THOMAS & HUTTON

BIDDING, CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

For

2016 SPLOST NORTH MAINLAND

PHASE II PUMP STATION IMPROVEMENTS

PREPARED FOR:

BRUNSWICK-GLYNN COUNTY JOINT WATER & SEWER COMMISSION

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SECTION 02204

EARTHWORK

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1.1 SECTION INCLUDES

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C. Backfilling.

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1.2 RELATED SECTIONS

A. Section 02211 – Erosion, Sedimentation, and Pollution Control (GA)

B. Section 02730 – Wastewater Pump Station

1.3 MEASUREMENT AND PAYMENT

A. Earthwork – All earthwork associated with the grading the pump station site shall not be measured for direct payment. Payment for the earthwork shall be included in the pump station lump sum price.

B. Dewatering – No direct payment shall be made for dewatering. Dewatering shall be included in the item to which it pertains.

1.4 REFERENCES

A. ASTM D 448–98 – Sizes of Aggregate for Road and Bridge Construction.

B. ASTM D 1556–00 – Density and Unit Weight of Soil in Place by the Sand–Cone Method.

C. ASTM D 1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.

D. ASTM D 2167–94 – Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

E. ASTM D 2487–00 – Classification of Soils for Engineering Purposes (Unified Soil Classification System).

F. ASTM D 2922–96e1 – Density of Soil and Soil–Aggregate in Place by Nuclear Methods (Shallow Depth).

G. ASTM D 3017–96e1 – Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

H. ASTM D 3740–01 – Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

I. ASTM E 329–00b – Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

1.5 SUBMITTALS

A. Section 01300 – Submittals: Procedures for submittals.

B. Materials Source: Submit names of materials source.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with Federal, State of Georgia, and Glynn County standards.

1.7 TESTING

A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 698, (Standard Proctor).

B. In place density tests in accordance with ASTM D 1556 or ASTM D 2922.

C. Testing laboratory shall operate in accordance to ASTM D 3740 and E 329 and shall be accepted by the Engineer.

D. The testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any of the tests.

E. Testing shall be Contractor's responsibility and performed at Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph C above.

F. Test results shall be furnished to the Engineer.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Borrow shall consist of sand or sand–clay soils capable of being readily shaped and compacted to the required densities, and shall be free of roots, trash and other deleterious material.

B. All soils used for structural fills shall have a PI (plastic index) of less than 10, and a LL (liquid limit) of less than 30. Fill soils shall be dried to appropriate moisture contents prior to compaction.

C. Additionally, fill soils used for the top 2 feet of fill beneath roads and parking lots shall have no more than 15% passing the # 200 sieve. Fill soils used for house lots shall have no more than 25% passing the # 200 sieve.

D. Contractor shall furnish all borrow material.

E. Contractor shall be responsible for and bear all expenses in developing borrow sources including securing necessary permits, drying the material, haul roads, clearing, grubbing, excavating the pits, placing, compaction and restoration of pits and haul roads to a condition satisfactory to property owners and in compliance with applicable state and local laws and regulations.

2.2 SOURCE QUALITY CONTROL

A. If tests indicate materials do not meet specified requirements, change material and retest.
B. Provide materials of each type from same source throughout the Work.

PART 3 – EXECUTION

3.1 TOPSOIL

A. Contractor shall strip all topsoil and stockpile on site at a location determined by the Owner at the Contractor's expense.

B. Topsoil shall be placed to a depth of 4" over all disturbed areas.

C. Any remaining topsoil will be hauled off site at the Contractors expense.

D. Do not excavate wet topsoil.

3.2 EXCAVATION

A. Shall be defined as unclassified excavation.

B. Suitable excavation material shall be transported to and placed in fill areas within limits of the work.

C. Unsuitable material, encountered in areas to be paved and under building pads, shall be excavated 2 feet below final grade and replaced with suitable material from site or borrow excavations.

D. Unsuitable and surplus excavation material not required for fill shall be disposed of off site.

E. Proper drainage, including sediment and erosion control, shall be maintained at all times. Methods shall be in accordance with the National Pollutant Discharge Elimination System standards and other local, state and federal regulations.

F. Unsuitable materials as stated herein shall be highly plastic clay soils, of the CH and MH designation, border line soils of the SC–CH description, and organic soils of the OL and OH description based on the Unified Soils Classification System. Further, any soils for the top two feet of pavement subgrade shall have no more than 15% passing the # 200 sieve.

3.3 GROUND SURFACE PREPARATION FOR FILL

A. All vegetation such as roots, brush, heavy sods, heavy growth of grass, decayed vegetable matter, rubbish, and other unsuitable material within the areas to be filled shall be stripped and removed prior to beginning the fill operation.

B. Sloped ground surfaces steeper than 1 vertical to 4 horizontal, on which fill is to be placed shall be plowed, stepped, or benched, or broken up as directed, in such a manner where fill material will bond with the existing surface.

C. Surfaces on which fill is to be placed and compacted shall be wetted or dried as may be required to obtain the specified compaction.

3.4 FILL

A. Shall be reasonably free from roots, organic material, trash and stones having dimensions greater than 4 inches.

B. Shall be placed in successive horizontal layers 8 inches to 12 inches in loose depth for the full width of the cross–section and compacted as required.

3.5 TOLERANCES

A. Unpaved areas to within 0.1 feet of elevations shown on the drawings provided such deviation does not create low spots that do not drain.

B. Paved Areas – Subgrade to within 0.05 feet of the drawing elevations less the compacted thickness of the base and paving.

3.6 FINISHED GRADING

A. All areas covered by the project including excavated and filled sections and adjacent transition areas shall be smooth graded and free from irregular surface changes.

B. Degree of finish shall be that ordinarily obtainable from either blade–grader or scraper operations, supplemented with hand raking and finishing, except as otherwise specified.

C. The finished surface of unpaved areas shall be not more that 0.10' above or below the established grade or approved cross–section.

D. Ditches and lagoon banks shall be finished graded, dressed and seeded within fourteen (14) calendar days of work to reduce erosion and permit adequate drainage.

3.7 DISPOSAL OF WASTE MATERIAL

A. All vegetation roots, brush, sod, broken pavements, curb and gutter, rubbish, and other unsuitable or surplus material stripped or removed from the limits of construction shall be disposed of by the Contractor.

3.8 PROTECTION

A. Graded areas shall be protected from traffic, erosion, settlement, or any washing away that may occur from any cause prior to acceptance.

B. Contractor shall be responsible for protection of below grade utilities shown on the drawings or indicated to him by the Owner at all times during earthwork operations.

C. Repair or re–establishment of graded areas prior to final acceptance shall be at the Contractors expense.

D. Site drainage shall be provided and maintained by Contractor during construction until final acceptance of the project. Drainage may be by supplemental ditching, or pumping if necessary, prior to completion of permanent site drainage.

3.9 DRAINAGE

A. Contractor shall be responsible for providing surface drainage away from all construction areas. This shall include maintenance of any ditches that exist or may be constructed by others in the immediate vicinity of the work. Contractor shall provide proper and effective measures to prevent siltation of wetlands, streams, and ditches both on the Owner's property, and those properties downstream.

3.10 FIELD QUALITY CONTROL

A. Compaction testing shall be performed in accordance with ASTM D 1556 or D 2922. Where tests indicate the backfill does not meet specified requirements, the backfill shall be removed, replaced, and retested at the Contractor's expense.

B. Unpaved areas – at least 90% of maximum laboratory density at optimum moisture content unless otherwise approved by the Engineer.

C. Paved Areas and Under Structures – top 6 inch layer of subgrade to at least 100% of maximum laboratory density at optimum moisture content. Layers below top 6 inches shall be compacted to 95% of maximum laboratory density at optimum moisture content.

D. Rolling and compaction equipment and methods shall be subject to approval by the Engineer. Approval in no way relieves Contractor of the responsibility to perform in correct and timely means.

E. Number of Tests – Under paved areas, no less than one density test per horizontal layer per 5,000 square feet of subgrade shall be made. In unpaved areas, no less than one density test per horizontal layer per 10,000 square feet of fill area shall be made.

Under curb and gutter, no less than one density test per every 300 linear feet.

END OF SECTION

INDEX TO

SECTION 02211 – EROSION, SEDIMENTATION, AND POLLUTION CONTROL (GA)

SECTION 02211

EROSION, SEDIMENTATION, AND POLLUTION CONTROL (GA)

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Soil erosion, sediment and pollution control measures shall include all temporary and permanent means of soil protection, trapping soils and containment of pollutants on the construction site during land disturbing activities. Activities covered in this section are regulated by the Manual for Erosion and Sediment Control in Georgia (latest revision) and Georgia's National Pollutant Discharge Elimination System Permit (NPDES), General Permit No. GAR100002.

B. Reporting

C. Sampling

1.2 RELATED SECTIONS

A. Section 02204 – Earthwork

B. Section 02730 – Wastewater Pump Station

1.3 PURPOSES

A. The purpose of this section is to achieve the following goals:

1. Minimize soil exposure by proper timing of clearing grading and construction.

2. Retain existing vegetation whenever feasible.

3. Vegetate and mulch disturbed areas as soon as possible.

4. Divert runoff away from disturbed areas.

5. Minimize length and steepness of slopes when it is practical.

6. Reduce runoff velocities with check dams or surface roughing.

7. Trap sediment on site.

8. Inspect and maintain erosion, sedimentation and pollution control measures.

9. Report on condition of Best Management Practices (BMPs).

10. Sample site run off per Georgia's NPDES Permit.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of soil erosion, sedimentation and pollution control systems products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

Codes and Standards: Comply with all applicable Local, State and Federal Standards pertaining to soil erosion, sedimentation and pollution control.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instruction for soil erosion, sedimentation and pollution control materials and products.

1.6 MEASUREMENT AND PAYMENT

A. No unit measurements will be made for soil erosion control. Payment will be made at the lump sum price as shown for pump station bid proposal. The cost of soil erosion control shall include all equipment, labor, maintenance, monitoring, reporting, and materials necessary to comply with the State of Georgia NPDES Permit.

PART 2 – PRODUCTS

2.1 VEGETATIVE MATERIALS

A. Mulch

1. Dry straw or hay.
2. Wood chips, sawdust or bark.
3. Cutback asphalt.

B. Temporary Seeding

1. Annual Ryegrass
2. Browntop Millet

C. Permanent Seeding

1. Common Bermuda
2. Centipede

D. Sod

1. Common Bermuda

2. Centipede

3. St. Augustine

E. Fertilizer

1. Commercial 6–12–12

2.2 STRUCTURAL MATERIALS

A. Check Dam

1. Stone (2" – 10")

2. Bales of densely baled hay or straw wrapped with synthetic or wire bands (two minimum per bale).

B. Construction Exit

1. Minimum 20' x 50' x 0.5' layer of 1.5" to 3.5" stone with a geotextile underliner.

C. Filter Ring

1. Minimum 2' high stone ring. Stone shall be no smaller than 3" to 5" when utilized at storm drain inlets and pond outlets with pipe diameters less than 12".

2. Minimum 2' high stone ring. Stone shall be no smaller than 10" to 15" when utilized at storm drain inlets and pond outlets with pipe diameters greater than 12".

D. Sediment Barrier

1. Bales of densely baled hay or straw wrapped with synthetic or wire bands (two minimum per bale).

2. Silt Fence – Shall be a woven geotextile fabric sheet of plastic yarn composed of a long chain synthetic polymer with at least 85% by weight propylene, ethylene, amide, ester or vinylidene chloride, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultra–violet and/or heat exposure. The fabric shall be finished so the filaments will retain their relative position with respect to each other. The fabric shall be free of defects, rips, holes or flaws. The manufacturer shall have either an approved color mark yarn in the fabric or label the fabricated silt fence with both the manufacturer and fabric name every 100'.

The fabric shall meet the following requirements:

Grab Strength	90 lbs.
Mullen Burst Strength	150 lbs.
UV Resistance	80 %

E. Inlet Sediment Trap

1. Silt fence (Type C) supported by steel posts.

2. Baffle Box – Constructed of 2" x 4" boards spaced a maximum of 1" apart or plywood with weep holes 2" in diameter (See detail).

3. Sod Inlet Protection – Four (4) one (1) foot wide strips of sod on each side of the inlet (See detail).

4. Curb Inlet Protection – Eight (8) inch concrete blocks wrapped in filter fabric, placed in front of a curb inlet.

F. Storm Drain Outlet Protection

1. Geotextile fabric equivalent to Mirafi 140N.

2. Rip–rap (See detail for size).

2.3 CHEMICAL MATERIALS

A. Dust Control – Calcium Chloride, Anionic Asphalt Emulsion, Latex Emulsion or Resin–in–Water Emulsion.

B. Anionic Polyacrylamide (PAM) – Consult state and local laws concerning the regulations of this chemical.

PART 3 – EXECUTION

3.1 GENERAL

A. All disturbed soil areas except those to support paving shall be graded and protected from erosion with vegetative materials. Sedimentation discharge from the construction site into natural drainage ways and storm drainage systems shall be prevented by means of vegetative measures and temporary structural practices. These vegetative measures and structural practices are known as Best Management Practices (BMPs). Rainfall, pollution control measures and construction exit condition shall be monitored and reported on each day when construction activities take place. Erosion and sedimentation control measures shall be monitored and reported on every seven (7) days and within 24 hours of a qualifying rainfall event of 0.5–inches or more. Sampling of construction site discharging water shall be sampled within 45 minutes of a qualifying rainfall event and analyzed immediately or no later than 48 hours after collection. The above reports shall be submitted to the Georgia EPD by the fifteenth day of the month following the reporting period.

B. The Contractor (Operator) is considered a "Primary Permittee" and shall submit a Notice of Intent (NOI) in accordance with General Permit No.GAR100002 at least

fourteen (14) days prior to the commencement of construction activities. Contractor shall retain a copy of the Erosion, Sedimentation, and Pollution Control Plan and Comprehensive Monitoring Program required by above permit at construction site or be readily available at a designated alternate location from date of project initiation to date of final stabilization. Copies of all Notice of Intent, Notice of Termination, plans, monitoring reports and all other records required by above permit shall be retained by Contractor for a period of at least three (3) years from date the site is finally stabilized. Copies of Notice of Intent (NOI), Notice of Termination (NOT) and General Permit Number GAR100002 are found at the end of this section.

3.2 ON–SITE OBSERVATION

A. Engineer is required by General Permit No. GAR100002 to check the installation of Erosion, Sedimentation and Pollution Control measures within one (1) week after initial construction activities commence. The Contractor shall notify Engineer within 24 hours of control measures installation for the above site visit. Engineer, within the above parameters, shall check subsequent installation of control measures.

3.3 VEGETATIVE PRACTICES

A. Mulch

1. Dry straw or hay shall be applied at a depth of 2 to 4 inches by hand or mechanical equipment providing complete soil coverage. Straw or hay shall be anchored immediately after application. Straw or hay can be anchored with a disk harrow, packer disk or emulsified asphalt.

2. Wood chips, sawdust or bark shall be applied at a depth of 2 to 3 inches by hand or mechanical equipment providing complete soil coverage. Netting of the appropriate size shall be used to anchor the above materials.

3. Cutback asphalt shall be applied at 1,200 gallons per acre or 1/4 gallon per square yard.

B. Seeding

1. Seed shall be applied uniformly by hand, cyclone seeder, drill, cultipacker seeder or hydraulic seeder. Drill or cultipacker seeders shall place seed 1/4" to 1/2" deep. Soil shall be raked lightly to cover seed with soil if seeded by hand.

2. During times of drought, water shall be applied at a rate not causing runoff and erosion. The soil shall be thoroughly wetted to depth insuring germination of the seed. Subsequent applications of water shall be made when needed.

3. Refer to Section 02902 – Grassing for additional seeding requirements.

C. Sodding

1. Bring soil surface to final grade. Clear surface of trash, woody debris stones and dirt clods larger than 1". Mix fertilizer into soil surface. Apply sod to soil when surface is not muddy or frozen. Lay sod with tight joints and in straight lines. Do not overlap joints. Stagger joints and do not stretch sod. On slopes steeper than 3:1, sod shall be anchored with pins or other approved methods. Installed sod shall be rolled or tamped to provide good contact between sod and soil. Irrigate sod and soil to a depth of 4" immediately after installation. Irrigation shall be used to supplement rainfall for a minimum of 2–3 weeks.

2. Refer to Section 02902 – Grassing for additional sodding requirements.

3.4 STRUCTURAL MEASURES

A. Check Dam

1. Stone – Shall be constructed of graded size 2–10 inch stone underlaid with a geotextile fabric. Mechanical or hand placement shall be required to insure complete coverage of entire width of ditch or swale and center of dam is lower than edges. Sediment shall be removed when it reaches a depth of one–half the original dam height or before.

2. Haybale – Shall be staked and embedded a minimum of 4" and may be used as temporary check dams in concentrated flow areas while vegetation is becoming established. They should not be used where the drainage area exceeds one acre. Sediment shall be removed when it reaches a depth of one–half the original dam height or before.

B. Construction Exit

1. A stone stabilized pad shall be located at any point where traffic will be leaving the construction site to a public right–of–way, street, alley, sidewalk, parking area or any other area where there is a transition from bare soil to a paved area. The pad shall be constructed of 1.5" to 3.5" stone, having a minimum thickness of 6" and not less than 20' wide and 50' long. The pad shall be underlayed with a geotextile fabric. The pad shall be maintained in a condition, which will prevent tracking or flow of mud onto public rights–of–way. This may require periodic top dressing with 1.5" to 3.5" stone. All materials spilled, dropped, washed or tracked from vehicles or site onto roadways or into storm drains must be removed immediately.

C. Filter Ring

1. Shall surround all sides of the structure receiving runoff from disturbed areas. It shall be placed a minimum of 4' from the structure. It may also be used below storm drains discharging into detention ponds, creating a centralized area for sediment accumulation. When utilized below a storm drain outlet, it shall be placed such that it does not create a condition causing water to back–up into the storm drain and inhibit the function of the storm drain system. The larger stone can be faced with smaller filter stone on the upstream side for added sediment filtering capabilities.

Mechanical or hand placement of stone shall be required to uniformly surround the structure.

2. Filter ring must be kept clear of trash and debris. This requires continuous monitoring and maintenance, which includes sediment removal when one–half full. Filter rings are temporary and should be removed when the site has been stabilized.

D. Sediment Barrier

1. Hay or straw bales may be used in areas of low sheet flow rates. They shall not be use if the project duration is expected to exceed three (3) months. Bales shall be placed in a single row, lengthwise, and embedded in the soil to a depth of 4". Bales must be securely anchored in place by stakes or bars driven through the bales or by other acceptable means to prevent displacement. Bales shall be placed so the binding wire or twine around the bale will not touch the soil. Sediment shall be removed once it has accumulated to one–half the original height of the barrier. Barriers shall remain in place until disturbed areas have been permanently stabilized. All sediment accumulated at the barrier shall be removed and properly disposed of before the barrier is removed. The slope lengths contributing runoff to a bale barrier cannot exceed those listed below.

Land Slope (Percent)	Maximum Slope Length Above Bale (Feet)
< 2	75
2 to 5	50
5 to 10	35
10 to 20	20
> 20	0

2. Silt fence may be used in areas of higher sheet flow rates. The drainage area shall not exceed ¼ acre for every 100' of silt fence. **Silt fence shall not be installed across streams, ditches, waterways or other concentrated flow areas.** Silt fence shall be installed according to this specification, as shown on the construction drawings or as directed by the Engineer. See details on the construction drawings for installation requirements.

a) Type A – A 36" wide filter fabric silt fence shall be used on construction sites where the life of the project is greater than or equal to six (6) months.

b) Type B – A 22" wide filter fabric silt fence shall be limited to use on minor projects, such as residential home sites or small commercial developments where permanent stabilization will be achieved in less than six (6) months.

c) Type C – A 36" wide filter fabric silt fence with wire reinforcement shall be used where runoff flows or velocities are particularly high or where slopes exceed a vertical height of 10'. Along stream buffers and other sensitive areas, two (2) rows of Type C silt fence or one (1) row of Type C silt fence backed by hay bales shall be used.

3. Where all runoff is to be stored behind the silt fence (where no stormwater disposal system is present), the slope lengths contributing runoff to a silt fence barrier cannot exceed those listed below.

Land Slope (Percent)	Maximum Slope Length Above Fence (Feet)
< 2	100
2 to 5	75
5 to 10	50
10 to 20	25
> 20*	15

*In areas where the slope is greater than 20%, a flat area length of 10' between the toe of the slope and the fence shall be provided.

4. Sediment shall be removed once it has accumulated to one–half the original height of the barrier. Filter fabric shall be replaced whenever it has deteriorated to such an extent that the effectiveness of the fabric is reduced (approximately six months). Barriers shall remain in place until disturbed areas have been permanently stabilized. All sediment accumulated at the barrier shall be removed and properly disposed of before the barrier is removed.

E. Inlet Sediment Trap

1. Shall be installed at or around all storm drain inlets receiving runoff from disturbed areas. Sediment traps must be self draining unless they are otherwise protected in an approved manner that will not present a safety hazard. The drainage area entering the inlet sediment trap shall be no greater than one acre. Sediment traps may be constructed on natural ground surface, on an excavated surface or on machine compacted fill provided they have a non–erodible outlet.

2. Type C silt fence supported by steel posts may be used where the inlet drains a relatively flat area (slope no greater than 5%) and shall not apply to inlets receiving concentrated flows, such as in street or highway medians. The stakes shall be spaced evenly around the perimeter of the inlet a maximum of 3' apart and securely driven into the ground, approximately 18" deep. The fabric shall be entrenched 12" and backfilled with crushed stone or compacted soil. Fabric and wire shall be securely fastened to the posts and fabric ends must be overlapped a minimum of 18" or wrapped together around a post to provide a continuous fabric barrier around the inlet. The trap shall be inspected

daily and after each rain. Repairs are to be made as needed. Sediment shall be removed once it has accumulated to one–half the height of the trap. **Sediment shall not be washed into the inlet.** It shall be removed from the sediment trap and disposed of and stabilized so it will not enter the inlet again. When the contributing drainage area has been permanently stabilized, all materials and any sediment shall be removed and either salvaged or disposed of properly. The disturbed area shall be brought to proper grade, smoothed and compacted. Appropriately stabilize all disturbed areas around the inlet.

3. A baffle box shall be used for inlets receiving runoff with a higher volume or velocity. The box shall be constructed of 2" x 4" boards spaced a maximum of 1" apart or of plywood with weep holes 2" in diameter. The weep holes shall be placed approximately 6" on center vertically and horizontally. The entire box shall be wrapped in Type C filter fabric that is entrenched 12" and backfilled. Gravel shall be placed around the box to a depth of 2" to 4". The trap shall be inspected daily and after each rain. Repairs are to be made as needed. Sediment shall be removed once it has accumulated to one–half the height of the trap. **Sediment shall not be washed into the inlet.** It shall be removed from the sediment trap and disposed of and stabilized so it will not enter the inlet again. When the contributing drainage area has been permanently stabilized, all materials and any sediment shall be removed and either salvaged or disposed of properly. The disturbed area shall be brought to proper grade, smoothed and compacted. Appropriately stabilize all disturbed areas around the inlet.

4. Sod Inlet Protection shall be used only at the time of permanent seeding, to protect the inlet from sediment and mulch material until permanent vegetation has become established. The sod shall be place to form a turf mat covering the soil for a distance of 4' from each side of the inlet structure. Sod strips shall be staggered so adjacent strip ends are not aligned. Re–sod areas where an adequate stand of sod is not obtained. New sod should be mowed sparingly. Grass height should not be less than 2" to 3".

5. Curb Inlet Protection shall be used on curb inlets receiving runoff from disturbed areas once pavement has been installed. Place 8" concrete blocks wrapped in filter fabric in front of the curb inlet opening. A gap of approximately 4" shall be left between the inlet filter and the inlet to allow for overflow and prevention of hazardous ponding in the roadway. **This method of inlet protection shall be removed if a safety hazard is created.** Sediment shall be removed from curb inlet protection immediately.

F. Storm Drain Outlet Protection

1. Outlet protection aprons shall be constructed at all storm drain outlets, road culverts, paved channel outlets discharging into natural or constructed channels. Apron will extend from end of the conduit, channel or structure to the point of entry into an existing stream or publicly maintained drainage system. Apron length, width and stone size shall conform to details on the construction drawings. Apron shall be

constructed with no slope along its length. Invert elevation of the downstream end of apron shall be equal to the elevation of the receiving channel invert. There shall be no overfall at the end of apron. Apron shall be located so there are no bends in the horizontal alignment.

2. Subgrade for geotextile fabric and rip–rap shall follow required lines and grades shown on the construction drawings. Compact any subgrade fill required to the density of surrounding undisturbed material. Low areas in subgrade on undisturbed soil may also be filled by increasing rip–rap thickness. Geotextile fabric shall be protected from punching or tearing during installation. Repair any damage by removing rip–rap and placing another piece of fabric over the damaged area. All connecting joints shall overlap a minimum of 1'. If damage is extensive, replace entire geotextile fabric. Rip–rap shall be placed by equipment or hand. Minimum thickness of rip–rap shall be 1.5 times the maximum stone diameter. Immediately after construction, stabilize all disturbed areas around apron with vegetation.

3. Check outlet apron after heavy rains to see if any erosion around or below the rip–rap has taken or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

3.5 CHEMICAL MEASURES

A. Dust Control

1. Dust raised from vehicular traffic shall be controlled by wetting down roads with water or by the use of chemicals. Chemicals shall be applied in accordance with the manufacturer's recommendations.

B. Soil Binding

1. This temporary practice is intended for direct soil surface application to sites where the timely establishment of vegetation may not be feasible or where vegetative cover is absent or inadequate. **This temporary practice is not intended for application to surface waters of the state.** It is intended for application within construction storm water ditches and storm drains which, feed into previously constructed sediment ponds or basins.

2. Anionic Polyacrylamide (PAM) is available in emulsions, powders, gel bars and logs. It is required that other Best Management Practices be used in combination with anionic PAM. The use of seed and mulch for additional erosion protection beyond the life of anionic PAM is recommended. Use 50' setbacks when applying anionic PAM near natural water bodies. Never add water to PAM, add PAM slowly to water. If water is added to PAM, globs can form which can clog dispensers. This signifies incomplete dissolving of PAM and therefore increases the risk of under application. Application rates shall conform to manufacturer's guidelines. **The maximum application rate of PAM, in pure form, shall not exceed 200pounds/acre/year.** Contractors using anionic PAM shall obtain and follow all Material Safety Data Sheet requirements and manufacturer's recommendations. Gel bars and logs of anionic PAM mixtures may be

used in ditch systems. This application shall meet the same testing requirements as anionic PAM emulsions and powders. Maintenance will consist of reapplying anionic PAM to disturbed areas, including high traffic areas, which interfere in the performance of this practice.

3.6 MONITORING AND REPORTING

A. Each day, when any type of construction activity takes place on the construction site, Contractor's qualified personnel shall monitor and record rainfall, inspect all areas where petroleum products are stored, used or handled for spills and leaks from vehicles and equipment and check all locations where vehicles enter or exit the site for evidence of off site sediment tracking. These inspections shall be conducted until a Notice of Termination (NOT) is submitted. For linear construction where a phased activity is conducted, this paragraph applies to the active phase(s) of work.

B. Once every seven (7) calendar days and within 24 hours of the end of a storm 0.5 inches or greater, Contractor's qualified personnel shall inspect disturbed areas of the construction site that have not undergone final stabilization, areas used for storage of materials that are exposed to precipitation that have not undergone final stabilization and structural control measures (BMPs). Erosion and sediment control measures identified in the Erosion, Sedimentation and Pollution Control Plan shall be observed to ensure they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s). These inspections must be conducted until a Notice of Termination is submitted. For linear construction where a phase activity is conducted, this paragraph applies to the active phase(s) of work.

C. Contractor's qualified personnel shall inspect a least once per month during the term of the General Permit, areas of the construction site having undergone final stabilization. These areas shall be inspected for evidence of, or the potential for, pollutants entering the drainage system and receiving water(s). Erosion and sediment control measure shall be observed to ensure they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measure are effective in preventing significant impacts to receiving water(s). For linear construction, monthly inspections in accordance with this paragraph shall be made for those phases on which final stabilization has been completed.

D. Contractor shall prepare a report summarizing the scope of inspections, name(s) of qualified personnel making the inspections, date(s) of inspections, major observations relating to the implementation of the Erosion, Sedimentation and Pollution Control Plan and any actions taken. This report shall be retained on the construction site or be readily available at a designated alternate location until the entire site or portion of a construction project that was phased, has undergone final stabilization and a Notice of Termination (NOT) is submitted to EPD. Such reports shall identify any incidents of non–compliance. Where the report does not identify any incidents of non–compliance, the re report shall contain a certification that the facility is in compliance with the Erosion, Sedimentation and Pollution Control Plan and the General Permit. The report shall be signed in accordance with the General Permit.

3.7 SAMPLING AND ANALYSIS

A. Contractor must manually or automatically sample in accordance with the Comprehensive Monitoring Plan (CMP) at least once for each rainfall event described below. For a qualifying event, samples must be taken within forty–five (45) minutes of:

1. The accumulation of the minimum amount of rainfall, if the storm water discharge to a monitored receiving water or from a monitored outfall has begun at or prior to the accumulation.

2. The beginning of any storm water discharge to a monitored receiving water or from a monitored outfall, if the discharge begins after the accumulation of the minimum amount of rainfall.

However, where manual and automatic sampling are impossible (as defined in the permit), or are beyond the Contractor's control, the Contractor shall take samples as soon as possible, but in no case more than twelve (12) hours after the beginning of the storm water discharge.

B. Sampling shall occur for the following events:

1. For each area of the site discharging to a receiving stream, the first rain event reaching or exceeding 0.5 inch and allows for monitoring during normal business hours* (Monday thru Friday, 8:00 a.m. to 5:00 p.m. and Saturday 8:00 a.m. to 5:00 p.m. when construction activity is being conducted by the Primary permittee) occurring after all clearing and grubbing operations are completed in the drainage area of the location selected as the sampling location;

2. In addition to (1) above, for each area of the site discharging to a receiving stream, the first rain event reaching or exceeding 0.5 inch and allows for monitoring during normal business hours* occurring either 90 days after the first sampling event or after all mass grading operations are completed in the drainage area of the location selected as the sampling location, whichever comes first.

3. At the time of the sampling performed pursuant to (1) and (2) above, if BMPs are found to be properly designed, installed, and maintained, no further action is required. If BMPs in any area of the site discharging to a receiving stream are not properly designed, installed, and maintained, corrective action shall be defined and implemented within two business days, and turbidity samples shall be taken from discharges of the same area for each subsequent rain event reaching or exceeding 0.5 inch during normal business hours* until the selected turbidity standard is attained, or until post–storm event inspections determine BMPs are properly designed, installed, and maintained;

4. Existing construction activities, i.e., those occurring on or before the effective date of this permit, having met the sampling required by (1) above shall sample in accordance with (2). Those existing construction

activities having met the sampling required by (2) above shall not be required to conduct additional sampling other than as required by (3) above.

* Note the Permittee may choose to meet the requirements of (1) and (2) above by collecting turbidity samples from any rain event reaching or exceeding 0.5 inch and allows for monitoring at any time of the day or week.

5. For linear construction, if at any time during the life of the project, BMPs have not been properly designed, installed or maintained for the construction activities that discharge into a receiving water which is not being sampled, the Contractor shall sample that receiving water for the first rainfall event greater than or equal to 0.5 inches thereafter and for every rainfall event greater than or equal to 0.5 inches until BMPs are properly designed, installed and maintained.

C. Sampling shall be collected by "grab samples" and the analysis of these samples must be conducted in accordance with methodology and test procedures established in the General Permit. Sample containers shall be labeled prior to collecting the samples. Samples shall be well mixed before transferring to a secondary container. Large mouth, well cleaned and rinsed glass or plastic jars shall be used for collecting samples. The jars shall be cleaned thoroughly to avoid contamination. Manual or automatic sampling shall be utilized. Samples required by the General Permit shall be analyzed immediately, but in no case later than 48 hours after collection. However, samples from automatic samplers must be collected no later than the next business day after their accumulation, unless flow through automated analysis is utilized. Samples are not required to be cooled. Samples taken for the purpose of compliance with the General Permit shall be representative of the monitored activity and representative of the water quality of the receiving water(s) and/or the storm water outfalls using the following minimum guidelines:

1. The upstream sample for each receiving water(s) must be taken immediately upstream of the confluence of the first storm water discharge from the permitted construction site but downstream of any other storm water discharges not associated with the site. Where appropriate, several upstream samples from across the receiving water(s) may need to be taken and the average turbidity of these samples used for an upstream turbidity value.

2. The downstream sample for each receiving water(s) must be taken downstream of the confluence of the last storm water discharge from the construction site but upstream of any other storm water discharge not associated with the site. Where appropriate, several downstream samples from across the receiving water(s) may need to be taken and the average turbidity of these samples used for a downstream turbidity value.

3. Samples shall be taken from the horizontal and vertical center of the receiving water(s) or the storm water outfall channel(s).

4. Care shall be taken to avoid stirring the bottom sediments in the receiving water(s) or in the outfall storm water channel(s).

5. Sampling container shall be held so the opening faces upstream.

6. Samples shall be kept from floating debris.

D. For all construction sites and common developments other than linear construction projects, the Contractor shall sample all receiving water(s), or all outfall(s) or a combination of receiving water(s) and outfall(s). For linear construction projects, the Contractor must sample all perennial and intermittent streams and other water bodies shown on an USGS topographic map and all other field verified perennial and intermittent streams and other water bodies, or all outfalls into such streams and other water bodies, or a combination thereof.

E. Contractor shall provide and implement all safety equipment and procedures necessary for sampling during hazardous weather conditions and in the event of biological, chemical or physical hazards

F. Contractor shall submit a summary of the monitoring results to the EPD at the address shown in the General Permit by the fifteenth day of the month following the reporting period. For a monitoring period during which no qualifying rainfall events occur, a monitoring report must be submitted stating such. Monitoring periods are calendar months beginning with the first month after the effective date of the General Permit. Monitoring reports shall be signed in accordance with the General Permit and submitted to EPD until such time as a NOT is submitted.

G. Contractor must retain copies of all monitoring results and monitoring information reported. In addition to other record keeping requirements, the monitoring information shall include:

1. Date, exact place and time of sampling or measurements.

2. Name(s) of the individual(s) who performed the sampling and measurements.

3. Date(s) analyses were performed.

4. Time(s) analyses were initiated.

5. Name(s) of the individual(s) who performed the analyses.

6. References and written procedures, when available, for the analytical techniques or methods used. A quality control/quality assurance program must be included in the written procedures.

7. The results of such analyses, including the bench sheets, instrument readouts, computer disks or tapes, used to determine these results.

8. Results exceeding 1,000 NTU shall be reported as "Exceeds 1,000 NTU."

H. Suggested monitoring and report forms are found at the end of this section.

END OF SECTION

INDEX TO

SECTION 02231 – AGGREGATE BASE COURSE

SECTION 02231

AGGREGATE BASE COURSE

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Aggregate base course.

1.2 RELATED SECTIONS

A. Section 02771 – Wastewater Collection System
B. Section 03301 – Concrete

1.3 MEASUREMENT AND PAYMENT

A. Aggregate Base Coarse: Payment will be made under the lump sum price for Pump House Repairs . Payment will include supplying all material, labor, and equipment, stockpiling, scarifying substrate surface, placing where required, and compacting.

1.4 REFERENCES

A. ASTM C 131–96 – Resistance to Degradation of Small–Size Coarse Aggregate by Abrasion and Impact in the Lost Angeles Machine.

B. ASTM D 1556–00 – Density and Unit Weight of Soil in Place by the Sand–Cone Method.

C. ASTM D 1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.

D. ASTM D 2167–94 – Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

E. ASTM D 2922–96e1 – Density of Soil and Soil–Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D 3017–96e1 – Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

G. ASTM D 3740–01 – Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock Used in Engineering Design and Construction.

H. ASTM E 329–00b – Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges.

1.6 TESTING

A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 698, (Standard Proctor).

B. In place density tests in accordance with ASTM D 1556 or ASTM D 2922.

C. Testing laboratory shall operate in accordance to ASTM D 3740 and E 329 and shall be accepted by the Engineer.

D. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any tests.

E. Testing shall be Contractor's responsibility and performed at Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph C above.

F. Test results shall be furnished to the Engineer.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Aggregate shall consist of processed and blended crushed stone. Aggregates shall be free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material and shall be durable and sound. Coarse aggregate shall have a percentage of wear not to exceed 65 after 500 revolutions as determined by ASTM C 131. Coarse aggregate shall meet applicable requirements of Section 800, Coarse Aggregate of the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges. Material shall meet the following gradation requirements of Section 815.

Sieve Size	Percent by Weight Passing
2"	100
1–1/2"	97 – 100
3/4"	60 – 90
#10	25 – 45
#60	5 – 30
#200	0 – 15

B. Prime Coat: Shall consist of low viscosity liquid asphalt such as MC–30, MC–70, MC–250, RC–30, RC–70, or RC–250, conforming to Section 412 of the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges.

PART 3 – EXECUTION

3.1 CONTRACTOR'S EXAMINATION

A. Verify subgrade has been inspected, is dry, and gradients and elevations are correct.

B. ON SITE OBSERVATIONS OF WORK: The Owner's Representative or Engineer will have the right to require any portion of the work be completed in his presence and if the work is covered up after such instruction, it shall be exposed by the Contractor for observation at no additional cost to the Owner. However, if the Contractor notifies the Owner such work is scheduled, and the Owner fails to appear within 48 hours, the Contractor may proceed without him. All work completed and materials furnished shall be subject to review by the Owner, Engineer or Project Representative. Improper work shall be reconstructed, and all materials, which do not conform to the requirements of the specifications, shall be removed from the work upon notice being received from the Engineer for the rejection of such materials. Engineer shall have the right to mark rejected materials so as to distinguish them as such.

Contractor shall give the Owner, Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

3.2 PREPARATION

A. Subgrade shall be leveled to lines and grades of the plans and cleaned of all foreign substances prior to constructing base course. Do not place base on soft, muddy or frozen surfaces. Correct irregularities in subgrade gradient and elevation by scarifying, reshaping, and recompacting.

B. At the time of base course construction, subgrade shall contain no frozen material.

C. Surface of subgrade shall be checked by the Engineer or Project Representative for adequate compaction and surface tolerances. Ruts or soft yielding spots appearing in areas of subgrade course having inadequate compaction, and areas not smooth or which vary in elevation more than 3/8–inch above or below required grade established on the plans, shall be corrected to the satisfaction of the Engineer or Project Representative. Base material shall not be placed until subgrade has been properly prepared and test results have so indicated.

3.3 AGGREGATE PLACEMENT

A. Aggregate shall be placed with an acceptable spreader in accordance Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges Sections 310 and in accordance with all terms included in these specifications. (Spreader shall contain a hopper, adjustable screed and designed so there will be a uniform, steady flow of material from the hopper. Spreader shall be capable of laying material without segregation across full width of the lane to a uniform thickness and to a uniform loose density.) Spreaders are not required on curb and gutter road sections.

B. Level and contour surfaces to elevations and gradients indicated.

C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

F. While at optimum moisture (± 1–1/2%), compact base course with rollers capable of obtaining required density. Vibratory, flatwheel, and other rollers accepted by the Engineer may be used to obtain required compaction. Rolling shall continue until base is compacted to 100% of the maximum laboratory dry density as determined by ASTM D 1557. In–place density of the compacted base will be determined in accordance with ASTM D 1556 or ASTM D 2922.

3.4 PRIME COAT

A. Bituminous material for the prime coat shall be applied uniformly and accurately in quantities of not less than 0.15 gallons per square yard nor more than 0.30 gallons per square yard of base course. All irregularities in the base course surface shall be corrected prior to application of prime coat.

B. Do not apply prime to a wet surface nor when temperature is below 40°F in the shade. Do not apply prime when rain threatens nor when weather conditions prevent proper construction and curing of prime coat.

3.5 TOLERANCES

A. Flatness: Maximum variation of ¼ inch measured with an acceptable 10–foot straight edge.

B. Scheduled Compacted Thickness: Within 3/8 inch.

C. Variation from Design Elevation: Within 3/8 inch.

D. Depth measurements for compacted thickness shall be made by test holes through the base course. Where base course is deficient, correct such areas by scarifying, adding base material and recompacting as directed by the Engineer. Measurements shall be made at staggered intervals not to exceed 250 feet for two–lane streets and roads.

3.6 FIELD QUALITY CONTROL

A. Quality Assurance: Field inspection.

B. Density and moisture testing will be performed in accordance with ASTM D 698.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Frequency of Tests:

1. Base Density – One (1) test per each driveway or 500 S.F. of crusher run parking area.

END OF SECTION

INDEX TO

SECTION 02330 – FLOW DIVERSION

SECTION 02330

FLOW DIVERSION

PART 1 – GENERAL

1.1 SCOPE

A. Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc. to implement a temporary pumping system for diverting the flow from both pump station 4036 and 4035 during the pump station modifications. Temporary pumping system includes, but is not limited to, all line stops, wet taps, pumps, temporary power and controls, etc. necessary to keep the lift station operational at all times until the work is complete.

B. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The Contractor shall employ the services of a vendor who can demonstrate to the Engineer that he specializes in the design and operation of temporary bypass pumping systems. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

1.2 SUBMITTALS

A. The Contractor must submit a plan for temporary bypass of the lift stations. The plan must include specific details such as pump capacities, power supply, alarms and controls. The plan must specify contact names and phone numbers for the Contractor's personnel responsible for the bypass. A schedule for implementation of the bypass and completion of the necessary work must also to be included in the plan.

B. The Contractor shall submit to the Engineer detailed plans and a description outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.

C. The plan shall include but not be limited to details of the following:

1. Staging areas for pumps;
2. Sewer Plugging method and types of plugs;
3. Number, size, material, location and method of installation of suction piping;
4. Number, size, material, method of installation and location of installation of Discharge piping;
5. Bypass pump sizes, capacity, number of each size to be on site and power requirements;
6. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted);
7. Standby power generator size and location;
8. Downstream discharge plan;

9. Method of protecting discharge manholes or structures from erosion and damage;
10. Thrust and restraint block sizes and locations;
11. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill;
12. Method of noise control for each pump and/or generator;
13. Any temporary pipe supports, and anchoring required;
14. Design plans and computation for access to bypass pumping locations indicated on the drawings;
15. Calculations for selection of bypass pumping pipe size;
16. Schedule for installation of and maintenance of bypass pumping lines;
17. Plan indicating selection location of bypass pumping line locations.

1.3 MEASUREMENT & PAYMENT

A. Payment for Flow Diversion will be made under the lump sum price for the item "Flow Diversion" for each pump station and such payment shall constitute full compensation for furnishing and placing pumps and bypass etc.

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric, or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows. All pumps must have solar batteries and solar battery chargers, both provided by the same manufacturer.

B. The Contractor shall provide the necessary stop/start controls for each pump.

C. The Contractor shall include one stand-by pump of each size to be maintained on site. Back-up pumps shall be piped and completely on-line, isolated from the primary system by a valve only.

D. Discharge Piping – In order to prevent the accidental spillage of flows, all discharge systems shall be temporarily constructed of rigid pipe with positive, restrained joints. Under no circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose will only be allowed in short sections and by specific permission from the Engineer.

E. Pumps shall be provided with solar batteries and solar battery powered chargers for the bypass pump starters. Both the batteries and the chargers are to be provided by the same manufacturer.

F. All fuel required for the bypass pumps is the responsibility of the Contractor. Pumps are to have adequate fuel at all times while on site.

2.2 SYSTEM DESCRIPTION

A. Design Requirements:

1. Bypass pumping systems shall have sufficient capacity to pump the wet weather peak flow of sewer. The Contractor shall provide all pipeline plugs, pumps of adequate size to handle peak flow, and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired. Bypass pumping system will be required to be operated 24 hours per day.

2. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure. Solar batteries and solar battery chargers are required for both pumps.

3. Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performances of work.

4. The Contractor shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System must overcome any existing force main pressure on discharge.

B. Performance Requirements:

1. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the pump station work. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, carry it past his work and return it to the existing sewer downstream of his work.

2. The existing Lift Station shall be provided with two identical bypass pumps and back-up. Pumps are to be provided by the same manufacturer. Each pump shall be fully enclosed with sound attenuated panels by the pump manufacturer for Lift Station (<69 db at 30 feet) due to the proximity to housing units. Each pump shall have a minimum **capacity of 5,000** gpm @ (100 ft TDH for Pump Station 4036, and 50 ft. for Pump Station 4035). Pumps shall be Godwin Critically Silenced Dri-Prime Pumps or approved equal by the Engineer and Owner.

3. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

4. The Contractor shall provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the main flows under any circumstances.

5. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers and that will protect public and private property from damage and flooding.

6. The Contractor shall protect water resources wetlands and other natural resources.

PART 3 – EXECUTION

3.1 GENERAL

A. In no case shall bypassing to any watercourse, storm sewer or other point where pollution may result be permitted.

B. The Contractor is responsible for all pumping and flow diversion including all necessary equipment. The BGJWSC is not obligated to supply any equipment.

C. If Line stops are needed at any of the station during flow diversion. All line stops, and/or wet taps required are the responsibility of the contractor.

D. Bypass pumping system shall be required to have full redundancy. Backup bypass pump must be installed, including all piping and valves so that it will be fully operationally and can be placed in service immediately, if needed.

3.2 FIELD QUALITY CONTROL AND MAINTENANCE

A. Test:

1. The Contractor shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. The Engineer will be given 24 hours notice prior to testing.

B. Inspection:

1. Contractor shall inspect bypass pumping system every two hours to ensure that the system is working correctly.

C. Maintenance Service:

1. The Contractor shall insure that the temporary pumping system is properly maintained, and a responsible operator shall be on hand at all times when pumps are operating.

D. Extra Materials:

1. Spare parts for pumps and piping shall be kept on site as required and stored per manufacturer recommendation.

2. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

3.3 PREPARATION

A. Precautions

1. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Authority and the Engineer. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.

2. During all bypass pumping operation, the Contractor shall protect the Pumping Station and main and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the Pumping Station and main and all local sewer lines caused by human or mechanical failure.

3.4 INSTALLATION AND REMOVAL

A. The Contractor shall modify or remove manhole sections (if needed) or make connections to the existing sewer and construct temporary bypass pumping structures only at the location indicated on the Drawings and as may be required to provide adequate suction conduit.

B. Plugging or blocking of sewage flows shall incorporate primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance or work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

C. When working inside manhole or force main, the Contractor shall exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible oxygen-deficient atmospheres, and confined spaces.

D. The installation of the bypass pipelines is prohibited in all saltmarsh/wetland areas. The pipeline must be located off streets sidewalks and on shoulders of the roads. When the bypass pipeline crosses local streets and private driveways, the contractor must place the bypass pipelines in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Engineer, the Contractor shall remove all the piping, restore all property to pre-construction condition and restore all pavement. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from the Authority.

3.5 CONTROL REQUIREMENTS

A. Contractor shall provide back-up power (i.e. generator) for all by-pass pumps required to complete the work. Contractor shall provide alarms for all by-pass pumps used to complete the work. The BGJWSC is not obligated to supply any equipment.

B. Contractor shall provide continuous bypass monitoring for bypass pumps and backup bypass pumping system.

C. Contractor shall provide 110 V power and phone service for operation of the autodialer during bypass pump operation.

D. Contractor shall provide a high-level mercury float switch in the suction manhole for the bypass pumps. The mercury float switch shall be enclosed in a smooth, chemical resistant urethane or polypropylene casing suspended on its own cable. The cable shall be of proper length to reach from the float switch in the manhole to the autodialer location without splices. The autodialer location shall be designated by the BGJWSC within the fenced portion of the lift station site. Contractor shall bury the cable for the float switch in the trench with the bypass suction lines.

3.6 EMERGENCY CONTACT REQUIREMENTS

A. Contractor shall provide two (2) emergency phone numbers that will be programmed into the auto dialer during operation of the bypass. The first two alarm calls will be made to the contractor, and the second two alarm calls will be sent to the BGJWSC. The contractor must call Jason Vo at 912- 324- 9905 to acknowledge receipt of each alarm call.

END OF SECTION

INDEX TO

SECTION 02570 – TRAFFIC CONTROL

SECTION 02570 – TRAFFIC CONTROL

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section covers the furnishing, installation and maintenance of all traffic control devices, portable signal equipment, warning signs and temporary traffic lanes used during the construction of the water main portion of the project.

1.2 RELATED WORK

A. Section 02731 – Wastewater Collection System

1.3 RESPONSIBILITY

A. The Contractor shall furnish, install, and maintain all necessary automated signals, barricades, concrete traffic barriers, warning signs, traffic barriers, traffic lanes and other protective devices. Ownership of these temporary warning devices shall remain with the Contractor provided the devices are removed promptly after completion and acceptance of the area of work to which the devices pertain. If such warning devices are left in place for more than 30 days after the specified time for removal, the Owner shall have the right to remove such devices and to claim possession thereof.

B. The contactor shall provide the engineer/owner and the County with a traffic control plans for review and approval 30 days prior to any construction.

1.4 MEASUREMENT AND PAYMENT

The work covered by this section will not be measured for direct payment. Payment will be included in the contract lump sum price for the item which it is associated.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All barricades signs, and traffic control signal devices shall conform to the requirements of the current Georgia Manual of Traffic Control Devices for Streets and Highways except as may be modified in these project specifications.

B. Portable traffic control signal devices, barricades, signs and other Control Devices shall be either new or in acceptable condition when first erected on the Project and shall remain in that acceptable condition throughout the construction period.

C. All signs shall have a black legend and border on an orange reflectorized background and will be a minimum of engineering grade reflective.

PART 3 – EXECUTION

3.1 ERECTION

A. Prior to the commencement of any actual construction on the project, the Contractor shall erect the appropriate advance warning signs and place the concrete traffic barriers where necessary. Subsequently, as the construction progresses and shifts from one side of the road to the other, temporary lanes must be installed to provide continuous two-way traffic and bike thoroughfare. All appropriate signs and traffic control devices pertinent to the work shall be erected ahead of the construction site to advise and warn the travelling public of the activity and any necessary detours.

3.2 DELAYS TO TRAFFIC

A. Except in rare and unusual circumstances, two–way traffic shall be maintained at all times by temporary and/or permanent roads. There are to be no traffic delays during the hours between 7 AM – 9 AM and 4 PM – 6 PM. Between the hours of 9 AM and 6 PM the maximum delay is to be 15 minutes.

B. When traffic is halted temporarily due to transition procedures including the ingress and egress of construction vehicles, the Contractor shall provide the necessary flagging personnel with proper equipment and clothing to hold such traffic.

C. If contractor's proposed traffic control plan involves more than occasional disruption to alternating one-way traffic through the work, then temporary, signalized control equipment will be required.

3.3 TEMPORARY TRAFFIC LANES

A. Two–lane traffic shall be maintained at all times unless prior written permission has been given and all necessary flagging personnel and/or signage has been installed. Temporary lane line stripes shall be applied to the detour paving, as agreed to by the engineer and owner's representative. The no–passing double center–line stripes shall be yellow. Such stripes shall be a temporary, degradable, reflectorized tape strip. All temporary stripping shall be maintained throughout the period the traffic control is needed.

B. Contractor is responsible for installation and removal of all temporary roads and trails throughout the construction process. These detour roads are to be in accordance with the Pavement Specifications herein.

3.4 SIGNS AND BARRICADES

A. The contractor shall provide a detailed map showing the location and verbage of all traffic control signs for the project. All critical warning signs for the project will be a minimum of engineering grade reflective material and include appropriate flashing lights.

A. Appropriate Safety Barricades shall be installed between the bicycle trail and the temporary traffic lanes. These barricades shall be impact resistant for passenger vehicles with a travelling speed of 40 mph.

1. Advance warning signs: These signs shall be placed approximately 500 feet in advance of the construction site and detour on each approach to the construction area with subsequent warning signs every 250 feet, until the construction site is met.

2. Road Construction Signs: Before and during construction of the detour, advance road construction signs shall be located as already stated above. The construction site detour lanes will have reflective trestle type barricade with flashing lights spaced a maximum of 25 feet apart to delineate each side of any temporary roadway. Additional signage shall be placed to indicate a reduced speed limit of 10 mph for the entire construction area. Other signs as appropriate to particular activity in the work area shall be erected in advance of that activity.

3. Barricades: While the detour is open to traffic, a line of concrete traffic barricades shall be placed across the closed roadway to channelize the traffic onto the detour. They shall be spaced across the blocked roadway end to end so that no vehicle will be able to pass between any two adjacent barricades.

4. Barriers: Shall be wooden having a minimum of 3 horizontal 6–inch rails spaced 20 inches on center. Markings for barrier rails shall be 6" wide alternate orange and white reflectorized stripes sloping downward at 45 degrees in the direction traffic is to pass.

   During hours of darkness, the contractor shall place and maintain flashing warning lights on the tops of all barriers.

5. Direction Arrow Signs: At each change in traffic direction along the detour, the contractor shall install a sign with an arrow indicating the change in traffic direction. This sign is to be located across the pavement from and facing the on–coming traffic.

6. End Construction Sign: This sign shall be 60" x 24" and erected approximately 200 feet beyond the end of the construction area on the right–hand side.

END OF SECTION

INDEX TO

SECTION 02730

WASTEWATER PUMP STATIONS

PART 3 – EXECUTION

SECTION 02730

WASTEWATER PUMP STATIONS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Influent Pump Station.

1.02 RELATED SECTIONS

A. Section 02330 – Flow Diversion (Bypass Pumping).

1.03 OPTIONS

A. The specifications describe several materials. The Engineer and Owner will decide which ones to be used. Where manufacturers and models of equipment are named in the specifications, it is intended these are to describe quality and function required. Contractor may use equipment or materials of other manufacturers provided they are reviewed and accepted by the Engineer, Owner, and Regulatory Agency and Operator as equivalent to those specified.

1.04 REFERENCES (Latest Revision)

A. ASTM D 3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

B. ANSI/AWWA C 150/A 21.50 – Thickness Design of Ductile Iron Pipe.

C. ANSI/AWWA C 151/A 21.51 – Ductile Iron Pipe, Centrifugally Cast, for Water, or Other Liquids.

D. ASTM A 746 – Ductile Iron Gravity Sewer Pipe.

E. ASTM D 3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

F. ASTM F 477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

G. ASTM D 2241 – Poly (Vinyl Chloride) (PVC) Pressure–Rated Pipe (SDR Series).

H. ASTM D 3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

I. ASTM C 443 – Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

J. ACI 318 – Building Code Requirements for Structural Concrete.

K. ASTM C 39/C 39M – Compressive Strength of Cylindrical Concrete Specimens.

L. ASTM C 890 – Minimum Structural Design Loading for Monolithic or Sectional

Precast Concrete Water and Wastewater Structures.

M. ASTM C 891 – Installation of Underground Precast Concrete Utility Structures.

N. ASTM C 913 – Precast Concrete Water and Wastewater Structures.

O. ASTM A 615/A 615 M – Deformed and Plain Carbon – Steel Bars for Concrete Reinforcement.

P. ASTM D–6938 – In–Place Density and Water Content of Soil and Soil–Aggregate by Nuclear Methods (Shallow Depth).

Q. ASTM D 2794 – Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

R. ASTM E 96 – Water Vapor Transmission of Materials.

S. ASTM G 154 – Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

T. ANSI/AWWA C 111/A 21.11 – Rubber–Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

U. ASTM A 377 – Index of Specifications for Ductile Iron Pressure Pipe.

V. ANSI/AWWA C 600 – Installation of Ductile Iron Water Mains and Their Appurtenances.

W. ANSI/AWWA C115/A21.15 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.

X. ANSI/AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches through 12 inches, for Water Transmission and Distribution.

Y. ANSI/AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 Inches through 48 inches, for Water Transmission and Distribution.

1.05 QUALITY ASSURANCE

A. Contractor will furnish the Engineer and Owner a description of <u>all</u> material before ordering. Engineer will review the Contractor's submittals and provide in writing an acceptance or rejection of material.

B. Where ductile iron pipe is indicated on the plans, or required by Engineer, it shall be used.

C. Material and equipment shall be the standard products of a manufacturer who has manufactured them for a minimum of two years and provides published data on their quality and performance.

D. A subcontractor for any part of the work must have experience on similar work, and if required, furnish Engineer with a list of projects and Owners or Engineers who are familiar with its competence.

E. Testing shall be by a testing laboratory which operates in accordance to ASTM D 3740 or E 329 and shall be acceptable to Engineer prior to engagement. Mill certificates of tests on materials made by manufacturers will be accepted provided the manufacturer maintains an adequate testing laboratory, makes regularly scheduled tests, spot checked by an outside laboratory, and furnishes satisfactory certificates with name of entity making test.

F. Pump performance, and hydrostatic tests on force mains shall be made by Contractor with equipment qualified by Engineer and in the presence of Engineer. Engineer or Project Representative reserves the right to accept or reject testing equipment.

G. Perform work in accordance with the State of Georgia, Georgia Department of Public Health and Georgia Environmental Protection Division minimum standards.

H. Install pumps and their associated mechanical, electrical and control accessories according to manufactures instructions.

I. Infiltration, line, and grade of sewer, pump performance, and hydrostatic tests on force mains shall be made by Contractor with equipment qualified by Engineer and in the presence of Engineer. Engineer or Project Representative reserves the right to accept or reject testing equipment.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Material shall be unloaded in a manner avoiding damage and shall be stored where it will be protected per manufacturer recommendations and will not be hazardous to traffic. If stored on private property, Contractor shall obtain permission from property owner and shall repair any damage caused by the storage. Material shall be examined before installation.

B. Neither damaged nor deteriorated material shall be used in the work.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping system from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of complete system.

E. Accept system components on site in manufacturer's original containers or configuration. Inspect for damage.

F. Store sensitive materials for field assembly in dry area in original shipping containers.

G. Repair damage to wet well and other infrastructure according to manufacturer's instructions.

1.07 JOB CONDITIONS

A. Installation of the improvements must be coordinated with ongoing operations.

B. Contractor shall replace or repair any damaged pipe or structure at no

additional expense to the Owner.

C. Installation of the sanitary sewerage system must be coordinated with other work on site. Generally, sanitary sewer pipes will be installed first and shall be backfilled and protected so subsequent excavating and backfilling of other utilities does not disturb them. Contractor shall replace or repair any damaged pipe or structure at no additional expense to the Owner.

1.08 ALTERNATIVES

A. The intention of these specifications is to produce the best system for the Owner. If the Contractor suggests alternate material, equipment or procedures will improve results at no additional cost, Engineer and Owner will examine suggestion, and if accepted, it may be used. The basis upon which acceptance of an alternate will be given is its value to the Owner, and not for Contractor's convenience.

1.09 GUARANTEE

A. Contractor shall guarantee quality of materials, equipment, and workmanship for 12 months after acceptance of the completed Project. Defects discovered during this period shall be repaired by Contractor at no cost to the Owner.

1.10 PRE–INSTALLATION MEETINGS

A. Section 01300 – Submittals

B. Convene minimum one week prior to commencing work of this section.

1.11 PERFORMANCE REQUIREMENTS

A. Operation:

1. Refer to SCADA System specifications for pump station controls.

B. Sound, Vibration, and Thermal Control – Dampen or suppress noise, absorb vibration, accommodate thermal expansion and stresses, and adjust or correct for misalignment in piping systems.

1.12 MEASUREMENT AND PAYMENT

The work covered by this section will not be measured for direct payment. Payment will be included in the contract lump sum price for the "Pump & Piping Modifications".

PART 2 – PRODUCTS

Materials and products used shall conform to one of the following and shall be as approved by the Engineer:

2.01 SEWER PIPE

A. PVC Pipe – Shall be polyvinyl chloride plastic (PVC) and shall meet all requirements of ASTM D 3034 SDR 26, (where depths is less than three feet ductile iron pipe must be installed). All pipe shall be suitable for use as a gravity sewer conduit. Provisions must be made for contraction and expansion at each joint with a rubber gasket. Pipe sizes and dimensions shall be as shown below. All pipe shall be green or white in color with factory marked homing lines. Fittings shall meet the same specification requirements as pipe.

Nom. Size	Outside Diameter		Min. Wall Thickness
	Average	Tolerance	SDR–26
4	4.215	± 0.009	.162
6	6.275	± 0.011	.241
8	8.400	± 0.012	.323
10	10.500	± 0.015	.404
12	12.500	± 0.018	.481

Tests on PVC Pipe – Pipe shall be designed to pass all tests at 73 °F. (± 3 °F.).

B. Ductile Iron – Shall conform to ANSI A 21.50 (AWWA C 150), ANSI A 21.51 (AWWA C 151) and ASTM A 746. All pipe shall be Pressure Class 350 unless otherwise noted. All ductile iron pipes and fittings shall be bituminous coated on the outside and lined with Protecto 401 Ceramic Epoxy or equivalent on inside.

1. Coating on the outside shall be an asphaltic coating approximately 1 mil thick. Finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to sun and shall be strongly adherent to the iron.

2. Protecto 401 Ceramic Epoxy or equivalent interior lining shall conform to ASTM E 96, ASTM D 714, ASTM D 2794 and ASTM G 53. Interior of the pipe shall receive 40 mils nominal dry film thickness of epoxy. Lining application, inspection, certification, handling, and surface preparation of area to receive the protective coating shall be in accordance with manufacturer's specifications and requirements.

2.02 JOINTS – GRAVITY SYSTEM

A. Joints for Ductile Iron Pipe – Shall be slip–on rubber equivalent to "Fastite," "All–tite," or "Tyton."

B. Joints for PVC Pipe – Shall be integral wall bell and spigot with a rubber ring gasket. Joints shall conform to ASTM D 3212 and gaskets to ASTM F 477.

2.03 FORCE MAIN

A. P.V.C. – All pipe shall be green in color with factory marked homing lines. Pipe with diameter less than 4 inches shall conform to all requirements of ASTM D 2241, SDR 26, Class 160. Pipe 4 inches through 12 inches shall conform to all requirements of AWWA C900, DR 25, Pressure Class of 165 p.s.i. Pipe 14 inches through 18–inches shall conform to all requirements of AWWA C905 with C1 outside diameter, DR 25, with a pressure rating of 165 p.s.i. Joints shall be in accordance with ASTM D 3139.

B. Ductile Iron pipe shall be in accordance with Paragraph 2.1–B and conform to ASTM A 377. Push–on–Joints shall be slip–on rubber equivalent to "Fastite," "All–tite," or "Tyton." Flanged joints shall conform to AWWA C 115. Gaskets shall conform to AWWA C 111.

C. Thrust blocking (if called for) shall be sized as detailed on the construction drawings of 3,000 p.s.i. concrete. Blocking shall be provided at all bends deflecting 11–1/4° or more and bear directly against the undisturbed trench wall.

D. Restrained Joints – Restrained joints for pipe, valves and fittings shall be mechanical joints with ductile iron retainer glands equivalent to "Megalug" or push–on type joints equivalent to "Lok–Ring," "TR Flex," or "Super Lock" and shall have a minimum rated working pressure equal to the item restrained with a minimum safety factor of 2:1. Joints shall be in accordance with the applicable portions of AWWA C–111. Manufacturer of joints shall furnish certification, witnessed by an independent laboratory, stating joints furnished have been tested without signs of leakage or failure. Restrained joints shall be capable of being deflected after assembly.

2.04 STONE BACKFILL

A. Shall be graded crushed granite with the following gradation:

Square Opening Size	Percent Passing
1 inch	100%
3/4 inch	90 to 100%
3/8 inch	0 to 65%
No. 4	0 to 25%

2.05 AIR RELEASE VALVE

A. Shall be designed for sewage service. The valve shall be constructed of a cast iron body, and stainless–steel float. The inlet shall be two inches. The working pressure shall be 0 to 50 p.s.i. It shall be on automatic air valve. The valve shall be single acting, pedestal type.

2.06 METAL DETECTOR TAPE

A. Will be installed above all pipe. Tape shall consist of 0.35 mils thick solid foil core encased in a protective plastic jacket resistant to alkalis, acids, and other destructive elements found in the soil. The lamination bond shall be strong

enough, so layers cannot be separated by hand. Total composite thickness shall be 5.0 mils. Foil core to be visible from unprinted side to ensure continuity. The tape shall have a minimum three–inch width and a tensile strength of 35 pounds per inch.

A continuous warning message indicating "sewer line" repeated every 16 inches to 36 inches shall be imprinted on the tape surface. Tape shall contain an opaque color concentrate designating color code appropriate to the line being buried (Sewer Line – Green).

2.07 MANHOLES

A. Masonry – Shall be new whole fired red brick of good quality laid in masonry mortar or cement mortar made of one–part Portland cement and two parts clean sharp sand. Every brick shall be fully bedded in mortar. Manholes shall conform to locations and details shown on the plans.

B. Precast Concrete – Shall be reinforced concrete constructed in accordance with ASTM C 478 and details shown on the plans "Precast Concrete Manholes." Coarse aggregate shall be granite stone. The joints shall be tongue and groove sealed with flexible gaskets or mastic sealant. Gaskets shall be O–Ring or equivalent to Type A or B "Tylox" conforming to ASTM C 443. Mastic shall be equivalent to "Ram–nek" with primer. Primer shall be applied to all contact surfaces of manhole joint at the factory in accordance with manufacturer's instructions.

C. Frames and Covers – Shall be composite cast iron equivalent to the following:

[Model V1327–1 RG V1327GS EPIC SAVANNAH SN manufactured by E.J.]

D. Manhole Steps **(No Manhole steps needed)**– Shall be equivalent to M.A. Industries, Type PS–1 or PS–2–PF. Steps shall be installed at the manhole factory and in accordance with recommendations of step manufacturer. Manholes will not be acceptable if steps are not installed accordingly.

E. Pipe Connections – Shall have flexible watertight joints at sewer main point of entry into the manhole. The joint shall be polyisoprene sleeve equivalent to "Kor–N–Seal", A–lock or equal.

F. Coatings – New manholes shall have all interior surfaces coated with a factory applied acrylic polymer–based coating and sealant. The coating shall be ConSeal CS–55 manufactured by Concrete Sealants, New Carlisle, Ohio or an accepted equivalent. The coating shall be applied in three coats to achieve a total dry film thickness of at least 3.5 mils in accordance with manufacturer's recommendations. Surfaces shall be cleaned of all dust, form oils, curing compounds and other foreign matter prior to the coating application.

All **new** force main discharge manholes drop manholes or drop manholes shall be coated with min. 0.5" wet film mils of Sewper Coat or an accepted equivalent. The interior surfaces shall be cleaned and prepared according to manufacturer's recommendations. Existing Manhole shall have min. of 1" wet film mils of Sewper Coat.

H. Pump Warranty – The pump manufacturer shall warrant pumps being supplied to

Owner against defects in workmanship and materials for a period of five years under normal use, operation, and service. In addition, manufacturer shall replace certain parts which become defective through normal use and wear on a progressive schedule of cost for a period of five years. Parts included are the mechanical seal, impeller pump housing, wear ring, and ball bearings. The warranty shall be in published form and apply to all similar units.

I. Operation and Maintenance Manual – The pump manufacturer shall furnish Owner with a minimum of six manuals for pumps installed.

2.08 PUMP STATIONS 4036 and 4035

A. Each station shall include installation of two (2) duty vertically– mounted dry well pumps and one (1) jockey pump. The specs are based on KBS Pump. The selected pump suction and discharge shall match the plans for both pump stations conforming to characteristics shown on the drawings and mentioned hereinafter:

Contact Jay Boudreaux with Pump & Process Equipment, Inc. at 912-659-6180.

Pump Station 4036 (Duty Pump)

KSB	KRT K Series
TDH	75 ft. (20 ft. Static Head)
Pump Capacity Min.	4,500 Gallons per minute
No. of Pump	2
Maximum RPM	1,185
Phase	3
Voltage	460
Minimum HP	121
Minimum Efficiency	79.2 %

Pump Station 4036 (Jockey Pump)

KSB	KRT K-D Series
TDH	40 ft. (20 ft. Static Head)
Pump Capacity Min.	2,500 Gallons per minute
No. of Pump	1
Maximum RPM	1,185
Phase	3
Voltage	460
Minimum HP	40
Minimum Efficiency	78.8 %

Pump Station 4035 (Duty Pump)

KSB	KRT K-D Series
TDH	42 ft. (21 ft. Static Head)
Pump Capacity Min.	5,000 Gallons per minute
No. of Pump	2
Maximum RPM	1185
Phase	3
Voltage	460

Minimum HP	80
Minimum Efficiency	81.1 %

Pump Station 4035 (Jockey Pump)

KSB	KRT K-D series
TDH	40 ft. (20 ft. Static Head)
Pump Capacity Min.	2,500 Gallons per minute
No. of Pump	1
Maximum RPM	900
Phase	3
Voltage	460
Minimum HP	30
Minimum Efficiency	78.5 %

1. Type of Installation – Proposed Pumps are semi–open, multi vane, non–clogging, self–cleaning permanently connected to inlet and outlet pipes in dry pit pumps. The work shall include furnishing, installing, and testing of the proposed pumps, valves and appurtenances. Contractor shall provide concrete support slab with dimensions according to the construction plans.

B. Pump Design – Pump shall be capable of operating in a continuous non–submerged condition in a vertical (NT) position in a dry pit installation, permanently connected to inlet and outlet pipes. Pump shall be of submersible construction and will continue to operate satisfactorily should the dry pit be subjected to flooding. Inlet elbow shall have an inspection cover – standard.

C. Pump Construction – Major pump components shall be of grey cast iron, ASTM A–48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be of stainless-steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Sealing design shall incorporate metal–to–metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile rubber O–rings. Fittings will be the result of controlled compression of rubber O–rings in two planes and O–ring contact of four sides without the requirement of a specific torque limit.

Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O–rings, grease or other devices shall be used.

1. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer–free polyester resin resulting

in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat–shrink fitted into the cast iron stator housing. The use of multiple step dip and bake–type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 30 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Pumps shall be grounded with thermistors and control module, and with seal failure sensors with Macromatic SFP120A250 relays. Provide relay to be mounted and connected in pump VFD's. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp–type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. 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. 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.

Motor horsepower shall be sufficient so that the pump is non–overloading throughout its entire performance curve, from shut–off to run–out. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

Shielded Power Cable:
The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The power cable shall be of a shielded design in which an overall tinned copper shield is included, and each individual phase conductor is shielded with an aluminum coated foil wrap. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

2. BEARINGS

The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two-row angular

contact ball bearing. The lower bearing shall be a two-row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 100,000 hours at any usable portion of the pump curve.

3. MECHANICAL SEALS

Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten–carbide ring. The upper secondary seal located between the seal chamber and the seal inspection chamber shall be a leakage–free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten–carbide seal ring. The rotating seal ring shall have small back–swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

Seal lubricant shall be non–hazardous and per manufacturer recommendation.

4. PUMP SHAFT

The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100–T.

Shaft sleeves will not be acceptable.

5. IMPELLER

The impeller shall be of Hard–IronTM (ASTM A–532 (Alloy III A) 25% chrome cast iron), dynamically balanced, semi–open, multi–vane, back swept, screw–shaped, non–clog design. The impeller leading edges shall be mechanically self–cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag–laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

6. VOLUTE / SUCTION COVER

The pump volute shall be a single piece grey cast iron, ASTM A–48, Class 35B, non–concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral–shaped, sharp–edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of Hard–IronTM (ASTM A–532 (Alloy III A) 25% chrome cast iron) and provide effective sealing between the multi–vane semi–open impeller and the volute housing.

D. Cooling System

Each unit shall be provided with an integral motor cooling system. A stainless-steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

1. Pump Station Pumps Cooling System – Closed loop cooling means that the cooling liquid is pumped up through the narrow space between the thin inner cooling jacket and the stator housing. The coolant is then circulated downwards between the inner and outer cooling jacket down to the cooling bottom. Finally, the coolant bottom transfers the heat from the coolant to the pumped media.

E. Pump Test – Pump manufacturer shall perform following tests on each pump before shipment from the factory:

1. Megger the pump for insulation breaks or moisture.

2. Prior to submergence, the pump shall be run dry and checked for correct rotation.

3. Pump shall be run for 30 minutes in a submerged condition.

4. Pump shall be removed from test tank, meagered immediately for moisture; oil plugs removed for checking of upper seal and possible water intrusion of stator housing.

5. A written certified test report giving above information shall be supplied with each pump at the time of shipment.

F. **Pump Controls for the Pump Station** – Pump control shall be as follows,

the jockey pump shall run when called upon and with a control scheme to match influent flow, (Flow Matching). The primary pumps will be called upon once the jockey pump is at full speed and the rate of rise of the water level exceeds the pumping capacity of the jockey. JWSC operations requests that the jockey be decelerating to stop prior to the first primary pump start up. To curb any instance of the jockey pump being dead headed against the larger pump, and to reduce the possibility of water hammer. The first primary pump will be in alternation with the other primary pump so not to always have the same primary as lead in sequence. The secondary pump shall come on after the primary pump flow matches with influent flow and the pump has ramped to full speed, but the rate of rise exceeds the possible flow of the primary pump. Then the 2nd primary pumps shall try to flow match until the tank has reached the all off point. Also provide prevision to able changes such as rise rate and flow match gain %, also characterized as trim. Also the characteristic shall be built in to avoid the pump from seeking will the flow may change from Influent flow.

-All lights & alarms to be located outside the building for audible and visual.

-Solar panels shall be provided and installed to maintain the batteries for the control cabinet, so as in a light out situation and by-pass pumping has begun the station can still hold out main hours or days during or after an emergency.

G. Shop Drawings:

1. Contractor shall submit for review by Engineer a complete schedule and data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, such as catalogs, diagrams, performance curves, and charts published by the manufacturer, to show conformance to specification and drawing requirements. Model numbers alone will not be acceptable. Complete electrical characteristics shall be provided for all equipment.

2. All shop drawings shall be completely checked and marked accordingly with Contractor's stamp prior to submitting drawings to the Engineer for review. Shop drawings with insufficient or incomplete data required to indicate compliance with these specifications are not acceptable and will be returned to the Contractor. Where shop drawings are "Furnished as Corrected," the reviewer has noticed deficiencies in compliance with contract specifications and drawings. It is understood corrections indicated will be incorporated by Contractor in the final product, operation and maintenance manuals and shop drawings submitted at completion of project. Rejected shop drawings shall not relieve Contractor from completing the project within time allowed by contract documents.

H. Pump Warranty – The pump manufacturer shall warrant pumps being supplied to Owner against defects in workmanship and materials for a period of five years under normal use, operation, and service. In addition, manufacturer shall replace certain parts which become defective through normal use and wear on a progressive schedule of cost for a period of five years. Parts included are the mechanical seal, impeller pump housing, wear ring, and ball bearings. The warranty shall be in published form and apply to all similar units.

I. Operation and Maintenance Manual – The pump manufacturer shall furnish Owner with a minimum of six manuals for pumps installed.

2.09 CHECK VALVES

A. Shall be designed for sewage service. The valve shall be cast iron and bronze fitted. The valve shall be a spring and lever type with neoprene seat and O–Ring seals on a stainless–steel valve pin, for pipes three inches and larger in diameter. For check valves smaller than three inches, the valve shall be a fully ported 150 p.s.i. rated ball check valve with a corrosion resistant phenolic base and a rubber seat. Check valve shall be of full waterway design for quiet operation and with a flow area through the valve equal to or exceeding flow area of pipe to which it is installed.

2.10 PLUG VALVES

A. Shall be fully ported and of the same diameter as pipes to which they are attached. They shall have semi–steel bodies, all metal plugs, stainless steel bearings, and be equivalent to DeZurik Series 100 eccentric valves, lever operated. All valves larger than eight inches shall be equipped with gear actuator and handwheel.

2.11 FLOW METER

The Contractor shall furnish and install a flow meter complete with all specified appurtenances, mounting brackets, hardware, and all interconnecting tubing, wiring, and conduit.

All brackets and other hardware shall be constructed of stainless steel.

The manufacturer shall supply all necessary transformers and appurtenances required for a complete installation and one-year supply of circular charts for the furnished meter.

A. Magnetic flow meter systems shall include a magnetic flow tube and a microprocessor-based "smart" transmitter that is capable of converting and transmitting a signal from the flow tube. Magnetic flow meters shall utilize the characterized field principle of electromagnetic induction and shall produce DC signals directly proportional to the liquid flow rate.

B. Each meter shall be furnished with a stainless-steel metering tube and carbon steel flanges with a polyurethane, ceramic, neoprene, or Teflon liner as required by the application and/or as specified herein. Liner shall have a minimum thickness of 0.125 inches. The inside diameter of the liner shall be within 0.125 inches of the inside diameter of the adjoining pipe. Liner protectors shall be provided on all flow tubes.

C. The flow tube shall be provided with flush mounted electrodes. Ultrasonic electrode cleaning shall not be acceptable.

D. Grounding rings shall be provided for all meters.

E. All materials of construction for metallic wetted parts (electrodes, grounding rings, etc.) shall be minimum 316 stainless steel, but shall be compatible with the process fluid for each meter in accordance with the recommendations of the manufacturer.

F. Flow tube shall be rated for pressures up to 1.1 times the flange rating of adjacent piping. System shall be rated for ambient temperatures of -30 to +65 deg. C. Meter and transmitter housings shall meet NEMA 4X requirements as a minimum. **The Flow Tube shall be rated IP68 for continuous submergence up to 30 feet (No exception).** 100 Feet (or as needed) of cable shall be included for remote mounting of Transmitter. All Conduits must be sealed from both ends to meet IP68 protection requirements. When meter and transmitter are located in classified explosion hazard areas, the meter and transmitter housings shall be selected with rating to meet the requirements for use in those areas. Non-metallic transmitter housings shall not be acceptable.

G. The transmitter shall provide pulsed DC coil drive current to the flow tube and shall convert the returning signal to a linear, isolated 4-20 mA DC signal. The transmitter shall utilize "smart" electronics and shall contain automatic, continuous zero correction, signal processing routines for noise rejection, and an integral LCD readout capable of displaying flow rate and totalized flow. The transmitter shall continuously run self-diagnostic routines and report errors via English language messages.

H. The transmitter's preamplifier input impedance shall be a minimum of 10^{9}-10^{11} ohms which shall make the system suited for the amplification of low-level input signals and capable of operation with a material build up on the electrodes.

I. The transmitter shall provide an automatic low flow cutoff below a user configurable low flow condition (0-10%). The transmitter's outputs shall also be capable of being forced to zero by an external contact operation.

J. Each flow tube shall be factory calibrated and assigned a calibration constant or factor to be entered into the associated transmitter as part of the meter configuration parameters. Manual calibration of the flow meter shall not be required. Meter configuration parameters shall be stored in non-volatile memory in the transmitter. An output hold feature shall be provided to maintain a constant output during configuration changes.

K. The transmitter shall be capable of communicating digitally with a remote configuration device via a frequency-shift-keyed, high frequency signal superimposed on the 4-20 mA output signal. The remote configuration device shall be capable of being placed anywhere in the 4-20 mA output loop. A password-based security lockout feature shall be provided to prevent unauthorized modification of configuration parameters.

L. Accuracy shall be 0.5% of rate over the flow velocity range of 1.0 to 30.0 ft/s. Repeatability shall be 0.1% of rate; minimum turndown shall be 100:1. Minimum required liquid conductivity shall not be greater than 5 uS/cm. Maximum response time shall be adjustable between 1 and 100 seconds as a minimum. Transmitter ambient temperature operating limits shall be -10 to +50 deg. C. Power supply shall be 115 VAC, 60 Hz.

M. Flow tubes shall be 150-lb flange mounted unless otherwise noted. The cables for interconnecting the meter and transmitter shall be furnished by the manufacturer. Transmitter shall be mounted separately on the wall, on top floor of the pump house as specified.

N. Magnetic flow meter systems shall be as manufactured by **Rosemount Model 8750WA.** Local Rep Robert M. Kazmier, P.E. Kazmier & Associates, INC. Alpharetta, GA # 770-475-2242. _Cable to be cut to length to make one run all the way to the transmitter unit in the MCC control room. NO JUNCTIONS.

O. Install ground magnetic flow meter flow tubes and grounding rings in strict accordance with the manufacturer's recommendations.

2.12 PRODUCT REVIEW

A. Contractor shall provide the Engineer with a complete description of all products before ordering. Engineer will review all products before they are ordered by Contractor.

PART 3 – EXECUTION

3.01 CONSTRUCTION OBSERVATION

A. The pump station operation shall be tested by Contractor under the direction of Engineer. Engineer or Project Representative will have the right to require any portion of work be completed in their presence. If work is covered up after such instruction, it shall be exposed by Contractor for observation. However, if Contractor notifies Engineer such work is scheduled and Engineer fails to appear within 48 hours, the Contractor may proceed. All work completed, and materials furnished shall be subject to review by the Engineer or Project Representative. All improper work shall be reconstructed. All materials not conforming to requirements of specifications shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

B. Contractor shall give the Project Engineer or Project Representative a minimum of 48 hours' notice for all required observations or tests.

C. It will also be required by Contractor to keep <u>accurate</u>, legible records of the location of all appurtenances. These records will be prepared in accordance

with "Record Data and Drawings" paragraph in the Special Conditions. Final payment to the Contractor will be withheld until all such information is received and accepted.

3.02 PARTIAL ACCEPTANCE OF THE WORK

A. Owner reserves right to accept and use any part of the work. Engineer shall have power to direct on what line the Contractor shall work and order thereof.

3.03 RECORD DATA

A. It will be required of the Contractor to keep accurate, legible records, locating all as–built conditions. These records will be made available to Engineer before final review for incorporation into the Engineer's Record Drawings. Final payment to the Contractor will be withheld until all such information is received and accepted.

3.04 AIR RELEASE VALVE

A. The installation of valve (if any) shall be where shown on the plans and in accordance with standard drawings.

3.05 PUMPING STATION

A. Install pumps including fittings, brackets, discharge piping, check valve to basin rail assembly, plug valve, and lifting device according to manufacturer's recommendation.

B. Contractor shall provide, at minimum, spare parts for each pump to include but not limited to:

1. One of each seal assemblies.

2. One complete set of bearings.

3. One set of wear rings.

4. One of each type relay.

3.06 STATION STARTUP, INITIAL TESTING, AND OPERATION

A. Notify Engineer personnel five working days prior to flow rate testing.

B. Hydraulically test station to performance requirements.

C. Correct failures during test by repairing or replacing malfunctioning parts or equipment of faulty workmanship, regardless of cause, within 24 hours.

D. After correcting failures caused by defective equipment, material, or faulty workmanship, retest until failures are eliminated.

E. Confirm general sequencing of pump and float operations at basin and control

panel are in accordance with performance requirements and Utility requirements.

F. Adjust pumps and control panel system to conform to performance requirements.

G. Document and certify startup results in start–up report.

3.07 MANUFACTURER'S FIELD SERVICE

A. Furnish factory trained representative and field technical assistance during the following periods of pumping station installation:

1. Unloading of station materials and components.

2. Start–up, testing, and demonstration of station systems pump, and control panel. Provide start-up report/ results certified by manufacturer rep. and the contractor.

3.08 LEAKAGE

A. In no stretch of sewer between any two adjoining manholes shall infiltration/exfiltration exceed 25 gallons per day per inch of pipe diameter per mile of pipe. In case leakage exceeds this amount, the sewer shall not be accepted until such repairs and replacements are made to comply with above requirements. Such corrections will be made at the Contractor's expense. All visible leaks shall be repaired, regardless of the amount of leakage.

B. Lines shall be tested for leakage by low–pressure air testing, infiltration tests, or exfiltration tests, as appropriate. Low–pressure air testing for PVC pipe shall be as prescribed in ASTM F 1417. Prior to infiltration or exfiltration tests, trench shall be backfilled up to at least the lower half of pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When water table is two feet or more above top of pipe at upper end of pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to Engineer. When Engineer determines infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so a head of at least two feet is provided above both water table and top of pipe at upper end of pipeline to be tested. The filled line shall be allowed to stand until pipe has reached its maximum absorption, but not less than four hours. After absorption, the head shall be re–established. The amount of water required to maintain this water level during a two–hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 25 gallons per inch diameter per mile of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Owner.

C. The Contractor shall furnish equipment and plugs and subject force mains to hydrostatic tests at 100 p.s.i. for a period of two hours. Any leaks shall be located and repaired. Each section tested shall be slowly filled with water, care being taken to expel all air from the pipes. No pipe installation will be accepted until leakage during pressure test is less than the number of gallons listed for each 1000–feet of pipe tested:

6 inches & less – 0.9 gallons	12 inches – 1.80 gallons
8 inches – 1.20 gallons	14 inches – 2.10 gallons
10 inches – 1.50 gallons	16 inches- 2.40 gallons

3.09 CLEANING AND ACCEPTANCE

A. Before acceptance of sewer system, it shall be tested and cleaned to the satisfaction of Engineer. Where any obstruction is met, Contractor will be required to clean sewers by means of rod and swabs or other instruments. The pipe line shall be straight and show a uniform grade between manholes. The Engineer shall check lines by lamping or other methods to determine final acceptance.

3.10 CLOSING PIPE

A. When work or pipe installation is suspended, either for the night or at other times, end of sewer must be closed with a tight cover. Contractor will be held responsible for keeping the sewer free from obstruction.

3.11 PUMPING STATIONS (if called for)

A. The precast sections shall be carefully handled and placed in position undamaged. Spalled areas, cracks, or exposed reinforcing in any section shall be cause for rejection of a section. Damaged elements shall be promptly removed from the job–site.

The structure shall be installed plumb and level by Contractor on a prepared, evenly distributed and level, minimum 12–inch–thick crushed–stone bed. Joints between sections shall be sealed with butyl–rubber or neoprene sealant. Asphaltic–based material or similar products shall not be used. The sealant shall be applied in accordance with sealant manufacturer's recommendation. Leakage through joints or around pipes will not be acceptable. Grout used at construction joints and around pipes shall be Five Star brand non–shrink grout or an acceptable equivalent.

Excavation shall be accomplished in a manner as required to protect adjacent property and utilities and for safety. Backfilling shall be accomplished as soon as practicable after the structure has been placed and sealed. Backfilling shall be achieved by placing material in equal lifts (maximum two feet) and compacting each lift to maintain stability and plumbness of the structure. Backfill material shall be a select granular material with a maximum plasticity index (P.I.) of 12. Compaction shall be accomplished by means of mechanical tamping to 98% of maximum laboratory density at optimum moisture when tested by ASTM D 6938. During backfilling operation and until its completion, the wet well sections shall be maintained in an absolute plumb position. To prevent structure from possibly becoming buoyant in hydrostatic or flooded conditions, Contractor shall take necessary steps to avoid flotation of the structure.

Drawings indicate the general arrangement and location of electrical equipment, conduit, piping, transformer, and generator. Installation and location of these items shall be coordinated with the pump station operating personnel.

3.12 FORCE MAIN

A. Ductile Iron Force Main shall be installed in accordance with AWWA C 600.

B. PVC Force Main shall be installed in accordance with ASTM D 2774.

C. Crossings with water mains shall conform to BGJWSC and the Georgia EPD requirements.

END OF SECTION

INDEX TO

SECTION 02731 – WASTEWATER COLLECTION SYSTEM

Paragraph	Title	Page

PART 3 – EXECUTION

SECTION 02731

WASTEWATER COLLECTION SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Sewer Pipes.

B. Manholes.

C. Connect to existing system.

D. All necessary appurtenances to collect the wastewater and deliver it to the existing system.

E. Force Main

1.2 RELATED SECTIONS

A. Section 02570 – Traffic Control.

C. Section 02956 – Wetwell & Manhole Rehabilitation.

D. Section 02730 – Wastewater Pump Station

1.3 OPTIONS

A. The specifications describe several materials. Where manufacturers and models of equipment are named in the specifications, it is intended these are to describe quality and function required. Contractor may use equipment or materials of other manufacturers provided they are reviewed and accepted by the Engineer and Owner as equivalent to those specified.

1.4 REFERENCES (Latest Revision)

A. ASTM A 139 – Electric–Fusion (Arc) Welded Steel Pipe (NPS 4 and Over).

B. ASTM A 377 – Index of Specifications for Ductile Iron Pressure Pipe.

C. ASTM A 615/A 615 M – Deformed and Plain Carbon – Steel Bars for Concrete Reinforcement.

D. ASTM A 746 – Ductile Iron Gravity Sewer Pipe.

E. ASTM C 39/C 39M – Compressive Strength of Cylindrical Concrete Specimens.

F. ASTM C 443 – Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

G. ASTM C 478 – Circular Precast Reinforced Concrete Manhole Sections.

H. ASTM C 890 – Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

I. ASTM C 891 – Installation of Underground Precast Concrete Utility Structures.

J. ASTM C 913 – Precast Concrete Water and Wastewater Structures.

K. ASTM D 714 – Evaluating Degree of Blistering of Paints.

L. ASTM D–1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.

M. ASTM D 2241 – Poly (Vinyl Chloride) (PVC) Pressure–Rated Pipe (SDR Series).

N. ASTM D 2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity–Flow Applications.

O. ASTM D 2774 – Underground Installation of Thermoplastic Pressure Piping.

P. ASTM D 2794 – Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

Q. ASTM D 3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

R. ASTM D 3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

S. ASTM D 3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

T. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

U. ASTM D–6938 – In–Place Density and Water Content of Soil and Soil–Aggregate by Nuclear Methods (Shallow Depth).

V. ASTM E 96 – Water Vapor Transmission of Materials.

W. ASTM E 329 – Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

X. ASTM F 477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

Y. ASTM F 1417 – Installation Acceptance of Plastic Non–Pressure Sewer Lines Using Low–Pressure Air.

Z. ASTM G 154 – Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for UV Exposure of Nonmetallic Materials.

AA. AWWA C 110 – Ductile-Iron and Gray-Iron Fittings

BB. AWWA C 111 – Rubber–Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

CC. AWWA C115 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.

DD. AWWA C 150 – Thickness Design of Ductile Iron Pipe.

EE. AWWA C 151 – Ductile Iron Pipe, Centrifugally Cast, for Water.

FF. AWWA C 153 – Ductile-Iron Compact Fittings

GG. AWWA C–500 – Metal–Seated Gate Valves for Water Supply Service.

HH. AWWA C–509 – Resilient–Seated Gate Valves for Water Supply Service.

II. AWWA C 600 – Installation of Ductile Iron Water Mains and their appurtenances.

JJ. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches through 60 inches, for Water Transmission and Distribution.

KK. ACI 318 – Building Code Requirements for Structural Concrete.

1.5 MEASUREMENT AND PAYMENT

A. Measurement – Items listed in the proposal shall be considered as sufficient to complete work in accordance with plans and specifications. Any portion of work not listed in the bid form shall be deemed to be a part of item it is associated with and shall be included in costs of unit shown on bid form. Payment for unit shown on the bid form shall be considered satisfactory to cover cost of all labor, material, equipment, and performance of all operations necessary to complete work in place. The unit of measurement shall be unit shown on bid form. Payment shall be based upon the actual quantity multiplied by unit prices. Where work is to be performed at a lump sum price, the lump sum shall include all operations and elements necessary to complete work. All the work associated with this project is Lump Sum as noted on the bid form.

B. Payment

1. Gravity Sewer Pipe – Measurements will be made between the centers of manholes or to other pipe ends. No deduction will be made for the space occupied by fittings. Payment will be made at the contract unit price per linear foot for each pipe size at various depths of cut. Depths of cut are measured from existing ground unless otherwise noted. Payment will include cost of pipe, plugs, dewatering, excavating all material, testing, backfilling, compaction, cleaning, metal detector tape, tracing wire, and all work necessary to complete the sewer lines.

2. Trench Wall Supports – No separate payment will be made for bracing and sheeting.

3. Removal and Replacement of Manholes – Payment for manholes will be made at the unit price for various types and depths. Manhole depths are measured from invert to proposed finish grade unless otherwise noted.

Payment shall include cost of excavating, dewatering, constructing manholes in accordance with plans, furnishing and installing a frame and cover, steps, interior and exterior coatings, pipe connectors, backfilling, and compacting material around the manhole. Payment shall also include all removal of existing manholes and all labor required for manhole removal.

4. Stone Bedding – Will be measured by using the length and depth for which stone is specified by Engineer or Geotechnical Consultant, times a width of 4 feet wider than outside barrel of pipe. Payment will include cost of removing unsuitable material and furnishing and placing the stone and structural geotextile.

5. Sand Bedding and Backfill– Will be measured by using the length and depth for which sand is specified by Engineer or Geotechnical Consultant, times a width of four feet wider than outside barrel of pipe. Payment will include excavating the unsuitable material below the invert, furnishing, and compacting the sand bedding.

6. Service Connection – Payment will be made at the contract unit price. Payment shall include the fitting, plug, and marking stake.

7. Metal Detector Tape – No separate payment will be made for tape. Cost of furnishing and placing metal detector tape shall be included in the contract unit price for installing sewer and force main pipe.

8. Tracer Wire – No separate payment will be made for wire. The cost of furnishing and placing tracer wire shall be included in the contract unit price for installing force main pipe, sanitary sewer, and service laterals.

9. Laterals – Shall be measured from center of main to the point where lateral reaches property line. Payment will include furnishing the pipe, cleanout, excavation, installation, metal detector tape, tracing wire, backfilling, compaction, and all work and materials necessary to complete laterals.

10. Grassing – Grassing shall be paid according to grassing Section 02902.

11. Remove and Replace Existing Pavement – Payment will be made on a square yard basis, and in accordance with the detail shown.

12. Force Mains – Shall be paid for at the contract unit price for various sizes. Payment will include the pipe, fittings, thrust blocking, restrained joints, excavation, backfilling, compaction, testing, grassing, metal detector tape, tracing wire, and clean–up.

13. Fittings – Fittings for iron and plastic pipe in the system will be paid for on the basis of the unit price per pound of ductile iron fittings at the weights listed in AWWA Specification C–153 for mechanical joint compact fittings. (Excluding Accessories.) No distinction will be made between the weight of compact ductile iron, cast iron or ductile iron fittings, unless the fittings used are not manufactured as compact fittings. Fittings not manufactured as compact fittings will be paid for on the basis of the unit price per pound

of ductile iron fittings at the weights listed in AWWA C–110. P.V.C. fittings used for P.V.C. pipe, at the Contractor's option, will be considered a subsidiary obligation to the pipe and will not be measured for separate payment. Payment for P.V.C. fittings shall be included in the unit price per foot for P.V.C. The adapters necessary to connect to valves shall be considered a part of the line in which they are installed.

14. Air Release Valve and Manhole – Payment will be made at the contract unit price and will include furnishing and installing valve and manhole, backfilling, compacting, grassing, and clean–up.

15. Plug, Check & Gate Valves – Payment will be made at the contract unit price and will include furnishing and installing valve, valve box or manhole, backfilling, compacting, grassing, and clean–up.

16. Connect Sewers to Existing Structures – Payment will be made at the contract unit price for each pipe size connected. For precast structures payment shall include cost of dewatering, excavation, coring, furnishing and installing flexible sleeve, installing and connecting pipe to sleeve, backfilling, compaction, clean–up, and all work necessary to complete the connection. For brick structures, payment shall include cost of dewatering, excavation, cutting a hole, installing and grouting in pipe, backfilling, compaction, cleanup, and all work necessary to complete the connection.

1.6 QUALITY ASSURANCE

A. Contractor will furnish the Engineer and Owner a description of all material before ordering. Engineer will review the Contractor's submittals and provide in writing an acceptance or rejection of material.

B. Where ductile iron pipe is indicated on the plans, or required by Engineer, it shall be used.

C. Material and equipment shall be the standard products of a manufacturer who has manufactured them for a minimum of two years and provides published data on their quality and performance.

D. A subcontractor for any part of the work must have experience on similar work, and if required, furnish Engineer with a list of projects and Owners or Engineers who are familiar with its competence.

E. If Contractor wishes to furnish devices, equipment, structures, and systems not designed by Engineer, these items shall be designed by either a Professional Engineer registered in the project state or by someone Engineer accepts as qualified. If required, complete design calculations and assumptions shall be furnished to the Engineer or Owner before acceptance.

F. Testing shall be by a testing laboratory which operates in accordance to ASTM D 3740 or E 329 and shall be acceptable to Engineer prior to engagement. Mill certificates of tests on materials made by manufacturers will be accepted provided the manufacturer maintains an adequate testing laboratory, makes

regularly scheduled tests, spot checked by an outside laboratory, and furnishes satisfactory certificates with name of entity making test.

G. Infiltration, line and grade of sewer, pump performance, and hydrostatic tests on force mains shall be made by Contractor with equipment qualified by Engineer and in the presence of Engineer. Engineer or Project Representative reserves the right to accept or reject testing equipment.

1.7 PRODUCT DELIVERY, STORAGE & HANDLING

A. Material shall be unloaded in a manner avoiding damage and shall be stored where it will be protected and will not be hazardous to traffic. If stored on private property, Contractor shall obtain permission from property owner and shall repair any damage caused by the storage. Material shall be examined before installation. Neither damaged nor deteriorated material shall be used in the work.

1.8 JOB CONDITIONS

A. Installation of the wastewater collection system must be coordinated with other work on site. Generally, wastewater pipes will be installed first and shall be backfilled and protected so subsequent excavating and backfilling of other utilities does not disturb them. Contractor shall replace or repair any damaged pipe or structure at no additional expense to the Owner.

1.9 SEQUENCING AND SCHEDULING

A. Contractor shall arrange the work so sections of sewers between manholes are backfilled and tested, lateral sewers connected, pavement replaced, and placed in service as soon as reasonable after installation.

1.10 ALTERNATIVES

A. The intention of these specifications is to produce the best system for the Owner. If the Contractor suggests alternate material, equipment or procedures will improve results at no additional cost, Engineer and Owner will examine suggestion, and if accepted, it may be used. The basis upon which acceptance of an alternate will be given is its value to Owner, and not for Contractor's convenience.

1.11 GUARANTEE

A. Contractor shall guarantee quality of materials, equipment, and workmanship for 12 months after acceptance of the completed Project. Defects discovered during this period shall be repaired by Contractor at no cost to the Owner.

1.12 EXISTING UTILITIES

A. All known utility facilities are shown schematically on the construction drawings, and are not necessarily accurate in location as to plan or elevation. Utilities such as service lines or unknown facilities not shown will not relieve the Contractor of responsibility under this requirement. "Existing Utilities Facilities" means any utility existing on the project in its original, relocated, or newly installed position.

Contractor will be held responsible for cost of repairs to damaged underground facilities, even when such facilities are not shown on the drawings.

B. The Contractor shall call for underground utility locations before starting work. Underground utilities location service can be contacted at [1–800–282–7411 (GA) or 811.

1.13 TESTING

A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 1557, (Modified Proctor).

B. In place density tests in accordance with ASTM D 2922.

C. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.

D. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48–hours' notice prior to taking any tests.

E. Testing shall be Contractor's responsibility and shall be performed at the Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph C above.

F. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

PART 2 – PRODUCTS

Materials used in the work shall be those named in Bid Form. In multiple type bids, selection of material types will be at the opinion of Owner. Materials and products used shall conform to one of the following:

2.1 SEWER PIPE

A. PVC Pipe (4"–15" Gravity Sewer) – Shall be polyvinyl chloride plastic (PVC) and shall meet all requirements of ASTM D 3034 SDR 26, except for depths less than 3 feet where ductile iron pipe must be installed. All pipe shall be suitable for use as a gravity sewer conduit. Provisions must be made for contraction and expansion at each joint with a rubber gasket. Pipe sizes and dimensions shall be as shown below. All pipe shall be green or white in color with factory marked homing lines. Fittings shall meet the same specification requirements as pipe.

Nom. Size	Outside Diameter		Min. Wall Thickness SDR–26
	Average	Tolerance	
4	4.215	± 0.009	.162
6	6.275	± 0.011	.241
8	8.400	± 0.012	.323
10	10.500	± 0.015	.404

12	12.500	± 0.018	.481

Tests on PVC Pipe – Pipe shall be designed to pass all tests at 73 ◦ F. (± 3◦ F.).

B. PVC Pipe (16" – 64" Gravity Sewer) – Shall be polyvinyl chloride plastic (PVC) and shall meet all requirements of AWWA C900 with a minimum DR of 18, except for depths less than 3 feet where ductile iron pipe must be installed. All pipe shall be suitable for use as a gravity sewer conduit. Provisions must be made for contraction and expansion at each joint with a rubber gasket. Pipe sizes and dimensions shall conform to AWWA C900. All pipe shall be green or white in color with factory marked homing lines. Fittings shall meet the same specification requirements as pipe.

Tests on PVC Pipe – Pipe shall be designed to pass all tests at 73 ◦ F. (± 3◦ F.).

C. Ductile Iron – Shall conform to AWWA C 150, AWWA C 151 and ASTM A 746. All pipe shall be Pressure Class 350 unless otherwise noted. All ductile iron pipes and fittings shall be bituminous coated on the outside and lined with Protecto 401 Ceramic Epoxy or equivalent on inside.

1. Coating on the outside shall be an asphaltic coating approximately 1 mil thick. Finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to sun, and shall be strongly adherent to the iron.

2. Protecto 401 Ceramic Epoxy or equivalent interior lining shall conform to ASTM E 96, ASTM D 714, ASTM D 2794, and ASTM G 53. Interior of the pipe shall receive 40 mils nominal dry film thickness of epoxy. Lining application, inspection, certification, handling, and surface preparation of area to receive the protective coating shall be in accordance with manufacturer's specifications and requirements.

2.2 JOINTS – GRAVITY SYSTEM

A. Joints for Ductile Iron Pipe – Shall be slip–on rubber equivalent to "Fastite," "All–tite," or "Tyton."

B. Joints for PVC Pipe – Shall be integral wall bell and spigot with a rubber ring gasket. Joints shall conform to ASTM D 3212 and gaskets to ASTM F 477.

2.3 FORCE MAIN

A. P.V.C. – All pipe shall be green in color with factory marked homing lines. Pipe with diameter less than 4 inches shall conform to all requirements of ASTM D 2241, SDR 26, Class 160. Pipe 4 inches through 18 inches shall conform to all requirements of AWWA C900 with CI outside diameter, minimum DR of 18, Pressure Class of 235 p.s.i. Joints shall be in accordance with ASTM D 3139.

B. Ductile Iron pipe shall be in accordance with Paragraph 2.1–B and conform to ASTM A 377. Push–on–Joints shall be slip–on rubber equivalent to "Fastite," "All–tite," or "Tyton." Flanged joints shall conform to AWWA C 115. Gaskets shall conform to AWWA C 111.

C. Thrust blocking shall be sized as detailed on the construction drawings of 3,000 p.s.i. concrete. Blocking shall be provided at all bends deflecting 11–1/4° degrees or more and bear directly against the undisturbed trench wall.

D. Restrained Joints – Restrained joints for pipe, valves and fittings shall be mechanical joints with ductile iron retainer glands equivalent to "Megalug" or push–on type joints equivalent to "Lok–Ring," "TR Flex," or "Super Lock" and shall have a minimum rated working pressure equal to the item restrained with a minimum safety factor of 2:1. Joints shall be in accordance with the applicable portions of AWWA C–111. Manufacturer of joints shall furnish certification, witnessed by an independent laboratory, stating joints furnished have been tested without signs of leakage or failure. Restrained joints shall be capable of being deflected after assembly.

E. Fittings:

1. Fittings for Ductile Iron or Plastic Pipe – Shall be ductile iron, manufactured in accordance with AWWA C–153. They shall be cement lined in accordance with AWWA C–104. Fittings shall be designed to accommodate the type of pipe used.

2. Fittings for Flanged Pipe – Shall be manufactured in accordance with AWWA C–110, Class 125 flanges.

3. Fittings for Plastic Pipe – Less than 4 inches shall be PVC with ring tite rubber joints conforming to ASTM D–3139.

2.4 CASING

A. Casing pipe shall be steel conforming to ASTM A 139, yield point of 35,000 p.s.i., of the diameter shown on drawings at each crossing. The minimum wall thickness shall be 0.25 inches.

2.5 CASING SPACERS

A. Casing spacers shall be bolt on style with a shell made in two sections of a minimum 14-gauge T–304 Stainless Steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner. All nuts and bolts shall be T–304 Stainless Steel. Runners shall be made of Ultra High Molecular Weight Polymer with inherently high abrasion resistance and a low coefficient of friction. The combined height of supports and runners shall keep carrier pipe a minimum of 0.75–inches from casing pipe at all times. Casing Spacers shall be as manufactured by Cascade Waterworks Manufacturing Company, or accepted equivalent.

2.6 MANHOLES

A. Masonry – Shall be new whole brick of good quality laid in masonry mortar or cement mortar made of one-part Portland cement and two parts clean sharp sand. Every brick shall be fully bedded in mortar. Manholes shall conform to locations and details shown on the plans.

B. Precast Concrete – Shall be reinforced concrete constructed in accordance with ASTM C 478 and details shown on the plans "Precast Concrete Manholes." Coarse aggregate shall be granite stone. The joints shall be tongue and groove sealed with flexible gaskets or mastic sealant. Gaskets shall be O–Ring or equivalent to Type A or B "Tylox" conforming to ASTM C 443. Mastic shall be equivalent to "Ram–nek" with primer. Primer shall be applied to all contact surfaces of manhole joint at the factory in accordance with manufacturer's instructions.

C. Frames and Covers – Shall be cast iron equivalent to the following:

Neenah Foundry Co. R–1668 Type "C" Lid

D. Manhole Steps – **(No Step Needed)** Shall be equivalent to M.A. Industries, Type PS–1 or PS–2–PF. Steps shall be installed at the manhole factory and in accordance with recommendations of step manufacturer. Manholes will not be acceptable if steps are not installed accordingly.

E. Pipe Connections – Shall have flexible watertight joints at sewer main point of entry into the manhole. The joint shall be an EPDM or polyisoprene sleeve equivalent to "Kor–N–Seal."

F. Coatings – New manholes shall have all interior surfaces coated with a factory applied acrylic polymer–based coating and sealant. The coating shall be ConSeal CS–55 manufactured by Concrete Sealants, New Carlisle, Ohio or an accepted equivalent. The coating shall be applied in three coats to achieve a total dry film thickness of at least 3.5 mils in accordance with manufacturer's recommendations. Surfaces shall be cleaned of all dust, form oils, curing compounds and other foreign matter prior to the coating application.

New or existing manholes requiring a force main tie–in and the next downstream manhole shall be coated with 125 wet film mils of Raven 405 ultra-high build epoxy or an accepted equivalent. The interior surfaces shall be cleaned and prepared according to manufacturer's recommendations.

2.7 TEES AND WYES

A. Gravity sewer tees and wyes shall be four or six inches and same diameter as the run of pipe. They shall be of same material as the sewer main.

B. Wyes for cleanouts shall be of same material as the lateral pipe.

2.8 LATERALS AND CLEANOUTS

A. Shall be Ductile Iron Pipe conforming to paragraph 2.1–B, with push–on joints or Polyvinyl Chloride pipe with bells and rubber gaskets for jointing, conforming, to Paragraph 2.1–A, PVC Pipe.

B. Cleanout Access Box shall be equivalent to U.S. Foundry USF 7623 in pavement or Genova Products 4–inch Schedule 40 PVC–DWV Cleanout Fitting with threaded plug out of pavement.

2.9 STONE BEDDING

A. Shall be graded crushed granite with the following gradation:

Square Opening Size	Percent Passing
1 inch	100%
3/4 inch	90 to 100%
3/8 inch	0 to 65%
No. 4	0 to 25%

2.10 SAND BEDDING AND BACKFILL

A. Shall be clean sand free from clay and organic material. Not more than 10% shall pass the No. 100 sieve.

2.11 BORROW

A. Where it is determined sufficient suitable material is not available from the site to satisfactorily backfill pipe to at least two feet above top of pipe, Contractor shall furnish suitable sandy borrow material to accomplish requirements. Material shall not have more than 60% passing the No. 100 sieve, nor more than 20% passing a No. 200 sieve.

2.12 AIR RELEASE VALVE

A. Shall be designed for sewage service. The valve shall be constructed of a cast iron body, and stainless-steel float. The inlet shall be 2 inches, 5/16-inch orifice, and a venting capacity of 35 c.f.f.a.m. The working pressure shall be 0 to 50 p.s.i. It shall conform to detail shown on the drawings.

2.13 METAL DETECTOR TAPE

A. Will be installed above all pipe. Tape shall consist of 0.35 mils thick solid foil core encased in a protective plastic jacket resistant to alkalis, acids, and other destructive elements found in the soil. The lamination bond shall be strong enough so layers cannot be separated by hand. Total composite thickness shall be 5.0 mils. Foil core to be visible from unprinted side to ensure continuity. The tape shall have a minimum 3-inch width and a tensile strength of 35 lbs. per inch.

A continuous warning message indicating "sewer line" repeated every 16 inches to 36 inches shall be imprinted on the tape surface. Tape shall contain an opaque color concentrate designating color code appropriate to the line being buried (Sewer Line – Green).

2.14 TRACER WIRE

A. Will be used over all force main, sanitary sewer and service lateral lines. Tracer wire shall be #12 AWG High–Strength Copper Clad Steel (HS–CCS) Conductor, insulated with 30 mil High Density Polyethylene (HDPE) Insulation, and rated for direct burial. Insulation color shall meet APWA color code standards for identification of buried utilities.

B. Wire connectors shall be designed for direct burial and moisture resistance. Connectors shall be equivalent to 3M DBR/Y–6 Direct Bury Splice Kit.

2.15 CHECK VALVES

A. Shall be designed for sewage service. The valve shall be cast iron and bronze fitted. The valve shall be a spring and lever type with neoprene seat and O–Ring seals on a stainless-steel valve pin, for pipes 3 inches and larger in diameter. For check valves smaller than 3 inches, the valve shall be a fully ported 150 p.s.i. rated ball check valve with a corrosion resistant phenolic base and a rubber seat. Check valve shall be of full waterway design for quiet operation and with a flow area through the valve equal to or exceeding flow area of pipe to which it is installed.

2.16 GATE VALVES

A. Two Inches and Larger – Shall be cast iron or ductile iron body, bronze mounted, double disc or resilient wedge design, with non–rising stems, conforming to AWWA C 500, C 509, or C 515. Valves shall have ends to match the pipe to which they are attached. Attachment to plastic pipe shall be made by special adapters. Valves shall have a working pressure of 200 p.s.i. and be tested at 400 p.s.i.

Valves shall be furnished with "O" ring packing. One "O" ring shall be located above the thrust collar and one below. Thrust collar shall be permanently lubricated and have an anti–friction washer on top of the thrust collar.

B. Smaller than 2 inches – Shall be all brass, ball valve type. The pressure rating shall be 175 p.s.i.

C. Valve Boxes – Underground valves shall be installed in acceptable valve boxes. Valve boxes shall have a suitable base that does not damage valve or pipe, and shaft extension sections to cover and protect the valve and permit easy access and operation. The box, cover, and extensions shall be cast or ductile iron having a crushing strength of 1,500 pounds per linear foot.

2.17 PLUG VALVES

A. Shall be fully ported and of the same diameter as pipes to which they are attached. They shall have semi–steel bodies, all metal plugs, stainless steel bearings, and be equivalent to DeZurik 100% port eccentric (PEF) valves, lever operated. All valves 6 inches and larger shall be equipped with gear actuator and handwheel.

2.18 PRODUCT REVIEW

A. Contractor shall provide the Engineer with a complete description of all products before ordering. Engineer will review all products before they are ordered by Contractor.

PART 3 – EXECUTION

3.1 CONSTRUCTION OBSERVATION

A. The line, grade, deflection, and infiltration of sewers shall be tested by Contractor under the direction of Engineer. Engineer or Project Representative will have the right to require any portion of work be completed in their presence. If work is covered up after such instruction, it shall be exposed by Contractor for observation. However, if Contractor notifies Engineer such work is scheduled and Engineer fails to appear within 48 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Engineer or Project Representative. All improper work shall be reconstructed. All materials not conforming to requirements of specifications shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

Contractor shall give the Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

It will also be required by Contractor to keep accurate, legible records of the location of all sanitary lines, service laterals, manholes, force mains, valves, bends, and appurtenances. These records will be prepared in accordance with "Record Data and Drawings" paragraph in the Special Conditions. Final payment to the Contractor will be withheld until all such information is received and accepted.

3.2 LOCATION AND GRADE

A. Line and grade of sewers and position of all manholes and other structures are shown on the drawings. Grade line as given on the profile or mentioned in these specifications means invert or inside bottom of pipe. Price for trenching shall include trench for depth below this line necessary to lay sewer to grade, but measurements for payment will be made only to grade line. Master control lines and bench marks have been provided by the Engineer. The Contractor shall be responsible for proper locations and grades of sewers.

3.3 SEWER EXCAVATION

A. Contractor shall perform all excavations of every description and of whatever substance encountered to the depth shown on the plans or specified for all sewers, manholes, and other appurtenances. All excavations shall be properly dewatered before installations are made, by the use of well points, pumping, or other methods accepted by Engineer. Trenches shall be excavated in conformance with the Occupational and Safety Health Administration's (OSHA) Regulations.

Where the character of soil is unsuitable for pipe bedding as determined by Engineer or Geotechnical Consultant, additional excavation will be authorized. Engineer or Geotechnical Consultant shall determine the depth needed for additional bedding and whether material will be sand or stone. The unsuitable material shall be disposed of at Contractor's expense in a proper manner. Bottom of all trenches shall be rounded to conform to the bottom of pipe, to afford full bearing on pipe barrel. Excavation in excess of depths and widths required for sewers, manholes, and other structures shall be corrected by pouring subfoundations of 3,000 p.s.i. concrete and half cradle at the Contractor's expense.

B. Trenches shall not be excavated more than 400 feet in advance of pipe laying.

3.4 TRENCH WALL SUPPORT

A. Bracing and Sheeting – The sides of all trenches shall be securely held by stay bracing, or by skeleton or solid sheeting and bracing, as required by soil conditions encountered, to protect adjoining property and for safety. Where shown on drawings or where directed by Engineer, the Contractor must install solid sheeting to protect adjacent property and utilities. Sheeting shall be steel or timber and Contractor shall submit design data, including the section modulus of members and arrangement for bracing at various depths, to Engineer for review before installing sheeting. It shall penetrate at least 3–feet below the pipe invert. Contractor shall ensure support of pipe and its embedment is maintained throughout installation and ensure sheeting is sufficiently tight to prevent washing out of the trench wall from behind sheeting.

B. Sheeting Removal – Sheeting shall be removed in units and only when backfilling elevation has reached the level necessary to protect pipe, adjoining property, personnel, and utilities. Removal of sheeting or shoring shall be accomplished in a manner to preclude loss of foundation support and embedment materials. Fill voids left on removal of sheeting or shoring and compact all materials to required densities.

C. Movable Trench Wall Supports – Do not disturb installed pipe and its embedment when using movable trench boxes and shields. Movable supports should not be used below top of pipe zone unless acceptable methods are used for maintaining the integrity of embedment material. Before moving supports, place and compact embedment to sufficient depths to ensure protection of the pipe. As supports are moved, finish placing and compacting embedment.

D. When sheeting or shoring cannot be safely removed, it shall be left in place. Sheeting left in place shall be cut off at least 2 feet below the surface. No separate payment shall be made for bracing and sheeting except where shown on drawings or authorized by the Engineer.

3.5 LAYING PIPE

A. All sewer pipe shall be laid upgrade with spigots pointing downgrade and in accordance with ASTM D 2321. The pipe shall be laid in a ditch prepared in accordance with Paragraph 3.3 "Sewer Excavation." When sewer is complete, the interior surface shall conform on bottom accurately to grades and alignment fixed or given by Engineer. Special care shall be taken to provide a firm bedding in good material, select borrow, stone backfill or 3,000 p.s.i. concrete, as authorized, for length of each joint and 1/2 of the circumference. Holes shall be provided to relieve bells from bedding strain, but not so large to allow separation of the bell from barrel by settlement after backfilling. All pipe shall be cleaned out, and left clean. Every third joint shall be filled around immediately after being properly placed.

B. Jointing – Comply with manufacturer's recommendations for assembly of joint components, lubrication, and making joints. When pipe laying is interrupted,

secure piping against movement and seal open ends to prevent the entrance of water, mud, or foreign material.

C. Placing and Compacting Pipe Embedment – Place embedment materials by methods that will not disturb or damage the pipe. Work in and tamp haunching material in area between the bedding and underside of pipe before placing and compacting remainder of embedment in pipe zone. Do not permit compaction equipment to contact and damage the pipe. Use compaction equipment and techniques compatible with materials used and location in the trench. Before using heavy compaction or construction equipment directly over the pipe, place sufficient backfill to prevent damage, excessive deflections, or other disturbance of the pipe.

D. Rock or Unyielding Materials in Trench Bottom – If ledge rock, hard pan, shale, or other unyielding material, cobbles, rubble, debris, boulders, or stones larger than 1.5–inches are encountered in the trench bottom, excavate a minimum depth of 6–inches below pipe bottom and replace with proper embedment material.

E. Vertical Risers – Provide support for vertical risers as commonly found at service connections, cleanouts, and drop manholes to preclude vertical or lateral movement. Prevent the direct transfer of thrust due to surface loads and settlement, and ensure adequate support at points of connection to main lines.

F. Exposing Pipe for Making Service Line Connections – When excavating for a service line connection, excavate material from above the top of main line before removing material from sides of pipe. Materials and density of service line embedment shall conform to specifications for the main line.

G. Cleanouts and access boxes shall be installed as shown on the construction drawings. Install concrete collar around access box as shown on detail.

H. Manhole Connections – Use flexible water stops, resilient connectors, or other flexible systems acceptable to the Engineer making watertight connections to manholes and other structures. Fill annular space between pipe and precast concrete on inside of manhole with non–shrink grout.

Where work involves a highway, a Resident Engineer of the State Department of Transportation shall be notified 3 days before crossing is started. Where work involves a railroad, the work shall conform to requirements of AREA specifications. Division Superintendent of the Railroad shall be notified 3 days prior to beginning work. Before commencing work within the right–of–way of railroads or highways, Contractor shall verify and coordinate with the Engineer that all the required permits have been obtained.

3.6 SEPARATION BETWEEN WATER & SANITARY SEWER

A. Parallel Installation:

1. Water mains shall be laid at least 10 feet horizontally from any existing or proposed sanitary sewer, storm sewer, or sewer manhole. The distance shall be measured edge–to–edge.

2. When conditions prevent a horizontal separation of 10 feet, water main may be laid closer to a sewer (on a case–by–case basis) provided 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 where bottom of water main is at least 18 inches above top of sewer. It is advised the sewer be constructed of materials and with joints equivalent to water main standards of construction and be pressure tested to assure water–tightness prior to backfilling.

B. Crossing:

1. Water mains crossing house sewers, storm sewers, or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of water main and top of sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

2. When conditions prevent a vertical separation of 18 inches, the sewer passing over or under water mains shall be constructed of materials and with joints equivalent to water main standards of construction and shall be pressure tested to assure water–tightness prior to backfilling.

3. When water mains cross under sewers, additional measures shall be taken by providing:

a. a vertical separation of at least 18 inches between bottom of the sewer and top of water main;

b. adequate structural support for sewers to prevent excessive deflection of joints settling on and breaking the water mains;

c. length of water pipe be centered at the point of crossing so joints will be equidistant and as far as possible from sewer; and

d. both sewer and water main shall be constructed of water pipe and subjected to hydrostatic tests, as prescribed in this document. Encasement of the water pipe in concrete shall also be considered.

3.7 BACKFILLING

A. All trenches and excavation shall be backfilled immediately after pipes are laid therein, unless other protection of the pipe line is directed. Backfilling material shall be selected and deposited with special reference to the future safety of pipes. Except where special methods of bedding and tamping are provided for, clean earth or sand shall be solidly tamped about pipe up to a level at least 2 feet above top of pipes, and shall be carefully deposited to uniform layers, each layer solidly tamped or rammed with proper tools to not injure or disturb the pipeline. Remainder of the trench backfilling shall be carried on simultaneously on both sides of pipe in such a manner preventing injurious side pressure. The material used shall be selected from excavations anywhere on site if any of this soil is suitable. Backfill material shall be clean and free of rock, organic and other deleterious matter.

Under traffic areas, the top 24 inches of backfill material shall be compacted to a density of not less than 98% of maximum laboratory density at optimum moisture. Below the 24–inch line and to and including area around pipe, density shall not be less than 95% of maximum laboratory density at optimum moisture. In non–traffic areas, the backfill material shall be compacted to a density of not less than 90% of maximum laboratory density at optimum moisture unless otherwise accepted by Engineer. Compaction tests shall be conducted in accordance with ASTM D 6938 by an independent testing laboratory. Tests are to be taken at the direction of Engineer.

Whenever trenches have not been properly backfilled, or if settlement occurs, they shall be refilled, smoothed off and finally made to conform to the ground surface. Backfilling shall be carefully performed, and original surface restored to the full satisfaction of Engineer immediately after installation.

Where thermoplastic (PVC) pipe is installed, Contractor shall take precautions in accordance with ASTM D 2321, during backfilling operations so not to create excessive side pressures, or vertical or horizontal deflection of the pipe nor impair flow capacity.

3.8 MANHOLES

A. Manholes shall be constructed where shown on the drawings or where directed by Engineer. The channel in bottom of manholes shall be smooth and properly rounded. Special care must be exercised in laying the channel and adjacent pipes to grade. Manhole top elevations shall be greater than or equal to the 50–year flood elevation, unless watertight covers are provided. Tops of manholes outside of roads shall be built to grades 1–inch above ground surface in developed areas and 6 inches above ground surface in undeveloped areas unless otherwise shown on the plans. Manholes in roads shall be built to grades designated by the Engineer. Manhole sections with either honeycomb defects; exposed reinforcing; broken/fractured tongue or groove; or cracked walls will be subject to rejection by Engineer for use on the project. When mastic sealant is used, improperly applied primer will also be cause for rejection.

No leaks in any manhole will be acceptable. All repairs made from inside the manhole shall be made with mortar composed of one part Portland cement and two parts clean sand. The mixing liquid shall be straight bonding agent equivalent to "Acryl 60."

3.9 STONE BEDDING

A. Where, in the Engineer's or Geotechnical Consultant's opinion, subgrade of pipe trench is unsuitable material, Contractor shall remove unsuitable material to a depth determined by Engineer or Geotechnical Consultant and furnish and place stone backfill in trench to stabilize subgrade. Presence of water does not necessarily mean stone backfill is required. If well points or other types of dewatering will remove the water, Contractor shall be required to completely dewater trench in lieu of stone backfill. Stone bedding will be limited to areas where well pointing and other conventional methods of dewatering will not produce a dry bottom. Stone shall be placed 4 feet wider than the outside

diameter of pipe. The pipe shall be carefully bedded in stone as specified, or in accordance with manufacturer's recommendations.

3.10 SAND BEDDING AND BACKFILL

A. Where, in the Engineer's or Geotechnical Consultant's opinion, character of soil is unsuitable for pipe bedding, even though dewatered, additional depth of excavation as determined by Engineer or Geotechnical Consultant shall be made and replaced with clean sand furnished by Contractor.

3.11 DEFLECTION

A. It is the Contractor's responsibility to assure backfill is sufficient to limit pipe deflection to no more than 5%. When flexible pipe is used, a deflection test shall be made by Contractor on the entire length of installed pipeline, not less than 30–days after completion of all backfill and placement of any fill. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 95% the inside pipe diameter. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface Brinell hardness of not less than 150. The device shall be center bored and through bolted with a 1/4-inch minimum diameter steel shaft having a yield strength of 70,000 p.s.i. or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer; a pull exerted on opposite end of shaft shall produce compression throughout remote end of ball, cylinder, or circular section. Circular sections shall be spaced so distance from the external faces of front and back sections shall equal or exceed diameter of circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through by hand or by being flushed through with water, shall be cause for rejection of individual run. When a deflection device is used for the test in lieu of a ball, cylinder, or circular sections described, such device shall be acceptable to Engineer prior to use. Device shall be sensitive to 1.0% of diameter of pipe being measured and shall be accurate to 1.0% of indicated dimension. Installed pipe showing deflections greater than 5% of the normal diameter of pipe shall be retested by a run from opposite direction. If retest also fails, the suspect pipe shall be repaired or replaced at no cost to Owner.

3.12 LEAKAGE

A. In no stretch of sewer between any two adjoining manholes shall infiltration/exfiltration exceed 25 gallons/day/inch of pipe diameter per mile of pipe. In case leakage exceeds this amount, the sewer shall not be accepted until such repairs and replacements are made to comply with above requirements. Such corrections will be made at the Contractor's expense. All visible leaks shall be repaired, regardless of the amount of leakage.

B. Lines shall be tested for leakage by low pressure air testing, infiltration tests, or exfiltration tests, as appropriate. Low pressure air testing for PVC pipe shall be as prescribed in ASTM F 1417. Prior to infiltration or exfiltration tests, trench shall be backfilled up to at least the lower half of pipe. If required, sufficient additional

backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When water table is 2 feet or more above top of pipe at the upper end of pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to Engineer. When Engineer determines infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so a head of at least 2 feet is provided above both water table and top of pipe at upper end of pipeline to be tested. The filled line shall be allowed to stand until pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re–established. The amount of water required to maintain this water level during a 2–hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 25 gallons per inch diameter per mile of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Owner.

C. The Contractor shall furnish equipment and plugs and subject force mains to hydrostatic tests at 100 p.s.i. for a period of two hours. Any leaks shall be located and repaired. Each section tested shall be slowly filled with water, care being taken to expel all air from the pipes. No pipe installation will be accepted until leakage during pressure test is less than the number of gallons listed for each 1000–feet of pipe tested:

6 inches & less – 0.9 gallons	12 inches – 1.80 gallons
8 inches – 1.20 gallons	14 inches – 2.10 gallons
10 inches – 1.50 gallons	16 inches – 2.40 gallons

3.13 CLEANING AND ACCEPTANCE

A. Before acceptance of sewer system, it shall be tested and cleaned to the satisfaction of Engineer. Where any obstruction is met, Contractor will be required to clean sewers by means of rod and swabs or other instruments. The pipe line shall be straight and show a uniform grade between manholes. The Engineer shall check lines by lamping or other methods to determine final acceptance.

3.14 CLOSING PIPE

A. When work or pipe installation is suspended, either for the night or at other times, end of sewer must be closed with a tight cover. Contractor will be held responsible for keeping the sewer free from obstruction.

3.15 PARTIAL ACCEPTANCE OF THE WORK

A. Owner reserves right to accept and use any part of the work. Engineer shall have power to direct on what line the Contractor shall work and order thereof.

3.16 GRASSING

A. Grassing of areas disturbed during construction shall be in accordance with Section 02902 – "Grassing."

3.17 RECORD DATA

A. It will be required of the Contractor to keep accurate, legible records, locating all sewers, force mains, tees, and laterals. These records will be made available to Engineer before final review for incorporation into the Engineer's Record Drawings. Final payment to the Contractor will be withheld until all such information is received and accepted.

3.18 REMOVE AND REPLACE PAVEMENT

A. Pavement shall only be removed after prior written authorization by the Owner. Pavement removed and replaced shall be constructed in accordance with latest specifications of the State Department of Transportation. Traffic shall be maintained and controlled per State Department of Transportation regulations.

Edges of the pavement shall be cut to a neat straight line with a masonry saw. Backfill shall be compacted and tested and a concrete base course of 5,000 p.s.i. placed on the fill as shown on details. The concrete base shall be placed within 24 hours after pipeline is installed. A temporary wearing surface may be used provided it presents a smooth surface. The final wearing surface shall be 1–1/2 inches of 9.5 mm asphaltic concrete.

3.19 METALLIC DETECTOR TAPE

A. Contractor shall place metallic detector tape, suitably coded, directly over all installed pipes at a depth of 18 inches below the finished surface.

3.20 TRACER WIRE

A. Tracer wire will be installed on all force mains, sanitary sewer and service laterals directly on top of the pipe. Wire shall be secured to the pipe with tape or other acceptable methods at spacings of no more than 36–inches apart. Where service laterals connect to main lines, the wire connection shall be made with a direct bury moisture resistant connector. Installation of connector shall be per manufacturer's instructions. The insulated wire must maintain electrical continuity. This tracer wire system shall be checked and tested by the Contractor, in presence of Engineer or Owner prior to acceptance of force main sanitary sewer and service laterals. All equipment, meters, detectors, etc., needed for testing shall be furnished by the Contractor.

3.21 CONNECT SEWERS TO EXISTING STRUCTURES

A. Contractor shall connect the system to existing structures where indicated. For brick structures, a hole not more than 4 inches larger than the outside diameter of new pipe shall be cut neatly in structure, new pipe laid so it is flush with inside face of structure, and annular space around pipe filled with a damp, expanding mortar or grout to make a watertight seal. For precast structures, core proper size hole in

structure for pipe being connected, attach flexible sleeve into cored hole and connect new pipe into flexible sleeve with a stainless-steel band.

3.22 FIELD QUALITY CONTROL

A. Soil and density tests shall be made by a testing laboratory acceptable to the Engineer. Laboratory tests of the soil shall be made in accordance with ASTM D 1557. In–place density tests shall be made in accordance with ASTM D 6938. Results of the tests shall be furnished to the Engineer.

The minimum number of tests required shall be:

Backfill over sewer in traffic areas……	1 per 100 linear feet or less for each 4 feet of depth or portion thereof.
Backfill over sewer in non–traffic areas…	1 per 500 linear feet or less for each 6 feet of depth or portion thereof.

3.23 AIR RELEASE VALVE

A. The manhole and installation of valve shall be in accordance with detail on drawings. Prior to deciding on the location of any air release valve, Contractor shall provide Engineer with an accurate profile of installed force main so high points in system can be determined.

3.24 FORCE MAIN

A. Ductile Iron Force Mains shall be installed in accordance with AWWA C 600.

B. PVC Force Main shall be installed in accordance with ASTM D 2774.

C. The Contractor shall perform excavation of whatever substances are encountered to a depth that will provide a minimum cover over the top of the pipe of 48 inches from the existing or proposed finished grade.

D. Alignment and Grade – The force mains shall be laid and maintained on lines and grades established by the plans and specifications for the project. Fittings, valves, and tapped or bossed outlets must be installed at the required locations unless field conditions warrant otherwise, and these changes are approved in accordance with the specifications. Valve-operating stems shall be oriented to allow proper operation.

E. Prior Investigation – Prior to excavation, an investigation shall be conducted to determine the location of existing underground structures and conflicts. During excavation, damage to existing structures should be avoided. Special precautions shall be taken when the force main being installed crosses or is adjacent to a facility that is cathodically protected.

F. Unforeseen Obstructions – When obstructions not indicated on the plans interfere with the progress of work, an alteration of the plans is required. These alterations or deviation in line and grade, or the removal, relocation, or reconstruction of the obstructions shall be performed in accordance with the specifications.

G. Trench Construction – The trench shall be excavated to the required alignment, depth, and width specified or shown on the plans and shall conform with all federal, state or provincial, and local regulations for the protection of the workers.

1. Trench Preparation – Trench preparation shall proceed in advance of pipe installation as stated in the specifications.

2. Discharges from trench dewatering pumps shall be directed away from the trench to prevent trench instability and shall be in accordance with federal, state or provincial, and local point-discharge requirements.

3. Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workers or the public, or obstruct sidewalks, driveways, roadways, or other structures. Excavated material shall be placed in compliance with federal, state or provincial, and local regulations.

4. Width – The width of the trench at the top of the pipe shall equal the single-pass capabilities of normally available excavating equipment. The width shall permit the pipe to be laid and joined properly and to allow the backfill to be placed in accordance with the specifications. Trench widths shown below may be used as a guide. When required, trenches shall be wider to permit the placement of timber supports, sheeting, bracing, and appurtenances as required by the safety requirements of the agency having jurisdiction.

Nominal Pipe Size		**Trench Width**	
In.	**(mm)**	**In.**	**(mm)**
3 and 4	(76 and 102)	28	(0.71)
6	(152)	30	(0.76)
8	(203)	32	(0.81)
10	(254)	34	(0.86)
12	(305)	36	(0.91)
14	(356)	38	(0.97)
16	(406)	40	(1.02)
18	(457)	42	(1.07)
20	(508)	44	(1.12)
24	(610)	48	(1.22)
30	(762)	54	(1.37)
36	(914)	60	(1.52)
42	(1,067)	66	(1.68)
48	(1,219)	72	(1.83)
54	(1,400)	78	(1.98)
60	(1,500)	84	(2.13)
64	(1,600)	88	(2.24)

5. Bell Holes – Holes for the bells shall be provided at each joint, and they shall be no larger than necessary to allow joint assembly and to ensure the pipe barrel will lie flat on the trench bottom. The dimensions of bell-hole depressions for push-on type joints should be large enough to ensure the

pipe is not resting on the bells and is supported by the full length of the pipe barrel.

6. Other than noted previously, the trench bottom shall be true and even to provide support for the full length of the pipe barrel. A slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle without damaging coating or polyethylene encasement.

7. Rock Conditions – When excavation of rock is necessary, all rock shall be removed to provide a clearance below and on each side of all pipe and fittings of at least 6 in. (150 mm) for nominal pipe sizes 24 in. (610 mm) or smaller and 9 in. (230 mm) for nominal pipe sizes 30 in. (762 mm) and larger. When excavation is completed, a layer of appropriate backfill material shall be placed on the bottom of the trench to the appropriate depths, then leveled and tamped.

8. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point of rock, boulder, or stone of sufficient size and placement that could cause a fulcrum point or pointload.

9. Previous Excavations–If the trench passes over a previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soils or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.

H. Protecting Property–Trees, shrubs, fences, and all other property and surface structures shall be protected during construction, unless their removal is shown in the plans and specifications.

1. All properties that have been disturbed shall be restored as completely as practical to their original condition.

I. Any cutting of tree roots or branches shall be performed in accordance with the specifications.

J. Temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered during the work shall be provided in accordance with specifications or applicable regulations.

K. Installing Pipe – The proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, valves, and other appurtenances shall be lowered carefully into the trench using a backhoe, a crane, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to force main materials and protective coatings and linings. Under no circumstances shall force main materials be dropped or dumped into the trench. Where practical, the trench should be dewatered prior to installation of the pipe.

K. Examining Material – All pipe, fittings, valves, and other appurtenances shall be examined carefully for damage and other defects immediately before

installation. Defective materials shall be marked and held for final disposition as required by the specifications.

L. Pipe Ends – All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign materials before the pipe is laid.

M. Pipe Cleanliness – Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other materials shall be placed in the pipe at any time.

N. Pipe Placement – As each length of pipe is placed in the trench, the joint shall be assembled, and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

O. Direction of Bells – It is common practice to lay pipe with the bells facing the upstream; however, it is not mandatory. For example, when the main is being laid on a slope, the pipe is frequently laid with the bells facing uphill for ease of installation.

P. Pipe Plugs – At times when pipe-laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means as specified. The plug shall be fitted with a means for venting. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation, if the trench fills with water.

Q. Prior to removal of the plug for extending the line or for any other reason, air and/or water pressure in the line shall be released.

R. Joint Assembly – Shall be performed in accordance to AWWA C 600.

S. Hydrostatic Testing – Shall be performed in accordance with AWWA C 600.

3.25 BYPASSING

A. Bypassing of raw wastewater onto the ground or into a receiving stream is prohibited.

B. Bypassing shall be accomplished with pumping equipment sufficient to maintain the flow of wastewater. Contractor shall provide pump, hoses, materials, and labor to operate and maintain the bypassing operation. A backup pump shall also be made available by the Contractor. Bypassing operations shall be reviewed and acceptable to the sewer system operator before being implemented.

END OF SECTION

INDEX TO

SECTION 02902 – GRASSING

SECTION 02902

GRASSING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Seeding, planting grass and fertilizing graded areas behind the structures, pipeline rights–of–way, roadway shoulders and other disturbed areas.

B. Seed protection.

C. Maintaining seeded areas until final acceptance.

1.2 RELATED WORK

A. Section 02204 – Earthwork: Grading.

B. Section 02731 – Wastewater Collection System.

1.3 DELIVERY, STORAGE AND HANDLING

A. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging and location of packaging. Damaged packages are not acceptable.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer. Damaged bags are not acceptable.

C. Deliver sod on pallets.

D. All material shall be acceptable to Engineer prior to use.

1.4 PLANTING DATES

A. This specification provides for the establishment of a permanent grass cover between the dates of March 1 and September 30. If finished earth grades are not completed in time to permit planting and establishment of the permanent grass during the favorable season between the dates specified above unless otherwise accepted, the Contractor will be required to plant a temporary cover to protect the new graded areas from erosion and to keep windborne dust to a minimum. The temporary cover shall be planted between October 1 and February 28 unless otherwise permitted.

1.5 MEASUREMENT AND PAYMENT

A. Payment for grassing will be made under the lump sum price for the item "Pump Station Upgrade" and such payment shall constitute full compensation for furnishing and placing seed and fertilizer or sod where directed and protecting and maintaining seed and sod in all graded and disturbed areas.

PART 2 – PRODUCTS

2.1 SEED

A. 100 percent Bermuda grass.

B. All seed shall conform to all State Laws and to all requirements and regulations of the State Department of Agriculture.

C. The several varieties of seed shall be individually packaged or bagged, and tagged to show name of seed, net weight, origin, germination, lot number, and other information required by the State Department of Agriculture.

D. The Engineer reserves the right to test, reject, or accept all seed before seeding.

2.2 FERTILIZER

A. 4–12–12, commercial fertilizer of approved type, conforming to state fertilizer laws.

2.3 SEEDING SCHEDULE

A.

SEED	RATE	PLANTING DATES
Bermuda	15 lbs/acre	March 1 – September 30
Rye	75 lbs/acre	October 1 – February 28

B. In areas where existing grass is to be matched, Contractor shall sow seed at the rate and dates recommended by seed distributor.

2.4 LIME

A. Agricultural grade, ground limestone.

2.5 SOD

A. Sod shall be densely rooted, good quality centipede grass, free from noxious weeds. The sod shall be obtained from areas where the soil is reasonably fertile. The sod shall be raked free of all debris and the grass mowed to two inches before cutting. The sod shall contain practically all of the dense root system and not be less than one (1) inch thick. Sod shall be cut in uniform strips not less than twelve (12) inches in width and not less than twenty–four (24) inches in length.

2.6 ACCESSORIES

A. Straw Mulch: Oat or wheat straw, reasonably free from weeds, foreign matter detrimental to plant life, and in dry condition.

B. Excelsior Mulch: Excelsior mulch shall consist of wood fibers cut from sound, green timber. The average length of the fibers shall be 4 to 6 inches. The cut shall be made in such a manner as to provide maximum strength of fiber, but at a slight angle to the natural grain of the wood so as to cause splintering of the fibers when weathering in order to provide adherence to each other and to the soil.

C. Wood cellulose fiber shall be made from wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer. It shall remain in uniform suspension in water under agitation and blend with grass seed and fertilizer to form a homogenous slurry. The mulch fibers shall intertwine physically to form a strong moisture holding mat on the ground surface and allow rainfall to percolate into the underlying soil. The mulch shall be heat processed so as to contain no germination or growth–inhibiting factors. It shall be dyed (non–toxic) an appropriate color to facilitate metering of material.

2.7 PRODUCT REVIEW

A. The Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered.

PART 3 – EXECUTION

3.1 PREPARATION

A. The areas to be seeded shall be made smooth and uniform and shall conform to the finished grade indicated on the plans.

B. Remove foreign materials, plants, roots, stones, and debris from surfaces to be seeded.

C. Grassing areas, if not loose, shall be loosened to a minimum depth of 3–inch before fertilizer, seed or sod is applied.

3.2 STAND OF GRASS

A. Before acceptance of the seeding performed for the establishment of permanent vegetation, the Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and the winter weather and be capable of re–establishment in the spring.

B. Before acceptance of the seeding performed for the establishment of temporary vegetation, the Contractor will be required to produce a stand of grass sufficient to control erosion for a given area and length of time before the next phase of construction or the establishment of permanent vegetation is to commence.

3.3 SEEDING DATES

A. Seeding shall be performed during the periods and at the rates specified in the seeding schedules. Seeding work may, at the discretion of the Contractor, be performed throughout the year using the schedule prescribed for the given period. Seeding work shall not be conducted when the ground is frozen or excessively wet. The Contractor will be required to produce a satisfactory stand of grass regardless of the period of the year the work is performed.

3.4 APPLYING LIME AND FERTILIZER

A. Following advance preparation and placing selected material for shoulders and slopes, lime, if called for based on soil tests and fertilizer, shall be spread uniformly over the designated areas and shall be thoroughly mixed with the soil to a depth of approximately 2–inches. Fertilizer shall be applied at the rate of 500 pounds per acre for the initial application unless otherwise directed by the Engineer. Lime shall be applied at the rate determined by the soil test. Unless otherwise provided, lime will not be applied for temporary seeding. In all cases where practicable, acceptable mechanical spreaders shall be used for spreading fertilizer. On steep slopes subject to slides and inaccessible to power equipment, the slopes shall be adequately scarified. Fertilizer may be applied on steep slopes by hydraulic methods as a mixture of fertilizer and seed. When fertilizer is applied with combination seed and fertilizer drills, no further incorporation will be necessary. The fertilizer and seed shall be applied together when Wood Cellulose Fiber Mulch is used. Any stones larger than 2–1/2 inches in any dimension, larger clods, roots, or other debris brought to the surface shall be removed.

3.5 SEEDING

A. Seed shall be sown within 24 hours following the application of fertilizer and lime and preparation of the seedbed as specified in Section 3.4. Seed shall be uniformly sown at the rate specified by the use of acceptable mechanical seed drills. Rotary hand seeders, power sprayers or other satisfactory equipment may be used on steep slopes or on other areas that are inaccessible to seed drills.

B. The seeds shall be covered and lightly compacted by means of cultipacker or light roller if the drill does not perform this operation. On slopes inaccessible to compaction equipment, the seed shall be covered by dragging spiked chains, by light harrowing or by other satisfactory methods.

C. Apply water with fine spray immediately after each area has been sown.

D. Do not sow seed when ground is too dry, during windy periods or immediately following a rain.

E. If permitted by the special provisions, wood cellulose fiber mulch or excelsior fiber mulch may be used.

3.6 SEED PROTECTION (STRAW MULCH)

A. All seeded areas seeded with permanent grasses shall be uniformly mulched in a continuous blanket immediately following seeding and compacting operations, using at least 2 tons of straw per acre.

3.7 SEED PROTECTION (EXCELSIOR MULCH)

A. Seed shall be sown as specified in Section 3.5. Within 24 hours after the covering of seed, excelsior mulch shall be uniformly applied at the rate of 2 tons per acre. The mulch may be applied hydraulically or by other acceptable methods. Should the mulch be placed in a dry condition, it shall be thoroughly wetted immediately after placing. The Engineer may require light rolling of the mulch to form a tight mat.

3.8 SEED PROTECTION (WOOD CELLULOSE FIBER MULCH)

A. After the lime has been applied and ground prepared as specified in Section 3.4, wood cellulose fiber mulch shall be applied at the rate of 1,500 pounds per acre in a mixture of seed and fertilizer. Hydraulic equipment shall be used for the application of fertilizer, seed and slurry of the prepared wood pulp. This equipment shall have a built–in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed and water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which will provide an even distribution of the slurry on the various areas to be seeded. The slurry tank shall have a minimum capacity of 1,000 gallons.

The seed, fertilizer, wood pulp mulch, and water shall all be combined into the slurry tank for distribution of all ingredients in one operation by the hydraulic seeding method specified herein. The materials shall be combined in a manner recommended by the manufacturer. The slurry mixture shall be so regulated that the amounts and rates of application shall result in a uniform application of all materials at rates not less than the amount specified. Using the color of the wood pulp as a guide, the equipment operator shall spray the prepared seedbed with a uniform visible coat. The slurry shall be applied in a sweeping motion, in an arched stream so as to fall like rain, allowing the wood fibers to build upon each other until an even coat is achieved.

3.9 SODDING

A. Sod shall be placed between March 1st and December 1st.

B. Sod shall be placed within 48 hours of cutting.

C. Sod shall be moist when laid and placed on moist ground. The sod shall be carefully placed by hand, beginning at the toe of slopes and working upwards. The length of the strips shall be at right angles to the flow of surface water. All joints shall be tightly butted and end joints shall be staggered at least 12 inches. The sod shall be immediately pressed firmly into the ground by tamping or rolling. Fill all joints between strips with fine screened soil. Sod on slopes shall be pegged with sod pegs to prevent movement. The sod shall be watered, mowed, weeded, repaired or otherwise maintained, to insure the establishment of a uniform healthy stand of grass until acceptance.

3.10 MAINTENANCE

A. Maintain seeded surfaces until final acceptance.

B. Maintenance shall consist of providing protection against traffic, watering to ensure uniform seed germination and to keep surface of soil damp, and repairing any areas damaged as a result of construction operations or erosion.

3.11 ACCEPTANCE

A. Before acceptance of the seeding performed for the establishment of permanent vegetation, the Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and the winter weather and be capable of reestablishment in the spring.

END OF SECTION

INDEX TO

SECTION 02956 – WETWELL & MANHOLE REHABILITATION

SECTION 02956-1

WETWELL & MANHOLE REHABILITATION

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. This section covers all work, materials, equipment and testing required for the rehabilitation of sanitary sewer manholes and wetwells as part of this project. The contract drawings indicate what type of rehabilitation is required for each manhole. The wetwell for both pump stations shall be cleaned, repaired and coated to include all walls, and ceilings.

1.2 SECTION INCLUDES

A. Manhole Protective Coating

B. Manhole Chemical Grouting

C. Manhole Frame and Chimney Seal

D. Manhole Frame Adjustment

E. Manhole Invert Repair

F. Manhole Chimney Replacement

1.3 RELATED SECTIONS

A. Section 02570 – Traffic Control

B. Section 02731 – Wastewater Collection System

1.4 OPTIONS

A. The specifications describe several materials. Where manufacturers and models of equipment are named in the specifications, it is intended these are to describe the quality and function required. Contractor may use equipment or materials of other manufacturers provided they are reviewed and accepted by Engineer and Owner as equivalent to those specified.

1.5 REFERENCES (LATEST REVISION)

A. ASTM C 62 – Building Brick (Solid Masonry Units Made from Clay or Shale).

B. ASTM C 109 – Compressive Strength of Hydraulic Cement Mortars.

C. ASTM C 144 – Aggregate for Masonry Mortar.

D. ASTM C 150 – Portland Cement.

E. ASTM C 207 – Hydrated Lime for Masonry Purposes.

F. ASTM C 293 – Test Method for Flexural Strength of Concrete (Using Simple Beam with Center–point Loading).

G. ASTM C 348 – Flexural Strength of Hydraulic Cement Mortars.

H. ASTM C 478 – Precast Reinforced Concrete Manhole Sections.

I. ASTM C 495 – Test Method for Compressive Strength of Lightweight Insulating Concrete.

J. ASTM C 496 – Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

K. ASTM C 579 – Compressive Strength of Chemical–Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

L. ASTM C 596 – Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.

M. ASTM C 666 – Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

N. ASTM C 882 – Test Method for Bond Strength of Epoxy–Resin Systems Used with Concrete by Slant Shear.

O. ASTM C 924 – Testing Concrete Pipe Sewer Lines by Low–Pressure Air Test Method.

P. ASTM D 543 – Evaluating the Resistance of Plastics to Chemical Reagents.

Q. ASTM D 638 – Tensile Properties of Plastics.

R. ASTM D 695 – Compressive Properties of Rigid Plastics.

S. ASTM D 790 – Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

T. ASTM D 2240 – Rubber Property – Durometer Hardness.

U. ASTM D 2584 – Ignition Loss of Cured Reinforced Resins.

V. ASTM D 4414 – Measurement of Wet Film Thickness by Notch Gages.

W. ASTM D 4541 – Pull–off Strength of Coatings Using Portable Adhesion Testers.

X. ACI 506.2 – Specification for Shotcrete.

1.6 SUBMITTALS

A. The following items shall be submitted:

1. Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.

2. Material Safety Data Sheets (MSDS) for each product used.

3. Project specific guidelines and recommendations.

4. Qualification of Contractor:

a. Manufacturer certification stating Contractor has been trained and permitted in the handling, mixing, and application of products to be used.

b. Certification the equipment to be used for applying products has been manufactured or accepted by the manufacturer and Contractor's personnel have been trained and certified for proper use of the equipment.

c. Five recent references of Contractor and subcontractors indicating successful application, submitted at the time of bid.

d. Proof of any necessary federal, state, or local permits or licenses necessary for the project.

5. Design details for any additional ancillary systems and equipment to be used in site and surface preparation, application and testing.

1.7 MEASUREMENT AND PAYMENT

A. Manhole Protective Coating – Payment will be made at the contract lump sum price of "Painting & Coating" based on the percentage of the work being completed. Payment will include examination of existing manhole and wetwells, interior surface preparation, application of repair materials, manhole chemical grouting, and protective coating, labor, testing, and all work necessary to complete the manhole coating.

B. Grout Pipe Entrance – Payment will be made at the contract lump sum price. Payment will include preliminary repairs, cleaning, drilling, grout, injection of grout, labor, testing, and all work necessary to complete the manhole grouting.

C. Manhole Frame and Chimney Seal – Payment will be made at the contract lump sum price. Payment will include non–shrink grout, rubber sleeve with stainless steel bands, labor, and all work necessary to complete the chimney seal.

D. Manhole Frame Adjustment – Payment will be made at the contract lump sum price. Payment will include excavation, removal, and replacement of existing

frame, cleaning, adjusting materials, labor, and all work necessary to complete the adjustment.

E. Manhole Invert Repair – Payment will be made at the contract lump sum price. Payment will include temporarily plugging sewer lines, bypassing sewage, cleaning, materials, labor, and all work necessary to complete the repair.

F. Manhole Chimney Replacement – Payment will be made at the contract lump sum price. Payment will include excavation, demolition, cleaning, materials, labor, and all work necessary to complete the replacement.

G. Uncover manhole (under asphalt pavement) – Payment will be made at the contract lump sum price. Payment will include location of manhole, removal of asphalt pavement, and all work and materials necessary to uncover the manhole.

H. Inside Drop for Service Lateral – Payment will be made at the contract lump sum price. Payment will include pipe, fittings, attaching pipe to wall of manhole if necessary, watertight connection of pipe through manhole wall, poured concrete invert for lateral and all labor and materials necessary to complete the inside drop.

I. Outside Drop for Service Lateral – Payment will be made at the contract lump sum price. Payment will include excavation, pipe, fittings, concrete encasement of drop, watertight connection of pipes through manhole wall, poured concrete invert for lateral, backfill, compaction, and all labor and materials necessary to complete the outside drop.

J. Manhole Beach Repair – Payment will be made at the contract lump sum price. Payment will include temporary plugging sewer lines, bypassing sewage, cleaning, cementitious build–back, curing, materials, labor, and all work necessary to complete the repair.

1.8 QUALITY ASSURANCE

A. Contractor will furnish the Engineer and Owner a description of all material before ordering. The Engineer will review Contractor's submittals and provide in writing an acceptance or rejection of material.

B. Material and equipment shall be the standard product of a manufacturer who has manufactured them for a minimum of two years and who provides published data on quality and performance of product.

C. A subcontractor for any part of the work must have experience on similar work, and if required, furnish Engineer with a list of projects and Owners or Engineers who are familiar with its competence.

D. Devices, equipment, and systems not designated by Engineer, the Contractor wishes to furnish, shall be designed by either a Registered Professional Engineer or by someone Engineer accepts as qualified. If required, complete design calculations and assumptions shall be furnished to the Engineer or Owner before acceptance.

E. Contractor shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE and SSPC standards and the manufacturer's recommendations.

F. Contractors performing repairs shall be trained to properly apply the grouts according to manufacturer's recommendations.

G. Contractors performing application of protective coating must be certified by the protective coating manufacturer and perform work according to manufacturer specifications.

H. Appropriate actions shall be taken to comply with local, state and federal regulatory and other applicable agencies with regard to environment, health and safety.

1.9 PRODUCT DELIVERY, STORAGE & HANDLING

A. Material shall be unloaded in a manner avoiding damage and shall be stored where it will be protected and will not be hazardous to traffic. If stored on private property, Contractor shall obtain permission from the property owner and shall repair any damage caused by storage. Material shall be examined before installation and neither damaged nor deteriorated material shall be used in the work.

B. Materials are to be kept dry, protected from weather, and stored under cover.

C. Protective coating materials are to be stored between 50° F and 90° F. Do not store near flame, heat, or strong oxidants.

D. Protective coating materials are to be handled according to their material safety data sheets.

1.10 JOB CONDITIONS

A. The manhole rehabilitation work must be coordinated with other work on site. Contractor shall replace or repair any pipe, materials, or structures damaged through the course of work.

B. Contractor shall conform with all local, state, and federal regulations including those set forth by OSHA, RCRA and the EPA and any other applicable authorities.

1.11 SEQUENCING AND SCHEDULING

A. The Contractor shall arrange work so rehabilitated manholes are placed in service as soon as reasonable after work is completed.

B. Method statements and design procedures shall be provided to the Owner or Engineer by Contractor when confined space entry, flow diversion, or bypass is necessary.

1.12 ALTERNATIVES

A. The intention of these specifications is to produce the best system for the Owner. If Contractor suggests alternate material, equipment or procedures will improve results at no additional cost, Engineer and Owner will examine the suggestion, and if it is accepted, it may be used. The basis upon which acceptance of an alternate will be given is its value to Owner, and not for convenience of Contractor.

1.13 GUARANTEE

A. Contractor shall guarantee the quality of materials, equipment, and workmanship for **10 years** after acceptance of completed project. Defects discovered during this period shall be repaired by Contractor at no cost to the Owner.

1.14 EXISTING UTILITIES

A. All known utility facilities are shown schematically on plans and are not necessarily accurate in location as to plan or elevation. Utilities such as service lines or unknown facilities not shown on plans will not relieve the Contractor of responsibility under this requirement. "Existing Utilities Facilities" means any utility existing on the project in its original, relocated, or newly installed position. Contractor will be held responsible for the cost of repairs to damaged underground facilities; even when such facilities are not shown on plans. Contractor shall contact all utility companies prior to beginning the work and request an accurate field location of their respective utility lines. Utilities protection center can be contacted at [1–800–282–7411 (GA) or 811.

PART 2 – PRODUCTS

2.1 WETWELL & MANHOLE PROTECTIVE COATING

A. Condition of Wetwell & Manhole to be Coated

1. Standard Portland cement or new concrete (not quick setting high strength cement) must be well cured prior to application of the protective coating. Generally, 28 days is adequate cure time for standard Portland. If earlier application is desired, compressive or tensile strength of the concrete can be tested to determine if acceptable cure has occurred.

2. Cementitious patching and repair materials should not be used unless their manufacturer provides information as to its suitability for topcoating with the proposed protective coating. Project specific submittals should be provided including application, cure time and surface preparation procedures which permit optimum bond strength with the protective coating.

3. Remove existing coatings prior to application of the new protective coating. Contractor is to maintain strict adherence to applicable NACE

and SSPC recommendations with regard to proper surface preparation and compatibility with existing coatings.

B. Repair Materials

1. Repair materials shall be used to fill voids, structurally reinforce, and/or rebuild surfaces, etc. as determined necessary by Engineer and Contractor prior to application of the protective coating. Repair materials must be compatible with the specified coating and shall be applied in accordance with manufacturer's recommendations.

2. The following products are acceptable as compatible repair basecoat materials for calcium aluminate topcoating:

a. Sewper Coat 100% calcium aluminate mortar by Kerneos Aluminate Technologies.

C. Protective coating material shall be:

1. Calcium aluminate mortar mix designed to withstand long–term exposure to a bacterically corrosive hydrogen sulfide environment. The mortar mix shall only require clean, potable water as an admixture to produce a material suitable for spray application. Mortar mix shall have the following chemical composition:

Al_2O_3	CaO	$FeO + Fe_2O_3$	SiO_2
39 – 44%	35 – 39%	9 – 14%	5 – 7%

Design properties of the mortar mix shall be as follows:

Compressive Strength (ASTM C495)	> 7,000 psi	24 hours
	> 9,000 psi	28 days
Flexural Strength (ASTM C293)	> 1,200 psi	24 hours
	> 1,400 psi	28 days
Splitting Tensile Strength (ASTM C496)	> 800 psi	24 hours
Bond Strength/Slant Shear (ASTM C882)	> 1,600 psi	28 days
Shrinkage at 28 days (ASTM C596) Freeze/Thaw after 300 Cycles (ASTM C666)	< 0.06% cured @ 90% relative humidity. No visible damage after 300 cycles	

Mortar mix shall be stored with adequate provisions for the prevention of moisture absorption. It shall be stored in a manner permitting easy access for inspection and identification.

D. Protective Coating Application Equipment & Applicator – Specifically designed spray equipment, accepted for use by the protective coating manufacturer. The applicator shall be certified by the manufacturer.

2.2 CHEMICAL GROUTING MATERIALS

A. Grout – Shall be acrylamide, acrylic, or urethane gels equivalent to those manufactured by Avanti International.

Following properties shall be exhibited by the grout:

1. Documented service of satisfactory performance in similar usage.

2. Controllable reaction times and shrinkage through use of chemicals supplied by the same manufacturer. The minimum set time shall be established so adequate grout travel is achieved.

3. Resistance to chemicals; to most organic solvents, mild acids, and alkali.

4. The chemical shall be essentially non–toxic in a cured form.

5. Sealing material shall not be rigid or brittle when subjected to dry atmosphere. The material shall be able to withstand freeze/thaw and moving load conditions

6. Acrylate grouts may not be used.

B. Additives – Grout additions may be utilized for catalyzing reaction, inhibiting reaction, buffering solution, lowering the freezing temperature of solution, acting as filler, providing strength, or for inhibition of root growth.

C. Material Identification – Contractor shall completely identify types of grout, mortar, sealant, and/or root control chemicals used and provide case histories of successful use or defend choice of grouting materials based on chemical and physical properties, ease of application, and expected performance, to the satisfaction of Engineer and the owner.

D. Mixing and Handling – Mixing and handling of chemical grout, which may be toxic under certain conditions, shall be in accordance with recommendations of the manufacturer and in such a manner as to minimize hazard to personnel. It is the responsibility of Contractor to provide appropriate protective measures to ensure chemicals or gels are handled by authorized personnel in a proper manner. All equipment shall be subject to acceptance by Engineer and the owner. Only personnel thoroughly familiar with the handling of grout material and additives shall perform grouting operations.

2.3 MANHOLE FRAME AND CHIMNEY SEAL

A. Non–shrink cement grout.

B. Internal or external manhole chimney seal equivalent to those manufactured by Cretex Specialty Products.

2.4 MANHOLE FRAME ADJUSTMENT

A. Mortar – Shall be composed of one part by volume of Portland cement and two parts of sand. The Portland cement shall conform to ASTM C–150, Type I or II. The sand shall conform to ASTM C–144 and shall be of an acceptable gradation. Hydrated lime may be added to mixture of sand and cement in an amount equal to 25% of the volume of cement used. Hydrated lime shall conform to

ASTM C–207, Type S. Quantity of water in the mixture shall be sufficient to produce a workable mortar but shall in no case exceed 7 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies and organic impurities. The mortar shall be used within 30 minutes from time ingredients are mixed with water.

B. Brick shall conform to ASTM Specification C–62, Grade SW or C–55, Grade S.

C. Precast concrete adjusting rings.

D. High Density Polyethylene (HDPE) Adjusting Rings as manufactured by Ladtech, Inc. or an accepted equivalent.

2.5 MANHOLE INVERT REPAIR

A. Concrete with a minimum compressive strength of 3,000 psi at 28 days.

B. Brick and Mortar

1. Brick – Shall conform to ASTM C62, Grade SW or C–55, Grade S.

2. Mortar – Shall be composed of one part by volume of portland cement and two parts of sand. Portland cement shall conform to ASTM C–150, Type I or II. The sand shall conform to ASTM C–144 and shall be of an accepted gradation. Hydrated lime may be added to mixture of sand and cement in an amount equal to 25% of the volume of cement used. Hydrated lime shall conform to ASTM C–207, Type S. Quantity of water in the mixture shall be sufficient to produce a workable mortar but shall in no case exceed 7 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes from time ingredients are mixed with water.

2.6 MANHOLE CHIMNEY REPLACEMENT

A. Mortar – Shall be composed of one part by volume of Portland cement and two parts of sand. Portland cement shall conform to ASTM C–150, Type I or II. The sand shall conform to ASTM C–144 and shall be of an accepted gradation. Hydrated lime may be added to mixture of sand and cement in an amount equal to 25% of the volume of cement used. Hydrated lime shall conform to ASTM C–207, Type S. Quantity of water in the mixture shall be sufficient to produce a workable mortar but shall in no case exceed 7 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes from time ingredients are mixed with water.

B. Brick shall conform to ASTM Specification C–62, Grade SW or C–55, Grade S.

C. Precast concrete adjusting rings.

D. High Density Polyethylene (HDPE) Adjusting Rings as manufactured by Ladtech, Inc. or an accepted equivalent.

E. Precast concrete cone or flat top section conforming to ASTM C 478.

2.7 PRODUCT REVIEW

A. Contractor shall provide the Engineer with a complete description of all products before ordering. Engineer will review all products by the submittal of shop drawings before they are ordered.

PART 3 – EXECUTION

3.1 MANHOLE PROTECTIVE COATING

The applicator shall be certified by the manufacturer.

A. Examination

1. All structures to be coated shall be readily accessible to Contractor.

2. Any active flows shall be dammed, plugged, or diverted as required to ensure the liquid flow is maintained below surfaces to be coated. Flows should be totally plugged and/or diverted when coating the invert. All extraneous flows into manhole or vaults at or above area coated shall be plugged and/or diverted until coating has set hard to the touch.

3. Pipe joint seals shall be installed by others. No leaks may be present prior to commencing and during work.

4. Installation of protective coating shall not commence until the concrete substrate has properly cured in accordance with these specifications.

5. Temperature of the surface to be coated should be maintained between 40 deg F and 120 deg F during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Where varying surface temperatures do exist, care should be taken to apply coating when the temperature is falling versus rising (i.e. late afternoon into evening vs. morning into afternoon).

B. Surface Preparation

1. Contractor shall inspect all surfaces specified to receive a protective coating prior to surface preparation. Contractor shall notify Owner and Engineer of any noticeable disparity in surfaces which may interfere with proper preparation or application of the repair mortar and protective coating.

2. All concrete or mortar which is not sound or has been damaged by chemical exposure shall be removed to a sound surface.

3. All contaminants including: oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed.

4. Surface preparation method(s) should be based upon conditions of substrate, service environment and requirements of the protective coating to be applied.

5. All surfaces shall be repaired as required by protective coating system in the intended service condition.

6. Surfaces to receive protective coating shall be cleaned and abraded to produce a sound surface with adequate profile and porosity to provide a strong bond between the protective coating and substrate. Generally, this can be achieved with a high-pressure water cleaning using equipment capable of 5,000 psi at 4 gpm. Other methods such as high-pressure water jetting (refer to NACE Standard No. 5/SSPC–SP12), abrasive blasting, shot blasting, grinding, scarifying or acid etching may also be used. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease, or other hydrocarbon residues from the concrete. Whichever method(s) are used, they shall be performed in a manner providing a uniform, sound, clean neutralized surface not excessively damaged. Contractor shall catch debris from cleaning efforts within the manhole. Debris passing into pipelines shall be cleaned at the Contractor's expense.

7. A mild chlorine solution may be used to neutralize the surface to diminish microbiological bacteria growth prior to final rinse and coating.

8. Infiltration shall be stopped by using a material which is compatible with the specified repair mortar and is suitable for topcoating with specified protective coating.

9. Test prepared surfaces after cleaning but prior to application of protective coating to determine if a specific pH or moisture content of the concrete is required according to manufacturer's recommendations.

10. Area between the manhole and manhole ring and any other area which might exhibit movement or cracking due to expansion and contraction, shall be grouted with a flexible or elastomeric grout or gel. Castings can be abrasive blasted and coated to prevent corrosion if desired.

11. All surfaces shall be checked by Engineer's Representative during and after preparation and before the repair mortar is applied.

C. Application of Repair Materials

1. Areas where structural steel has been exposed or removed shall be repaired in accordance with the Engineer's recommendations.

2. Repair materials shall meet the specifications herein. Materials shall be trowel or spray applied utilizing proper equipment on to specified surfaces. Material thickness shall be specified by the Engineer according to Owner's requirements and manufacturer's recommendations.

3. If using acceptable cementitious repair materials, such shall be trowelled to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the protective coating. No bugholes or honeycomb surfaces should remain after the final trowel procedure of repair mortar.

4. The repair materials shall be permitted to cure according to manufacturer recommendations. Curing compounds should not be used unless formulated for compatibility with the specified protective coating.

5. Application of repair materials, if not performed by a coating certified applicator, shall be checked by the protective coating certified applicator to ensure proper finishing for suitability to receive specified coating.

6. After abrasive blast and leak repair is performed, all surfaces shall be checked for remaining laitance prior to protective coating application. Any evidence of remaining contamination or laitance shall be removed by additional abrasive blast, shotblast or other acceptable method. If repair materials are used, refer to these specifications for surface preparation. Areas to be coated must also be prepared in accordance with these specifications after receiving a cementitious repair mortar and prior to application of the protective coating.

7. All surfaces shall be checked during and after preparation and before the protective coating is applied.

D. Application of Protective Coating

1. Application procedures shall conform to recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment.

2. The spray equipment shall be specifically designed to accurately ratio and apply specified protective coating materials and shall be regularly maintained and in proper working order.

3. Protective coating material must be spray applied by a certified applicator of the protective coating manufacturer.

4. Manhole walls, benches, and frame shall be coated by spray application of the protective coating. Spray application of epoxy will have a minimum and average wet film thickness of 100 mils. Spray application of calcium aluminate will have a minimum finished thickness of 1/2 inch.

5. Airless spray application equipment acceptable to coating manufacturer shall be used to apply each coat of the protective coating.

6. If necessary, subsequent top–coating or additional coats of the protective coating should occur as recommended by protective coating manufacturer.

E. Testing

1. During application of epoxy, a wet film thickness gage, which meets ASTM D4414, shall be used to ensure a monolithic coating and uniform thickness during application. Thickness of calcium aluminate will be measured with a ruler while the material is still wet.

2. Measurement of protective coating bond strength to the substrate can be measured in accordance with ASTM D4541. Any areas detected to have inadequate bond strength shall be evaluated by the Project Engineer. Further bond tests may be performed in failed area to determine the extent of potentially deficient bonded area and repairs shall be made by Applicator in strict accordance with manufacturer's recommendations.

3. Manhole Testing – Type A: Vacuum test. All pipes entering manhole shall be plugged, taking care to securely place plugs from being drawn into the manhole. The test head shall be placed, and seal inflated in accordance with manufacturer's recommendations. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, time shall be measured for the vacuum to drop to nine 9 inches. Following are minimum allowable test times for manhole acceptance at the specified vacuum drop:

DEPTH (FEET)	TIME (SECONDS)		
(Manhole length)	48–Inch diameter	60–Inch diameter	72–Inch diameter
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
Add for 2–feet more depth:	5	6.5	8

Note: These numbers have been taken from ASTM C 924.

If a manhole fails the initial test, repairs and adjustments necessary due to extenuating circumstances (i.e. pipe joint, liner, plug sealing) should be made. Retesting shall proceed until a satisfactory test is obtained.

Manhole Testing – Type B: Exfiltration test. Incoming and outgoing sewer and service lines shall be plugged, plugs restrained, and the manhole filled with water to top of manhole frame. A soaking period of up to one hour will be allowed if bypassing of the sewage is not required or has been provided. At the end of this optional soaking period, manhole shall be

refilled with water and test begun. If water loss exceeds amount shown in the following table, manhole will have failed test. Repairs and adjustments necessary due to extenuating circumstances (i.e. pipe joint, liner, plug sealing) should be made. Retesting shall proceed until a satisfactory test is obtained. Maximum Allowable Loss is determined assuming a standard 4-foot diameter manhole.

Depth of Manhole	Maximum Allowable Loss
Under 8 feet deep	1 inch in 5 minutes
Over 8 feet deep	1/8 inch per foot of depth in 5 minutes

4. A final visual observation shall be made by the Engineer and manufacturer's representative. Any deficiencies in the finished coating shall be marked and repaired according to the procedures set forth herein by Manufacturer's Representative.

5. The system may be put back into non–severe operational service as soon as final observation has taken place. However, for severe corrosion duty such as high concentrations of acids, bases or solvents, 3 to 7 days and/or force cure by heat induction to the coated surfaces may be necessary prior to returning to service. Consult coating manufacturer for further details.

3.2 MANHOLE CHEMICAL GROUTING

A. Manhole grouting shall not be performed until repair of the manhole frame and grade rings or any other structural manhole repairs are complete.

B. Preliminary Repairs

1. Contractor shall cut and trim all roots within the manhole.

2. Contractor shall seal all unsealed lifting holes, unsealed step holes, and voids larger than approximately 1/2 inch in thickness. All cracked or deteriorated material shall be removed from the area to be patched and replaced with a waterproof quick setting mortar in accordance with manufacturer's specifications.

3. Contractor shall control all inflowing water through cracks, manhole joints, brick joints, pipe entrances, grade rings, and manhole frames.

C. Temperature – Normal grouting operations shall be performed in accordance with manufacturer's recommendations.

D. Grouting Material Usage – Grouting of the manhole shall include corbel, wall, pipe seals, manhole joints, benches and trough.

E. Drilling and Injection

1. Injection holes shall be drilled through the manhole wall at locations as recommended by manufacturer.

2. Grout shall be injected through the holes under pressure with a suitable probe. Injection pressure shall not cause damage to the manhole structure or surrounding surface features. Grout shall be injected through the lowest holes first. The procedure shall be repeated until manhole is externally sealed with grout.

3. Grouting from the ground surface shall not be allowed.

4. Grout travel shall be verified by observation of grout to defects or adjacent injection holes. Provide additional injection holes, if necessary, to ensure grout travel.

5. Injection holes shall be cleaned with a drill and patched with a waterproof quick setting mortar for brick and concrete manholes.

F. Testing – Exfiltration or vacuum testing shall be used. See paragraph 3.1E for testing instructions. 100% of the sealed manholes shall be tested. Failing Manholes shall be reworked and retested by the Contractor. This process continues until the testing is satisfactory.

Limitations and considerations include recognizing exfiltration and vacuum testing may be impractical or cost– prohibitive for all manholes; therefore, use of either method is subject to the following limitations and considerations:

1. Complete Sealing: These methods are used only when the entire manhole has been sealed or rehabilitated. The lack of sealing or rehabilitation of some portions of manhole may prevent passage of either of these tests. Spot repairs and partial sealing or rehabilitation are therefore subject to infiltration and visual testing only.

2. Structural Condition: Structural condition of some manholes may be such the testing with these methods is impractical or destructive. The Owner's Representative and Contractor shall therefore deem as structurally sound, prior to testing using these methods, those manholes which have not been structurally lined.

3.3 MANHOLE FRAME AND CHIMNEY SEAL

A. Plaster brick work or concrete adjusting rings and under manhole frame with a non–shrink grout according to manufacturer's recommendations.

B. Seal frame and chimney with a rubber and stainless-steel banded sleeve on the interior or exterior according to manufacturer's recommendations.

3.4 MANHOLE FRAME ADJUSTMENT

A. Manhole frames shall be adjusted using one of the following methods:

1. Remove existing frame and cover from manhole. Clean existing brick or precast manhole top of dirt and loose brick, mortar or concrete. Place a minimum of 1/2 inch thick and 4 inches wide layer of mortar to receive the first course of brick. Joints between brick shall be completely filled and shall be smooth and free from surplus mortar on the inside of manhole. Continue with mortar and brick courses until appropriate grade is attained. Brickwork shall be plastered with 1/2 inch of mortar over the entire inside and outside. For square or rectangular structures, brick shall be laid in stretcher courses with a header course ever sixth course. For round structures, brick shall be laid radially with every sixth course a stretcher course. Set frame in 1/2-inch-thick layer of mortar.

2. Remove existing frame and cover from manhole. Clean existing brick or precast manhole top of dirt and loose brick, mortar or concrete. Place a minimum of 1/2 inch thick and 4 inches wide layer of mortar to receive the first precast concrete adjusting ring. Continue with mortar and adjusting ring courses until appropriate grade is attained. Precast concrete rings shall be plastered with 1/2 inch of mortar over the entire inside and outside. Set frame in 1/2-inch-thick layer of mortar.

3. Remove existing frame and cover from manhole. Clean existing brick or precast manhole top of dirt and loose brick, mortar, or concrete. Install appropriate height of high-density polyethylene (HDPE) adjusting rings and frame and cover according to manufacturer's installation instructions.

3.5 MANHOLE INVERT REPAIR

A. Plug influent lines into manhole. Bypass sewage as necessary. Clean manhole bottom of all water, sewage, debris, and all substances preventing concrete or mortar from bonding to the existing structure.

B. Construct inverts and benches using concrete or brick and mortar. Dimensions shall conform to detail on the contract drawings. Newly constructed invert shall cure adequately before allowing flow through manhole. Any damage to the invert due to flow of sewage will be repaired at Contractor's expense.

3.6 MANHOLE CHIMNEY REPLACEMENT

A. Manhole chimneys shall be replaced using one of the following methods.

1. Remove existing frame and cover from manhole. Remove existing deteriorated chimney down to solid brickwork. Clean brick of dirt and loose mortar. Relay the new chimney with brick and mortar using same wall thickness as existing manhole. Joints between brick shall be completely filled and shall be smooth and free from surplus mortar on the inside of manhole. Continue with mortar and brick courses until appropriate grade is attained. Brick work shall be plastered with 1/2 inch of mortar over the entire inside and outside. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course. For round structures, brick shall be laid radially with

every sixth course a stretcher course. Set frame in ½ inch thick layer of mortar.

2. Remove existing frame and cover from manhole. Remove existing deteriorated chimney down to solid brickwork. Clean brick of dirt and loose mortar. Relay the new chimney with precast concrete adjusting rings. Continue with mortar and adjusting ring courses until appropriate grade is attained. Precast concrete rings shall be plastered with 1/2 inch of mortar over the entire inside and outside. Set frame in 1/2-inch-thick layer of mortar.

3. Remove existing frame and cover from manhole. Remove existing deteriorated precast manhole section or sections down to a solid precast section. Clean top joint of precast left in place. Coat top joint with mastic primer and install mastic joint sealer material around edge of joint. Install new precast concrete section or sections as necessary to previous grade. Set frame in 1/2-inch-thick layer of mortar.

END OF SECTION

INDEX TO

SECTION 03001 – CONCRETE

SECTION 03001

CONCRETE

PART 1 – GENERAL

1.1 WORK INCLUDED (Slabs, Walls, Reaction Blocking, Fence Footings, and other Footings and Structures)

A. Formwork, shoring, and bracing.

B. Concrete reinforcement and accessories.

C. Cast–in–place concrete.

1.2 RELATED WORK

A. Section 02731 – Wastewater Collection System
B. Section 11257 – BioAir Odor Control

1.3 REFERENCES

A. American Concrete Institute (ACI) Standards:

1. ACI 301–84 (Revised 1984) – Specifications for Structural Concrete for Buildings.

B. American Society for Testing and Materials (ASTM) Standards:

1. ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement.

2. ASTM A615 – Deformed and Plain Billet–Steel Bars for Concrete Reinforcement.

3. ASTM C33 – Concrete Aggregate.

4. ASTM C94 – Ready–Mixed Concrete.

5. ASTM C150 – Portland Cement.

6. ASTM C260 – Air–Entraining Admixtures for Concrete.

7. ASTM C309 – Liquid Membrane – Forming Curing Compounds for Curing Concrete.

8. ASTM C494 – Chemical Admixtures for Concrete.

9. ASTM C618 – Fly Ash and Raw or Calcined Natural Pozzolans for Use in Portland Cement Concrete.

10. ASTM D1190 – Concrete Joint Sealer, Hot–Poured Elastic Type.

11. ASTM D1751 – Preformed Expansion Joint Fillers for Concrete Paving and

Structural Construction (Non–extruding and Resilient Bituminous Types).

12. ASTM D1850 – Concrete Joint Sealer, Cold–Application Type.

C. Corps of Engineers Specifications:

1. CRD–C–621–80 – Non–Shrink Grout.

1.4 QUALITY ASSURANCE

A. All concrete work shall conform to the requirements of ACI 301, except as modified hereinafter.

B. The Contractor shall maintain a copy of ACI 301 on site at all times during construction.

1.5 TESTS:

A. All sampling and testing services shall be performed by a testing agency which operates in accordance to ASTM 329–77 (reapproved 1983 or latest edition) and shall be accepted by the Engineer, at the Contractor's expense.

B. The Contractor shall submit to the Engineer, for review, the concrete materials and the concrete mix designs for each class of concrete proposed for use. This submittal shall include the results of all testing performed to qualify the materials and establish the mix designs. All mix designs shall be proportioned in accordance with Section 3.9 of ACI 301, trial batches or field experience. The average strength used as the basis for selecting proportions shall be as specified in Paragraph 3.9.2.3 of ACI 301.

C. The testing laboratory shall conduct strength tests of the concrete during construction in accordance with Section 16.3.4 of ACI 301. At least one strength test (3 test cylinders) shall be made for each 50 cubic years, or fraction thereof, of each mix design of concrete placed in any 1 day.

D. Slump tests shall be conducted regularly during construction in accordance with Section 16.3.5 of ACI 301.

E. The air content of the concrete sample for each strength test shall be determined in accordance with Section 16.3.6 of ACI 301.

F. Results of all tests shall be submitted to the Engineer, with copies to the Contractor. The test reports shall include the exact location in the work at which the batch represented by a test was deposited.

G. Evaluation of test results and acceptance of concrete shall be in accordance with Chapter 17 of ACI 301.

1.6 ACCEPTANCE OF COMPLETED WORK

A. Acceptance or rejection of completed concrete work shall be in accordance with Chapter 18 of ACI 301.

1.7 SUBMITTALS

A. Mix designs and test results as specified in Article 1.05 – TESTS.

B. Shop Drawings: Submit shop drawings of reinforcing steel to the Engineer for review. Indicate sizes, spacing, and locations of reinforcing steels, supporting and spacing devices, bar bending details, and bar lists.

1.8 MEASUREMENT AND PAYMENT

A. All concrete will be considered a part of the structure in which it is used, and no direct measurement or payment will be made for it.

PART 2 – PRODUCTS

2.1 FORM MATERIALS

A. Shall conform to ACI 301.

B. Shall be wood, plywood, metal, or other qualified material and shall be of the grade or type suitable to obtain the finish specified.

2.2 REINFORCING STEEL

A. Reinforcing Steel: ASTM A 615, Grade 60 billet steel deformed bars; uncoated finish.

B. Welded Steel Wire Fabric: Plain type, ASTM A185; uncoated finish.

2.3 CONCRETE MATERIALS:

A. Portland Cement: ASTM C–150, Type I.

B. Fine and Coast Aggregates: ASTM C33. 1–inch maximum nominal size.

C. Water: Clean, fresh and free from injurious amounts of mineral and organic substances.

2.4 ADMIXTURES

A. Admixtures to be used in concrete, when required by the contract documents or specifically permitted by the Engineer, shall conform to the appropriate specifications listed below:

1. Air–Entraining Admixtures: ASTM C260.

2. Water–Reducing Admixture: ASTM C 494, Type A; Eucon WR–75 by the Euclid Chemical Company, or equal.

3. Water–Reducing Admixture: ASTM C494, Type D; Eucon Retarded – 75 by the Euclid Chemical Company, or equal.

4. High Range Water–Reducing Admixture (Superplasticizer): ASTM C494, Type F or G; Eucon 37 by the Euclid Chemical Company, or equal.

5. Non–Chloride Accelerator: ASTM C 494, Type C or E; Accelguard 80 by the Euclid Chemical Company, or equal.

6. Pozzolanic Admixtures: ASTM C 618.

B. Calcium chloride or admixtures containing more than 0.1% chloride ions are not permitted.

C. Certification: Written certification of conformance to the above–mentioned requirements and the chloride ion content will be required from the admixture manufacturer prior to mix design review by the Engineer.

2.5 ACCESSORIES

A. Bonding Compound: Polyvinyl acetate, rewettable type; Euco Weld by the Euclid Chemical Company, or equivalent.

B. Epoxy Adhesive: Two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces; Euco Epoxy #463 or #615 by the Euclid Chemical Company, or equivalent.

C. Non–Shrink Grout: CRD–C–621–80, non–metallic; Euco N–S by the Euclid Chemical Company, or equivalent.

D. Vapor Barrier: ASTM D 2103, 6 mil thick clear polyethylene film.

E. Expansion Joints: Pre–molded expansion joint filler strips conforming to ASTM D 1751.

F. Joint Sealant: Hot or cold applied, ASTM D 1190 or D 1850.

G. Form Release Agent: Qualified material which will not stain concrete or absorb moisture.

H. Manhole Step: Polypropylene covered steel; M.A. Industries model PS–1–PF or IMCO Reinforced Plastics, Inc. Model F.R.P. or equivalent. Color: Black or grey.

2.6 CURING MATERIALS

A. Membrane Curing Compound: ASTM C 309, clear with fugitive dye; Kurez by the Euclid Chemical Company, or equivalent.

2.7 CONCRETE MIX

A. Concrete shall be ready–mixed and shall be batched, mixed, and transported with sufficient facilities to deliver the concrete at the rate required and in accordance with ASTM C 94. The ready–mix concrete supplier shall furnish the Engineer a certified statement that the concrete furnished to the job conforms to the provisions of these specifications.

B. Compressive Strength:

1. Concrete for Reaction Blocking: 2,000 psi

2. Concrete for Footings: 3,000 psi

3. Concrete for Fencing: 2,000 psi

4. All other concrete: 4,000 psi at 28 days

C. Slump: Unless otherwise permitted or specified, the concrete shall have a slump of 4–inches or less if consolidation is to be by vibration, and 5–inches or less if consolidation is to be by methods other than vibration.

PART 3 – EXECUTION

3.1 ON SITE OBSERVATIONS OF WORK: The Engineer will have the right to require that any portion of the work be done in his presence and if the work is covered up after such instruction, it shall be exposed by the Contractor for observation. However, if the Contractor notifies the Engineer that such work is schedule, and the Engineer fails to appear within 48 hours, the Contractor may proceed without him. All work done and materials furnished shall be subject to review by the Engineer or Project Representative, and improper work shall be reconstructed, and all materials, which do not conform to the requirements of the specifications, shall be removed from the work upon notice being received from the Engineer for the rejection of such materials. The Engineer shall have the right to mark rejected materials so as to distinguish them as such.

The Contractor shall give the Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

3.2 FORMWORK ERECTION

A. Forms shall conform to shapes, lines, and dimensions of the members as called for on the plans and shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape.

B. Earth cuts shall not be used as forms for vertical surfaces.

C. The Contractor shall coordinate the work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Before placing of either the reinforcing steel or the concrete, the surfaces of the forms shall be covered with an approved coating material that will effectively percent absorption of moisture and prevent bond with the concrete and will not stain the concrete surfaces.

3.3 REINFORCEMENT

A. All reinforcement shall be free of mud, oil, or other materials that may adversely affect or reduce the bond. Reinforcement will rust, mill scale, or a combination of both will be accepted as being satisfactory without cleaning or brushing provided the dimensions and weights, including heights of deformations of a cleaned sample shall not be less than required by the applicable ASTM specifications.

B. Reinforcements shall be placed, supported, and secured against displacement by construction loads or the placing of concrete. Bar supports and spacers shall be

made of concrete, metal, plastic, or other accepted material, and shall be subject to the review of the Engineer. Where the concrete surface will be exposed to the weather in the finished structure, the portions of all accessories within 1/2–inch of the concrete surface shall be noncorrosive or protected against corrosion.

C. All splices not shown on the drawings shall be subject to review of the Engineer.

3.4 PREPARATION FOR PLACING

A. Water shall be removed from excavations before concrete is deposited. Hardened concrete debris and other foreign materials shall be removed from the interior of forms and from the inside of mixing and conveying equipment.

B. Concrete shall be placed only upon surfaces that are free from frost, ice, mud, and other detrimental substances. When concrete is to be placed on dry soil or other pervious material, polyethylene sheeting shall be laid over the surfaces that are to receive the concrete.

3.5 PLACING CONCRETE

A. Concrete shall be handled and deposited using equipment and methods which will percent segregation or loss of ingredients. Equipment and methods for placing concrete shall be subject to the acceptance of the Engineer.

B. Concrete having attained its initial set or having contained water for more than 45 minutes shall not be used in the work. Retardants may be used subject to acceptance by the Engineer.

C. Sufficient mixing and placing capacity shall be provided so that the concrete which is being integrated with fresh concrete is still plastic. Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be placed as acceptance by the Engineer.

D. Concrete shall not be allowed or caused to flow horizontally or on slopes in the forms. Concrete placing on a slope shall begin at the lower end of the slope and progress upward.

E. Concrete shall be consolidated by mechanical vibration so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms.

F. When the temperature of the surrounding air is expected to be below 40° F during placing or 24 hours thereafter, the temperature of the plastic concrete as placed, shall be no lower than 55° F for sections less than 12–inches in any dimension nor 50° F for any other sections. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints, and shall not exceed 90° F unless permitted by the Engineer.

3.6 REMOVAL OF FORMS

A. Forms shall be removed in such a manner and at such time as to ensure the complete safety of the structure. In no case shall supporting forms or shoring be

removed until members have acquired sufficient strength to support their weight and imposed loads of safety.

3.7 REPAIR OF SURFACE DEFECTS

A. With prior approval of the Engineer as to methods and materials, all repair of defective areas shall be in accordance with ACI 301, Chapter 9, except that the specified bonding compound must be used. The patching mortar shall be placed after the bonding compound has dried.

B. All structural repairs shall be made using the specified epoxy adhesive and/or epoxy mortar, as directed by the Engineer.

C. The use of bonding compounds, adhesives, and other proprietary materials, where specified and/or permitted by the Engineer, shall be installed and/or applied in strict accordance with the manufacturer's recommendations.

3.8 FINISHES AND FORMED SURFACES

A. Rough form finish on all surfaces which will not be exposed to view in the finished work.

B. Smooth rubbed finish on all surfaces which will be exposed to view in the finished work.

3.9 CURING

A. Beginning immediately after placement, concrete shall be protected from moisture loss for not less than 7 days. Materials and methods of curing shall be subject to review by the Engineer.

B. For concrete surfaces not in contact with forms, curing compound shall be applied after completion of placement and finishing. The compound shall be applied in accordance with the manufacturer's recommendations immediately after any water sheen which may develop after finishing has disappeared from the concrete surface.

C. Moisture loss from surfaces placed against forms shall be minimized by keeping the forms wet until they are removed. If forms are removed during the curing period, surfaces shall be cured as specified above until the end of the specified curing period.

D. Protect concrete by suitable methods to percent damage by mechanical injury or excessively hot or cold temperatures.

3.10 JOINTS AND EMBEDDED ITEMS

A. Construction Joints:

1. Construction joints not shown on the drawings shall be so made and located as to least impair the strength of the structure and shall be approved by the Engineer. Joints shall be perpendicular to the main reinforcement.

2. All reinforcement shall be continued across joints. Longitudinal keys at least

1–1/2–inches deep shall be provided in all joints in walls and between walls and slabs or footings.

3. The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed prior to placing adjoining concrete.

4. Bond shall be obtained as specified in Article 3.11 – BONDING.

B. Expansion Joints:

1. Expansion joints shall be constructed and located as indicated on the drawings.

2. In no case shall reinforcement, or other embedded metal items bonded to the concrete, extend continuously through an expansion joint, except where detailed on the drawings.

3. Pre–molded expansion joint filler shall be of the type specified.

C. Other Embedded Items: All sleeves, inserts, anchors and embedded items required for adjoining work or for its support shall be placed prior to concreting.

D. Expansion joint material and other embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to percent the entry of concrete into the voids.

3.11 BONDING

A. Unexposed Work: The hardened concrete of joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in unexposed walls, and all others not mentioned below shall be dampened (but not saturated) immediately prior to placing of fresh concrete.

B. Exposed Work: The hardened concrete of joints in exposed work, joints in beams, girders, joints, or slabs, and joints in work designed to contain liquid shall be dampened (but not saturated) and then coated with the specified bonding compound or epoxy adhesive, as directed by the Engineer. The agent shall be applied in strict accordance with the manufacturer's recommendations on a clean sound concrete surface. New concrete shall be placed after the bonding compound has dried or while the epoxy adhesive is still tacky.

END OF SECTION

INDEX TO

SECTION 04220 – CONCRETE UNIT MASONARY

SECTION 04220

CONCRETE UNIT MASONRY

PART 1 – GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):

a. 530.1/ASCE 6/TMS 602, Building Code Requirements for Masonry Structures and Specifications for Masonry Structures and Related Commentaries.

b. ACI SP-66, ACI Detailing Manual

2. ASTM International (ASTM):

a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

b. A153, Standard specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

c. A167, Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

d. A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

e. C33, Standard Specification for Concrete Aggregates.

f. C62, Building Brick (Solid Masonry Units Made from Clay or Shale)

g. C67, Sampling and Testing Brick and Structural Clay Tile

h. C90, Standard Specification for Loadbearing Concrete Masonry Units.

i. C91, Masonry Cement

j. C94, Ready Mixed Concrete

k. C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

l. C144, Standard Specification for Aggregate for Masonry Mortar.

m. C150, Standard Specification for Portland Cement.

n. C270, Standard Specification for Mortar for Unit Masonry.

o. C476, Standard Specification for Grout for Masonry.

p. C494, Chemical Admixtures for Concrete

q. C578, Rigid, Cellular Polystyrene Thermal Insulation

r. C744, Standard Specification for refaced Concrete and Calcium Silicate Masonry Units.

s. C780, Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

t. C1019, Sampling and Testing Grout

u. C1072, Measurement of Masonry Flexural Bond Strength

v. C1142, Extended Life Mortar for Unit Masonry

w. C1289, Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

x. C1314, Standard Test Method for Compressive Strength of Masonry Prisms.

y. C2287, Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

z. E514, Standard Test Method for Water Penetration and Leakage through Masonry.

3. Brick Institute of America (BIA).

4. International Code Council (ICC):

a. International Building Code (IBC) Chapter 21.

b. ICC Evaluation Service (ICC-ES) Reports.

5. National Concrete Masonry Association (NCMA).

1.02 SUBMITTALS

A. Submittals for Review:

1. Product Data:

a. Accessories.

b. Concrete Masonry Units (CMU).

c. Mortar - include required environmental conditions, admixture limitations and manufacturer's instructions for packaged dry mortar installation.

d. Reinforcement.

2. Certificates:

a. Manufacturer letters of certification stating materials meet or exceed the specified requirements.

B. Informational Submittals:

1. Statement of Acknowledgement of Quality Assurance Plan in accordance with IBC Section 1705.3.

1.03 QUALITY ASSURANCE

A. Compliance: Comply with the requirements and criteria of the NCMA, BIA, ASTM C90, ASTM C216, and ACI 530.1 for masonry finish and appearance, dimension tolerances, tolerances of construction, joint tolerances, and wall plumb tolerances.

B. Spare Vibrator: Maintain at least one spare vibrator on site at all times.

C. Bracing and Scaffolding: Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local code.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Temperature: Do not lay masonry when ambient temperature is below 32 degrees F on a rising temperature, or below 40 degrees F on a falling temperature, or when there is a probability of such conditions occurring within 48 hours, unless written approval of procedure for protection from freezing is obtained from Engineer. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 or applicable building code, whichever is more stringent.

B. Moisture Protection: Protect masonry construction from loss of moisture during curing period of 7 days when ambient air temperature is 90 degrees F or greater and when relative humidity is less than 50 percent.

PART 2 – PRODUCTS

2.01 MASONRY UNITS

A. General:

1. Furnish or cut special shapes for corners, jambs, lintels, and other areas shown or required.

2. Special units shall match properties of standard units.

3. Where units are placed so end of unit is exposed, such as at a corner or intersection, exposed end of that block shall have surface to match color and texture of sides of other units.

4. Furnish sound, dry, clean units free of cracks, prior to placing in structure.

5. Vertical Cells to be Grouted: Capable of alignment sufficient to maintain clear, unobstructed continuous vertical cell dimensions in accordance with ACI 530.1, Table 7.

6. Masonry unit size and shape shall allow for all placement patterns to prevent materials, such as grout or poured insulation, from escaping from cell being filled to adjacent cells where material is not intended to be placed.

B. Plain Face Concrete Masonry Units (CMU):

1. Load Bearing Units: ASTM C90: lightweight, hollow block, grouted as indicated.

2. Nominal Size: 16 inches long by 8 inches high by required thickness, or as shown on Drawings.

3. Minimum Compressive Strength, f'_m: 1,500 psi

4. Color of Units: Natural.

5. Surface Texture: Smooth.

C. Decorative Concrete Masonry Units:

1. Texture: Split face and smooth face, as indicated.

2. Colors: As selected by Architect.

3. Manufacturers: Subject to compliance with requirements, provide selected products by one of the following:

a. Cemex.

b. Johnson Cement Co.

c. Trenwyth Industries/Oldcastle.

D. Integral Water Repellent for Decorative Concrete Units: Provide units made with integral water repellent for exposed units. Provide one of the following:

1. Headwaters Construction Materials; Eucon BlockTite.

2. Grace Construction Products; Dry-Block.

3. BASF; Rheopel.

2.02 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM CI50, Type I.

B. Lime: ASTM C207, Type S hydrated.

C. Aggregates:

1. Mortar: ASTM C144, sand.

2. Grout: ASTM C404.

D. Water: Fresh, clean, and potable.

E. Colored Cement for Decorative Concrete Masonry: Packaged blend made from mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients. Provide one of the following:

1. Essroc; Flamingo Color Masonry Cement.

2. Holcim; Rainbow Mortamix Custom Color Masonry Cement.

3. Lehigh; Lehigh Custom Color Masonry Cement.

F. Mortar Mix:

1. Mortar for Unit Masonry, Type S in accordance with ASTM C270.

2. Minimum 28-day compressive strength of 2,100 psi.

G. Grout:

1. For bond beams, lintels and vertically reinforced cells.

2. Grout shall be in accordance with ASTM C476, premixed type in accordance with ASTM C94.

3. Consistency required to fill completely the volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less;

coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

4. Minimum 28-day compressive strength of 3,000 psi. Slump: 8 inches to 11 inches.

2.03 REINFORCEMENT

A. Horizontal Joint Reinforcement:

1. Truss or ladder type, ASTM *A82,* 9ga, galvanized.

2. Reinforcement: Clean and free from loose rust, scale, and coatings that reduce bond.

3. Furnish special manufactured corner and wall intersection pieces.

4. Manufacturer: Dur-O-Wal, Inc., Aurora, IL.

B. Deformed Bars: As specified in Section 03 30 00 Cast-In-Place Concrete.

2.04 PREFORMED CONTROL JOINTS

A. Solid rubber cross-shape extrusions as manufactured by:

1. Wire-Bond, Rubber Control Joint.
2. Hohmann and Barnard, Inc; RS Series.

PART 3 – EXECUTION

3.01 GENERAL

A. Protect masonry construction to prevent efflorescence. Provide measures to prevent moisture from entering incomplete walls.

3.02 PREPARATION

A. Prepare surface contact area of foundation concrete for initial mortar placement by one of following methods:

1. Sandblasting foundation and reinforcing dowels after concrete has fully cured to remove laitance and spillage and to expose sound aggregate.

2. Water blasting foundation and reinforcing dowels after concrete has partially cured to remove laitance and spillage and to expose sound aggregate.

B. Clean surfaces of loose material prior to initial mortar placement.

C. Prevent surface damage to foundation concrete that will be exposed to view outside of contact area.

3.03 LAYING MASONRY UNITS

A. General:

1. Conform to building code applicable to this Project and as supplemented by these Specifications.

2. Do not start laying masonry units unless foundation wall is plumb within 1/4 inch in 10 feet or not straight within *5/16* inch in 10 feet.

3. Finish Tolerances (Measured on Interior surfaces):

d. Maximum permissible variation from plumb of masonry wall or line of joints in masonry wall: 1/16 inch per foot of height and *1/4* inch in total height of wall.

e. Maximum permissible variation from horizontal line along base of wall or for lines of horizontal joints: *1/16* inch per block and *1/4* inch per 50 feet of wall with proportionately greater tolerance for longer walls up to *1/2* inch in total length of wall.

4. Place units with chipped edges or corners such that chipped area is not exposed to view.

B. Wall Units:

1. General:

a. If necessary, to move a unit after set in-place, remove from wall, clean, and set in fresh mortar.

b. Toothing of masonry units is not permitted.

2. Running Bond:

a. Unless otherwise shown, lay up walls in straight, level, and uniform courses using a running bond pattern.

b. Place units for continuous vertical cells and mortar joints to prevent materials, such as grout or poured insulation, from escaping from cell being filled to adjacent cells where material is not intended to be placed.

3. Corners: Lay standard masonry bond for overlapping units and grout solid.

4. Intersecting Walls: Bond with reinforcement, not with masonry bond.

C. Special Shapes:

1. Provide and place such special units as corner block, doorjamb block, lintel block fillers, and similar blocks as may be required.

2. Use required shapes and sizes to work to corners and openings, maintaining proper bond throughout wall.

3.04 BUILT-IN ITEMS

A. Position door frames, windows, vents, louvers, and other items to be built in wall, and construct wall around them.

B. Install masonry anchors to secure items to wall.

C. Fill spaces around items with mortar or grout.

D. Do not place electrical, instrumentation, or water conduits in a cell containing reinforcement, unless approved in writing by Engineer. Pipes, sleeves, and conduits shall not be placed closer than three diameters, center-to-center, nor shall they impair strength of construction.

3.05 MORTAR JOINTS

A. General:

1. Straight, clean, with uniform thickness of 3/8 inch.

2. Horizontal and vertical mortar joints shall have full mortar coverage on face shells.

3. Vertical Head Joints:

a. Butter well on each unit for a width equal to face shell of unit, shove tightly so mortar bonds well to both units.

b. Solidly fill joints from face of block to at least depth of face shell.

4. As units are laid, remove excess mortar from grout space of cells to be filled.

5. Place mortar before initial setting of cement takes place. Do not retemper mortar that has started to set or is not used within one hour. Retempering of colored mortar is not allowed.

B. Exposed Joints:

1. Tool joints exposed to view after final construction, unless otherwise noted or shown.

2. Cut joints flush and as mortar takes its initial set tool to provide a concave joint.

3. Perform tooling when mortar is partially set but still sufficiently plastic to bond.

4. Perform tooling with tool that compacts mortar, pressing excess mortar out rather than dragging it out.

5. Rake out joints that are not tight at time of tooling, point, and then tool.

6. Rake and tool joints at split-face surfaces interior and exterior.

C. Concealed Joints: Strike flush with no further treatment required.

3.06 CONTROL JOINTS

A. Preformed Control Joints:

1. Omit mortar from vertical joints.

2. Place rubber control joint material as wall is built.

3. After wall is grouted, cured, and cleaned, install backing rod and sealant as specified in Section 07 92 00, Joint Sealants.

4. Place and tool sealant to match depth of typical joint.

5. Maximum spacing from all corners shall be 20 times wall thickness, maximum spacing between joints shall be 40 times wall thickness.

3.07 REINFORCING

A. Foundation Dowels:

1. Size, number, and location of foundation dowels shall match vertical wall reinforcing, unless otherwise noted.

2. When foundation dowel does not line up as intended, with vertical core, do not slope more than 1 horizontal to 6 vertical to bring it into alignment.

B. Vertical Reinforcing:

1. Use deformed bars.

2. Hold in position near the ends of bars by wire ties to dowels or by reinforcing positioners.

3. Lap reinforcing bars as shown, where spliced and wire tie together.

4. Minimum Bar Clearance: One bar diameter from masonry and from additional parallel bars in same grout space.

5. Hold in position at maximum intervals of 160 bar diameters by reinforcing positioners.

C. Horizontal Reinforcing:

1. Use deformed bars.

2. Lay on webs of bond beam units and place as wall is built.

3. Lap reinforcing bars as shown, where spliced and wire tie together.

4. Minimum Bar Clearance: One bar diameter from masonry and from additional parallel bars in same grout space.

5. Terminate reinforcing bars 2 inches clear from control joints as shown.

D. Horizontal Joint Reinforcement:

1. Use for stack bond.

2. Provide in addition to typical wall reinforcing steel.

3. Space maximum 16 inches apart, vertically.

4. Lap ends 6 inches minimum.

5. At control joints make reinforcement discontinuous.

6. Use manufactured corner and other wall intersection pieces.

3.08 MORTAR PRODUCTION

A. General:

1. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use. Mix ingredients 3 minutes to 5 minutes after all ingredients are introduced.

2. Provide volumetric control by using batching box or similar measuring device. Do not use shovel to introduce materials directly into batch.

3. Maintain sand uniformly damp immediately before the mixing process.

4. Use cool mix water.

5. Do not use anti-freeze compounds to lower the freezing point of mortar.

6. If water is lost by evaporation, re-temper only within two hours of mixing.

3.09 GROUTING

A. General:

1. Do not mix, convey, or place with equipment constructed of aluminum.

2. Secure vertical and horizontal reinforcement, ties, bolts, anchors, and other required embedments in place; inspect and verify before placing grout.

3. Grout beams over openings in one continuous operation.

4. Maintain vertical alignment in ACI 530.1, Table 7.

5. Maximum grout pour shall be 5'-0", unless otherwise approved, in writing, by Engineer.

6. Place grout as soon as possible after mortar has set to reduce shrinkage cracking of vertical joints.

7. Vertical Reinforcement:

   a. First wire tie to foundation dowels, then build wall around it.

   b. Provide reinforcing positioners or a proved cross bracing to secure top of steel in place.

   c. Do not drop in vertical steel after block is laid, unless reinforcing positioners are provided in the course above previously grouted course.

B. Grouting Requirements:

1. Brace masonry to resist wet grout pressure.

2. Do not start grouting until wall has cured for 24 hours, minimum.

3. Partial Grouting Requirements:

   a. Walls Not Requiring Solid Grouting: Fill cells containing reinforcing steel, anchor bolts, and other embedded items as shown with grout.

   b. Construct cells to be filled to confine grout within cell.

   c. Cover tops of unfilled vertical cells under a bond beam with metal lath to confine grout fill to bond beam section.

4. Form horizontal construction joints between pours by stopping grout pour 1–1/2 inches below a mortar joint, except at a bond beam; stop pour 1/2 inch below top of masonry unit.

5. Partial Grouting with Insulation Fill:

   a. Where cells of masonry units are to receive masonry fill insulation in some cells and to receive grout in some cells, provide continuous

mortar on block webs on each side of cells to be filled with grout to ensure insulation without enter grout cells.

b. Where bond beams are required with masonry fill insulation and grout, limit pours to less than 5 feet in height.

6. Fully embed horizontal steel with grout in an uninterrupted pour.

7. Do not construct wall more than one course above top of grout pour prior to placing grout.

8. Vibration:

a. Use internal "pencil" type, low energy vibrator to thoroughly consolidate grout and reduce amount of air voids. Do not use concrete vibrators.

b. After waiting sufficient time to permit grout to become plastic, but before it has taken any set, reconsolidate grout.

c. Waiting period will vary depending upon weather conditions and block absorption rates, but under "normal" weather conditions with average masonry units the waiting period should be between 30 minutes to 60 minutes.

9. Cleanouts:

a. Provide for grout pours over 5 feet in height.

b. Provide for sufficient size to permit cleaning of cell, positioning of reinforcing, and inspection at bottom of every vertical cell containing reinforcing.

c. Location: Concealed from view after final construction, unless otherwise approved by Owner.

d. After wall has been inspected and approved and prior to grouting, cap cleanouts in a manner that will seal them from grout *leakage* and provide a flush finish.

3.10 FIELD QUALITY CONTROL

A. Masonry shall be tested by independent testing agency, retained by Owner, in accordance with ASTM C1314, Method B, as modified by ACI 530.1/ASCE 6.

B. Masonry test samples, when required, shall be constructed onsite with same materials and workmanship to be used for Project.

C. Provide adequate facilities for safe storage and proper curing of masonry prisms, mortar samples, and grout samples, as applicable, onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

D. Masonry Testing:

1. Unit Strength Method:
   a. Method and frequency for mortar, grout, and masonry unit sampling and testing in accordance with IBC 2105.2.2.1.

   b. Provide masonry units for test samples required.

E. Corrective Action:

1. If compressive strength tests made prior to construction of permanent structure fail to meet Specifications, adjustments shall be made to mix designs for mortar, or grout, or both, as needed to produce specified strength. Masonry units shall also be tested to verify compliance to requirements of ASTM C90, Type 1.

2. If strength tests performed on materials representative of in-place construction fail to meet Specifications, prisms or cores shall be cut from constructed walls in sufficient locations to adequately determine strength in accordance with IBC 2105.3.

3.11 CLEANING

A. Immediately after completion of grouting, clean masonry surfaces of excess mortar, grout spillage, scum, stains, dirt, and other foreign substances using clean water and fiber brushes.

3.12 PROTECTION OF INSTALLED WORK

A. Do not allow grout and mortar stains to dry on face of exposed masonry.

B. Protect tops of walls at all times. Cover tops of walls with waterproof paper when rain or snow is imminent and when the Work is discontinued.

C. Adequately brace walls until walls and roof are completed.

D. Provide sufficient bracing to protect walls against damage from elements, including wind and snow.

E. Protect masonry against freezing for minimum 2 hours after being laid.

F. Protect masonry from damage until final acceptance of the Work. Damaged units will not be accepted.

END OF SECTION

INDEX TO

SECTION 05100 – MISCELLANEOUS METALS

SECTION 05100

MISCELLANEOUS METALS

PART 1 – GENERAL

1.1 DESCRIPTION:

The work covered by this section includes the grating and other miscellaneous items used in structures on the project.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

Other items of work required for the completed structures for which miscellaneous metals are required are specified in the following sections:

A. Section 02731 – Wastewater Collection System

B. Section 09900 – Painting

1.3 MEASUREMENT AND PAYMENT:

The work covered by this section will not be measured for direct payment. Payment will be included in the contract lump sum price for the item which it is associated.

PART 2 – PRODUCTS

2.1 ALUMINUM:

Unless otherwise specified, aluminum items shall be in standard mill finish.

A. Extrusions: Shall be alloy 6063–T–4.

B. Plate: Shall be heat treatable alloy 6061–T–4.

C. Structural: Shall be alloy 6061–T–4 with the sizes shown on the drawings.

2.2 EXPANSION SHIELD:

Shall conform to Federal Specification FF–S–325.

2.3 ANCHOR BOLTS AND CONNECTING BOLTS:

Shall conform to Federal Specification FF–B–588, hot dipped galvanized or cadmium plated. Where specified, located on the drawings or submerged locations, stainless steel bolts and accessories shall be used.

2.4 GRATING:

Shall be aluminum, grating shall be designed to support a uniform live load of 300 pounds per square foot for the spans shown on the drawings. They shall be I–Bar or Extruded.

Bearing bars shall be alloy 6061–T–6. Extruded grating shall be 6–inches wide extruded planks welded to each other and to end bars. Extruded grating shall be alloy 6063–T–6.

2.5 STRUCTURAL STEEL:

Shall conform to ASTM A–36 (Structural).

2.6 ACCESS DOORS (HATCH COVERS): (If indicated on Plans)

Shall be of the size and dimensions as shown on the drawings and similar to those manufactured by Bilco, Halliday Products, Washington Aluminum or accepted equivalent. Door shall be 1/4" aluminum diamond pattern plate, alloy 6061–T6, reinforced to withstand a live load of 300 pounds per square foot (min). Frame shall be an extrusion, alloy 6063–T6. Door shall be equipped with a minimum of two heavy duty stainless steel hinges with stainless steel pins and an automatic hold–open device.

All material shall have a standard mil finish. The embedded portion of the frame shall have a heavy shop coat of bituminous paint.

2.7 UNI–STRUT:

Shall be hot–dipped galvanized steel appropriately sized to support the control panel and electrical equipment for the pump station.

PART 3 – EXECUTION

3.1 GENERAL:

Miscellaneous metal work required shall be as herein specified. See drawings, schedules, and details for items and location of miscellaneous metals required. Supplementary materials and parts necessary to complete each item, through such work is not definitely shown or specified, shall be included. Miscellaneous bolts and anchors, supports, braces and connections necessary for completion of the work shall be provided, including bolts, anchors, sockets, and other fastenings required by other trades for securing miscellaneous metalwork to other construction. Standard products, generally meeting such requirements, will be accepted if details of construction and installation are approved by the Engineer. Gauges of nonferrous metals are Brown and Sharpe. Items specified to be galvanized, when practical and not indicated otherwise, shall be hot–dipped processed after fabrication. Galvanizing shall be in accordance with ASTM Specification A–123, A–163, A–386, or A–525 as applicable. All steel shall be cleaned of rust and scale.

3.2 WORKMANSHIP:

All miscellaneous metal work shall be well formed to shape and size with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Corner joints shall be coped or mitered, well formed and in true alignment. All work shall be accurately set to establish lines and elevations and securely fastened in place. This work shall be executed and finished in accordance with approved drawings, cuts, details, and samples.

A. Fastenings: Shall be exposed. Thickness of metal and details of assembly and supports shall give ample strength and stiffness.

B. Delivery to Site and Installation: At the proper time, deliver and set in place items of metal work to be built to adjoining construction.

3.3 SHOP DRAWINGS:

Shop drawings of materials shall be submitted to the Engineer for approval before fabrication.

3.4 STRUCTURAL SHAPES:

Furnish miscellaneous structural items for lintels and other structural sections as required by the drawings.

3.5 HANDRAIL AND GRATING:

Furnish and install railing and grating on existing and proposed structures as required by the drawings.

A. Handrails: Shall be installed with posts plumb and rails true to line. Anchorages shall be rigid.

B. Grating and Frames: Exterior edges of grating shall be banded with bars of the same size and bearing bars. Where openings have been cut in grating, the edges around the openings and removable section shall also be banded as specified for exterior edges. Frames of shapes and all welded construction finished to match grating shall be provided as indicated. Frames shall be provided with welded–on anchors. Support angles, beams, and other items shall be provided as required. Steel grating and frames shall be galvanized.

3.6 ANCHORAGE:

Anchorage shall be provided for fastening miscellaneous metal items in place. Anchorage shall be provided as indicated and specified herein. Secure anchors and bolts in place as work progresses.

3.7 SHOP PAINTING:

Surfaces of ferrous metal, except galvanized surfaces, shall be cleaned and shop coated with manufacturer's standard protective coating. Items to be finished painted shall not be given a bituminous protective coating. Surfaces shall be cleaned with solvents to remove grease and oil and with power wire–brushing or sandblasting to remove loose rust, loose mill scale, and other foreign substances. Surfaces of items embedded in concrete shall not be painted.

END OF SECTION

INDEX TO

SECTION 08342 – FIBERGLASS REINFORCED PLASTIC DOORS

SECTION 08342

FIBERGLASS REINFORCED PLASTIC DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiberglass reinforced plastic door and frame at the pump stations.

1.2 RELATED SECTIONS

A. Section 08712 – Door Hardware.

1.3 SYSTEM DESCRIPTION

A. Design door opening assemblies to resist failure from corrosion in an environment of chlorine gas.

1.4 SUBMITTALS

A. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, cut–outs for glazing, and finish.

B. Product Data: Indicate door configurations, location of cut–outs for hardware reinforcement.

C. Manufacturer's Installation Instructions: Indicate special installation instructions.

D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept doors on site in manufacturer's packaging. Inspect for damage.

B. Break seal on–site to permit ventilation.

C. Store door assemblies in manufacturer’s packaging. Store on end in a dry area and protect from damage.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.8 COORDINATION

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.9 MEASUREMENT AND PAYMENT

A. The work covered by this section will not be measured for direct payment. Payment will be included in the contract lump sum price for misc. items for each pump stations.

1.10 WARRANTY

A. Manufacturer's 10–year warranty against failure due to corrosion from H2S gas.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fiberglass Mat: Random Glass Fiber Mat, minimum 4.5 ounces per square foot weight of glass material.

B. Polyurethane Foam: Minimum density of 4 pounds per cubic foot.

C. Roving: Unidirectional Glass Fiber Mat, minimum 16 ounces per square yard weight.

D. Resins: Formulated for chlorine gas environment.

E. Anchors and Fasteners: Stainless steel.

2.2 MANUFACTURED UNITS

A. Fiberglass Reinforced Plastic (FRP) Door

1. Thickness: 1–3/4 inches.
2. Thermal Insulating Valve: "R" Factor 12.
3. Stile and Rail Structure: One–piece molded U–shaped cross–section, 20 mil gel coat, minimum three (3) layers random fiberglass mat, saturated with resins.
4. Core: Polyurethane foam.
5. Face Sheets: 20 mil gel coat, with minimum two (2) layers random fiberglass mat and one (1) layer roving, saturated with resins.
6. Finish: Semi–gloss surface.
7. Color: To be determined by the Owner.
8. Glazing: Safety glass with wire.

B. Fiberglass RTM Door Frame

1. One–piece molded cross–section with molded stop, 20 mil gel coat,

minimum two (2) layers random fiberglass mat, saturated with resins.
2. Finish: Semi–gloss surface.
3. Color: To be determined by the Owner.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's latest written instructions.

B. Anchor components securely to wall construction without distortion or stress.

C. Fit and align door assembly including hardware, level and plumb, to provide smooth operation.

D. Door closer furnished under Section 08712 Door Hardware.

3.3 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Adjust door for smooth and balanced door movement.

3.5 PROTECTION

A. Protect door assemblies and door hardware from damage by subsequent construction activities until final acceptance.

END OF SECTION

INDEX TO

SECTION 08712 – DOOR HARDWARE

SECTION 08712

DOOR HARDWARE

PART 1 GENERAL

1.1 WORK INCLUDED

A. Hardware for fiberglass reinforced plastic doors.

B. Thresholds.

C. Gaskets.

D. Closers

1.2 COORDINATION

A. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

1.3 QUALITY ASSURANCE

A. Manufacturers: Companies specializing in manufacturing door hardware with minimum three years experience.

B. Hardware Supplier: Company specializing in supplying commercial door hardware with three years documented experience.

C. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this Section.

1.4 SUBMITTALS

A. Submit schedule, shop drawings, and product data.

B. Indicate locations and mounting heights of each type of hardware.

C. Submit manufacturer's parts lists, templates, and installation instructions.

D. Submit manufacturer's certificate that hardware meets or exceeds specified requirements.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products per manufacturer recommendation.

B. Package hardware items individually; label and identify package with door opening code to match hardware schedule.

C. Deliver minimum two set of keys to Owner by security shipment direct from hardware supplier.

D. Protect hardware from theft by cataloging and storing in secure area.

1.7 WARRANTY

A. Provide five year warranty.

1.8 MAINTENANCE MATERIALS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.9 MEASUREMENT AND PAYMENT

A. The work covered by this section will not be measured for direct payment. Payment will be included in the contract lump sum price for "Pump House Repairs."

PART 2 PRODUCTS

2.1 KEYING

A. Door locks and keys shall be reviewed and approved by owner.

2.2 FINISHES

A. For fiberglass reinforced plastic doors, butts, locksets, flushbolts, closers. Door stop, and threshold shall be stainless steel.

2.3 LOCK SETS:

A. Contractor to provide heavy duty industrial grade hasp for use with BGJWSC supplied pad lock. Provide stainless steel face and back plates at hasp as necessary for reinforcement to prevent damage to fiberglass doors.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions.

B. Use the templates provided by hardware item manufacturer.

C. Conform to ANSI A117.1 for positioning requirements for the handicapped.

3.3 SCHEDULE

A. Pair of fiberglass doors to have the following:

6 Hinges	4–1/2 x 4–1/2 NRP
1 Lockset	6 Pin, Storage Room Function
2 Flush Bolts	Provide 16" chain for top bolt
2 Kickplates	8" x 34"
2 Closers	
1 Threshold	
1 Set	Weather-stripping
Fiberglass Louvers	(as shown on drawings)
Door Stop (S.S.)	(all doors)
Window	(as shown on drawings)

B. Fiberglass reinforced plastic door to having the following:

3 Hinges	4–1/2 x 4–1/2
1 Lockset	6 Pin, Storage Room Function
1 Kickplate	8" x 34"
1 Threshold	
1 Set	Weather-stripping
1 Closers	
Door Stop (S.S.)	(all doors)
Fiberglass Louvers	(as shown on drawings)
Window	(as shown on drawings)

END OF SECTION

INDEX TO

SECTION 08800 – GLAZING

SECTION 08800

GLAZING

PART 1 – GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Architectural Manufacturers Association (AAMA): 800, Voluntary Specifications and Test Methods for Sealants.

2. American National Standards Institute (ANSI): Z97.1, Safety Glazing Materials Used in Buildings–Safety Performance Specifications and Methods of Test.

3. ASTM International (ASTM):

   a. C542, Standard Specification for Lock–Strip Gaskets.
   b. C564, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and pacers.
   c. C920, Standard Specification for Elastomeric Joint Sealants.
   d. C1036, Standard Specification for Flat Glass.
   e. C1045, Standard Specification for Heat–Treated Flat Glass–Kind HS, Kind FT Coated and Uncoated Glass.
   f. C 1172, Standard Specification for laminated Architectural Flat Glass.
   g. E774, Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units.

4. Code of Federal Regulations (CFR): 16 FR 1201, Safety Standard for Architectural Glazing Materials.

5. Glass Association of North America (GANA):
   a. Glazing Manual.
   b. Sealant Manual.

6. Insulating Glass Certification Council (IGCC)

7. Insulating Glass Manufacturer's Alliance (IGMA)`

8. Underwriters Laboratories Inc. (UL):

   a. 752, Standard for Bullet–Resisting equipment.
   b. Automotive Burglary Protection and Mechanical Equipment Directory (ABPMED).

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:

a. Complete schedule of glass and glazing material to be used for each purpose.
b. Catalog cuts of glazing materials with inclusion of glass edge cutting procedures.

2. Samples:

a. Two of each different type of glass at least 12 inches by 12 inches properly labeled.
b. Two of each different type of glazing materials.

B. Informational Submittals:

1. Manufacturer's Certificate of Compliance for each type of glazing, in accordance with Section 01 43 33, Manufacturers' Field Services.
2. Details and methods of glazing for each type of glazing condition; include manufacturer's recommendations for setting, sealing materials, and installing each type of glazing.
3. Documentation declaring compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants and other glazing materials.
4. Documentation of glazer's previous experience and manufacturer's approval.

1.03 QUALITY ASSURANCE

A. Glazier:

1. Have previous experience with installation of equal size and requirements that can be inspected by Engineer.

2. Have approval of glass and framing manufacturer(s).

B. Factory Label Glass: Non–labeled glass will be rejected.

C. Single Source Fabrication Responsibility: Fabrication processes, including Low–E and reflective coatings, insulating, laminating, silkscreen, and tempering, shall be fabricated by a single fabricator.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage:

1. Support cases on both sides when stored vertically.

2. After unpacking, place interleaving protection between lites.
3. Keep glass and interleaving dry by storing inside where temperatures are above dewpoint, or if outside storage is necessary, cover the glass interleaving with opaque tarpaulins or plastic and inspect periodically. Wet interleaving can stain glass.
4. Avoid exposing stored glass to direct sunlight.

B. Handling:

1. Stack individual lites on edge and lean them against sturdy uprights at a slope of 5 degrees to 7 degrees from vertical.
2. Cushion bottom edges with soft, firm pads free of dirt, grit, glass chips, or other foreign material.
3. Do not rotate or cartwheel insulating glass units over their corners. Use turning device such as a rolling block if units must be rotated.

1.05 SPECIAL GUARANTEE

A. Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as Special Guarantee. Special Guarantee shall provide for correction of equipment found defective during a period of 5 years after the date of Substantial Completion. Guarantee to cover deterioration due to normal conditions of use and not due to handling installing and cleaning practices performed contrary to glass manufacturer's published instructions. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the General Conditions.

1.06 MEASUREMENT AND PAYMENT

A. The work covered by this section will not be measured for direct payment. Payment will be included in the contract lump sum price for "Pump House Repairs."

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Products of the following manufacturers, that meet these Specifications, may be used on this Project:

1. Laminated Safety Glass, Tempered and Heat–Strengthened Glass:
   a. AFG Industries, Inc.
   b. Arch Aluminum & Glass Co.
   c. Cardinal LG.
   d. Interpane Glass Company.
   e. TPG Technical Glass Products.

2. Sealant, Gasket, Tape, and Compound:
   a. Dow Corning.
   b. General Electric Silicones.
   c. Pecora Corporation.

d. Tremco.
e. F. H. Maloney Co.
f. Standard Products Co.

2.02 GLAZING MATERIALS

A. Tempered Float Glass (T.G.): ASTM C1048, Type I, Class 2 (tinted, heat absorbing, and light–reducing) Glazing Quality q3; meeting ANSI Z97.1 and 16 CFR 1201, as applicable; 1/4 inch (6 mm) minimum thickness.

B. Laminated Safety Glass (S.G.): ASTM C1172, 7 mm minimum total thickness, consisting of two lights of float glass, bonded to minimum 0.030–inch clear polyvinyl butyral (PVB) interlayer, meeting 16 CFR 1201, Class 1 (transparent), as applicable, and ANSI Z97.1 and testing of 16 CFR 1201 for Category II materials.

C. Wire Glass (W.G.): ASTM C1036, TYPE II, Class 1, Form 1, glazing quality, clear float, UL listed meeting ANSI Z97.1 with 0.020 inch diameter welded wire in square mesh pattern embedded with 6mm thickness.

D. Tinted Insulating Glass (I.G.–T.): Insulating glass units with 1/2–inch air space, specified tinted glass outboard and clear laminated glass inboard, each sheet 5 mm minimum thickness meeting ASTM E774, Class C, warranted by manufacturer against failure of edge sealing for minimum 5 years from date of manufacture.

2.03 ANCILLARY MATERIALS

A. Setting Blocks: ASTM C864 Option silicone or EPDM, 70 Shore A durometer hardness, chemically compatible with sealant used and composition of laminated glass.

B. Glazing Tape: Preformed, semisolid, polymeric–based material of proper size and compressibility. Use only where glazing rabbet is designed for tape and tape is recommended by glass or sealant manufacturer.

C. Glazing Channels: Resilient EPDM or vinyl gaskets, as recommended by glass manufacturer, as provided with aluminum frames to be glazed.

D. Metal Sash Glazing Compounds: AAMA 800, non–skinning type butyl.

E. Glazing Sealant: One–component non–sag silicone elastomeric sealant ASTM C920, Type S, Grade NS, Class 25, Use G, or AAMA 800.

F. Compression Gaskets: Preformed dense elastomeric compression glazing gaskets, ozone resistant, meeting ASTM C864, Option 1, Shore A durometer between 65 and 75, of profile required to maintain weathertight seal.

PART 3 – EXECUTION

3.01 PREPARATION

A. Do not perform glazing work in damp, foggy, or rainy weather, or when temperatures are not within range recommended by GANA "Glazing Manual."

B. Surfaces: Smooth, even, sound, dry, and clean.

C. Priming: Complete and cured.

D. Measure size of frames to receive glass and compute actual glass size allowing for edge clearances.

E. Use wire glass in all glazed openings in labeled fire doors and tempered glass in all other interior doors, transoms, and sidelights.

F. Verify functioning weep system is present.

G. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.02 GLAZING INSTALLATION

A. General: Follow recommendations of glass manufacturer GANA "Sealant Manual," GANA "Glazing Manual" and the following:

1. Cutting:

a. Make concealed edges clean, straight cut, and free from chips and fissures.
b. Shop cut all glass. Nipping glass on job not allowed.
c. Allow for maximum grip on all edges.

2. Positioning Glass:

a. Set glass with equal bearing on entire width of pane.
b. Position sheets of glass with setting blocks of hardness, chemically compatible with sealants used, and sizes recommended by glass and sealant manufacturers.
c. Set tong marks of tempered glass at bottom of installed sheet.
d. Orient pattern and draw of glass pieces in same direction.
e. Place glass waves parallel or horizontal to floor.
f. Set glass with one translucent surface, with smooth surface, on weather side.

3. Glass shall not move or rattle.

B. Stop Glazing:

1. Set glass on glazing tape.

2. Fill all voids around perimeter and between exterior glass and stop with glazing compound to provide complete watertight installation.
3. Trim tape and compound flush with sight line.

C. Putty Glazing:

1. Glaze steel sash with galvanized metal glazing clips and glazing compound.
2. Cut putty off neatly and evenly to sight line of sash with sharply mitered corners.
3. Installed putty shall present a smooth surface of uniform width.

D. Channel Glazing:

1. Set glass in glazing channel in accordance with manufacturer's installation instructions.
2. Do not stretch channel.

E. Sealant Glazing (Wet):

1. Place setting blocks at quarter points of sill rabbet.
2. Install spacers in channel.
3. Install filler rod in channel.
4. Apply sealant to back and bottom of rabbet.
5. Bed glass in position, centered vertically and horizontally, with glazing points or clips.
6. Apply sealant to face with sufficient force to eliminate voids.
7. Trim sealant to form watershed sloping away from glass.

F. Tape Glazing:

1. Cut glazing tape to length and set against permanent stops, horizontal strips first, extending over width of opening, then vertical strips.
2. Place setting blocks at quarter points.
3. Remove paper backing from tape.
4. Position glass on setting blocks and press against tape for full contact.
5. Place glazing tape on free perimeter of glass.
6. Seal butt joints of tape with joint sealant.
7. Install removable stop, avoiding displacement of tape, and exert pressure on tape for full continuous contact.

G. Gasket Glazing (Dry):

1. Cut compression gasket with mitered corners to length of channel without stretching and install as recommended by gasket and frame manufacturer.
2. Apply gasket to outside fixed edge of rabbet perimeter.
3. Place setting blocks at quarter points of sill rabbet.
4. Place glass on setting blocks and center horizontally.
5. Apply gasket to inside stop, mitering corners.

3.03 HOSE TEST

A. Use 3/4–inch minimum hose without nozzle. With full stream, flood glazing from bottom to top.

B. Correct any leaks disclosed by hose test by re–glazing and retesting until eliminated.

3.04 CLEANING

A. Leave glass and glazing in undamaged condition and ready for final cleaning.

B. Remove excess glazing compound from installed glass.

C. Remove labels from glass surface at time of final cleaning.

D. Wash and polish both faces of glass.

E. Clean plastic sheet in accordance with manufacturer's instructions.

3.05 PROTECTION OF COMPLETED WORK

A. Protection:

1. Keep glass free from contamination by materials capable of staining glass.
2. Install tape across lights secured to frames or structure.
3. No tape or marking allowed on glass.

B. Replacements and Repairs: Prior to Substantial completion, replace broken, defective, or scratched glass and repair damage compounds.

END OF SECTION

INDEX TO

SECTION 09900 – PAINTING

SECTION 09900

PAINTING

PART 1 – GENERAL

1.1 DESCRIPTION:

A. The work covered by this section includes the surface preparation and coatings of structural steel, pumps, piping, interior and exterior of building, and equipment and other places or items listed in the painting schedule herein or shown on the drawings.

1.2 RELATED WORK:

A. Section 02730 – Wastewater Pump Station
Section 02731 – Wastewater Collection System

1.3 QUALITY CONTROL:

A. Paint Manufacturer: The paint shall be a product of a manufacturer with a record of at least 5 years of producing paint of the type specified.

B. Applicators: The paint shall be applied by skilled painters with experience in painting structures like those specified and with the use of the type of coatings described. If a painting contractor is used, he shall furnish the Engineer with a list of similar projects he has completed and the names of the Owners and Engineers who are familiar with his capabilities.

1.4 ALLOWABLE TOLERANCES:

A. The thickness of coatings shall be at least 90% of that specified for any coat and shall be at least 100% of that specified for the total thickness.

1.5 CERTIFICATE:

A. The manufacturer shall furnish the Engineer with a certificate showing the composition and physical properties of the paint proposed for use. Proprietary formula will not be required but the information must include at least the following:

Binder	Pot Life
Resin	Theoretical Coverage Per Mil Thickness
Pigment	Solvent
Solids by Weight	Solids by Volume

B. Coatings used on water piping, tanks, pumps, and other water related materials and equipments shall be certified by the NSF that the coatings conform to NSF Standard 61–Drinking Water Components – Health Effects.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. All material must be brought to the job site in the original sealed and labeled containers. It shall be stored in a protected manner to preserve the labels and seals.

1.7 JOB CONDITIONS:

A. No paint shall be applied when the surrounding air temperature, as measured in the shade, is below 40B F. No paint shall be applied when the temperature of the surface to be painted is below 35B F. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog or mist. No paint shall be applied when it is expected that the air temperature will drip below 40B F. within 18 hours after the application of the paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until midmorning to be certain that the surfaces are dry. Further, the days painting should be completed well in advance of the probable time of day when condensation will occur, to permit the film an appreciable drying time prior to the formation of moisture.

All paint should be applied in strict accordance with the paint manufacturer's instructions.

1.8 PROTECTION:

A. Painted surfaces shall be protected until thoroughly dry and cured. Any damage to painted surfaces that mar or abrade the surface shall be repaired by the Contractor by sanding to a sound surface and repainting with the same paint used on surrounding surfaces. Where a repainted surface does not blend completely with the surrounding surface, the Contractor shall repaint the entire area or part or segment of the surface that will make the repair not discernable.

1.9 SEQUENCING AND SCHEDULING:

A. The Contractor shall arrange his work so that the finish paint coat is done after all equipment has been installed and other work finished.

1.10 ALTERNATIVES:

A. The intention of these specifications is to produce the best protective coating for the Owner. If the Contractor suggests alternate material or methods that will improve the results at no additional cost, the Engineer will examine the suggestion and if it is accepted, it may be used. The basis upon which acceptance of an alternate will be given will be its value to the Owner and not for the conveniences of the Contractor.

1.11 GUARANTEE:

A. The Contractor shall guarantee the quality and performance of material and workmanship for a period of 12 months after acceptance. Defects discovered during the period shall be repaired by the Contractor at no cost to the Owner. The Performance Bond shall reflect this guarantee.

1.12 COLOR:

A. Contractor shall provide the Owner with a color selection chart and obtain his choice on color prior to ordering.

1.13 MEASUREMENT AND PAYMENTS:

A. No separate payment will be made for work included in this Section. All costs and charges in connection therewith shall be included and reflected in the payment for the item of work to which it pertains.

PART 2 – PRODUCTS

2.1 PAINT QUALITY:

A. The paint shall be a product of a manufacturer with a record of at least 5 years of producing the type of paint specified. The quality of the paint shall be equivalent to those manufactured by the following:

Sherwin Williams
Mobil Coatings
Glidden Coatings
Inertol Company
Kop–Coat, Division of Carboline Company
Royston Laboratories
Savannah Paint
Tnemec Company
Induron Coatings, Inc.
Industrial Paint Company

Products of other manufacturers comparable in quality and type will be acceptable, if offered by the Contractor with satisfactory data on past performance in similar installations and if accepted by the Engineer.

2.2 PRODUCT NAMES:

A. Product names of certain manufacturers are used in the following paint schedules to indicate the type, thickness, color and method of application. Products of other manufacturers that in the opinion of the Engineer are equivalent to the Products named will be accepted.

2.3 PAINT MATERIALS:

A. The painting materials to be used shall be similar and equivalent to the following products of Mobil or Koppers. The painting materials to be used for the various surfaces and conditions of service shall be similar and equivalent to the following:

	Kop–Coat Coatings
Exterior Structural Steel & Miscellaneous Ferrous Metal	Shop Primer: One coat (Carboline) 622 LCF, 1.5 dry film mils Field Spot Primer: 622 LCF Finish: Two coats Glamortex 501 Enamel, 1.5 dry film mils per coat
Exterior Galvanized Metal	Field Primer: One coat 40 Passivator, 1.0 dry film mils Finish: Tow coats Glamortex Enamel 1.5 dry film mils per coat
Exterior and Interior Machinery & Equipment	Shop Primer: One coat 340 Gold, 2.0 dry film mils Field Spot Primer: 340 Golf Finish: One coat Hi–gard, 5.0 dry film mils per coat
Structural Steel & Miscellaneous Ferrous Metals (submerged)	Shop Primer: One coat 340 Gold, 2.0 dry film mils Field Spot Primer: 340 Gold Finish: Two coats Super Hi–gard, 5.0 dry film mils per coat
Galvanized Metal (Submerged)	Field Primer: One coat 40 Passivator 1.5 dry film mils Intermediate: One coat 837A, 2.0 dry film mils Finish: One coat A–8305, 3.0 dry film mils
Exterior & Interior Cast Iron & Steel Piping & Valves (non–submerged)	Shop Primer: One coat 340 Gold, 2.0 dry film mils Field Spot Primer: 340 Gold Finish: One coat Hi–gard, 5.0 dry film mils per coat
Cast Iron & Steel Piping & Valves (submerged)	Shop Primer: One coat 340 Gold 1.0 dry film mils Field Spot Primer: 340 Gold Finish: Two coats 300M, 10.0 dry per coat
Concrete Floors and Walks	Two coast Ramac Floor, 15 dry film mils per coat
Interior Concrete Block, Concrete or Brick Walls (non–submerged)	Primer: One coat Block Filler Finish: Two coats Glamortex, 1.5 dry film mils per coat
Concrete (submerged)	First Coat: One coat Hi–gard Epoxy (thinned, dark color) Finish: Two coats Hi–gard Epoxy (light color)

B. If necessary to achieve satisfactory application, thinning will be done in accordance with paint manufacturer's recommendations using thinner from same manufacturer as paint.

2.4 PRODUCT REVIEW:

A. The Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered.

PART 3 – EXECUTION

3.1 ON SITE OBSERVATION OF WORK:

A. Surfaces shall be checked by the Engineer after cleaning. After each coat has been applied and allowed to dry for 24 hours, the dry coating thickness will be measured by the Engineer using a dry coating thickness gauge. A low voltage thickness gauge shall be furnished by the Contractor and kept on the job site. The Contractor shall give the Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

3.2 SURFACE PREPARATION:

A. All surfaces shall be clean, dry and in suitable condition to receive the finish. Incidental or necessary minor cleaning, sanding and dusting of surfaces shall be done so that they are in proper condition to receive the finish. All dirt, grease and rust shall be removed from metal work with benzine, sandpaper or wire brush. All abrasions shall be rubbed smooth and edges of all paint feathered and then touched up with paint specified for finish, in such a manner that the patch will not show on completion. All metal surfaces shall be clean, free from dirt, scale, loose paint, oil and grease. In general, metal surfaces will have a priming coat before shipment. The abraded portions shall be touched up prior to applying final coats.

All surfaces to be painted shall be free form cracks, holes or other defects which will prevent obtaining a smooth unbroken paint film.

1. Steel: The steel surface must be prepared by blast cleaning.

(a) Blast Cleaning: As a minimum, all unprimed metal surfaces shall be field sandblasted in accordance with NACE No. 2 (SSPC–SP10), near white blast. A NACE No. 3 (SSPC–SP6), commercial blast, shall be required on any metal surface to be subsequently finished with coal tar epoxy. All weld areas shall be smooth.

Blast cleaning shall not develop an anchor pattern exceeding 1/.3 the total thickness of the film used and may be obtained with a 16–30 mesh sand. All dust or grit remaining on the surfaces after blasting shall be removed by brush or vacuum.

(b) Shop Primed Coats: Certain shop coats are to be furnished for some items as specified under other parts of these specifications. Consequently, field prime coats will not be required on surfaces shop primed, except for touch–up and repair of any damage to same as the result of shipping, erecting or construction operations. Such touch–up and repair shall be with a field primer recommended

by the paint manufacturer.

It shall be the responsibility of the Contractor to ensure that all field applied painting materials are compatible with the shop allied painting materials over which they will be used.

3.3 APPLICATION:

A. The Painter shall apply each coating at the rate specified by the manufacturer. If materials has thickened or must be diluted for application by spray guns, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of paint as originally furnished by the manufacturer must not cover a greater square foot area when applied by spray gun than when applied by brush unthinned.

Sufficient time shall elapse between successive coats to permit proper drying. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks and variations in color, texture and finish.

Paint coats on metal may be either brushed or sprayed on. If sprayed, the gun shall be operated by mechanics, the nozzle held perpendicular to the surface being painted and the coats applied uniformly and in a manner that will bond the paint properly to the surface. Air spray application of paint shall be followed immediately with a paint brush applied along the vertical and lower horizontal edges of members and along all abutting surfaces, edges of connections, between the rivet heads and the like points to remove all surplus paint and to smooth out all runs. All sags in paint films wherever located shall be brushed out immediately.

For submerged metal surfaces, all or part including below or above grade surfaces constantly wet or exposed to moisture and condensation must be dry, clean and free of oil and grease. Proper cleaning is essential. Sandblast to a near white blast in accordance with Steel Structures Painting Council recommended methods outlined in Specification SP10. Surfaces shall be primed immediately after sandblasting with the Primers as outlined in these specifications.

3.4 PAINTING SCHEDULE:

A. The following paint schedule indicates the surfaces to be painted using the painting materials previously specified for the type of surface and conditions of service as directed by the Owner and Engineer. The colors will be selected by the Owner from the manufacturer's standard color charts and, where required to match existing or other colors provided, the manufacturer shall obtain the same by the mixing and/or tinting of his particular products. Colors are subject to final acceptance by the owner at the time of construction.

The surfaces to be painted shall include the following:

1. Within the work area, new pumps, piping, valves, electrical conduits, panels and miscellaneous steel which will remain in service upon completion of the work.

2. Pump building, concrete wall (interior & exterior), Concrete floor (all rooms), and ceiling, unpainted and primed metal.

4. Pumps, piping, valves, electrical conduits and miscellaneous metal.

5. The painting of all doors and windows, pipe supports and hangers.

If any of the above items are furnished in aluminum, bronze or stainless steel, no painting is required.

END OF SECTION

SECTION 11200

ODOR CONTROL
EXTRUDED ALUMINIUM FLAT COVER

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section defines the design requirements for the aluminum extruded flat cover(s) as described in the contract drawings and documents.

1.02 SUBMITTALS

A. Before executing any of the work in this section, prints or drawings shall be submitted to the engineer showing dimensions, sizes, thickness, gauges, materials, finishes, joint attachment and erection procedure. Drawings shall bear the seal and signature of the design engineer, registered in the state of the project.

B. A complete set of design calculations for the cover(s) shall also be submitted. These calculations shall be signed by a registered professional engineer registered in the state of the project. Provide shop drawings to Engineer for approval. All work shall be fabricated and erected in accordance with the approved drawings.

C. Certification that the specified material alloys, sizes and quantities have been furnished shall be submitted upon completion of the project.

1.03 REFERENCES

A. The following codes and standards form a part of this section to the extent specified herein:

1. ASTM C–864–90 Standard Specifications for Preformed Gasket and Sealing Material

2. Aluminum Association Specifications for Aluminum Structures

3. Aluminum Association Aluminum Design Manual; Specifications and Guidelines for Aluminum Structures

4. ASCE 8–02 Specification for the Design of Cold–Formed Stainless Steel Structural Members

5. ASTM F593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

6. Federal Specification TT – S – 00230C

1.04 MEASUREMENT AND PAYMENT

A. The work covered by this section will not be measured for direct payment. Payment will be included in the contract lump sum price for "Pump House Repairs."

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. The extruded flat covers shall be clear–span and self–supporting from the peripheral structure. The cover system shall consist of removable panels each weighing no more than 150 pounds. The required lifting force per panel shall not exceed the dead weight of the panel. The extruded panels utilize specially extruded panel structural members, slip–resistant top planks with stiffeners, and integral perimeter flashing/endcaps. Both male and female panels must independently be designed to meet both the design loading and the deflection limits specified herein. Elastomeric weatherseal gasket shall form a continuous substantially watertight seal along all panel edges. The gaskets shall be fully enclosed to prevent ultraviolet exposure.

B. Each panel must be able to be removed without needing to remove more than the two adjacent panels. The need for removing separate flashing or "hold–down" extrusions longer than the width of the panel is prohibited. Primary panel support members shall be integral to the panels. Upon removal of the panels, the entire area beneath the panels shall be exposed and no substructure in the form of beams or box–beams shall remain in the basin(s) to be covered. To facilitate removal, panels shall incorporate integral lifting handles. Handles shall be located at both ends of the cover panels and shall not penetrate the cover panels or pond water.

C. The extruded flat cover shall have an integral bi–directional slip resistant surface which extends a minimum of 0.1–inch above the panel surface. Raised surfaces without the use of texturing to achieve slip resistance are not acceptable. The use of checkered plate, paint, tape, sandblasting, or other applied systems to achieve the slip resistant surface is expressly prohibited.

D. The extruded flat cover system shall be Flush Mount, with the covers slip resistant walking surface flush with the top of the basin or tank wall. Lifting handles shall be integral with the panel endcaps.

E. All metal components of the flat cover structure shall be aluminum or 300 series stainless steel. No galvanized, painted, or plated steel shall be used. The use of structural plastic is expressly prohibited. Dissimilar materials in the supporting structure shall be isolated from the aluminum flat cover by means of a compatible elastomeric gasket.

F. The use of structural members in contact with the contents of the tank is expressly prohibited.

G. The design shall prevent water pooling which may result in over–stressing the flat cover.

H. The extruded flat cover will have a mill finish surface.

I. Fasteners shall be designed with a factor of safety of 2.34 on ultimate strength and 1.65 on yield strength.

J. The removable extruded flat cover system shall be designed to be substantially air and water tight under the specified design loading conditions

2.02 EXPERIENCE/QUALIFICATIONS

A. No equipment shall be supplied by any manufacturer not regularly engaged in the manufacturing and production of extruded flat cover(s) in the size and character herein specified. The manufacturer must have designed, manufactured and installed at least one (1) formed panel flat cover of the same type and size as unit(s) specified herein. This flat cover must be in satisfactory use for a period not less than ten (10) years.

B. The cover manufacturer must own and operate its own US–based manufacturing facility, and the use of a fabrication facility that is not US–based and/or owned and operated by the cover manufacturer is expressly prohibited. Manufactures that do not meet these qualifications will not be considered.

C. The cover manufacturer must be ISO 9001 certified.

2.03 MATERIALS

A. The following is a summary of approved materials and/or material specifications. All aluminum alloys shall be as defined by the Aluminum Association and published in the ALUMINUM STANDARDS AND DATA.

1. **Bolts and Fasteners** – Bolts shall be 300 series stainless steel per ASTM F593, Alloy Group 1. Lock bolts shall be 7075–T73 aluminum or 305 stainless steel. Screws shall be aluminum or 300 series stainless steel.

2. **Structural Shapes** – Aluminum structural shapes shall be alloy 6061–T6 or 6063–T6. Load supporting surfaces shall be 0.1–inch minimum thickness.

3. **Miscellaneous Shapes** – Miscellaneous aluminum shapes shall be alloy 6061–T6 or 6063–T6.

4. **Gaskets** – All gaskets shall be Neoprene conforming to ASTM C–864–90, resistant to ozone and shielded from exposure to ultraviolet light. The gaskets must have a ¼" minimum thickness.

5. **Sealant** – All sealants shall be silicone, GE Silpruf SCS 9000.09 and resistant to ozone and ultraviolet light and conform to Federal Specification TT–S–00230C.

6. **Miscellaneous Penetration Seals**– All other penetration seals shall be weatherproof rubber seals.

7. **Support Bearings** – Bearings at the supports (if required) shall conform to AASHTO Division 2 Section 25. Acceptable bearing surfaces for sliding bearings are Teflon to stainless steel only. In order to avoid damage to the Teflon and to reduce the coefficient of bearing friction, Teflon shall not bear on aluminum surfaces.

2.04 DESIGN LOADS

A. The entire extruded flat cover structure shall be designed to sustain the loads specified herein, within the stress limitations of the Aluminum Association Aluminum Design Manual. In no case shall the formed panel flat cover be designed for any loads less than those specified by the local building code and/or local amendments.

B. The load cases to be considered shall be those described below unless more severe loads are specified by the purchaser.

1. **Dead Load** – The dead load shall be defined as the weight of the structure and all permanently attached to and supported by the structure.

2. **Live Load** – As designated on the drawings.

3. **Snow Load** – As required per ASCE 7–10, but not less than required by local building codes and/or local amendments.

   Importance Factor (I) = 1.0 or greater per ASCE 7–10 Table 1–1.
   Exposure Factor (C_e) = 1.0 or greater per ASCE 7–10 Table 7–2.
   Thermal Factor (C_t) = 1.2.

4. **Non–Uniform Snow Load** – As required per ASCE 7–10 but not less than required by local building codes and/or local amendments.

5. **Wind Load** – As required per ASCE 7–10, but not less than 157 MPH.

   Exposure Factor = C

6. **Vacuum/Pressure Load** – N/A.

7. **Load Combinations** – As required per ASCE 7–10 Section 2.4.1.

8. **Temperature** – The load combinations listed above shall be considered for a temperature change of 100 degrees F below the installation temperature and 100 degrees F above the installation temperature and for a material temperature range of 40 degrees F below 0 to 160 degrees F above zero.

9. **Panel Design Load** – In addition to the above-mentioned loads and load combinations, the aluminum panels shall be designed for a **300-pound** load distributed over one square foot at any location. This load is to be

taken as acting separately and not simultaneously with other design loads.

10. **Deflection** – For the above loads and load combinations, the deflection of all components (structural and cladding) shall not exceed L/240 with L equal to the span of the component. This deflection limit applies not only to the flat cover as a whole, but also to the decking of the cover spanning between the supporting edges of each panel or module. Calculations stamped by a Georgia registered Professional Engineer shall be provided at the time of submittal to ensure that this requirement has been met.

2.05 MANUFACTURERS

A. The aluminum extruded flat cover shall be as manufactured by TemcorConservatek – Gardena, California (310) 353–5100 or Conroe, Texas (936) 539–1747, or Hallsten Ingenuity Cover, (contact Nick Jackson, Kazmier & Associates 912-467-2055).

PART 3 – EXECUTION

3.01 INSTALLATION

A. All work shall be executed by skilled mechanics with a supervisor experienced in the erection of extruded flat covers. The flat cover shall be erected plumb and level and in proper alignment.

3.02 WARRANTY

A. The extruded flat cover manufacturer shall warrant that the work described herein shall be free from defects, workmanship and material. The flat cover manufacturer shall replace, or repair only faulty workmanship or defective material furnished by it that is reported to it within one (1) year from the date of completion of this scope of work.

END OF SECTION

INDEX TO

SECTION 11257 – BIOLOGICAL ODOR CONTROL SYSTEM

SECTION 11257

BIOLOGICAL ODOR CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install and test the biotrickling filter odor control system (System) at the BGJWSC pump stations 4035 and 4036. System shall be complete with all appurtenances as specified herein.

1. Manufacturer shall furnish biotrickling filter equipment including blower, biotrickling filter vessel, interconnecting ductwork between blower and vessel, flexible connectors, manual airflow dampers, nutrient addition system, water addition system and control panel along with instrumentation and controls for a fully functioning system.

2. The System is designed as a once-through, non-recirculating system. If a recirculating system is proposed, any additional equipment including but not limited to duty/standby pumps, pH probe and transmitters, etc. will be provided for a complete and operating system. The Manufacturer will be responsible for all changes or modifications to the equipment shown on the project plans.

3. Manufacturer shall provide shop drawings and Operation and Maintenance manuals.

4. Manufacturer shall provide startup and performance acceptance testing services as specified herein.

5. Placement, installation, bolting to the pad and connection of ductwork, water piping, drainage piping, power and control wiring provided by Contractor.

B. The System shall comprise of the following major components:

1. Single or multi-stage biotrickling filter vessel. The FRP vessel shall be comprised of at least one main module and one top piece and may contain additional modules as the design conditions require. Each media module shall house the structured synthetic media in series and contain a single water/nutrient injection spray system.

2. Structured, engineered, plastic, synthetic media to optimize mass transfer and facilitate the growth of bacteria necessary for biological oxidation of odorous compounds. The media bed shall be uniform and structured throughout and made entirely of a plastic, synthetic, non-reactive material.

3. A UL, factory-labeled electrical control panel housing a single

Programmable Logic Controller (PLC) system and other components required for the control and monitoring of the System.

4. A water panel that houses all components necessary for the control and monitoring of the media irrigation system, including an Automatic Flow Control system with capability to automatically compensate for water supply pressure changes.

5. A single-pass irrigation system to allow the development of heterotrophic bacteria in the upper media zone.

6. Odor control blower (s) to move the odorous air from the source and be able to compensate for all pressure losses at the design airflow.

1.02 CONTRACTOR RESPONSIBILITY

A. Installation of all Manufacturer-supplied equipment components, which includes among others, receiving, offloading, placement and bolting of all equipment to the concrete pad, connection of ductwork, water piping, drainage piping, and power and control wiring, all in accordance with the Manufacturer's installation instructions.

B. If applicable, onsite storage and maintenance of all equipment, suitably protected, per the Manufacturers written instructions, from weather and any conditions that could adversely affect the material from its intended function.

C. Supply of all odorous air ductwork including flex connectors and damper valves upstream of the blower.

D. Site preparation and clearing.

E. Construction of concrete equipment pad for placement of the biotrickling filter(s) and supply of system anchor bolts.

F. External water piping and drain piping to and from the biotrickling filter(s) and Water Control Panels.

G. Power supply to the electrical control panel, power to the odor control blowers and connection of all ancillary instrumentation mounted remotely to the System Control Panels.

H. Installation of any additional items as noted on the contract drawings.

I. Heat tracing and insulation of any air ductwork, water pipes/tubes, and/or nutrient storage tanks as required by this Specification or elsewhere in the Contract Documents.

J. Adjusting and Balancing of all upstream odor sources.

K. Temporary piping for startup of the system.

1.03 PROCESS DESCRIPTION

The odor control system shall remove hydrogen sulfide, organic reduced sulfur compounds (RSCs) and/or other odorous compounds from the foul air stream, as required per Section 2.04 below, using a biotrickling filter operating in a counter-current fashion. Co-current systems shall not be allowed.

The foul air shall enter the system at the bottom of each reactor and flow upward through each of the media layers. The media bed shall be intermittently irrigated from above using suitable reclaimed plant effluent or potable water in a once-through fashion. The water then trickles through the media and is collected in a sump at the bottom of the reactor. The drain water from the system will pass from the sump in the bottom of the reactor vessel and be piped to a discharge point as detailed on the Contract drawings. Systems using recirculation of irrigation water through the reactor vessel shall not be allowed.

The hydrogen sulfide is oxidized by the autotrophic bacteria resident on the lower media layer(s). Because of the once-through irrigation configuration, a neutral-pH area of the media will be established, near the top of the media, providing conditions suitable for heterotrophic bacteria to oxidize other organic odorous compounds as required. The airstream is then released to the atmosphere via the exhaust stack at the top of the reactor.

1.04 REFERENCES

The following is a list of standards which may be referenced in this section:

A. ASTM E679: "Standard Practice of Odor and Taste Thresholds By a Forced-Choice Ascending Concentration Series Method of Limits".

B. EN13725-2003 - Air Quality - Determination of Odor Thresholds by Dynamic Dilution Olfactometry

C. ASTM D-2563: "Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts".

D. ASTM D-2583: "Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor".

E. ASTM C582: "Revision of C582-02 Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment".

F. ASTM D-883: "Definition of Terms Relating to Plastics".

G. ASTM D-3299: "Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks".

H. ASTM D-2996: "Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe

I. ASTM D 4167 – Standard Specification for Fiber-Reinforced Plastic Fans and

Blowers j

J. ASTM D-4097: "Standard Specification for Contact Molded Glass Fiber Reinforced Thermoset Resin Corrosion-Resistant Tanks".

K. ASTM D-3982: "Standard Specification for Contact Molded Fiberglass Ducts".

L. PS 15-69: National Bureau of Standards Voluntary Product Standard "Custom Contact Molded Reinforced Polyester Chemical Resistant Process Equipment".

M. American National Standards Institute (ANSI).

N. American Society of Mechanical Engineers (ASME).

O. Institute of Electrical and Electronic Engineers (IEEE).

P. National Electrical Manufacturers Association (NEMA).

Q. National Electrical Code (NEC).

R. National Fire Protection Agency (NFPA).

S. National Bureau of Standards (NBS).

T. Underwriters Laboratories (UL).

U. American Society for Testing and Materials (ASTM).

1.05 SUBMITTALS

A. The Manufacturer shall submit information as required to show complete compliance with these specifications. Submittals shall be provided as one (1) hard copy and one (1) digital copy. At a minimum, this information should include the following:

1. A detailed list of any and all deviations and/or exceptions from this specification along with an explanation for the deviation/exception. Clearly list all benefits to the owner and the dollar ($) figure refund due to the owner for the exception.

2. References for ten (10) systems using the proposed media, treating a minimum of 3,000 cfm and that have been in operation for at least ten (10) years.

3. Manufacturer's catalog/data sheets and descriptive literature for each piece of equipment supplied.

4. Technical data on each major piece of equipment including weights of all items greater than 200 lb.

5. Structural calculations and drawings for the main reactor vessel, to include wind and seismic load calculations, dead loads, live loads and

anchor bolt sizing. Consideration shall be given to the effect of all cutouts and openings in the vessel. Calculations shall be signed and sealed by a Professional Engineer licensed in the State of Georgia.

6. Modeling results, in graphical format, with velocity contour plots at 24" media height over the entire media cross section shall be provided to confirm that the airflow through the media is homogeneous at the average airflow rate. For the purpose of this specification, homogeneous is defined as being when the upflow velocity over the entire media cross sectional area is equal to the average upflow velocity ± 10%.

7. If not named as a pre-approved vendor, performance data must be submitted from a minimum of five (5) operating systems demonstrating media elimination capacity ≥ 33% greater than the proposed system loading.

8. Detailed bill of material complete with material of construction.

9. Dimensional drawings showing elevation and plan views of the System and all applicable connections.

10. Process and Instrumentation Diagram (P&ID) showing all main equipment components, flow rates and instrumentation.

11. Process control narrative.

12. Complete details on the Electrical and Water Control Panels:

    a. Heat calculations pertinent to installation in Georgia.
    b. Indemnification certificate for all control strategies and programs made out to the owner.
    c. Confirmation that all programming is done in-house, and programs are the property of the Manufacturer.
    d. Details on the in-house Factory Acceptance Testing (FAT) procedures for review and approval of the engineer.

    e. Description of Automatic Flow Control equipment to demonstrate compliance with Section 2.05.D.3.

13. A list of the Manufacturers recommended Spare Parts for one (1) year's operation

14. Equipment offloading and installation instructions with sufficient detail to allow the Contractor to complete the mechanical and electrical installation of all System components.

15. Annual utility and nutrient usage calculations (if applicable).

16. Statement of Manufacturer's Warranty.

17. Information on hazards associated with the System and appropriate safety precautions, including applicable Material Safety Data Sheets

(MSDS).

18. Proposed Performance Testing Plan, to include a list of sampling and logging equipment and all sampling and testing methods and protocols.

B. The Manufacturer shall submit the following information, as a minimum, for the Operation and Maintenance Manuals.

1. As-built dimensional drawings showing plan and elevation views of the System and all applicable connections.

2. As-built Process and Instrumentation Diagrams (P&IDs).

3. Detailed bill of material along with specification of System components and materials of construction. The list to include the make, model number and descriptive literature of all items furnished by the Manufacturer.

4. Performance data for the odor control blower, to include curves showing capacity, pressure, horsepower demand and efficiency over the entire operating range, including blower manufacturer's descriptive literature and blower model number(s).

5. Special precautions for any components or materials associated with the System and its operation that should be subject to particular safety precautions, including MSDS.

6. Manufacturer's Service Department contact information and service order form.

7. Statement of Manufacturer's Warranty.

8. System startup and restart instructions.

9. Detailed information on proper settings and operation of the Automatic Flow Control System.

10. Special maintenance procedures, including recommended weekly, monthly and annual preventative maintenance requirements.

11. Troubleshooting guide.

12. Individual Operation and Maintenance instructions for all major system components.

13. O&M manual shall be provided in digital copy for review/comment/approval. After approval, the Manufacturer shall provide two (2) hard copies for the owner's records.

1.06 SHIPPING, DELIVERY, STORAGE & HANDLING

A. All equipment and materials shall be properly protected per manufacturer

recommendation such that no damage will occur from the time of shipment until the time of installation.

B. All exposed openings shall be protected to prevent entrance of debris, moisture or water during transportation and storage.

C. Contractor shall be responsible for offloading all shipped equipment and shall inspect all equipment upon arrival. Contractor shall notify the Manufacturer within 24 hours of any damage to equipment or surface finish due to shipping.

D. Contractor shall store all equipment such that, for the duration of the storage period, there will be no deterioration in equipment appearance or performance. Manufacturer shall supply detailed storage instructions, as necessary, at the time of shipment.

1.07 WARRANTY

The biotrickling filter Manufacturer shall warrant that the equipment supplied meets these specifications and the performances detailed in section 2.04 and that it is new and unused, free from defects in materials and/or workmanship. This warranty shall be for 18 months from equipment delivery to the job site or 12 months from equipment handover, whichever comes first. In the event that it is determined that a defect exists, at the Manufacturer's discretion, the Manufacturer shall repair or replace the defective components, provided that any such defect was not the result of misuse of the component by the Owner or his agents.

The biotrickling filter Manufacturer shall warrant the plastic, synthetic media against defects in material and workmanship for five (5) years from equipment delivery. In addition, the manufacturer shall warrant the media against shrinking, swelling or plugging (such that the design airflow cannot be achieved) for a period of five (5) years. In the event that it is determined that a defect exists, at the Manufacturer's discretion, the Manufacturer shall repair or replace the defective components, provided that any such defect was not the result of misuse of the component by the Owner or his agents. The inability of the System blower (s) to provide the full design airflow will indicate failure of the media.

The biotrickling filter Manufacturer shall warrant that the irrigation spray nozzles shall remain clog and maintenance free for ten (10) years.

All System Warrantees are predicated on operation and maintenance of the System being in accordance with the Manufacturers written O&M manual and inlet conditions being in-line with these specifications. Demonstration of the above will be provided through written logs and records provided by the owner.

1.08 MEASUREMENT AND PAYMENT

A. The work covered by this section will be paid under lump sum price of "Odor Control System" line item in the Bid Form for each Pump Station."

PART 2 - PRODUCTS

2.01 GENERAL

The odor control equipment supplied under this section must be provided by a single Manufacturer who will be solely responsible for the design, delivery and performance of the system. The equipment must be new and unused and meet the detailed specifications and warranty requirements stated herein.

2.02 QUALITY ASSURANCE

The Manufacturer shall be an industry recognized process company specializing in the design, manufacture and operation of biological odor and air emissions equipment utilizing a once-through (non-recirculated) irrigation system.

The System Manufacturer shall have the following full-time employees on staff to ensure proper system support: mechanical engineer, environmental engineer, electrical engineer and a dedicated service department.

Any manufacturer whose main business is FRP manufacturing will not be accepted as a supplier for the odor control system specified herein.

The biotrickling filter Manufacturer is responsible for the coordination of all equipment specified herein. Systems shall be as manufactured by BioAir Solutions, LLC. or BIOREM. Proposal of an unnamed Manufacturer after the bid will not be considered.

A. Experience Requirements

The biological odor control system Manufacturer shall be experienced in the design, manufacture, installation and operation of biotrickling filters designed to remove hydrogen sulfide and organic RSCs from municipal water and wastewater odor sources. The System Manufacturer shall have a minimum of ten (10) years of experience producing substantially similar equipment and shall show evidence of at least twenty (20) systems (using the media specified herein) in satisfactory operation for at least five (5) years in the United States.

B. Substitution

Any substitutions or deviations in equipment or arrangement from that shown on the drawings or specified herein shall be the responsibility of the Contractor. Any deviation must be accompanied by detailed structural, mechanical and electrical drawings and additional supporting data for review by the Owner and the Owner's Engineer and must be stamped and certified by a registered Professional Engineer (PE) licensed in the State of Georgia.

All costs associated with the review of substitutions or deviations, and costs to the Engineer or Owner associated with project drawing changes as a result of approval of the substitution, shall be borne by the Contractor. There shall be no additional costs to the Owner due to substitutions or deviations.

C. Acceptable Manufacturers

Where a Manufacturer's standard equipment name is used in these specifications, the intent is to establish a minimum standard in terms of equipment quality, performance, functionality and experience. Substitutions as detailed above must be pre-approved by the engineer prior to bidding. Request for pre-approval must be received in writing 21 days prior to the bid opening date and must include the following supporting documentation and information –

- A detailed list of any and all deviations and/or exceptions from this specification along with an explanation for the deviation/exception.
- Provide project specific drawings showing arrangement of biotrickling filter, blower and electrical and water control panels.
- Performance data from a minimum of three (3) operating systems demonstrating media elimination capacity ≥ 10% greater than the proposed system loading.
- A typical AERMOD dispersion model for the proposed unit based on the specified conditions and performance requirements.
- Provide project specific Process and Instrumentation Diagram (P&IDs)
- Calculations showing cost of operation – power consumption, water consumption, nutrient consumption, expected biotrickling media life, carbon life calculations, etc.
- A list of ten (10) similar installations with contact names and phone numbers, length of time in operation and volume of air being treated. Provide performance data for each reference, showing H_2S removal % and % of overall odor removed. Each of the installations must use the same media as proposed for this project and must be operating a once-through irrigation system. Systems using any form or recirculation will not be considered for evaluation as an equal for this project.
- Installation list detailing equipment capacity, length of time in service, performance record and performance records for two installations for a minimum 1-week duration for each system.
- Resumes for in-house Mechanical and Electrical Engineering staff, Process Manager and all in-house Service personnel.
- Local service center details.
- Qualifications of key individuals
- Company financial documentation – D&B report, Bonding Capacity, etc.

In addition, the following may be included to aid the evaluation process -

- Cut-sheets, bulletins, company brochures, etc
- Testimonial or recommendation letters from previous customers
- Published Industry technical papers / bulletins

2.03 OPERATING CONDITIONS

The System shall be suitable to treat air coming from a continuous supply from the odor source and all equipment must be suited to the operating conditions to which it will be subjected and the various compounds/substances with which they will reasonably be expected to come into contact. The operating conditions, at a minimum, include the following:

Duty	Continuous air supply and odor source
Location	Outdoors
Inlet air temperature	55 – 100°F
Inlet relative humidity	60 – 100%
Contaminants	Hydrogen sulfide, organic RSC's, ammonia.

2.04 DESIGN REQUIREMENTS

At a minimum, the System shall treat the following and meet the following minimum performance criteria:

Pump Station 4035

Number of vessels	One (1)
Model	EcoFilter® EF62
Flowrate	1,004 cfm
Design pressure drop across vessel	2 " w.c.
Contaminant concentration:	
Average hydrogen sulfide concentration	250 ppmv
Peak hydrogen sulfide concentration	500 ppmv
Maximum instantaneous Irrigation water flow	16 gpm
Available Irrigation water pressure (dynamic)	65 psi

Pump Station 4036

Number of vessels	One (1)
Model	EcoFilter® EF62
Flowrate	1,148 cfm
Design pressure drop across vessel	2 " w.c.
Contaminant concentration:	
Average hydrogen sulfide concentration	250 ppmv
Peak hydrogen sulfide concentration	500 ppmv
Maximum instantaneous Irrigation water flow	16 gpm
Available Irrigation water pressure (dynamic)	65 psi

Performance requirements (H_2S):
The system shall have passed the performance test if either one of the following conditions is true:

- Average H_2S removal efficiency is ≥ 99.5% for inlet air H2S concentrations ≥ 10 ppmv but ≤ 500 ppmv
- Average Outlet H_2S concentration is ≤ 0.1 ppmv for inlet air H2S concentrations ≤ 10 ppmv

- *All control components located with 3 feet of odorous air/sewer gas shall be UL listed for Class 1, Div. 2 hazardous areas.*

2.05 SYSTEM COMPONENTS

A. Biotrickling Filter Vessel

The biotrickling filter vessel shall be free standing and of vertical "tower" configuration operating in a counter-current manner. Each vessel shall consist of

one (1) or more modules containing EcoBase® plastic, structured media and one (1) top piece. Each module shall be constructed from Fiberglass Reinforced Plastic (FRP) and be designed with adequate strength to support the number of required modules. Each FRP module shall contain, as a minimum, a 100 mil vinyl ester resin corrosion barrier. The structural layer shall consist of isophthalic resin with chop strand and continuous glass. The exterior top coat shall be isophthalic resin with UV resistant pigment (minimum service life of 10 years). The exterior color shall be CCP base white enamel (W005).

Biotrickling filter vessels shall not provide access to any area beneath the media or any location within the vessel where there is a chance for dripping acidic filtrate or hydrogen sulfide gas.

The reactor vessels shall be provided with 316 stainless steel hold down lugs to account for all anticipated loads to comply with local wind code requirements.

B. Media

The structured media shall be EcoBase®, high porosity, chemically resistant, engineered, plastic, synthetic porous material made from polyvinyl chloride, polyethylene or polyurethane. Organic media, carbon derived lava rock or lava rock media and/or random synthetic or non-synthetic inorganic media materials shall not be allowed.

The media characteristics (available surface area, density, and pressure drop) shall be structured and uniform throughout the media bed with pre-manufactured, engineered flow channels. Random media types (chips, clay balls, foam cubes, etc.) shall not be allowed.

The media shall have a minimum available specific surface area of 230 ft^2/ft^3 and a void opening of more than 96%. Pressure drop shall not exceed 0.25" w.g. per ft of media depth.

The media shall be guaranteed not to clog or require cleaning, scrubbing, backwashing, acid-washing or replacement for a period of ten (10) years.

Media beds / stages shall be self-supporting, enclosed in a shell or otherwise removal as a single piece. Entry into the vessel shall not be necessary for media removal.

Media shall resist compaction or swelling due to varying moisture levels and shall not degrade when subjected to low pH (i.e. pH < 2) conditions.

The uniform structure of the media shall minimize the potential for short circuiting and encourage a uniform water and air flow pattern over the entire media cross sectional area.

The manufacturer shall provide evidence that the airflow through the media at 24" height from the bottom of the media is homogeneous at the average airflow rate. For purposes of this specification, homogeneous is defined as being when the upflow velocity over the entire media cross sectional area is equal to the average upflow velocity ± 10%. The airflow modeling results with velocity contour

plots at 24" media height over the entire cross section shall be provided in graphical format as part of the Submittal requirements.

Sufficient media shall be provided to ensure the performance requirements listed in section 2.04 are met.

Media shall be pre-installed in the FRP module (s) by the system manufacturer prior to shipment to the job site. Medias that require a contractor for installation or placement are not permitted.

C. Irrigation System

Each reactor shall be configured with at least one (1) irrigation point which shall distribute the irrigation water evenly over the entire upper surface of the media layer.

The irrigation system will, without exception, be a once-through system. Recirculated systems will not be considered for this application.

Spray nozzles shall be 316 Stainless Steel, without exception and shall be warranted to not clog or require maintenance for a ten (10) year period.

Each spray nozzle shall be tested by the Manufacturer and a certificate of conformity supplied with the shop drawings to show that the nozzle has been tested and meets the specified standards for uniform distribution.

Spray nozzle array systems with multiple nozzles, shall not be acceptable.

If applicable, the irrigation system shall be supplied with a nutrient addition system to provide the macro and micronutrients required by the bacteria for optimal metabolism of the odorous compounds being treated.

D. Control System

1. Electrical Control Panel (ECP)

The ECP enclosure shall be NEMA 4X and constructed of 316SS, and the panel shall come with a 316SS panel stand.

The ECP shall house the necessary electronic components and an Allen Bradley MicroLogix 1400 PLC with PanelView 800 (HMI) for the control and monitoring of the irrigation system. Dry contacts shall be provided for external notification of alarm status. Alarms, at a minimum, shall be provided for low irrigation water flow, high irrigation water flow, no nutrient flow (if applicable) and blower fail. An Ethernet connection shall be provided to allow for remote monitoring/control of the system. **Provide Modbus TCP/IP communications connection for alarm and monitoring to pump station SCADA panel**. There shall be an allowance to manually open the irrigation spray valve (located in the water control panel) for the purpose of routine maintenance checks but the valve should be normally closed.

The system shall contain a PLC with an Ethernet/IP port, two (2) serial ports, on-line editing capability, a built-in backlit LCD screen, and a built-in high-speed counter. The PLC shall be expandable with up to seven (7) additional input/output modules.

The ECP shall monitor and log water flow and provide the following summary –

Daily water consumption
Weekly water consumption, etc.…

The ECP shall require a single electrical connection of 480V/3Phase/60Hz. Transformers shall be provided as necessary for power and control voltages. A 120 volt, GFCI convenience outlet shall be provided in the ECP.

2. Water Control Panel (WCP)

The Water Control Panel shall be constructed of 316SS and be mounted on the common 316SS panel stand, back-to-back with the ECP.

The WCP shall contain a panel heater, valves, motorized ball valves, strainers, instruments and piping for the control of the irrigation system and shall operate from control signals from the ECP.

The WCP shall contain, without exception, a pulse generating, paddlewheel water flow meter. Irrigation water flow shall be monitored and recorded to ensure proper operation and aid in trouble-shooting. Monitoring irrigation water pressure alone is not acceptable.

The WCP shall allow for a single connection to either a potable water source or suitable final effluent plant water source (if available).

The WCP shall house, if applicable, the nutrient addition system.

The WCP shall also contain a flexible spray hose with a hand trigger to allow for convenient rinsing of the strainer, filling of the nutrient barrel, and general convenience. A dedicated ball valve shall be provided in front of the spray hose to allow for the operation of the water panel while simultaneously allowing for isolation in case of a leak in the hose.

3. Automatic Flow Control System

Without exception, the ECP and WCP shall contain the necessary programming, circuitry, and hardware for an Automatic Flow Control System, which shall have the following features and shall be capable of meeting the Automatic Flow Control System performance test outlined in Section 3.05.E:

a. The system will periodically monitor the irrigation water flow rate during the irrigation sequence.
b. If the irrigation water flow rate is outside of the target flow range

the irrigation valve will automatically adjust to correct the irrigation water flow rate.

c. The following parameters shall be operator-adjustable:

1. Target irrigation flow rate
2. Allowable flow error
3. Amount of valve adjustment when error is detected
4. Flow evaluation period

d. The following non-adjustable readings shall be shown on the ECP HMI:

1. Instantaneous irrigation water flow rate
2. Actual irrigation valve open %

The following will NOT be considered to be meeting the Automatic Flow Control Systems requirements:

a. Systems using irrigation valves that are only capable of fully-open or fully-closed operation. Solenoid Valves do not meet this requirement and are not allowed.
b. Systems using mechanical-only means of adjusting the irrigation water flow such as manual diaphragm valves, globe valves, pressure reducing or adjusting valves.
c. Systems that require operator interaction in order to correct the irrigation water flow.

E. Odor Control Blower

1. The blower(s) shall be single-width wheel, single-inlet as designed and manufactured by Verantis, The New York Blower Company or approved equal.

2. The blower shall be constructed such that all surfaces in contact with the odorous airstream are to be made of corrosion resistant FRP.

3. All nuts, bolts and fasteners in contact with the gas stream shall type 316 SS.

4. Blowers shall be AMCA Arrangement 9 or 10. AMCA Arrangement 4, which places the motor shaft in the odorous airstream, is not allowed.

5. Blower ratings shall be based on tests made in accordance with AMCA Standard 210 and licensed to bear the AMCA Certified Ratings Seal for Air Performance. Blowers not licensed to bear the AMCA Seal for performance shall be tested, at Contractor's expense, in an AMCA Registered Laboratory.

6. Blower brake horsepower shall be equal to or less than 1.4 BHP at 1004/1148CFM and 4 inches static pressure.

7. Blower shall be constructed in accordance with ASTM D-4167 standard

specification for FRP blowers and blowers to ensure structural integrity.

8. Blower housing shall be constructed of polyester resin.

9. Wheel shall be radial, or backwardly-inclined, non-overloading design. Wheel shall be fabricated of vinyl ester resin.

10. Wheel hub shall be securely fastened to the shaft and completely encapsulated in FRP to ensure corrosion-resistant integrity. Wheels shall be ground and polished carbon steel, encapsulated in FRP.

11. The blower motor shall be a standard efficiency, 480V/3Phase/60Hz electric motor suitable for installation in a Class I, Div. 2 classified area and as manufactured by US Electric Motors, Baldor, Reliance or approved equal.

12. Blower shall be equipped with a Teflon shaft seal.

F. Recirculation System

Systems requiring a permanent recirculation system shall not be allowed.

2.06. EQUIPMENT NAME PLATES

Each separate piece of equipment shall be furnished with a unique name plate identifying the Manufacturer, model & serial number, date of manufacture and, if applicable, capacity and any performance limitations. The nameplates shall be Gravograph Gravoply 2 ply plastic and firmly affixed to the exterior surface of the equipment and in a location that is accessible and easily read.

2.07. SPARE PARTS (Each Pump Station)

At a minimum, the following spare parts shall be supplied with the equipment.
One (1) set of fuses, one (1) for each fuse rating.
One (1) set of lamp lenses.
One (1) strainer.
Spare parts shall be stored, by the Contractor, on site and shall be handed over to the Owner at equipment handover.

PART 3 - EXECUTION

3.01 FACTORY ACCEPTANCE TEST

A. Reactor Vessel

FRP reactor vessel shall be inspected prior to shipping for conformance to the following:

1. Dimensions match those shown on submittal drawings and are within Manufacturer's specified tolerances.

2. Flanges and connections between reactor parts fit securely without improper bending or stressing of parts.

3. Damage or imperfections to paint or fiberglass work, including cracking/crazing are minimal and in accordance with FRP specifications in Section 2.05A.

4. Manufacturer shall keep a record of the quality control document for each reactor vessel(s) that is available to the Engineer upon request.

B. Electrical Control Panel

Electrical control panel shall be inspected prior to shipping for conformance to the following:

1. NEMA rating according to Section 2.05D and bear the UL508 label.

2. PLC program and HMI shall be tested for proper communication and functionality.

3. PLC digital and analog inputs shall be electrically tested to ensure input recognition in the proper area of the PLC program.

4. All wiring between panel components and terminal strips shall be checked for proper labeling and connection.

C. Water Panel

All water panel piping and/or other pre-installed piping shall be tested prior to shipping for conformance to the following:

1. System shall have no leaks when subjected to a pressure test at 80 psi for a minimum of 1 hour.

2. All installed instruments, sensors, pumps, actuated valves, and other electrical components shall be tested for proper operation.

3. All wiring from terminal strips to all electrical components shall be tested to ensure proper wiring.

D. Spray nozzle

Spray nozzle shall be factory tested to ensure compliance with Manufacturer standards for uniform distribution.

E. FAT log

Prior to release for shipment, the Manufacturer shall Submit to the engineer for approval the results of the FAT demonstrating that Testing is complete and that the controls are ready for shipment and installation.

3.02 INSTALLATION & EQUIPMENT STARTUP

As far as is reasonably possible, all equipment should be pre-assembled prior to shipment, to minimize the need for on-site assembly. Media should be pre-installed by the Manufacturer and certified to meet the specified performance requirements.

Installation of all equipment will be conducted by the Contractor and must be in accordance with Manufacturer's written installation and startup instructions and by workers experienced in the handling of fiberglass vessels, electrical work, plumbing and instrumentation. The final installation must be certified by the Manufacturer as complete and correct.

The Manufacturer shall provide the Contractor with required clearances, tolerances and limitations, such as smoothness/flatness of concrete pad and shall be available to answer questions prior to and during the installation of the equipment.

Once the installation has been certified by the Manufacturer, the Contractor, with assistance from the Manufacturer, shall start the System to begin the biological acclimation period. This startup period shall take no longer than six (6) weeks but at any point during this startup period, at the discretion and direction of the Manufacturer, the contractor shall switch the system over to normal operation. Any minor re-piping or plumbing required will be clearly detailed in the Manufacturer's installation and startup manual and will be performed by the Contractor.

Any special tools or materials required for this startup/acclimation period shall be provided by the Manufacturer and delivered to the Owner to keep.

After satisfactory startup and the corresponding switch over to normal operation, the Contractor shall, in the presence of the Engineer, conduct the performance test as detailed in section 3.05 below.

3.03 FIELD PAINTING & CORROSION PROTECTION

If painted surfaces are damaged during shipment, off-loading or installation, as long as the damage is surface only and in no way affects the integrity of the equipment or its ability to perform, these blemishes, scratches or other imperfections shall be touched up by the Contractor in accordance with instructions from the Manufacturer. Materials used shall me compatible with the original coating material in quality and color. Contractor to protect all equipment name plate information from paint.

3.04 PERFORMANCE TESTING

Performance testing shall not commence until the Manufacturer and Engineer agree that they system has been satisfactorily started-up and sufficient time has been allowed for the acclimation of the bacteria.

After the odor control system has been satisfactorily started-up and switched to normal operation, the Contractor shall, in the presence of the Engineer, demonstrate that the system will perform as specified in section 2.04 of this specification.

The Contractor shall provide the Engineer with a written test protocol and the performance test may not be conducted until the test protocol has been reviewed and approved by the Engineer.

The Manufacturer may be present during the performance test and, at its own discretion, may conduct a parallel performance test as long as they do not interfere with the performance test being conducted by the Contractor.

The Contractor shall supply, install and operate all equipment, sensors and instrumentation required to complete the performance test.

A. H_2S Testing procedure

1. Measure airflow into each unit and, if necessary, adjust to the design airflow +/- 10%. Airflow balancing can be conducted by BioAir and witnessed by the Engineer and/or Contractor if desired. Airflow shall be measured at the beginning of the test period. The set position on the damper(s) will be marked or noted. Airflow will not change as long as damper(s) remain in position.

2. Measure pressure drop across each biotrickling filter at beginning of test period.

3. Measure temperature of the inlet, outlet and ambient air.

4. Performance test period to begin at a noted time and last for four (4) hours. H_2S data from the common inlet location and from the outlet of each odor control system will be measured and logged once every 10 minutes to demonstrate performance during test period.

    a. The inlet H_2S data will be logged with a pre-calibrated OdaLog gas data logger with appropriate range and accuracy for the inlet air stream (0-1000 ppmv or 0 - 200 ppmv range, 1 ppm display resolution or 0.0 - 50.0 ppmv range, 0.1 ppmv display resolution).

    b. The outlet H_2S data will be logged with a pre-calibrated OdaLog gas data logger with appropriate range and accuracy for the outlet air stream. (0.00 - 2.00 ppmv range, 0.01 ppmv display resolution or 0.0 - 50.0 ppmv range, 0.1 ppmv display resolution).

B. H_2S Acceptance criteria:

The System's H_2S removal efficiency shall be determined by calculating the average inlet H_2S concentration and the average outlet H_2S concentration and using the following formula: H_2S removal efficiency (%) = (1 – (average outlet H_2S concentration/average inlet H_2S concentration)) x 100. The system shall have passed the H_2S performance test if the H_2S removal efficiency is 99.5% or more for inlet air H_2S concentrations ≥ 50 ppmv but ≤ 500 ppmv, or the average outlet air H_2S concentration is ≤ 0.1 ppmv, whichever is greater.

In the event that the average inlet H_2S concentration during the four (4) hour test period exceeds the specified average inlet H_2S concentration as listed in this Specification, or the maximum inlet H_2S concentration during the four (4) hour test period exceeds the specified maximum inlet H_2S concentration as listed in this Specification, the H_2S acceptance criteria shall not apply and the system shall be

considered to have passed the performance test.

C. Automatic Flow Control System testing procedure

In the presence of the Engineer, the Manufacturer shall demonstrate the operation of the Automatic Flow Control System as given below.

1. Review the requirements list given in Section 2.05.D.3 and prove or demonstrate compliance with each point.
2. The following procedure shall be followed for each irrigation valve in the system. The cycle time shall be minimized to allow the procedure to be completed within 30 minutes.

    a. Open all manually controlled valves allow for maximum flow through the WCP. Set the target irrigation flow rate to 3x the normal irrigation flow rate (to allow the irrigation valve to fully open). Demonstrate that the valve will reach 100% open status within 20 s during irrigation.
    b. In between irrigation cycles, while the irrigation valve is CLOSED, set the target irrigation flow rate to the proper design irrigation flow rate. Demonstrate that the irrigation valve will automatically close in order to reach the design flow rate within 30 s during its next irrigation cycle.
    c. Repeat steps a. and b. above for a minimum of 3 additional set points both above and below the normal target irrigation flow rate.
    d. Set the target irrigation flow rate to the normal target irrigation flow rate. Partially close at least one valve upstream of the modulating ball valve and demonstrate that the irrigation valve will automatically adjust to a more open position in order to reach the design flow rate within 30 s during its next irrigation cycle.
    e. Return all Automatic Flow Control settings to their normal positions and fully open all upstream and downstream valves. Demonstrate that the system will return to normal flow control operation.

3.05 MANUFACTURER'S SERVICES

In addition to being available by phone to assist the Contractor during the offloading, installation, and startup of the equipment, the following Manufacturer's services shall be provided with the number of trips and days on site as a minimum.

Startup assistance	One (1) trip, two (2) days on site
Performance testing assistance/training	One (1) trip, one (1) day on site

Notwithstanding the above, the Manufacturer shall continue to assist the Contractor with questions, issues and remote assistance until the system is properly installed, running satisfactorily and handed over to the Owner.

END OF SECTION

DIVISION 16

ELECTRICAL

PART 1 – BASIC ELECTICAL REQUIREMENTS

1.01 QUALITY ASSURANCE

A. All electrical work shall be in accordance with the following codes and agencies:

1. The National Electrical Code (NFPA-70), 2017 Edition
2. The International Building Code, 2012 Edition with 2014 & 2015 Georgia Amendments.
3. Regulations of the local utility company concerning metering and service entrance.
4. State and local ordinances governing electrical work.

B. All materials shall be new and shall conform to standards where such have been established for the particular material. All UL listed equipment shall bear the UL label.

1.02 PERMITS

A. Obtain all permits and inspections required for the work involved. Deliver to the owner all certificates of inspection.

1.03 WARRANTY

A. The contractor shall warrant to the owner that all work shall be free from defects and will conform to the contract documents. This warranty shall extend not less than one year from the date of beneficial occupancy.

1.04 MEASUREMENT & PAYMENT

A. Payment for Electrical & SCADA Control installation will be made under the lump sum price for the item “Electrical & SCADA Control for each pump station, and such payment shall constitute full compensation for furnishing and placing all electrical components as shown on the plans.

1.05 DESCRIPTION

A. The work covered by this Section of these Specifications includes but is not necessarily limited to the following items of work:

1. Electrical service, distribution equipment and control equipment for the pumpstation and building.
2. Coordination with utility for power and metering.
3. Provision and installation of the emergency generator receptacle and transfer switch.

1.06 SCOPE OF WORK

A. This section of the specifications covers the complete electrical systems as indicated on the drawings or as specified herein. Provide all materials, labor, equipment, and supervision to install electrical systems. The work shall consist of, but shall not be limited to, the installation of the following:

1. Install new service, electrical distribution, and control equipment for a pump station.
2. Coordination with utilities for power service indicated.
3. SCADA system for each station.

1.07 CUTTING, PATCHING, EXCAVATING & BACKFILLING

A. All cutting and patching required to carry out the work shall be provided under other Specification Sections.

B. All excavation and backfilling required to install conduit shall be provided under this Section. Backfill shall be compacted as required under other Specification Sections.

1.08 WORKMANSHIP AND MATERIALS

A. Workmanship: All work necessary to complete the project shall be executed in a thorough, neat and workmanlike manner.

B. Materials: All materials shall be new and equipment included in Underwriters Label Service shall bear that label.

C. Substitutions: Model numbers indicated herein or shown on the drawings are the Basis of Design. The Contractor may substitute equal and approved equipment provided said equipment meets all requirements of the plans and specifications and will fit in the available spaces in the building as shown. The approval or disapproval of any submitted item will be considered only if submitted before beginning work. Each request shall include a description of the proposed substitute, the name of material or equipment for which it is to be substituted, drawings, cuts, performance and test data for an evaluation and a statement from the equipment manufacturer's representative that the items to be substituted meet or exceed the specifications of the item substituted for.

D. Costs: If the contractor chooses to provide equipment, which meets all the aforementioned requirements but has different characteristics, which cause any additional costs, he shall bear all costs associated with that substitution. All changes shall be coordinated with the engineer, owner and general contractor.

1.09 SHOP DRAWINGS

A. The Contractor shall submit for review by the Engineer a complete schedule and data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, such as catalogs, cuts, diagrams, performance curves, and charts published by the manufacturer, to show conformance to

specification and drawing requirements; model numbers alone will not be acceptable. Complete electrical characteristics shall be provided for all equipment.

B. Submittals shall be made for each of the following items:

Material List
Automatic Transfer Switch
Emergency Generator Connection Box
Lighting Fixtures
Panelboards
Short Circuit Study & Arc Flash Hazard Anaylsis
Disconnect Switches
SCADA System
Enclosed Circuit Breakers
Wiring Devices
Surge Protection
Transformer
VFD's

C. Each individual submittal item for materials and equipment shall be marked to show specification section and paragraph number which pertains to the item.

D. Prior to submitting shop drawings, review the submittal for compliance with the Contract Documents and place a stamp or other confirmation thereon which states that the submittal complies with Contract requirements. Submittals without such verification will be returned disapproved without review.

1.10 SERVICE

A. Electrical service shall be 3 phase, 4W, 277/480 wye. Service shall be underground. Coordinate service location and metering with local utility.

B. Complete metering systems shall be provided. Install the system in accordance with the utility standards. Coordinate meter location with local utility and provide channel rack for mounting of meter.

1.11 DRAWINGS

A. The drawings indicate the general arrangement of electrical equipment, based on one manufacturer's product. Coordinate installation of equipment with all other trades and existing conditions. Do not scale drawings for connection locations. Bring all discrepancies to the immediate attention of the engineer.

B. Contractor shall install and circuit all electrical work as indicated on drawings unless specific building construction requires a change or rerouting of this work. He shall keep a record of the location of all concealed work, including the underground utility lines. He shall document all changes in the manner specified by the General Conditions, Special Conditions and Supplementary General Conditions to the Mechanical and Electrical Work.

1.12 EQUIPMENT REQUIRING ELECTRICAL SERVICE

A. Review all specification sections and drawings for equipment requiring electrical service. Provide service to and make connections to all such equipment.

B. Drawings are based on design loads of one manufacturer. If equipment actually furnished have loads, numbers of connections, or voltages other than those

indicated on the drawings, then control equipment, feeders, and overcurrent devices shall be adjusted as required, at no additional cost to the owner. Such adjustments are subject to review by the engineer.

C. Catalog numbers indicated with equipment, devices and lighting fixtures are for convenience only. Errors or obsolescence shall not relieve the furnishing of items which meet the technical description given in specifications, noted, or required by function designated.

1.13 SHORT-CIRCUIT STUDY/ARC FLASH HAZARD ANALYSIS

A. The contractor shall furnish short-circuit and protective device coordination studies which shall be prepared by the equipment manufacturer.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

C. The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

D. The results of the short-circuit and arc flash hazard analysis studies shall be summarized in a final report. No more than five (5) bound copies of the complete final report shall be submitted.

E. The report shall include the following sections:

1. One-line diagram showing protective device ampere ratings and associated designations, cable size & lengths, motor & kVA ratings, and switchgear/switchboard/panelboard designations.
2. Descriptions, purpose, basis and scope of the study.
3. Tabulations of the worst-case calculated short circuit duties as a percentage of the applied device rating (automatic transfer switches, circuit breakers, fuses, etc.); the short circuit duties shall be upward-adjusted for X/R ratios that are above the device design ratings.
4. Fault study input data, case descriptions, and current calculations including a definition of terms and guide for interpretation of the computer printout.
5. Incident energy and flash protection boundary calculations.
6. Comments and recommendations for system improvements, where needed.
7. Executive Summary including source of information and assumptions made.

F. Qualifications

1. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies. The Registered Professional Electrical Engineer shall be a full-time employee of the Engineering Services Organization.

G. Data collection

1. Contractor shall furnish all field data as required by the power system studies.

H. Short-circuit and protective device evaluation study

1. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standards 141, latest edition.
2. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
   a. Electric utility's supply termination point
   b. Incoming switchgear
   c. Manual transfer switches
   d. Branch circuit panelboards
3. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
4. Protective Device Evaluation:
   a. Evaluate equipment and protective devices and compare to short circuit ratings

I. Arc flash hazard analysis

1. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.
2. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system where work could be performed on energized parts.
3. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt systems.
4. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.
5. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2.

J. Field adjustment

1. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

K. Arc flash warning labels

1. The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
2. Provide training to owner outlining requirements for protective equipment and personnel clothing due to arc flash levels.

1.14 MECHANICAL SYSTEM INTERFACE

A. All control wiring for HVAC equipment and pump station shall be installed under Division 16000. Power wiring to all motors and motor controllers and between motors and controllers shall be provided under Division 16000. All motor controllers shall be furnished and installed under Division 16000.

1.15 SITE INVESTIGATION AND RENOVATION CONDITIONS

A. Prior to submitting bids for the project, visit the site to become familiar with existing conditions. The project shall be restored to its existing condition, with the exception of work under this contract, prior to final payment.

1.16 PRODUCT DELIVERY, STORAGE, HANDLING, AND PROTECTION

A. Provide a dry, weather tight space for storing materials. Store packaged materials in original undamaged condition with manufacturer's labels and seals intact. Handle and store material in accordance with standards to prevent damage. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable. Replace damaged materials.

1.17 CLEANING AND PAINTING

A. Remove oil, dirt, grease and foreign materials from all equipment to provide a clean surface. Touch up scratched or marred surfaces of lighting fixtures, panelboards and cabinet trims, and equipment enclosures with paint manufactured specifically for that purpose. Paint plywood backboards used to mount electrical equipment with two coats of light grey semi-gloss enamel. All other painting shall be done under the "Painting" section of these specifications.

PART 2 - BASIC MATERIALS

2.01 RACEWAYS

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratory, Inc. Publications 1, 6, 467, 651, 797, 1242.
2. American National Standards Institute C-80.1, C-80.3.

B. Raceway is required for all wiring, unless specifically indicated or specified otherwise. The minimum size of conduit shall be ¾ ", but shall not be less than size indicated on the drawings or required by the NEC.

C. Conduits in dry pit side, exposed or exterior shall be rigid aluminum.

D. Conduits installed in direct contact with earth shall be schedule 80, heavy wall PVC.

E. Conduits installed in wet well area shall be 304 stainless steel. All fittings, straps and anchors shall be stainless steel.

F. Conduit installation in hazardous areas of (Class I, Div 1) shall conform to NEC Article 501.

G. Use flexible conduit for connections to dry type transformers, and all vibrating equipment.

1. Length shall not exceed 18".
2. Maintain ground continuity through flexible conduit with a green equipment grounding conductor.

3. Liquid-tight flexible conduit shall be used in mechanical equipment rooms and exterior installations,

H. Rigid aluminum fittings shall be standard threaded couplings, threaded hubs, bushings, and elbows. All rigid aluminum fittings shall be aluminum alloy; set screw or non-threaded fittings are not permitted. Non-metallic conduit fittings shall be of the same material as the conduit furnished and shall be the product of the same manufacturer.

I. All conduit support parts and hardware shall be stainless steel. Conduit straps shall be two piece/part stainless steel pipe clamp type. Conduit support channels shall be 1 ½" x 1 ½" – 14 gauge channel.

J. Leave all empty conduits with a 200 lb. test nylon cord pull line. Complete raceway runs prior to installation of wires or cables. Deformed conduits shall be replaced. Protect conduits against dirt, plaster, and foreign debris with conduit plugs.

K. Fasten conduit support devices to structure with wood screws on wood, toggle bolts on hollow masonry, expansion anchors on solid masonry or concrete, and machine bolts or clamps on steel. Nails are not acceptable. Seal all conduits penetrating building exterior with insulating electrical putty to prevent entrance of moisture or migration of gas.

L. Conduit shall be run parallel or at right angles to walls, ceilings, and structural members. Support branch circuit conduits at intervals not exceeding 10 feet, and within 3 feet of each box or change of direction.

2.02 WIRES AND CABLES

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 44, 83, 486, 493.
2. Insulated Cable Engineers Association Standards S-61-402, S-66-524.
3. National Electrical Manufacturer's Standards WC-5, WC-7.

B. Conductors shall be electrically continuous and free from short circuits or grounds.

C. All open, shorted, or grounded conductors and any with damaged insulation shall be removed and replaced with new material free from defects.

D. Conductor size shall be minimum of No. 12 AWG, unless larger size is required by the drawings or the NEC. Emergency system conductors shall be minimum No. 10 AWG. Insulation voltage level rating shall be 600 volts. All wire and cable shall bear the UL label.

E. Conductors No. 10 and smaller shall be solid copper, 90 degrees C. type THWN/THHN. Conductors larger than No. 10 shall be stranded copper, 90 degrees C. type THWN/THHN, or XHHW. Fixture wire shall be No. 16 AWG silicone rubber insulated, stranded fixture wire type SFF-2 or No. 16 thermoplastic nylon jacketed stranded fixture wire type TFFN.

F. Color code all conductors. No. 6 and smaller shall have solid color compound or coating. No. 4 and larger shall have solid color compound or colored phase tape; tape shall be installed on conductors in every box, termination point, cabinet, or enclosure. Coding shall be as follows:

1. 240/120 volt single phase three wire system: Phase A-black, Phase B-red, neutral-white.
2. 480Y/277 volt three phase four wire wye system: Phase A-brown, Phase B-orange, Phase C-yellow, neutral-grey.
3. Grounding conductors shall be green or green traced.

G. Maintain phase rotation established per N.E.C. at service equipment throughout entire project.

H. Group and lace with nylon tie straps all conductors within enclosures. Make splices in conductors only within junction boxes, wiring troughs, or other NEC approved enclosures. Do not splice conductors in pull boxes, panelboards, safety switches, or motor control enclosures. Identify each conductor as to circuit connection in all boxes and enclosures.

I. Terminate stranded conductors No. 10 AWG and smaller with crimp-type lug or stud. Crimp terminal shall be the configuration type suitable for terminal point.

J. Torque each terminal connection to the manufacturer's recommended torque value. A calibrated torquing tool shall be used to insure proper torque application.

K. No more than two opposing circuits in a single phase system, or three opposing circuits in a three phase system, may be installed in a single raceway.

2.03 BOXES

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 50, 467, 514.

B. Review engineering drawings for areas where outlets occur within specific features and install outlets as shown on architectural drawings; or, if not shown, center and align boxes within the predominant features.

C. Outlet boxes for switches and receptacles in exposed wiring systems shall be cast FS type with matching device plate. Provide aluminum or stainless. For exterior installations, use weatherproof in use hinged covers. Provide larger boxes as required for special purpose devices.

D. Dimensions of pull and junction boxes shall not be less than those required by the NEC for the number, size, and position of conductors entering the box. Wood supports within pull boxes are not acceptable. Provide box covers for all boxes.

E. All boxes shall be completely accessible and as required by the NEC. Provide an outlet box for each lighting fixture or as indicated on the drawings and for each device. Box sizes shall be increased from those outlined above if required by Article 314 of the NEC.

F. Support every box from structure. Secure to wood with wood screws, hollow masonry with toggle bolts, metal with sheet metal screws, solid masonry or concrete with expansion anchors, metal studs with spring steel clamp, and structure with threaded steel rod when suspended.

G. After completion, using indelible ink wide tip marker, indicate on the cover of each junction and pull box the designation of each circuit contained therein.

2.04 WIRING DEVICES

A. The following specifications and standards are incorporated into and become a part of this specification:

1. National Electrical Manufacturer's Association Publications WD-1, WD-5.

B. Single pole, 20 amp, 277 volt toggle switches shall be Hubbell 1221. Weatherproof, 20 amp, 277 volt switches shall be Hubbell 1281-1750. Three-position, center-off, maintained contact switches shall be Hubbell HBL 1385. Equivalent switches manufactured by Cooper, Legrand, or Leviton are acceptable.

C. Fifteen amp, 125 volt grounded duplex receptacles (NEMA 5-15R) shall be Hubbell HBL52CM62. Twenty amp, 125 volt grounded duplex receptacles (NEMA 5-20R) shall be HBL53CM62. Ground fault interrupter (GFI) receptacles shall be Hubbell GFR5362SG. Equivalent receptacles manufactured by Cooper, Legrand, or Leviton are acceptable.

D. Device plates shall be one piece single or multi-gang type selected to match the device or combination of devices. Device plates for flush mounted devices shall be smooth surfaced plastic of the same finish as the devices. All devices installed in areas exposed to the weather shall be provided with a while-in-use cover.

E. All devices shall be provided with ivory finish. Mount all devices within outlet boxes to allow device plates to be in contact with wall on all sides. Install wall switches on the strike side of doors.

2.05 DISCONNECT SWITCHES

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 98, 198.2, 198.4.
2. National Electrical Manufacturer's Association Publications KS-1.

B. Products of General Electric, Eaton or Square D which comply with these specifications are acceptable.

C. Disconnect switches shall be heavy duty non-fusible safety switch type, unless fused type is indicated on the drawings, with the number of poles required to disconnect all ungrounded conductors serving the equipment.

1. Furnish a solid neutral when the circuit includes a neutral conductor.
2. Furnish an equipment grounding conductor lug bonded to the switch enclosure.

3. Furnish NEMA type one enclosure for all interior dry locations, and NEMA type 4X stainless steel for all damp, wet, or exterior locations unless other types are indicated on the drawings.

D. Switches shall have the following features:

1. Quick-make, quick break switching mechanism.
2. Line terminal shields.
3. Provisions for padlocking in the "off" position.
4. Door interlocks to prevent door from opening when switch is closed. Provide inconspicuous means to defeat this interlock.
5. Permanent name plate indicating all ratings.
6. Arc chute for each pole.
7. 600 volt rating for 250 to 600 volt systems, 250 volt rating for systems below 250 volts. All switches shall be rated “heavy-duty”.

E. Disconnect switches for three phase motors rated two horsepower and above shall be three pole non-fusible type. Disconnect switches for three phase motors rated less than two horsepower shall be three pole manual motor starter switches without overload protection. Disconnects for single phase motors shall be single or two pole horsepower rated switches without overload protection.

F. Locate switches to provide full accessibility and working clearances required by the NEC. Locate adjacent to equipment served unless drawings indicate otherwise. Mount switch directly to structure or to metal channel depending upon field conditions. Mount switch handle between 36" and 60" above finished floor.

2.06 SUPPORTING DEVICES

A. Provide and install supporting devices which comply with manufacturer's standard materials, design, and construction in accordance with published standards and as required for complete installation.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices. Install hangars, supports, clamps, and attachments to support piping properly from building structure only. Torque sleeve seal nuts, complying with manufacturer's recommended values. Ensure that sealing grommets expand to form water-tight seal.

C. All supports and hardware shall be stainless steel.

2.07 ELECTRICAL IDENTIFICATION

A. Install engraved plastic - laminate sign on each major unit of electrical equipment. Provide a single line of text, 1/2" high lettering on 1 1/2" high sign (or 2" high sign if 2 lines required). Provide signs for each unit of the following:

1. Panelboards.
2. Electrical cabinets and enclosures.
3. Transformers.
4. Motor controllers.
5. Disconnect switches.
6. Automatic Transfer switches

7. Enclosed breakers
8. Junction boxes

PART 3 - DISTRIBUTION EQUIPMENT

3.01 GROUNDING SYSTEMS

A. Equipment grounding system shall be established with equipment ground conductors. The use of metallic raceways for equipment grounding is not acceptable. Unless indicated otherwise, provide equipment ground the same size as phase conductors.

B. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 44, 83, 467, 486, 493.
2. National Electrical Manufacturer's Association Standards WC-5, WC-7.

C. Grounding electrode conductors shall be bare or green insulated copper sized as indicated on the drawings. Equipment grounding conductors shall be green insulated type THW, THWN, or XHHW sized as indicated on the drawings. Where sizes are not indicated, grounding conductor shall be sized in accordance with NEC Article 250.

D. Each receptacle and switch device shall be furnished with a grounding screw connected to the metallic device frame. Provide a conductor termination grounding lug bonded to the enclosure of each junction box, transformer, motor controller, and disconnect switch.

E. Ground all non-current carrying parts of the electrical system, i.e., wireways, equipment enclosures and frames, junction and outlet boxes, machine frames, and other conductive items in close proximity with electrical circuits. Ground the neutral of all dry type transformers to grounding delta that shall serve as the grounding electrode for the separately derived system. Grounding connections to building steel rebar shall be made with a chemical exothermic weld.

F. Grounding conductors for branch circuits are not shown on the drawings; however, grounding conductors shall be provided in all branch circuit raceways and cables, including flexible conduit. Grounding conductors shall be the same AWG size as branch circuit conductors.

G. The equipment grounding conductor shall be terminated with a screw or bolt used for no other purpose. Equipment grounding conductors shall terminate on panelboard grounding bus only. Do not terminate on neutral bus.

3.02 TRANSFORMERS

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 506.
2. National Electrical Manufacturer's Association Publication ST-20.
3. American National Standards Institute Publications C-57, C-89.2.

B. Products of General Electric, Eaton or Square D which comply with these specifications are acceptable.

C. Transformers shall be self-cooled, rated for continuous operation at rated KVA, 24 hours per day, 365 days per year with normal life expectancy. Transformers shall be rated for average temperature rise by resistance of 150 degrees C. in 40 degrees C. maximum ambient, 30 degrees C. average ambient unless otherwise indicated. Transformer insulation system shall be UL rated as 220 degrees C. system. Sound rating shall not exceed NEMA and ANSI standards for the KVA rating. Internal vibration dampening shall be provided on all transformers.

D. Transformers up to 25 KVA, transformers shall be totally enclosed, non-ventilated with a resin encapsulated core and coil and drip-proof housing.

E. Primary ratings shall be 480 volts, 1 phase, 2 wire. Secondary service shall be 240/120 volts, 1 phase, 3 wire. Nominal impedance shall be 4.5 percent minimum.

F. Core assemblies and the center ground connection point of the coil secondaries shall be grounded to their enclosures by adequate, flexible ground straps. Provide grounding lug at the strap to enclosure bonding location for connection of three conductors.

G. Do not install equipment over transformer, unless indicated on the drawings. Provide full working clearances as required by the NEC.

3.03 PANELBOARDS

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 50, 67,489.
2. National Electrical Manufacturer's Association Publications PB-1, AB-3.

B. Products of General Electric, Eaton or Square D which comply with these specifications are acceptable.

C. All panels and circuit breakers shall be UL listed and bear a UL label. Panels shall be of the dead front safety type. Provide panels complete with factory assembled circuit breakers connected to the bus bars. Number all panel boards in the following sequence: Circuits 1 and 2 - Phase A; circuits 3 and 4 - Phase C.

D. All bus bars shall be copper. Main lugs and main breaker shall be UL approved for copper or aluminum conductors and shall be of a size range for the conductors indicated on the drawings. Each panel shall contain a full size grounding bus and, when required, a full size insulated neutral bus. The neutral and ground busses shall have a sufficient number of lugs to singularly terminate each individual conductor requiring a connection. The ground bus shall be brazed or riveted to the panel enclosure, but not attached to the panel interior. Where designated, each "space' shall include all bussing, device supports and connections for future breaker installation.

E. Branch circuit panel board width shall be between 20 and 22 inches; depth shall be 5 3/4" maximum. Distribution panel board width shall be 32" minimum and depth shall be 14" maximum. Provide gutters and bending space to conform with the NEC. Key all panels throughout the project alike.

F. Circuit breakers shall be quick-make, quick-break, thermal magnetic type bolted to the bus. Multi-pole breakers shall be common trip and common reset type; tie handle connections are not acceptable. Interrupting ratings on 240 volt systems shall be 10,000 RMS symmetrical amps minimum and on 480 volt systems shall be 14000 RMS symmetrical amps minimum; provide higher ratings when indicated on the drawings. Multiple branch circuits in a common raceway shall be protected by a multi-pole breaker with a common trip and reset handle; all circuits in the raceway shall be deenergized by the single breaker. Provide designated enclosed breakers with arc reduction maintenance switch (ARMS) with pilot light.

G. Mount panel boards with top circuit not more than 6'-6" above finished floor. Enclosures shall be secured by a minimum of four fastening devices.

H. Provide in each panel board a typewritten circuit directory mounted under clear plastic in metal holder in the door of the panel reflecting all field changes additions. Install push-in knock-out closure plugs in any unused knock-out openings.

PART 4

4.01 PROJECT COMPLETION

A. Electrical Systems Operational Test

1. Prior to final inspection, the following systems or equipment shall be tested and reported as herein specified.
    a. Each ground rod installation shall be tested after all connection to ground rods are made. Ground rod installations shall be tested by “fall of potential” measuring method using ground resistance test meter and two auxiliary electrodes driven into the earth, interconnected through the meter with the ground rod installation being tested. Placement of auxiliary electrodes shall be in accordance with operating instructions of test meter, but in no case shall auxiliary current electrodes be placed within seventy feet of the grounding system being tested. Test data shall indicate placement of auxiliary electrodes with respect to system being tested, data readings were taken and lowest resistance recorded.
    b. Three (3) typewritten copies of the test shall be submitted to the Engineer for approval.
2. Demonstrate operation of all devices and systems.

B. Record Drawings

1. At the time of final inspection, provide three (3) sets of data on electrical equipment used in the project. This data shall be in bound form and shall include the following items:
    a. Shop drawings on equipment listed above.
    b. Data sheets indicating electrical characteristics of all devices.
    c. Data sheets on all lighting fixtures indicating voltage, illumination source characteristics, and driver used in each fixture.

d. Test results required by “Electrical Systems Operation Test.”
e. VFD startup reports with all VFD settings and parameters.
f. SCADA system including cut sheets and as-built drawings.

END OF SECTION

SECTION 16500

AUTOMATIC TRANSFER SWITCH

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. The work required under this section of the specifications consists of the installation of an automatic transfer switch at each pump station. All materials and devices which are an integral part of this system shall be provided under this section of the specifications.

B. Bypass/isolation Automatic Transfer Switch (ATS): An automatic transfer switch is self-acting equipment for transferring one or more load conductor connections from one power source to another, with controls to allow operation from SCADA system. Provide for Modbus TCP/IP connection to SCADA system.

1.03 MEASUREMENT & PAYMENT

A. Payment for Electrical & SCADA Control installation will be made under the lump sum price for the item “Electrical & SCADA Control for each pump station, and such payment shall constitute full compensation for furnishing and placing all electrical components as shown on the plans.

1.04 QUALITY ASSURANCE

A. The following specifications and standards are incorporated into and become a part of this specification by reference.

1. National Fire Protection Association (NFPA):
    a. NFPA-70 National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701 and 702.

B. Acceptable Manufacturers: Products of the following manufacturers, which comply with these specifications, are acceptable:

1. Transfer Switches:
    a. ASCO 7000 Series with Power Control Center
    b. Cummins/Onan OTPC Series
    c. Russell
    d. GE/Zenith

C. Equipment Dimensions:

1. Dimensions indicated on the drawings are maximum allowable and shall not be exceeded. Where equipment of acceptable manufacturers listed exceeds the maximum dimensions, products of such manufacturers shall not be acceptable.

D. Coordination:

1. Review shop drawings submitted under this and other sections, as well as other divisions, to insure coordination between work required among different trades. Coordinate the installation sequence with other contractors to avoid conflicts and to provide the fastest overall installation schedule. Coordinate installation with architectural and structural features, equipment installed under other sections of the specifications, and electrical equipment to insure access and to insure clearance minimums are provided.

1.05 SUBMITTALS

A. Refer to the SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Section for required procedures.

B. Manufacturer's Product Data:

1. Submit material specifications and installations data for products specified under Part 2 - Products to include:
   a. Transfer switches

C. Shop Drawings: Submit shop drawings to indicate information not fully described by the product data to indicate compliance with the contract drawings. Submittals containing less than the information listed below will be rejected.

1. Shop drawings for the transfer switch shall contain not less than the information listed as follows:
   a. Description of switch including operational sequence for switch to be controlled from SCADA system.

D. Quality and Service:

1. All materials and parts of the EPSS shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment. Units and components offered under these specifications shall be covered by the manufacturer's parts and labor warranty for a minimum of five (5) years from date of Owner acceptance of the project on a new machine, a copy of which shall be included in the shop drawings submittal.
2. Submittals will be accepted only on transfer switches which can be properly maintained and serviced without requiring the Owner to stock spare parts or wait longer than twenty-four hours for service. Submittals shall include the nearest location of permanent parts outlet from which parts may be obtained and written assurance that trained service personnel will be available on twenty-four hour's notice. Units with service centers more than 100 miles from project site will not be accepted.

E. Record Drawings

1. Include in each set three sets of operating, maintenance, and parts manuals covering all components for the EPSS. Each supplier shall provide instructions

to the Owner in operation and maintenance of his equipment, both in written form and with on-site personnel for a minimum of four hours.

PART 2 – PRODUCTS

2.01 TRANSFER SWITCH

A. Transfer switch shall be rated at not less than as indicated on the drawings at rated voltage. Transfer switch shall be rated and marked for total system load.

B. Transfer switch serving 480V three phase four wire loads shall be four poles with a switched neutral. Neutral contacts must be on the same shaft as the associated main contacts and have the same continuous current rating and withstand current rating. Neutral contacts shall break last and make first.

C. Transfer switch shall be an automatic type.

D. Transfer switch shall be wall mounted in a NEMA 4X type 316 stainless steel enclosure. Enclosure shall have hinged door with three point latching and factory installed key locking enclosure door. The switch shall only require front access.

E. Operation shall be inherently double-throw whereby all contacts move simultaneously. Electrical spacing shall be equal to or exceed those listed in Table 15.1 of UL-1008. Only those main contact structures specifically designed for transfer switch service shall be acceptable. An overload or short circuit shall not cause the switch to go to a neutral position. A manual operating handle shall be provided. All main contacts shall be silver alloy type protected by arc quenchers and, for switches rated 600 amps and larger, by arching contacts. Operating transfer time shall be 1/15 second or less on switches rated below 600 amps.

F. All switch and contacts, coils, springs and control elements shall be removable from the front of the transfer switch without removal of the switch panel from the enclosure and without disconnecting power conductors or drive linkages. Control and sensing relays shall be continuous duty industrial type with minimum contact rating of ten amps.

G. Transfer switch shall be rated to withstand in RMS symmetrical amperes not less than the available symmetrical RMS amperes when protected by the circuit protective device on the line side of the transfer switch. Withstand rating of switch shall be based on switch contacts not welding under fault conditions. Provide switch with current limiting fuses to increase current withstand rating when switch is not rated for fault duty.

H. The control panel for each automatic transfer switch shall contain the following accessories:

1. Adjustable 0.5 to 6 second time delay on starting of EPS to override momentary power dips and interruptions of the normal services. Time delay shall be factory set at 1 second.
2. Time delay on transfer to emergency adjustable from 0 to 60 seconds, factory set at 0 seconds.

3. Test switch on enclosure door to simulate failure of the normal power source. ATS shall transfer load to the EPS.
4. Push button to bypass time delay on re-transfer to normal.
5. Close differential voltage sensing shall be provided on all phases of the normal power supply. The pickup voltage shall be adjustable from 85% to 100% of nominal and the dropout voltage shall be adjustable from 75% to 98% of the pickup value. The transfer to emergency will be initiated upon reduction of normal source to 85% of nominal voltage and re-transfer to normal shall occur when normal source restores to 95% of nominals.
6. Independent single phase voltage and frequency sensing of the emergency source. The pickup voltage shall be adjustable from 85% to 100% of nominal. Pickup frequency shall be adjustable from 90% to 100% of nominal. Transfer to emergency upon normal source failure when emergency source voltage is 90% or more of nominal and frequency is 95% or more of nominal.
7. A time delay on re-transfer to normal source. The time delay shall be automatically bypassed if the emergency source fails and normal source is available. The time delay shall be field adjustable from 0 to 25 minutes and factory set at 15 minutes.
8. An unloaded running time delay for emergency generator cool-down, factory set at 5 minutes.
9. The transfer switch shall be the programmed transition type with intermediate position (adjustable time delay) before transfer. In phase monitor transition will not be accepted.
10. Pilot light for indicating switch in normal position (include fuses and auxiliary contact).
11. Pilot light for indicating switch in emergency position (include fuses and auxiliary contact).
12. An exerciser for exercising standby power plant on a weekly basis shall be provided in the transfer switch. Exerciser shall be set to exercise standby plant for one half hour per week under load. Time of plant exercise shall be set in field. Exerciser timer shall have reserve power back-up, either by battery or spring-wound clock, to ride through power outages to the switch.
13. Auxiliary contact (gold plated) which closes when normal source fails. (Closed after override delay of 0.5 to 6 seconds).
14. Auxiliary contact (gold plated) which opens when normal source fails. (Opens after override delay of 0.5 to 6 seconds).
15. Auxiliary contacts on same shaft as main contacts (closed on normal.)
16. Auxiliary contacts on same shaft as main contacts (closed on emergency).

I. Transfer switch shall be capable of being operated from a remote SCADA signal to go from normal, to intermediate or to emergency position based on controls from SCADA and if voltage is available at position selected. Allow for switch to remain in intermediate position.

PART 3 – EXECUTION

3.01 TRANSFER SWITCH INSTALLATION

A. Floor mounted transfer switch (es) shall be installed where indicated on the drawings. Locate transfer switch (es) to provide working clearance and full accessibility as required by the National Electrical Code.

B. Lace and group conductors installed in transfer switch with nylon tie straps. Only one conductor shall be installed under terminals. Form and train conductors in enclosure neatly parallel and at right angles to sides of box. Uninsulated conductor shall not extend beyond one-eights inch from terminal lug. Conductors shall be installed such that no stresses are transferred to terminal lugs.

C. Mounting and Support

1. Mounting
   a. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. Transfer switches 400 amps and larger shall be secured by a minimum of eight (8) devices. A 1.5 inch minimum diameter round washer shall be used between head of screw or bolt and enclosure.
   b. Enclosures shall be mounted where indicated on the drawings or specified herein. Support from the structure with fastening device specified.
   c. Attach enclosure directly to masonry, concrete, or wood surfaces.
   d. Mount enclosure on metal channel (strut), which is connected to structure with fastening device specified, for installations on steel structure, sheet metal equipment enclosure, or sheet rock walls.
   e. Do not splice conductors in enclosure. Where required, install junction box or wireway adjacent to transfer switch and splice or tap conductors in box. Refer to number of conductors in a conduit limitation defined in the WIRES AND CABLES section of the specifications and do not exceed.
   f. Conductors not terminating in transfer switch shall not extend through or enter transfer switch enclosure.
   g. Install push-in knock-out closure plugs in any unused knock-out openings.
   h. Free standing transfer switch (es) shall be installed on a four inch high concrete pad, with horizontal base dimension exceeding base dimension of switch by three inches.
   i. Cleaning and Adjustment
      1) After completion, clean the interior and exterior of dirt, paint and construction debris.
      2) Touch up paint all scratched or marred surfaces with factory furnished touch up paint of the same color as the factory applied paint.

3.02 TESTING

A. Submit verification letter to engineer indicating successful completion of sequence of operations testing and certification that all functions are operational. The local authority having jurisdiction shall be given advance notification of the time of the final test in order that he may witness the tests.

B. A failure of any test or any component during a test will require a complete retest program at no additional cost to the Owner.

3.03 O&M MANUALS

A. At least three sets of an instruction manual(s) for all major components of the EPS shall be supplied by the Manufacturer(s) of the EPS and shall contain:

1. A detailed explanation of the operation of the system.
2. Instruction for routine maintenance.
3. Detailed instructions for repair of the EPS and other major components of the EPS.
4. Pictorial parts list and part numbers.
5. Pictorial and schematic electrical drawings of wiring systems, including operation and safety devices, control panels, instrumentation and annunciators.
6. Startup and testing report.

3.04 IDENTIFICATION

A. Refer to the ELECTRICAL IDENTIFICATION section of these specifications for identification requirements.

END OF SECTION

SECTION 16600

VARIABLE FREQUENCY DRIVE UNITS

PART 1 -- GENERAL

1.1 THE SUMMARY

A. General

1. The CONTRACTOR shall provide variable frequency drive (VFD) units, complete and operable, as indicated in accordance with the Contract Documents.
2. It is the intent of this Section to require complete, reliable, and fully tested variable frequency drive systems suitable for attended or unattended operation.

B. Single Manufacturer

1. Like products shall be the end product of one manufacturer in order to standardize appearance, operation, maintenance, spare parts, and manufacturer's services.
2. This requirement, however, does not relieve the CONTRACTOR of overall responsibility for the WORK.

C. Coordination

1. Equipment provided under this Section shall operate the electric motor driver and the driven equipment as indicated under other equipment specification Sections.
2. The VFDs control submersible type pumps that are provided with internal safety monitors and control module. Coordinate exact requirements for each pump and submit a statement with shop drawings that VFDs being provided match pump requirements, including power for module and alarm interfaces.
3. Mount auxiliary relays provided with pumps and provide power and connections required.

D. Provide Modbus TCP/IP connection to SCADA system.

1.2 CONTRACTOR SUBMITTALS

A. Shop Drawings: Include the following information:

1. Equipment Information
   a. Name of drive manufacturer
   b. Type and model
   c. Assembly drawing and nomenclature
   d. Maximum heat dissipation capacity in kw
2. Conduit entrance provisions
3. Circuit breaker type, frames, and settings
4. Information related to relays, timers, pilot devices, control transformer va, and fuse sizes, including catalog cuts
5. Ladder Diagram
   a. Submit the system schematic ladder diagram and interconnection diagrams.
   b. The schematic ladder diagram shall include remote devices.

c. The ladder diagram shall incorporate the control logic on the corresponding elementary schematic as indicated.
d. Submittals with drawings not meeting this requirement will not be reviewed further and will be returned to the CONTRACTOR stamped "REJECTED."

6. Factory test data certifying compliance of similar equipment from the same manufacturer with requirements of this Section

B. The Technical Manual shall include the following documentation:

1. Manufacturer's 2-year warranty
2. Harmonic analysis report
3. Field test report
4. Programming procedure and program settings

C. Spare Parts List

1. Submit information for parts required by this Section plus any other spare parts recommended by the controller manufacturer.

1.3 MEASUREMENT & PAYMENT

A. Payment for Electrical & SCADA Control installation will be made under the lump sum price for the item “Electrical & SCADA Control for each pump station, and such payment shall constitute full compensation for furnishing and placing all electrical components as shown on the plans.

PART 2 -- PRODUCTS

2.1 EQUIPMENT

A. General

1. The power supply shall be an adjustable frequency inverter designed to convert incoming 3-phase, 480-volt, 60-Hertz power to a DC voltage and then to adjustable frequency AC by use of a 3-phase inverter. Provide NEMA I enclosure. See drawings for maximum dimensions. Equipment larger than dimensions shown will not be acceptable.
2. Inverters shall be sized to match the KVA and inrush characteristics of the motors actually provided.
3. Match the controller to the load (variable torque or constant torque) as well as the speed and current of the actual motor being controlled.
4. Variable Frequency Drive permitted configuration
   a. “Clean power” 18-Pulse VFD
   b. 6-Pulse VFD with AP Broadland Filters for motors greater than or equal to 50Hp.
   c. Active front end VFD designs with 3 level type active rectification with TDI at drive input terminals is no more than 5%.
   d. VFD with internal DC links reactors.
   e. Do not exceed dimensions shown on the drawings.
5. Harmonic Reduction
   a. The VFD shall be provided with line-side harmonic reduction, as required, to insure that the current distortion limts, as defined in table 10.3 of IEEE 519-1992, are met. PCC, defined as the low voltage side of the distribution

transformer, is used for purposes of calculation and referred, by the turns ratio of the transformer, to the PCC deinfed by the IEEE Recommended Practices as the Consumer-Utility interface. The tables of limits set forth therein are with reference to the PCC (primary side of the main transformer).

b. Harmonic solutions shall be designed to withstand up to 2% line imbalances with the maximum Current Distortion not to exceed 11% at 100% load.
c. Harmonic solutions shall be capable of withstanding up to 2% ambient voltage distortion with the maximum Current Distortion not to exceed 12% at 100% load.
d. To ascertain the harmonic contribution of the VFD's at the PCC and to show compliance with IEEE 519-1992, harmonic analysis shall be performed and provided in the submittal package. The contractor shall provide the VFD vendor the below listed information for submittal.
    i. kVA rating of the low voltage distribution transformer(s)
    ii. X/R Ratio of utility low voltage distribution transformer(s)
    iii. Primary voltage
    iv. Secondary voltage
    v. Secondary %IZ (impedance)
    vi. Length, size and number of conductors between transformer LV side and distribution panel
    vii. System Single Line Diagram and electrical equipment list showing transformer and VFD detail
    viii. Total linear load kW to be connected to the distribution transformer
    ix. Anticipated maximum demand load (15 minute or 30 minute) on the distribution transformer (IEEE 519)
e. Note that each station has a jockey pump, plus 2 large pumps and other loads. The jockey pump does not run if one or both of the large pumps run. Both large pumps can run at same time.

B. Inverter

1. The inverter shall be of a voltage-source design, producing a pulse-width-modulated type output.
2. Six-step and current-source inverters will not be accepted.
3. Motor Coordination
    a. Inverters shall be capable of operating with 460-volt, 3-phase, 60-Hertz, submersible pump motors.
    b. Inverters shall be capable of operating motors over the range of 50-100 percent of base speed without derating or requiring any motor modifications.
4. Inverters shall be capable of delivering the nameplate horsepower exclusive of service factor without the need for mandatory thermostats or feedback tachometers.
5. The VFD shall vary both the AC voltage and frequency simultaneously in order to operate the motor at required speeds.

C. The minimum VFD inverter efficiency shall be 95 percent at 100 percent speed and load, and 85 percent efficiency at 50 percent speed and load.

D. Power Outage

1. The VFD shall shut down in an orderly manner when a power outage occurs on one or more phases.

2. Upon restoration of power and a START signal, the motor shall restart and run at the speed corresponding to the current process input signal.

E. The VFD shall be provided with the following features:

1. Inrush current adjustment between 50 and 110 percent of motor full load current (factory set at 100 percent)
2. Overload capability at 110 percent for 60 seconds for variable torque loads and 150 percent for constant torque loads.
3. Adjustable acceleration and deceleration
4. Input signal of 4 - 20 ma from process
5. Output speed signal of 4 - 20 ma; signals other than 4 - 20 mA will not be accepted.
6. Upon loss of input signal, the VFD shall operate at a preset speed.
7. A minimum of 2 selectable frequency jump points in order to avoid critical resonance frequency of the driven system.
8. Additional devices and functions as indicated
9. Ethernet communications to transmit VFD data to/from the SCADA control system.
10. Provide De-Rag and/or spin backwards controls if pump clogs up to flow match. Auto function of De-Rag based on criteria that's monitored from the drives and power consumption.

F. The VFD shall be provided with, as a minimum, the following protection features:

1. Input line protection with metal oxide varistor (MOV) and RC network
2. Protection against single phasing
3. Instantaneous overcurrent protection
4. Electronic overcurrent protection
5. Ground fault protection
6. Overtemperature protection for electronics
7. Protection against internal faults
8. Ability to start into rotating motor (forward or reverse rotation)
9. Additional protection and control as indicated and as required by the motor and driven equipment

G. The VFD shall be designed and constructed to satisfactorily operate within the following service conditions.

1. Elevation
   a. Elevation to 3300 feet
   b. For elevation greater than 3300 feet, the VFD shall be derated in accordance with the manufacturer's recommendation
2. Ambient Temperature: 0 to 40 degrees C
3. Humidity: 0 to 95 percent, non-condensing
4. AC Line-Voltage Variation: plus 10 percent to minus 10 percent
5. AC Line-Frequency Variation: plus and minus 2 Hertz

H. Electrical equipment provided in addition to the adjustable frequency inverter for each drive shall include:

1. 2-1/2-percent (minimum) line and load reactors integral to the drive enclosure.

2. Fused 480-to-120-volt control transformer to provide system control power for the logic and pilot lamps.
3. Provide an input circuit breaker.
4. Provide power and alarm controls for submerible pump and control modules to include:
   a. 24 volt power source. Coordinate with modules.
   b. Provide connections and interfaces as required for internal motor safety sensors. These are included for KSB pumps: Thermal Winding Protection, Motor Housing Monitor, Mechanal Seal leakage detector and Bearing Temperature Monitor. If interface relays are provided with pump, install in VFD's and connect. If not provided, provide Macromatic seal fail relay and temperature monitor relay as required and connect.
   c. If pump safety controls occur, shut off pump and provide amber pilot lamp in cover of VFD reading "PUMP MODULE FAILURE."

I. Inverter Signal Circuits

1. The inverter signal circuits shall be isolated from the power circuits and shall be designed to accept an isolated 4-20 mA signal in the automatic mode of operation.
2. The inverter shall follow the setting of a remote or local potentiometer control while in the manual mode.
3. Refer to the Elementary Schematic indicated on the Drawings for speed control and START/STOP methods.
4. Access to set-up and protective adjustments shall be protected by key-lockout.
5. The following operator monitoring and control devices for the inverter shall be provided on the face of the VFD enclosure, either as discrete devices or as part of a multi-function microprocessor-based keypad access device:
   a. AUTO/HAND selection from a remote logic relay or switch
   b. While in AUTO, the inverter shall operate from the SCADA system, and while in HAND control shall operate from a local or remote manually operated speed potentiometer; speed pot ratings shall be coordinated with the supplier of the Local Control Station.
   c. Speed indicator calibrated in percent speed
   d. Inverter fault trip pilot light and output alarm contacts
   e. Trip reset pushbutton
   f. RUN and OFF indicating lights
   g. Provide other controls and readouts normally furnished as standard equipment, or as otherwise indicated on the Elementary Schematics indicated on the Drawings.

J. Properly identified screw type terminal boards shall be provided for interconnection to remote controls and instrumentation

K. Provide Elementary Schematics for hardwired VFD control inputs. The electrical design is based on 120VAC. Where the drive is not provided with "wetting" voltage of 120VAC the supplier shall provide interposing relays so that all field wiring remains 120VAC.

L. Maximum dimensions shown on the drawings cannot be exceeded.

2.2 HARMONIC ANALYSIS FOR DRIVES

A. The CONTRACTOR shall perform a harmonic study of the facilities included in this Project.

B. The following assumptions shall be utilized for the harmonic analysis:

1. The distribution system is a "general" system as classified by IEEE 519 under low voltage systems.
2. Assume 95 percent of total plant operating load is motor load and 5 percent is resistive.
3. Assume a 70 percent plant diversity factor (i.e., 70 percent of the total plant load is operating), with motors other than VFDs operating at 90 percent of their nameplate horsepower.
4. Assume all VFDs are operating except as shown in paragraph 2.1.ASE.
5. Report
    a. Results of the harmonic analysis shall be submitted prior to VFD shipment.
    b. Excessive harmonic distortion shall be specifically denoted.
    c. Corrective measures shall be submitted for action by the ENGINEER.

2.3 SPARE PARTS

A. Furnish the spare parts listed below, suitably packaged and labeled with the corresponding equipment number.

B. Modified Parts

1. At any time prior to Substantial Completion, the CONTRACTOR shall notify the ENGINEER in writing about any manufacturer's modification of spare part numbers, interchangeabilities, or model changes.
2. If the ENGINEER determines that the modified parts no longer apply to the equipment provided, the CONTRACTOR shall furnish other applicable parts as part of the WORK.

C. The following spare parts shall be furnished:

1. Provide one set of spare power fuses of each form, voltage, and current rating.
2. Provide 10 spare control and power fuses of each type and rating.
3. Provide 10 panel lamps of each type (form, voltage, and current rating).
4. Provide one of each type of circuit board, as applicable:
    a. Control board
    b. Power board
    c. Diode bridge
    d. Transistor module
5. Provide one of each size and type power diode and transistor.
6. Provide one set of any special tools required for maintenance of the VFD units

2.4 MANUFACTURERS, OR APPROVED EQUAL

A. GE/ABB – no substitutions

PART 3 -- EXECUTION

3.1 MANUFACTURER'S SERVICES

A. General

1. An authorized service representative of the manufacturer shall be present at the Site for 1 day to furnish the services listed below.
2. For the purpose of this Paragraph, a Day is defined as an 8-hour period excluding travel time.

B. The authorized service representative shall supervise the following and shall certify that the equipment and controls have been properly installed, aligned, and readied for operation:

1. Installation of the equipment
2. Inspection, checking, and adjusting the equipment
3. Startup and field testing for proper operation
4. Performing field adjustments such that the equipment installation and operation comply with requirements

C. Instruction of OWNER's Personnel

1. The authorized representative shall instruct the OWNER's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with test equipment.
2. The instruction shall be specific to the VFD models provided.
3. Training shall be scheduled a minimum of 3 weeks in advance of the first session.
4. Training shall include individual sessions for 4 shifts of plant personnel.
5. Proposed training materials shall be submitted for review, and comments shall be incorporated.
6. Training materials shall remain with the trainees.
7. The OWNER may videotape the training for later use with the OWNER's personnel.

3.2 INSTALLATION

A. Conduit stub-ups for interconnected cables and remote cables shall be located and terminated in accordance with the drive manufacturer's recommendations.

B. Programming

1. The CONTRACTOR shall perform programming of drive parameters required for proper operation of the VFDs included in this project.
2. Submit records of programming data in the equipment Technical Manual, including setup and protective settings.

3.3 FIELD TESTING

A. Testing, checkout, and startup of the VFD equipment in the field shall be performed under the technical direction of the manufacturer's service engineer.

B. Under no circumstances shall any portion of the drive system be energized without authorization from the manufacturer's representative.

C. Verify proper operation of control logic in every mode of control.

D. Harmonic Analysis

1. The CONTRACTOR shall test the completed installation for actual harmonic distortion at the point of common coupling.
2. Harmonic analysis shall be performed in accordance with IEEE 519 - Harmonic Control and Reactive Compensation of Static Power Converters at unit full load using a harmonic analyzer by Hewlett Packard, or equal
3. Tests shall demonstrate that the harmonic voltage distortion at the 480-volt distribution bus of the panelboard, motor control center, or switchgear serving the VFD is limited to a magnitude of 5 percent of the fundamental, with the isolation transformer in the circuit as indicated and with the maximum number of drives, as permitted by the process, in operation and in conformance with the applicable requirements of IEEE-519.
4. Provide a report that shall include the following:
   a. Expected harmonic voltage (THD) through the 35th harmonic, calculated with isolation transformers
   b. Actual RMS value and measured percentage of the THD in the field

3.4 O&M MANUAL

A. Provide 3 sets of O&M Manuals. Document all settings of VFDs in manuals.

END OF SECTION