 2210.1.02.

4. Unsuitable Bottom When unsuitable material is found below subgrade, as determined by the TOWN, CONTRACTOR shall remove the material to a depth determined by the TOWN, and provide compacted bedding material as specified

in Section 2210.2.02 to backfill the trench in the area where unsuitable material has been excavated.

3.06 TRENCH BACKFILLING (Open Terrain)

A. Backfill to Bottom of Pipe Barrel

All trench excavation shall be backfilled immediately after pipe is laid. Compacted bedding material as described in Section 2210.2.02 shall be used to backfill the trench from 4" below the pipe to the bottom of the pipe.

B. Initial Backfill

From the bottom of the pipe barrel to 12" above the top of the pipe barrel, either native backfill or bedding material, as described in Section 2210.2.02, shall be used as backfill material per the standard detail drawings. Care shall be taken to avoid injuring or moving the pipe. The material shall be placed in uniform 6 inch loose layers and each layer compacted so as to eliminate the possibility of settlement, pipe misalignment or damage of joints.

C. Remaining Trench Backfill

In unopened areas from the top of the initial backfill to the surface, native backfill, shall be used as backfill material. No material shall be used for backfilling that contains frozen earth, rock, large stones, boulders, or other unsuitable material. The CONTRACTOR may use mechanical equipment to place the backfill. This shall be done in such a manner that the material does not free fall, but shall be so placed that it will flow onto the previously placed material. The CONTRACTOR shall consolidate the backfill in such a manner as will insure the minimum possible settlement and the least interference with traffic. No compacting of the backfill with mechanical equipment, such as wheeled vehicles, will be permitted unless sufficient cover is provided over the pipe to prevent damage to the pipe.

D. Surface Conditions

The trench surface shall be regularly attended to during the course of the Contract. The CONTRACTOR shall take prompt corrective measures to correct any settlement or wash-out. The trench surface shall be maintained in a safe condition and shall not interfere with natural drainage.

E. Deficiency of Backfill

Any material required for backfilling the trenches or for filling depressions caused by settlement or wash-out shall be supplied and placed by the CONTRACTOR at his expense.

3.07 GRANULAR BACKFILL - (5' Near Road)

A. Backfill to Bottom of Pipe Barrel

All trench excavation shall be backfilled immediately before pipe is laid. Compacted bedding material as described in Section 2210.2.02 shall be used to backfill the trench from 4" below the pipe to the bottom of the pipe.

B. Initial Backfill

From the bottom of the pipe barrel to 12" above the top of the pipe barrel, bedding material or granular backfill, as described in Section 2210.2.02, shall be used as backfill material per the standard details. Care shall be taken to avoid injuring or moving the pipe. The material shall be placed in uniform 6 inch loose layers and each layer compacted so as to eliminate the possibility of settlement, pipe misalignment or damage of joints.

C. Remaining Trench Backfill

Granular backfill, when indicated on the Plans or as ordered by the TOWN, shall be used for backfilling providing it meets the requirements of Indiana Department of Transportation Standard Specification, Section 211 - Special Fill and Backfill ("B" Borrow).

D. Surface Conditions

The trench surface shall be regularly attended to during the course of the Contract. The CONTRACTOR shall take prompt corrective measures to correct any settlement or wash-out. The trench surface shall be maintained in a safe condition and shall not interfere with natural drainage.

E. Deficiency of Backfill

Any material required for backfilling the trenches or for filling depressions caused by settlement or wash-out shall be supplied and placed by the CONTRACTOR at his expense.

3.08 FLOWABLE BACKFILL

A. Backfill to Bottom of Pipe Barrel

All trench excavation shall be backfilled immediately before pipe is laid. Compacted bedding material as described in Section 2210.2.02 shall be used to backfill the trench from 4" below the pipe to the bottom of the pipe.

B. Initial Backfill

From the bottom of the pipe barrel to 12" above the top of the pipe barrel, bedding material or flowable fill, as described in Section 2210.2.02, shall be used as backfill material per the standard details. Care shall be taken to avoid injuring or moving the pipe. The material shall be placed in uniform 6 inch loose layers and each layer

compacted so as to eliminate the possibility of settlement, pipe misalignment or damage of joints.

C. Remaining Trench Backfill

Under drives or roadways backfill shall be flowable fill a minimum of 100 psi.

D. Surface Conditions

The trench surface shall be regularly attended to during the course of the Contract. The CONTRACTOR shall take prompt corrective measures to correct any settlement or wash-out. The trench surface shall be maintained in a safe condition and shall not interfere with natural drainage.

E. Deficiency of Backfill

Any material required for backfilling the trenches or for filling depressions caused by settlement or wash-out shall be supplied and placed by the CONTRACTOR at his expense.

3.08 QUALITY ASSURANCE TESTING

The OWNER or TOWN reserves the right to have the CONTRACTOR provide Independent Quality Assurance Testing for the backfill material at the CONTRACTOR's expense.

3.09 TRENCH MAINTENANCE

The CONTRACTOR shall be responsible for the condition of the trenches for a period of one (1) year from the date of the final acceptance of the CONTRACTOR's work, or as required by state, county or local authorities, and any materials required for filling depressions caused by settlement or washout shall be supplied and placed by the CONTRACTOR at his expense.

END OF SECTION

SECTION 02240 - DEWATERING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor and equipment required to dewater all excavations to allow proper installation of new facilities.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork is included in Section 02300.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 GENERAL

A. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill or other material or structure in the excavation.

B. Dewatering shall include proper removal of any and all liquid, regardless of its source, from the excavation and the use of all practical means available to prevent surface runoff from entering any excavation.

C. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent flooding and/or damage to other locations within the construction area where it may be detrimental. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at least two (2) feet below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of two (2) feet below the lowest excavation subgrade made until the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water.

D. All dewatering flows are to be settled in siltation basins or directed through filtering devices before discharge to stabilized sites, such as streams or storm sewers; not onto exposed soils, stream banks, or any other site where the flow could cause erosion.

E. Silt from construction operations shall not be permitted to enter the storm sewer system. When construction occurs near storm sewer inlets, erosion control measures such as inlet

filters and hay bales shall be used to prevent silt from entering the storm sewers.

F. Convey water from the construction site in a closed conduit. Do not use trench excavations as temporary drainage ditches.

END OF SECTION

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

Provide all materials, labor, equipment and services necessary to do all clearing and grubbing, excavation, backfilling, providing of additional fill material and topsoil, control of surface drainage and ground water, finished site grading and erosion control required to construct the work as shown.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. State and local code requirements shall control the disposal of trees and shrubs.

B. All burning shall be controlled by applicable local regulations.

C. Geotechnical Report, if available.

1.03 JOB CONDITIONS

A. Weather: Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained on account of rain, snow, ice, drought or other adverse weather conditions.

B. Existing Utilities: Prior to commencement of work, the Contractor shall locate existing underground utilities in areas of the work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

C. Use of Explosives: The Contractor (or any of his Subcontractors) shall not bring explosives onto site or use in work without prior written permission from the Owner. All activities involving explosives shall be in compliance with the rules and regulations of the State of Indiana. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

D. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights.

   a. Operate warning lights as recommended by authorities having jurisdiction.

   b. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

E. Dust Control: Use all means necessary to control dust on or near the project site where such dust is caused by the Contractor's operations or directly results from conditions left by the Contractor.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Definitions:

1. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups Class II GW, Class II GP, Class III GM, Class III SM, Class II SW, Class II SP, Class III GC, Class III SC, Class IV ML, and Class IV CL.

2. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups MH, CH, OL, OH and PT. The Contractor shall notify the TOWN if these soil materials are encountered.

3. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.

4. Drainage Fill: Washed, evenly graded mixture of crushed stone, or uncrushed gravel, with 100 percent passing a 1 - ½ inch sieve and not more than 5 percent passing a no. 4 sieve.

5. Backfill and Fill Materials: Satisfactory soil materials free of debris, waste, frozen materials, vegetable, and other deleterious matter.

PART 3 - EXECUTION

3.01 CLEARING AND GRUBBING

A. Work shall consist of cutting and removing designated trees, stumps, brush, logs, removal of fences, or other loose and projecting material. Unless otherwise specified, it shall also include the grubbing of stumps, roots, and other natural obstructions which, must be removed to execute properly the construction work and operate properly the facility upon the completion of construction.

B. No cleared or grubbed materials shall be used in backfills or embankment fills. All stumps, roots, and other objectionable material shall be grubbed up so that no roots larger than 3 inches in diameter remain less than 18 inches below the ground surface. All holes and depressions left by grubbing operations shall be filled with suitable material and compacted to grade, as recommended in Paragraph 3.06.

C. The Contractor shall also remove from the site and satisfactorily dispose of all miscellaneous rubbish including, but not limited to, masonry, scrap metal, rock, pavement, etc., that is under the fill or to be removed as shown on the Drawings, specified herein, or directed by the TOWN.

D. Existing improvements, adjacent property, utility and other facilities, and trees, plants, and brush that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.

E. Trees and shrubs, designated to remain or that are beyond the clearing and grubbing limit, which are injured or damaged during construction operations shall be treated or replaced at the Contractor's expense by experienced tree surgery personnel.

3.02 EROSION CONTROL

A. Temporary measures shall be applied throughout the construction period to control and to minimize siltation to adjacent properties and waterways. Such measures shall include, but not be limited to, the use of berms, baled straw silt barriers, gravel or crushed stone, mulch, slope drains and other methods.

B. These temporary measures shall be applied to erodible material exposed by any activity associated with the construction of this project.

3.03 EXCAVATION

A. Excavation of every description and of whatever substances encountered within the grading limits of the project shall be performed to the lines and grades indicated on the Drawings. All excavation shall be performed in the manner and sequence as required for the work.

B. All excavated materials that meet the requirements for fill, subgrades or backfill shall be stockpiled within the site for use as fill or backfill, or for providing the final site grades. Where practicable, suitable excavated material shall be transported directly to any place in the fill areas within the limits of the work. All excavated materials which are not suitable for fill, and any surplus of excavated material which is not required for fill shall be disposed of by the Contractor.

C. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent flooding and/or damage to other locations within the construction area where it may be detrimental. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at least two (2) feet below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of two (2) feet below the lowest excavation subgrade made until the excavation is backfilled or the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water.

D. Excavations for concrete structural slabs and footings on grade shall extend two (2) feet below the indicated bottom of slabs and footings. The over-excavation shall be backfilled with 18 inches, compacted thickness, of over lot fill material or suitable material as herein specified. The remaining six (6) inches of over-excavation shall be backfilled with porous fill material. The porous fill layer shall extend beyond the limits of the concrete slab a minimum of two (2) feet on all sides as indicated on the Drawings. The porous fill shall be crushed stone or gravel and shall have the following U.S. Standard Sieve gradation:

Sieve	1-1/2	1	3/4	½	3/8
% Passing	Min 100	95±5	58±17	Max 15	Max 5

E. Excavations for the construction shall be carefully made to the depths required. Bottoms for footings and grade beams shall be level, clean and clear of loose material, the lower sections true to size. Bottoms of footings and grade beams, in all locations, shall be at a minimum depth of 30 inches below adjacent exterior finished grade or 30 inches below adjacent existing grade, whichever is lower, whether so indicated or not. Footings and grade beam bottoms shall be inspected by the TOWN before any concrete is placed thereon.

F. In excavations for structures where, in the opinion of the TOWN, the ground is spongy or otherwise unsuitable for the contemplated foundation, the Contractor shall remove such unsuitable material and replace it with suitable material properly compacted.

G. Sheeting and shoring shall be provided as necessary for the protection of the work and for the safety of the personnel. The clearances and types of the temporary structures, insofar as they affect the character of the finished work, will be subject to the review of the TOWN, but the Contractor shall be responsible for the adequacy of all sheeting, bracing and cofferdamming. All shoring, bracing and sheeting shall be removed as the excavations are backfilled in a manner such as to prevent injurious caving; or, if so directed by the TOWN, shall be left in place. Sheeting left in place shall be cut off 18 inches below the surface.

H. Excavation for structures which have been carried below the depths indicated without specific instructions shall be refilled to the proper grade with suitable material properly compacted, except that in excavation for columns, walls or footings, the concrete footings shall extend to this lower depth. All work of this nature shall be at the Contractor's expense.

3.04 FILL

A. All existing fill below structures and paved areas must be stripped of topsoil. The upper six (6) inches of the natural subgrade below shall be scarified and recompacted at optimum moisture to at least ninety-five per cent (95%) of Standard Proctor Density ASTM D 698 (latest revision).

B. All vegetation, such as roots, brush, heavy sods, heavy growth of grass and all decayed vegetable matter, rubbish and other unsuitable material within the area upon which fill is to be placed shall be stripped or otherwise removed before the fill is started. In no case will such objectionable material be allowed to remain in or under the fill area. Existing fill from excavated areas on site shall be used as fill for open and/or planted areas. Additional fill stockpiled at the site can be used for structural fill if approved by the TOWN. Any additional material necessary for establishing the indicated grades shall be furnished by the Contractor and approved by the TOWN. All fill material shall be free from trash, roots and other organic material. The best material to be used in fills shall be reserved for backfilling pipe lines and for finishing and dressing the surface. Material larger than 3 inches maximum dimension shall not be permitted in the upper 6 inches of the fill area. Fill material shall be placed in successive layers and thoroughly tamped or rolled in a manner approved by the TOWN, each layer being moistened or dried such that the specified degree of compaction shall be obtained. No fill shall be placed or compacted in a frozen condition or on top of frozen material. No fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed and no compaction of fill will be permitted with free water on any point of the surface of the fill to be compacted.

C. Where concrete slabs are placed on earth, all loam and organic or other unsuitable material

shall be removed. Where fill is required to raise the subgrade for concrete slabs to the elevations as indicated on the Drawings or as required by the TOWN, such fill shall consist of suitable material and shall be placed in layers. Each layer shall be moistened or dried such that the specified degree of compaction shall be obtained. All compaction shall be accomplished in a manner and with equipment as approved by the TOWN. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for adjacent fill.

3.05 BACKFILLING

A. After completion of footings, grade beams and other construction below the elevation of the final grades and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris. Material for backfilling shall be as specified for suitable material, placed and compacted as specified hereinafter. Backfill shall be placed in horizontal layers of the thickness specified and shall have a moisture content such that the required degree of compaction is obtained. Each layer shall be compacted by mechanical tampers or by other suitable equipment to the specified density. Special care shall be taken to prevent wedging action or eccentric loading upon or against the structure. Trucks and machinery used for grading shall not be allowed within 45 degrees above the bottom of the footings or grade beams.

B. The trenches shall be backfilled following visual inspection by the TOWN and prior to pressure testing. The trenches shall be carefully backfilled with the excavated materials approved for backfilling, or other suitable materials, free from large clods of earth or stones. Each layer shall be compacted to a density at least equal to that of the surrounding earth and in such a manner as to permit the rolling and compaction of the filled trench with the adjoining earth to provide the required bearing value, so that paving, if required, can proceed immediately after backfilling is completed.

3.06 COMPACTION

A. Suitable material as hereinbefore specified shall be placed in maximum 8" horizontal layers. Compaction shall be performed by rolling with approved tamping rollers, pneumatic-tired rollers, three wheel power rollers or other approved equipment. The degree of compaction required is expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D-698 (Standard Proctor Density – latest revision). Laboratory moisture density tests shall be performed on all fill material. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction. Compaction requirements shall be as specified below:

Fill Utilized For	Required Density (%) Standard Proctor	Maximum Permissible Lift Thickness As Compacted, Inches
Backfill & Utility Trenches Under Foundations & Pavements	95-100	8
Backfill Around Structures	95-100	8

Field and Utility Trench Backfill Under Sidewalks	90-100	8

B. Field density tests shall be performed in sufficient number to insure that the specified density is being obtained. Tests shall be in accordance with ASTM Standards D 1556 or D 2922/D 3017 and shall be performed as authorized by the TOWN. Payment for field density tests shall be by the Owner. Contractor shall provided suitable notification for coordination of testing. Delays due to the lack of adequate advance notification shall be the responsibility of the Contractor.

3.07 SITE GRADING

A. Where indicated or directed, topsoil shall be removed without contamination with subsoil and spread on areas already graded and prepared for topsoil, or transported and stockpiled convenient to areas for later application, or at locations specified. Topsoil shall be stripped to full depth and, when stored, shall be kept separate from other excavated materials and piled free of roots, stones, and other undesirable materials.

B. Following stripping, fill areas shall be scarified to a minimum depth of six (6) inches to provide bond between existing ground and the fill material. Material should be placed in successive horizontal layers not exceeding twelve (12) inches uncompacted thickness. In general, layers shall be placed approximately parallel to the finished grade line.

C. In general and unless otherwise specified, the Contractor may use any type of earth moving equipment he has at his disposal, provided such equipment is in satisfactory condition and of such type and capacity that the work may be accomplished properly and the grading schedule maintained. During construction, the Contractor shall route equipment at all times, both when loaded and empty, over the layers as they are placed, and shall distribute the travel evenly over the entire area.

D. The material in the layers shall be of the proper moisture content before rolling or tamping to obtain the prescribed compaction. Wetting or drying throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on the fill thus affected shall be delayed until the material has dried to the required moisture content. If the material is too dry, it shall be sprinkled with water and manipulated to obtain the uniform moisture content required throughout a layer before it is compacted.

E. Each layer of the fill shall be compacted by rolling or tamping to the standard specified in Paragraph 3.06 and not less than 90% maximum density at optimum moisture content as determined by field density tests made by the Standard Proctor method in accordance with ASTM D 698. In general and unless otherwise specified, the Contractor may use any type of compaction equipment such as sheepsfoot rollers, pneumatic rollers, smooth rollers and other such equipment he has at his disposal, provided such equipment is in satisfactory condition and is of such design, type, size, weight, and quantity to obtain the required density in the embankment. If at any time the required density is not being obtained with the equipment then in use by the Contractor, the TOWN may require that different and/or additional compaction equipment be obtained and placed in use at once to obtain the required compaction.

F. The Contractor shall be responsible for the stability of all embankments and shall replace any

portion which, in the opinion of the TOWN, has become displaced due to carelessness or negligence on the part of the Contractor.

3.08 TOPSOIL

A. Provide all labor, materials, equipment and services required for furnishing and placing topsoil. Samples of topsoil shall be submitted to the TOWN for review before topsoil is placed. The material shall be good quality loam and shall be fertile, friable, mellow, free from stones larger than 2 inches, excessive gravel, junk metal, glass, wood, plastic articles, roots and sod shall have a liberal amount of organic matter. Light sand loam or heavy clay loam will not be acceptable.

B. The topsoil shall be minimum of 4 inches thick in all areas to be seeded. No topsoil shall be placed until the area to be covered is excavated or filled to the required grade. Imported backfill material may be stockpiled on site for structure backfilling and top soiling.

END OF SECTION

SECTION 02400 - BORING AND JACKING

PART 1 - GENERAL

1.01 SCOPE OF WORK

Provide all labor, materials, equipment and services required to furnish and install all bored and jacked carrier pipes in encasement pipes as shown on the Drawings and/or specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A Earthwork: Section 02300

B. Water Distribution Piping: Section 02510

C. Gravity Sewer Piping: Section 02530

D. Sewage Force Mains: Section 02531

E. Identification / Location Guide: Section 02558

1.03 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the TOWN for review before ordering. The proposed layout of jacking and receiving pits shall be indicated.

PART 2 - PRODUCTS

2.01 CARRIER PIPE

Carrier pipe shall be as specified in the applicable Division 2 section unless otherwise noted.

2.02 CASING PIPE

A. Casing pipe shall be steel, plain end, have a minimum yield point strength of 35,000 psi and conform to ASTM A 252 Grade 2 or ASTM A 139 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 18 foot lengths. The casing pipe shall be coal tar epoxy coated.

B. The minimum diameter and wall thickness of the casing pipe shall be as indicated on the standard details.

However, should casing pipe thickness be specified or required on Railroad or Highway permit approval sheets, said permit thickness requirement shall govern.

2.03 CASING SPACERS

A. Stainless Steel Casing Spacers: Stainless steel casing spacers shall be bolt-on style with a shell made in two (2) sections of heavy T-304 stainless steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner .090" thick with 85-90 durometer. All nuts and bolts are to be 18-8 stainless steel. Runners shall be made of ultra high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction. Runners shall be supported by risers made of heavy T-304 stainless steel. The supports shall be mig welded to the shell and all welds shall be fully passivated.

B. Solid Polyethylene Casing Spacers: Solid polyethylene casing spacers shall be bolt-on style with a shell made in two (2) sections. Carrier pipe shall be wrapped with rubber strap inside casing space to prevent slippage. All nuts and bolts are to be stainless steel.

2.04 CASING END SEALS

End seals shall be made of a waterproof flexible membrane forming a watertight seal. The ends of the end seal shall be sealed on the casing and carrier pipe by stainless steel bands. End seals shall be Model C end seals by Pipeline Seal and Insulator, Inc., Houston, Texas or approved equal.

PART 3 - EXECUTION

3.01 CROSSINGS - GENERAL

A. Where designated on the drawings, crossings beneath maintained railroads, state maintained roads, county roads, or other surfaces not to be disturbed shall be accomplished by boring and jacking a casing pipe.

B. Steel casing pipe for crossings shall be bored and/or jacked into place to the elevations shown on the drawings. All joints between lengths shall be solidly butt-welded with a smooth non-obstructing joint inside. The casing pipe shall be installed without bends. The carrier pipe shall be installed after the casing pipe is in place, and shall extend a minimum of two (2) feet beyond each end of the casing to facilitate making joint connections. The carrier shall be braced and centered with casing spacers within the casing pipe to preclude possible flotation. Casing spacers shall be installed on a 6 foot centers on the carrier pipe within the casing pipe. The height of the supports and runners combined shall be sufficient to keep the carrier pipe at least .75" from the casing pipe wall at all times.

C. At each end of the casing pipe, the carrier pipe shall be sealed with casing end seals. The end seals shall extend a minimum of 12 inches in each direction from the end of the casing pipe.

D. After the carrier pipe has been installed, inspected, tested and sealed as specified, the trench shall be backfilled as required for the type of pipe and area as applicable.

3.02 BORING AND JACKING

A. The Contractor shall excavate, as necessary, and will set line and grade stakes for the proposed installation. Permits, as required, will be furnished or obtained by the Developer and shall be furnished to the Contractor's before any excavating is commenced.

B. The boring method shall consist of pushing the pipe into the earth with a boring auger rotating within the pipe to remove the spoil.

1. The boring operation shall be progressed on a 24-hour basis without stoppage (except for adding lengths of pipe) until the leading edge of the casing pipe has reached the receiving pit.

2. The front of the casing pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger from leading the casing pipe so that there will be no unsupported excavation ahead of the casing pipe.

3. The auger and cutting head arrangement shall be removable from within the casing pipe in the event an obstruction is encountered. If the obstruction cannot be removed without excavation in advance of the casing pipe, the casing pipe shall be abandoned in place and immediately filled with grout.

4. The over-cut by the cutting head shall not exceed the outside diameter of the casing pipe by more than ½ inch. If voids should develop or if the bored hole diameter is greater than the outside diameter of the casing pipe by more than approximately 1 inch, grouting or other approved methods must be used to fill such voids.

5. The face of the cutting head shall be arranged to provide a reasonable obstruction to the free flow of soft or poor material.

6. Any method which does not have this boring arrangement must be reviewed and approved on a case by case basis. Contractor's boring arrangement plans and methods must be submitted to, and approved by, the TOWN.

C. Insurance to be furnished by the Contractor to cover this type of work shall be adequate to meet the requirements of the Railroad and/or State or County Highway Departments.

END OF SECTION

SECTION 02508 – HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to utilize the trenchless technology of horizontal directional drilling (HDD) for the installation of below grade Ductile Iron or PVC piping and appurtenances as specified herein. Piping shall be as allowed in the applicable section for the type of pipeline. Appropriate joint restraints shall be provided to allow the installation

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Water Piping: Section 02510

B. Sewage Force Mains: Section 02531

C. Identification/Location Guide: Section 02538

1.03 EXISTING CONDITIONS

A. So that piping conflicts may be avoided, Contractor shall locate the utility (vertically & horizontally) well ahead of the pipe laying operation to confirm exact locations of existing piping before installing any new piping.

B. Contractor shall provide all fittings and adapters necessary to complete all connections to existing piping.

1.04 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the TOWN for review before ordering.

B. At the time of submission, the Contractor shall, in writing, call TOWN's attention to any deviations that the submittals may have from the approved project plans..

C. Work Plan - Prior to beginning work, the Contractor must submit to the TOWN a general work plan outlining the procedure and schedule to be used to execute the project. Work Plan should be realistic and document the thoughtful planning required to successfully complete the project.

D. Bore Plan – Prior to beginning the work, the Contractor shall submit a drawing indicating the pilot bore plan.

E. Equipment - Contractor shall submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project.

Specifications for any drilling fluid additives that the Contractor intends to use shall be submitted for review by the TOWN.

F. As-Built Drawings – After completion of the work, a record of the actual as-built bore path, including plan views, vertical depths, horizontal and vertical deviations, indicating the relation to the planned path, must be submitted to the TOWN for review and approval.

1.05 QUALITY ASSURANCE

A. The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the TOWN's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a mixing and delivery system for drilling fluid of sufficient capacity to successfully complete the installation, a guidance system to accurately guide boring operations, control and containment of drilling fluid, along with trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of the project.

2.02 DRILLING SYSTEM

A. Drilling Rig - The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the installation. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations.

B. Drill Head - The drill head shall be steerable by changing it's rotation and shall provide the necessary cutting surfaces and drilling fluid jets.

C. Mud Motors (if required) - Mud motors shall be of adequate power to turn the required drilling tools.

D. Drill Pipe - Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

2.03 GUIDANCE SYSTEM

A. The Guidance System shall be of a proven type and shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance system shall be capable of tracking all required depths in any soil condition and rock encountered along the proposed installation route. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate and calibrated to manufacturer's specifications of the vertical depth of the borehole at sensing positions at a depth up to fifty feet and accurate to 2-feet horizontally.

B. The Guidance System shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

C. Contractor shall maintain a daily project written log of the directional drilling operation and guidance system. Log shall be reviewed by TOWN on a regular basis and submitted in written/tabular form to TOWN upon completion of construction activities as part of as-built records. Log information shall include horizontal plan stationing, azimuth (horizontal direction), inclination (vertical direction), and vertical depth below grade. Additional information including soil characteristics, drilling fluid usage, drill head being used may also be required at the direction of the TOWN. Logs shall be recorded at a maximum interval of once every 30 feet. Shorter log intervals of once every 15 feet may be required at the direction of the TOWN when encountering horizontal or vertical turns, or in vicinity of obstacles or critical areas.

2.04 DRILLING FLUID (MUD) SYSTEM

A. Mixing System - A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be sized for adequate storage of the mud mixture. Mixing system shall continually agitate the drilling fluid during drilling operations.

B. Drilling Fluids - Drilling fluid shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5 – 10 and/or as per mixing requirements of the Manufacturer. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No hazardous additives may be used. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall.

C. Delivery System - The mud pumping system shall have a minimum capacity to supply mud in accordance with the drilling equipment pull-back rating at a constant required pressure. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. A berm, minimum of 12" high, shall be

maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage facilities.

2.05 OTHER EQUIPMENT

A. Pipe Rollers - Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall used to prevent excess sagging of pipe.

B. Pipe Rammers - Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of TOWN.

C. Restrictions - Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the TOWN prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the project.

D. Location Wire: A minimum of two strands of extra high-strength locate wire compliant with Specifications Section 02558 and the Town Standard Details must be installed on horizontal directionally drilled pipe.

PART 3 -EXECUTION

3.01 GENERAL

A. The TOWN must be notified 48 hours in advance of starting work. The TOWN's approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract.

B. The Contractor shall be fully responsible for all damages resulting from his failure to comply with all applicable state, federal and local regulations, and requirements of these specifications.

3.02 DRILLING PROCEDURE

A. Site Preparation - Prior to any alterations to work-site, contractor shall photograph or video tape entire work area, including entry and exit points. One copy shall be given to the TOWN and one copy to remain with contractor for a period of one year following the completion of the project. Work site as indicated on drawings, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

B. Drill Path Survey - Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If contractor is using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic variations or anomalies.

C. Environmental Protection – Contractor shall have in place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations.

D. Safety - Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to TOWN.

E. Pipe Joining shall be as required in the Division 2 piping specification, hereinafter. Pipe will be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

F. Pilot Hole - Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100'. In the event that pilot does deviate from bore path more than 5% of depth in 100', contractor will notify TOWN and TOWN may require contractor to pull-back and re-drill from the location along bore path before the deviation. In the event that a drilling fluid fracture, inadvertent returns or returns loss occurs during pilot hole drilling operations, contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fracture or returns loss continues, contractor will cease operations and notify TOWN. TOWN and contractor will discuss additional options and work will then proceed accordingly.

G. Reaming - Upon successful completion of pilot hole, contractor will ream bore hole to a minimum of 1.25 times not to exceed a maximum of 1.5 times the outside diameter of pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.

H. Pull-Back - After successfully reaming bore hole to the required diameter, contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel. Once pullback operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations contractor will not apply more than the maximum safe pipe pull pressure at any time. In the event that pipe becomes stuck, contractor will cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, contractor will notify TOWN. TOWN and contractor will discuss options and then work will proceed accordingly.

3.03 PIPE TESTING

A. All pipe testing shall be as required in the Division 2 piping specification, hereinafter.

3.04 SITE RESTORATION

A. Following drilling operations, contractor will de-mobilize equipment and restore the worksite to original condition. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to original. All mud shall be disposed of by the Contractor.

END OF SECTION

SECTION 02510 - WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

Provide all labor, materials, equipment and services required for furnishing and installing all piping and appurtenances specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 02300

B. Boring and Jacking: Section 02400

C. Horizontal Directional Drilling: Section 02508

D. Identification/Location Guide: Section 02558

1.03 SUBMITTALS

A. A notarized certification shall be furnished for all pipe and fittings that verifies compliance with all applicable specifications.

1.04 EXISTING CONDITIONS

A. All new piping which ties into existing lines must be made compatible with that piping.

B. So that piping conflicts may be avoided, Contractor shall open up his trench well ahead of the pipe laying operation to confirm exact locations of existing piping before installing any new piping.

C. Contractor shall provide all fittings and adapters necessary to complete all connections to existing piping.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE & FITTINGS

A. Ductile Iron Pipe:

1. Ductile iron pipe shall conform to AWWA C151, latest revision, Pressure Class 350 (12-inch pipe and smaller) or Pressure Class 250 (14-inch and larger), with push-on joints.

2. The interior of the pipe shall be double cement-mortar lined with bituminous seal coat in accordance with AWWA C104, latest revision. Thickness of the lining shall be set forth in the aforementioned specification unless otherwise directed by the Town. The exterior of all pipe, unless otherwise specified, shall receive either coal tar or asphalt base coating a minimum of 1 mil thick.

3. Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or the word "DUCTILE". Pipe manufacturer shall furnish notarized certificate of compliance to the above AWWA or ANSI specifications.

4. Provide AWWA C110 mechanical joint plugs and locked or restrained pipe joints where indicated on Drawings. Fittings under structures shall be mechanical joint with retainer glands.

5. All underground ductile iron pipe shall be encased with polyethylene film in tube or sheet form conforming to AWWA C105 (latest edition). The raw material used to manufacture polyethylene film shall be:

   Type: I
   Class: Grade A or C
   Grade: E-1
   Flow Rate: 0.4 maximum

   The polyethylene film shall have the following characteristics:

Tensile Strength:	1,200 psi minimum
Elongation:	300 percent minimum
Thickness:	0.008 inches minimum (8 mil)

   Storage and installation of polyethylene shall be in accordance with the manufacturer's recommendation and shall prevent contact between the pipe and the surrounding backfill and bedding material; but is not intended to be airtight or watertight.

B. Ductile Iron Fittings:

1. Fittings shall be Class 350 ductile iron fittings in accordance with AWWA C153 and shall conform to the details and dimensions shown therein. Fittings shall have mechanical joints meeting the requirements of AWWA C111. Fittings shall have interior cement-mortar lining as specified for the ductile iron pipe. Ductile iron fittings shall be encased in polyethylene film as specified hereinbefore.

2. Plugs, where required, shall be restrained with the use of ductile iron mechanical joint retainer glands.

3. Adapters, transition gaskets, or specials shall be furnished, as required, to connect the plastic pipe to the ductile iron mechanical joint valves, fittings, and pipe.

C. Joints for Ductile Iron Pipe & Fittings:

1. The joints for ductile iron pipe shall be of the push-on or mechanical joint type

conforming to AWWA C111. Joints shall have the same pressure rating as the pipe or fitting of which they are a part.

2. Push-on type joints shall have an annular recess in the pipe socket to accommodate a single rubber gasket. Plain ends shall be suitably beveled to permit easy entry into the bell. The gasket and annular recess of the socket shall be so designed and shaped that the gasket is located in place against displacement as the joint is assembled.

3. Mechanical joints shall be bolted and of the stuffing box type and shall consist of a bell, with exterior flange and interior recess for the sealing gasket, a pipe or fitting plain end, a sealing gasket, a follower gland, tee-head bolts and hexagon nuts. All bolts and nuts shall be high strength, heat treated ASTM A36 or A-307 carbon steel as a minimum requirement. After field installation, all steel surfaces shall have one coat of Sherwin-Williams Targuard; or equal, coal tar epoxy coating applied before backfill. Nuts and bolts shall meet the requirements of AWWA C111.

4. All valves for buried service on the water mains shall be of the mechanical joint type unless otherwise specified. Joints for ductile iron fittings shall be mechanical joint type only.

5. Mechanical joint plain and bell ends of fittings shall conform to the dimensions set forth in AWWA C111.

6. The cleaning and assembly of pipe and fitting joints shall be in accordance with the manufacturer's recommendations.

2.02 POLYVINYL CHLORINE (PVC) PLASTIC PIPE

A. AWWA C-900 and C-905:

1. 4-inch through 12-inch - PVC plastic pipe shall conform to ANSI/AWWA C-900, Class 200 (DR 14). PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform with the requirements of ASTM F-477. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.

2. 14-inch through 36-inch - PVC plastic pipe shall conform to ANSI/AWWA C-905, Class 235 (DR 18). PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform with the requirements of ASTM F-477. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.

B. PVC pipe shall be blue in color for water main use.

C. Joints for PVC mains shall be integral bell and spigot type joints with rubber-o-ring gasket. The cleaning and assembling of the pipe joints shall be in accordance with manufacturer's recommendations.

D. Fittings shall be Ductile Iron Mechanical Joint as specified in Section 2.01.

2.03 RESTRAINED JOINTS:

A. Restrained joints for pipe, fittings, and valves shall be required where restraint of the pipe is needed, and applies to restrained joints at ductile iron fittings, across the joints of bell and spigot pipe joint, and where the spigot end of pipe connect with valves or other items that have mechanical joint ends. Mechanically restrained joints for both Ductile Iron and PVC water mains shall be as follows:

1. Ductile Iron Pipe: Ductile iron pipe restraint shall be accomplished by mechanical joint retainer glands cast of ductile iron, Grade 60-42-10, and equipped with special alloy steel cupped and set screws. Restraining devices shall be Mega-Lug Series 1100 or 1100SD (as applicable) as manufactured by EBAA Iron Sales, Inc., Eastland, Texas; Mechanical-Joint Coupled-Joint by American Ductile Iron Pipe; MECH-LOK Restrained Joint by Griffin Pipe; or equal.

2. PVC: Restraining devices for connecting existing PVC pipe to new ductile iron fittings shall be Series 1600, 2000PV, or 2000SV (as applicable) as manufactured by EBAA Iron Sales, Inc., Eastland, Texas, or approved equal. Restraining devices shall be encased in polyethylene film as specified herein before.

3. Restrained joints shall have a minimum working pressure of 175 psi. Restraining devices shall be encased in polyethylene film as specified hereinbefore.

4. Field-lock gaskets (a.k.a. gripper gaskets) are only allowed for use in directional drilling applications.

2.04 RESILIENT SEAT GATE VALVES

A. All gate valves shall be furnished with mechanical joint end connections, unless otherwise shown on the Drawings or specified hereinafter. Plastic pipe "stub-joint" ends on valves for PVC water mains will not be accepted. All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working pressure case on the body of the valve.

B. Gate valves shall be resilient seated manufactured to meet or exceed the requirements of AWWA C509. Valves shall have a clear, unobstructed water way when fully opened shall be at least as large as the pipe inside diameter for which it is intended.

C. All internal and external surfaces shall be coated with a fusion bonded epoxy to a minimum thickness of eight mils. Said coating shall be non-toxic, impart no taste to water and shall conform to AWWA C550 of latest revision. Said coating shall be applied to assembly such that all exposed areas, including end connection bolt holes, body-to-bonnet bolt holes, etc., shall be coated with epoxy. All bolts shall be stainless steel.

D. Valves shall be provided with two 0-ring stem seals located above the thrust collar. The two rings shall be replaceable with the valve fully open and subject to full rated working pressure. The area between the 0-ring shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. One anti-friction washer shall be located below and one anti-friction washer above the thrust collar.

E. The sealing mechanism shall provide 0 leakage at the water working pressure when installed with the line flow in either seat direction, and shall consist of a cast iron gate with a resilient urethane rubber seat completely encapsulated to the gate. Further, it shall be designed such that no sliding of rubber on the seating surfaces is required to compress the rubber. It shall also be designed such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate.

F. All valves shall be seat tested at the rated working pressure of 200 psi and shall test at 400 psi in accordance with Section 6 of AWWA C509. All valves shall be satisfactory for applications involving valve operation after long periods of inactivity.

G. Gate valves set with valve boxes shall be provided with two inch square operating nut and shall be opened by turning to the left (counterclockwise). Each gate valve shall be installed in a vertical position with a valve box.

H. Gate valves shall be Model A-2360 resilient wedge gate valves as manufactured by Mueller Company, Decatur, Illinois or approved equal. All gate valves shall be encased in polyethylene film as specified herein before.

2.05 VALVE BOXES

A. Valve boxes shall be of 5¼ inch standard cast iron, two or three piece, screw type valve box with drop cover marked "WATER". Valve boxes for gate valves shall be three piece type; valve boxes for butterfly valves and other bonnetless valves shall be two piece type. Valve boxes shall be accurately centered over valve operating nut, and backfill thoroughly tamped about them. Valve box bases shall not rest on the valves but shall be supported on crushed stone fill. They shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be at grade in any paving, walk or road surface, and two and three inches above ground in grass plots, fields, woods or other open terrain. A utility marker shall be provided for all valve box covers in open terrain. Valve boxes and covers shall be as manufactured by Tyler Corporation, Opelike Foundry, Bingham & Taylor, or approved equal.

B. All valves, in undeveloped areas shall include a locating ball.

2.06 FIRE HYDRANTS

A. Hydrants shall conform in all respects to the requirements of AWWA C502, be listed by Underwriters Laboratories, Inc. and have Factory Mutual Research approval.

B. Hydrant barrel shall have safety breakage feature above the ground line. All hydrants shall have six (6) inch mechanical joint shoe connection, two (2) 2½ inch discharge nozzles and one (1) 5" Storz pumper nozzle connection. Connection threads shall conform to local standards. Main valve shall have 5¼ inch full opening and be of the compression type opening against water pressure so that valve remains should barrel be broken off.

C. Hydrants shall be fully bronze mounted. Main valve shall have a threaded bronze seat ring assembly of such design that it is easily removable by unscrewing from a threaded bronze drain ring. Bronze drain ring shall have multiple ports providing positive automatic drainage as the main valve is opened or closed. Drainage waterways shall be completely bronze to prevent rust

and corrosion.

D. Operating stem shall be equipped with anti-friction thrust bearing to reduce operating torque and assure easy opening. Stop shall be provided to limit stem travel. Stem threads shall be enclosed in a permanently sealed lubricant reservoir protected from weather and the waterway with 0-ring seals.

E. The operating nut shall be protected by a cast iron weather shield. The operating nut size and shape shall be 1½ inch pentagon.

F. Hydrant shall have an upper valve plate and two (2) rubber facings which activate the drain ports. Hydrant shall be manufactured with a bronze lower valve plate which bottoms out in the shoe for maximum opening.

G. Hydrant shall be manufactured with a main valve seat ring of bronze threaded into a bronze drain ring. A 360 degree drain channel shall have a minimum of two (2) draining outlets. All drainage outlets shall have set screws/plugs installed such that the hydrant barrel is non-draining after usage.

H. Hydrant shall be a "Traffic Model, " complete with safety flanges and steel stem coupling. Nozzle section must rotate 360 degrees.

I. Hydrant shall be manufactured with nozzles mechanically locked into the barrel and having O-ring seals.

J. Hydrants shall be designed for 250 psi working pressure and shop tested to 500 psi pressure with main valve both opened and closed. Under test the valve shall not leak, the automatic drain shall function and there shall be no leakage into the bonnet.

K. All piping in connection of fire hydrant to water main shall be ductile iron pipe as specified herein before. Water main tee fitting shall be ductile iron.

L. Hydrants shall be set plumb and backed with concrete blocking per the Standard Details or equivalent. Set hydrants so that centerline of pumper nozzle is minimum 18 inches above finished grade. An operating wrench and traffic damage repair kit shall be provided to the Town for every 15 hydrants, rounded up. Provide one (1) set where quantity of hydrants is less than 15.

M. Contractor shall provide and install barrel extensions such that the base of the hydrant shall extend above finished grade between 2 to 4 inches.

N. Hydrants shall be 5¼ inch Mueller Super Centurion 250, Model A-423 as manufactured by Mueller Company, Decatur, Illinois or approved equal. A five (5) year limited warranty on each hydrant shall be provided to the Town upon completion of the project.

O. Blue reflectors shall be installed at every hydrant in the center of the road; Stimsonite Snowplowable Marker, or equal.

P. Public Fire Hydrant color shall be red. Private Hydrant color shall be yellow.

2.07 CUSTOMER SERVICE CONNECTIONS

A. All Service lines shall be installed in accordance with these Standards.

B. Portions of service lines installed on private property shall be installed in accordance with the latest addition of the One and Two Family Dwelling Code and the Uniform Plumbing Code

C. Service Lines shall utilize polyethylene pipe, crystal blue ENDOT Pure Poly type designed for 200 psi.

2.08 CORPORATION STOPS

A. Corporation stops, of the size required, shall be connected into the water main using a stainless steel tapping sleeve. Corporation stops shall have AWWA C800 C.C. threaded inlet. Outlets shall be suitable for the type of service piping furnished and laid, and the Contractor shall verify compatibility with "copper tubing size" service piping as required before ordering stops.

B. Corporation stops shall be Mueller 300 Ball Valve, or approved equal. Stainless steel tapping sleeves shall be used for tapping water mains. No saddles will be allowed.

2.09 WATER METERS

A. Per Town of Whitestown requirements. Contact utility office. Compound meters shall be required for 1.5" or larger.

2.10 METER SETTERS/BOXES

A. The minimum diameter for meter pits shall be as shown on Detail Drawing Sheet. Meter pit lids shall be properly sized for the meter pit used and shall contain predrilled holes for Radio Read Antenna mounting. The lid shall be the recessed type, Mueller or approved equal. Lid shall be equipped with a large locking Pentagon nut and shall indicate water service. Pits shall be set at the property line with a bottom depth of 54" and the lid at finish grade to allow easy access for Utility personnel.

B. Meter Pit shall be T-Z Products. See Detail Drawing Sheet.

2.11 TAPPING SLEEVES AND VALVES FOR CONNECTION TO EXISTING WATER MAINS

A. Tapping sleeves for connection to existing water lines shall be of full body stainless steel with stainless steel flange suitable for working pressures of 150 psi and shall have stainless steel bolts. Tapping sleeves shall be encased in polyethylene film as specified herein before.

2.12 MATERIALS TESTING

A. Whenever in these documents, or as required by the Town, inspection and testing of materials is required, bureaus, laboratories and/or agencies selected for such inspection and testing service shall be approved by the Town. The cost of all such inspection and testing services shall be

borne by the Contractor.

2.13 REMOVAL OF WATER

A. The Contractor, at his own expense, shall provide adequate facilities for promptly and continuously removing water from all excavations in accordance with Section 02240.

PART 3 - EXECUTION

3.01 LOCATION OF WATER MAIN

A. The Contractor shall install the new water main in the location indicated on the approved plans.

3.02 EXCAVATION FOR PIPELINE TRENCHES

A. Unless otherwise directed by the Town, trenches in which pipes are to be laid shall be excavated in open cut to the depths required by field conditions or as otherwise specified. In general this shall be interpreted to mean that machine excavation in earth shall not extend below an elevation permitting the pipe to be properly bedded. Installation shall be in accordance with either ASTM-D-2774 or AWWA C-150 except as modified herein and as shown on Drawing Details.

B. Excavation may be undercut to a depth below the required invert elevation that will permit laying the pipe in a bed of granular material to provide continuous support for the bottom quadrant of the pipe. When this method is used, the bedding shall be as set out in Paragraph 3.03 hereinafter.

C. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe, but unless specifically authorized by the Town, trenches shall in no case be excavated or permitted to become wider then 2'-0" plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than 2'-0" at the level of or below the top of the pipe, special precaution may be necessary, such as providing compacted, granular fill up to top of the pipe or providing pipe with additional crushing strength as determined by the Town after taking into account the actual trench loads that may result and the strength of the pipe being used.

D. All excavated materials shall be placed a minimum of two feet (2') back from the edge of the trench.

E. Before laying the pipe, the trench shall be opened far enough ahead to reveal obstructions that may necessitate changing the line or grade of the pipeline.

F. The trench shall be straight and uniform so as to permit laying pipe to lines and grades given on the approved plans. It shall be kept free of water during the laying of the pipe and until the pipeline has been backfilled. Dry conditions shall be maintained in the excavations until the backfill has been placed. During the excavation, the grade shall be maintained so that it will freely drain and prevent surface water from entering the excavation at all times. Temporary

drainage ditches shall be installed to intercept or direct surface water which may affect work. All water shall be pumped or drained from the excavation and disposed of in a suitable manner without damage to adjacent property or to other work.

G. Minimum cover of 54" shall be provided for all pipelines.

3.03 PIPE BEDDING

A. All water main pipe shall be supported on a bed of clean sand, (Type II bedding) as shown in the Drawing Details of the plans. Bedding material shall be free from large rocks and be acceptable to the Town. In no case shall pipe be supported directly on rock.

B. In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe and insofar as possible where bell and spigot pipe is involved so that none of the load will be carried on the bells.

C. Where undercutting and granular bedding is involved it shall be of such depth that the bottom of the bells of the pipe will be at least three inches above the bottom of the trench as excavated.

D. In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. Yielding and mucky materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.

E. Installation shall be in accordance with ASTM D 2774 or AWWA C-150 except as modified hereinafter.

3.04 PIPE INSTALLATION AND JOINTING – CERTA-LOK RESTRAINED JOINT PVC

A. Jointing of Certa-Lok with nylon splines inserted into coupling and shall be accomplished in accordance with the manufacture's recommendations.

3.05 LAYING PIPE

A. The laying of pipe in finished trenches shall be commenced at the lowest point so the spigot ends point in the direction of flow.

B. All pipes shall be laid with ends abutting and true to line and grade as given by the Town. Supporting of pipes shall be as set out hereinbefore under "Pipe Bedding" and in no case shall the supporting of pipes on blocks be permitted.

C. Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure its being clean. Each piece of pipe shall be lowered separately unless special permission is given otherwise by the Town. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, they shall be removed and replaced with a satisfactory pipe or fitting without

additional charge. In case a length of pipe is cut to fit in a line it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

D. Pipe shall not be laid on solid rock. A pad of granular material as specified in Paragraph 3.02 "Pipe Bedding", shall be used as a pipe bedding. Irregularities in subgrade in an earth trench shall be corrected by use of granular material.

E. When ordered by the Town, unsuitable materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.

F. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood or fabricated plug fitted into the pipe bell, so as to exclude earth or other material, and precautions taken to prevent flotation of pipe by runoff into trench.

G. No backfilling (except for securing pipe in place) over pipe will be allowed until the Town has had an opportunity to make an inspection of the joints, alignment and grade, in the section laid.

H. Jointing of push-on type or mechanical joint pipe with rubber gasket couplings shall be in accordance with pipe manufacturer's recommendation.

I. Where directed, water services under highways shall be installed by boring plastic or copper service piping under the roadway without a casing pipe. Minimum depth of cover on water service lines bored under all roads shall be 54".

3.06 BACKFILLING PIPELINE TRENCHES

A. Backfilling of pipeline trenches shall be accomplished with the requirements set forth in "Earthwork" Section 02300 as shown on the Drawings and with details set forth hereinafter.

B. Backfilling in Open Terrain:

Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

1. The primary backfill shall be as specified in Paragraph 3.02 "Pipe Bedding". This material shall be placed in a manner approved by the Town, and shall be carefully compacted to avoid displacement of the pipe. Compaction shall be accomplished by hand-tamping or by approved mechanical methods.

2. The secondary backfill (upper portion of the trench above the primary backfill) shall be backfilled with material that is free from large rock (common fill). Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. Backfilling this portion of the trench may be accomplished by any means approved by the Town. The trench backfill shall be heaped over or leveled as directed by the Town.

C. Backfilling Under Paved Areas:

Backfilling of pipeline trenches under paved areas shall be accomplished in the following manner:

1. The primary backfill shall be as specified in Paragraph 3.02 "Pipe Bedding". This material shall be placed in a manner approved by the Town, and shall be carefully compacted to avoid displacement of the pipe. Compaction shall be accomplished by hand-tamping or by approved mechanical methods.

2. The secondary backfill (upper portion of the trench above the primary backfill) to the elevation of the pavement subgrade, shall be backfilled with clean granular material per requirements of Indiana Department of Transportation for structural fill. Material shall be compacted as set forth in Section 02300 "Earthwork" Paragraph 3.06 "Compaction" or as directed by the Town.

3. The upper portion of the trench from the top of the secondary backfill, shall be backfilled with a base course of dense graded aggregate. At such time that pavement replacement is accomplished, the excess base course shall be removed as required.

D. Before final acceptance, the Contractor will be required to level off all trenches or to bring the trench up to grade. The Contractor shall also remove from roadways, rights-of-ways and/or private property all excess earth or other materials resulting from construction.

E. In the event that pavement is not placed immediately following trench backfilling in streets and highways, the Contractor shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

3.07 CONCRETE, CRADLE, ANCHORS OR ENCASEMENT

A. Concrete, cradle, anchors or encasement shall be placed where shown on the Drawings, required by the Specifications, or as directed by the Town.

B. For cradle and encasement, concrete shall be 3000 psi, delivered from a concrete plant only, and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. Concrete shall have at least a 6" minimum thickness under and/or around the pipe as applicable.

C. For anchors, concrete shall be 3000 psi, delivered from a concrete plant only, and shall be formed or be sufficiently stiff to maintain the forms indicated on the Drawing Details.

D. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints. Concrete shall not be placed outside the specified limits without authorization from the Town.

3.08 WATER MAIN CONSTRUCTION NEAR SANITARY SEWERS

A. Water mains shall be laid at least ten feet horizontally from any existing sanitary sewer or force main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, the water main may be installed closer to a sewer provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. Should the vertical separation requirement not be possible, then the water main shall be completely encased in concrete until these location requirements can be met.

B. Water mains crossing sanitary sewers or force mains shall be laid to provide a minimum vertical distance of 18" between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. At crossings, one full length of water main shall be located so both joints will be as far from the sewer as possible. Special structural support for the water main and sewer pipes may be required. No water main shall pass through or come in contact with any part of a sewer manhole.

3.09 BITUMINOUS CONCRETE HIGHWAY, STREET AND DRIVEWAY REPLACEMENT

A. The Contractor shall replace those sections of existing roads, streets and driveways required to be removed to install the pipe lines under this contract. He shall construct same to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to the operations.

B. Prior to trenching, the pavement shall be scored or cut to straight edges at least six (6) inches outside each edge of the proposed trench to avoid unnecessary damage to the remainder of the paving. Edges of the existing pavement shall be re-cut and trimmed to square, straight edges after the pipeline has been installed and prior to placing the new base and pavement.

C. Backfilling of the trench shall be in accordance with Section 3.06 as applicable and described hereinbefore. Base course for the paving shall be a compacted aggregate base course of crushed stone to the depths indicated on the Drawing Details.

D. A subslab of reinforced concrete shall be placed for Bituminous Highways with concrete subslabs as indicated on the Drawings. The subslab shall have a minimum thickness of 6 inches. Concrete for the subslab shall be 4,000 psi, in accordance with the Details shown on the Drawings. For concrete driveways the concrete thickness shall be equal to the depth of existing pavement and in no case less than 6 inches.

E. The Bituminous wearing surface of roads, streets, and driveways shall be plant mix bituminous concrete, furnished and placed in accordance with the current requirements of the Indiana D.O.T. Standard Specifications equal to a depth of existing paving and in no case less than one and one half (1-1/2) inches.

3.10 UNPAVED DRIVEWAY (CRUSHED STONE) SURFACE REPLACEMENT

A. The Contractor shall replace those sections of existing driveways and parking areas required to be removed to install the pipe lines under this contract. He shall construct same to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to the operations.

B. Material for backfilling of the pipeline trench shall be dense-graded aggregate, matching the materials of the existing driveway, in accordance with backfill in paved areas requirements as described hereinbefore.

3.11 PORTLAND CEMENT CONCRETE HIGHWAY, STREET AND DRIVEWAY REPLACEMENT

Wherever Portland cement concrete streets, highways and driveways are removed, they shall be

reconstructed to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than existed prior to the operation.

The existing concrete paving shall be saw cut to straight edges 6" outside the edges of the trench or broken out to an existing joint, as directed by the Resident Project Representative. The maximum width of the trench at pavement level shall be as shown on the Detail Drawings, unless otherwise specified by the Resident Project Representative. The concrete pavement shall be equal to the existing pavement thickness but not less than 8" in thickness for streets and highways and 4" for driveways. Base course for the pavement shall be dense graded crushed limestone furnished and placed to a depth of 3" in both roads and streets and driveways.

Pavement replacement shall be accomplished with 4,000 psi concrete in accordance with the details shown on the Drawings.

3.12 REMOVING AND REPLACING CONCRETE CURB AND GUTTER OR SIDEWALK

A. The Contractor shall remove the curb and gutter or sidewalk when encountered when required for laying the pipe. Only that portion of the curb and gutter or sidewalk needed to lay the pipe shall be removed. Saw cuts shall be made in the existing concrete to facilitate the clean removal of concrete materials.

B. Where concrete curb and gutter or sidewalk is removed or disturbed during the construction work, it shall be replaced, using 3000 psi concrete, in fully as good or better condition than that which existed prior to the Contractor's operation.

3.13 REPLACEMENT OF EXISTING MAIL BOXES, CULVERTS, CLOTHES LINE POSTS, FENCES, DRAIN TILE AND OTHER SUCH FACILITIES

A. Existing mail boxes, drainage culverts, drainage tile, clothes line posts, fences and the like shall not be damaged or disturbed unless necessary, in which case they shall be replaced in as good condition as found as quickly as possible. Existing materials shall be reused in replacing such facilities when materials have not been damaged by the Contractor's operations. Existing facilities damaged by Contractor's operation shall be replaced with new materials of the same type at the Contractor's expense. Work in this category is not a pay item.

B. All existing farm field or roadway drain tiles shall be maintained in service wherever work under this Contract interferes with such facilities. Any such drains that have been disturbed shall be replaced as detailed on Drawing Details. Replacement shall occur immediately upon disruption of the drain tile and prior to trench backfilling.

C. Replacement of paved drainage ditches within highway right-of-way shall be accomplished in accordance with Indiana Department of Transportation specifications.

3.14 TESTING

All domestic water mains shall be flushed, tested and disinfected in accordance with these Standards.

All domestic water lines will be pressure tested with the Town's Inspector present. The

Owner/Contractor shall notify the Town's Water Department at least 48 hours in advance of testing. The Contractor shall provide all equipment necessary for the testing.

Each section of pipe shall pass a pressure and leakage test in accordance with the most recent requirements of AWWA Standard C600. Prior to testing, lines shall be thoroughly flushed at a minimum rate of 2.5 fps. Flushing shall be accomplished by partially opening and closing valves and hydrants several times under the expected line pressure.

A. Test Restrictions

Test pressure shall not be less than 1.5 times the working pressure of the lowest point along the test section, or 150 psi, whichever is greater, but shall not exceed the pipe, fitting or thrust-restraint design pressures at any point. Test pressure shall not vary by more than ±5 psi for the duration of the test. Duration of the test is to be not less than 2 hours.

Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests at these pressures, the test set-up should include provisions, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or opened fully if desired.

Test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section included closed, resilient-seated gate valves, or butterfly valves. No test sections shall exceed 2000 feet in length without prior approval from the Town.

B. Test Procedures

The specified test pressure, which is based on the elevation of the lowest point of the line or section being tested as corrected to the elevation of the test gauge, shall be applied by means of a pump connection to the pipe in a manner satisfactory to the Town. Allow the system to stabilize at the test pressure before conducting the leakage test.

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at high points, the Contractor shall install corporation cocks at such points so that air can be expelled as the line is slowly filled with water. After the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged, or left in place if requested by the Town.

All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged components during or after the pressure test shall be repaired at the contractors expense. The test shall be repeated until the results are satisfactory to the Town.

C. Allowable Leakage

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

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 per hour
S = Length of pipe tested, in feet
D = Nominal diameter of the pipe, in inches
P = Average test pressure during leakage test, in pounds per square inch (gauge)

ALLOWABLE LEAKAGE PER 1000 FT. OF PIPELINE*

Nominal Pipe Diameter. In.

Avg. Test Pressure psi	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450	0.48	0.64	0.95	1.27	1.5	1.91	2.23	2.56	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400	0.45	0.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.60	5.41	6.31	7.21	8.11
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300	0.30	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.50	3.12	3.90	4.68	5.46	6.24	7.02
275	0.37	0.50	0.75	1.00	1.24	1.40	1.74	1.99	2.24	2.40	2.99	3.73	4.48	5.23	5.98	6.72
250	0.36	0.47	0.71	0.95	1.19	1.42	1.56	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.48	5.00	5.73
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.50	1.79	1.98	2.38	2.98	3.68	4.17	4.77	5.36
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.56	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125	0.25	0.34	0.50	0.87	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.60	1.80	2.25	2.70	3.15	3.60	4.05

* If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gph/in. of nominal valve size shall be allowed.

When hydrants are in test section, the test shall be made against closed hydrant valves.

D. Acceptance of Testing

If test results disclose leakage greater than allowable limits, the Contractor shall, at his own expense, locate and make approved repairs as necessary until the leakage is within the specified allowance. Additional tests performed after the repairs will be at the Contractor's expense. All visible leaks are to be repaired, regardless of the amount of leakage.

E. The Owner will provide initial water for testing the pressure piping. Should the first test fail to pass, all additional water required for subsequent tests shall be furnished at the Contractor's expense.

F. The cost of testing of pressure piping is incidental and is to be included in the Contractor's unit cost price for water main installation.

G. All testing shall be done in the presence of the Town.

3.15 CLEAN UP

Upon completion of installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the Work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line. Grass areas shall be restored per Section 02920.

3.16 DISINFECTION OF POTABLE WATER LINES

A. Disinfection of System

After construction is complete, the newly installed system shall be flushed to remove dirt and foreign material. The lines shall then be disinfected in accordance with procedures outlined by the American Water Works Association Standard AWWA C651.

B. Chlorinating Requirements

Water shall be supplied to the new system at a constant, measured rate. In the absence of a meter, the rate may be approximated by methods such as placing a Pitot gauge in the discharge and measuring the time to fill a container of known volume.

At a point not more than 10 ft. downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 50 mg/L free chlorine. To assure that the correct concentration is provided, measure units shall be taken at regular intervals in accordance with the procedures described in the current edition of Standard Methods for the Examination of Water or Wastewater, AWWA Manual M12, or by using an appropriate chlorine test.

The following table lists the amount of chlorine required for each 100 feet for various diameters of pipe. Solutions of 1-percent chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. A solution using calcium hypochlorite requires 1 lb. per 8 gallons of water.

CHLORINE REQUIRED TO PRODUCE 50 mg/l CONCENTRATION IN 100 FT. OF PIPE BY DIAMETER

Pipe Diameter in.	100-Percent Chlorine lb.	1-Percent Chlorine Solution gal.
4	0.026	0.32
6	0.06	0.72
8	0.108	1.30
10	0.17	2.04
12	0.24	2.88
16	0.434	5.2

While chlorine is being applied, valves shall be positioned so that the strong chlorine solution will not flow into water mains in active service. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall be retained in the main for at least 24 hours. During this time, all valves and hydrants in the section being

treated shall be operated to ensure disinfection of all appurtenances. At the end of the period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine.

C. Flushing

After the applicable testing period, heavily chlorinated water shall be removed in order to prevent damage to the pipe. The chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the min is greater than 0.5 mg/L but less than 2.0 mg/L.

Chlorinated water shall be properly discharge to an approved sanitary sewer. If no sanitary sewer is available a reducing agent shall be applied to the water to be waste in order to thoroughly neutralize residual. The following table shows the amount of neutralizing chemicals required. Where necessary, federal, state and local regulatory agencies should be contacted to determine if there are special provisions for the disposal of heavily chlorinated water.

POUNDS OF CHEMICALS REQUIRED TO NEUTRALIZE VARIOUS RESIDUAL CHLORINE CONCENTRATIONS IN 100,000 GALLONS OF WATER*

Residual Chlorine Concentration mg/L	Sulfur Dioxide (SO_2)	Sodium Bisulfate ($NaHSO_3$)	Sodium Sulfite (Na_2SO_3)	Sodium Thiosulfate ($Na_2S_2O_35H_20$)
1	0.8	1.2	1.4	1.2
2	1.7	2.5	2.9	2.4
10	8.3	12.5	14.6	12.0
50	41.7	62.6	73.3	60.0

* Except for residual chlorine concentration, all amounts are in pounds.

D. Bacteriological Test

Satisfactory bacteriological test results approved by the Indiana State Board of Health shall be produced for two (2) successive sets of sample, collected at twenty-four (24) hour intervals, before the new mains are accepted for use. A copy of the test results shall be provided to the Town.

Contractor shall notify the Whitestown Municipal Utilities when the system and disinfection is complete and the water is ready for bacteriological testing. The Utilities representative will be present when the Contractor collects the sample. The Town will submit the sample to an Town selected independent certified laboratory for bacteriological analysis.

Samples shall be collected from the end of the line, and tested for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater. At least one set of samples shall be collected from the new main and one from each branch. In case of long mains, samples shall be collected along the length of the line, at reasonable intervals, as well as at its end. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate. No hose or fire hydrant shall be used in the collection of samples.

E. Re-testing and Disinfection

If test results are unsatisfactory, Contractor shall reflush the lines and repeat the disinfection.

Testing shall be repeated as noted above until the testing results are satisfactory and the mains are approved for service. The Contractor shall have to pay for the laboratory testing costs of any retesting required

F. Water mains shall be flushed, prior to sampling, at a minimum 2.5 foot per second velocity. Bacteriological sampling shall be done by the Contractor at a maximum of 1200 foot intervals along all new mains. The Contractor shall provide any additional taps as required to meet this requirement at no additional cost to the Owner. Newly installed mains must show a chlorine residual indicative of normal system characteristics.

G. All testing costs and scheduling shall be the responsibility of the Contractor. All testing shall be taken in the presence of the Town.

H. Contractor shall be responsible for all flushed water during testing/flushing operations that include de-chlorination, damage to ditch, private property, etc.

3.17 INSTALLATION OF LOCATION WIRE

A. Location wire shall be installed with all buried water lines in accordance with the manufacturer's installation instructions and as specified herein.

B. The location wire shall be looped up into valve boxes for connections to a locating device. The wire shall be one continuous piece from end to end (or valve box to valve box).

C. All Tracer Wire shall be blue in color for all water mains.

D. Location wire for horizontal directional drilling applications shall be provided in sufficient quantity and redundancy (minimum of 2 wires) in accordance with pipe manufacturer's installation recommendations. Tracer Wire shall be manufactured by Copperhead Industries, LLC or approval equal.

END OF SECTION

SECTION 02515 – SEWER AND FORCEMAIN VALVES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all valves shown on the Drawings and/or specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Piping is specified in Division 2 Specification sections.

1.03 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Town for review before ordering.

B. At the time of submission, the Contractor shall, in writing, call Town's attention to any deviations that the submittals may have from the requirements of the Town's Contract Drawings and Specifications.

PART 2 - PRODUCTS

2.01 PLUG VALVES

A. All plug valves shall be ¼ turn, eccentric plug valves unless otherwise specified.

B. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall be to the AWWA Standard C111-64, grooved ends per AWWA C-606-87. Screwed ends shall be to the NPT standard.

C. Valve bodies shall be of ASTM A126 Class B cast iron. Bodies in 4" and larger valves shall be furnished with a 1/8" welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

D. Plugs shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.

E. Valves shall have sleeve type metal bearings and shall be of sintered, oil impregnated

permanently lubricated type 316 ASTM A743 Grade CF-8M in 2" sizes. In valves larger than 36", the upper and lower plug journals shall be fitted with ASTM A-240 type 316 stainless sleeves with bearings of ASTM B30, Alloy C95400 aluminum bronze. Non-metallic bearings shall not be acceptable.

F. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

G. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72". Each valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.

H. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, etc., as indicated on the plans. All valves 6" and larger shall be equipped with gear actuators. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated.

I. Valves and gear actuators for buried or submerged service shall have seals or all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.

J. Actuators shall be equipped with an operating nut to allow manual valve operation in case of supply failure.

K. All valves and actuators shall be as manufactured by DEZURIK; Val-matic; or approved equal, and shall open to 100% of the corresponding pipe diameter.

L. All buried service plug valves shall have mechanical joint ends, have all exterior surfaces shop painted with two coats of Fed. Spec. TT-C-494A Asphalt Varnish with 2-inch square nut operator in a vertical position for use in a valve box. Provide nut operator stem extension for all plug valves buried deeper than 5 feet, sufficient to raise operator nut to within 3 feet of finished grade.

2.02 CHECK VALVES

A. Check valves shall be cast iron body, with a domed access cover, and flexible internal disc, rated for 150 psi working pressure. Flanges shall be faced and drilled in accordance with ANSI B16.1, Class 125 Standard.

B. Valve body shall have a full-flow equal to nominal pipe diameter at all points through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. A threaded port with pipe plug shall be provided on the bottom of the valve to allow for installation of a backflow actuator without special tools or removing the valve from the pipeline.

C. The top access port shall be full size, allowing for removal of the disc without removing the valve from the pipeline. The access cover shall be domed in shape to provide flushing action over the disc for operation in lines containing high solids content.

D. The disc shall be of one-piece construction, precision molded Buna-N, with an integral o-ring type sealing surface, and contain steel and nylon reinforcement in the hinge. Non-slam closing characteristics shall be provided through a short 35-degree disc stroke and a memory disc return action.

E. A screw-type backflow actuator shall be provided for field installation to allow opening of the valve during no-flow conditions. Buna-N seals shall be used to seal the stainless steel stem in a bronze bushing. The backflow device shall be of the rising stem type to indicate position and furnished with a T-handle for ease of operation.

F. Swing check valves shall be the Swing-Flex Series #500 as manufactured by Val-Matic Valve & Mfg. Corporation or Series 100 Swing Check Valve as manufactured by Apco Valve and Primer Corporation; or approved equal.

2.03 AIR AND VACUUM RELEASE VALVES

A. All air and vacuum release valves installed shall be conical shaped to maintain maximum air gap with the spring loaded float and seal plug connection combining to ensure no contact between the sewage and the seal.

B. The valve shall have a double float design with the upper float being enclosed in the main body of the valve. The body shall be constructed of stainless steel, and shall have a conical shaped lower body to automatically drain sewage back into the system.

C. All internal metal parts are to be made from corrosion resistant stainless steel, with all operating parts in the upper section to be non-metallic plastic materials. The hinge for operation for the opening and closing of the seal on the orifice shall be made of EPDM rubber. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The working pressure shall be 150 psi and tested to 225 psi.

D. All hardware shall be of Stainless Steel bolts and nuts. The connection on all pipelines shall be 2-inch threaded stainless steel with stainless steel isolation ball valve of the same size.

E. This specification and the basis of design is based on an ARI valve. Combination air valves shall be ARI D-025-ST as manufactured by A.R.I. Flow Control Accessories Ltd., Valmatic air release valve or approved equal. Sizing shall be consistent with the ARI valve. All valves shall be installed in accordance with manufacturer recommendations and shall have an isolation valve connection for control. All valves shall have ISO 9002 certification and be warranted for a period of no less than 5 years after the date of Substantial Completion acceptance.

F. Valves shall be installed in a manhole structure per the Standard Details.

2.04 VALVE BOXES

A. Valve boxes shall be of 5-1/4 inch standard cast iron, two-piece, screw type valve box with drop cover marked "SEWER". Valve boxes for valves larger than 8 inches shall be three-piece. Valve boxes shall be accurately centered over valve operating nut, and backfill thoroughly tamped about them. Valve boxes shall not rest on the valves but shall be supported on crushed stone fill. They shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be grade in any paving, walk or road surface, and 2 to 3 inches above finish grade in grass plots, fields, woods or other open terrain. In grass areas, provide concrete pad around valve box; slightly crowned in all directions to shed water. Valve boxes and covers shall be as manufactured by Tyler Corporation, Opelika Foundry or equal.

B. Contractor shall furnish two (2) 6-foot T-handle operating wrenches for underground valves. Nut operator extensions for all valves buried deeper than 3 feet shall be provided with stem extensions sufficient to raise operator nut to within 3 feet of finished grade.

C. Circular hi-density polyethylene boxes shall be as manufactured by Mid-States Company, Lexington, Kentucky; Tallman Conduit Company, Louisiana, Missouri; or equal, size as indicated on Drawings. Covers shall be solid one-piece flat lids, sized to fit box, as manufactured by Charlotte Pipe and Foundry, or equal.

D. Valve boxes inside a paving, walk, or road surface shall not be set on the valves but shall be supported on crushed stone fill.

E. Wherever valve boxes fall outside of the roadway pavement, the top of the box shall be set in a concrete slab 18" x 18" x 4" thick (or 18" circular x 4" thick) with the top of the slab and box flush with the top of the ground. This provision shall apply to all new and all existing valve boxes which fall within the limits of the contract, unless otherwise stated on the plans or ordered by the Town.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All valves shall be installed in accordance with details on the Contract Drawings and with the manufacturer's recommendations.

B. All valves shall be anchored in accordance with the details on the Contract Drawings.

END OF SECTION

SECTION 02530 - GRAVITY SEWER PIPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for furnishing and installing all gravity sewer piping and appurtenances as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 02300

B. Boring and Jacking: Section 02400

1.03 SUBMITTALS

A. Submit manufacturer's data on the pipe material to be used.

1.04 INTERNAL PIPE DIAMETER

A. All sewer pipe provided shall have a minimum actual internal diameter which is equal to or greater than the diameter indicated on the Contract Drawings.

PART 2 - PRODUCTS

2.01 GRAVITY SEWER PIPE

A. Polyvinyl Chloride PVC Pipe and Fittings

1. PVC plastic pipe 15" diameter and smaller shall conform to ASTM D3034. PVC SDR-35 (Depth 15' or less) and SDR-26 (Depth greater than 15')

2. PVC Plastic Pipe larger than 15" shall meet the requirements of either ASTM F679, ASTM F949 or ASTM F794. The minimum pipe stiffness shall be 46 psi for pipes 15 feet deep or less and 115 psi for pipes greater than 15 feet deep.

3. All joints shall be push on type (slip seal) or ductile iron mechanical joint.

4. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.

5. PVC sewer shall be green in color for wastewater use.

2.02 COMPRESSION COUPLINGS

A. When joining different types of pipe together or new pipe to existing pipe, the Contractor shall use Fernco Non-Shear Type Compression Couplings, or equal, that are resistant to corrosion by soil and sewage and that will provide a permanent watertight joint.

B. The compression coupling shall meet the physical test and joint-leak requirements specified in ASTM C425. The bands for attaching pipes shall be stainless steel conforming to ASTM C425. Each coupling shall bear the manufacturer's name and an indication of its size.

2.03 CONCRETE PIPE ANCHORS

A. Where indicated on the Drawings, required by the specifications or as directed by the Town, concrete pipe anchors shall be installed. Concrete shall be 3,000 psi, and reinforcing bars shall be as indicated on the anchor detail.

PART 3 - EXECUTION

3.01 EXCAVATION FOR PIPELINE TRENCHES

A. Unless otherwise directed by the Town, trenches in which pipes are to be laid shall be excavated in open cut to the depths required by field conditions or as specified by the Town. In general this shall be interpreted to mean that machine excavation in earth shall not extend below an elevation permitting the pipe to be properly bedded. Installation shall be in accordance with ASTM-D-2321 except as modified herein.

B. Excavation may be undercut to a depth below the required invert elevation that will permit laying the pipe in a bed of granular material to provide continuous support for the bottom quadrant of the pipe. When this method is used, the bedding shall be as set out in Paragraph 3.02 hereinafter.

C. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe, but unless specifically authorized by the Town, trenches shall in no case be excavated or permitted to become wider then 2'-0" plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than 2'-0" at the level of or below the top of the pipe, special precaution may be necessary, such as providing compacted, granular fill up to top of the pipe or providing pipe with additional crushing strength as determined by the Town after taking into account the actual trench loads that may result and the strength of the pipe being used. The Contractor shall bear the cost of such special precautions as are necessary.

D. All excavated materials shall be placed a minimum of two feet (2') back from the edge of the trench.

E. Before laying the pipe, the trench shall be opened far enough ahead to reveal obstructions that may necessitate changing the line or grade of the pipeline.

F. The trench shall be straight and uniform so as to permit laying pipe to lines and grades

given by the Town. It shall be kept free of water during the laying of the pipe and until the pipeline has been backfilled. Removal of trench water shall be at the Contractor's expense. Dry conditions shall be maintained in the excavations until the backfill has been placed. During the excavation, the grade shall be maintained so that it will freely drain and prevent surface water from entering the excavation at all times. When directed by Town, temporary drainage ditches shall be installed to intercept or direct surface water which may affect work. All water shall be pumped or drained from the excavation and disposed of in a suitable manner without damage to adjacent property or to other work.

G. Minimum cover of 36" shall be provided for all gravity sewer pipelines.

3.02 PIPE BEDDING

A. All sewer pipe shall be supported in Class I Bedding (#8 crushed stone) accordance with the ASTM D 2321. In no case shall pipe be supported directly on rock. Bedding shall be provided in earth bottom trenches, as well as rock bottom trenches. Bedding material shall be free from large rock, foreign material, frozen earth, and shall be acceptable to the Town. Bedding shall be a minimum of 4" below pipe barrel.

B. In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe so that none of the load will be carried on the bells.

C. The bedding shall be placed up to at least the spring line (horizontal centerline) of the pipe. The bedding material and procedures shall conform to ASTM D 2321-89 and any Technical Specifications set out hereinafter.

D. Where undercutting and granular bedding is involved it shall be of such depth that the bottom of the bells of the pipe will be at least three inches above the bottom of the trench as excavated. Undercutting is not a separate pay item. See Soils Report in Appendix A.

E. In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. When ordered by the Town, yielding and mucky materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe. Crushed stone or other such granular material, if necessary, as determined by the Town to replace poor subgrade material. Removal of poor material and additional material for pipe bedding is not a separate pay item.

F. Installation shall be in accordance with ASTM D 2321 except as modified hereinafter.

3.03 LAYING PIPE

A. The laying of pipe in finished trenches shall be commenced at the lowest point so the spigot ends point in the direction of flow.

B. All pipes shall be laid with ends abutting and true to line and grade as given by the Town. Supporting of pipes shall be as set out hereinbefore under "Pipe Bedding" and in no case shall the supporting of pipes on blocks be permitted.

C. Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure its being clean. Each piece of pipe shall be lowered separately unless special permission is given otherwise by the Town. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, they shall be removed and replaced with a satisfactory pipe or fitting without additional charge. In case a length of pipe is cut to fit in a line it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

D. Pipe shall not be laid on solid rock. A pad of granular material as specified in Paragraph 3.02 "Pipe Bedding", shall be used as a pipe bedding. Pipe bedding is not a separate pay item. Irregularities in subgrade in an earth trench shall be corrected by use of granular material.

E. When ordered by the Town, unsuitable materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.

F. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood or fabricated plug fitted into the pipe bell, so as to exclude earth or other material, and precautions taken to prevent flotation of pipe by runoff into trench.

G. No backfilling (except for securing pipe in place) over pipe will be allowed until the Town has had an opportunity to make an inspection of the joints, alignment and grade, in the section laid.

3.04 BACKFILLING PIPELINE TRENCHES

A. Backfilling of pipeline trenches shall be accomplished with the requirements set forth in "Earthwork" Section 02300 as shown on the Drawings and with details set forth hereinafter.

B. Backfilling in Open Terrain:

Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

1. The primary backfill shall be as specified in Paragraph 3.02 "Pipe Bedding". This material shall be placed in a manner approved by the Town, and shall be carefully compacted to avoid displacement of the pipe. Compaction shall be accomplished by hand-tamping or by approved mechanical methods.

2. The secondary backfill (upper portion of the trench above the primary backfill) shall be backfilled with material that is free from large rock (common fill). Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. Backfilling this portion of the trench may be accomplished by any means approved by the Town. The trench backfill shall be heaped over or leveled as directed by the Town.

C. Backfilling Under Paved Areas:

Backfilling of pipeline trenches under paved driveways shall be accomplished in the following manner:

1. The primary backfill shall be as specified in Paragraph 3.02 "Pipe Bedding". This material shall be placed in a manner approved by the Town, and shall be carefully compacted to avoid displacement of the pipe. Compaction shall be accomplished by hand-tamping or by approved mechanical methods.

2. The secondary backfill (upper portion of the trench above the primary backfill) to the elevation of the pavement subbase, shall be backfilled with clean granular material per requirements of Indiana Department of Transportation for structural fill. Material shall be compacted as set forth in Section 02300 "Earthwork" Paragraph 3.06 "Compaction" or as directed by the Town.

3. The upper portion of the trench from the top of the secondary backfill, shall be backfilled with a base course of dense graded aggregate. At such time that pavement replacement is accomplished, the excess base course shall be removed as required.

F. Before final acceptance, the Contractor will be required to level off all trenches or to bring the trench up to grade. The Contractor shall also remove from roadways, rights-of-ways and/or private property all excess earth or other materials resulting from construction.

G. In the event that pavement is not placed immediately following trench backfilling in streets and highways, the Contractor shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

3.05 CONCRETE CRADLE, ANCHORS OR ENCASEMENT

A. Concrete cradle, anchors or encasement shall be placed where shown on the Drawings, required by the specifications, or as directed by the Town.

B. Concrete shall be 3,000 psi and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints. Concrete placed outside the specified limits or without authorization from the Town will not be subject to payment.

3.06 BITUMINOUS CONCRETE HIGHWAY, STREET AND DRIVEWAY REPLACEMENT

A. The Contractor shall replace those sections of existing roads, streets and driveways required to be removed to install the pipe lines under this contract. He shall construct same to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to the operations.

B. Prior to trenching, the pavement shall be scored or cut to straight edges at least twelve (12) inches outside each edge of the proposed trench to avoid unnecessary damage to the remainder of the paving. Edges of the existing pavement shall be re-cut and trimmed to square, straight edges after the pipeline has been installed and prior to placing the new base and pavement.

C. Backfilling of the trench shall be in accordance with backfilling in paved areas requirements as applicable and described hereinbefore. Base course for the paving shall

be a compacted aggregate base course of crushed stone to the depths indicated on the Drawing Details.

D. A subslab of reinforced concrete shall be placed for Bituminous Highways with concrete subslabs as indicated on the Drawings. The subslab shall have a minimum thickness of 6 inches. Concrete for the subslab shall be 4,000 psi, in accordance with the Details shown on the Drawings. For concrete driveways the concrete thickness shall be equal to the depth of existing pavement and in no case less than 6 inches.

E. The Bituminous wearing surface of roads, streets, and driveways shall be plant mix bituminous concrete, furnished and placed in accordance with the current requirements of the Indiana D.O.T. Standard Specifications equal to a depth of existing paving and in no case less than one and one half (1-1/2) inches.

3.07 UNPAVED DRIVEWAY (CRUSHED STONE) SURFACE REPLACEMENT

A. The Contractor shall replace those sections of existing driveways and parking areas required to be removed to install the pipe lines under this contract. He shall construct same to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to the operations.

B. Material for backfilling of the pipeline trench shall be dense-graded aggregate, matching the materials of the existing driveway, in accordance with backfilling in paved areas requirements as described hereinbefore.

3.08 PORTLAND CEMENT CONCRETE HIGHWAY, STREET AND DRIVEWAY REPLACEMENT

Wherever Portland cement concrete streets, highways and driveways are removed, they shall be reconstructed to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than existed prior to the operation.

The existing concrete paving shall be saw cut to straight edges 6" outside the edges of the trench or broken out to an existing joint, as directed by the Resident Project Representative. The maximum width of the trench at pavement level shall be as shown on the Detail Drawings, unless otherwise specified by the Resident Project Representative. The concrete pavement shall be equal to the existing pavement thickness but not less than 8" in thickness for streets and highways and 4" for driveways. Base course for the pavement shall be dense graded crushed limestone furnished and placed to a depth of 3" in both roads and streets and driveways.

Pavement replacement shall be accomplished with 4,000 psi concrete in accordance with the details shown on the Drawings.

3.09 REMOVING AND REPLACING CONCRETE CURB AND GUTTER OR SIDEWALK

A. The Contractor shall remove the curb and gutter or sidewalk when encountered when required for laying the pipe. Only that portion of the curb and gutter or sidewalk needed to lay the pipe shall be removed. Saw cuts shall be made in the existing concrete to facilitate the clean removal of concrete materials.

B. Where concrete curb and gutter or sidewalk is removed or disturbed during the construction work, it shall be replaced, using 3000 psi concrete, in fully as good or better condition than that which existed prior to the Contractor's operation.

3.10 REPLACEMENT OF EXISTING MAIL BOXES, CULVERTS, CLOTHES LINE POSTS, FENCES, DRAIN TILE AND OTHER SUCH FACILITIES

A. Existing mail boxes, drainage culverts, drainage tile, clothes line posts, fences and the like shall not be damaged or disturbed unless necessary, in which case they shall be replaced in as good condition as found as quickly as possible. Existing materials shall be reused in replacing such facilities when materials have not been damaged by the Contractor's operations. Existing facilities damaged by Contractor's operation shall be replaced with new materials of the same type at the Contractor's expense. Work in this category is not a pay item.

B. All existing farm field or roadway drain tiles shall be maintained in service wherever work under this Contract interferes with such facilities. Any such drains that have been disturbed shall be replaced as detailed on Drawing Details. Replacement shall occur immediately upon disruption of the drain tile and prior to trench backfilling.

C. Replacement of paved drainage ditches within highway right-of-way shall be accomplished in accordance with Indiana Department of Transportation specifications.

3.11 TESTING

On all projects involving installation of sanitary gravity sewer lines, the finished work shall comply with the provisions listed below or similar requirements which will insure equal or better results:

A. High Pressure Jet Clean: After the collecting and/or outfall lines or system have been brought to completion, and prior to final inspection, the Contractor shall high pressure jet clean the entire system by cleaning each individual line in the system, from manhole to manhole, using appropriate tools for the removal from the lines of any and all dirt, debris and trash.

B. Visually Inspect Lines: During the final inspection, the Town may require the Contractor to inspect each individual line, from manhole to manhole, either by use of lights or other means at his disposal to determine whether the completed lines are true to line and grade as laid out or as shown on the plans.

C. Television Inspection: Television inspection is required for all new sanitary sewers.

1. Televised inspections shall be performed at the time of air and mandrel testing.

2. Televised inspection shall be performed by Contractor at the Contractor's expense.

3. A Town of Whitestown representative shall witness the televised inspection process.

4. Televised inspection shall be recorded on a DVD and shall document the location

of the camera as it moves through the pipe based on feet from an identified manhole. All joints and lateral connections shall be identified. A software program similar to "WINCAM" shall be used to identify, document and record laterals and all identified concerns in the pipeline. The video recording, still pictures and sewer segment logs shall be provided to the Town of Whitestown on a DVD. A printed copy sewer segment logs and photos of identified problems shall also be provided to the Town of Whitestown.

D. Deflection tests shall be performed on a flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system. No pipe shall exceed a deflection of 5 percent. If deflection exceeds 5 percent, pipe shall be replaced or corrected. The rigid ball cylinder or mandrel used for the deflection test shall have a diameter not less than 95 percent of the base inside diameter or average inside diameter of the pipe depending on which is specified in the ASTM Specification, including the appendix, to which the pipe is manufactured. The pipe shall be measured in compliance with ASTM D2122 Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings. The test shall be performed without mechanical pull devices.

E. Replace Defective Lines: All lines or sections of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced at the Contractor's expense.

F. I & I Limits: The Contractor shall lay sewer lines, including house connections so that the access of ground water or loss of water from the sewer system or other gravity flow piping which does not normally flow full will be limited to 10 gallons per inch diameter per mile per day. This limitation is inclusive of manholes, sewers, house connections, and appurtenances. This requirement may be applied to a portion of the contract work, such as the sewers in a separate drainage area or to a single section of the line between two manholes.

G. Low Pressure Air Test: To test for leaks, the Town will require that all completed piping as specified herein after back filling be tested by low-pressure air test, exfiltration, or infiltration test. Should the low pressure air test results be inconclusive, or at the request of the Town, an exfiltration or infiltration test will be required on the low pressure air tested segments. Labor, equipment and supplies required for all tests shall be furnished by the Contractor.

Low pressure air test shall conform to ASTM F1417-92 "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air". The low pressure air test shall consist of meeting a required holding time during a measured pressure drop. The initial test pressure shall be 4.0 psi greater than the average back pressure of any groundwater over the pipe. The pressure shall be maintained until the temperature of the pipe and the air have equalized, no less than two minutes. After the temperature is stabilized, the air supply shall be disconnected and the pressure allowed to drop with the allowable pressure loss being 1.0 psi (from 3.5 psi to 2.5 psi) during the calculated holding time. Holding time shall be as indicated in the following table:

Minimum Specified Time Required for a 1.0 psig Pressure Drop and Multiplier for Calculating Time By Length of Pipe (L)

1 Pipe Diameter (inches)	2 Minimum Time (min : sec)	3 Maximum Length for Minimum Time (feet)	4 Time for Longer Length (sec)
4	3:46	597	0.380 L
6	5:40	398	0.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470 L
24	22:40	99	13.674 L
27	25:30	88	17.306 L
30	28:20	80	21.366 L
33	31:10	72	25.852 L
36	34:00	66	30.768 L

Notes: (1) Column 1 is the diameter of pipe to be tested.
(2) Column 2 is the minimum time permitted for any length of pipe up to and including the length listed in Column 3.
(3) If the length of pipe to be tested is greater than the length listed in Column 3, multiply the length of the pipe to be tested (L) by the number listed in Column 4.

H. Exfiltration Test: In order to test for infiltration the Town may also require exfiltration tests on each section of pipe between manholes after it has been laid but prior to back filling of joints. Exfiltration tests shall be conducted by plugging the lower end of the section of sewer to be tested and filling the sewer with water to a point approximately five feet above the invert at the lower end and at least one foot above the pipe at the upper end, observing for leakage at all joints and measuring the amount of leakage for a given interval of time. Exfiltration shall not exceed 110 percent times the infiltration limits set out hereinbefore. All observed leaks shall be corrected even though exfiltration is within the allowable limits.

I. Infiltration Test: To test for infiltration, the Town may also require that the Contractor plug the open ends of all lines at the manhole so that measurements may be made at each section of the sewer line. Infiltration tests shall consist of weir measurement to determine quantities of any infiltration. Measurements shall be taken at line locations directed by the Town. This infiltration test will not be made until the sewer line is completed, and the Contractor will be required to correct all conditions that are conductive to excessive infiltration and may be required to relay such sections of the line that may not be corrected even though infiltration is within allowable limits.

J. Smoke testing may be used only to locate leaks and in no case shall be considered conclusive. In all cases the smoke test shall be accompanied by an air test, exfiltration test or infiltration test. Smoke testing may only be performed where ground water is low and smoke is blown into a conduit that is properly sealed. All such leaks or breaks discovered by the smoke tests shall be repaired and/or corrected by the Contractor at his own expense. Equipment and supplies required from smoke tests shall be furnished by the Contractor. The Contractor may also be required to smoke test the first section (manhole-to-manhole) of each size of pipe and type of joint on each construction contract prior to backfilling to establish and check laying and jointing procedures. Other supplementary smoke tests prior to backfilling may be performed by the Contractor at his

option; however, any such tests shall not supplant the final tests of the completed work unless such final tests are waived by the Town.

3.12 CLEAN UP

A. Upon completion of installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the Work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line. Grass areas shall be restored per Section 02920.

END OF SECTION

SECTION 02531 - SEWAGE FORCEMAINS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for furnishing and installing all sewage forcemains and appurtenances specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 02300

B. Boring and Jacking: Section 02400

C. Horizontal Directional Drilling: Section 02508

D. Identification/Location Guide: Section 02558

1.03 SUBMITTALS

A. Submit manufacturer's data and shop drawings for all materials and as specified herein.

B. A notarized certification shall be furnished for all pipe and fittings that verifies compliance with all applicable specifications.

1.04 EXISTING CONDITIONS

A. All new piping which ties into existing lines must be made compatible with that piping. So that piping conflicts may be avoided, Contractor shall open up his trench well ahead of the pipe laying operation to confirm exact locations of existing piping before installing any new piping. Contractor shall provide all fittings and adapters necessary to complete all connections to existing piping.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORINE (PVC) PLASTIC PIPE

A. AWWA C-900 and C-905:

1. 4-inch through 12-inch - PVC plastic pipe shall conform to ANSI/AWWA C-900, Class 200 (DR 14). PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform with the requirements of ASTM F-477.

The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.

2. 14-inch through 36-inch - PVC plastic pipe shall conform to ANSI/AWWA C-905, Class 235 (DR 18). PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform with the requirements of ASTM F-477. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.

B. PVC forcemain shall be green in color for wastewater use.

C. Joints for PVC mains shall be integral bell and spigot type joints with rubber-o-ring gasket. The cleaning and assembling of the pipe joints shall be in accordance with manufacturer's recommendations.

D. Fittings shall be Ductile Iron Mechanical Joint in accordance with AWWA C153 with joints meeting the requirements of AWWA C111.

2.02 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall conform to the current requirements of AWWA C151, Pressure Class 350, with push-on joints unless otherwise noted on drawings.

B. The interior of the pipe shall be cement-mortar lined with bituminous seal coat in accordance with the current requirements of AWWA C104. Thickness of the lining shall be set forth in Section 4.10.1 of the aforementioned specification unless otherwise directed by the Town. The exterior of all pipe, unless otherwise specified, shall receive either coal tar or asphalt base coating a minimum of 1 mil thick.

C. Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or the word "DUCTILE". Pipe manufacturer shall furnish notarized certificate of compliance to the above AWWA or ANSI specifications. Fittings shall be ductile iron and rated for a minimum of 350 psi in accordance with the current requirements of AWWA C110 (ANSI A21.10) shown therein. Fittings shall have mechanical joints meeting the current requirements of AWWA C111 (ANSI A21.11). Fittings shall have interior cement-mortar lining as specified for the pipe. Compact ductile iron fittings meeting the current requirements of AWWA C153 will also be acceptable. Provide notarized certificate of compliance to the AWWA specifications.

D. Provide AWWA C110 mechanical joint plugs and locked or restrained pipe joints where indicated on Drawings. Fittings under structures shall be mechanical joint with retainer glands. Retainer glands shall be of the "wedge action" design, where tightening the screws causes the wedge to lock onto the pipe. Retainer glands shall be Uni-Flange Series 1400 or equal.

E. The cleaning and assembly of pipe and fitting joints shall be in accordance with the manufacturer's recommendations.

2.03 RESTRAINED JOINTS

Mechanically restrained joints for force mains shall be as follows:

1. Ductile Iron Pipe: Restraining devices for ductile iron pipe restraint and connecting PVC pipe to mechanical joint valves shall be accomplished by mechanical joint retainer glands cast of ductile iron, Grade 60-42-10, and equipped with special alloy steel cupped and set screws. Restraining devices shall be MEGALUG Series 1100 or 1100SD (as applicable) as manufactured by EBAA Iron Sales, Inc., Eastland, Texas, or approved equal. Restrained joints shall have a rated working pressure of 350 psi (16" and smaller).

2. PVC Pipe: Restraining devices for PVC pipe restraint to ductile iron fittings shall be Series 2000PV, 2000SV, or 2800 as applicable as manufactured by EBAA Iron Sales, Inc., Eastland, Texas, or approved equal. Restraining devices for PVC pipe restraint across pipe joints shall be Series 1600, 2800, or 6500 as applicable as manufactured by EBAA Iron Sales, Inc., Eastland, Texas, or approved equal

PART 3 - EXECUTION

3.01 EXCAVATION FOR PIPELINE TRENCHES

A. Unless otherwise noted on the approved plans, trenches in which pipes are to be laid shall be excavated in open cut to the depths required by field conditions or as specified. In general this shall be interpreted to mean that machine excavation in earth shall not extend below an elevation permitting the pipe to be properly bedded. Installation shall be in accordance with ASTM-D-2774 or AWWA C-150 except as modified herein.

B. If the foundation is good firm earth and the machine excavation has been accomplished as set out hereinbefore, place bedding as required. Where bell and spigot is involved, bell holes shall be excavated during this latter operation to prevent the bells from being supported on undisturbed earth. If for any reason the machine excavation in earth is carried below an excavation that will permit the type of bedding specified above, then a layer of granular material shall be placed so that the lower quadrant of the pipe will be securely bedded in compact granular fill.

C. Excavation may be undercut to a depth below the required invert elevation that will permit laying the pipe in a bed of granular material to provide continuous support for the bottom quadrant of the pipe. When this method is used, the bedding shall be as set out in Paragraph 3.02 hereinafter.

D. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe, but unless specifically authorized by the Town, trenches shall in no case be excavated or permitted to become wider then 2'-0" plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than 2'-0" at the level of or below the top of the pipe, special precaution may be necessary, such as providing compacted, granular fill up to top of the pipe or providing pipe with additional crushing strength as determined by the Town after taking into account the actual trench loads that may result and the strength of the pipe being used. The Contractor shall bear the cost of such special precautions as are necessary.

E. All excavated materials shall be placed a minimum of two feet (2') back from the edge of the trench.

F. Before laying the pipe, the trench shall be opened far enough ahead to reveal obstructions that may necessitate changing the line or grade of the pipeline.

G. The trench shall be straight and uniform so as to permit laying pipe to lines and grades given by the Town. It shall be kept free of water during the laying of the pipe and until the pipeline has been backfilled. Removal of trench water shall be at the Contractor's expense. Dry conditions shall be maintained in the excavations until the backfill has been placed. During the excavation, the grade shall be maintained so that it will freely drain and prevent surface water from entering the excavation at all times. When directed by Owner, temporary drainage ditches shall be installed to intercept or direct surface water which may affect work. All water shall be pumped or drained from the excavation and disposed of in a suitable manner without damage to adjacent property or to other work.

H. Minimum cover of 54" shall be provided for all pressure pipelines.

3.02 PIPE BEDDING

A. All forcemain pipe shall be supported in accordance with the ASTM D 2774 or AWW C-150. In no case shall pipe be supported directly on rock. Bedding of clean sand (Type II Bedding) shall be provided in earth bottom trenches, as well as rock bottom trenches. Bedding material shall be free from large rock, foreign material, frozen earth, and shall be acceptable to the Town. Bedding shall be a minimum of 4" below pipe barrel.

B. In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe so that none of the load will be carried on the bells.

C. Where undercutting and granular bedding is involved it shall be of such depth that the bottom of the bells of the pipe will be at least three inches above the bottom of the trench as excavated. Undercutting is not a separate pay item.

D. In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. When ordered by the Town, yielding and mucky materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe. Crushed stone or other such granular material, if necessary, as determined by the Town to replace poor subgrade material, shall be a separate pay item and classified as "Special Pipe Bedding". Removal of poor material is not a separate pay item.

E. Installation shall be in accordance with ASTM D 2774 or AWWA C-150 except as modified hereinafter.

3.03 LAYING PIPE

A. The laying of pipe in finished trenches shall be commenced at the lowest point so the spigot ends point in the direction of flow.

B. All pipes shall be laid with ends abutting and true to line and grade as given by the Town. Supporting of pipes shall be as set out hereinbefore under "Pipe Bedding" and in no case shall the supporting of pipes on blocks be permitted.

C. Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure its being clean. Each piece of pipe shall be lowered separately unless special permission is given otherwise by the Town. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, they shall be removed and replaced with a satisfactory pipe or fitting without additional charge. In case a length of pipe is cut to fit in a line it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

D. Pipe shall not be laid on solid rock. A pad of granular material as specified in Paragraph 3.02 "Pipe Bedding", shall be used as a pipe bedding. Pipe bedding is not a separate pay item. Irregularities in subgrade in an earth trench shall be corrected by use of granular material.

E. When ordered by the Town, unsuitable materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.

F. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood or fabricated plug fitted into the pipe bell, so as to exclude earth or other material, and precautions taken to prevent flotation of pipe by runoff into trench.

G. No backfilling (except for securing pipe in place) over pipe will be allowed until the Town has had an opportunity to make an inspection of the joints, alignment and grade, in the section laid.

3.04 BACKFILLING PIPELINE TRENCHES

A. Backfilling of pipeline trenches shall be accomplished with the requirements set forth in "Earthwork" Section 02300 as shown on the Drawings and with details set forth hereinafter.

B. Backfilling in Open Terrain:

Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

1. The primary backfill shall be as specified in Paragraph 3.02 "Pipe Bedding". This material shall be placed in a manner approved by the Town, and shall be carefully compacted to avoid displacement of the pipe. Compaction shall be accomplished by hand-tamping or by approved mechanical methods.

2. The secondary backfill (upper portion of the trench above the primary backfill) shall be backfilled with material that is free from large rock (common fill). Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. Backfilling this portion of the trench may be accomplished by any means approved by the Town. The

trench backfill shall be heaped over or leveled as directed by the Town.

C. Backfilling Under Paved Areas:

Backfilling of pipeline trenches under paved areas shall be accomplished in the following manner:

1. The primary backfill shall be as specified in Paragraph 3.02 "Pipe Bedding". This material shall be placed in a manner approved by the Town, and shall be carefully compacted to avoid displacement of the pipe. Compaction shall be accomplished by hand-tamping or by approved mechanical methods.

2. The secondary backfill (upper portion of the trench above the primary backfill) to the elevation of the pavement subgrade, shall be backfilled with clean granular material per requirements of Indiana Department of Transportation for structural fill. Material shall be compacted as set forth in Section 02300 "Earthwork" Paragraph 3.06 "Compaction" or as directed by the Town.

3. The upper portion of the trench from the top of the secondary backfill, shall be backfilled with a base course of dense graded aggregate. At such time that pavement replacement is accomplished, the excess base course shall be removed as required.

F. Before final acceptance, the Contractor will be required to level off all trenches or to bring the trench up to grade. The Contractor shall also remove from roadways, rights-of-ways and/or private property all excess earth or other materials resulting from construction.

G. In the event that pavement is not placed immediately following trench backfilling in streets and highways, the Contractor shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

3.05 SETTLEMENT OF TRENCHES

A. Whenever lines are in, or cross, driveways and streets, the Contractor shall be responsible for any trench settlement which occurs within these rights-of-way within one year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the Contractor at no extra cost to the Owner. Repair of settlement damage shall meet the approval of the Owner and/or the County.

3.06 CONCRETE CRADLE, ANCHORS OR ENCASEMENT

A. Concrete, cradle, anchors or encasement shall be placed where shown on the Drawings, required by the specifications, or as directed by the Town.

B. For cradle and encasement, concrete shall be 3,000 psi and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed.

C. When tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints. Concrete placed outside the specified limits or without authorization from the Town will not be subject to payment.

3.07 BITUMINOUS CONCRETE HIGHWAY, STREET AND DRIVEWAY REPLACEMENT

A. The Contractor shall replace those sections of existing roads, streets and driveways required to be removed to install the pipe lines under this contract. He shall construct same to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to the operations.

B. Prior to trenching, the pavement shall be scored or cut to straight edges at least twelve (12) inches outside each edge of the proposed trench to avoid unnecessary damage to the remainder of the paving. Edges of the existing pavement shall be re-cut and trimmed to square, straight edges after the pipeline has been installed and prior to placing the new base and pavement.

C. Backfilling of the trench shall be in accordance with backfilling in paved areas requirements as applicable and described hereinbefore. Base course for the paving shall be a compacted aggregate base course of crushed stone to the depths indicated on the Drawing Details.

D. A subslab of reinforced concrete shall be placed for Bituminous Highways with concrete subslabs as indicated on the Drawings. The subslab shall have a minimum thickness of 6 inches. Concrete for the subslab shall be 4,000 psi, in accordance with the Details shown on the Drawings. For concrete driveways the concrete thickness shall be equal to the depth of existing pavement and in no case less than 6 inches.

E. The Bituminous wearing surface of roads, streets, and driveways shall be plant mix bituminous concrete, furnished and placed in accordance with the current requirements of the Indiana D.O.T. Standard Specifications equal to a depth of existing paving and in no case less than one and one half (1-1/2) inches.

3.08 PORTLAND CEMENT CONCRETE DRIVEWAY REPLACEMENT

Wherever Portland cement concrete streets, highways and driveways are removed, they shall be reconstructed to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than existed prior to the operation.

The existing concrete paving shall be saw cut to straight edges 6" outside the edges of the trench or broken out to an existing joint, as directed by the Resident Project Representative. The maximum width of the trench at pavement level shall be as shown on the Detail Drawings, unless otherwise specified by the Resident Project Representative. The concrete pavement shall be equal to the existing pavement thickness but not less than 8" in thickness for streets and highways and 4" for driveways. Base course for the pavement shall be dense graded crushed limestone furnished and placed to a depth of 3" in both roads and streets and driveways.

Pavement replacement shall be accomplished with 4,000 psi concrete in accordance with the details shown on the Drawings.

3.09 UNPAVED DRIVEWAY (STONE) SURFACE REPLACEMENT

A. The Contractor shall replace those sections of existing driveways and parking areas required to be removed to install the pipe lines under this contract. He shall construct same to the

original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to the operations.

B. Material for backfilling of the pipeline trench shall be dense-graded aggregate, matching the materials of the existing driveway, in accordance with backfilling in paved areas requirements as described hereinbefore.

3.10 REPLACEMENT OF EXISTING MAIL BOXES, CULVERTS, CLOTHES LINE POSTS, FENCES AND OTHER SUCH FACILITIES

A. Existing mail boxes, drainage culverts, clothes line posts, fences and the like shall not be damaged or disturbed unless necessary, in which case, they shall be replaced in as good condition as found or better as quickly as possible. Existing materials shall be reused in replacing such facilities when materials have not been damaged by the Contractor's operations. Existing facilities damaged by Contractor's operation shall be replaced with new materials of the same type at the Contractor's expense. Work in this category is not a pay item.

B. Replacement of paved drainage ditches within highway right-of-way shall be accomplished in accordance with INDOT Standard Specifications.

3.11 RIP-RAP STREAM BANK SLOPE PROTECTION

A. The Contractor shall install rip-rap stream bank slope protection at locations directed by the Town. Rip-rap slope protection shall be 12-inches thick and shall meet Indiana Department of Transportation Standard Specifications.

3.12 TESTING OF PVC OR DUCTILE IRON PIPE

A. Hydrostatic pressure testing of force mains is the only method of force main testing approved by the Owner. All pressure piping (lines not laid to grade) shall be given a hydrostatic test in accordance with the applicable AWWA standard based on force main material and in accordance with ASTM E103 "Standard Method for Hydrostatic Leak Testing". The hydrostatic pressure test shall proceed as follows:

1. The force main shall be completely backfilled prior to testing.

2. The influent line and effluent discharge shall be appropriately plugged/bulkheaded. The plugs/bulkheads shall be equipped with a minimum of two (2) openings for filling/draining the pipeline and for bleeding air from the line. Thrust blocking restraints are required at each bulkhead and shall be furnished in accordance with the bulkhead manufacturer's requirements.

3. The test line shall be filled with water at a slow rate to prevent air entrapment. Trapped air shall be expelled through high point bleed off valves as the line is being filled.

4. The test line shall be pressurized to 1.5 times the pump shutoff head as determined by the pump manufacturer's performance curve or to 100 psi, whichever is greater.

5. Water shall be added to the test segment to maintain the test pressure for a period of no less than 2 hours and no more than 8 hours. The Town must be present for at least the first 2 hours of testing.

6. The maximum allowable leakage shall be determined by the following formula:

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

where, L = allowable leakage, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during leakage test, in psig

The formula is based upon an allowable leakage of 11.65 gallons per day per mile per inch diameter at a pressure of 150 psi.

7. If the force main or any portion thereof fails the hydrostatic pressure test, the Contractor shall remove and replace or otherwise repair the force main to the satisfaction of the Town and the force main shall be re-tested.

B. Contractor shall be responsible for providing all of the equipment and tools necessary to conduct the hydrostatic test, including, but not limited to:

1. Hydrostatic test pump (jockey pump).

2. 4½" diameter calibrated pressure test gauge of range 0-150 psi graduated in 1 psi increments. The manufacturer's calibration papers and test date information shall be made available at the request of the Town.

3. All pipe plugs, bulkheads, and/or caps required to perform the hydrostatic test.

4. Calibrated/graduated container to measure quantity of water required to be added during the hydrostatic pressure test to maintain specified test pressure.

C. All pipe, fittings, valves, and other materials found to be defective under test shall be removed and replaced at no additional expense to the Owner.

D. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.

E. Where nonmetallic joint compounds are used, pipelines should be held under normal operating pressure for at least three days before testing.

F. The Owner will provide initial water for testing the pressure piping. Should the first test fail to pass, all additional water required for subsequent tests shall be furnished at the Contractor's expense.

G. The cost of testing of pressure piping is incidental and is to be included in the Contractor's unit Contract Price.

3.13 CLEAN UP

A. Upon completion of installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the Work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line. Grass areas shall be restored per Section 02920

END OF SECTION

SECTION 02532 - SANITARY SEWER MANHOLES, FRAMES, AND COVERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for furnishing and installing all manholes and appurtenances specified herein and shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 02300

B. Gravity Sewer Piping: Section 02530

C. Sewage Force Mains: Section 02531

D. HMA Paving: Section 02700

1.03 SUBMITTALS

A. Submit manufacturer's data and shop drawings for the materials specified herein.

PART 2 - PRODUCTS

2.01 MANHOLES

A. Manholes of the form and dimensions shown on the Drawings shall be constructed of ASTM C 478 precast reinforced concrete manhole sections erected on 3,000 psi concrete foundation.

B. The excavation shall be kept free of water while the manhole is being constructed and the manhole shall not be backfilled until inspected by the Town.

C. Standard Manholes:

1. The standard manhole shall be a minimum of 4' -0" in diameter and shall be cone type- top construction as shown on the Drawings.

D. Shallow Manholes:

The shallow manholes shall be six (6) feet or less in depth, measured from the top of the cover frame to the invert of the outlet and shall be of flat top construction as shown on the Drawings.

E. Concrete Manhole Sections:

Precast concrete manhole sections (risers and grade rings) shall conform to ASTM C 478.

F. Precast Manhole Section Joints:

Precast manhole section joints shall be jointed with ASTM C 443 rubber gaskets and one of the following products:

AASHTO M-198-75 preformed flexible butyl type joint sealant
Hamilton-Kent "Kent-Seal No. 2"
K.T. Snyder Co. "Rub'r-Nek"
Press Seal Gasket "E-Z stik"
Concrete Sealants, Inc. "Conseal"

or equal, or joined with bituminous mastic joint sealing compound. When making joints with mastic compound prime and seal all joints with primer supplied with the joint compound. Manhole section joints shall be watertight. These requirements apply to all joints, including manhole risers, cones, and grade rings.

G. Manhole Frames and Covers:

Manhole castings shall consist of cast iron frames with a minimum clear opening of twenty-two (22) inches. Casting shall have a minimum of four (4) bolt holes for the purpose of anchoring the casting to the manhole cone or grade ring.

Manhole covers must set neatly in the rings, with contact edges machined for even bearing and tops flush with ring edge. They shall have sufficient corrugations to prevent slipperiness and be marked in large letters, "SANITARY SEWER". The covers shall have two concealed pick holes and a rubber self seal gasket. Covers on sanitary sewer manholes shall not be perforated.

The frame and cover shall be Neenah R-1772 AVH Type B as manufactured by Neenah Foundry Company, Neenah, WI; 1022-1AGSMD Type B as manufactured by East Jordan Iron Works, East Jordan, MI, or equal.

All manhole frames and covers shall be heavy duty.

H. Pipe Connections Into Manholes:

Sewer pipe shall be sealed in the manhole section pipe openings with a resilient connector meeting the requirements of ASTM C923, Dura-Seal III by Dura-Tech, Dayton, Ohio; A-LOK premium connector as manufactured by A-LOK Products, Inc., Tullytown, PA; or equal.

Resilient connector shall be cast integrally into the wall of the manhole section at time of manufacture. There shall be no mortar placed around the connector on the outside of the manhole and no mortar shall be placed around the top half of the connector on the inside of the manhole when completing the invert work.

I. Manhole Inverts:

Manhole inverts shall be formed with 3,000 psi concrete. Inverts shall be constructed as shown on the Contract Drawings and shall form a smooth finish. The inverts shall be

constructed on site after both inlet and outlet pipes are installed.

J. Manhole Steps

Plastic manhole steps shall be PS1-PF (Press Fit) polypropylene plastic as manufactured by MA Industries, Peachtree City, Georgia; 93810R (Press Fit) as manufactured by Bowco Industries, Inc.; or equal. Steps shall be driven into specially sized holes cast into the manhole section. Holes shall be formed in the manhole section using an insert plug that is removed upon curing.

Steps shall be aligned vertically above the outlet, in line with the flow through. Step spacing shall be 15".

K. Precast Concrete Manhole Base Sections:

Precast concrete manhole base sections, shall be "monolithic", consisting of base slab, and base riser section. Upon review and approval by the Town, precast base sections may include floor invert channel and apron. All precast base sections with pipe openings shall be furnished with ASTM C 923 pipe-to-manhole connector gaskets, as specified hereinbefore.

L. Drop Connections into Manholes

Where indicated on the Drawings, drop connections into manholes shall be installed. Drop connections shall be cast-in-place or precast, and shall conform to the requirements shown on the Details.

M. Precast Concrete Eccentric Cones:

Precast concrete eccentric cones shall be of the size and shape shown on the Drawings and shall conform to ASTM C 478.

N. Connection to Existing Manhole:

If a connection is required to an existing manhole the connection point shall be core drilled and sealed with a flexible rubber connection.

PART 3 - EXECUTION

3.01 EXCAVATION FOR MANHOLE INSTALLATION

A. Unless otherwise directed by the Town, excavation in which manholes are to be installed shall be excavated in open cut to the depths required by field conditions or as specified by the Town. In general this shall be interpreted to mean that machine excavation in earth shall not extend below an elevation permitting the manhole to be properly bedded.

B. Excavation may be undercut to a depth below the required invert elevation that will permit installing the manhole on a bed of granular material to provide continuous support for the manhole base. When this method is used, the bedding shall be as set out in Paragraph 3.02 hereinafter.

C. Excavations shall be of sufficient dimensions to provide free working space on all sides of the manhole and to permit proper backfilling around the manhole. All excavated materials shall be placed a minimum of two feet (2') back from the edge of the excavation.

D. The excavation shall be straight and uniform so as to permit installation of the manhole to lines and grades given by the Town. It shall be kept free of water during the installation of the manhole and until the manhole has been backfilled. Removal of water shall be at the Contractor's expense. Dry conditions shall be maintained in the excavations until the backfill has been placed. During the excavation, the grade shall be maintained so that it will freely drain and prevent surface water from entering the excavation at all times. When directed by the Owner or the Town, temporary drainage ditches shall be installed to intercept or direct surface water which may affect work. All water shall be pumped or drained from the excavation and disposed of in a suitable manner without damage to adjacent property or to other work.

3.02 MANHOLE BEDDING

A. All manholes shall be supported on a bed of granular material. In no case shall manhole be supported directly on rock. Bedding shall not be a separate pay item unless otherwise set out in the Detailed Specifications. Bedding shall be provided in earth bottom excavations, as well as rock bottom excavations. Bedding material shall be free from rock, foreign material, frozen earth, and be acceptable to the Town. Bedding shall be a minimum of 6-inches below manhole base.

B. Granular bedding shall be Size #8 or ASTM C 33, crushed stone, fine gravel, or sand, and is not a separate pay item.

C. Where undercutting and granular bedding is involved it shall be of such depth that the bottom of the manhole will be at least six inches above the bottom of the excavation. Undercutting is not a separate pay item.

D. In wet, yielding, mucky locations where the manhole is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe and/or manhole might take place during the placing of the backfill, the pipe and/or manhole must be weighted or secured permanently in place by such means as will prove effective. When ordered by the Town, yielding and mucky materials in subgrades shall be removed below ordinary excavation depth in order to prepare a proper bed for the manhole. Crushed stone or other such granular material, if necessary, as determined by the Town to replace poor subgrade material, shall be a separate pay item and classified as "Special Pipe Bedding". Removal of poor material is not a separate pay item.

3.03 REPLACEMENT OF EXISTING MAIL BOXES, CULVERTS, CLOTHES LINE POSTS, FENCES AND OTHER SUCH FACILITIES

A. See Section 02530 for specification on replacement of existing mail boxes, culverts, clothes line posts, fences and other such facilities.

3.04 MANHOLE FRAME INSTALLATION

A. The manhole frame casting shall be centered over the opening in the cone or grade ring of the manhole, with a bituminous mastic joint sealing compound applied between the concrete and the casting.

B. The frame shall be bolted to the cone or grade ring with wedge anchors.

C. The manhole chimney from the precast cone to the casting frame shall receive an exterior Butyl wrap ConSeal CS212 or equal.

3.05 TESTING

This specification shall govern the vacuum testing of sanitary sewer manholes and precast concrete structures and shall be used as a method of determining acceptability by the Owner, in accepting maintenance of a sanitary sewer manhole or structure on behalf of the public. Manholes must be tested in accordance with ASTM C1244-93, "Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test". Other forms of testing of some manholes may be required, as deemed necessary by the Owner.

A. Each manhole shall be tested after installation with all connections in place.

1. Lift holes, if any, shall be plugged with an approved, non-shrinkable grout prior to testing.

2. Drop connections shall be installed prior to testing.

3. The vacuum test shall include testing of the seal between the cast iron frame and the concrete cone, slab or grade rings.

4. The manholes shall be backfilled and finished to design grade.

B. Test Procedure:

1. Temporarily plug, with the plugs being braced to prevent the plugs or pipes from being drawn into the manhole, all pipes entering the manhole at least eight inches into the sewer pipe(s). The plug must be inflated at a location past the manhole/pipe gasket.

2. The test head shall be placed inside the frame at the tope of the manhole and inflated, in accordance with the manufacturer's recommendations.

3. A vacuum of 10" of mercury shall be drawn on the manhole. Shut the valve on the vacuum line to the manhole and disconnect the vacuum line.

4. The pressure gauge shall be liquid filled, having a 3.5 inch diameter face with a reading from zero to thirty inches of mercury.

5. The manhole shall be considered to pass the vacuum test if it holds at least 9 inches of mercury for the following time durations:

	Time (Minutes)		
Manhole Depth	4' Diameter	5' Diameter	6' Diameter
20 Feet or Less	1	2	3
20.1 to 30 Feet	2	3	4

6. If a manhole fails the vacuum test, the manhole shall be repaired with a non-shrinkable grout or other suitable material based on the material of which the manhole is constructed and retested, as stated above.

7. All temporary plugs and braces shall be removed after each test.

Manholes will be accepted as having passed the vacuum test requirements if they meet the criteria stated above.

3.06 CLEAN UP

A. Upon completion of installation of the manholes and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the Work. The Contractor shall grade the ground around and adjacent to the construction area in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

END OF SECTION

SECTION 02535 - SEWER FLOW CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. When completing work on an existing active sewer, maintain the depth of flow at the upstream manhole of the section being worked below the allowable maximum depth of flow by operation of pump stations, plugging or blocking of the flow, or by pumping and bypassing of the flow as specified. NO OVERFLOW OF SEWAGE SHALL BE ALLOWED.

1.02 ALLOWABLE DEPTH OF FLOW

A. Depth of flow shall not exceed that shown below for the respective pipe sizes as measured in the manhole when connecting to the existing sewer.

B. Maximum Depth of Flow:

6" - 12" Diameter Pipe	10% of pipe diameter
15" - 24" Diameter Pipe	15% of pipe diameter
over 27" Diameter Pipe	20% of pipe diameter

1.03 PLUGGING OR BLOCKING

A. A sewer line plug shall be inserted into the line upstream of the section being worked. The plug shall be so designed that all or any portion of the sewage can be released. During connection to the existing sewer, flow shall be reduced to within the limits specified above. After the work has been completed, flow shall be restored to normal.

1.04 PUMPING AND BYPASSING:

A. When pumping and bypassing is required, the Contractor shall supply the pumps, conduits, and other equipment to divert the flow of sewage around the area in which connection is being made to the existing sewer. The bypass system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during wet weather. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. If bypass pumping is utilized by the Contractor to control flows, the Contractor shall be responsible for monitoring, the bypass operation at all times, during construction and non-construction hours, until Work is complete. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum. The location of pump(s), temporary piping, discharge point, pumping rates, etc. shall be approved by the Town.

B. Contractor shall prepare a detailed Flow Control Plan that describes the measures to be used to control sewer flows. Contractor shall submit the Plan to, and obtain approval of

the Plan, from the Town prior to beginning any flow control work. Contractor's plan shall include, but not be limited to, the following:

1. Location of flow diversion structure(s), pumps and related materials and equipment.

2. Key operational control factors

3. Pump type, sizes, and flow rates.

4. Destination of bypassed flow including routing of temporary piping and provisions for vehicular and personnel traffic as necessary.

5. Wet weather event procedures.

6. Anticipated duration of bypass event(s)

C. The number and size of pumps utilized in bypass pumping shall be such that if the largest pump is out of service, bypass flows will be maintained during the bypass operation. Where the flow control mechanism is not sufficient to handle a wet weather event, the flow control/diversion or pumping system shall be capable of quick removal so as not to create an overflow or surcharge to surface waters, overflow to ground, or back-up in dwellings or buildings.

1.05 FLOW CONTROL PRECAUTIONS

A. When flow in a sewer line is plugged, blocked, or bypassed; sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved. If such damage occurs, it shall be the Contractor's responsibility to clean, disinfect, and replace, where appropriate, any and all damaged public or private property as quickly as possible.

B. Where the flow control mechanism is not sufficient to handle a wet weather event, the flow control/diversion or pumping system shall be capable of quick removal so as not to create an overflow to surface waters, overflow to ground, or back-up in buildings.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 02558 - IDENTIFICATION/LOCATION GUIDE

PART 1 - GENERAL

1.01 SCOPE OF WORK

Furnish and install underground utility identification tape and location wire over the centerline of all underground pipe and electrical lines.

PART 2 - PRODUCTS

2.01 IDENTIFICATION TAPE

A. Identification Tape for Buried Pipe

Identification tape shall be manufactured of polyethylene with a minimum thickness of 4-mils and shall have a minimum 0.35-mil thick metallic foil core. The tape shall be highly resistant to alkalis, acid and other destructive agents found in soil. Tape width shall be a minimum of 3" and a maximum of 6" and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2' for entire length of tape.

B. Tape background colors and imprints shall be as follows:

Imprint	Background Color
"Caution - Buried Electric"	Red
"Caution - Gas Line Buried Below"	Orange
"Caution - Sewer Line Buried Below"	Green
"Caution - Water Line Buried Below"	Blue

C. Identification tape shall be "Terra Tape" as manufactured by Reef Industries, Inc., Houston, TX; "Underground Tape" as manufactured by Brimar Industries, Inc., Garfield, NJ; or approved equal.

2.02 LOCATION WIRE

A. Open Cut/ Open Ditch Applications:

Use High Strength (HS) Tracer Wire

Tracer wire for open cut/open ditch shall be a #12 AWG High-Strength Copper Clad Steel conductor (HS-CCS), insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. HS-CCS conductor must be a 21% conductivity for locate ability purposes, Break load 250# minimum. HDPE insulation shall be RoHS compliant and utilize virgin grade material.

Insulation color shall meet the APWA color code standard for identification of buried utilities. Tracer wire shall be HS-CCS HDPE 30 MIL and made in the USA.

B. Directional Drilling/Boring Applications:

Use **Two** Extra High Strength (EHS) Tracer Wire

Tracer wire for directional drilling/boring shall be #12 AWG Extra-High-Strength Copper-Clad Steel conductor (EHS-CCS), insulated with a 45 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. EHS-CCS conductor must be a 21% conductivity for locate ability purposes, Break load will be 1150# minimum. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities. Tracer wire shall be EHS-CCS HDPE 45 MIL and made in the USA.

C. Anodes:

Anodes shall be used for grounding at all dead end points of the tracer wire. Anodes shall consist of a 1# x 1.315"D x 18.5"L, Magnesium Drive in Anode with HDPE cap and 10' of Red 14 AWG Copper Clad Steel Tracer Wire (Factory Installed to Anode) with 30 mil high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts, HDPE insulation shall be RoHS compliant and utilize virgin grade material. Each anode shall include one connector filled with non-hardening moisture displacement silicon which is corrosion resistant for splicing anode wire to main tracer wire and made in the USA.

D. Splices:

All splices shall be accomplished by overhand knotting the wires and soldering the ends together. The soldered joint shall then be covered with a waterproof wrap.

C. Location wire Valve Boxes:

1. Where tracer wire ends under roadway pavement, a valve box shall be installed to hold the tracing wire connections. Valve boxes shall be of 5-1/4 inch standard cast iron, two-piece, screw type valve box with drop cover marked "SEWER" or "WATER". The valve box shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be grade in any paving, walk or road surface. This provision shall be applied as directed by the Town. Valve boxes and covers shall be as manufactured by Tyler Corporation, Opelika Foundry or approved equal.

2. Wherever the tracer wire valve box falls outside of the roadway pavement (in yard areas), the top of the box shall be set in a concrete slab 18" x 18" x 6" thick (or 18" circular x 6" thick) with the top of the slab and box flush with the top of the ground. Valve boxes shall be of 5-1/4 inch standard cast iron, two-piece, screw type valve box with drop cover marked "SEWER" or "WATER". The valve box shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be grade in any paving, walk or road surface. This provision shall be applied as directed by the Town. Valve boxes and covers shall be as manufactured by Tyler Corporation, Opelika Foundry or approved equal.

2.03 DOMED MARKER POSTS

A. Marker post for Pipe:

The marker post shall be molded from specially formulated engineering grade plastics and is UV protected. The marker post shall be guaranteed for life not to fade, peel or chip. All signs shall be custom designed and conform to D.O.T. regulations.

Marker Post Features:

Post Color: White
Dome Colors: Green for sanitary sewer; Blue for potable water
Sign:
Name of Owner.
Emergency telephone number in event of pipe rupture.

Marker Size: The Dome is 22" in length with 3" nominal pipe. Wall thickness of pipe is 0.150". The standard length of a unit shall be 8 feet.

The domed post marker shall be manufactured by Handley Industries, inc.; or approved equal. See details for additional information.

PART 3 - EXECUTION

3.01 INSTALLATION OF IDENTIFICATION TAPE

A. Identification tape shall be installed over the centerline of all buried sanitary sewer, sanitary sewer forcemains, electrical lines, gas lines and water lines in accordance with the manufacturer's installation instructions and as specified herein.

B. Identifications tape shall be installed 2' below final grade over centerline of pipe.

C. Identification tape for horizontal directional drilling applications using pipe shall not be required.

3.02 INSTALLATION OF LOCATION WIRE

A. Location wire shall be installed with all buried sewer lines in accordance with the manufacturer's installation instructions and as specified herein.

B. Location wire shall be installed no greater than 6-inches in height above the centerline of the buried pipe.

C. In all plastic pipe installations, the location wire shall be looped up into the valve boxes for connections to a locating device. The wire shall be one continuous piece from end to end (or valve box to valve box).

D. Location wire for horizontal directional drilling applications shall be provided in sufficient quantity and redundancy (minimum of 2 wires) in accordance with pipe manufacturer's installation recommendations.

E. Location wire for pressure sanitary service laterals shall terminate at the grinder pump and shall be brought up at the grinder pump unit and connected under the electrical hood at top of grinder pump. Location wire for gravity sanitary service laterals shall terminate at the cleanout and shall be brought up into the cleanout below the cover. Locate wire for water service shall be brought into the meter pit.

F. In directional drilling applications, extra high strength tracer wire shall be installed as per manufacturer recommendations.

G. In all pipe installations, the location wire shall be looped up into the valve boxes for connection to a locating devise. The tape shall be one continuous piece from valve box to valve box.

3.03 INSTALLATION OF MARKER POSTS

A. Marker post shall be place at locations where the location wire ends or as directed by the Town.

B. Marker Post shall be located at Valves, Air Release Valves, Flushing Connections, Pipe Bends, and at minimum every 400 feet or as required for line of sight in undeveloped areas.

C. Marker post shall be buried three (3) feet below the surface.

D. Location wire is to be brought up through the marker post into the dome.

END OF SECTION

SECTION 02700 - HMA PAVING

PART 1 - GENERAL

1.01 SCOPE OF WORK

The HMA paving work includes the construction of an aggregate base course, HMA binder and HMA wearing courses to match existing courses and as specified herein. This work is to replace asphalt paving disturbed by the construction and any damages to paving by Contractor's operations, as well as new pavement and driveways, within the limits shown on the plans.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions and General Requirements apply to the work specified in this section.

B. Earthwork: Section 02300

1.03 SUBMITTALS

A. Submit manufacturer's data as specified herein.

B. All submittals shall include the following information as a minimum:

1. Supplier's Name
2. Job Mixture Formula
3. Material Quantities

1.04 APPLICABLE STANDARDS

All references in this section to the standard specifications shall refer to the most recent Edition of the Indiana Department of Transportation Standard Specifications with all amendments thereto.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Weather Limitations: Apply prime and tack coats only when ambient temperature is above 50 degrees F., and when temperature has not been below 35° for 12 hours immediately prior to application. Do not apply when bases are wet or contain an excess of moisture.

B. Construct HMA surface courses only when atmosphere temperature is above 40°F and when base is dry. Base course may be placed when air temperature is above 30°F and rising.

C. Grade Control: Establish and maintain required lines and elevations.

PART 2 - PRODUCTS

2.01 MATERIALS

All materials required for work in this section shall be as specified in the Standard Specifications of the Indiana Department of Transportation as follows:

A. Subgrade: Section 207.

B. Subbase: Section 304

C. HMA Surface and HMA Binder: Section 402.

D. Tack Coat: Section 405.

PART 3 - EXECUTION

3.01 INSPECTION

A. Pavement installer must examine the areas excavated and backfilled and conditions under which pavement is to be constructed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until satisfactory embankments and subgrade have been established to a uniform line, properly shaped and compacted.

3.02 SUBGRADE

A. On the unimproved areas, the ground surface shall be stripped of all vegetative cover, and the top 6" layer of soil shall be scarified and compacted in place.

B. On the improved areas, the existing gravel surface shall be leveled and prepared to receive aggregate base.

C. The preparation of the subgrade shall be in accordance with Section 207 of the Standard Specifications and compacted to 95% standard proctor density.

D. The subgrade shall be prepared to the full width of the base course plus one foot of additional width beyond each edge, except where limited by structures.

E. The subgrade shall be shaped by mechanical means until a uniform line and grade are established.

F. Subgrade for the aggregate surface access road shall be shaped to a crown with slopes 1/2" to 3/4" per foot.

3.03 AGGREGATE BASE COURSE

A. Aggregate base course shall consist of Type "O", Size No. 53 aggregate for repair of existing driveways and roads. Aggregate base course for existing driveways and roads shall have a compacted thickness as shown in the Standard Details.

B. Thickness on the access road shall be uniform over the shaped subgrade to maintain the crown.

C. Aggregate shall be machine compacted to the density established as satisfactory by the Town.

D. The mixture shall be placed, spread to a string-line, and shaped without segregation by the use of power equipment operated so as to produce the desired compacted depth to the line, grade and cross section required.

3.04 PRIME COAT

Prior to placing the HMA binder course, the granular base course shall be thoroughly cleaned and a prime coat of Refined Tar RT-2 shall be uniformly applied at the rate of 0.35 gallons per square yard by pressure distributor or other approved pressure spray method.

3.05 HMA BINDER COURSE

A. The HMA binder course shall be hot mixed, hot laid, bituminous concrete base, furnished and placed in accordance to match the existing depth or to a minimum compacted thickness as shown in the Standard Details.

B. HMA binder courses shall be constructed in accordance with Section 402 of the Standard Specifications or in accordance with the governing Highway Department Specification.

3.06 HMA SURFACE COURSE

A. The HMA surface course shall be hot mixed, hot laid, bituminous concrete in accordance to match existing depth or to a minimum compacted depth of 1-1/2 inches.

B. HMA surface course shall be constructed in accordance with Section 402 of the Standard Specifications or in accordance with the governing Highway Department Specification.

C. Standard Specifications: All HMA paving work shall comply with Section 402 of the Standard Specifications, including the removal of pavement samples to be tested by an independent laboratory for composition and density to insure quality control.

3.07 HIGHWAY, STREET AND DRIVEWAY REPLACEMENT

A. The Contractor shall replace those sections of existing roads, streets and driveways required to be removed to install the pipe lines under this contract. He shall construct same to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to the operations.

B. Prior to trenching, the pavement shall be scored or cut to straight edges at least six (6) inches outside each edge of the proposed trench to avoid unnecessary damage to the remainder of the paving. Edges of the existing pavement shall be re-cut and trimmed to square, straight edges after the pipeline has been installed and prior to placing the new base and pavement.

C. Backfilling of the trench shall be in accordance with requirements for paved areas as described hereinbefore.

D. A sub-slab of reinforced concrete shall be placed for State maintained highways. The sub-slab shall have a minimum thickness of 6 inches. Concrete for the sub-slab shall be 2500 psi, in accordance with the Details shown on the Drawings.

E. Prior to placing the HMA binder course, the granular base course shall be thoroughly cleaned and broomed and a prime coat of Refined Tar RT-2 shall be uniformly applied at the rate of 0.35 gallons per square yard.

F. The HMA binder course patch shall be hot mixed, hot laid, bituminous concrete base, furnished and placed in accordance with Section 402 of the Standard Specifications, and to match the existing depth or to a minimum as shown on the Standard Details.

G. The HMA surface course shall be hot mixed, hot laid, bituminous concrete, furnished and placed in accordance with Section 402 of the Standard Specifications, and to match the existing depth or to a minimum as shown on the Standard Details.

END OF SECTION

SECTION 02775 - SIDEWALKS

PART 1 - GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and services required for constructing concrete sidewalks where shown on the Drawings and as specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Concrete: Section 03300

PART 2 - PRODUCTS

2.01 PREMOLDED EXPANSION JOINT FILLER

Premolded expansion joint filler shall be closed cell polyethylene foam type, Sonneborn Sonoflex F, Williams Products Expand-O-Foam, or equal. Seal joint with one-part self-leveling polyurethane sealant, Sonneborn Sonolastic SL 1, or equal, maximum 3/8" deep. Prepare and prime joints per manufacturer's instructions.

PART 3 - EXECUTION

3.01 BASE

Following finished grading, a base course of crushed stone shall be placed to a compacted thickness of four (4) inches. Immediately prior to placing concrete, crushed stone base shall be thoroughly wetted, or the concrete placed on a layer of heavy building paper.

3.02 SURFACE

Concrete paving shall consist of 4 or 6 inches (to match existing) of 3,000 psi reinforced concrete, struck off to accurately placed screens and worked with a float until mortar appears on the top. After surface has been thoroughly floated, it shall be brushed to leave markings of a uniform type, providing non-slip finish. No dusting or plastering will be allowed.

3.03 FINISHING

All joints and edges shall be finished with an edging tool. Dummy joints shall be formed about five (5) feet apart to form rectangular blocks. Expansion joints of 1/2 inch premolded expansion joint material shall be provided at the intersection of all vertical surfaces with the sidewalks slabs and at approximately 30-feet intervals along the walks.

3.04 QUALITY

The allowable variation shall be 1/8 inch to 10 feet transversely and longitudinally.

END OF SECTION

SECTION 02920 - LAWNS AND GRASSES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

Provide all labor, materials, equipment, and services required for seeding of all disturbed areas caused by construction activities and for installation of sod where indicated on the Contract Drawings or specified herein.

1.02 RELATED DOCUMENTS

A. Earthwork: Section 02300

1.03 MAINTENANCE

A. Maintenance shall begin immediately following the last operation of installation for each portion of lawn and shall continue in accordance with the following requirements:

B. Lawns shall be maintained by watering, reseeding, and mowing for a period of forty-five (45) days. At the end of this period an inspection will be made and any deficiencies, which may be attributable to the Contractor, will be noted in writing. At this time, the Owner will assume the maintenance. Another inspection will be made at the beginning of the next planting season, and any of the previously noted deficiencies still existing shall be repaired by the Contractor.

1.04 INSPECTION FOR ACCEPTANCE

A. The Inspection of the Work:

The inspection of the work of lawns to determine the completion of Contract Work exclusive of the possible replacement of plants, will be made by the Town upon written notice requesting such inspection submitted by the Contractor at least ten (10) days prior to the anticipated date.

B. Acceptance:

After inspection, the Contractor will be notified in writing by the Owner of acceptance of all work of this Section, exclusive of the possible replacement of plants subject to guaranty, or if there are any deficiencies of the requirements of completion of the Work.

PART 2 - PRODUCTS

2.01 WATER

Water used in this work shall be suitable for irrigation and free from ingredients harmful to plant life. Hose and other watering equipment required for the Work shall be furnished by the Contractor.

2.02 TOPSOIL

The Contractor shall furnish and place sufficient topsoil for the installation of trees, shrubs, and other plants.

2.03 FERTILIZER

A. Pre-Fertilizer:

Fertilizer shall be commercial grade pelleted or chip type, as "Agriform Blue Chip", or equal, uniform in composition, dry and free flowing, of the following analysis:

Nitrogen	24.0% Minimum
Nitroform	14.0% Minimum
Phosphoric Acid	24.0% Minimum
Potash	8.0% Minimum
Iron (Metallic)	0.4% Minimum

Particle size not less than 2% through a number 48 mesh.

Fertilizer shall be delivered to the site in the original unopened container bearing the manufacturer's guarantee analysis. Any fertilizer that becomes caked or damaged making it unsuitable for use, will not be accepted.

B. Commercial Fertilizer:

Commercial fertilizer for lawn areas shall be complete fertilizer, formula 12-12-12, for lawns and shall conform to the applicable State fertilizer laws. Fertilizer shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guarantee analysis. Any fertilizer which becomes caked or otherwise damaged making it unsuitable for use will not be accepted. Fertilizer shall be applied at the rate of 20 pounds per 1,000 square feet.

C. Lime:

The lime used for lawn areas shall be agricultural limestone.

2.04 GRASS SEED

A. The seed mixture to be sown shall be in the following proportions:

Common Name	Proportion By Weight	% of Purity	% of Germination
Fine Lawn Fescue	40	90	85
Chewings Fescue	25	90	85
Italian Rye Grass	20	90	85
Red Top	10	90	85
White Clover	5	95	90

B. All seed shall be fresh and clean and shall be delivered mixed in unopened packages, bearing a guaranteed analysis of the seed mixture.

C. Germination must be certified to conform to the following minimums:

Purity	90%
Germination	85%

2.05 SOD

A. Sod shall be at least 70% Bluegrass, strongly rooted and free of pernicious weeds.

B. It shall be mowed to a height not to exceed 3" before lifting, and shall be of uniform thickness with not over 1-1/2" or less than 1" of soil.

2.06 MULCH

Mulch for seeded areas shall be Conwed Hydro Mulch, Silva-Fiber, or equal. It shall be suitable for use in a water slurry or for application with hydraulic equipment.

PART 3 - EXECUTION

3.01 TIME OF PLANTING

The Contractor shall be notified in writing by the Owner when other divisions of the Work progressed sufficiently to commence work of planting. Thereafter, planting operations shall be conducted under favorable weather conditions during the next season or seasons which are normal for such work as determined by accepted practice in the locality of the project. At the option and on full responsibility of the Contractor, planting operations may be conducted under unseasonable conditions without additional compensation.

3.02 LAWNS

A. Areas to be sodded are designated on the Drawings or noted above.. All other lawn areas, including areas of cut and fill and where existing ground has been disturbed by construction operations shall be seeded.

B. Soil Improvements:

1. Agricultural Ground Limestone:

   Agricultural Ground Limestone shall be spread at the rate of one ton per acre.

2. Fertilizer:

   Fertilizer shall be applied at the rate of 20 pounds per 1,000 square feet to the lawn area being prepared for planting and mixed lightly into the top few inches of topsoil. Fertilizer may be mixed with and distributed with grass seed.

C. Planting of Lawns:

1. Sowing of Seed:

   Immediately before any seed is to be sown, the ground shall be scarified as necessary, and shall be raked until the surface is smooth, friable and of uniformly fine texture. Lawn areas shall be seeded evenly with a mechanical spreader at the rate of 3 pounds per 1,000 square feet of area, lightly raked, rolled with a 200-pound roller and watered with a fine spray. The method of seeding may be varied at the discretion of the Contractor on his own responsibility to establish a smooth, uniform turf composed of the grasses specified. The sowing of seed shall be done only within the season extending from February 15th to May 15th and from August 15th to October 15th, unless other seasons may be approved by the Owner.

2. Laying of Sod:

   Before any sod is laid, all soft spots and inequalities in grade shall be corrected. Fertilizer spread shall be raked in. Sod shall be laid so that no voids occur, tamped or rolled and then thoroughly watered. The complete sodded surface shall be true to finish grade, even and firm at all points. Sodding shall be done only within the seasons extending from February 15th to May 15th and from August 15th to October 15th, unless other seasons may be approved by the Owner..

3. Sod on Slopes:

   Sod on slopes 2 to 1 or steeper shall be held in place by wooden pins about 1-inch square and about 6 inches long driven through the sod into the soil until they are flush with the top of the sod, or by other approved methods for holding the sod in place.

4. Mulching:

All seeding areas are to be mulched with Conwed Hydro Mulch, Silva-Fiber, or equal, as specified under PRODUCTS. Mulch shall be applied at the rate of 1,500 pounds per acre. It may be applied with hydraulic equipment or may be added to the water slurry in a hydraulic seeder and the seeding and mulching combined in one operation.

3.03 EXCAVATION FOR TREES AND SHRUBS

A. Excavate pits, beds, and trenches with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation.

1. For bar root trees and shrubs, make excavations at least 12 inches wider than root spread and deep enough to allow for setting of roots on a layer of compacted backfill and will collar set at same grade level as in nursery, but one inch below finished grade at site.

   a. Allow for nine inch setting layer of planting soil mixture.

2. For balled and burlapped (B&B trees and shrubs), make excavations at least half again as wide as the ball diameter and equal to the ball depth, plus following allowance for setting of ball on a layer of compacted backfill:

   a. Allow for three inch thick setting layer of planting soil mixture.

3. For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.

B. Dispose of subsoil removed from planting excavations. Do not mix with planting soil or use as backfill.

C. Fill excavations for trees and shrubs with water and allow water to percolate our prior to planting.

3.04 PLANTING TREES AND SHRUBS

A. Set balled and burlapped (b&b) stock on layer of compacted planting soil mixture, plumb and in center of pit or trench with top of ball at same elevation as adjacent finished landscape grades. Remove burlap from sides of balls; retain on bottoms. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately two-thirds full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.

B. Set bare root stock on cushion of planting soil mixture. Spread roots and carefully work backfill around roots by hand and puddle with water until backfill layers are completely saturated. Plumb before backfilling and maintain plumb while working backfill around roots and placing layers of soil mixture above roots. Set collar one inch below adjacent finish landscape grades. Spread out roots without tangling or turning up to surface. Cut injured roots clean; do not break.

C. Set container grown stock, as specified, for balled burlapped stock, except cut cans on two sides with an approved can cutter; remove bottoms of wooden boxes after partial backfilling so as not to damage root balls.

D. Dish top of backfill to allow for mulching.

E. Mulch pits, trenches, and planted areas. Provide not less than the following thickness of mulch, and work into top of backfill and finish level with adjacent finish grades.

1. Provide one-inch thickness of mulch.

F. Apply anti-desiccant, using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage.

1. If deciduous trees or shrubs are moved when in full-leaf, spray with anti-desiccant at nursery before moving and spray again two weeks after planting.

G. Prune, thin out, and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Town, do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any. Prune shrubs to retain natural character.

H. Remove and replace excessively pruned or misformed stock resulting from improper pruning.

I. Wrap tree trunks of two inches caliper and larger. Start at ground and cover trunk to height of first branches and securely attach. Inspect tree trucks for injury, improper pruning and insect infestation and take corrective measures before wrapping.

J. By and stake tress immediately after planting, as indicated.

3.05 CLEAN UP

All soil, peat or similar material which has been brought over paved areas by hauling operations or otherwise, shall be removed promptly, keeping these areas clean at all times. Upon completion of the planting all excess soil, stone and debris which have not previously been cleaned up shall be removed from the site or disposed of as directed by the Owner. All lawns shall be prepared for final inspection.

3.06 OTHER WORK

The Contractor also shall be responsible for the repair of any damage caused by his activities or those of his subcontractors, such as the storage of topsoil or other materials, operations or equipment, or other usages to all on-site areas outside the contract limits. Such repair operations shall include any regarding, seeding or other work necessary to restore such areas to an acceptable condition.

3.07 QUALITY CONTROL

Areas seeded shall be protected until a uniform stand develops, when it will be accepted and the Contractor relieved of further responsibility for maintenance. Displaced mulch shall be replaced or any damage to the seeded area shall be repaired promptly, both in a manner to cause minimum disturbance to the existing stand of grass. If necessary to obtain a uniform stand, the Contractor shall re-fertilize, re-seed and re-mulch as needed. Scattered bare spots up to one (1) square yard in size will be allowed up to a maximum of 10 percent of any area.

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all cast-in-place concrete as indicated on the Drawings and specified herein.

B. All concrete construction shall conform to all applicable requirements of ACI 301 (latest), Specifications for Structural Concrete for Buildings, except as modified by the supplemental requirements specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Earthwork: Section 02300

1.03 SUBMITTALS

A. Concrete mix designs, test results and curves plotted to establish water-cement ratio if ACI 301-89 Section 3.9.3.3 is followed.

B. Proposed mix designs and all necessary substantiating data used to establish the proposed mix designs if ACI 301-84 Section 3.9.1 is followed.

C. Mix designs shall be submitted for all mixes proposed or required to be used, including all mixes containing admixtures.

D. A certified copy of the control records of the proposed production facility establishing the standard deviation as defined in Paragraph 3.8.2.3 of ACI 301.

1.04 QUALITY ASSURANCE

The Contractor shall obtain and have available in the field office at all times, the following references:

A. Specifications for Structural Concrete for Buildings ACI 301 (latest Revision).

B. Field Reference Manual: Specifications for Structural Concrete for Buildings SP-15 (89).

Available from:

The American Concrete Institute
Publications Department
P.O. Box 19150
Detroit, Michigan 48219-0150

C. Manual of Standard Practice - CRSI. (First printing, 1990).

D. Placing Reinforcing Bars - CRSI (1991).

Available from:

Concrete Reinforcing Steel Institute
933 North Plum Grove Road
Schaumburg, Illinois 60173-4758

PART 2 - PRODUCTS

2.01 CLASSES OF CONCRETE AND USAGE

A. Structural concrete of the various classes required shall be proportioned by either Method 1 or Method 2 of ACI 301 to produce the following 28-day compressive strengths:

1. Selection of Proportions for Class A Concrete:

   a. 4,000 psi compressive for strength at 28 days.

   b. Type II cement plus dispersing agent and air.

   c. Max. (water)/(cement and dispersing agent) ratio = 0.45.

   d. Min. cement content = 564 lbs. (6.0 bags)/cu. yd. concrete.

   e. Nominal max. size coarse aggregate = No. 67 (3/4" max.) or No. 57 (1" max.). Walls with architectural treatment shall use No. 67 (3/4" max.).

   f. Air content = 6% plus or minus 1% by volume.

   g. Slump = 3" - 4" in accordance with ASTM C 143.

2. Selection of Proportions for Class B Concrete:

   a. 3,000 psi compressive strength at 28 days.

   b. Type I cement plus dispersing agent and air.

   c. Max. (water)/(cement and dispersing agent) ratio = 0.56.

   d. Min. cement content = 470 lbs. (5.0 bags)/cu. yd. concrete.

   e. Nominal max. size coarse aggregate = No. 67 (3/4" max.) or No. 57 (1" max). Walls with architectural treatment shall use No. 67 (3/4" max.).

   f. Air content = 6% plus or minus 1% by volume.

   g. Slump - 3" - 4" in accordance with ASTM C 143.

B. Concrete shall be used as follows:

1. Class A concrete for all concrete work except as noted below.

2. Class B concrete for fill concrete, thrust blocks and topping over hollow-core slabs, and where indicated on the Drawings.

C. Type II cement conforming to ASTM C 150 shall be used in all structural concrete. The alkali content shall not exceed 0.6% calculated as sodium oxide. Cement for exposed to view concrete shall have a uniform color classification.

D. Coarse aggregate for concrete shall be size No. 57, as specified in ASTM C33 unless a smaller size aggregate is required to conform to provisions of Section 3.6 of ACI 301. Coarse aggregate shall conform to all requirements of ASTM C33.

E. Manufactured sand shall not be used as fine aggregate in concrete.

2.02 ADMIXTURES

A. An air entraining admixture shall be used on all concrete and shall be synthetic air entrainment such as that manufactured by Master Builders or approved equal. Certification attesting to the percent of effective solids and compliance of the material with ASTM C 260 shall be furnished, if requested.

B. A water-reducing, set controlling admixture (nonlignin type) shall be used in all concrete. The admixture shall be a combination of polyhydroxylated polymers including catalysts and components to produce the required setting time based on job site conditions, specified early strength development, finishing characteristics required, and surface texture, as determined by the Town.

C. Certification shall be furnished attesting that the admixture exceeds the physical requirements of ASTM C 494, Type A, water-reducing and normal setting admixture, and when required, for ASTM C 494, Type D, water-reducing and retarding admixture when used with local materials with which the subject concrete is composed.

D. The admixture manufacturer, when requested, shall provide a qualified concrete technician employed by the manufacturer to assist in proportioning concrete for optimum use. He shall also be available when requested to advise on proper addition of the admixture to the concrete and on adjustment of the concrete mix proportions to meet changing job conditions.

E. The use of admixtures to retard setting of the concrete during hot weather, to accelerate setting during cold weather, and to reduce water content without impairing workability will be permitted if the following conditions are met:

The admixture shall conform to ASTM C494, except that the durability factor for concrete containing the admixture shall be at least 100 percent of control, the water content a maximum of 90 percent of control and length change shall not be greater than control, as defined in ASTM C 494.

F. Where the Contractor finds it impractical to employ fully the recommended procedures for hot weather concreting, the Town may at his discretion, require the use of a set retardant

admixture for mass concrete 2.5 feet or more thick for all concrete whenever the temperature at the time concrete is cast exceeds 80°F. The admixture shall be selected by the Contractor subject to the review of the Town. The admixture and concrete containing the admixture shall meet all the requirements of these Specifications. Preliminary tests of this concrete shall be required at the Contractor's expense.

G. Admixtures shall be used in concrete design mixes in the same manner and proportions as in the field so that the effects of the admixtures are included in preliminary tests submitted to the Town for review prior to the start of construction.

H. When more than one (1) admixture is used, all admixtures shall be compatible. They should preferably be by the same manufacturer.

I. Calcium chloride will not be permitted as an admixture in any concrete.

2.03 REINFORCEMENT

A. The minimum yield strength of the reinforcement shall be 60,000 pounds per square inch. Bar reinforcement shall conform to the requirements of ASTM A 615. All bar reinforcement shall be deformed.

B. Wire-mesh reinforcement shall be continuous between expansion joints. Laps shall be at least one full mesh plus 2 inches, staggered to avoid continuous lap in either direction, and securely wired or clipped with standard clips.

C. Smooth dowels shall be plain steel bars conforming to ASTM A 615, Grade 60, or steel pipe conforming to ASTM A 120, Schedule 80. Pipe, if used, shall be closed flush at each end with mortar or metal or plastic cap. Dowels shall be installed at right angles to construction joints and expansion joints. Dowels shall be accurately aligned parallel to the finished surface, and shall be rigidly held in place and supported during placing of the concrete. One end of dowels shall be oiled or greased or dowels shall be coated with high density polyethylene with a minimum thickness of 14 mils.

D. Reinforcement supports and other accessories in contact with the forms for members which will be exposed to view in the finished work shall be of stainless steel or shall have approved high-density polyethylene tips so that the metal portion shall be at least one-quarter of an inch from the form or surface. Supports for reinforcement, when in contact with the ground or stone fill, shall be precast stone concrete blocks. Particular attention is directed to the requirements of Paragraph 5.5.3 of ACI Standard 301. These requirements apply to all reinforcement, whether in walls or other vertical elements, inclined elements or flatwork.

E. Particular care shall be taken to bend tie wire ends away from exposed faces of beams, slabs and columns. In no case shall ends of tie wires project toward or touch formwork.

2.04 OTHER MATERIALS

A. Anchorage items shall be of standard manufacture and of type required to engage with the anchors to be installed therein under other sections of the Specifications and shall be subject to approval by the Town.

1. Slots shall be galvanized dovetail-type as specified in Section "Masonry Work".

2. Inserts shall be malleable iron or steel, and of sturdy design adequate strength for the load to be carried. All inserts shall be galvanized. Adjustable wedge inserts shall have an integral loop or strap at the back, or shall be slotted to receive a special-headed bolt not smaller than 5/8-inch in diameter and of the required length and fitted with hexagonal nut. Other inserts shall be either threaded or slotted as required by their usage. Threaded inserts shall have integral lugs to prevent running.

3. Concrete anchors shall be an approved expansion type conforming to Federal Specification FF-S-325, Groups I, II, III, or VIII and shall be installed in strict accordance with the manufacturer's recommendations. Material for anchors shall be as specified in Section 05500 "Miscellaneous Metals". Anchors shall develop ultimate shear and pull out loads of not less than the following values in Class A concrete:

Bolt Diameter (Inches)	Min. Shear (Pounds)	Min. Pull-Out Load (Pounds)
1/2	4,500	4,600
5/8	6,900	7,700
3/4	10,500	9,900

B. Epoxy bonding adhesive used to bond fresh plastic concrete to sound, hardened concrete shall meet the following Specification. Contractor shall furnish a notarized certification by the manufacturer that the proposed material meets the Specification.

1. Material:

The epoxy material shall consist of a 2-component system whose components conform to the following requirements:

a. Component A - Component A shall be a modified epoxy resin of the epichlorohydrin bisphenol A condensation type, containing suitable viscosity control agents and having an epoxide equivalent of 180-200.

b. Component B - The B component shall be primarily a reaction product of one mole of an aliphatic polyamine and two moles of mono-functional epoxide containing compounds modified with 2, 4, 6 tri (dimethylaminomethyl) phenol.

c. The component ratio of B to A by volume shall be as specified by the manufacturer.

2. Properties of Mixed Components:

a.	Solids Content	100% by weight
b.	Pot Life	25-35 min. @ 73-1/4F.
c.	Tack-Free Time (Thin Film)	4-5-1/2 hrs @ 73-1/4F.

d.	Final Cure ASTM D 695 (75% ultimate strength)	3 days at 73-1/4F.
e.	Initial Viscosity (A+B)	2,000 cps. min at 73-1/4F.
f.	Color Mixed	Straw

3. Properties of Cured Material (Neat Material):

a.	Tensile Strength ASTM D 638	3,000 psi min. @ 14 days 73-1/4F. cure
b.	Tensile Elongation ASTM D 638, modified	1/2 - 2% at 14 days 73-1/4F. cure
c.	Compressive Strength ASTM D 695	12,500 psi min. at 73 degrees F. cure
d.	Compressive Modules ASTM D 695	470,000 psi min. @ 28 days, 73°F cure
e.	Compressive Strength ASTM D 695	5,500 psi min. @ 24 days 73°F cure
f.	Water Pick-up ASTM D 570	1.5 max.

C. Reglets shall be correctly placed into forms prior to placing concrete in formwork, if necessary.

D. Premolded expansion-joint filler strips shall conform to ASTM D 1752 and shall be 3/8-inch thick unless otherwise shown.

E. Joint sealants shall conform to ANSI A 116.1. The following joint sealants are acceptable:

1. Colma by Sika Chemical Corporation

2. Hornflex by A.C. Horn, Inc.

3. Sonolastic by Sonneborn Division of Contech, Inc.

F. Nonshrink grout shall be Embeco 636 grout by Master Builders Company, Euco Firmix grout by the Euclid Chemical Company, or equal. The approved product shall be delivered to the site of the Work in the original sealed containers, each bearing the trade name of the material and the name of the manufacturer.

G. Hardeners and dustproofers shall be colorless, aqueous solution of zinc or magnesium fluosilicate. Each gallon of solution used for the first application shall contain not less than one pound of crystals. Each gallon of solution used for subsequent application shall contain not less than two pounds of crystals. Materials

shall be reviewed by the Town.

H. Porous fill shall be crushed rock or gravel of such size that all will pass a 1-1/2 inch screen and not more than 5 percent will pass a No. 4 screen, free from earth clay or other foreign substances.

I. Waterstops: Waterstops shall be styrene-butadiene rubber, standard (non-split) type, flat dumbbell shape (no center bulb), of size shown on Drawings, complete with fittings as required such as unions, vertical tees, vertical ells, flat crosses, flat ells, flat tees, etc. Waterstops shall be securely wired into place to maintain proper position during placement of fresh concrete, as shown on the Drawings. Care shall be taken in the installation of the waterstop and the placing of the concrete to avoid "folding" while concrete is being placed, and to prevent voids in the concrete surrounding the waterstop.

All materials, including adhesive, shall be W.R. Grave SERVICISED Construction Products; Williams Products, Inc.; Construction Gaskets, Inc.; or equal, and shall be installed in accordance with the manufacturer's recommendations.

J. Form Liners: Form liners for construction of fluted wall treatment shall be prefabricated plastic liners as manufactured by Greenstreak Plastic Products, Interform Company, or Symons Corporation.

Liners shall be fiberglass or ABS (acrylonitrile - butadiene - styrene) of such configuration as to obtain the fluted pattern shown or indicated on the Drawings.

For purposes of designating type and quality of material required, form liners shall be pattern 361 trapezoidal liners as manufactured by Greenstreak Plastic Products.

Preparation of forming materials, sealing of joints to prevent grout leakage and form release treatment (if required) shall be in strict compliance with the manufacturer's printed instructions and recommendations.

PART 3 - EXECUTION

3.01 FINISHES

A. Exposed to Public View Concrete Surfaces:

1. All concrete exposed to view in the completed structure shall be produced using materials and workmanship to such quality that only nominal finishing will be required. The provisions of paragraphs 13.3, 13.4, and 13.6 of ACI 301 shall apply to all exterior exposed to public view concrete surfaces, including the outside surfaces of tanks.

2. Forms for exposed concrete surfaces shall be exterior grade, high-density overlay plywood, steel, or wood forms with smooth tempered hard-board form-liners.

3. Forms shall be coated with an approved release agent before initial pour and between subsequent pours, in accordance with the manufacturer's printed instructions. Form

boards shall not be wet water prior to placing concrete.

4. Recessed joints in concrete shall be formed using lacquer-coated wood battens or forms, milled to indicated profiles. Battens and corner strips shall be carefully inspected before concrete is placed and damaged pieces replaced.

5. Chamfer strips shall be 1 inch radius with leg, polyvinyl chloride strips by Gateway Building Products, Saf-T-Grip Specialties Corp., Vinylex Corp., or equal.

6. Particular attention is directed to the requirements of paragraphs 10.2.2 and 13.3 of ACI 301. Form panels shall be provided in the maximum sized practicable in order to minimize form joints. Wherever practicable, form joints shall occur at recessed joints. All form joints in exterior exposed to view surfaces shall be carefully caulked with an approved nonstaining caulking compound. Joints shall not be taped. Form oil or other material which will impart a stain to the concrete shall not be allowed to contact concrete surfaces.

7. Care shall be taken to prevent chipping of corners or other damage to concrete when forms are removed. Exposed corners and other surfaces which may be damaged by ensuing operations shall be protected from damage by boxing, corner boards or other approved means until construction is completed.

8. Form ties shall remain in the walls and shall be equipped with a waterseal to prevent passage of water through the walls. Minimum set back of form ties shall be 1-1/2 inches from faces of wall. The hole left by removal of tie ends shall be sealed and grouted as per ACI Par. 9.3 and in accordance with the procedure described hereinafter in Par. 3.01.F. Form ties will be permitted to fall within as-cast areas of architecturally treated wall surfaces (ACI Chapter 13); this does not apply to walls receiving textured decorative waterproof masonry coating.

9. All formed exposed to view concrete surfaces shall have a "smooth rubbed finish". Exterior vertical surfaces shall be rubbed to one foot below grade. Interior exposed to public view vertical surfaces of liquid containers shall be rubbed to one (1) foot below the minimum liquid level that will occur during normal operations.

B. All vertical surfaces in liquid containing structures shall have a "smooth form" finish.

All "smooth form" concrete vertical surfaces shall be a true plane within 1/4 inch in 10 feet as determined by a 10 foot straightedge place anywhere on the surface in any direction. Abrupt irregularities shall not exceed 1/8 inch.

C. Basin, flume, conduit and tank floors shall have a "troweled" finish unless shown otherwise on Drawings.

D. Weirs and overflow surfaces shall be given a "troweled" finish.

E. Exterior platforms, steps and landings, shall be given a "broom" finish. "Broom" finish shall be applied to surfaces which have been steel-troweled to an even, smooth finish. The troweled surface shall then be broomed with a fiber-bristle brush in the direction transverse to that of the main traffic.

F. Patching of holes due to removal of tie ends and other repairable defective areas, shall be as

follows: Entire contact area of hole shall be coated with two-part moisture insensitive epoxy bonding compound as specified in Par. 2.04.B. in accordance with manufacturer's specifications, and prior to placing of freshly mixed patching mortar. Parching mortar shall be mixed and placed in general accordance with ACI Par. 9.2.2., 9.2.3, and 13.6.

G. For floors and slabs in which drains occur, special care shall be exercised to slope the floors uniformly to the drains. All floors with drains shall be sloped not less than 1/8 inch per foot unless otherwise shown. In all areas where quarry tile or other materials requiring more than 1/4 inch drop are to be overlaid, the concrete base slab shall be depressed as shown to provide a finished floor at the same elevation as surrounding areas.

H. Where not otherwise specified, finishes shall be in accordance with Paragraphs 10.4 and 11.8 of ACI 301.

3.02 TESTING

A. All testing shall be in accordance with provisions of ACI 301. Testing services listed in ACI Sections 16.3, 16.4 and 16.5 shall be performed by a testing agency acceptable to the Town.

B. The testing services of ACI sections 16.3 and 16.4 will be performed at the Contractor's expense. The Contractor shall be responsible for making concrete test cylinders, storing and protecting concrete cylinders and delivering cylinders to the Owner's testing laboratory.

C. Testing services of ACI Section 16.5 shall be paid for by the Contractor. Test shall be made for each 50 cubic yards of concrete and/or each day concrete is placed.

3.03 ADDITIONAL REQUIREMENTS

A. Unless otherwise directed by the Town, the vertical surfaces of footings shall be formed. Excavations and reinforcement for all footings shall have been inspected by the Town before any concrete is placed.

B. The installation of underground and embedded items shall be inspected before slabs are placed. Pipes and conduits shall be installed below the concrete unless otherwise indicated. Fill required to raise the subgrade shall be placed as specified in Section 02300 "Earthwork". Porous fill not less than 6 inches in compacted thickness shall be installed under all slabs, tank bottoms, and foundations. The fill shall be leveled and uniformly compacted to a reasonably true and even surface. The surfaces shall be clean, free from frost, ice, mud and water. Waterproof paper, polyethylene sheeting of nominal 4-mil minimum thickness, or polyethylene-coated burlap shall be laid over all surfaces receiving concrete.

C. Concrete shall be placed in layers not over 18 inches deep and each layer shall be compacted by mechanical internal-vibrating equipment supplemented by hand spading, rodding and tamping as directed. Vibrators shall not be inserted into lower courses that have begun to set.

D. Concrete that is truck mixed or transported in truck mixers or truck agitators shall be delivered to the site of the work and discharge completed in the forms within the time specified in Paragraph 10.7 of ASTM C 94 except that when the concrete temperature exceeds 85°F., the time shall be reduced to 45 minutes. Transit-mixed concrete that is completely mixed at the site of concrete placement or batched cement and aggregates

transported to mixers shall be placed in the forms within 1-1/2 hours after cement has been added. Concrete shall be placed in the forms within 15 minutes after discharge from the mixer at the job site.

E. If concrete is placed by pumping, no aluminum shall be used in any parts of the pumping system which contact or might contaminate the concrete. Aluminum chutes and conveyors shall not be used.

F. All concrete surfaces not in contact with forms shall be moist cured by the application of absorptive mats or double thicknesses of fabric kept continuously wet. Forms shall be kept continuously wet. Use of other curing methods will not be permitted unless written authorization is received from the Town.

G. The unit of operation shall not exceed 30 feet for tank walls and walls exposed to weather, and 45 feet for other work in any horizontal direction and not less than 48 hours shall elapse between casting of adjoining units unless these requirements are waived by the Town. Provision shall be made for jointing successive units as indicated or required to be made at spacing of approximately 25 feet. Additional construction joints required to satisfy the 25 foot spacing shall be located by the Contractor subject to the review of the Town. The Contractor shall submit for review drawings separate from the steel reinforcing drawings, showing the location of all proposed construction joints. All construction joints shall be prepared for bonding as specified in Paragraph 6.1.4.3. of ACI Standard 301. Joints in walls and columns shall be maintained level. Concrete shall be placed in layers not over 18 inches deep and each layer shall be compacted by mechanical internal-vibrating equipment supplemented by hand spading, rodding and tamping as directed. Vibrators shall not be inserted into lower courses that have begun to set.

H. Formwork for beam soffits and slabs and other parts that support the weight of concrete, shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified or permitted.

I. Concrete Walks and Curbs:

1. Subgrade shall be true and well compacted at the required grades. Spongy and otherwise unsuitable material shall have been removed and replaced with approved material. Concrete walks shall be placed upon porous fill covered with waterproof paper, polyethylene sheeting of nominal 4-mil minimum thickness or polyethylene-coated burlap.

2. Concrete walks shall be not less than 4 inches in thickness. Walks shall have contraction joints every 5 linear feet in each groove in the top surface of the slab to a depth of at least one-fourth the slab thickness with a jointing tool. Transverse expansion joints shall be installed at all returns, driveways, and opposite expansion joints in adjacent curbs. Where curbs are not adjacent, transverse expansion joints shall be installed at intervals of approximately thirty (30) feet. Sidewalks shall receive a "broomed" finish. Scoring shall be in a transverse direction. Edges of the sidewalks and joints shall be edged with a tool having a radius not greater than 1/6 inch. Sidewalks adjacent to curbs shall have a slope of 1/4 inch per foot toward the curb. Sidewalks not adjacent to curbs shall have a slope of 1/4 inch per foot. The surface of the concrete shall show no variation in cross section in excess of 1/4 inch in 5 feet. Concrete walks shall be reinforced with 66-1010 welded wire fabric.

3. Concrete curbs shall be constructed to the section indicated on the Standard Detail, and all horizontal and vertical curves shall be incorporated as indicated or required. Forms shall be steel as approved by the Town. At the option of the Contractor, the curbs may be precast or cast-in-place. Cast-in-place curbs shall be divided into sections 8 to 10 feet in length using steel divider plates. The divider plates shall extend completely through the concrete and shall be removed. Precast curbs shall be cast in lengths of 4 to 5 feet. All exposed surfaces of concrete shall be finished smooth. All sharp edges and the edges of joints and divisions shall be tooled to 1/2 inch radius. Steel reinforcement shall be installed where the curb crosses pipe trenches or other insecure foundations. Such reinforcement shall consist of two (2) No. 4 deformed bars near the bottom of the curb and shall extend at least 24 inches beyond the insecure area. Transverse expansion joints shall be installed at all curb returns and at intervals of approximately 30 feet.

J. Column base plates, bearing plates for beams and similar structural members, machinery and equipment bases shall, after being plumbed and properly positioned, be provided with full bearing with nonshrink grout. Concrete surfaces shall be rough, clean, free of oil, grease, and laitance and shall be moistened thoroughly immediately before grout is placed. Metal surfaces shall be clean and free of oil, grease and rust. Mixing and placing shall be in conformance with the material manufacturer's printed instructions. After the grout has set, exposed surfaces shall be cut back 1 inch and covered with a parge coat of mortar consisting of 1 part Portland cement, 2 parts sand and sufficient water to make the mixture placeable. Parge coat shall have a smooth dense finish. Exposed surfaces of grout and parge coat shall be water cured with wet burlap for 7 days.

K. Grout fill which is formed in place by using rotating equipment as a screen, such as clarifiers and similar types of equipment, shall be mixed in proportions and consistencies as required by the manufacturer or supplier of the equipment.

L. Watertightness:

1. The structures which are intended to contain liquids and/or will be subjected to exterior hydrostatic pressures shall be so constructed that, when completed and tested, there shall be no loss of water and no wet spots shall show.

2. As soon as practicable, after the completion of the structures, the Contractor shall fill them with water and if leakages develop or wet spots show, the Contractor shall empty such structures and correct the leakage in an approved manner. Any cracks which appear in the concrete shall be dug out and suitably repaired. Temporary bulkheads over pipe openings in walls shall be provided as required for the testing.

3. After repairs, if any are required, the structures shall be tested again and further repaired if connection with these tests and repairs shall be at the expense of the Contractor.

4. Waterstops shall be placed in other locations as indicated on the Drawings and as may be required to assure the watertightness of all containers of liquids. Special shop fabricated ells, tees and crosses shall be provided at junctions. Waterstops shall be extended at least 6 inches beyond end of placement in order to provide splice length for subsequent placement. In slabs and tank bottoms, water stops shall be turned up to be made continuous with waterstops at bottom of walls or in walls.

5. Joints between pipe (except cast iron wall pipe) and cast-in-place concrete walls shall be sealed by means of a groove cast completely around the pipe; the groove shall be filled with a quick setting hydraulic compound similar and equal to Waterplug as made by Standard Dry Wall Products, Inc., mixed and applied in accordance with the manufacturer's instructions.

M. Unless otherwise shown or directed, all pumps, other equipment, and items such as lockers, motor control centers and the like, shall be installed on concrete bases. The bases shall be constructed to the dimensions shown on the plans or as required to meet plan elevations. Where no specific plan elevations are required, the bases shall be 6 inches thick and shall extend 3 inches outside the metal equipment base. In general, the concrete bases shall be placed up to 1-inch below the metal base. The equipment shall then be properly shimmied to grade and the 1-inch void filled with nonshrink grout. Prior to the final set of the grout it shall be cut back and the edge plastered with 1:2 cement mortar.

N. Concrete which, in the opinion of the Architect-Town, has excessive honeycomb, aggregate pockets or depressions will be rejected and the Contractor shall, at his own expense, remove the entire section containing such defects and replace it with acceptable concrete.

O. Manhole or access steps shall be plastic, constructed of copolymer polypropylene meeting the requirements of ASTM D 2146 for Type II, Grade 16906 material. Step shall be reinforced with ASTM A 615, Grade 60, #4 deformed steel reinforcing bar, be 9" deep, 14" wide, provided with notched tread ridge, foot retainer lugs on each side of tread and penetration stops for press fit installation. Plastic steps shall be PS2-PF as manufactured by M.A. industries, Inc., Peachtree City, Georgia. Steps shall be installed by drilling 1" diameter holes, minimum 3-3/4 inches deep into the wall, and then driving steps into hole to the penetration stop, resulting in a press fit condition.

P. Tank pressure relief valves shall be 6" diameter Neenah Foundry Company R-5001-1, American Valve & Hydrant B315.1, or equal, floor type, with outside hooks or inside self-contained lock; quantity and spacing as shown on structural drawings. No part of pressure relief valves shall project above the neat line of the tank floor to prevent fouling of scraper mechanisms where used.

Q. All existing contact surfaces with new patch shall be coated with moisture insensitive epoxy bonding adhesive, Sikadur Hi-Mod, Sonobond, or equal. Patch shall consist of base pour of 4,000 psi structural concrete, then a topping of non-shrink natural aggregate grout, Master Builders Masterflow 713, Sonogrout, or equal, mixed and placed in accordance with manufacturer's instructions, to the thicknesses shown on Drawings. Coat base pour with epoxy bonding adhesive prior to placing grout course.

END OF SECTION

DIVISION 11

EQUIPMENT

SECTION 11210 – LIFT STATIONS

PART 1 – GENERAL

1.01 DESCRIPTION

This Chapter pertains to the requirements for the design and construction of submersible type pump stations, which are the primary type constructed as part of private development. Wet well/dry pit stations are acceptable, **and their design and approval will be handled on a case-by-case basis by the Town of Whitestown**. The Developer shall request a predesign meeting with the Town to discuss any planned Lift Station prior to design commencing.

Pump stations must meet or exceed the requirements set herein. Any proposed alteration of the pump station dimensions, equipment, controls, etc. from the standards set forth herein will be approved only upon the submittal of plans and specifications of the proposed changes to the Town of Whitestown, and upon the Town's written approval. The Town of Whitestown reserves the right to alter any standard set forth hereinafter.

Pump Stations, in general, shall be submersible type including a minimum of two (2) pumps and motors each meeting the station's rated capacity under site operating conditions, wet well separate valve pit, valves, piping, hatches, guide rails, pump removal components, control center, level sensors, remote monitor package, interconnecting electrical wiring, incoming power and all other features regularly and normally required as a part of a complete and functional facility. All work shall be in accordance with site requirements, details in the Plans, these Standards and the manufacturer's recommendations.

1.02 SCOPE OF WORK

A. The Work specified in this Section consists of furnishing, installing, testing, and placing into service all pumping equipment including pumps, motors, bases, and appurtenances. Unless otherwise specified, the pump manufacturer shall furnish each pumping unit complete with drive motor and all other components and shall be held entirely responsible for the compatibility in all respects of all components furnished. Pumping units shall be as specified herein, and shown on the Drawings.

B. Equipment Arrangement: Unless specifically indicated otherwise, the arrangement of equipment shall be as shown on the Standard Drawings. Some aspects of the Drawings are diagrammatic and some features of the illustrated equipment arrangement may require revision to meet the actual equipment requirements. Structural supports, foundations, piping and valve connections, and electrical and instrumentation connections, indicated may have to be altered to accommodate the equipment provided. Substantiating calculations and drawings shall be submitted prior to beginning the installation of equipment.

1.03 QUALITY ASSURANCE

A. All similar components shall be manufactured and furnished by one manufacturer unless specifically approved by the Town in writing.

B. Equipment shall be in accordance with the following standards, as applicable and as indicated in each equipment specification:

1. American Society for Testing and Materials (ASTM).

2. American National Standards Institute (ANSI).

3. American Society of Mechanical Engineers (ASME).

4. American Water Works Association (AWWA).

5. American Welding Society (AWS).

6. National Fire Protection Association (NFPA).

7. National Electrical Manufacturers Association (NEMA).

8. Manufacturer's published recommendations and specifications.

1.04 SUBMITTALS

A. Shop Drawings: Shop Drawings for the lift station and associated equipment shall be submitted. Submittals shall include, but not be limited to, the following documentation:

1. Descriptive literature including materials of construction, equipment weight, motor data, pressure ratings, certification of all applicable ASTM standards;

2. Predicted performance curves developed for the specific application. Performance curves shall plot speed, capacity, head, horsepower, efficiency, and NPSH requirements over the manufacturer's recommended range of operation;

3. Dimensional factory drawings including cross sectional views of pumps and all equipment showing details of construction;

4. Written report on the factory test results;

5. Manufacturer's installation instructions.

B. Operation and Maintenance Manuals: The Developer shall submit two (2) Operation and Maintenance Manuals to the Town. Manuals shall include, at a minimum, the following:

1. Warranty Statement

2. Pump down test procedures and results from the start-up tests;

3. Operation Instructions;

4. Maintenance Instructions;

5. Recommended spare parts list;

6. Lubrication schedules;

7. Structural diagrams;

8. As-built wiring diagrams;

9. Piping and Instrumentation Drawings (P&ID); and

10. Bill of materials

1.05 EXPERIENCE QUALIFICATIONS

The equipment to be furnished hereunder shall be made by a manufacturer regularly engaged in such work, and who has furnished similar installations and had them in successful and continuous operation for a period of 10 years.

1.06 FACTORY TESTS

Each pump to be delivered under this Section shall be tested for performance at the pump manufacturer's factory to determine head versus capacity, efficiencies, and kilowatt draw required for the operating points that are specified. All tests shall be run in accordance with the latest edition of the American Hydraulic Institute Standards and Submersible Wastewater Pump Association and at the appropriate voltage and frequency. Testing shall also include, but not be limited to, the following:

A. Head vs. flow with five (5) equally spaced points including shutoff and maximum flow shall be certified.

B. The input KW, speed, power factor, no load current, and torque characteristics shall be certified.

C. Impeller, motor rating, and electrical connections shall first be checked for compliance to the specifications.

D. Insulation Test: A motor and cable insulation test for moisture content or insulation defects shall be made.

E. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

F. Operational Test: The pump shall be run for 30 minutes submerged, under a minimum of six feet of water.

G. After the operational test (described in line F) has been conducted, the insulation test (described in line D above) shall be performed again.

H. After testing, the pump shall be inspected to insure that the pump maintains full watertight integrity.

I. A written report stating the tests have successfully been completed and providing the results of the test shall be provided for each pump. The pump manufacturer shall also certify that similar tests have been conducted on pumps of a similar size for a period of not less than five (5) years.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Hydromatic

B. Alternates and substitutions to be approved by Town of Whitestown.

2.02 SCHEDULE

The following schedule shall be filled out by the Developer Design Engineer and submitted for approval by the Town.

Parameter	**Pump Schedule**
Manufacturer	
Pump Model	
Quantity	
Impeller Size	
Motor HP	
RPM	
Electric Service	
Operating Point (1 pump)	
Operating Point (2 Pumps)**	
Minimum Pump Efficiency	
Maximum NPSH Required	
NEC Classification	
Cooling Jacket Equipped	
VFD Operation	
Discharge Connection	
Shut-Off Head	

(**) Basis of Design at full speed

2.03 SUBMERSIBLE PUMPS AND APPURTENANCES

A. Pump Design

1. The pump shall be centrifugal, non-clog, solids handling, submersible type capable of handling raw water or unscreened sewage. The pumps shall be designed for hazardous locations, NEC Class1, Division 1, Groups C and D and Factory Mutual rated. The discharge connection elbow shall be permanently installed in the wetwell along with the discharge piping. The pump shall be automatically and firmly connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection or service. There shall be no need for personnel to enter the wetwell. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.

2. The pump mounting base shall include guide rail supports and a discharge connection with a 125-lb. standard flange, faced and drilled. The base and the discharge piping shall be permanently mounted in place. The base plates shall be anchored in place utilizing epoxy type anchors with stainless steel studs and nuts as manufactured by HILTI Fasteners, Inc. or equal. No portion of the pump shall bear directly on the floor of the sump.

B. Pump Construction

Pump volute, motor and seal housing are to be high quality gray cast iron ASTM A-48, Class 30. All mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton/FKM rubber O-rings. Sealing shall be accomplished when metal-to-metal contact is made, resulting in controlled compression of the rubber O-rings without requirement of a specific torque limit.

C. Rail System

1. A rail system shall be provided for easy removal of the pump and motor assembly for inspection and service. The entire weight of the pump shall be guided by no less than two (2) stainless steel guide rails, size as recommended by pump manufacturer, extending from the top of the station to the discharge connection. The guide rails shall be positioned and supported by the pump mounting base. The guide rails shall be aligned vertically and supported at the top by an attachment to the access hatch frame. Stainless steel intermediate guide rail support(s) shall be required in accordance with pump manufacturer's spacing recommendations.

2. The rails shall function to allow the complete weight of the pumping unit to be lifted on dead center without binding and stressing the pump housing. The rail system shall function to automatically align the pumping unit to the discharge connection by a simple downward movement of the pump. No twisting or angle approach will be considered acceptable.

D. Motor

The stator winding, rotor and bearings are to be mounted in a sealed submersible type housing. Insulation utilized in the stator windings shall be Class H with maximum

temperature capability of 155°C. Motor housing shall be filled with a high-dielectric oil, NEMA A and B design, to give superior heat transfer and allow the bearings to run in a clean, well lubricated environment; or the housing shall be air filled with grease lubricated bearings. The motors shall be Premium Efficient in accordance NEMA MG1 and IEC 60034-30, level IE3. The pump and motor are to be specifically designed so that they may be operated partially or completely submerged in the liquid being pumped. Stators shall be securely held in place with a removable end ring and threaded fasteners so that it may be easily removed in the field without use of heat or a press.

Motor shall be provided with heat sensing units attached to the motor windings, which shall be connected to the control panel to shut down the pump if overheating occurs.

The minimum motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.3. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. Motor shall meet the requirements of NEMA part 30 and 31 for operation on PWM type VFD's. All motors shall be fitted with shaft grounding rings if they are going to be on VFD service. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

1. Power Cable:

   The power cable shall be sized according to the NEC standards and shall be of sufficient length to reach the junction box without the need of any splices. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity. The motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire pump performance curve, from shut-off through run-out.

E. Bearings and Shaft

An upper radial bearing and a lower thrust bearing shall be required. These shall be heavy-duty single row ball bearings that are permanently lubricated by the dielectric oil that fills the motor housing. The upper radial bearing shall have a minimum B-10 life at the specified condition of 50,000 hours, and the lower thrust bearing shall have a minimum B-10 life at the specified condition of 50,000 hours.

The shaft shall be machined from a solid 416 stainless steel forging and be a design that is of large diameter with minimum overhang to reduce shaft deflection and prolong bearing life.

F. Mechanical Seals

The pump shall be provided with a mechanical rotating shaft seal system running in an oil reservoir having separate, constantly lubricated lapped seal faces. The lower seal unit between the pump and oil chamber shall consist of one (1) stationary seat and one (1) rotating ring held in place by its own spring. The lower seal shall be removable without disassembling the seal chamber. The upper seal between the motor and the seal chamber shall be of the same design with its own separate spring system. The lower and upper seals shall be carbon and ceramic. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The shaft sealing system shall

be capable of operating submerged to pressures equivalent to two hundred (200) feet. No seal damage shall result from operating the pump unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication. The seal chamber shall also be equipped with a seal failure sensor probe which will sense water intrusion through the lower seal. This sensor is to be connected to an alarm in the control panel to indicate lower seal failure.

G. Impeller

Impeller shall be ductile iron ASTM A-536 of a non-clog design capable of handling minimum three (3) inch sphere solids, fibrous material, heavy sludge and other matter found in normal sewage applications. Impeller shall be of the two-vane, enclosed non-clogging design and have pump-out vanes on the front and backside of the impeller to prevent grit and other materials from collecting in the seal area.

Impellers shall be dynamically balanced. The tolerance values shall be listed below according to the International Standard Organization grade 6.3 for rotors in rigid frames. The tolerance is to be split equally between the two balance planes that are the two impeller shrouds.

RPM	**Tolerance**
1750	.02 in. – oz./lb. of impeller weight

Impeller shall be either slip fit or taper fit with key to securely lock the impeller to the driving shaft. A 300 series stainless steel washer and impeller bolt shall be used to secure the impeller to the shaft for both threaded and tapered shafts. Straight end shafts for attachment of the impeller shall not be acceptable.

H. Volute

The casing shall be of the end suction volute type, cast iron ASTM A-48 Class 30, having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the centerline discharge type equipped with an automatic pipe coupling arrangement for ease of installation and piping alignment. The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers.

A volute case wear ring shall be provided to minimize impeller wear. The wear ring shall be Alloy 230 brass, ASTM B-43 and held by 300 series stainless steel fasteners. The wear ring shall be easily replaceable in the field.

I. Lifting System

Each submersible pump shall be provided with a Type 316 stainless steel lifting chain and bale of sufficient length extending from the top of the station to the pump unit. The working load of the lifting system shall be 50% greater than the pump unit weight.

J. Protection

Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm.

2.04 FLOW METER – If Required

SITRANS F M MAG 5100 W electromagnetic flow meter manufactured by Siemens shall be installed in a separate vault if required by the Town. The flow meter shall be rated for flood submergence (IP68) and and be combined with SITRANS F M MAG 5000 transmitter. The vault shall be of sufficient size to accommodate the meter. Plug valves shall be included upstream and downstream of the meter to allow for servicing. A drain shall be provided on the vault. The transmitter shall be incorporated into the station control panel.

2.05 SCADA SYSTEM

A. The SCADA system panel shall be incorporated into the station control panel.

1. OmniSite Crystal Ball Cellular Dialer

   a. Power: 12 VDC or 120 VAC

   b. Communications: Cellular GSM 850/900/1800/1900 MHZ

   c. Access Key: Smart security key to identify personnel on site

   d. Terminal Blocks: Removable style accepts #14-18 AWG solid or stranded wire.

   e. Operating Temperature -20/150 Deg. F

   f. Operating Humidity: 0-90% RH Non-condensing

   g. Certifications: UL Pending

   h. Dimensions: 8.9"H x 9.4"W x 3.8"D

   i. Memory Stick: Shall have one (1) gigabyte storage space

   j. LCD Display: 4x20 rugged operation

   k. Keypad: Eight (8) universal navigation buttons

   l. Analog Inputs: Four (4) 4-20mA, isolated, 10 bit resolution

   m. Relay Outputs: Four (4) 20A @ 120 VAC resistive.

   n. Digital Inputs: 14 Universal inputs accept 12 VAC/VDC – 120 VAC/VDC

2.06 PUMP STATION CONTROLLER – Required for Lift Stations with larger than 15 Hp pumps.

A. Pump station controller shall be manufactured by USEMCO, Inc., Tomah, Wisconsin. The controls shall have the following features.

1. Graphic touch screen
2. Event log
3. Dry telemetry contacts for high and low level, transducer fail, pumps failed, and common alarm.
4. Password protected.
5. High and low level alarms and timers.
6. Pumps on delay, and start fail timers.
7. Operation based on transducer level input.
8. Seal fail and motor over temperature indication.

2.07 VARIABLE FREQUENCY DRIVES – If Required

A. The Variable Frequency Drives, if required, shall be incorporated into the station control panel.

B. General Information

VFD shall be Allen-Bradley

This section provides specification for AC variable frequency drives or herein identified as VFD's for use with {NEMA A, NEMA B} design AC induction motors.

Any exceptions / deviations to this specification shall be indicated in writing and submitted with the quotation.

References
The products covered in this section shall be designed, manufactured, and tested in accordance with the latest applicable standards as follows:

CSA 22.2 N14-95	Industrial control equipment
EN 50178	Low Voltage Directive
EN 60204-1	Safety of machinery-electrical equipment of machines. Part 1 - Specification for general requirement.
EN 60950	Safety of information technology equipment including electrical business equipment.
EN 61010-1	Safety requirement for electrical equipment for measurement, control, and laboratory use. Part 1 – general requirement.
EN 61800-3	Electro Magnetic Compliance
UL 508	Industrial control equipment.

UL 508C	Power conversion equipment.
IEC 664	Insulation coordination for equipment within low-voltage systems.
IEC 60068-2-6	Environmental testing – Part 2 – Test Fc: vibration (sinusoidal).
IEC 60068-2-27	Environmental testing. Part 2: Tests. Test Ea and guidance: Shock
IEC 801-4	Electrical Fast Transient (Supplementary Wave).
NEMA ICS6	Industrial control and systems enclosures.
NEMA 250	Enclosures for electrical equipment.

C. Quality Assurance

The manufacturer of the VFD shall be a certified ISO 9001 and ISO 14000 facility.

The VFD, including its internal electronic thermal overload protection circuit, shall be UL and cUL Listed in accordance to UL 508C - Power Conversion Equipment.

UL / cUL labels shall be attached on the outside of each VFD as verification.

The VFD shall be designed in accordance with NEMA, IEC, EN, UL and CSA standards.

The VFD manufacturer shall have 20 years of experience, minimum, in the design, construction and application of variable frequency drives.

The VFD manufacturer shall have an existing service organization.

The manufacturer of the VFD shall have the ability to design and manufacture insulated gate bipolar transistors (IGBT) to be incorporated into the construction of the VFD.

The manufacturer of the VFD shall have the ability to evaluate any component failure at their own analysis lab. The services available shall include x-ray magnification of components, complete electrical testing, and the ability to analyze failures within the components.

D. Description

The VFD shall convert the input AC mains power to an adjustable frequency and adjustable voltage as defined in the following sections.

The input power section shall utilize a full wave 6-pulse bridge design incorporating diode rectifiers. The diode rectifiers shall convert AC line power of fixed voltage and frequency to fixed DC voltage. This power section shall be insensitive to phase sequence of the AC line voltage.

The DC bus shall have external connections for external braking and allow for customer common DC Bus for multiple drive regeneration.

The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall utilize insulated gate bipolar transistors (IGBT's).

2.08 PUMP STATION CONTROL PANELS

A. All of the power, alarm and automatic control equipment for the station is to be supplied by one manufacturer and properly designed to operate the pumps supplied with the station. The control panel shall be of sufficient size to accommodate all required equipment and shall be factory assembled, wired, tested and covered by complete electrical drawings and instructions. The control panel shall be UL listed 698A.

B. General

1. The Pump Control Panel enclosures shall be as follows:

   a. Freestanding or rack mounted (as detailed on drawings or as approved via shop drawing review process) enclosures located outside shall be rated NEMA 4X, stainless steel, provided with accessories and components as shown on the drawings and detailed in the project specifications. Enclosures mounted inside electrical buildings shall be NEMA 12.

2. Provide water tight conduit hubs for all NEMA 4X enclosures, conduit seals for explosion-proof wiring applications, and moisture seals for non-hazardous applications.

C. Panel Construction

1. General

   a. Stiffening members shall be provided for strength and stiffness as required.

   b. Seamless welded construction shall be used throughout. All exposed seams shall be continuously welded and ground smooth.

   c. Lifting rings shall be provided.

   d. Sub panels shall be provided as required, with mounting designed for easy removal. The subpanels shall be finished with 2 coats of white enamel paint.

   e. Print pockets shall be attached to the interior side of each door.

   f. Hinges shall be stainless steel piano continuous hinge type.

   g. Provide 3-point door latching mechanisms with handles on front of panel door(s).

   h. Provide gasketing if required for rating.

D. Panel Grounding

1. Provide an equipment grounding bus bar or terminal block.

   a. The ground busbars shall be of nickel-plated copper, rated for 200

amperes.

b. The bus bar shall be provided with two (2) screw clamp terminal blocks, which shall be capable of accepting conductors up to #3/0 AWG.

c. Provide a secondary ground bus bar with a minimum of twenty (20) screw clamp terminal blocks, which shall be capable of accepting conductors up to #10 AWG.

E. Panel Wiring

1. Wiring within the enclosure shall be continuous and shall be terminated only at terminal blocks or equipment terminals.

2. Not more than two wires shall be terminated at any terminal.

3. Wiring splices and wire nuts will not be permitted within the enclosure.

4. Wiring within the enclosure shall be protected as follows:

a. In general, all wiring within the enclosure shall be put in plastic wiring ducts. Wiring ducts shall be sized to include 100% (percent) spare capacity.

b. Wiring outside of the ducts shall be restrained by means of plastic ties.

c. Wiring passing a door hinge shall be grouped and wrapped in a protective wire harness.

d. Provide abrasion protection for wire bundles passing through holes or across metal edges.

5. In general, wiring within the enclosure shall be as follows:

a. Control wiring within the enclosure shall be #14 AWG stranded, type MTW, 600V.

b. Wiring for 4-20 mA DC analog signals shall be #16 AWG twisted shielded pair, except #14 AWG size shall be used for analog circuits of 100Ft or longer.

1) Cables shall meet the following criteria:

a) U.L. Listed Subject 1277
b) Pass IEEE 383 or UL 1581 Flame Test
c) OSHA Acceptable
d) Pall UL VW-1 Flame Test
e) #16 AWG conductors, 7 strand, bare copper
f) 100% aluminum/polyester foil shield
g) 600 volt 90o C rated insulation
h) Each conductor shall be numbered and color-coded.
i) Comply with NEC articles #318, #340 and #501, for power limited tray cable (PLTC)

j) Nominal 2" lay
k) PVC insulation, with ripcord and nylon jacket
l) Suitable for use in wet locations

2) The manufacturer of the cables shall be an ISO 9001 certified facility.

6. In general, wiring within the enclosure shall follow the following color convention to comply with NFPA 79 (1994), part 16:

a. Neutral conductors shall be white.

b. Line, load and control conductors shall be black.

c. Grounding conductors shall be green.

d. Foreign voltage control conductors shall be yellow or orange.

e. Low voltage (below 50 volts) AC conductors shall be red.

f. Low voltage neutral (grounded) conductors shall be white with a red stripe.

g. DC control conductors shall be blue.

h. DC (+) power conductors shall be blue with a white stripe or purple.

i. DC (-) (grounded) power conductors shall be white with a blue stripe.

j. Wiring with multi-conductor cables shall be color-coded.

Note: Foreign voltage means all control circuits that may remain energized when the main disconnecting means is in the OFF position. Interlocking conductors shall be yellow or orange throughout the entire circuit, including wiring in the control panel and the external field wiring.

7. AC and DC wiring shall be separated from each other. Where AC and DC wire runs parallel, the minimum separation between them shall be four (4) inches. Where AC and DC wire runs cross, they shall cross at 90o. Provide separate wiring duct for AC and DC wiring.

8. Equipment and signal ground wiring, as well as Neutral wiring, shall not be daisy-chained; they shall each be terminated at isolated, bussed terminal blocks.

9. Each conductor end shall be terminated at a terminal block or at an equipment-wiring terminal. Each terminal block shall have a unique identification number. The terminal blocks shall be arranged and numbered in consecutive order, based on standard alphanumeric order.

10. Terminal blocks within enclosure shall be grouped as follows:

a. 120 Volts AC power.

b. 120 Volts AC control wiring.

c. AC isolated Neutral.

d. 24 Volts DC power.

e. 24 Volts DC control wiring for discrete signals

f. 24 Volts DC Common.

g. Analog signal wiring (for 4-20 mA DC signals).

h. Grounding.

11. Provide 25% spare terminal blocks (minimum of six) for each type used in each enclosure.

F. Terminal Blocks

1. Except for incoming power terminal blocks, terminal blocks within enclosures shall be of the high density modular types, constructed of nylon material, suitable for mounting on standard DIN rails. Termination type shall be tubular screw with serrated pressure plate. The terminal block system shall be manufactured by Phoenix Contact, Weidmuller, or equal.

2. All current carrying parts (metal bodies) shall be made of nickel/tin-plated copper.

3. Ground terminals shall be color coded in accordance with international standard, which shall be yellow/green.

4. Matching jumper bridges shall be color coded to the wiring colors.

5. Panel power distribution fused terminal blocks shall be provided with disconnect lever puller mechanism and illuminated indication.

a. Fused shall be standard ¼" by 1-¼", and shall be sized as shown on the drawings.

b. The terminal blocks shall be able to accept up to number 8 AWG conductor.

c. Terminal blocks shall be rated for 15 amps at 250 VAC.

d. Terminal blocks shall be Phoenix Contact type UK 6.3-HESiLA-250, Weidmuller type 6/2, or equal.

6. Terminal blocks for discrete inputs and outputs shall be two-level types:

a. Both levels shall be of the feed through types.

b. Terminals shall be rated for up to 20 amperes at 300 VAC, and shall be able to accept up to #12 stranded conductors.

c. Terminal blocks shall be Phoenix Contact type UKKB-3, Weidmuller WDK 2.5, or equal.

7. Terminal blocks for analog inputs and outputs shall be three-level types:

a. The top and center terminations shall be feed through types.

b. The bottom termination shall be grounded through the railing.

c. The terminal blocks shall be rated for up to 10 amperes at 300 VAC, and shall be able to accept up to #12 AWG stranded conductors.

d. The terminal blocks shall be Phoenix Contact type SLKK-5, Weidmuller type DLD 2.5/PE or equal.

8. Terminal blocks for foreign voltage "hot" conductors shall be single level disconnecting type:

a. Blocks shall be orange or yellow to match control wiring per Part 2.04, F.

b. The terminal blocks shall be rated for 10 amperes at 300 VAC, and shall be able to accept #22 thru #12 AWG conductors.

c. The terminal blocks shall be lever type with clear indication of open/close status.

d. The terminal blocks shall be Weidmulller type WRT 2.5, Phoenix Contact or equal.

G. Panel Accessories

1. Provide (furnish and install) interposing relays to interface all field-mounted equipment with power limited electronic control and communication equipment including the wet well and dry well devices. Use intrinsically safe relays where devices are located in hazardous areas.

2. Provide thermostatically controlled heater with integral fan and integral thermostat.

3. Provide an air conditioner unit if VFD's are included in the panel.

H. Panel Instruments

1. Provide all analog signal boosters and isolators necessary to interface all field mounted equipment with control system equipment.

2. Provide audible alarm signaling devices. The device shall be as manufactured by Edwards, Federal Signal, Benjamin, or equal. The unit shall incorporate the following:

a. Flush panel mounting.

b. Weather and vandal resistant

c. Internal gain control for output adjustment (80 dba maximum at 15 feet)

d. UL listed

e. Operating Voltage: 120 VAC

I. Pilot and Control Devices

1. Pilot Devices: Pushbuttons, selector switches, and indicating lights shall be rated heavy-duty, oil-tight or watertight and corrosion resistant as required. All units shall be furnished with standard size legend plates with legends as described on the project Drawings.

2. Selector switches shall have the number of positions, switching arrangement, number and type of contact blocks indicated on the project Drawings.

3. Contact blocks shall have a minimum continuous current rating of 10 amperes at 240 VAC. Contact blocks shall have screw type connection terminals.

4. Indicating lights shall be light emitting diode type 120VAC, color cap, and push-to-test feature. Provide flashing type lights where indicated.

5. Pilot device manufacturers shall be:

a. Same manufacturer as motor starters.

6. Control relays shall be plug-in type with sockets and hold-in clips. Sockets shall have screw terminals. Contacts shall be silver-cadmium, rated 10 amperes at 240 VAC. Relays shall have three-pole, double throw contacts (3PDT). Relays shall have a manual operator and pilot light. Coil voltages shall be 120 VAC, or as noted on the project Drawings. Relays shall be as manufactured by same manufacturer as motor starters.

J. Equipment Identification and Wire Tagging

1. All control wiring shall be identified by means of computer-generated, heat shrink type wire marker. Wire numbers shall be as shown on the drawings.

2. Each component mounted within the enclosure shall be provided with equipment identification. Equipment and device nameplates or identification shall be of engraved laminated plastic, with black lettering on white background. Nameplates shall be as listed herein or as shown on the project Drawings.

K. Regulated Power Supply

1. When DC power supply is required for controllers, and 2-wire analog loops, provide two redundant 24 V DC regulated power supplies.

2. The contractor shall be responsible for providing and sizing all instrument loop power supplies. The instrument loop power supplies shall be sized to include at

least 100% spare capacity. Submit power supply load calculations with the panel shop drawings.

3. The power supply shall be sized to include 100% spare capacity.

4. Acceptable power supply manufacturers:

   a. Phoenix Contact

   b. SOLA

   c. Or equal

L. Accessory Circuit Breakers

1. Accessory circuit breakers shall have terminal lug wire size #14 - #2 AWG Cu or Al. Reversible line and load lugs for flush mount wiring. DIN mounted (symmetrical rail 35 x 7.5 DIN/EN 50 022). UL Listed as HACR type from 15 A to 70 A. Field installable quick connectors. Single handle with internal common trip. UL Listed 120/240VAC (10,000 AIC).

2. Accessory circuit breakers shall be thermal magnetic type.

3. Accessory circuit breakers shall be supplied with reversible lugs. Mounting brackets shall be provided for flush installation.

4. Accessory circuit breakers shall be Square D Class 860, Multi 9 miniature circuit breakers, or equal.

M. Motor Branch Circuit Breakers

1. Motor branch-circuit breakers shall be motor circuit protector type with adjustable instantaneous trip.

2. Motor branch-circuit breakers shall be provided by manufacturer/supplier of the motor starters/controllers.

N. Accessory and Control Power Transformer

1. Accessory and control power transformer primary shall be as specified on the drawings, dry type, rated 240 volt primary, 120 volt secondary, 60HZ, single phase, with two 5% FCBN taps, 115 degrees C temperature rise.

O. VFD (Variable Frequency Drives) – If Required.

1. Pump Control Panels shall incorporate the use of variable frequency drives indicated on drawings.

2. A NEMA rated full voltage non-reversing motor starter with manual reset, ambient compensated, 3-phase thermal overload relay shall be provided for the pump(s). The bypass NEMA starters will be employed in the event of a VFD failure. The motor starter pilot voltage shall be 120 volts.

P. Motor Starters/Controllers

1. NEMA size 1 shall be the smallest acceptable size. Provide sizes as required by the motor as shown on the drawing.

2. All magnetic motor starters shall be NEMA rated; not IEC type.

3. Provide a control power transformer for 120VAC control wiring. Transformer shall be sized to meet the requirements of the control circuit involved. Overcurrent protection shall be provided by an accessory breaker or fuses.

4. Each phase of a motor circuit shall have an overload relay. The Contractor shall be responsible for providing the correct overload and/or adjusting the overloads. The overloads shall be adjusted in accordance with the actual, full load, nameplate current rating of the motor supplied.

5. All magnetic motor starters shall have as a minimum, a hand-off-auto selector switch, "on" pilot, "off" pilot, and one set of auxiliary contacts.

6. Magnetic starters shall be manufactured by the same manufacturer.

7. All motors shall be protected by an adjustable, automatic resetting phase failure relay with adjustable time delay.

8. All motors shall an individual instantaneous motor circuit protector, or a thermal magnetic circuit breaker. MCPs shall have a continuous current rating not less than 125% of the motor full load amperes, and shall trip at approximately 1100% of FLA. Circuit breakers shall be sized at not less than 200% of motor full load amperes and not more than 250% of motor FLA.

9. All submersible pumps with integral thermal and seal failure/moisture protection devices shall have intrinsic safety relays and control wiring interlock to motor starters. Proof of this interlock must be provided to the pump manufacturer so as not to void the pump warranty.

10. All power wiring shall terminate on power distribution blocks. Each conductor shall have an individual termination. Do not share terminations for more than one wire.

11. Provide an alternator relay to alternate the activation of each motor. This feature may be built-in to a programmable controller.

12. Where indicated on the drawings, provide reduced voltage motor starters with solid state components that include overload protection, adjustable motor starting parameters, built-in bypass contacts, control interface module, and pump control. The solid starter shall also indicate the type of failure such as over-temperature, jam, stall, phase loss, and phase reversal. Surge suppression components shall also be included with the motor starters. Reduced voltage starters shall have a pump control option or approved equal.

13. Motor branch-circuit breaker and reduced voltage motor starters shall be by the same manufacturer.

Q. Contactors and Relays

1. These units shall be type and size with the number of poles and accessories as indicated on the Drawings.

2. Unless indicated otherwise, these units shall be by the same manufacturer as the magnetic motor starters.

3. Control relays shall be plug-in "ice-cube style" with screw terminal base and hold-in clips.

R. Accessory Devices

1. These devices shall be heavy duty type and shall mount in the starter/pump control panel enclosure on the swing out panel or panel door, as indicated.

2. Unless otherwise indicated, these devices shall be by the same manufacturer as the magnetic motor starters.

S. Pump Panel Enclosure

1. Provide stainless steel NEMA 4X or NEMA 12 enclosures, as indicated on the drawings, with interior painted steel back panel for mounting components, interior painted steel swingout panel for mounting control devices such as control switches and pilot lights, and exterior door with padlock hasp. Non-metallic swingout and non-metallic back panels are not acceptable. Hoffman, Weigman, or equal.

T. Transient Voltage Surge Suppression System

1. The TVSS shall be constructed using multiple surge current diversion arrays of metal oxide varistors (MOV), matched to 1% variance. The array shall consist of multiple gap-less metal oxide varistors, with each MOV individually fused. The arrays shall be designed and constructed in a manner which ensures MOV surge current sharing. No gas tubes, silicon avalanche diodes or selenium plates/rectifiers shall be used. The status of each array shall be continuously monitored and a green LED shall be illuminated if the array is in full working order. All protection modes, including N-G, shall be monitored and internally fused. Summary alarm dry contacts shall be provided: phase loss, undervoltage, power loss, protection failure. Similar to Liebert Accuvar Series# ACV 480D 200 RK, or equal by LEA International, or Advanced Protection Technologies.

U. Other Control Devices and Accessories

1. Refer to the project drawings and details for other control components and equipment that may be required for this project, in addition to the devices and components noted above. Drawings and specifications are intended to be complimentary.

2. For Lift Stations with pumps larger than 15 Hp.

a. A submersible transducer shall be supplied for primary pump control. It shall send a 4-20 mA signal to the pump controller and shall be a Sigma 6100 or equal.

b. One multitrode sensor, model 3.0/1XX and a MTR relay or FOGROD equal shall be supplied for backup control and shall be completely separated from the main pump control.

3. For Lift Stations with pumps 15 Hp and smaller.

a. One multitrode sensor, model 3.0/1XX and a MTR relay or FOGROD equal shall be supplied for primary control.

b. A standard 4 float system (Pumps off, Lead On, Lag On, Alarm) shall be provided as backup control and shall be wired separately from the primary controls.

2.09 PANEL AIR CONDITIONER – REQUIRED IF VFD'S ARE PROVIDED

A. An Air Conditioner shall be included to keep safe operating temperatures for the VFD's. The unit will have a stainless steel cabinet and corrosion resistant package.

B. Heat balance calculations shall be submitted with the shop drawings for the control panel showing that the system is capable of functioning without damage or premature control failures with all equipment in operation at the ambient temperatures specified.

C. Temperature calculations shall consider the following:

- VFD operating temperature ranges -10° to 50°C.
- Ambient temperature of -20°F to +104°F.
- Heating system designed for -20°F with no components in operation, windy conditions and no solar heat gain.
- Cooling system designed for +104°F with one drive and all components necessary for operation of the system, solar heat gain from bright sun and no wind.

2.10 SPARE PARTS

A. Contractor is required to supply the following spare parts:

- One spare Impeller for each pump
- One complete set of gaskets, wear rings and mechanical seals for each pump
- One set of spare level controller(s)- transducer, level probe or floats; one duplicate for each provided in the station. i.e. if the station has one transducer and one level probe, provide an extra of each.
- any other spare equipment recommended by the pump/panel manufacturer.

PART 3 – EXECUTION

3.01 PREPARATION

A. Coordinate with other trades, equipment and systems to the fullest extent possible.

B. Take all necessary measurements in the field to determine the exact dimensions for all work and the required sizes of all equipment under this contract. All pertinent data and dimensions shall be verified by the Contractor.

3.02 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Contract Drawings. Anchor bolts shall be set in accordance with the manufacturer's recommendations and setting plans.

B. The Contractor shall also provide from the submersible pump supplier the service of a qualified start-up engineer (factory representative) who has had prior on-site start-up experience to assist in performing start-up, check-out and initial operation services of the pumping units. The start-up engineer shall also instruct the Town's personnel on the operation and maintenance procedures for the station. Qualified supervisory services, including manufacturers' engineering representatives, shall be provided for a minimum of two (2) full working days to ensure that the work is done in a manner fully approved by the respective equipment manufacturer. The pump manufacturer's representatives shall specifically supervise the installation of the pump and the alignment of the connection piping. If there are difficulties in the start-up or operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Town.

C. A certificate from the pump manufacturer shall be submitted stating that the installation of his/her equipment is satisfactory, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.03 FIELD TESTS

After installation of the pumping equipment, and after inspection, operation, testing, and adjustment have been completed by the qualified start-up engineer, each pump shall be given a running test in the presence of the Town. Testing shall be conducted to indicate that the pumps, motors, and drives generally conform to the efficiencies and operating conditions specified and its ability to operate without vibration, overheating, or over-loading. The pumps and motors shall operate at the specified capacities in the range of heads and capacity specified without undue noise or vibration. Any undue noise or vibration in the pumps or motors, which is objectionable, will be sufficient cause for rejection of the units.

3.04. PUMP WARRANTY

Pump warranty shall be provided by the pump manufacturer and shall warrant the units against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. The warranty shall be in printed form and apply to all similar units. A copy of the warranty statement shall be submitted with the approved shop drawings.

END OF SECTION